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Challenges and Opportunities of Using Artificial Intelligence in the Public Sector

a Systematic Literature Review

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ABSTRACT:

The need to improve and speed up public sector processes is growing. Digitalisation and the introduction of new technologies are being promoted at a rapid pace. The debate on artificial intelligence has been hot for a long time and now the guidelines for artificial intelligence are being adopted by both the private and public sectors. This study focuses on the opportunities and challenges posed by artificial intelligence in the public sector.

The theoretical part of this thesis focuses on the concept of artificial intelligence and the ethics of AI. The study itself was conducted as a systematic literature review, in which a total of 17 studies were selected. The research material was collected from electronic databases. Precise criteria were set for the selection of the material, such as the freshness of the articles, they had to be peer-reviewed and made in English. The themes of all selected articles revolved around the relationship between artificial intelligence and the public sector. The material was analysed qualitatively according to the set research questions.

The study succeeded in highlighting the suitability of artificial intelligence for the public sector and presenting both its opportunities and risks. It was found that artificial intelligence can, at best, create efficiency, cost-savings and also serve as an excellent assistance in the public sector decision-making processes. The explicability of artificial intelligence processes and the loss of responsibility were identified as challenges in the utilization of artificial intelligence. Lack of regulations and laws can also slow down the successful implementation of artificial intelligence. In the future, special attention must be paid to the successful implementation of artificial intelligence and the creation of regulations. The need for further research was also noted. In the future, efforts could be made to study the applicability of artificial intelligence in more detail in various state institutions, for example through case studies.

KEYWORDS: Artificial intelligence, Public sector, AI ethics, AI challenges, AI opportunities

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TIIVISTELMÄ:

Tarve julkisen sektorin prosessien parantamiselle sekä nopeuttamiselle kasvaa koko ajan. Digitalisaatiota sekä uusien teknologioiden käyttöönottoa edistetään kovalla vauhdilla. Tekoälykeskustelu on käynyt kuumana jo pitkään ja nyt suuntaviivoja kohti tekoälyä aletaan ottaa sekä yksityisellä, että julkisella sektorilla. Tässä tutkimuksessa keskitytään tekoälyn tuomiin mahdollisuuksiin sekä haasteisiin julkisella sektorilla.

Tutkielman teoriaosuus keskittyi tekoälyn käsitteistöön sekä tekoälyn etiikkaan. Itse tutkimus toteutettiin systemaattisena kirjallisuuskatsauksena, johon valikoitui yhteensä 17 tutkimusta. Tutkimusaineisto kerättiin sähköisistä tietokannoista. Aineiston valintaan asetettiin tarkat kriteerit, joita olivat esimerkiksi artikkelien tuoreus, ne tuli olla vertaisarvioituja sekä englanninkielisiä. Kaikkien valittujen artikkelien teemat pyörivät tekoälyn ja julkisen sektorin välisessä suhteessa. Aineistoa analysoitiin laadullisesti mukailien asetettuja tutkimuskysymyksiä.

Tutkimuksen avulla onnistuttiin nostamaan esiin huomioita tekoälyn soveltuvuudesta julkiselle sektorille, eli sekä sen mahdollisuuksista että riskeistä. Havaittiin, että tekoäly voi parhaimmillaan luoda tehokkuutta, säästöjä sekä toimia erinomaisena apukätenä myös julkisen sektorin päätöksentekoprosesseissa. Tekoälyn hyödyntämisen haasteiksi havaittiin tekoälyprosessien selitettävyyden ja vastuun kadottaminen. Myös puuttuvat sääntelyt ja lait voivat hidastaa tekoälyn onnistunutta käyttöönottoa. Tekoälyn onnistuneeseen implementointiin ja sääntelyn luomiseen tulee kiinnittää tulevaisuudessa erityistä huomiota. Huomattiin myös tarve jatkotutkimuksille. Tulevaisuudessa voisi pyrkiä tutkimaan tekoälyn hyödynnettävyyttä tarkemmin eri valtion instituutioissa, esimerkiksi tapaustutkimusten avulla.

AVAINSANAT: Artificial intelligence, Public sector, AI ethics, AI challenges, AI opportunities

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Abbreviations

AI	Artificial Intelligence
ML	Machine Learning
DL	Deep Learning
ANN	Artificial Neural Networks
AGI	Artificial General Intelligence
ANI	Artificial Narrow Intelligence
AIS	Artificial Intelligence Systems
XAI	Explainable Artificial Intelligence

1 Introduction

Artificial Intelligence seems to be everywhere at the moment. It can be seen in the popular culture; it is a primary star in the areas of development both in the private and public sector and it is basically in the everyday lives of an ordinary citizen. Haenlein et al. (2019, p. 6) contemplate that the journey of artificial intelligence can be traced back to the 1940's as various scientists created the first computers. One of the most famous of them was Alan Turing who was creating a machine which helped to decode the Enigma code used by the German army in the World War II. Later on, he wrote multiple articles about creating intelligent machines and more specifically how to test their intelligence. AI is still the trend of our time and the most probably the future of our society.

Dwivedi et al. (2019) observe that the conversation about artificial intelligence has been diverse and have had some controversial remarks and debates. Some fascinate about the idea where man and machines have a great partnership and that the technologies are to augment human intelligence. Some fear that the development of full artificial intelligence could mean the very end for human race. Should humans indeed be worried about the threat posed by artificial intelligence, or should we instead exploit the opportunities it has to offer everywhere we can? Is co-existing possible? Massaron & Mueller (2016, p. 13) present that popular culture is serving an amusing tableau of AI as it is often presenting the human like side of it. But at this very moment even the most intelligent algorithms cannot present any form of self-awareness or exercise human like behaviour nor free will.

The Ministry of Economic Affairs and Employment in Finland (2017) states in their publication that if looking from the perspective of the public sector Artificial Intelligence could create an exceptional opportunity to expedite development. As the needs of the citizens change society needs to adapt more quickly and offer services as promised. A proactive society is a system that will be able to respond better and more rapidly to the needs of every citizen and their different life situations. From the point of view of an ordinary citizen, new technologies as artificial intelligence could offer many new

opportunities for better well-being. The Digital and Population Data Services Agency in Finland (2021) states that the aim of AI would be to facilitate access to services in a personalised manner in different life situations, in other words, bettering the process and making it more efficient. It is also crucial to note that the change will always involve hard transition periods with challenges and uncertainty. With all the pressure to change and adapt will measure the speed and ability of many institutions. As exploiting artificial intelligence could mean effective and more accurate processes as well as AI would therefore be a great support system for people in many areas of exploitation, which will help and facilitate the performance of tasks and improve many outcomes.

This research thus seeks to detect the challenges and opportunities of using artificial intelligence in the public sector. This thesis is built in the following way: in the first few chapters theoretical framework is presented and the key concepts of artificial intelligence are being defined. The aim for the theoretical framework is to give a solid ground for the empirical part. The fifth chapter will introduce the chosen method of research and as well offer an overview of the data used in this thesis. In the sixth chapter the findings will be presented and analysed. The thesis will end with a conclusion chapter that will bind everything together.

This study will be concluded as a systematic literature review. It will search, review, and analyse scientific articles and publications from the perspective of artificial intelligence in the public sector. This method is chosen for the reason which is the need to combine already conducted studies and publications. Salminen (2011) has stated that a literature review might not be the most used research method in the field of public administration, but it does not mean it would not be an effective one. A critical grip and vast examination can give fertile results.

2 Defining Artificial Intelligence

Defining Artificial Intelligence is a hard task, since it simply cannot be described unambiguously. AI is a large set of different methods, technologies, applications and research directions. And it is only a one part of the broad reference framework for digitalisation. Russell & Norvig (2021) states in their piece that the major limitation and an error in defining Artificial Intelligence is thinking that it would be just building machines that are intelligent when in reality it does not actually explain at all what AI really is and what makes machines intelligent. A key is to remember that it is an interdisciplinary science with multiple different approaches and the defining of it depends on the approach. According to Berryhill et al. (2019, p. 7) and OECD Recommendation on Artificial Intelligence, the current status of AI could be described as a machine-based systems that can perform predictions, recommendations and even decisions influencing real or virtual environments. And as AI is an interdisciplinary study, the terms could mean different things to different people.

Though Artificial Intelligence does not seem to have a precise definition in literature, it is often characterized in the following way: AI is a science and engineering of imitating, extending and augmenting human intelligence through artificial means and techniques to make intelligent machines. (Shi, 2011, p. 1) Some will prefer intelligence called rationality (Russell et al., 2021.) or are speaking of augmented intelligence. AI is based on these reviews trying to replicate human problem-solving practices to achieve solutions more effectively and for enhancing performance skills. The core competencies of a human-like intelligent behaviour includes perception, understanding, action and learning. Das et al. (2020, pp. 4–6) describe intelligence as a capacity to do the right thing at the right time. It is the ability to respond to the challenges and opportunities that context presents. It observes that intelligence is, in fact, a process that occurs in a specific location and at a specific time. Artificial means that something was created through a human process, which implies that humans are responsible for it. As AI occurs by and with design it can be seen as a by-product. Thus, AI is produced intentionally and on purpose.

Shi (2011, p.1) notes that as artificial intelligence's purpose is somehow imitating and extending the human intelligence but in artificial means and techniques. What can be seen in history as well is that the one of the greatest achievements for mankind is to free humans from manual labour and get machines to do the necessary work instead. To take that even further is for us to be able to profit from intelligent machines. Shi (2011) also then characterizes intelligence in the way that it involves purposeful actions, reasonable thinking as well as comprehensive capabilities to effectively adapt to the environment. So, intelligence is something that one can understand the objective world and also then apply knowledge to solve different kinds of problems. Human intelligence consists for example capability to gain experience and knowledge through learning and then apply this knowledge to problem solving. Human beings naturally have the ability to be creative, innovative and have the capacity to even understand complex questions. The goal for Artificial Intelligence would be able to succeed at imitating these features. Downing (2015, pp. 4–5) presents that intelligence could be also evaluated based on the result of a process and not based on the process itself. So, the quality and quantity of intelligence is seen by the so-called end product.

Russell & al. (2021) have explored four approaches that have defined the field of Artificial Intelligent:

1. Thinking humanly
2. Thinking rationally
3. Acting humanly
4. Acting rationally

Neittaanmäki & al. (2019) are presenting the fact that modern day AI applications are mainly based on learning from different kinds of data. Data collection is crucial and is the main source of AI to be able to work even though computers are able to solve even complex logical reasoning and calculation tasks. However, for AI it is hard to work on tasks that are presented in a difficult format that would be easy for humans to solve. In order to reach the capability of human activity level, AI should be able to learn things from

texts, speech, images and other chains of event. Still, AI algorithms are unable to add or create information solely on themselves and the quality and coverage of AI is therefore dependent on data. The processing of this data requires and uses wide range of techniques.

So, to get an even boarder view and explanation of artificial intelligence and its subsets, this chapter tries to explain the key concepts of it.

2.1 Key Concepts

A researcher in machine learning Pedro Domingos (2022) has characterized artificial intelligence in the following way:

“AI is the goal: Artificial Intelligence is the planet we are headed to. Machine learning is the rocket that is going to take us there and Big Data is the fuel.”

Thus, artificial intelligence contains so much more inside of it. In the following parts of this chapter, the key concepts are presented. Stirling (2017.) notes that AI is a very broad term since it covers everything from machine learning to general intelligence.

2.1.1 Big Data

Big data could be described as such: “it is that we do is increasingly leaving a digital trace or data, which we can use and analyse to become smarter.” (Marr, 2015, p. 9) It is not only a large database but also includes the idea of complexity and depth. Massaron et al. (2016, pp.25–26) note that the term “big data” can be a bit misleading or tell-it-all but to simplify it, it is the collection and analysis of very large amounts of disorganized and ever-increasing masses of data. As we are tracking and storing data in huge volumes it also creates many possibilities. The real value of this large volume data collection is that how we can utilize and analyse it, in other words, big data could be used to improve different kind of institutional decision-making. The broadness of big data is so massive

that humans need the help of machines and machine learning to make sense and use of big data.

McSharry & Thomas (2015, p.81) mention that over the past 20 years the amount of data had increased significantly. New data is constantly being generated for example from our social media behavior and various kinds of registers. In other words, each and one of us creates massive amounts of data every day. Data can be collected by individuals, organizations and various different agencies. The goal is often to achieve a competitive advantage and improve services. The intelligence of machines is merely based on their ability to generate and analyze data and then using the data to drive action.

The learning happens through big data and the learning algorithms are specially designed to take advantage of large amounts of data. The availability of big data is therefore crucial. Russel & al. (2021) state that the real revolution is not in the machines that calculate it but in the data itself and how can we utilize and benefit from it. Cukier & Mayer-Schönberger (2013, p. 7) characterize the big data to be a blessing in disguise since it can be messy. Using all available data in the world is possible but it comes at a cost, error may and will occur and corrupted figures will always find their way to datasets. Treating the data as imperfect from the start will give us an upper hand and will thus give us better tools to understand and work with it. In other words, messiness of big data is not inherent but instead the tools we use to measure and analyse it might have the imperfect functions. For that reason, artificial intelligence needs to learn to analyse the data effectively, fairly and precisely.

2.1.2 Machine Learning

Machine learning uses a wide spread of methods. It is a branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention, it works with big data, and it can analyse it fast and efficiently. Machine learning is already widely used in many applications today, and the technology is so advanced that we don't even realize it exists. One example is for

instance are the chat robots that can virtually assist customers and citizens with variety of issues.

Massaron et al. (2016) gives a great and a simple example of machine learning in their publication that machine learning is the use of technologies as Siri, a virtual assistant who uses speech recognition and uses advanced machine learning. The capability of a smartphone to function and learn from the user's speech is a primary example of an AI and machine learning is the technology behind it. However, machine learning and AI differs from each other a lot even though they are closely related. Massaron et al. (2016) also note that as artificial intelligence includes machine learning but on the other hand machine learning does not fully define AI. Alpaydin (2016, p.17) also notes that what machine learning provides is the learning part and it is not to be confused with intelligence, awareness or consciousness. Although machine learning is a requirement for artificial intelligence to work. So, a system that could be described as intelligent should have the ability to learn. Machine learning's core function is to be able to analyse huge amounts of data with the help on algorithms. The performance level is way faster than any human's level and as a result of that machines learning can help humans work more efficiently.

Massaron et al. (2016, pp. 20–24) states that the basis of machine learning is in math and algorithms, but as this thesis is not going to dive into the technological parts and terms it is still crucial to mention the background. The data which machine learning and algorithms rely on is not itself predictable, but the algorithms can process input data in specific ways and therefore create predictable outputs based on the data patterns. Artificial intelligence and machine learning will help to make sense of the patterns. The goal is to also know what kind of algorithms to use, and which will best suit the data you want to analyse to get the desired outcomes and goals. Algorithms are in the essence when talking about machine learning. They determine how a machine decodes big data. The specific algorithm used to perform machine learning will affect the results but also the outcome of the learning process.

Kaluza et al. (2017, p.14) note that machine learning is not trouble-free and is also lacking some qualities. In many cases it can be very successful in a very narrow direction and make predictions by using very irrelevant data and as it works only properly with the given data that the humans have provided for the machine.

2.1.3 Deep Learning and Artificial Neural Networks

Kaluza et al. (2017, pp. 15–16) present the difference of a human mind and the way of thinking from machines. A machine does not know which phenomena it should focus on and what kind of information it should use when making decisions. Whereas humans, by experience or by instinct are excellent at catching these specific features. If, however, machines could find notable features from the data given to them and understand the concept from the features by itself, it could mean it has reached the level of deep learning. Merilehto (2018) describes deep learning to be an advanced and a newer branch of machine learning. Its purpose is to optimize artificial neural networks to solve increasingly challenging problems. Deep learning differentiates from machine learning in a way that it tries to mimic the function of a human brain, even enabling systems to cluster data and make incredibly accurate predictions. Deep learning is therefore a subset of machine learning, it is also learning from a large sets of data like machine learning is but in deep learning the goal is to simulate the behaviour of the human brain.

Marr (2022) characterizes that even though both machine and deep learning are subsets of artificial intelligence, deep learning represents the next evolution of machine learning. As described earlier in machine learning algorithms created by humans are the basis for the learning process from the data and they make decisions based on what they learn from data. Deep learning on the other hand learns through an artificial neural network that acts and functions very much like a human brain and hence allowing the machine to analyse data in human like structures. So, the process in deep learning does not require a human programmer to programme and tell the machines what to do with the data. But as in machine learning, deep learning is deeply dependent on data. The

amount and quality of data will determine the process and success of deep learning. Fjelland (2020, pp. 1–4) states that neural networks could learn even when it is not given explicit instructions but also agrees that the challenge of neural networks is handling and tackling of great amounts of data.

Kwon (2011) states that artificial neural network will implement more complex data-analysis by using even more intelligent human-like application of knowledge. The goal for ANN is to processes and performances such as learning from experience and making generalizations. Dwivedi et al. (2019) observe that artificial neural networks are in the front line of the expansion and development of AI.

2.1.4 Levels of Artificial Intelligence

Goertzel & Wang (2012, pp.1–2) characterizes that artificial intelligence could be divided to three levels of AI: artificial general intelligence (AGI), artificial strong intelligence and artificial narrow/weak intelligence. Narrow AI is currently dominating the field of artificial intelligence. As presented earlier the examples of a narrow AI are virtual assistants such as Siri or Alexa. Therefore, narrow AI does not contain cognitive abilities and does not have consciousness or a mind in the same way that humans experience, which strong AI could be headed to. Fjelland (2020). has characterized AGI to be kind of in the middle of narrow and strong artificial intelligence but could be classified as a strong level of AI. Shevlin & al. (2019.) describes artificial general intelligence to be able to solve nearly all tasks humans could solve and even have cognitive abilities, therefore it has the potential to fundamentally alter our society and its functions. A machine which could operate in a wide range of environments and achieve goals would be an example of AGI. However, AGI is not being close to achieve, yet. Goertzel & Pennachin (2007, pp. 1–6) agree that artificial general intelligence aim is to be able to solve variety of complex problems also controlling itself autonomously with its own feelings, worries, weaknesses, and strengths. General intelligence denotes the ability to acquire and apply knowledge as well as reason and think, in a wide range of domains, rather than just one.

Goertzel & al. (2007) also note that researching and achieving AGI has been the main goal and original focus for several artificial intelligence researchers over the years. Goertzel (2014) however notes in his later piece that narrow artificial intelligence has become the mainstream in the field of AI. AGI and ANI do not have to exclude one another, and both can be researched and developed in the future.

Wang et al. (2021, p.2) remind about the famous Turing test, which roots can be traced back to Turing's early work with intelligent machines. With Turing's test intelligent machines can be tested whether they truly have intelligence. It works in a way that if a machine demonstrates intelligence if it can converse with a human without being detected as a machine. And even today, the Turing test is regarded as the touchstone for determining the intelligence of artificial systems.

To summarize chapter two, defining artificial intelligence can be a hard task since it has many different meanings within the AI research community. As it is interdisciplinary science with multiple approaches it will also have it an influence of the definition. In its shortness artificial intelligence could be defined as a machine that is capable of making intelligent functions and decisions, independently. Artificial intelligence includes several key areas, such as machine and deep learning and in the essence of all these is the need for quality data and the processing the huge amounts of data. The subareas of AI, such as machine learning, are already being utilized in a number of functions. Great examples are smartphones and various applications that we use in our day to day lives. Koulu & al. (2019, p.127) state that the digitalisation of public services has been one of the key themes in the development of the public sector. The expansion and exploitation of artificial intelligence systems has also come up in the debate. The use of intelligent systems as part of public sector functions should be assessed more widely taking into account both legal and ethical challenges as well as opportunities.

3 AI Ethics

When it comes to artificial intelligence and the public sector, it is natural to also raise the ethics of artificial intelligence and the challenges associated with it. Thus, this chapter presents the challenges already observed in the literature but also presents the instruments of artificial intelligence ethics.

3.1 Public Sector Ethics

Salminen (2016) highlights the importance of ethics, especially when weighing at the relationship between government and citizens. Traditionally, the three E's (efficiency, economy and effectiveness) have dominated public sector research, but the importance of the fourth E (ethics) should not be overlooked. Salminen (2016) emphasizes the following values in the field of public sector: responsibility, accountability, trust, openness and transparency. These values highlight the need to act in a transparent and equitable manner. Open and transparent governance is crucial as it improves the functioning of the public sector and ultimately the services of citizens. At best, ensuring transparency can lead to the prevention of potential abuses. However, adherence on ethical values and norms can also fail. Raymond (2009, pp. 42–43) characterizes that public servants are as well responsible for decision-making processes although regulations and norms are designed to secure decision-making, avoid abuses and mistakes that could violate public trust. These regulations should also safeguard the accountability of officials. Still, there is always a danger that ethical failure occur. Raymond (2009, p. 44) displays the term administrative evil. Administrative evil can be thought of as a bureaucratic process that encourages unethical behavior or destructive patterns, for example biased decisions. Public servants do not actively pursue such activities, but continue to follow incorrect administrative procedures. These erroneous procedure can lead to unethical as well as undesirable outcomes. Thus, could artificial intelligence act as an inhibitor of administrative evil and on the other hand what could be the potential ethical issues of AI?

3.2 Ethical Issues and Benefits of AI

Stahl (2021, pp. 38–40) has identified following ethical issues of artificial intelligence and has listed total of 39 of them in his study. This section will raise the most common of the issues: cost to innovation, lack of trust, disappearance of jobs, problems of integrity, lack of privacy, lack of transparency, bias and discrimination, unfairness, unequal power relations, misuse of personal data, negative impact of justice system, negative impact of democracy, reduction of human contact, potential criminal use, violation of fundamental human rights, lack of accountability and liability, negative impact on environment, loss of human decision-making. The following ethical issues are not only ethical in nature but also directly related to legislation. An ethical question may not rule out the possibility that the challenge is also a legal issue. While Wang et al. (2018, p. 2) have detected three different categories where ethical issues fall. Firstly, the features AI possess may give rise to ethical issues, secondly there might be human factors that could cause ethical risks and lastly the methods to teach the AI systems to be ethical. Wang et al. (2018, p. 3) characterize that bias, such as race and gender bias might be planted to AI systems by humans since it is a by-product of humans. The construction and training of artificial intelligent applications therefore must be greatly supervised. Moor (2006) has raised three possible level of how artificial intelligence could behave ethically. Either in the way, artificial intelligence controls implicit ethical agents, and the functions performed by the machine are limited in order to restrict unethical results. Another option is to have explicit agents, meaning that it is clearly stated which functions are possible and which are prohibited. The third level would be a machine with completely and fully ethical agents. In this scenario, machines would have consciousness and free will, and would be expected to operate ethically on their own will. More about ethical instruments are discussed in the following subchapter.

Stahl (2021, pp. 41–42) raises the question of privacy and data protection as the most important and frequently mentioned ethical issued concerning the use of AI. Using artificial intelligence based on machine learning poses a number of threats to data security. Artificial intelligence has the ability to detect patterns in a way it might pose privacy risks

even when there is no direct access to personal data. All the possibilities of risks cannot be detected therefore it will create more and more ethical concerns. Thus, concerns about privacy and data protection point out broader concerns about the reliability of AI systems. The opacity and unpredictability of AI systems undermine trust. For example, the results of machine learning systems depend on the data and the data should be reliable and sufficient. The reliability of artificial intelligence systems and their results will probably have to be assessed differently than other systems, precisely because of their opacity. It is more difficult to identify and address bias and discrimination when there is a lack of transparency. Wang et al. (2018, p. 2–3) agree that the data used and the outcomes of using AI systems pose privacy risks. Therefore, they for instance suggest that it is critical to consider the data used and who is in charge of the data.

The aforementioned issues may well be possible, but without a concrete experience it is still challenging to evaluate. Furthermore, the specificity and likelihood of occurrence of these issues vary greatly. Some are unavoidable, such as data protection or data concerns. Others such as lack of trust are conceivable and likely to happen. In some cases, it is clear who should handle the issues, while in others, it is not so clear. The list is thus too one-dimensional, but it offers a first sight view which ethical issues could rise. It must be processed even further in order it to be useful in determining how these issues can be addressed and what the priorities are.

However, Stahl (2021, pp. 35–37) also considers the ethical benefits of artificial intelligence, as many studies may focus solely on the potential moral problems of AI. However, artificial intelligence offers numerous technical benefits that are also linked to ethical advantages. The benefits can thus be seen in AI's efficiency, consistency, and ability to delve into large amounts of data, better than humans. There are however situations where ethical benefits such self-direction, safety and benevolence can be identified from artificial intelligence. According to Stahl (2021, p. 37) there are two approaches identifying the ethical benefits of AI: the substantive benefits and the procedure of achieving them. In practice, substantive benefits are those that are widely regarded as good in

society. One such concrete benefit could be the goals of sustainable development or the advancement of human rights by exploiting the potential of artificial intelligence. Also, according to European Commission (2019) AI really has the potential to bring ethical benefits, especially in the fields of societal well-being, innovation and helping to achieve set goals such as tackling climate change and promoting gender balance.

3.3 Ethical Instruments of AI

Well, as stated, ethics can and should be linked in all kinds of activity of humans but especially be really considered in the actions in the public sector. As the current so-called AI boom, it is crucial to examine the norms and ethics of artificial intelligence as well. Dubber et al. (2020, p.6) point out that artificial intelligence is produced intentionally and it truly occurs by and with a human desing. Thus the actions of humans are behind the production and the design of it. Coeckelbergh (2020, pp. 109–110) notes that the more responsibility we give to the AI for example in decision making the more we need to consider the attribution of moral responsibility. The essence of the issue is the question: who is responsible when something might go wrong. When humans are making decision they must understand the consequences of their actions and therefore also know their responsibility and norms and guidelines on how to do the certain actions or decisions. Dubber & al. (2020, p.5) also contemplates whether artificial intelligence could make accountability easier. It does depend on how and in what ways we use the capabilities artificioal systems provide. Increases methods can only obscure our own responsibility if they are not accompanied by appropriate measures.

A significant attention must also be made by noticing the operational environment. Who has the responsibilty in the end? The developers or the policy makers? And who should make the rules and guidelines of AI policy and AI ethics and in the last hand to AI laws. All in all, the explicability shoud be raised as one of the most important codes as it is really a moral requirement. For having responsible and accountable decision made, it is crucial to have explicability. Dignum (2018) is presenting that the ethics of artificial intelligence could be divided into at least three main fields. The first field can be

described as the integration of ethical reasoning into autonomous systems (ethics for design). The second field concerns ethics, which includes the design of various intelligent systems (ethics in design). The third field is seen as ethics, in which procedures and standards are intended to safeguard the activities of both developers and users on the basis of accepted moral principles. Thus, in terms of design, implementation, operation and management. (ethics for designer).

Rességuier & Rodrigues (2020) state that various ethics mechanisms have been emerging over the past couple of years to respond to the massive development of AI. These mechanisms include lists of principles, ethics codes, recommendations, and guidelines. Multiple policy makers and organizations are showing interest and their concerns about getting things right to ensure the ethical and responsible development of AI ethics. As it is well recognized that the implementation of artificial intelligence could go wrong without taking into consideration ethics. Harmful impacts of poor consideration could for instance be bias and discriminative decision-making, privacy infringements, loss of autonomy and even straight forward discrimination on individuals. European Commission (2019) has presented some guidelines of what features a trustworthy AI should have. These three components should work on the same time to ensure the security and trustworthiness of artificial intelligence. The components include the AI to be lawful – as respecting all applicable laws and regulations, to be ethical – respecting ethical principles and values, and to be robust – both from technical perspective while taking into account its social environment, since even the end goals are to be good, can AI systems cause unintentional harm. These requirements apply to all stakeholders involved in the life cycle of AI systems, including developers, deployers, and end users, as well as the broader society. Developers are those who conduct research, design, and/or develop AI systems. Deployers are public or private organizations that use AI systems in their business processes and to provide products and services to others. End users are those who interact with the AI system, either directly or indirectly. Finally, the broader society includes everyone who is directly or indirectly affected by AI systems. European Commission (2019) has also suggested these guidelines to be taken into consideration with

AI ethics, to have technical methods such as testing and architecture but also non technical methods such as codes of conduct, education and awareness as well as diversity and inclusive design team.

Haenlein & Kaplan (2019, pp. 10–11) still remarks that since possibly in the near future AI applications will increasingly rise and be a part of our day-to-day lives. The need for regulation grows extensively and if it is needed, in which form. Although AI is inherently objective and without prejudice, this does not rule out the possibility of bias in AI-based systems. Due to its nature, any bias existing in the data that is used to train the AI systems might persist in the data and even be amplified. Haenlein et al. (2019) state that research have shown that for example decision supporting systems might be racially biased. They suggest that rather than attempting to regulate artificial intelligence itself, the simplest approach to avoid such errors is to set commonly accepted requirements for AI algorithm testing and training.

And as it is inherent that regulations and laws must be modified and created for new technologies such as artificial intelligence. But what other instruments must be considered to construct an ethical AI. Which ethical and technical requirements are needed and what are the best practices? Jobin et al. (2019, p. 7–8) have listed various ethical principles which can be detected when focusing on AI ethics and also on the instruments which must be taken into account besides national and transnational laws. For instance, they suggest that the principle of transparency is greatly linked to instruments such as open dialogue, participation as well as the principles of democracy. An open dialogue and interaction with the developers of AI and civil servants must be secured. An opportunity for whistleblowing should also be guaranteed.

To guarantee fairness, equity and fair access to AI based systems, Jobin et al. (2019, pp. 8–9) suggest and emphasize the need for raising public awareness of artificial intelligence as well as public rights and regulation. A risk-management strategies must be integrated for preventing unethical behaviour and this would need to include active participation across different disciplines and stakeholders. As using artificial intelligence is

a complex phenomenon both private, public and third sector should be involved in creating principles for ethical use of AI. An overall trust needs to be built not only into AI systems but to the guidelines built and how can they also be evaluated and how are they interpreted.

Although Hagendorff (2020) has evaluated in his article that unfortunately in many cases the guidelines of AI ethics does not have an actual impact. Ethics may lack mechanism to reinforce even its own normative claims. The guidelines seem to be rather weak and soft. There is a crucial need to produce a concrete legislative grounds and laws for AI activity and AI systems. Ethical guidelines are needed and work as an normative instrument, but concrete laws concerning AI are being demanded. Ashok et al. (2022, pp. 13– 14) also agree that the scarcity, lack of clarity and implementation of AI ethics and principles are still causing challenges.

Hagendorff (2020) also still recognizes following ethical issues. The issue of accountability, privacy, fairness, discrimination, and bias. But he also criticises the adequacy of these guidelines in the wider social context. Coeckelbergh (2020, pp. 116– 118) also raises the problem of explicability and transparency. As examined in chapter two, artificial intelligence can be built and designed in many ways; some artificial intelligence is strictly using algorithms and so-called decision trees and making decisions based on the instructions humans have coded. Then the process of the made decision is clear and humans can thus clearly explain how did the AI came to it's conclusion. However if the decision is made by an AI which uses machine learning or even deep learning that uses neural networks the process is no longer transparent and humans cannot fully explain the decision made. As the process is no longer transparent it also loses the code of responsibility.

To conclude, the ethics of artificial intelligence is a wide and a changing field, and its development work will be an ongoing project. In order to be able to create the right kind of regulations and ethical standards, the ethical challenges as well as the ethical benefits

must be detected and defined. The ethical standards for artificial intelligence should be flexible as well as adaptable in a changing environment. Building a trustworthy AI starts with legitimate regulation and this regulation needs to include ethics.

4 Artificial Intelligence in The Public Sector

Artificial intelligence or the subsets of it are in fact being already used some ways in public institutions in Finland. For example, Kela, the Social Insurance Institution as well the Finnish Tax Administration are utilizing automation and automated decision-making in their processes. In the article of Finnish Broadcasting Company (2019) is stated that these automated processes are already being used even though there is now precise law or guidelines how much and where artificial intelligence or automation could be used. Most of these decisions made by a machine are characterized with a low level of individual familiarity and are of a standard procedure. The levels used could be characterized as so-called narrow AI and utilizing algorithms. Thus, increasing the automatization level of standard procedures has been a huge interest in the public sector as a higher level of automatization could lead to a significant cost-savings and efficiency. Autioniemi (2020, p. 5) notes that the development of artificial intelligence in the public sector must consider both knowledge of public management and public innovation. Knowledge of artificial systems itself is not enough.

The Ministry of Finance (2022) presents that creating a functional artificial intelligence programme has been one objective of the Prime Minister Marin's Government Programme. The National programme has been named as AuroraAI and the end goal would be to offer personalised services to every citizen at a right time and thus it would promote cost-savings and better public services. The programme was originally launched in 2020 and AuroraAI would already be in use in the end of 2022. The purpose of the AuroraAI programme is to introduce the use of artificial intelligence more widely in the public institutions, it would also help to break the bureaucratic silos and make connections between the agents of public sector, and this would help the citizens to function in the field and get rightful services. As the needs in a society are changing constantly, the right ways to tackle them must be found. For that reason, many nations have started their journey to benefit from the use of artificial intelligence.

Berryhill et al. (2019, pp. 73–76) report that out of 50 countries including the European Union have already existing or soon coming AI strategies. The strategies are including the aspects of experimenting AI with government work, increasing the collaboration across sectors, automation of routine processes, enhancing efficiency of civil services and even the use of artificial intelligence in governmental decision-making. The enormous potential which AI holds would probably be utilized best with governments and their services and connections with citizens. Berryhill et al. (2019, pp. 76–77) also suggest that the most immediate effect would be the help of AI with simple routine tasks and AI acting as a guidance with decision-making for more efficient and informative processes. The outcome in the end would most probably lead to better governance. Berryhill et al. (2019, pp. 78–84) also present the following sectors where AI could be a huge assistance for the public sector: healthcare, security, relationships with other sectors as well as citizens, regulation issues and even achieving sustainable development goals. Arntz et al. (2016) notes that new technologies such as artificial intelligence make it possible to improve productivity and efficiency in different organizations and thus act as a driver of change. They also have major impacts on performing tasks, processes, and effects on the ways of working. Dubber et al. (2020, p. 6) however contemplate that there is yet no evidence that AI will fundamentally or at least immediately change the cost equation since the processes of change are expensive and require time and knowledge.

Stirling (2017) has presented five possible levels of AI in the public sector and public services. In the following figure Stirling has presented the different levels of utilization of artificial intelligence. As it moves from level to level, artificial intelligence is able to perform the task assigned to it more and more independently.

Level 5	Fully automated system which never requires human intervention
Level 4	Automation – A public service runs itself unless it hits an extreme case where it requires human intervention

Level 3	Semi-autonomous – Computers monitoring and running e.g., a regulatory system
Level 2	Close supervision – Routine administration of systems e.g., energy networks with difficult decision referred to a human
Level 1	Simple augmentation – data entry, processing, identifying clusters of activity, profiling etc e.g., in fraud detection
Level 0	No automation – people powered public services

Figure 1. Five levels of AI in Public Service (Stirling, 2017, retrieved from: <https://www.oxfordinsights.com/insights/2017/7/12/five-levels-of-ai-in-public-service>)

When interpreting the figure, different views can be created, but it is more than clear that we are still far from level five, which would mean the utilization of fully automated systems. Can level five be reached? When, and would it even be safe.

Dewivi & al. (2019) remark that as the creation of more advanced level of AI technology progresses, AI could undertake more and more complex missions that even require cognitive capabilities. As a result of this, an increasing number of tasks can be performed autonomously by AI systems without human oversight or control. There are numerous reports on the advantages of AI for decision-making since AI is thought to be capable of assisting organizational employees in making better judgments and enhancing decision-making abilities. Autioniemi (2020, p.6) observes that the development of technology and digitalisation, as well as the utilization of artificial intelligence, does not create an absolute value of improvement of the public services. Decreased autonomy and increased levels e-services can lead to a reduction in face-to-face customer service, which is still considered as an important factor, and thus can even lead to dissatisfaction with the quality of services.

To summarize this chapter, it was seen important to give an overview of the public sectors and artificial intelligence's relationship at the moment. For instance, in Finland a clear state of mind concerning the utilization of artificial intelligence has been made and

other members of the European Union have adapted some future AI strategies as well. The next chapter will present the chosen method of research and in the sixth chapter, the selected data is analysed. The opportunities and challenges of artificial intelligence in the public sector will be examined more in detail in the following chapters.

5 The Research Method and Data

Chapter four will dive into the chosen method of research and will offer a closer look of a literature review. The chapter includes a portrayal of the literature review as such and will present an overview of the phases of a systematic literature review. After that, this chapter will give a detailed run-through of the search process of the data as well as the selection criteria of it.

5.1 Research Questions

After the introduction, theory and the presentation of the key concepts, the thesis will head to the research part where the research questions are set, and the research method is presented. The aim of the research is to bring together the information already collected on the potential opportunities and challenges of artificial intelligence in the public sector, but also to fill the existing research gap since the subject in total is fairly new. The study will be concluded as a systematic literature review. As this thesis will seek to find is artificial intelligence suitable for public sector the following research questions are set:

1. What are the challenges and opportunities of using AI in the public sector?
2. Is artificial intelligence applicable for the public sector?

5.2 Literature Review as A Research Method

Haaparanta & Niiniluoto (2016) state in their piece that one of the most important tasks and objectives of science is to produce new and rational information. Although one concrete statement is hardly enough to define such a broad concept this statement still separate science and from knowledge such as beliefs and information that people have gathered from surroundings over time. Hirsjärvi, Remes & Sajavaara (1997, pp. 18–27) present that information can be unreliable if it is based only on own observations and experiences. The following four but later criticized points emerged as guiding standards for

scientific knowledge in the 1900's. These scientific principles consist of universality, communality, impartiality, and criticality. Among this ethos a fair scientific study requires ethical standards. Johnson (2002, p. 7.) notes that every research process is different and unique and therefore need to utilize different approaches. All research are also flawed and a good researcher remembers to present the limitations of it. A research process is all but a linear and changes must be made throughout the process and it also becomes more focused and the best method will be found as it is proceeding. For this thesis, the chosen method of research will be a literature review.

As a research method literature review is fundamentally a technic which investigates, and reviews already produced scientific information. Though it ought not to be confused as a book review or as a summary. Salminen (2011) characterizes literature review as a method which will carry out "research into research". Thus, various studies and their results will be assembled as the basis for a new research. The method is greatly justified for example by Baumeister and Leary (1997, p. 312.) as they present five different goals for a literature review. The first objective and the most ambitious one is to involve theory development in one's literature review or indeed even provide new theories based on the material reviewed. The second goal presented is focusing more on the evaluation of the theory. In the essence of this is the published literature to provide a database from which the current author can draw outcomes and conclusions from. Thirdly comes the type of literature reviews which will produce useful and significant overviews and combinations existing literature. Such reviews can often generate valuable data in the means of combining phenomenon and building an overall picture of the theory. The fourth type is to identify and reveal problems and weaknesses. Though this type may cause more questions than answers. The fifth, final and considerably most less used category is to portray a historical development of the chosen theory.

A literature review as an administrative research technic can be seen as a mixed method of qualitative and quantitative methods. (Salminen, 2011, p. 4). When drawing the attention to the connection between the used sources as well as the technology used to

obtain the results it can be referred as a systematic literature review. Salminen (2011, p.6) has portrayed the other two types of literature reviews as narrative literature and meta-analysis. In this thesis the chosen type will be a systematic literature review. This research will also focus on the scientific articles which are produced in texts. The paper will be a qualitative research so it will aim to describe the chosen phenomenon.

5.2.1 A Systematic Literature Review

The characterizing feature of a systematic literature review is in the screening's accuracy and punctuality. Each of the studies are thoroughly reviewed and this also ensures the credibility of the method. Salminen (2011, p. 9) is describing it as a type of summary which includes the most essential content of the previous research on a particular topic. It can be seen as a very effective technique to screen and bring together significant and vital research. In order for a systematic literature review to be successful, a large amount of research material must be reviewed. Due to its comprehensive method, it can reveal surprising omissions and thus highlight the needs for more research on the topic. However, the comprehensiveness should not be taken as an absolute value as a research can also fail and remain too one-sided depending on the source choices. It is therefore important to succeed in the following four tasks: to answer a clear research question, to reduce possible bias in the retrieval of the studies, to critically assess the quality of the chosen studies and to summarize the studies as objectively as possible. If successful, a systematic literature review can be an effective way to present the results different studies and at the same time evaluate their coherence.

Metsämuuronen (2000, p. 22) points out that the aim is not only to gather as many sources as possible but also to be able to demonstrate that the researcher has familiarized one self with the selected phenomenon. The problem of focusing only on collecting the largest possible number of sources can easily occur in literature reviews. Besides on that it could procude additional problems, such as the lack of interconnection of the articles or focusing only on the sources of interest of the researcher. A broad review may also result in a lack of information on the methods by which the selected

studies were obtained. Therefore a systematic literature review can provide ways to avoid these shortcomings. And the systematicity also creates criteria for the method that can construct credibility for the research.

Salminen (2011, p. 10) also refers that evidence-based decision-making is strongly associated with systematic literature review. This means importing scientific information to support and make decisions. The aim is therefore to find the best practices from the studies in other words it is linked to the models on best practices and benchmarking. Cooper (1989, p. 13) describes that by doing a literature review one can highlight the important issues that might have been left unresolved on the previous research. It can also give a direction for the future research to uncover the maximum amount of information. Petticrew (2006, p. 2) agrees that systematic literature reviews are a great way to make sense of large amounts of information and contributing to the answers to questions about what works and what does not. Systematic literature reviews can also be executed when there is a need for identifying areas of uncertainty and areas where little or no relevant research has been previously done and where new studies are required.

As artificial intelligence is a burning phenomenon at the moment using a literature review therefore provides an excellent framework for combining and comparing studies that are already carried out on the subject. Baumaister et al. (1997, p. 113) state that when studies are combined and similarities sought, it is possible to be able to answer more board questions. Literature reviews can serve as important tools for many disciplines in closing the research gaps that individual studies can leave. A comprehensive research into multiple different studies and their results can offer essential information. As a relatively large amount of scientific research on the topic has already been produced, the use of this method is justified.

5.3 The Phases of a Literature Review

As the chosen method of research for this thesis is a literature review and more closely looked a systematic literature review, it is only natural to utilize Arlene Fink's (2020) model the seven steps in conducting of research literature review. The model consists of total seven steps which are presented next on the figure. The figure is an illustration of the Fink's model.

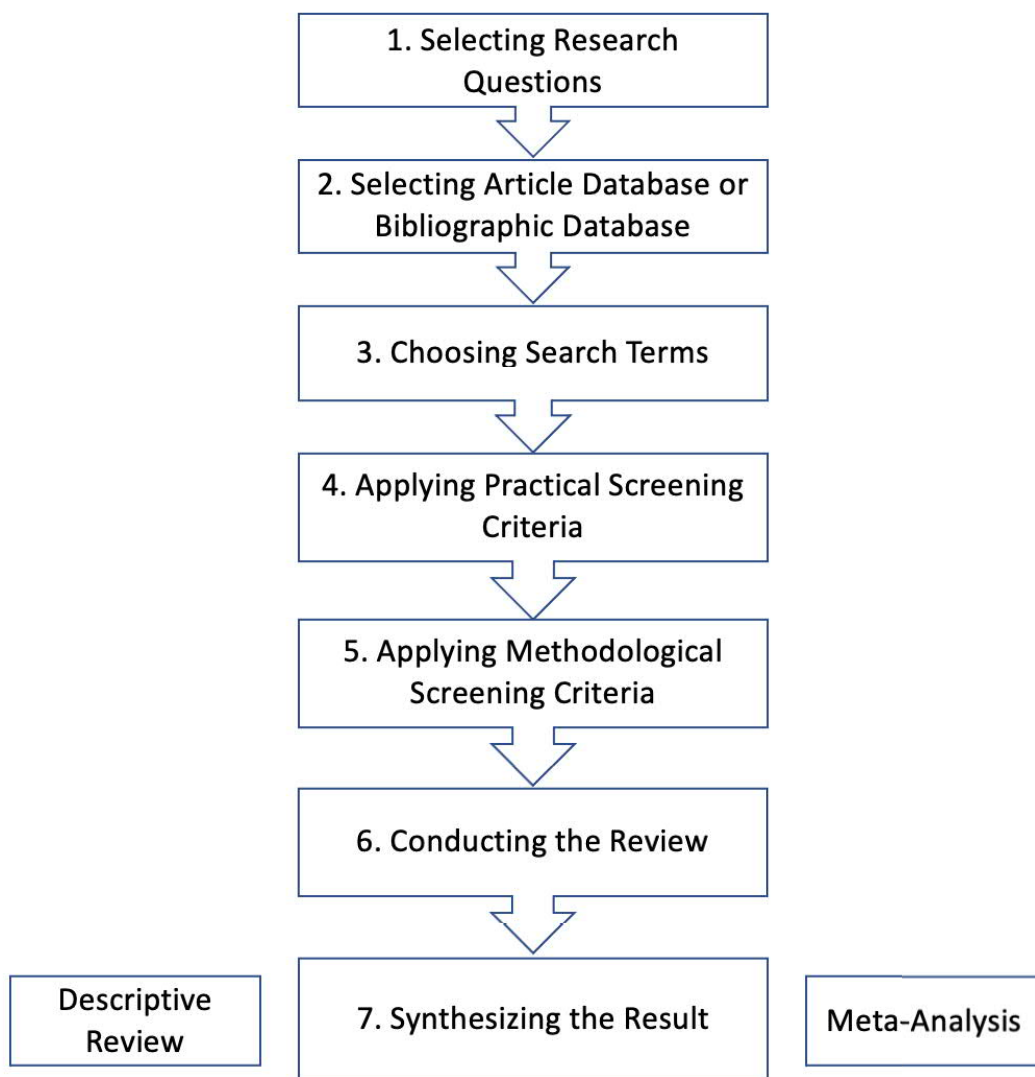


Figure 2. Seven Steps in Conducting a Literature Review (adapted from Fink, A., 2020, p. 5)

As sketched in the figure one, Fink's seven step model in conducting a literature review consists of total seven steps and is quite straightforward on how to proceed with the research process. Fink (2020, pp. 6–7) introduces the seven steps followingly. In the first stage of the model a clear research question is set. Setting a clear research question is a crucial task since it guides the making of the whole review. In the second stage the literature and the databases are selected. The third step consists of choosing the appropriate search terms and phrases. Search terms are used to screen the databases to find relevant articles and to eliminate unnecessary material. They should be formed in a way that they frame the research topic and questions.

In the following stage Fink (2020, pp. 6–7.) presents are the phases of reviewing the sources. In the fourth step, the practical criteria for the search are defined in other words the search results are narrowed down for example by choosing the wanted language and the years of publication of the articles. There could be huge numbers of search results but only few of them may be relevant for one's research, therefore defining the phrases is important. In the fifth stage the results are screened methodically with the aim of selecting the highest quality studies possible. In the sixth step the review itself is being conducted. In order for the review to be reliable, it should be conducted in the most standardized format possible, meaning that the data on the selected articles will be abstracted in a specified manner. The seventh and final step is to synthesize the results. The results can be presented either descriptively or by performing a meta-analysis. This review and the final synthesis will be done descriptively. The descriptive synthesis consists of the researcher's interpretations of the results of the review. The results are based on the reviewers' experience and the quality and the content of the data. Salminen (2011, p. 10) notes that the synthesis phase can especially involve risks as the analysis of the researcher can easily become too shallow and one-sided.

5.4 The Retrieval Process

For a literature review to be successful as a research, the researcher must familiarize oneself with a wide range of potential sources and finally select the most important

articles. There is no exact limit on how many articles should be studied, but it is very unlikely that huge amounts of articles would be necessary for the study. It is also not expedient to search data without any restrictions. Fink (2020, pp. 51–57) notes that to ensure the accuracy of the screening process and to retrieve high-quality data the researcher must perform two search screens (practical and methodological) as stated earlier. The researcher can narrow down the material by defining for example the publication language and which databases or journals he or she would like to use.

It was decided to search material mainly from databases of social sciences such as Academic Search Elite (EBSCO), SAGE Journals Online, Business Source Premier (EBSCO), Emerald Journals and Wiley Online Library Journals. The search process' starting point was to utilize the web page of the library of University of Vaasa (Tritonia and Finna). There were in total 19 databases that are based on social sciences, after excluding the databases that are offering material only in other languages than English there were total 16 databases left. One demarcation was to exclude the surveys that are not in English.

In the next stage of the data retrieval, experimental searches were carried out in various databases from which it was possible to select the most fruitful platforms for this particular research. After doing the initial screening with the results given the following databases were selected after the experimental searches: Academic Search Elite (EBSCO), Business Source Premier (EBSCO), Oxford Academic, SAGE Journals Online and Taylor & Francis Online. The data search was also carried out with the help of Google Scholar which can provide significant information and articles that are essential for the research. The purpose of this thesis is to examine the opportunities and challenges of artificial intelligence in the public sector thus different search terms were rotated between the following words: Artificial Intelligence, AI, A.I., Public Sector, Government, Benefits, Challenges. It took time to find the suitable search terms since not all the terms thought ended up being used as they yielded thousands of results and it would have been too time consuming and not at all practical to go through all of them. It is therefore

important to limit the search result to minimum for the researcher to be able to have the opportunity to look more closely into the studies. This ensures the quality of the research.

Keywords were combined using Boolean operators. The results can be specified using the AND, OR, NOT operators. After the experimental search the following words were chosen as search terms: Artificial Intelligence or AI or A.I AND Public Sector. It was also decided to use only fairly recent studies in this thesis, the publication years were limited to the 2015 to 2022 time period. It was decided not to limit the studies based on the country or continent. The same search terms and definitions were used in all databases. The aim was also to select articles with different researchers as authors. Glasziou (2001, p. 29) therefore recommends that the more results are obtained from a variety of sources and researchers, the better and more comprehensive the summary can be constructed.

Selection criteria listed:

- studies that are carried out in English
- peer-reviewed
- full text available
- published in 2015-2022
- e-article
- keywords: artificial intelligence, ai, a.i. and public sector

As stated earlier the search terms had to be rotated for a while to find the most suitable articles for research. It was also important to find a suitable delineation of terms so that they would not produce too many search results that would be impossible to go through. As an example, after finding suitable terms in the Academic Search Elite (EBSCO) database, a total of 25 research articles were offered using the search criteria, all of which could be read through and thus select the most relevant articles for the research. Of these 25 articles, two were selected. Business Source Premier (EBSCO) also gave the

same amount of research articles, in total 25. Of those 25 articles one was selected. From SAGE Journals one article was found to be suitable for this study. Three research articles were selected from Taylor & Francis Online and from Google Scholar and Finna four articles were chosen.

After the original data search, an additional search was made to discover even more material for this research. The database of the library of university of Vaasa was used to conduct the additional search and the exact same search terms (Artificial Intelligence and Public Sector) were used as before. After careful screening, total of 6 more articles were chosen to reinforce and complement the earlier chosen data.

5.5 The Chosen Data

After the screening, a total of 17 articles were selected for this study. The articles are all from the years 2018–2021, which means that their publication time is relatively recent. One of the search criteria was the limitation of the publication years to 2015–2022. All selected studies focused on artificial intelligence and its relationship with the public sector as well as the opportunities, challenges, and future prospects.

According to Fink's model (2020), after screening the material and selecting the articles, we move on to the sixth and seventh stages of the review, in other words, making the review itself and synthesizing the material. The selected articles are presented in the table at the beginning of the sixth chapter. The studies selected for this work were the most fruitful in content, as many of the articles confirmed each other's results, but also brought out different perspectives. In the selected research articles, a literature review had been used as the research method, but case studies had also been conducted. The results have been presented using both qualitative and quantitative methods. All studies somehow addressed the relationship between AI and public sector functions or considered the impact of AI on the public sector through both opportunities and risks.

McNabb (2008, pp. 374–376) states that for a literature review to be successful, it should not be conducted as a summary of the research findings of selected articles. Efforts should be made to critically analyse the results and not highlight issues with which the researcher agrees. Reviewing articles is an important task and should be done carefully in order to highlight the key information. Petticrew (2008, pp. 125–128) reminds that the evaluation process of research methods and results should be a critical appraisal and evaluation of the quality of the research. This seeks to determine whether the study is sufficient to answer the set questions. Critical appraisal helps the researcher to give attention to all the key aspects. The studies can be done by many different methods, and these can produce bias. He also then notes that bias cannot always be avoided, and this may affect the results of the study.

The analysis of this literature review is carried out qualitatively and descriptively. Meta-analysis would have been another option for the analysis. Descriptive synthesis compiles an overall picture of the material analysed, which will hopefully bring in new research data, but at least reinforce already researched data.

6 Findings

The purpose of this study is to investigate the opportunities and challenges of artificial intelligence in the public sector. According to Fink's model (2020), data was collected and screened carefully. Based on the set criteria, a total of 17 articles were selected for this literature review. The chosen articles are next presented in a tabular form. The table will describe the authors of the articles and the publication year, then the title of the article and the publication forum/journal. The next column introduces the theme of the article, the fifth column briefly describes the research method used for each research article. Chapter six will therefore analyse the information found on these articles and seeks to answer the research questions posed in this study.

The chapter proceeds in such a way that the research results of the selected articles are categorized around three themes and these themes will present their own subcategories as well. The first theme concerns the challenges and risks posed by artificial intelligence in the public sector. The second theme deals with the opportunities provided by artificial intelligence in the public sector and the third theme deals with the directions of artificial intelligence in general.

Table 1. The Chosen Research Data

Writer(s) and the year of publication	The name of the article and the <i>publication forum</i>.	Theme	Research method
Bannister, F. & Connolly, R. (2020).	Administration by algorithm: A risk management framework. <i>Information Polity</i> .	Observing risks of AI and creating framework	Literature review
Bullock, J., Young, M. M. & Wang, Y. F. (2020).	Artificial intelligence, bureaucratic form, and discretion in public service. <i>Information Polity</i> .	Examining the relationship between AI and	Case study of two organizations

		bureaucratic discretion.	
Campion, A., Gasco-Hernandez, M., Mikhaylov, S. J. & Esteve, M. (2020).	Overcoming the Challenges of Collaboratively Adopting Artificial Intelligence in the Public Sector. <i>Social science computer review</i> .	Examining challenges AI brings while adopting AI tools.	Case study - interviews
Desouza, K. C., Dawson, G. S., & Chenok, D. (2020).	Designing, developing, and deploying artificial intelligence systems: Lessons from and for the public sector. <i>Business horizons</i> .	Examining AI applications in the public sector, observing risks and benefit.	Literature review
Di Vaio, A., Hassan, R. & Alavoine, C. (2022).	Data intelligence and analytics: A bibliometric analysis of human–Artificial intelligence in public sector decision-making effectiveness. <i>Technological forecasting & social change</i> .	Investigates how AI could improve public sector decision-making processes.	Quantitative method – bibliometric analysis
Henman, P. (2020).	Improving public services using artificial intelligence: Possibilities, pitfalls, governance. <i>Asia Pacific journal of public administration</i> .	Examining the use of AI in the public sector.	Literature review
Kaplan, A. & Haenlein, M. (2020).	Rulers of the world, unite! The challenges and opportunities of artificial intelligence. <i>Business horizons</i> .	Observing dilemmas of AI.	Framework

Smuha, N. A. (2021).	From a 'race to AI' to a 'race to AI regulation': regulatory competition for artificial intelligence. <i>Law, innovation and technology</i> .	Arguing the risks of AI in regulatory point of view.	Literature review
Sobrinho-García, I. (2021).	Artificial Intelligence Risks and Challenges in the Spanish Public Administration: An Exploratory Analysis through Expert Judgments. <i>Administrative sciences</i>	Detecting challenges artificial intelligence possess in the public administration environment.	Case study - interviews
Sousa, W. G. d., Melo, E. R. P. d., Bermejo, P. H. D. S., Farias, R. A. S. & Gomes, A. O. (2019).	How and where is artificial intelligence in the public sector going? A literature review and research agenda. <i>Government information quarterly</i> .	Applicability of artificial intelligence in the public sector.	Systematic literature review and meta-analysis with prisma protocol
Sun, T. Q. & Medaglia, R. (2019).	Mapping the challenges of Artificial Intelligence in the public sector : Evidence from public healthcare. <i>Government information quarterly</i> .	Observing challenges and benefits of AI.	Case study – Interviews
Toll, D., Lindgren, I., Melin, U. & Østergaard Madsen, C. (2019).	Artificial Intelligence in Swedish Policies: Values, Benefits, Considerations and Risks.	Mapping the benefits and risks of AI in the	Document analysis - qualitative

		government sector.	
Vogl, T., Cathrine, S., Ganesh, B. & Bright, J. (2020).	Smart Technology and the Emergence of Algorithmic Bureaucracy: Artificial Intelligence in UK Local Authorities. <i>Public administration review</i> .	Investigating the use of smart technologies in the public sector.	Surveys and interviews – mixed-method
Wang, C., Teo, T. S. & Janssen, M. (2021).	Public and private value creation using artificial intelligence: An empirical study of AI voice robot users in Chinese public sector. <i>International journal of information management</i> .	Examining value creation and artificial intelligence in the public sector.	Surveys
Wirtz, B. W., Weyerer, J. C. & Geyer, C. (2019).	Artificial Intelligence and the Public Sector—Applications and Challenges. <i>International journal of public administration</i> .	Observing AI and public sector related opportunities and challenges.	Literature review
Wirtz, B. W. & Müller, W. M. (2019).	An integrated artificial intelligence framework for public management. <i>Public management review</i> .	Risk and benefit analysis of AI and public sector.	Literature review, qualitative comparison
Wirtz, B. W., Weyerer, J. C. & Sturm, B. J. (2020).	The Dark Sides of Artificial Intelligence: An Integrated AI Governance Framework for Public Administration.	Observing risks of AI and creating recommendations.	Literature review

	<i>International journal of public administration.</i>		
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The selected research articles selected for this thesis observe the applicability of artificial intelligence in the public sector from different perspectives. Many of the articles highlighted both the risks and opportunities arising from the use of AI. Many of them also presented concrete ways these risks could be addressed and what procedures must be done before a successful utilization of AI in the public sector.

6.1 Challenges and Risks

Most of the articles highlighted the difficulty of defining artificial intelligence, the difficulty and challenge of not having a commonly agreed definition of it. Bannister et al. (2020) reinforce the idea of the diversity of artificial intelligence as it cannot be described by simple definitions alone, since it involves many different technologies and approaches. Sobrino-Garcia (2021, p. 10) support the need for a clear and homogeneous definition of artificial intelligence. In order to create intelligent machines that at best are able to think and learn, we need to be able to define the concept itself and the processes involved. Smuha (2019, p. 63) raises this issue as one crucial risk from a regulatory point of view, as it makes it inconvenient to formulate necessary regulation for AI systems. The lack of a unified definition is also a significant issue for example for governments seeking to implement AI-specific regulations. As analysing the articles, the following subcategories emerged that could pose potential risks for the applicability of artificial intelligence and have a negative effect for instance on decision-making in the public sector. Bannister et al. (2020, pp. 471–472) points out that the risks can be challenging to understand, identify and predict since there are so many different technologies involved in artificial intelligence and only fraction of them are currently in use. Kaplan et al. (2020, p. 41) also consider the same as the use of AI at the moment is merely limited to the area of so-called weak AI, hence it is hard to predict the potential risks that the use of more

advanced technology, for example the use of deep learning and artificial neural networks may pose. However, they point out that it never seems too early to prepare for future challenges.

6.1.1 The Loss of Accountability and Responsibility

The first risk theme which was detected from the articles was the loss of accountability and responsibility if utilizing artificial intelligence systems in the public sector. It could be almost a self-evident fact that if the power of making decisions is given to a machine, a loss of accountability and responsibility may emerge. Wirtz et al. (2020, p. 820) note that depending on the level at which artificial intelligence would make decisions and actions, and especially when a machine could learn independently, it can obscure the fact of who is ultimately responsible. Although people operate on the background of AI systems, they cannot predict all the outcomes. Who can then be accountable?

As artificial intelligence systems are much more capable and faster of processing large amounts of data than humans. Wirtz et al. (2019, pp. 1085–1086) therefore observe that this combination can cause the problem that the results are no longer understandable or verifiable to humans. The process thus creates a black box phenomenon, which means the process is not traceable. The role of humans would be then to be the data feeder and the recipient of the results. The process it therefore difficult to explain and the boundaries of responsibility are blurred. Wirtz et al. (2018, p. 603) though state that even if such a responsibility gap arises, people should ultimately be responsible for these decisions and the consequences. In Sobrino-Garcia's research (2021, p. 11) also was clear that the opacity and the lack of transparency is still huge issue if utilizing artificial intelligence systems. It was characterized that AI could create trust and the problem lies strongly in the human capital. Since artificial intelligence systems are created and trained by humans, the values and ideologies rise from humans.

6.1.2 The Loss of Explicability

The loss of accountability and responsibility are strongly related to explicability. Thus, Wirtz et al. (2019, p. 1086) also observe that if the control over making of a decision process and describing of the decision process is lost, then explicability is completely lost. And if explicability is lost, then control can slowly or completely shift to an artificial intelligence system. Meaning that human authorities could no longer have control of the process or that they will lose the control entirely to artificial intelligence and it would be able to make arbitrary decisions. Kaplan et al. (2020) though characterize that a case of an evil robot/machine is an extreme example, but there is serious worry of AI to spiral out of control. A black box phenomenon, in theory, could open the door for AI to outwit us. If in the future more intelligent systems are being utilized, such as deep learning, does machines get smarter and how can we then maintain control. Bannister et al. (2020, p. 474) note that while AI-assisted can be of great help in decision-making and problem-solving, it should not be blindly relied upon. Too much reliance on AI and the transfer of decision-making power to an autonomous system can create severe problems. These systems should be, if not completely, but at least partially, under human control. They further state that while the development of artificial intelligence is rapid and can be beneficial, the development itself must remain under control to avoid the worst-case scenarios.

Explicability can be linked also to the data used in the artificial intelligence processes. As much of the data has been generated in some way or another by humans. Bannister et al. (2020, pp. 475–476) points out that AI is almost never full neutral, and decisions are therefore not objective. The data entered into the systems may contain, inadvertently or intentionally, codes and values that discriminatory in nature. Bannister et al. (2020) have found that many facial recognition techniques that utilize artificial intelligence fail to identify individual with darker skin tones. Kaplan et al. (2020, p. 44) agree that AI systems could be biased from the start. Artificial intelligence is all about interpreting and learning from external data. If the data used to train AI is biased, the bias will be carried over or even amplified in the AI systems. Sobrino-Garcia (2021, p. 12) then notes that the

existence of the biases in algorithms can be determined by whoever designs the algorithm. This could be conscious or unconscious deed. Because public administrations are guardians of citizens' equal rights and opportunities, the presence of any biases in the algorithms that public administrations may use is strictly unacceptable.

Wirtz et al. (2019, p. 1086) describe that, especially in the public sector, decisions are strongly associated with human like qualities, in which emotions and empathy are also crucial, hence there is a risk that artificial intelligence will not be able to make decisions in these respects. If artificial intelligence lacks such qualities and values, is it morally legitimate to rely on fundamental decisions to be made by artificial intelligence. Therefore Wirtz et al. (2019, p. 601) suggest that for no AI systems may have a role as enhancing and helping of making the decisions but not have a total control.

6.1.3 The Loss of Safety and Privacy

Protecting one's security and privacy is especially important today. Wirtz et al. (2018, p. 604) note that as data is the heart of artificial intelligence technologies and is collected from variety of sources, the security of both individuals and the data itself must be guaranteed in the process. Data should be collected with the consent of the individuals, citizens, not in secret. Sobrino-Garcia (2021, p. 13) notes that it must be considered that the processing of personal data in public administrations involves different risks than others, and that these risks stem, at the very least, from the volume of affected subjects, the extent of the data collected, or, in many cases, the impossibility of processing personal data. Thus, the development and the design of artificial intelligence must adhere current data protection legislation.

The security aspect can also be viewed through AI applications. Wirtz et al. (2018, p. 603) point out that artificial intelligence systems are particularly vulnerable to cyber threats. Gomes de Sousa et al. (2019) observe that indeed the security threats to privacy can cause mistrust between artificial intelligence technology and citizens. Wirtz et al. (2020, p. 821) note that these issues are strongly related to regulation and the formulation of

the right laws, as well as human rights and how to secure data from third parties. Unfortunately, many parties may also use AI technology to collect data without the consent of citizens. An example of this is the collection of location data. Without the consent of the citizens, this could compromise their privacy. Desouza et al. (2020, p. 212) comment that possible security threats must be considered in time and the control of AI technologies must be increased.

Campion et al. (2020, p. 468–469) found out that one major challenge that is caused by the privacy and security concerns is the resistance of sharing data between different organizations. As argued earlier, the data is a key factor of AI systems to work and inter-organizational collaboration would be much needed to help in the successful adaptation of artificial intelligence. The lack of available data will affect the quality of the outcomes. The resistance of data sharing might be due to the lack of understanding what kind of data is being needed for various AI projects. But the main concern is still in the ethical challenges that data sharing may cause.

6.1.4 The Lack of Regulation and Ethics

These three aforementioned challenges all can be bind to the last found threat, the lack of regulation and ethics. As argued before, the public sector functions are strictly based on laws, regulations, and ethical norms as well. Therefore, the use of AI technologies must be regulated, and the actions must be based on pre-agreed norms. Wirtz et al. (2018, p. 604) highlight the challenges of regulation and ethical issues. Controlling and managing AI will be a challenging task, especially if moving to a more advanced level in artificial intelligence applications, such as deep learning and neural networks. The creation of global and flexible governance is also a challenge since the focus should be on the national legal systems of different countries but also on the diversity of AI applications. They also point out the creation of machine ethics, but also the possibility to embed ethical principles into artificial intelligence systems so that they would be able to make moral decisions. AI systems may develop their own value system and frame of reference, which may be incompatible with the human value system. In the worst-case

scenario, machine judgment will contradict human value judgment, potentially leading to independent AI technology causing harm by turning against humans. But this would be another extreme case.

Sun et al. (2019, pp. 374–375) observe following ethical dilemmas in the ethical challenges of the use of AI in the public sector. The first dilemma concerns the lack of trust in AI-based decisions. This may be due, for example, to the fact that face-to-face transactions are still highly appreciated, and that the decision comes from a real person. These values are related to humanity, such as empathy and understanding. Clarity and explicability of the decision chain is also an important factor. These can be difficult to detect behind the decisions made by AI. Wirtz et al. (2019, p. 821) also raise the issue of AI discrimination, which is one of the severest challenges. As discussed earlier, the algorithms behind artificial intelligence systems may be biased and may contain prejudices. The decisions then are not at all objective. Another problem is that if AI learn from these algorithms the AI could learn false associations and will incorporate them into future data processing as well.

The other unethical issue Sun et al. (2019, pp. 374–375) observe concerns the unethical use of data sharing. For instance, data sharing between public sector institutions may pose challenges of misuse. Wirtz et al. (2019, p. 822.) suggest that in order to build trust between artificial intelligence and citizens, public administration must concretely show it by creating and following good governance, AI governance. Toll et al. (2019, p. 308–309) also raise the issue of the commitment of both citizens and other stakeholders, as it is the participation and commitment of citizens that increases credit and promotes digitalisation and its development. Thus, AI may not act as an enabler for citizen engagement, although the power of digitalization would be best to use to increase the engagement of citizens. Smuha (2019, p. 65) argues that what can be challenging since not all AI-based systems pose the same need for same regulation. The risks are therefore context as well as domain specific. Many things ought to be reconsidered while creating functional regulation. She however notes that the race for benefiting of AI will also

create a race of creating AI regulation, which will therefore be an opportunity for artificial intelligence systems to flourish.

Well, as argued the issues raised clearly show that regulation and guidelines for the use of artificial intelligence need to be developed. Kaplan et al. (2020, p. 44) however notice that too little regulation will inevitably result in civil rights violations, while too much may encourage AI driven know-how and firms relocate their AI investments to another jurisdiction.

Other notable challenges to be considered include the economic issues of both in the implementation of artificial intelligence technology and the disadvantages it may cause. It is not self-evident that the advantages AI could offer would benefit all groups in society. Wirtz et al. (2018, p. 606) argue that for instance, it can create a larger notch between different on socioeconomic status and thus produce more and more dissatisfaction and lack of trust. Employment could drastically change or there might appear loss of posts, meaning that people would lose their jobs. Sun et al. (2019, p. 374) identified social challenges related to unrealistic expectations for AI technology and a lack of knowledge about the values and benefits of AI technologies. But, on the other hand, artificial intelligence and its deployment could create completely new employment opportunities. This, of course, would require owning and learning new set of skills.

6.2 Opportunities

Now that we have detected the challenges using artificial intelligence in the public sector may pose it is time to move on the opportunities it can bring. Most of the articles agreed that utilizing AI could boost and enhance the efficiency level of public sector tasks. Banister (2020) characterizes that using AI could even help such administrative problems in ways not previously possible. Wirtz et al. (2019) state that the motive in the utilization of AI is to create public value.

6.2.1 Creating Efficiency

Wirtz et al. (2019, pp. 1084–1085) notice that a somewhat universal problem in the processing times of public sector organizations. The volume of cases to be processed is large and the processing times are long. The implementation of AI applications could therefore bring great relief to long processing times and thus create efficiency in the processes. One of the greatest benefits of artificial intelligence is its ability to handle huge amounts of data and do it quickly. It could also produce increasingly accurate information and guarantee the success of the decisions. Toll et al. (2019, p. 306) also found that a desirable and positive effect of using artificial intelligence systems is that it creates effective processes and save time from human workforce. Wirtz et al. (2018) agree that utilizing AI can significantly reduce administrative burden. They also argue that AI could help to create so-called virtual workforce, intelligent automation and labour and capital augmentation where AI could possibly complement the skills and competence of existing workforce. Di Vaio et al. (2022, p. 10) also agree that AI augmented systems will improve decision-making processes in the public sector as they bring overall decision and system support. In a long term, AI will boost the efficiency levels. And as it could work as a support system, AI could help boost the innovativeness and creativity of human workforce. They also suggest that organisations have now recognized that their success is primarily due to the human capital such as the experience, knowledge, and skills of their employees. Now intelligent machines could even more enhance the knowledge and skills.

Bullock et al. (2020, pp. 9–11) describes that the use of artificial intelligence would also affect the exercise of discretion of civil servants and could thus be problematic. If AI is programmed to solve the tasks assigned to it by certain rules, a case-by-case discretion become more difficult. Therefore, they suggest that AI would be directed towards tasks that require less discretion. Thus, artificial intelligence can even revolutionize administrative behaviour and the tools used in the public sector. This can create new forms of bureaucracy that public sector should be able to prepare for. On the other hand, even if new forms of bureaucracy emerge, it could also allow for new ways of exercising discretion, offering new feature for data collection, decision-making itself as well as proactive

action. All of these characteristics could help human experts perform their tasks more efficiently. Wang et al. (2021) agree that reducing discretion can help to create and improve more and more efficient processes.

However, Toll et al. (2019, pp. 307–308) point out that improving efficiency through artificial intelligence is seen only as a positive and desirable thing, and its disadvantages are not sufficiently taken into account. The downside could be the loss of jobs and the drastic changes in the needs of the public sector and the skills requirements of human workers, as argued earlier.

6.2.2 Creating Assistance

Artificial intelligence at least at the moment and probably in the future, can be seen as a partner alongside human's expertise. As argued earlier, giving AI full autonomous powers for decision-making can create a great deal of risks. Bullock (2020, pp. 8–10) therefore describes AI to be a decision support tool. He gives an example from public health insurance administration. Artificial intelligence could be used to collect large amounts of data and process the collected data quickly. It also helped to prevent health insurance fraud attempts and could therefore be an excellent tool for prediction and prevention. Identifying fraudulent attempts using both human and AI expertise could give more fruitful results. And as earlier stated Di Vaio et al. (2022, pp. 10, 13.) highlight the value and efficiency creation when intelligent systems and human workforce interact together and therefore creating more efficient and accurate processes. They also emphasize the need to embed the innovation thinking into human workforce and the training of the skills needed with artificial intelligent systems.

Wirtz et al. (2019, p. 1085) though contemplate that the lack of human expertise could partially be compensated by the power produced by AI. Meaning that human expertise could be directed toward more demanding cases and that AI would handle manual tasks. Thus, human specialists are directed to the task for which it is most needed. Artificial intelligence could also partly replace human workers by implementing intelligent

systems that automates at least some of the processes. Vogl et al. (2020, p. 952) found out that for instance, in social work context intelligent systems work greatly. Smart technologies have the advantage of being able to learn and adapt in response to inputs documented by different workers, improving pattern identification and prediction. Decision support is much needed when dealing with huge amounts of data in beyond of the human ability. Intelligent systems can then create the support needed when making decision based on large sets of data.

But let's discuss what are the actual ways that could enhance the public sector processes and how artificial intelligence could act as an assistance to human workforce. Henman (2020, p. 212) note that governments are increasingly using AI-based chatbots to help manage the enormous volumes of requests and contacts from citizens. Vogl et al. (2020, p. 949) agree that in many countries local authorities have starting to adopt new technologies in their day-to-day work, particularly utilizing autonomous agents such as chatbots. The assistance of chatbots can assist to build and create better services for the citizens and also help public administrators to perform their tasks. Using chatbots provides relief for many different tasks. The availability of services could be improved as services would be available around the clock. Citizens could turn to chatbots, including the citizens who are still unfamiliar with digital services. Such interaction would increase engagement and accessibility. So chatbots could replace some parts of human labour, but behind the scenes and building them successfully, people are still needed. Rather than completely replacing workers, automation with AI chatbots can handle more complex services than procedural tools, such as web forms and expert systems, and add another tool that could be used in tandem with existing staff to provide more efficient responses to public service queries of varying levels of complexity. This implies that work may not be transferred entirely to intelligent machines, but that responses will be composed of a mingling of material and human agents. Vogl et al. (2020) though note that the adaption of such autonomous systems requires the involvement of many stakeholders and public servants.

6.2.3 Creating Public and Private Value

Improving public services is greatly linked to creating public and private value and satisfaction to citizens. Thus, implementing artificial intelligence could be a helpful tool creating value with faster and higher quality processing and services. Wang et al. (2021) characterize that AI could have all the potential to enrich the lives of citizens as well as boost and transform private and public sector functions. They observe (2021, p. 4) that acquire both private and public value. Private value could be defined as something that citizens receive to satisfy their own needs as well as their well-being. Public value would then be the benefits citizens derive from using public services that increase the well-being of society.

Wang et al. (2021, pp. 3–4) describe that services are provided on demand and to citizens, but at the same time the aim is to provide them as cost-effective as possible. The outcomes are related to the achievements when the services have been produced and successful outcomes could be, for instance, high efficiency in resolving decisions and guaranteed services for all citizens. Trust, on the other hand, refers to the relationship between citizens and government. Trust will remain strong once the public sector has succeeded in its mission. A new addition to these three themes could be the development of digitalisation, automation, and functional e-government, assuming that they would add value and create satisfaction as well as trust. Wang et al. (2021, pp. 10–11) observed that the use of AI had a positive effect on the value generated by the services. Their study was on the use of AI voice robots. In particular, the help of voice robots created private value. Indeed, they consider that in future, the public sector should boldly reform service design and actively adopt new technologies, such as artificial intelligence, to provide citizens higher quality services. Encouraging the citizens to use new services must also be applied.

Souza et al. (2019, p. 7) observe that AI creates value for citizens in a variety of area, ranging from infrastructure to public security. for example, they found the utility of

artificial intelligence in many different industries. As an aid to health care in the prevention of diseases or as an aid to agricultural production and the construction of infrastructure.

The producer of the value in the future could be to present a completely new service design, especially if utilizing AI also changes the public administration's own practices and bureaucracy in a new way.

6.3 Overall Applicability and Directions

To summarize a little bit, the opportunities and risks are greatly linked together and need to be assessed together. Di Vaio et al. (2022, p. 1) though characterize that artificial intelligence has all the potential to revolutionize our society and its processes. Bullock et al. (2020, p.11) note that although artificial intelligence has the potential to improve the performance of increasingly complex tasks, little is known about how these applications and tools are integrated into the processes of decision-making and to the structure of public organizations. Therefore, some directions for applicability of AI will be presented next.

Sun et al. (2019, pp. 377–378) calls attention for following measurements and the need for them to the safe use of artificial intelligence in the public sector. Great attention should be paid to the operation of AI applications, but firstly the focus should be on AI management and creating guidelines. The focus should be on the governance of artificial intelligence not on governance by artificial intelligence. This requires not only public managers, but also other specialists and scientists to focus on advancing our own comprehension of AI governance rather than pushing the idea of machines replacing all human staff. Wirtz et al (2019) agree that the development of artificial intelligence in the public sector should not be left to the hands of technology experts alone, but that an understanding of the complex issues of governance which public managers pose, should be included. They also emphasize the continuous development of the skills and training of personnel. They however also highlight the skills of technology skills and specialists

since various technical issues may rise. Bannister (2019) for instance points out that AI feedback mechanisms may be partial or even non-existent. Thus, systems do not fully learn themselves or even learn the wrong things and run the risk of relying on the wrong information. The need for technological know-how is therefore also great in order to prevent such problems. The issue however might be the lack and competition of AI expertise. The question is whether the public sector has sufficient opportunities and resources to attract competence to this sector.

Furthermore Souza et al. (2019, p. 6) state that the use of AI must take place in the context of laws and policies in order to avoid mistakes, misinterpretations, prejudices, and other possible issues. It is critical to emphasize that artificial intelligence is being used as intended, otherwise, if proper control and regulation are not in place, unwanted human behaviours such as prejudice and discrimination can be replicated by the machine. Smuha (2019, p. 64) points out the need for technology-neutral regulation that is clearly focused on a specific objective, regardless the technology, whether it is a more challenging AI system or more a rule-based system. She gives an example of the European Union's General Data Protection Regulation (GDPR), which focuses on a clear objective, the protection of personal data. This regulatory approach could avoid the previously raised issue of the difficulty of defining artificial intelligence and would shift the focus to identifying and defining risks as well as the design of the human right that need to be protected. Sobrino-Garcia (2021, p. 14) also raised the need for embracing human-centric principles such as respect for human-rights, dignity, equality, and democracy. For instance, the European Union and the member states have already a strong regulatory framework that will help set the global standard for AI systems.

If these following guidelines are considered, AI could perhaps be used more and more widely in the public sector. Still given the issues raised, risk management, but also, to some extent, risk-taking along with foresight, should be increasingly integrated into the public sector. There are multiple questions to be considered when implementing a successful AI. And it seems that, in line with the themes identified, an accountability

framework needs to be built. A framework for planning, implementation, management, and control are needed as well. The benefits of artificial intelligence could outweigh the disadvantages, as long as the potential challenges can be identified in time and necessary frameworks are being made. This enforces trust among citizens and can hopefully guarantee the beneficial use of artificial intelligence.

7 Conclusion

The primary purpose of this master's thesis was to study the utilization of artificial intelligence and the opportunities and risks it brings to the public sector. The theoretical part ended up focusing on artificial intelligence as a concept and introducing its many different aspects and related ethical dilemmas. As a research method, a systematic review of the literature was used to select the articles to be used in the research. With the help of the literature review, it was possible to synthesize three different themes that had already also been set at the beginning, namely the challenges arising from the use of artificial intelligence, the possibilities, and the direction of the utilization of artificial intelligence in the public sector. These three themes were used to answer the research questions.

Challenges arising from the use of artificial intelligence were first identified in the data selected for the study. The themes raised revolve around the themes of explicability, responsibility, and lack of safety and privacy, and attention was also drawn to the fact that the use of artificial intelligence has not been properly regulated yet. Ethical dilemmas also arose, which are crucial since utilizing AI may for example cause biased decisions. It can also be seen that the challenges detected can also easily amplify each other creating more and more challenges, which public administrators and developers need to consider. This is in line with the findings Campion et al. (2020) also registered. The benefits that the use of artificial intelligence could bring to the public sector are the efficiencies it creates in a wide range of tasks. Such as handling large amounts of data accurately and quickly as well as acting as an assistance, freeing human expertise elsewhere. Therefore, AI could free, even partially, people from administrative burden and manual labour. Henman (2020, p. 212) argue that continuous advancements in automated decision-making and chatbots are expected to improve governments' as well as citizens' abilities in complex policy and administration areas. Value creation, public and private, are greatly linked to the other two themes detected.

It really seems that the development of technology and digitalisation will not stop, and the adoption of AI systems will grow, also in the public sector. Hence, it would be rather safe to argue that indeed, artificial intelligence would be applicable for the public sector and can be seen as the future tool and assistance. It seems to bring positive impacts on the processes of public sector functions and thus create better public services and create value for citizens. Artificial intelligence could be an excellent support tool for both public and private sector, a liberator of the manual labour and an innovator for new models of bureaucracy. Vogl et al. (2020, p. 953) argued that a shift from so-called traditional bureaucracy to algorithmic bureaucracy is happening in the public sector as more and more authorities are adapting autonomous agents and artificial intelligent systems in their processes. New forms of bureaucracy mean shift in the work culture as well, when more interaction, collaboration and engagement in multiple levels are needed. Campion et al. (2020) emphasize the cross-organisational collaboration and building the trust between organisations willing to adapt AI systems. Mutual trust must be strengthened, and the involvement of citizens must be reinforced. Otherwise, there is a risk of losing trust and spreading harmful disinformation.

However, the exploitation of AI is not entirely unproblematic, and public managers need to consider multiple questions before a successful implementation. One of the biggest issues is the explicability or possible inexplicability of artificial intelligence decision-making process. Wirtz et al. (2019, pp. 1085–1086) for instance observed that the combination of AI's ability to process huge amounts of data and in a quick manner will cause a so-called black box effect. That means that the process is no longer traceable and therefore difficult to explain and understand. And that of course is a huge dealbreaker, especially in the public sector, where decision should be transparent and public. de Bruijn et al. (2021) discuss in their article the concept of explainable AI (XAI), which means that the results produced by artificial intelligence and the process that lead to the result can be explained in more detail and understood by humans. This could potentially help to address the challenges and opaqueness of which AI decision-making can create and the black box phenomenon could be potentially avoided.

As Salminen (2016) has argued, that the fourth E (ethics) of public sector research must not be forgotten, it is the case also here. Ethical guidelines for artificial intelligence have been created, but they have been argued as insufficient. Many ethical issues were also detected, such as bias and discrimination of AI based decisions. As Dignum (2018) has presented, ethics for design, ethics in design and ethics for designer are needed. Meaning that ethical reasoning should be integrated in autonomous systems and in the activities of the developers as well. Laws, regulations, and structures are needed for public sector activities, but they must be proportionate to what is being sought.

In her article, Smuha (2019, p.83) highlighted the competition in both the implementation of AI technology and the creation of necessary regulation. The development and deployment of artificial intelligence are on the strategic lists of multiple organizations. The race of utilizing AI has indeed started, interesting is which companies or institutions are going take advantage of the possibilities that AI has to offer. Haenlein et al. (2019) also therefore raises concerns on the fact that how can we regulate a technology that is indeed constantly evolving. More competence on the subject and regulations are needed, both public managers and technology expertise. Artificial intelligence knowledge will certainly be a desired and sought-after skill in the future labor markets.

This study confirmed the observations already made in the previous studies and here is hoping that artificial intelligence research in the public sector would be continued. Further research into the applicability of artificial intelligence, as well as its concrete benefits and risks, should be carried out. More detailed case studies in different institutions could provide fruitful information and help develop artificial intelligence research in the public sector as well. As automation is already being used at some level in some government agencies, experience with the use of artificial intelligence technology could provide insight on how to proceed in the future. Many of the selected articles focused heavily on the challenges posed by artificial intelligence, understandably. The use of artificial intelligence is not so advanced that its benefits could have been enormous. It would be

interesting to have more concrete information and empirical research on the benefits it brings. Bullock (2020, p. 13) also highlights the need to examine in more detail the traditional issues of public administration and artificial intelligence. For example, a closer view on the relationship between principals and agents as well as the motivations agents may possess. A research gap was also found in AI ethics, since both building an ethical machine and creating functional guidelines and integrating them to already existing laws need more visibility.

7.1 Reliability and Limitations of the Study

The research method of this master's thesis was a systematic literature review, as the aim was to collect high-quality data as possible to answer the research questions. Doing a systematic literature review already in the process itself brings reliability to the research. However, there is always a possibility that the researcher will fail in his or her task. Cooper (1984, p. 61) for instance observes that after the screening phase, researcher may inadvertently lose fruitful articles. The large amount of possible material thus poses a challenge to compile a perfect data. Although artificial intelligence research is still relatively young, a great deal of research has already been conducted. Many of the studies has also been done in recent years, so it can be assumed that the results of the studies are very current.

Sarajärvi et al. (2009, p. 129) point out that the choice of the research topic itself could also be an ethical issue. Setting up a research question is challenging, and each discipline already has their own perceptions and value starting points. Research can also be driven by the researcher's personal motives, but efforts have been made to avoid these on this thesis. Therefore, in the beginning, a set-up was made to highlight both the challenges and the benefits of AI, and the aim was to present the results as objectively as possible.

The aim was to select research articles from several different authors for the review, yet in few articles same author did appear. It was nevertheless decided to include these in the study because their content was relevant. All the articles selected and analysed were

peer-reviewed. If more research articles had been selected for the study, more accurate results could have been obtained. Thus, there is a real need for further research, and the concrete benefits of artificial intelligence in different public institutions could be explored in the future, especially as case and empirical studies.

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