Government report on information policy and artificial intelligence

VM/2527/00.01.00.01/2017

5 December 2018

Contents

Summary
1 Introduction
1.2 What is artificial intelligence?
1.3 What are the aims of the report and public debate?
2 International outlook
3 Situation in Finland
3.1 Finland's national Artificial Intelligence Programme
3.2 Situation awareness analysis of Finland's information policy
3.3 VISION: Finland, a land of the good life
4 Our way
4.1 Choices guided by ethics
4.1.1 Demand for an ethics of information and artificial intelligence
4.2 Harnessing information
4.2.1 Access to data and data access rights
4.2.2 Empowering citizens and gaining a competitive edge through ethical use of personal data 17
4.2.3 Securing the information base is key
4.3 Interaction between humans and machines
4.4 Competence, social inclusion and trust
4.4.1 Competence
4.4.2 Social inclusion
4.4.3 Reliability builds trust
4.5 Strengthening the competitiveness of the data economy
4.5.1 The principles and economies of scale of the data economy
4.5.2 Promoting competitiveness and the data market
4.5.3 Incentives for investments and data sharing in business environments
5 Glossary

Summary

One of the objectives of Prime Minister Juha Sipilä's Government is for Finland to become a leader in information policy and application of artificial intelligence (AI). Policy actions geared towards contributing to good management and effective use of information can be characterised as information policy. Information policy applies to the public, private and third sectors alike. This Government Report to Parliament provides a knowledge base and a policy foundation for future efforts to build a roadmap with prioritised measures. The report marks the beginning of a new common policy area.

Information policy principles and guidelines are required right now, because society has become networked, knowledge-intensive and digitalised. As a result of digitalisation, society's functions increasingly rely on data and information as well as on the knowledge and services made up from these. Information has significant economic and social value, which will continue to grow even further moving forward. Artificial intelligence requires high-quality data to ensure that its decisions can be trusted. The capacity of artificial intelligence to compile data will create completely new kinds of ethical questions.

Different countries are competing over the types of conditions that they can create for making use of information. Together with other EU countries, Finland has the chance to build an information policy based on strong ethical principles, allowing it to stand out in competition with other countries. This means that leadership is built on trust, human and fundamental rights, and a human-centred approach.

Finland's strengths include its world-class basic information resources, good governance, trust in public bodies and their actions, high level of educational attainment, active citizenship, strong progress in digitalisation, and cooperation between different parties. Finland's extensive track record in AI research gives it a competitive edge over many other countries. Finland has plenty of open public sector data, an operating model for joint metadata and information management in public administration, strong business based on the data economy, readiness for sharing and pooling data also in the private sector, and high-quality cybersecurity expertise.

However, a specific problem for Finland is that its progress is being bogged down by gaps in its AI and data economy competencies and its somewhat slow awakening to the pressures for change posed by digitalisation. The sparsely populated country's infrastructure also presents a challenge for the development of service and transport automation, for example. Moreover, the investment opportunities of a small economy are limited.

In Finland's vision, information and technology will serve people. The large-scale production of information and its safe, ethical, responsible and innovative utilisation will provide opportunities for everyone. Information policy measures will aim to consolidate the agency and social inclusion of citizens. Finns will have the confidence to adopt, apply and make use of technologies to improve their quality of life, facilitate the availability and use of services, and boost competitiveness and added value. The security risks involved in the data economy will have been identified and will be addressed through comprehensive security management.

A responsible information economy is built on shared core values and debates on ethical principles. Together with other EU countries, Finland has the chance to build competitiveness with the aid of an information policy and AI strategy based on strong ethical principles.

The advantages of using technology and artificial intelligence are tied to the quality and accessibility of available data. Access to data held by both the public and private sectors must be promoted through common ground rules. The aim is to share data through open interfaces. Finland is a pioneer in the management and use of personal data.

Increasing automation and developing robotics will amplify both opportunities and threats. The responsibility for decisions made by machines must remain with human beings. The use of AI systems requires transparent algorithms and technologies as well as regulatory mechanisms.

Success in a global operating environment depends on the ability of citizens and organisations to produce, understand and make use of information. Measures to strengthen competencies and capabilities concern the entire population. A functional and democratic digital society is based on trust and inclusion.

New technologies and widespread use of data and information have a powerful bearing on society, services and corporate revenue-generation models. Open access to information is of great value. The competitiveness of the data economy can be reinforced through research and innovation. Finnish companies must be provided with better opportunities to become success stories in the platform economy.

1 Introduction

Finland's story of survival and success has relied on a firm belief in the power of information and every citizen's right to access information, as exemplified by its full literacy, general compulsory education, high level of educational attainment, public libraries, and principle of public access to official documents. These still form the foundation for our economic success and high level of all-round education and competence.

Information is playing an increasingly significant role in terms of society and the economy. Different countries are competing over the types of conditions that they can create for making use of information. During the current government term, the Finnish government has outlined policies to promote the use of information in documents such as its resolutions on the use of data. Contributions to digitalisation and use of information have been made in keeping with the Government Programme.

In its strategy review session on 29 January 2018, Prime Minister Sipilä's Government decided to draw up a report on artificial intelligence and information policy for submission to Parliament in the autumn of 2018, in keeping with the objectives of the Government Programme. The report combines these two aspects while paying special attention to ethical issues. The report was drafted by a separate ministerial working group, a preparatory working group consisting of representatives of all ministries, and a secretariat supported by various networks. Through the networks, about 200 people from different sectors of society were involved in working on the material.

The report is based on and gives due consideration for the measures already taken to date, such as the Age of Artificial Intelligence programme, information policy choices outlined in various government resolutions and a publication of the Ministry of Finance entitled 'Finland needs an information policy'.

The working title given to the report during its drafting stage was 'Ethical information policy in the age of artificial intelligence'. The report is the result of collaboration between all ministries and the experts involved in the work through the networks. The report's key content was drafted in the spring and summer of 2018, and observations made during the autumn consultation process have also been taken into account.

This Government Report to Parliament provides a knowledge base and a policy foundation for future efforts to build a roadmap with prioritised measures.

1.1 What is an ethical information policy?

Policy actions geared towards contributing to good management and effective use of information can be characterised as information policy. Information policy is devised to promote aspects such as collecting, opening, combining, sharing and storing data, as well as strengthening data protection and information security in a way that respects people's rights and freedoms. The objective of information policy is to advance and enhance the use and refinement of data for the common good while also identifying and preventing its abuse. Furthermore, information policy guidelines are also required in order to ensure adequate competencies and address regulatory considerations.

The ethical and legal issues involved in the use of both data and artificial intelligence have gained prominence as a result of big data analytics that has been enabled by the advancement of information technology, on the one hand, and the development of artificial intelligence, on the other. The use of data and artificial intelligence can be trusted when it is carried out in an ethically sustainable manner. At the same time, the ethical use of data and artificial intelligence can be translated into an international competitive edge through trust. Finland is a stable trust-based society. Trust is further strengthened by the commitment of different social actors to shared ethical principles and core values. This, in turn, is conducive to creating a safe operating environment for citizens, trade and industry, as well as for cross-border expertise and investments. With this in mind, the report raises artificial intelligence and the ethics of information policy to the fore.

A national information policy must take EU law and international commitments and recommendations into account, while its development also entails formulating Finland's positions on topical information policy issues. Based on a shared national vision, Finland will be able to make coherent contributions rooted in its own values and national objectives in the international forums involved in forging information policies. Finland should assume an active role in defining international ground rules and values while also developing its own operating environment, taking account of the need to maintain its competitiveness.

Keeping key digital information resources reliable and available for future reference is a prerequisite for the continuity of society. This is one of the aspects that need to be addressed through information policy.

In the field of cybersecurity, a more and more important role is assigned to stepping up technological security, building up society's resilience in response to crises and disruptions, and heightening awareness among citizens. This calls for developing observational and analytical skills, for example. Influence attempts are not limited to technological means alone; so-called hybrid operations are becoming more and more prominent.



Figure 1. Key dimensions of information policy.

This report explores information policy, not only in terms of information management, but also from the perspectives of the prerequisites for making use of information, core values and ethical principles, as well as economic impacts. While artificial intelligence is expected to open up considerable opportunities for analysing and making use of information, it also presents completely new kinds of challenges for information policy. The report looks at information policy, on the one hand, from the perspective of social actors and, on the other, in terms of the aspects recognised as key social objectives, i.e. safety and security, wellbeing and national competitiveness, whilst taking individual citizens into account.

1.2 What is artificial intelligence?

The concept of 'artificial intelligence' (AI) is used in many senses. In this report, 'artificial intelligence' refers to various types of computer software that allow machines, devices, programs, systems and services to operate intelligently - i.e. in a flexible and appropriate manner - in complex environments that are, to some extent, unforeseeable.

Intelligent features are based on the data available to artificial intelligence, algorithms and the AI system architecture. An 'algorithm' means a precise, often mathematical representation of how to solve a particular problem. Algorithms are studied making use of the methods and findings of several disciplines, such as engineering and information processing sciences, linguistics, cognitive and neurosciences, as well as physics, mathematics and philosophy.

Today's artificial intelligence mainly consists of software designed for specialised data processing tasks. Even the most sophisticated AI applications currently available represent so-called artificial narrow intelligence, as they only perform the specific limited task for which they were developed. Artificial narrow intelligence does not possess any understanding beyond the scope of its own task; nor is it capable of setting its own cognitive or moral goals.

At present, artificial intelligence mainly functions as an assistant to human data processing – i.e. as 'augmented intelligence'. Although artificial intelligence is likely to play an auxiliary role for a long time to come, even this role involves aspects that require attention. Interaction between artificial intelligence and humans differs from traditional human/machine interaction, as the machine seems to understand. As artificial intelligence develops, its behaviour may increasingly take on some independence, which will highlight the importance of limiting its nature to its intended purposes.

Furthermore, the increasing use of AI applications will bring to the fore a number of ethical, societal and legal issues relating to aspects such as responsibilities. Increasing AI use will also involve several economic, educational and security-related considerations, even though wider deployments are still being carried out with caution. As intelligence gains more and more strength as a driver for growth, development efforts are increasingly focusing on expanding the scope of AI utilisation into new areas.

AI developers are paying increasing attention to the openness, risks and validation of technologies. Increasing openness aims to improve the safety, legitimacy and reliability of AI utilisation. Openness may concern data use, open source code, open research, openness of security technology, open innovation as well as openness relating to organisational objectives and cultures.

Artificial intelligence and robots are often equipped with human-like and emotive features, which will influence human/machine interaction. These may profoundly change our perception of humanity, consciousness and emotions. Nevertheless, artificial intelligence and robots should always operate under human supervision.

1.3 What are the aims of the report and public debate?

- 1. To formulate a common and comprehensive information policy, tapping into the information principles in place in different fields and the measures taken on the basis of experiences;
- 2. To build a knowledge society that is sustainable both in terms of human wellbeing, safety and security and with regard to the economic, social, cultural and environmental dimensions;
- 3. To clarify information policy guidelines and principles so as to create a foundation for measures aimed at strengthening the competitiveness and decision-making capacity of Finland, businesses operating in the country and other social actors;
- 4. To build Finland up as an attractive operating environment for the data economy;
- 5. To form Finland's position, on the basis of which Finland will make pioneering efforts to influence the international operating environment, commitments and regulatory framework relating to the use of information;
- 6. To consolidate the ethical values at the core of making information policy choices and developing artificial intelligence, including fundamental and human rights, social inclusion, responsibility, trust, safety and security;
- 7. To promote the ability to analyse, anticipate and respond to threats in a changing operating environment.

2 International outlook

There has been an almost exponential growth in business operations based on the data economy, the platform economy and artificial intelligence. By way of example, the world's ten largest companies by market capitalisation mostly operate in the platform economy. Major platform economy companies are undermining traditional economic mechanisms.

The leading countries in the data economy are the United States, China and Japan, which also boast the highest level of both private and public investments in innovation, and which have dedicated major efforts to drawing up national AI and information society strategies and policies. Among EU Member States, the most visible AI strategies have been published by France and the United Kingdom, while the European Union also has a strategy of its own. At the same time, many other countries are also preparing their own strategies. By way of example, India is expected to come out with a significant initiative in the field of AI development.

The distribution of market shares between AI, data economy and platform economy companies does not only concern business, but also the distribution of power over data between companies and states, and the individuals and organisations sharing their data. France, for example, stresses in its AI strategy that data must be collected for shared use to prevent all the power from slipping into the hands of big companies.

Many states are aspiring to become pioneers in AI innovations. Within the framework of the European Union, the Member States aim to pave the way towards ethical, human-centred use of information and artificial intelligence. An economy resting on data analytics and intelligent algorithms will deliver on its promise of growth through trust. This is precisely where Finland and Europe can stand out in AI competition.

Data protection and taxation are the areas through which Europe has aimed to regulate the phenomenon, while also seeking to secure a more level playing field for competition. By way of example, the EU General Data Protection Regulation (GDPR) is a step towards a more ethical and human-centred approach to making use of information. It reinforces the rights of citizens to access data concerning them. It has been estimated to provide businesses operating in Europe with an opportunity to develop a competitive data economy with due consideration for data protection. A significant proportion of the data economy consists of personal data.

Artificial intelligence and the ethical issues relating to its use were already discussed in a report commissioned by the Obama administration in 2016. In response, China declared that it would become the global AI leader by 2030. The policies of the Trump administration focus on commercial advantages. The United States and China play a very considerable role in AI research: the combined proportion of these two countries was 44% of all scientific publications in the field of machine learning in 2017.

A large enough national market also provides an apt springboard to world markets. In population terms, the Chinese market is larger than that of the United States, which contributes to opening up new business opportunities for Chinese companies. The European common market operates less effectively. So far, potential common European interests have been overshadowed by national interests and boundaries, strengthening the foothold of US players in Europe.

Within the European Union and in international settings, Finland cooperates with other countries with a view to strengthening a market-based data economy, access to data and cross-border data mobility, with due consideration for privacy and national security. Finland participates in international processes aiming to create ethical frameworks and shared core values for making use of artificial intelligence. This will ensure that Finland is proactively involved in contributing to the recommendations and standards that should also be applied in national policies. Discussions are taking place both within the United Nations, UNESCO, OECD and the Council of Europe and at the EU level.

The Council of Europe and the Commission of the European Union are currently drafting their ethical frameworks for sustainable use of artificial intelligence, resting on fundamental and human rights. The EU framework focuses at least on the impacts of artificial intelligence on privacy, human dignity, consumer protection and non-discrimination. The Commission has actively highlighted the ethical issues of artificial intelligence, cooperation between states and more efficient use of data.

The accessibility and quality of data are essential to the functioning of the data economy. Europe needs more ambitious objectives for opening up data in a usable format and for eliminating the barriers to secure data access. The European Commission recommends the use of open interfaces as a key way of enabling data sharing in practical terms.

The measures adopted by Finland and the European Union are very much aligned. Finland has aimed to promote the accessibility, portability and interoperability of data on the European digital single market, as exemplified by the opening of transport data held by the private sector alongside public data.

3 Situation in Finland

Finland is a democratic Nordic welfare state based on the rule of law and the principle of public access. Within the European Union and in international settings, Finland cooperates with other countries with a view to strengthening a market-based data economy, access to data and cross-border data mobility, with due consideration for privacy and national security. Finland participates in international processes aiming to create ethical frameworks and shared core values for making use of artificial intelligence. This will ensure that Finland is proactively involved in contributing to the recommendations and standards that should also be applied in national policies. Discussions are taking place both within the United Nations, UNESCO, OECD and the Council of Europe and at the EU level.

Finland's success in a global operating environment depends on the ability of citizens, public bodies and businesses and other organisations to produce, protect, understand and make use of information. Our population's high standard of basic skills and people's opportunities to develop their own competencies are prerequisites for success. Their maintenance and development call for strategies, structures and funding that support information competence among children, young people and the adult population. Their renewal on the labour market is guaranteed through concerted action by the worlds of education and work.

Strengths:	Challenges:
 The most stable country in the world, resting on a foundation of trust, broad social inclusion and a strong rule of law A high standard of competence, high-quality research and advanced research infrastructure Effective data economy infrastructure, extensive information resources and robust use of digitalisation in different sectors of society Different social actors from public institutions to businesses and citizens are interested in trying out new solutions and making use of information Broad-based cooperation between different social actors in areas such as the cooperation model for comprehensive security Permissive general legislation in electronic procedures as well as leadership in enabling legislation governing information and automation in certain sectors Leadership in the My Data approach Networks and a culture of experimentation A diverse and active civil society 	 Regulatory culture more stringent than the EU regulatory framework Gaps in understanding the significance of data, divergent views relating to the principles of data sharing Awareness of the new regulatory framework for data protection within the administration and businesses Inadequate level of interoperability between systems Resilience to disruptions Putting too much confidence in our possibilities to maintain a reliable and interference-free digital environment Infrastructure challenges in a sparsely populated country Caution and scarce resources of businesses Keeping technological competencies abreast of international developments Consistent use of information critical to society Ensuring long-term access to digital data; archiving Availability of skilled labour Access to risk financing for growth-phase businesses
Opportunities:	Threats:
 Open data policy guidelines An enabling regulatory framework for access to personal data Data exchange based on open interfaces and distributed data sharing infrastructure Open national co-creation Extensive competence and its development Services built on trust National development of interoperability Making Finland globally attractive in data utilisation Emerging ecosystems being created around the use of both public and private data Services based on ethically functioning artificial intelligence 	 Global developments leading to a situation where innovations are made outside Finland and the European Union Failure to look after the digital competence and information literacy of citizens, businesses and other organisations Information operations as part of hybrid operations Adequacy of digital and physical infrastructure and insecure energy supply in crisis situations Excessive reliance on artificial intelligence Failure to validate artificial intelligence and open up algorithms Multiplier effects on society caused by open data and failure to pay attention to cybersecurity Inspiring projects implemented somewhere else or abandoned Monopolisation of data and AI solutions and international market imbalance Overemphasising caution and stability in administrative functions Substantial austerity measures in education and research Excessive concentration of registries and information systems and

In Finland, the key legislative parameters for information management and utilisation stem from the Constitution of Finland (733/1999), international agreements binding on Finland and European Union law. Over the last 20 years, their transformation in Europe has been characterised by increasing emphasis on fundamental and human rights in parallel with technological advancements and digitalisation.

Finland has what it takes to become a pioneer in the use of information. Finland's trust-based society, good governance, high standard of competence, registers and other information resources, innovative businesses and strong progress in digitalisation form the springboard for the country to become an exemplar of a sustainable data ecosystem by 2025. Furthermore, the significant role of municipalities and joint municipal authorities in information policy as both producers and users of information creates conditions for its pioneering role. Businesses operating in Finland are well positioned to make use of artificial intelligence in their operations. Their links to research and readiness to change their operating methods facilitate the rapid deployment of AI solutions. Finland's extensive track record in AI research and the high quality of research and technological expertise contribute to creating a national advantage over most countries. One of the prerequisites for success is the readiness and ability of businesses to cooperate in data sharing. Some sectors have already gained some experience of this.

Finland has exceptionally comprehensive and high-quality information resources in healthcare and social welfare services. Mining data from these resources – based on law, appropriate management plans, official decisions, etc. – makes it possible to promote people's health and wellbeing in an equitable manner, prevent disease and develop new treatments. Combined with other register data, genomic data – i.e. data obtained from human genome – enables the use of more individualised criteria to choose the most effective treatments, for example. The personal data stored by citizens on themselves using various devices may be harnessed in support of planning treatments and wellbeing in general. Treatments can be tailored individually for each patient, making use of data accumulated from different sources by means of self-learning AI systems.

An example of using data for assessment purposes is the service system for information-based guidance, which will be used by the National Institute for Health and Welfare (THL) to assess the success of forthcoming counties in organising health and social services by means of extensive national registers and other information resources. The assessment covers all functions of healthcare and social welfare services and the criteria for success include equal access to services, client orientation, and the quality and cost-effectiveness of services.

Internationally recognised examples of enabling legislation include Finland's new Act on Transport Services (320/2017). The Act contains data regulation governing the sharing and use of data held by the public and private sectors, openness and coordination of interfaces, and compliance with the principle of asking for new information only once (the 'once-only' principle). Furthermore, it also supports the use of artificial intelligence.

The Biobank Act (688/2012) has also been internationally regarded as a successful example of enabling regulation. The Act aims to promote domestic and international research based on extensive processing of human biological samples and related personal data. A further objective of the Act is to promote people's self-determination and privacy. Based on openness and transparency, the Act has increased people's awareness of the use of healthcare register data as well as their involvement in controlling access to their personal data.

Making use of public information resources by means of new technologies requires reforming and harmonising information management practices and legislation. A legislative process is currently underway to draft a general act on information management in public administration in keeping with the life-cycle model of information. Its aim is to improve access to data, safeguard the integrity of data, and ensure the fluent exchange of data between public authorities.

AI development has raised issues that call for a legislative review. It is necessary to engage in detailed legal consideration on the types of tasks which can be left to a machine and which will still require a human being. In many cases, the use of artificial intelligence requires special attention in legislation, in order to also make it possible to create new operating models in areas such as the use of anonymised personal data. The first steps have been taken in the Act on Transport Services.

National tax systems are facing new challenges as technological advancements and intensifying globalisation are rapidly transforming the economic operating environment. Short-term needs to secure tax receipts must not, however, lead to solutions such as a robot tax that may significantly weaken Europe's economic growth and Finland's international competitiveness in the long run by putting the brakes on the deployment of innovations and the use of technological advancements. Further contributions must still be made to cooperation in the area of developing international taxation.

International taxation should be developed to respond to the needs of a more and more rapidly digitalising world. A comprehensive and balanced solution to taxation of the digital economy should be identified on the global level. The OECD will release its final report on the topic in 2020. The European Union should take an active part in this development work, but it should avoid unilateral and hasty solutions so as not to compromise its competitiveness in relation to the rest of the world. The field also involves more general problems, relating to issues such as harmonised tax bases and the proper incidence of taxation.

Finland has a long tradition in open development of various technologies intended to protect data. If data shared across the European Union is to be used, its protection mechanisms should also be transparent. Finland is well positioned to become a pioneering country by offering transparent protection and encryption mechanisms that are independent of individual governmental parties.

Finland needs to prepare for being increasingly targeted by hostile hybrid operations through cyber-attacks, data theft, information operations, etc. Hybrid operations involve falsification of data or its origins. The mere suspicion of falsification erodes the key success factor of leadership and society as a whole, i.e. mutual trust.

Hybrid operations mix conventional and unconventional means. They manifest in various attempts to influence the structures of society and its political, economic, military and information functions. This is why responding to hybrid threats will, in certain cases, call for comprehensive preparation and coordinated action by all sectors of society.

Finland safeguards the vital functions of society through comprehensive preparation. Finland's model of comprehensive security and the broad-based inter-agency cooperation that it builds on also provide good capabilities and points of departure for facing hybrid threats. Furthermore, Finns' high level of education and versatile literacy contribute to improving society's resilience.

3.1 Finland's national Artificial Intelligence Programme

Finland has an Artificial Intelligence Programme launched by Prime Minister Sipilä's Government with a view to establishing artificial intelligence and robotics as the cornerstones of success for Finnish companies. Finland's objective is to be the best country in the world at applying artificial intelligence, while also ensuring a prosperous Finland in a time when artificial intelligence is widely used. In order to achieve this objective, the programme raises the following three key challenges to be resolved during its implementation:

- 1. How can we ensure that the potential offered by artificial intelligence is utilised to its full extent in order to guarantee business competitiveness and economic growth?
- 2. How can we ensure that the public sector is able to make use of the possibilities offered by artificial intelligence in its own activities in order to effectively produce high-quality public services?
- 3. How can we ensure that our social structures adapt to the changes brought about by artificial intelligence and that Finland will be able to continue to provide a well-functioning society and wellbeing for its citizens?

Implementing the programme has involved extensive efforts to promote business cooperation in applying artificial intelligence and robotics. The artificial intelligence accelerator established by the Federation of Finnish Technology Industries will lower the threshold for businesses to make use of artificial intelligence. Furthermore, Business Finland has launched an AI funding programme to develop new solutions.

As part of implementing the Artificial Intelligence Programme, a report entitled Work in the age of artificial intelligence was published in June 2018. In order to harness the potential of AI application,

society must invest in updating workers' skills, facilitating workforce mobility and generating innovations that complement human labour. A well-functioning labour market will play an increasingly important role.

The aspects frequently highlighted as the values of a good artificial intelligence society include transparency, responsibility and extensive societal benefits. As part of implementing the programme, an ethics challenge for enterprises was announced in September 2018 with a view to promoting the transparency and responsibility of the ethics of applying artificial intelligence.

3.2 Situation awareness analysis of Finland's information policy

A review commissioned from KPGM by the Ministry of Finance, analysing the policy guidelines concerning information policy and AI utilisation in place in different ministries and their respective administrative branches as well as their key measures and projects, indicates that there are plenty of development projects currently ongoing within central government. The review is appended to this report.

Only a few administrative branches have drawn up any specific policy guidelines of their own for information policy or AI utilisation. Instead, these are either included in the priorities set out in the Government Programme and the common principles of digitalisation in central government or in strategic documents of individual administrative branches. Almost all branches have a clear plan in place on how to promote information policy and AI utilisation as part of developing the branch in question. As a whole, the range of measures is very broad.

In all administrative branches, information policy measures are divided into a very wide variety of themes. The key measures and development projects identified by different branches include various efforts to modernise the existing information systems. A specific area regarded as requiring improvement is development of cooperation between central and local government.

Software robotics, artificial intelligence and various functions that enhance analytics capabilities are widely utilised in Finland. AI utilisation – or at least exploring its potential – also plays a visible role in the key measures in almost all of the branches.

Measures relating to open data and ecosystem development are especially emphasised in the administrative branches of the Ministries of Education and Culture, Agriculture and Forestry, the Environment, Social Affairs and Health, Transport and Communications, and Economic Affairs and Employment. Correspondingly, making use of big data is especially highlighted in the branches that traditionally hold plenty of various masses of data. In many respects, making use of big data is also linked to improving access to data and developing ecosystems involved in its use.

Most of the key measures and development projects in different administrative branches focus on developing internal processes. This is part of normal development of organisational operations. However, it is now clear that there are efforts to take a broader view of the central government's internal processes: there are several cross-administrative development processes.

While a significant proportion of services are mostly provided for citizens through internal development efforts within different administrative branches, there are some initial signs that also point to increasing cross-administrative cooperation. By way of example, service packages sensitive to various life events can be found in many different branches.

3.3 VISION: Finland, a land of the good life

Every individual, community and business in Finland recognises their own opportunities and role as a responsible member of society. Information and technology serve people and free up resources. Innovative, knowledge-intensive and internationally successful businesses create widespread growth and wellbeing.

Information policy measures aim to consolidate the agency and social inclusion of citizens, helping them recognise their own capabilities and make the most of their potential at different stages of their lives. Finland has a broad base of education. Finnish citizens, communities and businesses are well-known for their high level of competence and learning skills. Trust in society and its institutions is strong among different parties.

Finns have the confidence to adopt, apply and make use of technologies to improve their quality of life, facilitate the availability and use of services, and boost competitiveness and added value. Public services are based on the predictive use of information and delivered at the right time in a human-centred manner. Technologies based on future artificial intelligence are geared towards supporting these objectives and their achievement.

The large-scale production of information and its safe, legal, ethical, responsible and innovative utilisation provide opportunities for everyone. The information that is exceptionally valuable or critical to the functioning of society has been identified and secured.

The security risks involved in the data economy, such as disinformation, identity theft or cybercrime, have been identified and are addressed through comprehensive security management. Finland is prepared for cyber and information operations launched against it and is able to identify and prevent such operations.

4 Our way

4.1 Choices guided by ethics

People come up against fundamental ethical issues in practical situations while developing and applying artificial intelligence. It is not possible to develop universally applicable guidelines; instead, ethical issues must be resolved on a case-by-case basis. Developing self-regulation so as to take ethical issues of information use into account provides Finland a competitive edge. So far, however, technological development has proceeded with focus on technology, while ethics has often emerged only when ethical issues have been encountered while applying technologies. Ethics reviews should be carried out in the early stages of technological development and, where necessary, as a continuous process alongside the technological development process, in order to expose any potential obstacles in time.

A responsible information economy entails creating and taking into account shared core values and ethical principles. There are still many unclear legal, ethical and economic issues to face in AI development. Finland must find its own role, strengths and opportunities in what is still a foggy international big picture.

The key ethical principles in terms of formulating an information policy are the so-called mid-level principles. These refer to principles that are sufficiently tangible, generally known to everyone, and agreed by a broad consensus. At the core of a mid-level principle lies a good and valuable goal to pursue, such as wellbeing, autonomy, life of dignity, justice, equity and biodiversity. Finland is committed to these principles in its Constitution, other legislation and culture, and they also guide information policy and issues relating to artificial intelligence. The ways in which these principles are interpreted also change with the times.

Technological advancements may affect the way in which aspects such as a life of dignity and integrity are assessed. Applying ethical principles calls for judgement, because they may be contradictory in certain cases, which require weighing them against each other. An example of a forum for ethical issues is the National Advisory Board on Social Welfare and Health Care Ethics (ETENE), which is tasked to discuss and provide statements on general principles in ethical issues relating to the healthcare and social welfare sector and the status of patients.

Correspondingly, the Finnish National Board on Research Integrity (TENK) addresses ethical issues relating to research and advances research ethics. Higher education institutions, research institutes and the Academy of Finland are committed to complying with research ethics guidelines for good scientific practice. Parties committed to the guidelines for good scientific practice also comply with the guidelines, as applicable, in national and international research cooperation with businesses and other parties.

The Council of Europe and the European Union are currently drafting ethical frameworks for sustainable use of artificial intelligence, resting on fundamental and human rights. The EU framework focuses wider attention at least on the impacts of artificial intelligence on privacy, human dignity, consumer protection and non-discrimination. The European Union has actively highlighted the ethical issues of artificial intelligence, cooperation between states and more efficient use of data, placing aspects such as ensuring an appropriate ethical and legal framework front and centre.

Moral decisions and choices will be made by humans, who will also bear the responsibility. A functional and democratic digital society is based on trust. The prerequisites for creating trust in society and its institutions include a sense of inclusion, freedom of speech and chance of societal change.

The ethical functioning of society includes safeguarding its continuity. This essentially entails ensuring the preservation of information significant in terms of society's continuity and progress for future reference, as well as consistent national use of information critical to society.

We must be aware of the fact that ethics cannot be defined in purely scientific terms, as it depends on the values of the individual or community exploring the issue. In order to identify and adopt commonly agreed approaches, we need research and public debate, which can especially be encouraged through a significant contribution from an active civic society.

4.1.1 Demand for an ethics of information and artificial intelligence

AI-related policy issues concern the openness of algorithms; the ethical and legislative foundations of data processing; data used by artificial intelligence and its transparency; rights, responsibilities and power; and the human/machine relationship.

Algorithms may improve or undermine equality. With regard to training and using systems based on intelligent technologies and artificial intelligence, it is necessary to determine how and for what purposes these are to be developed and used. By way of example, public bodies may gear their procurement processes to promote the deployment of licensing-based software, allowing free reuse and redevelopment while preventing the risk of vendor lock-in situations.

Training artificial intelligence requires ethical standards in order to ensure stronger data protection for citizens and the quality and reliability of data. In addition to transparent practices and the reliability of data processing and sharing, we need ethical guidelines for developing algorithms and architectures. Special attention should be paid to data selection to prevent the biases and distortions of the human mind from being copied to algorithms that would reproduce them.

As autonomous functions develop and become more common, it is of the utmost importance to ensure that the systems and their guiding algorithms comply with ethical principles, legal statutes and agreed operating models. For this purpose, it would be advisable to create standards and quality assessment mechanisms for auditing autonomous systems.

It is particularly necessary to have global ethical debate on the effects of algorithms on human safety (such as road safety of autonomous vehicles) and, where required, forge international agreements on the transparency of algorithms, with due consideration for business secrets. Finland should take an active part in such debate.

The ethical concerns of AI systems raised in public debate are especially related to warfare, privacy and control, responsibilities, copyrights and equality. It is therefore necessary to establish the potential forms of data processing and AI application that it would be wrong to even try to develop, making it justifiable to prohibit their development by means such as international agreements. It is also necessary to determine the types of AI development that are to be prioritised for public funding and to discuss which party or parties can decide the permitted AI application areas.

The core values of information policy have already been partly defined in currently valid legislation. In order to resolve the ethical issues of artificial intelligence, it is nevertheless necessary to devise a structure where developers, appliers and researchers from both the private and public sectors can engage in critical debate and work together to develop operating models.

Intelligent systems and artificial intelligence call for a code of ethics in support of their development and responsibility for training their developers to comply with shared ethical principles. It is equally important to define the areas that should be left for humans to decide and deal with, despite the development of artificial intelligence. In this context, the grounds may include the technological limitations of AI systems in areas such as transport or nursing. Furthermore, it is necessary to determine responsibilities for AI system functionality in the event of failure.

Policy guidelines:

- Ethics and values, and the opportunities and threats involved in new technologies will be subjected to continuous debate.
- Efforts will be made to consolidate multidisciplinary education, training and research necessary to develop competitive and ethically and socially responsible AI applications.
- Finland will participate in international cooperation and influence the content of ethical frameworks.

4.2 Harnessing information

Information policy helps us prepare for a future where societal functions, service development and economic competitiveness lean on knowledge-based competitiveness. The advantages of technology, artificial intelligence and robotics are tied to the quality and accessibility of available data. Technological advancements and the platform economy are changing information management among citizens and organisations, information environments and practices, and competencies required in the world of work.

The development of a trust-based society building on knowledge is predicated on people's sense of inclusion. A citizen should be seen as an active and independent agent, who has extensive rights to receive understandable information. Moving forward, the opportunities of citizens to manage data concerning them and decide on its distribution will be included among the prerequisites for the legitimacy of both public and private activities. Public authorities and businesses are required to deal with data quality, accessibility and access rights in a responsible and competent manner. While data should be as easily accessible as possible, access to data is restricted by various legal provisions, and data is a significant competitive asset in commercial operations.



Figure 2. Perspectives on the openness and availability of data. Source (adapted): OECD.

4.2.1 Access to data and data access rights

Data is the foundation for all digital operations. Innovations and new kinds of business operations and services are created by combining data. Access to data held by both the public and private sectors must be promoted through common ground rules and, where required, also through legislation. Information security should be ensured by means such as standards, certifications, audits and accreditations. Where necessary, information security is guaranteed through cross-administrative cybersecurity measures.

Businesses need access to plenty of data in order to train and run artificial intelligence. In order to harness artificial intelligence in service of people, it is necessary to ensure access to data and considerations such as privacy.

As the role of data and computing is constantly increasing in different disciplines, this requires keeping their supporting research infrastructure up to date. Ensuring the openness of research data will also promote access to data.

From the perspective of extensive and versatile use of data, it is more important to discuss data access rights rather than data ownership, as the value of data will not grow until it is used. There are different levels of openness and sharing of data relating to copyrights, business secrets, security and personal data protection.

Ethical information policy in the age of artificial intelligence



Figure 3. The data exchange onion and access rights. Source: Valtioneuvoston periaatepäätös kehittämissuunnitelmaksi logistiikan ja kuljetussektorin sekä satamien digitalisaation vahvistamiseksi 28.3.2018 [Government Resolution of 28 March 2018 for a development plan to enhance digitalisation in logistics and the transport sector as well as in ports].

The outermost layer of the data exchange onion comprises totally open data. As a general rule, this includes the data held by public authorities, with the exception of certain data contents subject to statutory restrictions. Sensitive personal data cannot be made openly accessible via a public database. The openness of data, publications and methods contributes to putting research produced through public funds to extensive use in society. In addition to use by public authorities, it is advisable to promote solutions and models to make information resources held by the private sector available for use in research activities. This will make it possible to create new competencies relevant to social progress, promote open innovation and improve competitiveness.

Businesses mainly share data with each other on the basis of their mutual agreements. There are also certain types of data that businesses may want to share openly with each other for their own benefit. In the logistics business, for example, data collected by transport companies on traffic conditions benefits all parties. Furthermore, businesses can share data confidentially with their partners for business purposes. In this case, data exchange is based on agreement. In order to provide businesses with better conditions for data sharing, it is necessary to formulate data access policies.

Data can be exchanged between public authorities and businesses, especially based on the statutory rights and obligations of public authorities. The exchange of data between public authorities is based on official duties. The private sector holds data that is essential to social progress and challenges and should therefore be made available for wider use without jeopardising privacy and business secrets. One of the reasons for doing so could be enabling safe autonomous transport in the future.

The data economy and network-based collaboration would be advanced by an approach similar to the Creative Commons licensing terms in lieu of complex copyrights regulation and separately negotiated restrictive agreements. The Creative Commons licensing framework has distilled legal complexities into a few standard licensing options, which allow rights-holders to promote the use and distribution of their works.

Information systems should be as secure, general-purpose, interoperable and technologically distributed as possible. The aim is to share data through open interfaces. This is the most secure solution that is as long-lasting as possible in terms of technological advancements. It is also the best way to enable the transfer of high-quality and up-to-date data as automatically as possible. Compliance with the 'once-only' principle means that data is only stored once on a single system, where it is accessible as required.

The assessment and management of risks relating to cybersecurity, information security and preparedness should be developed into a continuous improvement process.

4.2.2 Empowering citizens and gaining a competitive edge through ethical use of personal data

Personal data is of high value in business operations, scientific research and public administration. Such data can be used to make new scientific discoveries and target services and products effectively. Personal data has also become a commodity and medium of exchange. Individuals may also share their own data to obtain various benefits, such as social media services. From the perspective of citizens and consumers, this development entails benefits – but also risks to their privacy. Increasing volumes of personal data are being accumulated in corporate and public sector information systems. Personal data is often managed by parties other than the individual concerned. Citizens' rights are restricted in terms of the extent to which they have a say in how their personal data is processed.

International data protection regulation has traditionally provided the framework for the ways in which third parties can process data relating to an individual. The European Union has a new General Data Protection Regulation (EU) 2016/679 (GDPR), which entered into force as directly applicable law in its Member States in May 2018, laying down provisions on the protection of natural persons with regard to the processing of personal data and on the free movement of such data. The GDPR emphasises the right of self-determination over personal data across the board; it includes means that help individuals to manage data concerning them, such as an individual's consent and right to access personal data. The GDPR specifies the conditions for consent. Furthermore, disclosure of data by public authorities is also governed by the Act on the Openness of Government Activities (621/1999) and any possible special laws.

As a result of the increasing use of personal data and value creation relating to such data, it has become clear that individuals should be provided with better means of managing their personal data. However, as the use of personal data becomes more prevalent, it may be difficult for individuals to keep track of the services and purposes to which they have given their consent.

A new term, 'My Data', has been introduced to refer to a phenomenon and a change in the mindset aimed at steering personal data management and processing from the current organisation-oriented model towards a human-centred approach. At the same time, My Data is also used to refer to personal data as a resource that the individuals themselves can use as they wish. This increases people's chances of having a say in how the data concerning them is to be used, while also providing them with the best possible capabilities to understand their own wellbeing, for example, and take action to enhance it as required. If an individual is unable to make use of their personal data collected by some other party, it cannot be called My Data.



Figure 4. Applications of My Data. Source: Poikola, Kuikkaniemi, Kuittinen, Honko, Knuutila. 2018. "MyData - johdatus ihmiskeskeiseen henkilötiedon hyödyntämiseen" [MyData – An introduction to human-centred use of personal data]. Ministry of Transport and Communications.

Finland has been one of the international pioneers in the My Data approach. My Data has been promoted in several administrative branches, including the transport and communications sector. People's opportunities to use and share their personal data have also been advanced in the education and training sector. A model based on My Data is being developed for the purpose of disclosing data from extensive registers of study records and educational qualifications, complete with solutions making this possible for citizens. This work will also provide broader support for creating common My Data practices in public administration.

The General Data Protection Regulation also includes the right to be forgotten and the principle of data portability. The latter means that the GDPR encourages data subjects to manage and make use of their own data by awarding them the right to transfer their data from one system or service provider to another. This GDPR provision does not apply to public authorities. The Act on Transport Services obliges the Finnish Transport Safety Agency (Trafi) to provide copies of an individual's personal data in a machine-readable format via an interface.

4.2.3 Securing the information base is key

Finland has world-class basic information resources on its population, businesses and built and natural environments, including coding systems and spatial data. These have enabled development of digital services, a high ranking in good governance surveys and a well-functioning society. However, the safe use of information resources has also stirred some debate.

Since many decisions that are significant for citizens are directly based on data included in basic information resources as such, the standard of quality of such data must be high. The value, quality and usability of data are made up of several elements. The quality elements of its content and structure make it possible to combine data, yielding the greatest benefits. Building such quality needs to be underpinned by clear legislation, information training and good information practices, extending from organisational information management to individual people's information-related roles and responsibilities in their activities and as information consumers.

Responsibilities for information are determined through legislation and information producers' self-regulation on the basis of widely accepted ethical principles. This makes it possible to develop a responsible information culture, which will also provide an ethical and transparent foundation for technologies and artificial intelligence. The information base can also be improved by measuring the maturity level of information management based on international standards.

While Finland has made good progress in opening up public information resources, there is still work to be done to improve the discoverability, machine-readability, classifications and descriptions of data. Finland has also made efforts to improve the interoperability of data contents. Progress has been slower elsewhere in Europe.

There are still open questions relating to whether or not the data held by the public sector should be subject to charge, and the principles are not consistent. Non-chargeability and opening of data are governed by the Directive on the re-use of public sector information (the PSI Directive). A new proposal presented by the European Commission that would further expand the opening of data is currently under consideration.

Finland has also made several decisions on opening up data at the national level, because its societal benefits have been considered to surpass any potential revenue. An example is topographic data that has formed a basis for several applications created for use by citizens. The chargeability of public data is based on the Act on Criteria for Charges Payable to the State (150/1992), but there are varying interpretations and ways of calculating costs. Differences naturally arise from the type of cost structure involved in amassing the data, but pricing is not consistent as a whole in terms of transparency and criteria. As part of implementing the new Directive at the national level, it will be possible and advisable to reconsider the policy guidelines for opening and chargeability of public sector data.

Furthermore, fostering the information base and accessibility of information essentially involve questions relating to long-term preservation and disposal of data. The issue should be examined in view of the future, history and the role of recorded information as part of humanity's memory.

Policy guidelines:

- The rights of citizens to manage and make use of their own data will be strengthened, while also clarifying the opportunities provided by law to manage personal data held by the public administration.
- The availability of information will be ensured by investing in data production, data access, access control, quality and interoperability.
- The integrity and confidentiality of information will be ensured by means of both information management, processing and sharing models and adequate competencies.
- The information critical to society will be identified while securing its accessibility and protection and the continuity of activities.
- Security will be ensured by means of standards, certifications and audits as well as impact assessments.
- Long-term preservation of digital data and data sets will be ensured.
- The effects of the chargeability and non-chargeability of data will be widely studied policy guidelines for the principles of chargeability and non-chargeability of data will be prepared.

4.3 Interaction between humans and machines

Not even the most sophisticated of our AI systems are capable of taking responsibility. They are incapable of bearing moral responsibility. The responsibility for decisions made by machines must rest with the individuals who delegate some of their powers of decision to systems or operate automated systems.

We need regulatory mechanisms to ensure that the use of AI systems will not give people a chance to escape responsibility. We must create practical mechanisms for management by knowledge that allow us to trace the consequences of using these systems back to the decisions made by individuals and to allocate responsibilities between people by means such as various registers and certificates. Furthermore, it is necessary to ensure that compensation systems are in place to ensure that any damages will be appropriately covered.

Efforts should be made to provide all parties with equal opportunities to assess the ethical, moral and privacy-related dimensions of AI solutions.

With many decisions, it does not necessarily make any difference to citizens whether they are made by a machine or a human being. In both cases, citizens affected by these decisions ought to be guaranteed an opportunity to receive understandable information on the grounds for such decisions. There are decisions, however, which it is not morally right to delegate to machines (such as whether to take children into care), albeit information searches and preparations of such decisions may still be computerised.

The 'black box' problem brought about by machine learning is a challenge from ethical, technological and legal perspectives alike. The black box problem refers to situations such as those where even the developers of a self-learning algorithm are not sure about the grounds for decisions made by the system or the mechanisms used to reach a decision. This entails considerable problems in terms of people's legal protection.

The transparency of algorithms and technologies is important to ensure the proper use of both artificial intelligence and the data that needs to be protected for different reasons. By way of example, the decisions made by artificial intelligence are only as good as its learning material and training algorithms allow. This is a growing area of research.

In many cases, however, the methods used in artificial intelligence and data protection are not transparent, while states also engage in indirect commercial protectionism for the benefit of national players. As a general rule, the Finnish business world involved in information security does, nevertheless, operate in keeping with the principles of transparent product information and open competition.

It is the responsibility of society to increase education, training and civic awareness so as to make it possible to respond to the demands of developing, applying and deploying AI technologies through competencies and AI literacy. Developing the division of work and cooperation between humans and machines for the benefit of citizens and society calls for recognition of the significance of human characteristics – creativity, social skills, the ability to grasp the big picture, and education and culture – and their active maintenance.

Increasing automation and developing robotics can be used to improve occupational safety by reassigning from humans to machines tasks that are too simple, dirty or dangerous for humans or require excessively fine motor skills, for example. At the same time, developments such as the growing mobility of robots and the increasing prevalence of autonomous vehicles are creating new types of risks relating to both physical safety and psychological strain. Digitalisation will further enable ever closer control of work and workers.

Moral responsibility or irresponsibility forms an essential part of being human. Artificial intelligence can be developed in a direction where it will have more and more human-like features. This is why we ought to invest in research into the human/machine relationship. In order to develop competitive and ethically and socially responsible applications to meet the needs of society, trade and industry, AI research and education need to be carried out from multidisciplinary and interdisciplinary perspectives, also paying attention to social, cognitive and ethical viewpoints in parallel with the technological dimensions.

Policy guidelines:

- Robots and AI systems will be built to promote wellbeing, to respect personal autonomy, citizens' fundamental rights and demands for justice, and to avoid causing suffering.
- Assessments will be made to determine the situations in which artificial intelligence can be used in support of decision-making processes or allowed to make independent decisions.
- Unintended multiplier effects on society should be taken into account.
- Active efforts will be made to prevent any adverse effects on the wellbeing of citizens and the safety and security of society or leading to increasing inequality.
- The regulatory mechanisms in place should ensure that the responsibilities are clear and that the parties responsible can be identified.
- Finland will promote international solutions to support trust and cybersecurity.

- Any methods used and applied in development work will be described openly while ensuring the traceability of the criteria used to make decisions.
- The safety of digital products will be improved by promoting safety certifications, standards and audits.
- The use of legislation on experimentation as part of AI development and application will be strengthened.

4.4 Competence, social inclusion and trust

4.4.1 Competence

Competent people constitute Finland's most important resource and competitive asset. Success in a global operating environment depends on the ability of citizens and organisations to produce, understand and make use of information. Information policy measures to strengthen competencies and capabilities concern the entire population.

The key competencies in terms of information policy include cognitive thinking and learning-tolearn skills, understanding phenomena, teamwork, multiliteracy, data security, and skills relating to information and communications technology (ICT). 'Information literacy' means the ability to acquire, interpret, understand, edit, produce, present and use information and the skill to assess the usefulness and validity of information. Competencies and information literacy start to develop in early childhood and continue to deepen and broaden throughout life. In order to be able to innovate and apply information creatively, people need to possess internalised knowledge and understanding. Competencies are also essentially linked to understanding of the ethical issues involved in the use of data and information.

The use of AI-based systems and technologies will have a bearing on both learning and the competencies required in the world of work. Individual differences in learning styles can be accommodated more effectively, while technologies can be harnessed to assist learning. It is necessary to increase focus on mathematical skills, communication and social skills as well as cognitive skills requiring creativity in all fields of education and training. Due to rapid and unforeseeable changes in competence requirements, education and training must provide everyone with capabilities to learn new things.

In the world of work, productivity is based more and more on situational, creative, interactive and shared problem-solving efforts, rather than on efficient repetition. There is considerable decline in the share of routine and autonomous tasks and a corresponding increase in the share of non-routine and collaborative tasks. This transformation will not, however, take place simultaneously in all fields; instead, the speed and scope of change will vary.

Characterised by increasingly complex tasks and career changes, the diverse and changing world of work will require continuous competence development throughout people's lives and careers to complement a solid and extensive educational foundation. A significant part of learning will take place at work and workplaces. Increasing the opportunities for continuous learning and motivating people to learn new things will require new solutions in legislation, taxation, the social security system, funding and development of education and training, and work-based learning.

New business operations being created at the interfaces between sectors place emphasis on combining different skill sets. Competencies, capabilities and combining various skill sets are equally important to parties operating in the private, public and third sectors, in order to ensure conditions for their growth at present and in the future.

Competence needs change rapidly and the difficulties in the availability of skilled labour are becoming an obstacle to growth and competitiveness. Finland will gain a competitive edge by consolidating the high standard of competence that forms the foundation for modernising sectors and boosting added value. Diverse contributions are being made to consolidate and maintain the entire population's broad base of competence and education, information literacy and digital skills within and outside the education system. Libraries play an important role in supporting informal learning.

4.4.2 Social inclusion

People have a sense of being equal and included in society and their own communities when they possess sufficient knowledge, skills and opportunities to participate and have a say in democratic decision-making processes. Social inclusion can be promoted by means such as ensuring that public data, functions and services are available and accessible to all citizens and that these are developed through inclusive processes.

Social inclusion involves the opportunity for individuals to learn and develop themselves throughout all stages of their lives. When people have the opportunities and capabilities to develop their knowledge and skills on their own terms and to fulfil themselves, they can also feel that they play a meaningful role in society.

In an increasingly digital society, social inclusion and accessible digital operating environments and the opportunities that these create constitute one of the conditions for human wellbeing. Besides social participation and influence, inclusion also encompasses people's sense of their own significance and the active agency in their community and society that this entails.

Advanced technologies can be used to promote equality and increase opportunities for social inclusion. This requires providing support for individuals who have difficulties functioning in digital environments. Furthermore, opportunities for social inclusion should also be guaranteed for those who cannot, at least for the time being, participate in the digital world even with support.

4.4.3 Reliability builds trust

Trust in other people, society and its institutions is a key force holding the fabric of society together, and it forms the foundation of the Finnish social model. Our trust-based society has laid the foundation for high-quality public services based on the rights of public authorities to receive comprehensive data on citizens. However, rapid social, cultural and technological transformation is challenging the Finnish trust that is based on shared values and predictability. In a complex, dynamic and closely connected operating environment, trust can be lost in an instant.

The significant role of trust becomes pronounced in a global and knowledge-intensive network economy characterised by technological communications, electronic services and increasing use of artificial intelligence.

Trust calls for transparency, responsibility and reliability. It can be upheld by ensuring clear responsibilities for information as well as the understandability, information security and data protection of digital products and services throughout their life cycles.

Serious, widespread disruptions in accessibility, availability or information security targeted at digital services, communications services or networks may jeopardise people's trust in these services. Inappropriate use of information may also undermine trust. Conversely, trust may be built up by preparing for disruptions and emergencies.

Trust is considered to be one of the key competitive assets on the AI market. The reliability of artificial intelligence can be promoted by means of high-quality and properly classified and described data from different sectors of society, while also ensuring data protection and security. Training artificial intelligence requires ethical standards in order to ensure the quality, reliability and representativity of data. In addition to transparent practices and the reliability of data processing and sharing, we need an ethical foundation for and solid competence in algorithm and architecture development.

As autonomous functionalities and systems develop and become more common, it will be of the utmost importance to ensure that the systems comply with ethical principles, legal statutes and agreed operating models.

The security of AI-based solutions must be ensured as part of comprehensive system-level security assessments. Special attention must be paid to the information security of autonomous systems critical to society. Where required, operations must resort to old but reliable technology. Making use of artificial intelligence as part of auditing AI systems is a newly developing area.

In order to audit autonomous systems, we need standards and a multi-step quality assessment framework taking into account both general requirements and those relating to specific use cases.

Policy guidelines:

- Contributions will be made to consolidate and maintain the entire population's broad base of competence and education, information literacy and digital skills within and outside the education system.
- Efforts will be made to reinforce the role of libraries as environments enabling the acquisition of information, its creative use and informal learning.
- The ability to foresight competence needs will be developed by strengthening research and the relevant information base.
- Efforts will be made to ensure geographically comprehensive provision of digital support services.
- The national standard of competence will especially be safeguarded from the perspective of readiness, preparedness and AI security.
- Active citizenship will be supported by making public data, functions and services accessible to everyone.
- Special measures will be geared towards consolidating the sense of social inclusion and participation opportunities among more vulnerable groups by means such as social innovations.

4.5 Strengthening the competitiveness of the data economy

4.5.1 The principles and economies of scale of the data economy

The economy has always been based on information and exchange of information. As a result of advancements in digital technology, the amount of information has increased exponentially. As more and more information has been made available in a digital format and as data processing and transmission technologies have developed, a market has emerged for data itself, known as the 'information economy' or the 'data economy'. The data economy involves significant spillover effects, which are growing constantly as goods, services and various commercial solutions are increasingly based on information technology, digitalisation and use of information.

The role of information as an economic driver is projected to grow even more, as cloud services and virtually infinite data storage and processing opportunities, complete with the development of artificial intelligence, will continue to accelerate the transformation of traditional economic value chains. New technologies and widespread use of data and information have a powerful impact on society, services and corporate revenue-generation models and, consequently, on the accumulation and distribution of value between countries.

From the perspective of the efficiency of the data economy, open access to information is of great value. Creating a genuinely open and transparent data market is the most efficient way to ensure that information will become widespread and that its asymmetry – i.e. uneven distribution – will be minimised. The asymmetry of information is expensive for societies. On the one hand, the asymmetry of information between different parties involved in the economy (where someone knows something that someone else does not) may contribute to eroding social trust. On the other, in order to stand out from competition, it is in the interests of companies and their ecosystems to build their business precisely on information and new solutions for making use of it.

Finnish businesses and ecosystems should know how to position themselves both in terms of their innovation activities and the openness of information in such a way that the value generated from their operations is funnelled into Finland so as to benefit Finnish society.

The currently winning model on the digital market is the platform economy, which brings together the new opportunities offered by digitalisation in order to create productivity and growth to meet the needs of societies. The most powerful platform companies combine networks from several sectors of society, creating a multilateral and multi-sector single global market. These companies generate their cash flows from sales of data to customers such as advertisers or from sales of more effectively targeted products and services.

Such situations may give companies in control of the platforms a monopolistic position both in horizontal and vertical terms. The underdeveloped data economy market has led to a situation where the course of the data economy is being set by a handful of global platform companies operating on a business model based on collecting and managing data on their own closed platforms. This raises challenging questions about the functioning of the market from the perspective of the distribution of taxation and societal benefits and the ethics of data use. Taxation of the resulting added value has created a global challenge which is yet to be solved. Solutions should be sought at a global level, such as through the OECD. Finland should form its own, clear position on the kind of strategy that it wants to pursue in the data economy.

Should the situation persist, states may resort to protectionist measures. Since value is created more and more by cross-border data flows, protectionist measures would undermine value creation. Competition and trade policies must pursue solutions that ensure that all national economies can take advantage of information on an equal footing.

For the time being, platform companies are mainly operating on the consumer market. The development trends in business-to-business trade are still taking shape. The most successful export companies in Finland focus their operations heavily on the investment and intermediate goods markets of industrial purchasers. The role of services in business and exports has been increasing for a long time now. As part of this development, the most advanced Finnish companies are revising their strategies to become more platform-based service enterprises.

It is essential for Finland's prosperity that Finnish companies succeed in the new model for value creation and find the operating models that ensure demand for Finnish competencies and return value to Finland. Business development and location of operations in Finland depend significantly on the fact that Finland does not only offer world-class excellence but also opportunities to implement and test new solutions based on versatile use of data. A key area for improvement is the capacity of businesses to rapidly introduce new products and services to the market.

4.5.2 Promoting competitiveness and the data market

While information is valuable in and of itself for individual parties, the key point from the perspective of society is how information is distributed. If an individual party manages to achieve a monopoly position through economies of scale, network effects and the platform economy, the asymmetry of information between parties will increase. Eliminating such asymmetry may require regulatory action by public authorities.

Since especially small and medium-sized enterprises have been overshadowed by the giants of the data economy, its playing field should be levelled. If we want to promote the data market in order to encourage healthy competition and versatile data refinement, it is necessary to significantly clarify the concepts of 'access rights' and 'management' relating to different types of information.

By adopting the General Data Protection Regulation (GDPR), the European Union has already made a value-based choice to pay special attention to protecting individuals' privacy and private lives. In order to create new services and innovations, it is necessary to specify common standards for transferring data collected by one service to another in real time and for granting and revoking access rights.

4.5.3 Incentives for investments and data sharing in business environments

When creating a framework for the data economy, it is still necessary to accept the limitations of the real economy, such as the scarcity of labour, capital and competence. This creates inertia and inflexibility that need to be reduced through active efforts. Breaking free from traditional economic limitations by means of the data economy calls for further investments in production of high-quality data. Research and innovation play a very significant role in terms of reinforcing the competitiveness of the data economy. A good research base is a prerequisite for making wide use of information and refining data into in-depth knowledge, understanding and useful applications. Without research and its international networking, it is also not possible to make use of information and research produced elsewhere.

Finland must improve its competitiveness and comprehensively support the opportunities of Finnish companies to reach the world-class level in the platform economy. This calls for development efforts carried out by many parties at many different levels.

Figure 5 from the roadmap for the digital platform economy drawn up as part of one of the Government's key projects illustrates this concept as a whole. An important part of the whole consists of key technologies and technological enablers, of which artificial intelligence may especially improve Finland's competitive position. Over the next few years, technological advancements will also provide Finnish companies with a wider range of opportunities, but the realisation of these opportunities will require, first and foremost, innovative approaches to IT solutions and business strategies. Seeking a competitive edge from combinations of these will present a continuous challenge for Finnish companies.



Figure 5. The National Roadmap to the Platform Economy; policy levels for promoting the platform economy.

Business rivalry has become more challenging than before, as businesses are now competing, not only with pay levels and labour output, but also with their ability to pull in data, process it into high-quality information and make use of it. Data, information, knowledge, competence and intelligence do not recognise borders and will nimbly move wherever the strongest incentives can be found. In this respect, there is no going back to the old times. Data market evolution will encourage businesses to look at the market value of their own data and customer satisfaction when reflecting on what types of data they should use themselves to provide better customer services and what to share with others.

Policy guidelines:

- The use of information in business will be placed front and centre in innovation policy.
- A data economy strategy will be drawn up for Finland, outlining the ground rules for taxation, data pricing and business models from the premises of an international operating environment and open market economy.
- Businesses will be encouraged to develop digital business ecosystems and business models based on artificial intelligence and the platform economy.
- Efforts will be made to consolidate a shared understanding of value creation in the digital economy and its effects on the Finnish economy within both the public and private sectors.
- Principles and practices will be created in order to develop a data economy that will benefit everyone.
- The national infrastructure required for digitalisation will be put in place.
- Any potential barriers to the use of new technologies will be eliminated in order to enable agility, rapid market access and innovations.
- Long-term contributions will be made to high-quality AI research and competencies.

5 Glossary

Algorithm

An algorithm is a detailed specification or instruction for how to perform a task or process in order to solve a specific problem.

Artificial intelligence (AI)

The concept of 'artificial intelligence' (AI) is used in many senses, even to the extent that its meaning becomes blurred. In many cases, however, it is used to refer to AI systems or applications as such. These are various types of computer software that allow machines, devices, programs, systems and services to operate intelligently – i.e. in a flexible and appropriate manner – in complex environments that are, to some extent, unforeseeable. The intelligent data processing features of an AI system are based on the data available to the AI, algorithms and the AI system architecture. Algorithms are studied making use of the methods and findings of several disciplines, such as engineering and information processing sciences, linguistics, cognitive and neurosciences, as well as physics, mathematics and philosophy.

Cybersecurity

A vision for a state in which the cyber operating environment can be trusted and in which its functions are safeguarded.

Data

String of characters, message, fact or observation that is not necessarily interpretable but that can be refined into information.

Data economy

The data economy is a measure of the value created through data market operations. Value is created in ecosystems where data is produced by some parties and processed by others.

In the data economy, data is used to develop services, products and business operations. The data economy has emerged as it has become technologically and economically possible to collect, store and transfer data on a large scale. The data economy is based on the use of data and it can be regarded as part of the information or knowledge economy. The concepts of 'data economy', 'information economy' and 'knowledge economy' are sometimes used synonymously.

Ecosystem

An ecosystem means a flexible entity in which communities, people, services and technologies are linked together through a natural customer need, utilising all operators in the ecosystem. In many cases, operational and business ecosystems accelerate innovations and improve services in a customer-centred manner. (JHKA (Julkisen hallinnon kokonaisarkkitehtuuri) Ekosysteemimalli [Public sector enterprise architecture, Ecosystem model] 0.91, 26.4.2017)

Hybrid operations

Politically motivated systematic operations used by a party to achieve its own objectives by various complimentary means, exploiting the target's weaknesses.

Information

Interpretable data that can be refined into knowledge.

Information economy; knowledge economy

Economy that is based on information and expert knowledge, where information, skills and education are seen as commercial properties. The data economy is part of the information economy.

Information policy

Commonly agreed-upon principles and policies on the operating methods and procedures that focus on the production, procurement, migration, opening, sharing, use, maintenance and storage of data.

Information security

Measures that are used to ensure the availability, integrity and confidentiality of data.

Knowledge

A justified, true belief; information that has been comprehended and internalised.

Knowledge is created when an information recipient interprets information and accepts this interpretation, which is then incorporated as part of their knowledge structure and changes its structure. Knowledge is the understanding that an individual possesses of themselves and of the world. Knowledge can also be defined as forming part of a citizen's cognitive system, which includes a wide variety of ingredients, such as beliefs, attitudes, values, opinions, facts, memories and experiences. Knowledge can be learnt and understood from an external source of information, or it may be formed internally. Knowledge may concern the state of affairs, or the ability to act and do what one wants to do. Everyday knowledge is not necessarily justified and true in a strict sense. In essence, knowledge is collaborative and is created in dialogue and interaction between citizens.

Machine learning

Machine learning is a subfield of computer engineering that usually applies statistical methods to equip computers with the ability to learn from data (i.e. to improve their performance in carrying out a certain task) without explicit programming. The methods of machine learning are used to predict and classify the outcomes of phenomena or actions.

My Data, MyData

Data (machine-readable information) pertaining to a person that the person in question can personally manage and utilise in accordance with MyData (principle).

Open application programming interface (API)

An open application programming interface refers to an interface with features that are publicly available for use without any restrictive conditions. A further prerequisite is for the API description and documentation to be made openly accessible. Users are free to use open APIs without charge and they do not have to ask an API holder's express permission or explain the purpose for which they intend to use the API.

An application programming interface (API) determines the way in which software data or services are provided to other information systems. It may either be a data interface or a functional interface. In order to be open, an application programming interface must be:

- 1. openly documented;
- 2. deployable;
- 3. testable.

Open data

Data produced or accumulated by a certain party made available for different reuse purposes by other parties free of charge and with permission. Open data can be extended, recycled and recombined in different applications. Open data may be held by the public administration, enterprises, other organisations and individuals. Examples of open data include the population statistics produced by Statistics Finland, the weather and radar observations made by the Finnish Meteorological Institute, and the topographic databases of the National Land Survey of Finland.

Platform economy

The platform economy is a quickly establishing business organisation model stemming from the development of the internet, especially used to implement rapidly scalable service packages. The best-known platform economy players include various businesses specialised in brokering goods and services, such as Amazon, Airbnb, Uber and Baidu. Another common phenomenon linked to the platform economy comprises various technological platforms on which other parties can build their products and services. These include platforms provided by Microsoft, Apple and Google, which are used by several independent developers as a basis for building their own business.

Preparedness; precautionary measures

Action taken to ensure as undisrupted performance of duties as possible and any non-routine measures that may be necessary in the event of disruption or emergency.

Link:

<u>Ministeriöiden toimenpiteet ja hankkeet tekoälyn ja tietopolitiikan alueilla</u> <u>-raportti [Report on the measures and projects of ministries in the fields of artificial intelligence and information policy],pdf</u> <u>885kB (in Finnish)</u>