Hacettepe University Graduate School of Social Sciences
Department of Political Science and Public Administration
Public Administration Program

BIG QUESTIONS OF ARTIFICIAL INTELLIGENCE (AI) IN PUBLIC ADMINISTRATION AND PUBLIC POLICY

Mehmet Metin UZUN

Master's Thesis

Ankara, 2021

BIG QUESTIONS OF ARTIFICIAL INTELLIGENCE (AI) IN PUBLIC ADMINISTRATION AND PUBLIC POLICY

Mehmet Metin UZUN

Hacettepe University Graduate School of Social Sciences
Department of Political Science and Public Administration
Public Administration Program

Master's Thesis

Ankara, 2021

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my esteemed supervisor, Prof. Dr. Mete Yıldız for mentorship, invaluable advice, continuous support, and patience during my research. Prof. Yıldız's immense knowledge and plentiful experience have encouraged me in all the time of my academic research and daily life. Additionally, I am extremely grateful to Prof. Dr. Murat Önder, who always inspired me by his hardworking attitude and ambition to research. I would like to thank Prof. Dr. Mehmet Devrim Aydın, who motivated me to become an academician when I was an undergraduate student. Finally, my appreciation also goes out to the Uzun and kL families and Ezgi Kurtcu for their support and tremendous understanding during my research process

"Any sufficiently advanced technology is indistinguishable from magic."

Arthur C. Clarke

ABSTRACT

UZUN, Mehmet Metin. Big Questions of Artificial Intelligence (AI) in Public Administration and Public Policy, Master's Thesis, Ankara, 2021.

Technological advancements have created notable turning points throughout the history of humanity. Significant changes in the structures of societies are the result of modern technological discoveries. The artificial intelligence (AI) revolution and complex algorithms now affect daily lives, societies, and government structures more than ever. Governments are the main coordinators of technological change and supervisors of the general activities of modern public administration systems. Hence, public administration has specific responsibilities in the integration and regulation of AI technology. This thesis concentrates on the big questions of AI in the public administration literature. The discussion of "big questions" in public administration began in 1995 by Roberth Behn. The fundamental motivation of the big questions approach is shaped by the fact that "questions are as important as answers." Within this framework, five big questions emerge out of the AI discussion in the public administration literature. The aim of this thesis is to identify big questions and to discuss answers and solutions to these questions in the literature. To this end, in the first chapter of this thesis, the definition of AI technology and future projections of AI are examined. In the second chapter, the digitalization process in public administration, the adaptation of AI into the public sector, and the potential opportunities and threats of AI are evaluated. In the third chapter, data-driven public policy, the effect of AI and machine learning on policy making process and the concepts of public policymaking 3.0 are evaluated. In the fourth chapter, AI governance, AI regulations, AI principles and AI ethics are discussed in a holistic perspective. Thus, this thesis aims to shed light on the use of AI in public administration and endeavors to draw attention to the position and importance of the public administration discipline in AI research.

Keywords

AI, big questions, public administration, public policy, AI governance, AI regulations, AI principles.

ÖZET

UZUN, Mehmet Metin. Kamu Yönetiminde ve Kamu Politikasında Yapay Zeka (YZ) ile İlgili Büyük Sorular, Yüksek Lisans Tezi, Ankara, 2021.

Teknolojik gelişmeler, insanlık tarihi boyunca önemli dönüm noktaları meydana getirmiştir. Toplumların yapılarındaki önemli değişiklikler modern teknolojik keşiflerin sonucudur. Yapay zekâ (YZ) devrimi ve karmaşık algoritmalar günlük yaşamı, toplumları ve modern devlet yapılarını derinden etkilemektedir. Hükümetler teknolojik değişimin ana koordinatörleri ve modern kamu yönetimi sistemlerinin genel faaliyetlerinin denetleyicileridir. Bu nedenle, kamu yönetiminin YZ teknolojisinin entegrasyonu ve düzenlenmesinde belirli sorumlulukları vardır. Bu tez, kamu yönetimi literatüründeki YZ ile ilgili büyük sorularına odaklanmaktadır. Kamu yönetiminde "büyük sorular" tartışması 1995 yılında Robert Behn tarafından ortaya atılmıştır. Büyük sorular yaklaşımının temel motivasyonu, "sorular da cevaplar kadar önemlidir" perspektifinde şekillenmektedir. Bu çerçevede, kamu yönetimi literatüründe YZ ile ilgili beş büyük soru ortaya çıkmaktadır. Tezin amacı literatürdeki büyük soruları tespit etmek ve bu sorulara cevap ve çözümleri tartışmaktır. Tezin ilk bölümünde, YZ teknolojisinin tanımı ve YZ'nin geleceğe yönelik projeksiyonları incelenmiştir. İkinci bölümde, kamu yönetiminde dijitalleşme süreci, YZ'nin kamu sektörüne adaptasyonu ve YZ'nin gelecekte kamu yönetiminde ortaya koyabileceği potansiyel fırsatlar ve tehditler değerlendirilmektedir. Üçüncü bölümde, veriye dayalı kamu politikası, YZ ve makine öğreniminin kamu politikası yapım sürecindeki etkisi ve "kamu politikası oluşturma 3.0" kavramları değerlendirilmektedir. Dördüncü bölümde, YZ yönetişimi, YZ düzenlemeleri, YZ ilkeleri ve YZ etiği bütüncül bir perspektifte ele alınmaktadır. Bu tez, kamu yönetiminde ve kamu politikasında YZ'nin kullanımına ışık tutmayı amaçlamakta ve yapay zekâ araştırmalarında kamu yönetimi disiplininin konumuna ve önemine dikkat çekmektedir.

Anahtar Sözcükler

Yapay zeka, büyük sorular, kamu yönetimi, kamu politikası, YZ yönetişimi, YZ düzenlemeleri, YZ ilkeleri

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

AGI	: Artificial General Intelligence
AI	: Artificial Intelligence
ANI	: Artificial Narrow Intelligence
ASI	: Artificial Super Intelligence
COMEST	: World Commission on the Ethics of Scientific Knowledge and Technology
DEG	: Digital Era Governance
DNN	: Deep Neural Networks
DPPC	: Dynamic Public Policy Cycle
ES	: Expert System
EU	: European Union
ICT	: Information and Communication Information Technology
IGCC	: International Governance Coordination Committee
IoT	: Internet of Things
IS	: Intelligent System
IT	: Information Technology
ITU	: International Telecommunications Union
ML	: Machine Learning
NATO	: North Atlantic Treaty Organization
NGO	: Non-Governmental Organization
NLG	: Natural Language Generation
NLP	: Natural Language Processing
NPM	: New Public Management
OECD	: Organization for Economic Co-operation and Development
UK	: United Kingdom
UN	: United Nations
UNDP	: The United Nations Development Program
UNESCO	: United Nations Educational, Scientific and Cultural Organization,
USA	: United States of America

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The digital age has brought about enormous transformations in many areas, including public administration. These transformations have affected studies conducted in the fields of public administration and public policy. Today, information and communication technologies (ICT) affect the structure, functioning, performance and change of organizations more than ever. With the digital transformations being realized in the public sector, public services have started to be provided with innovative approaches. The digitization steps, which begun with the e-Government approach in the 1990s, became more widespread in the 2000s thanks to ICT and mobile applications. Especially after the 2000s, internet technology has become widespread worldwide with the developments in ICT, such as the operating system capacity of computers. In the process of transition to "information society", governments' need to strengthen and develop their technological infrastructures has become more urgent. Furthermore, the concepts of data processing and data mining entered the agenda of governments.

Different approaches to the understanding of e-Government have emerged both in academia and in practice. The ICTs covered by e-Government 1.0 focused on organizational infrastructures; e-Government 2.0 includes social media, Web 2.0 tools and open data; whereas e-Government 3.0 focuses on new developments such as data analytics-modeling, simulation, AI, and Internet of Things (IoT) (Charalabidis et al., 2019).

The Fourth Industrial Revolution, defined as Industry 4.0, consists of "AI and big data". Industry 4.0 refers to integrated smart systems which work with AI algorithms (Ing et al., 2019; Kolberg & Zühlke, 2015). In addition, AI technologies are foreseen to form a shift that will influence not only the future of the industry or the marketplace, but also the future of humankind. Karnofsky (2016) indicates that "potential future AI precipitates a transition comparable to (or more significant than) the agricultural or Industrial Revolution". The underlying reason for this is that the process brings about an important transformation not only for human beings but also for machines.

AI technology is one of the essential components of the Industry 4.0 approach which has a structure consisting of many sub-components and techniques, such as machine learning, deep learning, expert systems, and robotics. Therefore, it is difficult to settle on a deal of a single definition of AI (Russell & Norvig, 2003). In a general perspective, AI refers to "the ability of a

digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings" (Copeland, 2020). Autonomous vehicles and robots have been imagined in myths and stories since ancient times.

The term AI, which was first used in the modern sense in the 1950s, emerged as a sub-branch of computer science. However, AI today constitutes one of the fields of study of cognitive science, philosophy, psychology, economics, and even law, beyond the field of computer science. Moreover, AI is evolving into an interdisciplinary field of research that has recently gained special attention of the society, politics, and the public sector, offering a variety of new opportunities and challenges (Boyd & Wilson, 2017; Wirtz & Weyerer, 2019). In this context, the public administration discipline has started to bear on studies related to AI since the 2010s. Especially with the COVID-19 outbreak, there has been an increase in the number of studies on AI in the field of public administration. In line with the rising trends in the field, this thesis aims to reveal the various AI dimensions by focusing on unearthing the big questions of AI in public administration & policy by reviewing the literature.

AI has enormous potential in different government sectors such as infrastructure, finance, health, and the legal and justice system. AI-driven public administration applications are critical for governments to enhance the quality of life for citizens and the capacity of governance (Cath, 2018c; Dwivedi et al., 2019a; Sharma et al., 2020).

Governments are the primary supervisors, coordinators, and regulators of technologies. Accordingly, the public sector has massive data sets thanks to developments and advancements in e-Government systems and applications. Data is a "new oil" that is the "fuel" of AI. Oil has much practical utilization, but it also causes pollution and toxic waste. Similarly, big data has a series of benefits, such as data analytic and data mining, but also it has several disadvantages in terms of privacy (Hirsch, 2015). Today, on the one hand, governments provide public policies by making use of data-based decision-making. On the other hand, this situation raises the necessity for regulation and governance concerning data privacy. Data is power, and AI with big data analysis methods so as to come up with a potential for transforming existing delivery methods, supply, or upgrade infrastructure and public service. AI and big data hybridization expand the limits of the classical conception of e-Government (Jimenez-Gomez et al., 2020). Thanks to AI adoption in the public sector, the current government mechanism is being transformed into a smart government (Engstrom & Ho, 2020).

The primary purpose of public administration is to prepare and develop laws and policies, provide citizens and residents with public goods, services as well as structures necessary for civil servants to carry out their duties. Therefore, public administration has notable roles in AI.

However, the use of AI in public administration is a double-edged sword. On the one hand, policy-makers will use AI systems to improve public relations and organizational controls (Kankanhalli et al., 2019; João Reis et al., 2020; Wirtz & Weyerer, 2019). AI applications and methods provide advantages such as distributing resources, predictive analysis, and automation of procedural tasks. On the other hand, AI can harm democratic values and human rights through monitoring and surveillance applications (Feijóo et al., 2020; Mehr, 2017). This situation can create digital autocratic regimes.

This thesis underlines that governments need to establish governance frameworks to produce specific regulation, and principles for maximizing AI gains in government, as well as minimizing AI risks and threats. Because the decisions to be made today by lawmakers and policymakers are essential for the future of AI, they have started to enact strict or soft and flexible laws and regulations on AI.

Scope and Purpose

This thesis reviews the literature on AI with the objective of defining and discussing the big questions of AI from the public administration and policy perspective. The discussion of "big questions" in public administration began in 1995 by Roberth Behn with his article "The Big Questions of Public Management". Behn (1995) emphasized that any field of science is defined by the big questions it poses. Behn's (1995) approach to big questions draws attention to the fact that a field of research is not driven by data or methodology but by research questions. Since the mid-1990s, public administration academics have focused on identifying the big questions in public administration (Behn, 1995; Neumann, 1996; Kirlin, 1996). The big questions literature in public administration can be directed in two approaches. One group of academicians deal with the general discussions by addressing the big questions from a macro or common perspective on public administration. In contrast, other academicians focus on the micro perception of big questions, including specific subthemes in public administration, such as education (Denhardt, 2001), democracy (Kirlin, 1996), public value (Barry, 2009), and e- Government (Yildiz, 2013). Table 1 lists these authors and their articles about the big question's literature in chronological perspective.

One of the main objectives of this thesis is to emphasize how the big questions literature represents a position in the projection of the public administration in the "AI" context. Not only big questions but also the answers to these questions are valuable. Recently, there has been an increase in research AI in the public administration literature. The most current studies are related to specific countries' national AI strategy and policies. Nevertheless, there are several gaps in the literature regarding AI in the public policy-making process, AI governance, and AI regulations. This thesis offers a comprehensive perspective on AI governance and presents an "integrated AI governance model". In addition, this thesis discusses several topics that are related to the impact of AI on public administration by providing a theoretical perspective on universal basic income (UBI), Weberian digitalism, and digital authoritarianism issues.

The review of the literature shows that the field of public administration has difficulty in answering its big questions. The lack of consensus on the big questions is the reason why the paradigmatic progress in public administration has been stalled (French et al., 2005). Behn (1995) stated that the reason of his specific focus of big questions is to explain the role of public administration in shaping society historically and its use to develop society in the future.

Table 1. The Big Questions Literature in Public Administration

Author	Year	Title
Robert Behn	1995	The Big Question of Public Management
Francis Neuman	1996	What Makes Public Administration a Science? Or, Are Its "Big Questions" Really Big?
John Kirlin	1996	Big Question of Public Administration in a Democracy
John Kirlin	2001	Big Questions for a Significant Public Administration
Robert Denhardt,	2001	The Big Questions of Public Administration Education
Richard Callahan	2001	Challenges of (Dis) Connectedness in the "Big Questions" Methodologies in Public Administration
Robert Agranoff Michael McGuire	2001	Big Questions in Public Network Management Research
Arthur C. Brooks	2002	Can Nonprofit Management Help Answer Public Management's "Big Questions"?
Terry L. Cooper	2004	Big Questions in Administrative Ethics: A Need for Focused, Collaborative Effort
Roger A. Lohmann	2007	Charity, Philanthropy, Public Service, or Enterprise: What Are the Big Questions of Nonprofit Management Today?
Barry Bozeman	2009	Public Values Theory: Three Big Questions
Donald Moynihan, Sanjay K. Pandey	2010	The Big Question for Performance Management: Why Do Managers Use Performance Information?
G. van der Waldt	2012	Contemplating the Big Five Questions in Public Administration and Management Circulation
Mete Yildiz	2013	Big Questions of E-Government Research
Matthew S. Mingus Zhu Jing	2017	The Big Questions of Chinese Public Management Research Administration
Staci M. Zavattaro	2018	What's in a Symbol? Big Questions for Place Branding in Public Administration

Source: Author

In this context, AI technology, which is frequently a transdisciplinary locus, is one of the most fundamental discussions of the future. This thesis reviews AI applications and techniques in public administration, AI policies/ strategies, and AI governance from various dimensions. Therefore, it aims to contribute to future research on AI and public administration.

Research Questions

This thesis aims to analyze the big questions of AI in the public administration discipline, as stated above. In this context, this research evaluated the AI studies in the public administration literature around five research questions:

1. What are the different definitions of AI?
2. How can AI technologies adopt the public sector?
3. How can AI change public policy-making?
4. How should AI governance and regulations be?
5. What are the opportunities and threats of AI in the public sector?

Organization of the Thesis

Based on the big questions identified in the literature, the study consists of six parts. The chapters in the thesis aim to deal with AI in public administration from different perspectives. This research aims to create a holistic view between chapters. The research plan of the thesis is summarized below.

In the first part of the thesis, the fundamental philosophy of the big questions approach is examined in the axis of public administration literature. The big questions in public administration literature written from 1995 to the present are addressed from a macro and micro perspective. On the other hand, the approaches to the big questions of public administration academics were compared. At the end of the chapter, the classification and chronology of the big question's techniques are presented. In addition, the several big questions approach, the number of questions, and various question patterns (What, how, why, which, etc.) in the literature were analyzed.

The first chapter of the thesis deals with the technical and general approaches to AI. This section summarizes the theoretical and conceptual structure of AI technology without going into details.

First, “different definitions of AI”, “the history of AI,” and “types of AI” are discussed. In this framework, the concepts of “narrow AI”, “general AI”, and “super intelligence” have been examined. In the following parts of the department, AI methods (machine learning, deep learning, robotics, expert system, computer vision, etc.) are presented with application examples in different sectors. In the last section, controversial perceptions regarding the future of AI are given. In this section, “data booming”, “the economic potential of AI”, “future of jobs”, “AI race”, and “technological singularity” concepts are discussed.

In the second part of the thesis, a conceptual framework regarding the use of technology and digitalization in public administration is drawn. In this chapter, the digital government approach is explained with its various components. Furthermore, “e-government”, “open government”, “algorithmic government”, and “data-driven government” approaches are examined. In the last part of the chapter, the adaptation of AI to the public sector is discussed. In this section, the first studies in the literature on AI in the discipline of public administration are evaluated. In addition, AI strategies which are one of the primary efforts of AI adaptation to the public sector, are discussed in a thematic perspective. In this section, potential opportunities and threats of using AI in the public sector are analyzed. AI will bring about fundamental transformations in the public sector. Hence, new paradigms and strategies will be required in the future. In this context, “universal basic income” (UBI), “Digital Weberianism”, and “smart city” issues were discussed.

In the third part of the research, the use of AI in public policy making and AI policies are analyzed. In this chapter, the public policy approach and the conceptual perspective on public policy analysis are examined. The transition from evidence-based policy-making to data-driven public policy has been examined. In the following parts of the study, the “policy-making 2.0” approach is analyzed. The “policy-making 3.0” model, which includes using machine learning technics in public policy-making, is presented. In the last part of the study, AI in the public policy-making process/cycle and dynamic public policy cycle (DPPC) is evaluated. In addition, examples of using AI in public policy are presented.

The last part of the chapter covers the “AI governance” concept comprehensively. In this section, the central research focus of the thesis has been discussed. The main discussions about the place of AI in public administration are shaped around this chapter. In this framework, the theoretical background of the concept of governance is presented in the first section, which is the transition process from the governance approach to Digital Era Governance (DEG) has been examined. In the second part of the chapter, the definition of AI governance and layers of AI governance (social

& legal, ethical and technical layers) are discussed. In this chapter, an "integrated AI governance model" is presented. In this model, six layers of AI governance: “the technical landscape of AI”, “AI regulation”, “AI Ethics”, “AI Principles”, “Collaborative AI”, and “Global AI Governance” are categorized separately. Each layer is divided into sub-themes within itself. At the end of this chapter, a comprehensive perspective present on AI regulations and AI principles. This section provides a framework for how AI governance and AI regulation should be. In the conclusion part of the thesis, policy recommendations for Turkey's AI strategy are presented.

Research Method

This research is designed around the big questions about artificial intelligence in the public administration literature. According to Behn (1995), "scientists do not start with data or methods. Scientists start with questions". The study is conducted by the question, not by data or methodology (Behn, 1995). In this respect, firstly, the big questions in the public administration literature were identified and categorized. In order to collect and classify the big questions on AI, a deep literature review was considered as a "must".

“Literature review” describes and combines the concepts in the relevant research (Hart, 1998; Rowley & Slack, 2004). The literature review method contributes to defining the boundaries of the research questions, identifying new research topics, and determining what future studies can be. However, a systematic review focuses on bringing together all the empirical evidence that meets the predetermined eligibility criteria to answer a particular research question (Snyder, 2019). This research aims to define, review, and summarize the best possible research on a particular research question. A systematic literature review is vital to determine “which key-term to search for”, “which sources to give priority”, and which “sources to use. The systematic literature review explores clearly specified questions derived from policy or practice problems by using existing studies (Denyer & Tranfield, 2009, p. 672).

A “Artificial Intelligence”, “AI”, “public policy”, “public administration”, “algorithmic government”, “AI governance”, “AI regulation”, “AI policy”, “government AI”, “AI principle”, “AI ethics”. Accordingly, the literature review presents academic research dealing with AI in the public sector, especially those focusing on “AI governance” and “AI policy”. On the other hand, research including the key terms “local government”, “AI law”, and "national AI strategy" were excluded from the scope of the research.

However, in addition to academic studies such as articles, books, book chapters, the reports of the OECD, World Bank, and EU international institutions were combined in the research. Tink tank, NGO, and finance sector reports (PwC, Deloitte, McKinsey, Accenture) and studies of technology companies (IBM, Google, Amazon, etc.) were also included in the research. In this context, this study presents various research types in the big questions of AI in public administration.

Limitations in Research

AI has been a popular area of discussion for many disciplines in recent years. However, studies on public administration and AI are still scarce. More than 80% of the articles examined in this thesis have been published in the last five years. Therefore, the most significant limitation of the research is the lack of resources. Most of the discussions about AI in the field focus on national AI strategies. This thesis has excluded national AI strategies due to the scope of the research. Finally, in this thesis, the public administration of AI is from the central government's perspective.

CHAPTER I

CONCEPTUAL FRAMEWORK OF ARTIFICIAL INTELLIGENCE

The search for knowledge has been the greatest motivation for the progress of human civilization. The desire for knowledge and cumulative technological transformation affect the dynamics of humanity. Human history includes specific turning points. Humanity, which made tools with stones and sticks in primitive times, later learned to process metals and strengthened their civilizations parallel with technological production with much more robust tools. The technological transformation experienced in this cumulative process has opened new horizons for humanity. For example, inventions such as the “cuneiform”, “gunpowder weapon”, “steam engines”, “vaccines”, and “computers” can be considered as turning points in the development process of our civilization. Problem-solving ability is the cornerstone of human progress and its ability to surpass other living things to a great extent in the evolutionary process. However, as one of these breaking points, AI technology is the harbinger of a new age for humanity. Google CEO Sundar Pichai mentioned that “AI is one of the most important things humanity is working on. It is more profound than electricity or fire” (Petroff, 2018). However, according to Stephan Hawking, one of the world's most brilliant scientists, “AI will be 'either best or worst thing' for humanity” (Hern, 2016).

1.1. A DEFINITION OF ARTIFICIAL INTELLIGENCE

AI, which is still in its development phase, has already gone beyond being a science fiction fantasy. The development process of humanity that started two million years ago has reached a new dimension with AI and complex algorithms. For thousands of years, humankind have been attempting to explain how we think; that is, how a mere handful of objects can interpret, grasp, anticipate, and control a world that is much greater and more complex than itself. The field of AI is also moving further: it seeks not only to learn but also to construct intelligent entities (Russell & Norvig, 2016).

AI emerged as research of intelligence's essence (Simon, 1995). Before defining AI, it is necessary to define "intelligence" and reveal its differences with AI. The Cambridge Dictionary defines intelligence as “the ability to learn and understand things” (Cambridge Dictionary, 2021). Similarly, the Oxford dictionary defines intelligence as “the ability to acquire and apply knowledge and skills” (Oxford Dictionary, 2021). In this perspective, intelligence can correctly and efficiently produce solutions to complex problems in the world. In short, intelligence is the

ability to create algorithms (Köroglu, 2017). Algorithms are structures that enable us to examine our ability to solve complex problems systematically. Algorithms divide these complex problems into small units that can be easily realized by the analysis method. When these successive units are carried out sequentially, the problem is solved.

On the other hand, Simon (1996) identified four indicators that distinguish the artificial from the natural. This reveals the limits of artificial sciences:

- Artificial things are synthesized by man.
- Artificial things can mimic appearances in natural things, although they lack the reality of the latter in one or many respects.
- Artificial things can be characterized in terms of functions, purposes, and harmony.
- Artificial things are often discussed in terms of imperatives and descriptors, especially when designing.

Different definitions of intelligence are crucial for our understanding of the philosophy of AI. Intelligence in both machines and humans is a nebulous phenomenon. That's why AI researchers mostly use the concept of rationality, which refers to the ability to select the best course of action to accomplish a specific objective (AI HLEG, 2019). AI has emerged with the motivation to have rational abilities such as perception, learning, reacting, thinking, problem solving, which are unique to human intelligence. Similarly, Sandford University AI and Life in 2030 report Grosz et al (2016, p.13) mentioned that “Human intelligence has no match problem-solving and artificial worlds for sheer versatility, with the abilities to reason, achieve goals, understand and generate language... create art and music, and even write histories”.

The perspective of AI has changed constantly in the historical process. Nevertheless, it is difficult to make a single definition of AI. Each discipline, field of science, and sector handles AI within its structure. Today, AI has become one of the fields of study of philosophy, psychology, economics, and even law, beyond the branch of computer science. Therefore, AI is gradually becoming an interdisciplinary field of research. The definitions related to AI are to differentiate in every sector, organization, and also discipline. In this context, the primary meanings of AI that stand out in the literature are as follows:

- “A machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments. AI systems are designed to operate with varying levels of autonomy” (OECD, 2019b).
- “.. AI refers to systems that display intelligent behavior by analyzing their environment and taking actions - with some degree of autonomy - to achieve specific goals” (European Commission, 2019).
- “AI enables computers and other automated systems to perform tasks that have historically required human cognition and what we typically consider human decision-making abilities” (U.S AI Strategy, 2019).
- “The science and engineering of making intelligent machines” (McCarthy, 2007).
- “The science of making machines do things that would require intelligence if done by men” (Minsky, 1968).
- “Combine of thinking-acting humanly and rationally. AI may be organized into four categories: systems that think like humans. systems that act like humans. systems that think rationally. systems that act rationally” (Russell & Norvig, 2003).
- “The ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings” (Britannica,2020)
- “… can perform or augment tasks, better inform decisions, and accomplish objectives that have traditionally required human intelligence, such as planning, reasoning using partial or uncertain information, and learning” (Deloitte, 2019).
- “... is a collective term for computer systems that can sense their environment, think, and in some cases learn, and take action in response to what they're sensing and their objectives” (PWC, 2018).
- “AI is the field of computer science dedicated to solving cognitive problems commonly associated with human intelligence, such as learning, problem-solving, and pattern recognition” (Amazon, 2021).
- “Anything that makes machines act more intelligently” (IBM, 2021).

There is no single and general definition of AI. From a technical perspective, AI is not a single technology but a set of technologies. However, AI is an "umbrella concept" that encompasses and interacts with many technologies (Gasser & Almeida, 2017). Because AI covers a range of techniques and sub-disciplines, ranging from speech recognition, computer vision, and expert

systems. While these definitions are varied, there are some common themes. Mardsen (2017) addressed these themes in three approaches:

1. AI takes action. That is, AI automates intelligent actions typically performed by a human being.
2. AI is task- or result-oriented and aims to achieve goals.
3. AI can re-program itself according to what it has learned. In this framework, AI is active, dynamic, automatic, and adaptable.

When the definitions of AI are evaluated from different perspectives, each one is essential and contains variations. In the next section, the history of AI will be summarized in different time periods.

1.2. SHORT HISTORY OF ARTIFICIAL INTELLIGENCE

Although the history of AI in the modern sense is about 70 years old, the dream of AI dates back to the ancient times of history. The process that started with primitive autonomous machines turned into complex algorithms over time. The progress of AI from past to present is important for our understanding of the philosophy behind AI.

1.2.1. First Steps: Myths and Autonomous Machines

The history of AI in the history of “myths, stories, fantasies, and most of all, hopes”. The first examples of AI exist since the earliest civilizations as myths and fictional stories. The desire of man to create something similar to himself is frequently expressed in ancient civilizations. The ancient Greeks had related myths about robots. For instance, In Homer’s Iliad, one of the famous works of ancient Greek literature, self-driving machines called “tripods” are mentioned. Autonomous machines are used in Chinese and Egyptian civilizations. In the Islamic world, the scientist Al-Jazari, who lived in the 12th century during the Mamluk Empire, designed machines that operate according to mechanical and hydraulic principles. In 1651, Thomas Hobbes published “Leviathan” on the social contract. In the introductory part of the book, Hobbes pointed out that it would be possible to build an “artificial animal.”(B. G. Buchanan, 2005; Haenlein & Kaplan, 2019).

The autonomous machine has a great place in the Western world and the imagination of the modern age. For example, René Descartes, one of the most influential scholars in contemporary Western philosophy, developed approaches to AI. Based on Descartes' scientific assumption of existence, he draws an essential framework for the autonomous machine. Descartes pointed out that building autonomous machines is doomed to fail as long as it is viewed as constructing intelligent objects. According to Descartes, it is possible to create an autonomous machine as complex as animals. Moreover, Descartes pointed out that an automaton with a sufficiently developed internal mechanical structure would be considered "alive" like animals (Nath, 2010). Some early accomplishments included research on problem-solving, which included essential work in learning, representation of information, and inference. For instance, chess-playing machines of the eighteenth and nineteenth centuries, most notably "the Turk," illustrated a meaningful example of the first robotic creature. The Turk or Mechanical Turk invented the fake chess machine in 1770 by Hungarian inventor Wolfgang von Kempelen. "Mechanical Turk", a mechanical robot and controlled by someone placed in the machine, played matches with many famous figures, such as Napoleon. (Buchanan, 2005). Ironically, the notable success of AI in the modern sense was in the match between IBM Deep Blue and Kasparov, the best chess player globally.

1.2.2. The Birth of AI: Winters and Summers

After World War II, interest in technology increased even more. Electromechanical devices produced with crypto analysis requirements during World War II accelerated computer science and AI studies. It became the used model of modern electronic computers created by Turing in the days following World War II. John Von Neumann and Alan Turing were the founding fathers of the technology behind AI. In 1950, Alan Turing's article titled "Computing Machinery and Intelligence" was published. Turing was aware of the potential of computers, who wrote this article to prepare humanity for the new age. The first part of the article titled:

"I propose to consider the question. Can machines think?" This should begin with definitions of the meaning of the term's "machine" and "think.?" (Turing, 1950).

Alan Turing proposed the Turing Test, and it examines thinking machines". Turing predicted that computers could mimic all human cognitive activity the Turing test measures whether computers perform a job indistinguishably to human beings. Generally speaking, the Turing test measures

whether an expert can distinguish the machine's performance from a human (Buchanan, 2005; French, 2000; Grosz et al., 2016).

Dartmouth Summer Research Project on Artificial Intelligence (DSRPAI) is a turning point in the history of AI. The foundation of AI in the modern sense is laid in this conference. The Rockefeller Institute funded the conference. For the first time in this conference, the name artificial intelligence term was used, which brought together a group of high-level scientists in Dartmouth in 1956. Participants in this conference were recognized as the pioneers or founding fathers of artificial intelligence. These pioneers include Marvin Minsky (founder of the AI lab at the Massachusetts Institute of Technology (MIT), Claude Shannon, Nathaniel Rochester (IBM), Allen Newell (first president of the American Artificial Intelligence Association), and Nobel Prize winner Herbert Simon.(Bench-capon et al., 2012; B. G. Buchanan, 2005; Haenlein & Kaplan, 2019)

In 1959, Ord. Prof. Dr. Cahit Arf (1959) published an article titled "Can A Machine Think and How Can It Think" in Erzurum Atatürk University journal. Arf (1959) endeavored an answer to the question of whether machines can think in his article. On the other hand, Arf (1959) predicted that machines cannot be aesthetically pleasing like human beings, that human beings act on their initiative, and that machines can act on their initiative even if it takes a long time. Moreover, Arf (1959)stated that machines could not reach this level immediately.

As Arf (1959) pointed out, AI development did not happen immediately. Over time, AI winters and summers are experienced. In the history of modern AI developed in various waves, there have been pauses and a lack of interest from time to time. This situation is defined as AI winters and summers (Haenlein & Kaplan, 2019). Several AI pioneers involved in the Darthmound Summer Conference were interested in imitating high levels of human intelligence. Their work has benefited to some extent from introspection of how people solve problems. In this framework, AI studies on designing pattern recognition game programs and semantic representations concentrated in the 1950s. It supported the technical developments that took place during the 1960s with some system supports and social factors. In the 1960s, new computer languages made it easier to build AI systems. For instance, In the 1960s, ELIZA, the first chatbot, was developed by Joseph Weizenbaum at the MIT AI Laboratory (Haenlein & Kaplan, 2019). Rapid progress was performed in AI research during the 1960s and until the mid-1970s. AI laboratories and workgroups have started to be established in Europe and the U.S. In this period, advances in

natural language processing (NLP) stand out at the beginning of the important developments in AI.

On the other hand, many new and important inventions of AI entered the first flowering period in this period. However, the second half of the 1970s is referred to as the AI winter. Between 1974-1980 criticisms about AI increased, and AI's money is considered a waste. However, In the 1980s, expert systems have brought further excitement to AI studies. In this period, transformations in expert systems and robotics took place under the leadership of the Japanese. The algorithmic structures that developed in this period were brought to the field of AI, which can be defined as "deep learning", that is, the computer's use of previously stored or used information in new experiences, put forward by John Hopfield and David Rumelhart (Nilsson, 2019).

1.2.3. Intelligent Systems from 1980s to the Present

In the beginning, pioneers of AI like Marvin Minsky have taken a very optimistic attitude that AI development will proceed very fast. However, the first winter of AI, which started in the late 60s and lasted for about ten years, has returned to summer since the late 70s, and expert systems and knowledge-based learning have become popular. The expectations from AI were very high, but information engineering-based systems required very complex rules and could only perform well in a particular area. This situation would again result in decreased state support, the decrease of researchers working in these fields, and less media coverage on these issues. However, in the 80s, the interest of the film industry in AI increased. For example, the themes of AI are frequently covered in Terminator and Star Wars movies.

On the other hand, in the 1980s, AI researchers began to benefit from other sciences such as language and psychology. AI was born as a part of computer science, but since the 1980s, it has become a new and multidisciplinary field of science. In the early 1990s, studies on artificial neural networks and expert systems increased.

One of the critical turning points regarding AI is the Kasparov-Deep Blue match in 1997. For decades, computer scientists have seen chess as a threshold for AI. Chess-playing calculators appeared in the late 1970s, but it took another decade for a team of Carnegie Mellon University graduate students to produce the first computer called "Deep Thought" to beat a chess player in a regular tournament game. This success was short-lived; because, in 1989, Kasparov easily defeated Deep Thought in two matches. IBM was sufficiently impressed with Carnegie Mellon University and began recruiting researchers. It used the CMU team's technology to develop an

early version of Deep Blue. The Deep Blue team lost again to Kasparov in 1996 in a tournament in Philadelphia. In 1997, Deep blue calculation capacity doubled (36 billion in 3 minutes). Among these new features, there was the possibility to manually adjust between games to orient according to different game styles. In other words, the program code and algorithm required according to the flow of the game could be developed between games. As a result of the match of 6 sets on May 11, 1997, Deep Blue beat Kasparov with 2.5 to 3.5 points (Campbell et al., 2002). Thus, for the first time in human history, a computer defeated the world chess champion. Deep Blue won this struggle, which took place in the shadow of mutual tension and accusations. IBM would not agree to play the third match or even close the Deep Blue program and allow it to play no other games.

Deep Blue can analyze and evaluate 200 million chess positions per second. Kasparov can only examine three posts per second. On the other hand, Deep Blue's knowledge of chess is scarce, but its computational skills are enormous (Nilsson, 2019). Similarly, AlphaGo, an AI-based Go player developed by Deep Mind and Google, defeated Go master Lee Sedol in 2015. Go is a very complex game with simplistic rules. Unlike chess, all pieces have the same value, but the strategic space between each other determines the nature of the game. The movement abilities of the stones are not limited. Indeed, there are so many places where you can play a piece. There are 20 possibilities for the first half move in the game of chess, 20 options for the second half move, and 400 opportunities for a whole movement (one white and one black). However, In the game of Go, there are 361 possibilities for the first piece (black), 360 options for the second piece (white), a total of 129,960 opportunities (Silver et al., 2017). Despite Deep Blue, Alpha Go can learn without the need for large data sets and processor power. This success was achieved by using "reinforcement learning," which has been used frequently since the 2000s for the training of Alpha Go (J. X. Chen, 2016; Silver et al., 2017; Wang et al., 2016). In the 2000s, multiple AI techniques under machine learning started to develop with massive acceleration.

Since 2000, AI systems have been used in daily life. However, technology giant companies (Google, IBM, Apple, Tesla, Amazon, etc.) have increased their investments in AI, and many new applications from smart home systems to driverless cars or self-driving cars have entered our lives. With the decrease in the cost of storing data sets in the 2000s, significant developments were experienced in machine learning, especially in deep learning systems. Algorithms have become an integral part of our lives, especially with the widespread use of the internet worldwide and increased social media applications. During this period, text recognition systems and translation systems became popular. In the 2010s, there was a new boom in AI. There were two

main reasons for this. First, massive volumes of data increased, and data storage costs decreased. In addition, especially image recognition and classification systems have developed. There was a significant capacity increase in computing power to the acceleration of algorithm calculations. In parallel with data storage, computing power and computer graphics both accelerated, and its cost decreased. For example, SIRI is an intelligent personal assistant and information explorer developed by Apple and is used as part of the operating system. SIRI is to take actions such as answering questions, giving advice, searching online. Personal assistants and chatbots are AI applications that came to the fore in the 2010s. On the other hand, there has been a transition from artificial narrow intelligence to (ANI) (weak) AI to general artificial intelligence (AGI) since the 2010s.

AI started as a myth, has become one of the parts of human life over the years, which experienced various waves (winters and summers) throughout its modern history.

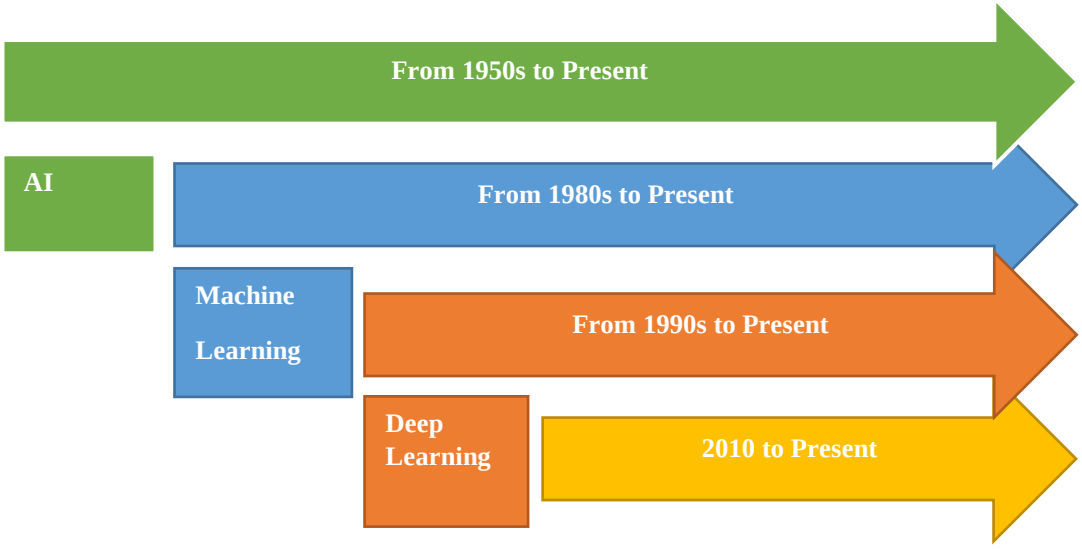

Figure 1. Changes in Artificial Intelligence Approaches: Historical Perspective

Source: Author

AI has made rapid progress since 1950. As can be seen from Figure 1, AI studies focus on different developments in different years. It is seen that the studies conducted have contributed significantly to the development of AI, a new algorithm, structure or architecture, platform, new learning algorithms, new applications, and hardware development (Haenlein & Kaplan, 2019). Many scientists from different scientific disciplines have contributed to AI studies. Artificial intelligence has gradually evolved into an interdisciplinary research field within the chronology of history. Neurologists, biologists, physiologists, engineers, mathematicians, psychologists, and

physicists have significantly contributed to bring AI to its present level by working in collaboration (Nilsson, 2019;). AI has been one of the main topics on the agenda of many governments since the early 2000s. Especially after 2017, many countries have started to work on the national AI strategy. Developments in AI also concern public administration and public policy.

1.3. TYPES OF ARTIFICIAL INTELLIGENCE

There is no consensus on the definition of AI. However, AI, an umbrella term, is integrated with many technologies. Scientists and AI experts acknowledge three broad perspectives that help determine expectations of how "intelligence" AI can be (Ayoub & Payne, 2016; Jamie Berryhill et al., 2019). The first is weak AI, applied AI or Artificial Narrow Intelligence (ANI), the second is strong AI or Artificial General Intelligence (AGI), and finally, it is likely utopian/dystopian Artificial Super Intelligence (ASI) in the future. The past, present, and future AI modules will be analyzed in these three types of AI.

1.3.1. Artificial Narrow Intelligence (ANI)

Artificial Narrow Intelligence (ANI) or weak AI is defined as the type of AI that performs better than or close to a human on a "specific" subject. ANI refers to the ability of the computer system to perform a narrowly defined task better than humans. On the other hand, this type of AI is used to study or perform specific problem-solving or reasoning tasks (Ayoub & Payne, 2016; Rivoltella, 2019). Most examples of AI in daily life, such as autonomous vehicles and personal digital assistants, fall into this category. Moreover, many devices and software around us, such as Siri, Google Assistant, are examples of ANI. On the other hand, chess-playing machines, natural language processing, self-driving cars, and speech/face recognition systems are specific examples of ANI. Thus, different groups of AI researchers have supported the development of various AI subfields over the years. Therefore, each focuses on a specific set of generally compatible tasks with different human abilities (OECD, 2019). A large amount of data sets is needed for ANI to successfully train itself. ANI systems are becoming more popular with big data sets and the cheaper storage costs of data.

1.3.2. General Artificial Intelligence (AGI)

Artificial general intelligence (AGI) means that the computer system is as capable as humans at all mental tasks. AGI also refers to machines closer to human intelligence that can establish cause-

effect relationships and have logic and comprehension capabilities in different problems. Indeed, AGI refers to the ability of a computerized system to depict human-like intelligence in multiple tasks (Intel, 2017). Additionally, Future of Privacy Forum (2018) defined AGI as a device theoretically equivalent or superior to human intelligence, representing the notion of computers capable of showing the full spectrum of human cognitive capabilities. The ability to generalize knowledge or expertise from a particular area takes experiential value. The world-famous business magazine FORBES has dealt with AGI in three different frameworks. According to FORBES perception, "AGI is focused on creating intelligent machines that can successfully perform any intellectual task that a human being can." This comes down to three aspects:

1. The ability to generalize knowledge from one domain to another and take knowledge from one area and apply it somewhere else,
2. The ability to make plans for the future based on knowledge and experiences,
3. The ability to adapt to the environment as changes occur (Walch, 2019).

AGI is the type of AI in science fiction fantasy where robots have conscious thoughts and act on their own motives. In short, AGI refers to the concept that humans could one day create artificial brains with the same capabilities as the human brain. Today, thanks to studies in neuroscience, approaches to how the human brain works motivate a transition from ANI to AGI. As such, AGI can complete tasks with the ability to self-discovery.

Unlike ANI, AGI can solve complex problems, make decisions in uncertain situations, and leverage previous knowledge to evaluate the current situation. AGI is on par with humans in terms of creativity and imagination. On the other hand, AGI can successfully handle a much more comprehensive range of tasks than ANI. However, in order for the AGI to match human intelligence, he/she needs to be able to transfer something learned from one environment to another or to an individual, work in cooperation, make logical decisions, think, and have a consciousness. From a historical perspective, AGI was the main focus of the AI field in the first steps the 1950s-1960s, but due to the proven challenge of the problem, AI researcher trends still focus on ANI (Pennachin & Goertzel, 2007). While ANI examples such as Alpha Go may outperform humans regardless of their specific task, such as playing chess or solving equations; Human-level AGI will outperform humans on almost any cognitive task. However, most of the AI experts emphasize that by the 2060s, a robust AI system with human intellectual abilities will emerge (Dilgemani, 2021). This situation brings up the "singularity" debates. Sophia is the humanoid robot developed by Hanson Robotics. Moreover, Sophia, the first robot citizen in the

world, is considered one of the most advanced robots of today but is still the prototype. On the other hand, Sophia is preparing to become the AGI type in the future.

1.3.3. Artificial Super Intelligence (ASI)

A system that has reached the level of artificial superintelligence (ASI) will be more successful than humans in almost every field, including scientific creativity, general wisdom, and social skills. ASI is essentially beyond human intelligence. More specifically, a super-smart system is more capable than a person who takes into account more information and can make high-quality decisions with more insight into the future. In this context, ASI is the future of AI technology and the ‘‘utopian/dystopic’’ part. If an AI imitates human behavior or intelligence and realizes its own consciousness and acts, it is called ASI. Nick Bostrom, Oxford philosopher and AI thinker describes the ASI as an intelligence that is far smarter than the best human brains in nearly every field, including scientific creativity, general wisdom, and social abilities (Bostrom, 2016).

Bostrom defined superintelligence as ‘intellects that greatly outperform the best current human minds across many very general cognitive domains”. Moreover, Bostrom has divided the superintelligence into three different categories according to different system types with varying performance characteristics: “speed superintelligence, collective superintelligence, and quality superintelligence” (Bostrom, 2016).

Table 2. Types of ASI

Speed Superintelligence	A system that can do all that a human intellect can do, but much faster.
Collective Superintelligence	A system composed of a large number of smaller intellects such that the system’s overall performance across many very general domains vastly outstrips that of any current cognitive system.
Quality Superintelligence	A system that is at least as fast as a human mind and vastly qualitatively smarter

Source: Bostrom, 2016

ASI systems that develop abilities beyond human intelligence will have many consequences. For example, ASI prototypes that have been released in science fiction films such as 2001: Space Odyssey and Terminator bring the end of humanity. Some scientists and experts are also anxious about the development of ASI. Moreover, most famous technology entrepreneur Elon Musk mentioned that developing super intelligence should be regulated. Superintelligence is one of the important agendas for the future of humanity. Although it is still a fantasy of science fiction

cinema, machines beyond human intelligence may emerge in the next centuries or even decades (Gruetzemacher, 2018).

Superintelligence could possibly be the last invention humanity will ever make. While superintelligence comes with existential threats that can certainly create a frightening future, it can also bring a utopian future. ASI will be capable of solving the deepest mysteries of the universe. The most brilliant minds throughout history will be able to discover the discoveries that would take millions of years to scrape the surface in an incredibly short time, such as minutes (Totschnig, 2019).

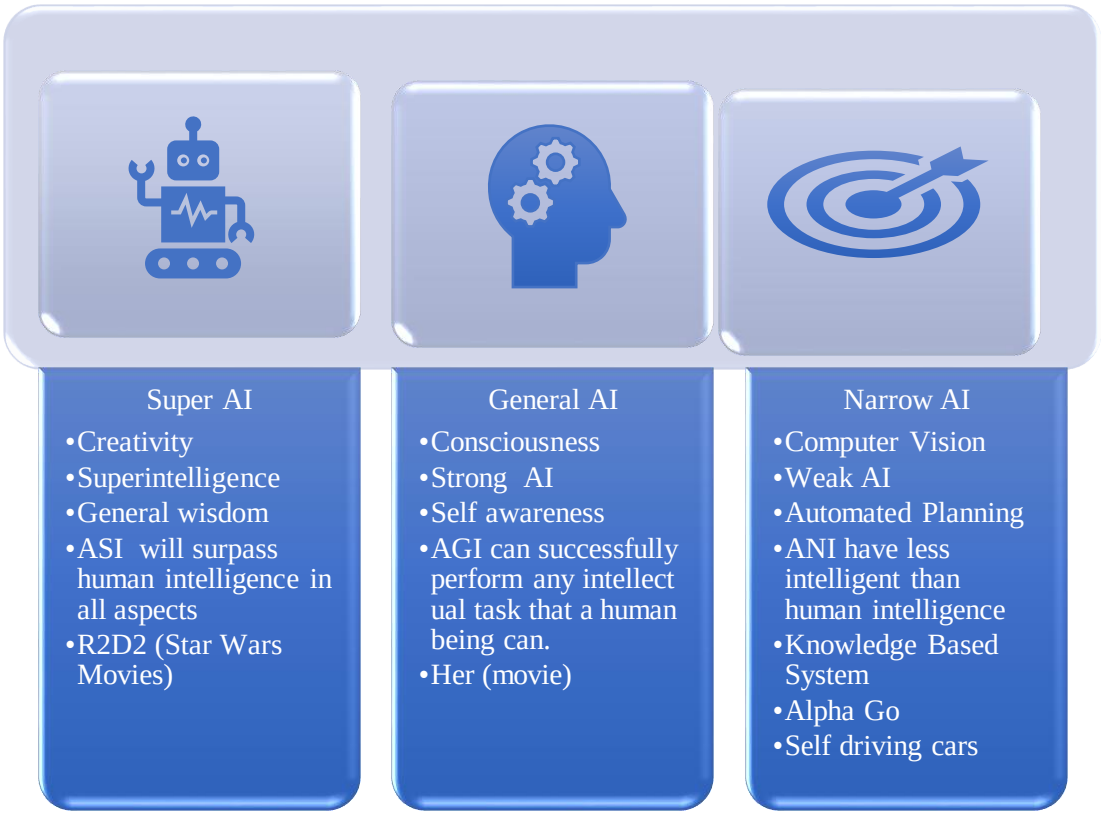

Figure 2. ANI, AGI and ASI

Source: Author

As seen in Figure 2, AI is used in a narrow or weak sense. However, before 2012, AI results closely followed Moore's Law(Intel, 2017), with computing doubling every two years. Since 2012, information processing has been doubling every three to four months. This means that it may be possible to see AGI examples in the following decades. Superintelligence is only in the fantasy for now. However, what the future will bring is uncertain. The truth is that AI is developing at a rapid pace. This development brings many discussions such as technological

singularity, which means that the future will be shaped by AI and high technology elements. Hence, technological singularity depicts a future in which social structure and even people are changed at radical levels (Goertzel, 2007; Van Der Zant et al., 2013).

1.4. ARTIFICIAL INTELLIGENCE TECHNICS

AI refers to systems or machines that mimic human intelligence to perform tasks and iteratively improve themselves based on their information. Since the beginning of the history of modern AI, the goal has been to develop systems that think and behave like humans. However, when it was understood that it was difficult to reach this, the direction of AI studies was turned to the design of systems that think and act rationally (Bryson et al., 2017; van der Zant et al., 2013). When AI techniques are examined, it has been tried to be applied to the solution of problems by imitating the work of human intelligence or the work of the brain and the work of other systems in the body, or by converting them into a different format. In this section, current AI techniques (expert systems, genetic algorithm, fuzzy logic), deep learning, and machine learning approaches will be discussed. AI is the general name of technologies that perform any prediction or decision process, whether they use machine learning or not.

Contrary to popular belief, AI can be an algorithm that works without machine learning or deep learning algorithms. Until machine learning algorithms emerged, AI studies were based on a structure described as “hard-coded” (Haenlein & Kaplan, 2019). However, that is, all logical and mathematical operations were coded by the software developer himself. Machine Learning refers to the learning of a machine system to use big data sets instead of hard-coded rules and instructions. Machine learning and deep learning systems take advantage of the processing power of modern computers that can efficiently process big data sets (Bruchansky, 2019). On the other hand, every deep learning algorithm is a machine learning algorithm because it performs learning from data. However, not every machine learning algorithm is a deep learning algorithm. Because deep learning is a specific type of machine learning. Deep learning is an advanced type of machine learning that uses algorithmic networks inspired by the brain's structure known as neural networks(Lecun et al., 2015). Figure 3 below illustrates this relationship better.

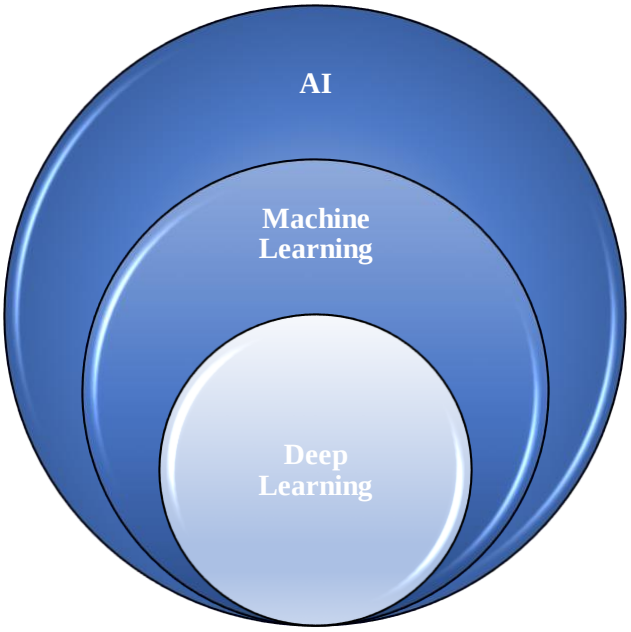

Figure 3. The Relationship between AI, Machine Learning and Deep Learning

Source: Author

Machine Learning is considered as a subset of AI. While AI is an idea of technology that behaves like a human, machine learning algorithms are geared towards finding patterns of big data. These self-learning algorithms allow machines to infer from data sets. Machines are trained to learn from experience how to perform a task. The concept AI covers expert systems, natural language processing, robotics, etc. However, machine learning does not cover any of these. Deep learning is also considered as a subset of machine learning. In deep learning, the algorithm learns to make an accurate prediction through its own data processing thanks to its artificial neural network. Based on all these approaches, AI techniques will be discussed under various headings. The field of AI is shifting towards creating intelligent systems that can collaborate effectively with humans, including creative ways to develop interactive and scalable ways (Grosz et al., 2016).

1.4.1. Machine Learning (ML)

Machine learning is a sub-branch of computer science developed in 1959 from numerical learning and model recognition in AI. ML is a system that can learn as a structural function and investigate the work and construction of algorithms that can make predictions over data. ML is used to teach machines how to use data more efficiently (Dey, 2016). These algorithms work by building a model to make data-based predictions and decisions from sample inputs rather than strictly following static program instructions. However, ML uses algorithms to identify patterns in data.

These patterns are also used to create a predictive data model. According to Hurwitz & Kirsch (2018), “When we explore machine learning, we focus on the ability to learn and adapt a model based on the data rather than explicit programming”.

ML algorithms help people discover, analyze, and find meaning in complex big data sets. Each algorithm is a limited and specific step-by-step set of instructions that a machine can follow to achieve a particular goal. The goal of the ML model is to create or discover patterns that people can use to make predictions or categorize information. Machine learning and deep learning techniques using image recognition, speech recognition, and language translation (Deng & Yu, 2013). On the other hand, ML techniques are required to increase the accuracy of predictive models. ML is examined in the various method as supervised, semi-supervised, unsupervised, and reinforced learning (Bruchansky, 2019; Dey, 2016; Mackenzie, 2015).

1.4.1.1. Supervised Learning

Supervised machine learning algorithms are the most widely used. Supervised learning usually begins with an understanding of a specific data set and how these data are classified. However, Supervised learning aims to find patterns in data that can be applied to an analytics process. Although it knows the correct answers to the questions, the algorithm explains patterns in the data, verifies observations, and makes predictions. While the algorithm makes predictions, the operator checks these predictions. This created system continues until the algorithm gets the best performance and the most accurate estimation (Caruana & Niculescu-Mizil, 2006).

The model created in supervised learning is to learn the relationship between them by giving them target values against a group of input values. In supervised learning, algorithms make predictions based on the labeled samples you provide. In this technique, where data sets are processed with tags or structures, the data acts as a teacher and improves the ability to make predictions or decisions by "training" the machine. Regression and classification algorithms are included in supervised learning (Atalay & Çelik, 2017; Silver et al., 2017). Classification models categorize input data. In regression tasks, the machine learning program must predict and understand the relationships between variables. Regression analysis focuses on one dependent variable and several other variables.

1.4.1.2. Unsupervised Learning

Unsupervised learning is a learning method with no outputs with a dataset. Finding common points by interpreting the data in the data set and obtaining meaningful data by clustering them. Data points are not labeled in unsupervised learning. The algorithm labels the data points for you by organizing the data or explaining their structure. This technique is useful in situations where you don't know what the result will look like. Unsupervised learning problems have only input variables but no output variables (Hastie et al., 2008). Unlabeled training data is used to model the underlying structure of the data. Unsupervised machine learning finds any unknown pattern in the data. Unsupervised methods help you find properties that can be useful for categorization. Clustering is an important concept when it comes to unsupervised learning. Generally, clustering deals with finding a structure or model in a collection of uncategorized data. For example, social media apps like Twitter, Instagram, and Snapchat all contain large volumes of unclassified data. Understanding the meaning behind these data requires algorithms that classify data based on found patterns or clusters (Hurwitz & Kirsch, 2018). Unsupervised learning performs an iterative process, analyzing data without human intervention (Bengio, 2009).

1.4.1.3. Reinforced Learning

The algorithm provides input from the data analysis, guiding the user to the best result (Hurwitz & Kirsch, 2018). Reinforcement learning differs from other types of supervised learning as the system is not trained with the sample data set. Here, the system learns by trial and error. Reinforcement Learning is a field of Machine Learning and is a learning method discovered based on behavioral psychology and is also used in artificial intelligence. It differs from other approaches to Machine Learning because it is a more goal-oriented learning method. The main goal is to get the feedback from the environment by activating the agent (learning agent) with the environment - this feedback is called reward. It aims to find the optimum policy by maximizing the rewards (Chen et al., 2008).

Reinforcement learning uses algorithms that learn from the results and decide the action to be taken. The algorithm receives feedback after each action that helps determine if the option is true, neutral, or false (Silver et al., 2017). The reinforcement learning model is different from supervised or unsupervised learning models. Reinforcement learning defines as a type of behavioral learning model. Therefore, AI applications from robotic systems to driverless vehicles will develop on the axis of the reinforced system method. Moreover, reinforcement learning is generally studied in many other branches such as game theory, control theory, operations

research, information theory, simulation-based optimization, and statistics (Szepesvári, 2010). Various approaches to machine learning are summarized in the headings above. Machine learning techniques and application examples are summarized in the figure below.

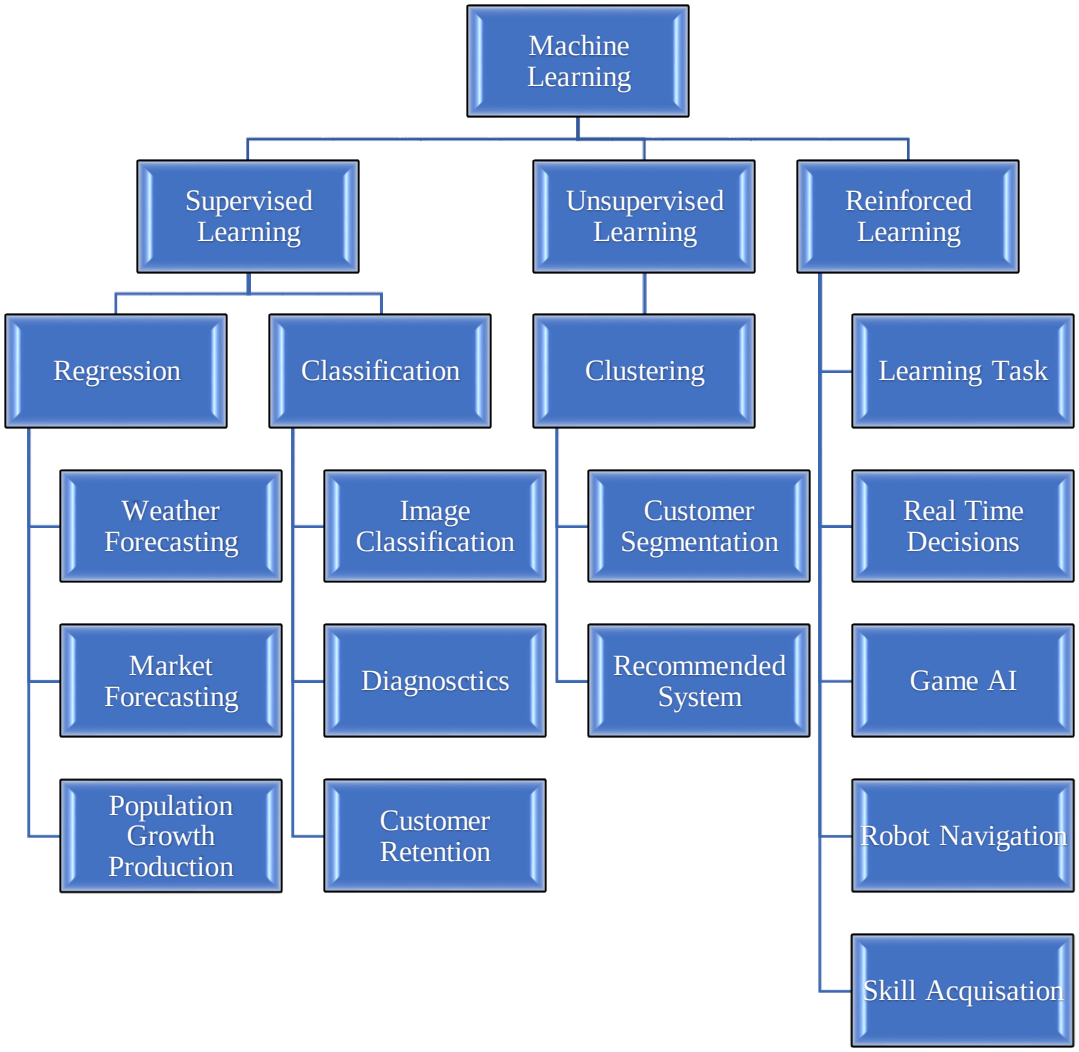

Figure 4. Classification of Machine Learning Techniques

Source: Author

1.4.2. Deep Learning

The AI field encompasses ML technics, where machines can learn through experience and gain skills without human participation. Similarly, every deep learning algorithm is a machine learning algorithm because it performs learning from data. However, not every ML algorithm is a deep learning algorithm. As a matter of fact, deep learning is a specific type of machine learning (Rusk, 2015).

Rapid progress has been made in deep learning systems since the 2010s. Deep learning algorithms require a lot of data to learn. The amount of data produced every day is increasing, and the amount of data produced per day is estimated at 2.6 million bytes. The increase in the amount of data produced and the developments in data storage techniques (i.e., cloud systems) enabled the deep learning technique to become famous. According to Deng and Yu (2013), two main points come to the fore in the patterns of deep learning in the definitions in the literature:

> "Models consisting of multiple layers or stages of nonlinear information processing; methods for the supervised or unsupervised learning of feature representation in successively higher, more abstract layers."

Deep learning is a set of algorithms and models that work on "artificial neural networks", which are multi-layered network structures inspired by the structural and functional properties of the brain. The biological sciences are rapidly using a powerful machine learning method that allows machines to solve perceptual questions like image and speech recognition (The Royal Society, 2019). Deep learning methods, such as artificial neural networks, use many computational layers to discover patterns and big data sets.

Artificial neural network algorithms have been developed based on the learning process in humans. Just as the neurons in the biological nervous system interact, structures defined as neurons in Artificial neural networks systems are modeled to be interconnected (Staub et al., 2015). The difference between artificial neural networks from traditional ML; is the ability to perform parallel processing. In other words, it is the work of independent computing resources on the same task at the same time. Traditional ML algorithms are linear. However, there is a hierarchy model that changes according to the complexity of the field to be applied in deep learning algorithms. The deep learning process repeats until the resulting success rate reaches a certain level (Bengio, 2009; Ongsulee, 2018).

Through artificial neural network models, data is parsed into independent processors, and each processor works independently. The deep learning approach consists of multiple abstraction structures and multiple processing layers combined with learning representations of data (Deng & Yu, 2013). While the deep learning algorithm also performs data-based learning, the learning process does not work on a single mathematical model as in standard machine learning algorithms but on calculations based on network diagrams expressed as a neural network (Lecun et al., 2015). It consists of various subgroups or components in deep learning, as in AI or ML. In this framework, different deep learning architectures such as deep neural networks (DNN),

convolutional deep neural networks (CNN), deep belief networks (DBN), and recurrent neural networks (RNN) have been applied to fields like computer vision, automatic speech recognition, natural language processing, audio recognition and bioinformatics where they have been shown to produce state-of-the-art results on various tasks (Ongsulee, 2018).

Deep learning techniques, image analysis, sound analysis, robotics, autonomous tools, gene analysis, cancer diagnosis and virtual reality etc. started to be used in many areas. Deep learning technique works in the fields of classification, description, prediction, diagnosis and image separation. Due to these broad fields of study, deep learning methods can be applied to every area where data is obtained. The several examples of deep learning applications are given in table 3 below.

Table 3. The Deep Learning Examples

Deep Learning	Application
Virtual Assistants	Alexa, Siri, Cortana, Google Home
Autonomous Vehicles	Self-driving Cars
Chatbots	Customer and citizen interaction
Facial Recognition	Social media automatic photo tagging (Facebook)
Healthcare	Early, accurate and speedy diagnosis discovering new drugs
Predictions	Demographic and Election Predictions
Language Recognition	Google Translate
Photo Description	Colorization of Black and White images
Entertainment	Netflix

Source: Author

1.4.3. Fuzzy Logic

Fuzzy logic, one of the AI techniques, was first introduced by Zadeh in 1965. According to Zadeh, fuzzy logic creates more propositions between 0-1 than classical logic's 0-1 propositions. Most scientific studies are based on classical logic. According to this logic, events are examined with two options: true-false, yes-no, 0-1. The definition of fuzzy sets proposed by Zadeh is different from the classical concept of the cluster not a member or not member of the set. There is no such thing as precision in fuzzy logic and fuzzy set theory (Zadeh, 1996). Fuzzy logic is a branch based on thinking like a human and operates by converting them into mathematical functions. The most crucial feature of fuzzy logic is that it is a mathematical discipline based on fuzzy set theory instead of binary Aristotle logic. There is nothing absolutely certain. Everything changes on the boundary between 0 and 1 if expressed mathematically. Therefore, Fuzzy logic is valid in

situations that require giving place to the opinions and value judgments of the people if the subject being examined is very complex, and there is not enough information about it (Chen et al., 2008; Zadeh, 2008).

Fuzzy logic has applications in many areas from everyday work machines to production engineering, from industrial technologies to automation(S. H. Chen et al., 2008). It is used in cancer research in the medical field and also for the diagnosis of diseases. In fuzzy logic, the values of a linguistic variable are expressed in fuzzy sets. Thanks to fuzzy logic, it is possible to obtain a large number of data collections from a small number of data. It allows modeling and solution of uncertain and complex systems.

1.4.4. Expert System (ES)

Expert systems (ES) are a subset of advanced AI that was first developed in the mid-1960s by AI. The fundamental concept behind ES is that experience, or a large body of task-specific information, is shifted from a human to a computer (Liao, 2005; Shangraw, 1987). ES are computer programs equipped with only the information related to that field in a specific area of expertise and can offer solutions to problems brought by a field expert. A well-designed ES mimics the thinking methodologies of experts in solving particular problems. ES uses experience-based inference methods instead of complex algorithms(Hadden, 1989). While developing the expert system, it aims to transfer the experts' knowledge and experience on a specific subject to the computer. Therefore, the design of expert systems is a complex and time-consuming process. One of the most significant differences between expert systems and traditional systems is the ability to reason. Conventional systems are weak in matters requiring judgment, unlike ES (Sağıroğlu, 2020). ES is used in various disciplines and professions to spread existing specialist knowledge to more expansive areas. In this way, expensive and scarce information becomes available with lower levels of knowledge and open to different people. ES is also successfully used in data interpretation, diagnosis of diseases, structural analysis of complex objects, design of complex things such as computer systems, and planning sequences. On the other hand, ES offers significant optimization in solving complex problems (Liao, 2005).

1.4.5. Genetic Algorithm (GA)

Genetic Algorithms (GA) management first emerged in the 1970s in the studies of John Holland (Kumar et al., 2020). The primary purpose of genetic algorithms is to investigate solutions to complex optimization problems with many limitations with software help. These algorithms use

recombination processors to preserve essential information when encoding a possible solution to a complex problem on a plain chromosome-like data model (Whitley, 1994). GA is a function that performs permutation-based optimization and searches under convergence criteria over probabilities. However, GA is a search and optimization method that works similar to the evolutionary process observed in nature. The Genetic Algorithm is a powerful evolutionary strategy inspired by the basic principles of biological evolution (Simon, 1996; Whitley, 1994). GA can solve complex problems quickly and almost optimally can be applied to various problem types. Scanning large solution spaces with traditional methods increase the computation time. However, acceptable solutions to such problems can be found in a short time with genetic algorithms. GA is commonly used in automatic programming and information system applications. In addition, it is used for the solution of many different business problems in functional areas of businesses such as finance and marketing, especially production/operations. Genetic algorithms have applications in various fields, particularly resource allocation, job scheduling, machine part grouping, and computer network design (S. H. Chen et al., 2008; Kumar et al., 2020).

1.4.6. Robotics

The term robot comes from the Slavic word "robot," which means labor or drudgery. The term "robot" for humanoid machines first appeared in the Czech author Karel Čapek (1890–1938). Isaac Asimov, a science fiction writer, first mentioned robots in his short story "Runaround" in 1942. However, the desire and idea to produce automatic machines date back much more. Leonardo Da Vinci made sketches and plans for robot construction. Similarly, the Islamic scholar Al-Cezeri also has prototypes related to robotics. Humans have always been impressed by creating machines that can perform tasks or interact with them (S. L. Anderson, 2008; Mccauley, 2007).

Robots are devices that perceive their surroundings with their sensors, interpret what they perceive, decide as a result of interpretation, and make a decision with an output signal. Robotic technologies; is a combination of many engineering and science branches, mainly mechanical, electronic, and computer engineering. In this respect, robotics is an interdisciplinary field. However, Robots are classified in various ways according to their joint structures, usage areas, functional features, control methods and working principles. In terms of historical development, robots are considered within the framework of the industrial and mobile robots. While industrial robots are classified according to their number of joints and functional features, mobile robots are

generally classified according to their working principles, number, size and application areas. Examples of mobile robots are humanoid robots, micro and nano-robots, swarm robots(S. H. Chen et al., 2008) Today, robots can be seen in every aspect of our daily life. On the other hand, the use of robots increases space research and the military/defense. Moreover, robots have started to do dangerous things for humans, such as industrial welding, disaster response, and space exploration (Gürgüze & Ürkoğlu, 2019).

From an industrial perspective, the number of robotic systems has been increasing day by day since the 1980s. This increase in the number of robots can cause new threats and risks in the long run.

1.4.7. Natural Language Processing

Natural Language Processing (NLP) is a computational technique that analyzes naturally occurring texts at one or more language analysis levels to perform human-like language processing for a range of tasks or applications (Chowdhury, 2003; Deng & Yu, 2013; Nadkarni et al., 2011). Computers need to use NLP to understand and communicate with people's languages. The ability of computers to understand, process, interpret, and even produce sentences is an example of NLP, which is a discipline in which artificial intelligence and linguistics are used together (Nadkarni et al., 2011). It is defined as NLP for machines to receive and process the language spoken by humans.

The working levels of NLP are discussed around four points. First, linguistics is concerned with understanding the meanings of words. It examines the meaning of a word by taking which affixes, thus understanding what the word is. Second, syntactic is the way the words in the sentence are arranged. It deals with how words are arranged in a sentence. Semantic examines the meaning of the sentences used. Because the sentence must be understood correctly to be processed correctly by the computer for the natural language to be processed correctly. Finally, discourse deals with the words used in a conversation and their meanings (Chowdhury, 2003; Seker, 2015).

Data-Drive methods for NLP have become so popular that they should be considered mainstream approaches to computational linguistics. A strong contributor to this development is undoubtedly the increasing amount of electronically stored data available to apply these methods. Today, technologies such as chatbots on websites' commands given to a virtual assistant on the phone, text mining, and online translators result from NLP (Cambria & White, 2014).

1.4.8. Computer Vision

The first studies of computer vision date back to the 1970s (Baumgart, 1975). Computer vision is the field of computer science that deals with technologies that enable computers to identify and process objects they see like humans. In this technique, AI performs operations from digital images or video images. Computer vision uses creating, processing, analyzing, and making sense of the digital image to produce information numerically or symbolically on the image (Szeliski, 2011). Computer vision aims to make sense of any two-dimensional, three-dimensional, or higher-dimensional visual numerical data, especially smart algorithms. On the other hand, there is a wide range of disciplines in computer Vision background. The field of computer vision solves these problems, uses geometry, 3D Model linear algebra, and statistical theory, differential equations, and the development and implementation of techniques based on graph theory (Deng & Yu, 2013).

Computer vision is used in various industrial and medical applications, for example, by processing the visual data used to diagnose diseases and pattern recognition which are achieved an efficient result for doctor and researcher (Zheng et al., 2007). Moreover, visual data detection and interpretation constitute the most critical algorithm steps in many applications, from autonomous systems such as driverless vehicles, robots, drones to security and biometric verification.

In addition, drones, spacecraft, vehicles sent to Mars and Moon surfaces, and self-driving cars use computer vision applications to detect their location and objects in the environment, avoid obstacles while moving on their routes or violate traffic rules. The outputs obtained from the machine view are fed as input to decision support systems in the next step and complete the AI systems (Szeliski, 2011).

1.5. APPLICATIONS OF ARTIFICIAL INTELLIGENCE

Today, AI techniques exist in many different sectors and areas (Dwivedi et al., 2019b; Mehr, 2017; Sousa et al., 2019a). Different AI techniques stand out in different domains. For example, while computer vision stands out in image and pattern recognition, NLP technique is used in text analysis. On the other hand, robotic systems are also integrated with multiple AI techniques. Since the 2000s, there have been groundbreaking developments in machine learning and deep learning techniques with rapidly expanding different data sets and the advancement of data mining techniques. Because data is the fuel of AI (Araujo et al., 2020). Big data can be obtained from many different sources. In addition to statistical databases, sensor data, photos and videos, as well

as human-sourced data such as social media data, blogs, content data of web sites (Akay, 2018). Researchers who have focused on Big data analysis in the last decade have used a variety of machine learning algorithms to extract information, link data, and make predictions. Machine learning and deep learning are particularly prominent in precisely defined tasks that involve huge amounts of data and require repetition (Gang-Hoon et al., 2014; Maciejewski, 2017; Pencheva et al., 2018).

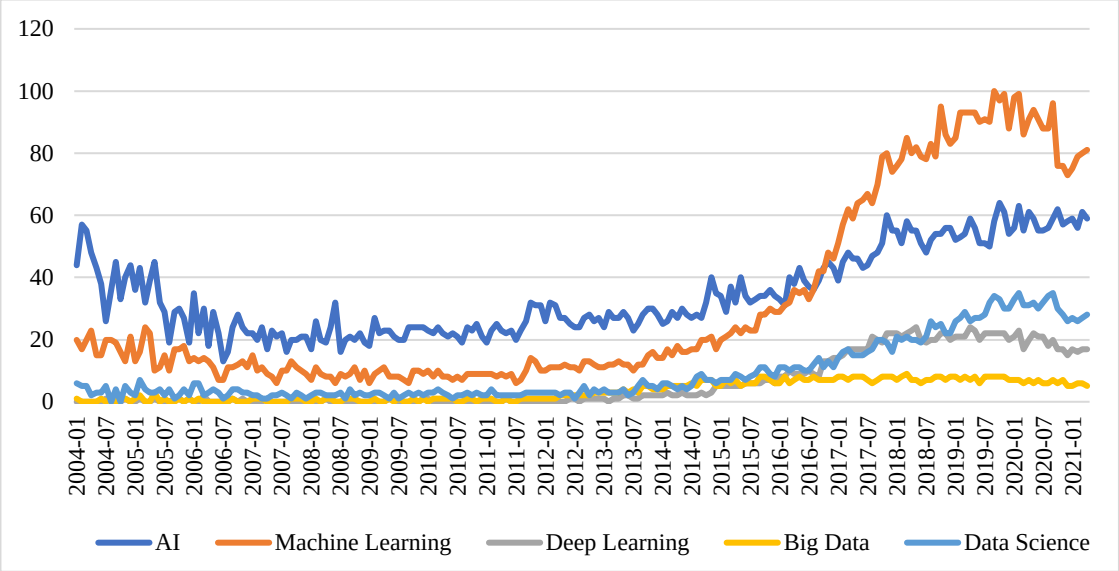

Figure 5. Google Search Statistics of AI Techniques between 2004 and 2021

Source: Google Trends, 2021

Figure 5 shows the change in the "science category" searches made on Google Trends about "data science", "big data", "machine learning", "deep learning," and "AI" over the years between 2004-2021. Especially with the increase in data sets, the interest in machine learning has increased enormously. It is expected that the interest in machine learning and deep learning will increase in the coming years.

AI is an interdisciplinary science area that has just begun to mark our age.AI research and applications are discussed in the literature around eight domains (Grosz et al., 2016; Kankanhalli et al., 2019; Mehta & Hamke, 2019; Sharma et al., 2020). These domains are healthcare, service, transport, health, education, public safety, recruiting, marketing and entertainment. Even the application examples of AI in healthcare are comprehensive research and individual thesis subjects. However, the scope of this thesis deals with AI applications in the public sector. For this reason, AI applications are briefly summarized in Table 4.

Table 4. Artificial Intelligence Technics and Applications in Different Sectors Perspective

Sector	AI Technics	AI Applications
Government	Machine Learning	automate routine tasks
	Virtual assistant and Chatbots	answering questions
	Natural Language Processing	searching documents and translations
	Facial Recognition	Security
Healthcare	Artificial Neural Network	medical diagnosis
	Computer Vision	computed tomography
	Expert System	drug developments
Military	Robotics	autonomous weapon
	Computer Vision	Drones
	Artificial Neural Network	radar and image signal processing
Transportation	Fuzzy Logic	traffic light controller
	Artificial Neural Network	road planning
	Autonomous Vehicles	self-driving vehicles
Service Sector	Machine Learning	human resources
	Natural Language Processing	customer services chatbots
	Personality Computing	marketing advertising
Finance	Predictive Analytics	test investment combinations
	Machine Learning	fraud detection
	Unsupervised Learning	categorize of business model
	Algorithmic Trading	fast trading decision
Industry & Manufacturing	Fuzzy Logic	electronic control systems
	Expert System	optimization and error detection
	Deep Learning	cyber-manufacturing
Education	Virtual Assistant	teacher and ai collaboration
	Intelligent Tutoring Systems	smart content
	Deep Learning	personalized learning
Agricultural	Predictive Analytics	soil and crop health monitoring system:
	Machine Vision	precision weed management
Entertainment & Media	Machine Learning	Content Personalization (Netflix, Youtube, Spotify)
	Natural Language Processing	Reporting automation
	Augmented Reality	Gaming

Source: Author

1.6. QUESTIONS ABOUT THE FUTURE OF AI

As summarized in the section above, it is possible to see AI techniques and applications in every part of our lives. New forms of automation and advanced robotic systems have begun to radically transform the means of production and our society. AI experts and futurists believe that AI technologies will be one of the main drivers of the fourth Industrial Revolution and have the potential to transform not only the technology industry but also the way we live our lives. AI

increases productivity and improves lives. Nevertheless, it also raises many big questions about the future. As a result of the AI revolution, what will happen to our business in the future, and what kind of skills will we need? How will humans and machines interact? Will the technological singularity happen? (Dobbs et al., 2015) is estimated that the destructive effects of artificial intelligence can be observed 100 times faster, and the scale will be 300 times higher compared to the first Industrial Revolution. For this reason, policy measures to be taken against both the global and national effects of AI and its possible destructive consequences should be analyzed with a holistic approach. On the axis of all these big questions, the future of AI and its effects will be discussed in various dimensions.

1.6.1. The Boom in Big Data

Especially with the smartphone revolution, human-AI interaction has increased even more. In parallel with the increasing importance of data defined as “the new golden” (O'Brien, 2018) the interest in AI technology has also escalated. Although computers entered human life 50 years ago, the amount of data collected has only reached a level that will cause significant changes in this manner in the last few years. Moreover, most of the data on the Internet consists of the data produced in the previous two years. As the world becomes more and more connected with the Internet of Things (IoT), the amount of data produced is growing with an increasing acceleration. According to the data shared by the World Economic Forum, it is estimated that by 2025, 463 exabytes of data (463. 1018 bayt) will be generated every day (Desjardins, 2019). In this case, it has become impossible for data to be processed by human beings. Data science is the process of using algorithms, methods, and systems to extract information and insights from structured and unstructured data. AI, Machine Learning, and Deep Learning technologies have gained significant importance to analyze different massive data sets that are getting complex (Ayas, 2018). The realization of Machine Learning is provided by designing structure algorithms that can be trained on data, rather than being specially trained on how to perform a task. With the data boom, data security and privacy are on the agenda of many governments. The recent Cambridge Analytica scandal demonstrates the power of data. The company used voters' social media data to broadcast personalized political advertising and manipulative news by micro-targeting.

With the massive amount of available data, companies in almost every industry have focused on leveraging data for competitive advantage. The volume and variety of data have exceeded the capabilities of manual analysis and, in some cases, exceeded the capacity of conventional

databases. This situation has made data science one of the most critical academic interests and career options of the future (Provost & Fawcett, 2013).

1.6.2. Economic Potential of Artificial Intelligence

Throughout the historical process, technological development has been one of the main factors that enabled radical changes in production, economic and social structure. Significant changes have occurred in the business ecosystem with the artificial intelligence revolution. Today's technology giants such as Facebook, Microsoft, NVIDIA and Apple are in a race with each other to invest in AI. The economic growth of artificial intelligence will be shared among several countries.

According to PwC company report (2017), AI has drawn attention to the potential contribution of up to $ 15.7 trillion to the global economy by 2030. This effect is greater than the current production of China and India. The world, in general, will not be able to benefit from the economic prosperity provided by AI. Table 5 below shows the contribution AI to the economies of countries.

Table 5. Which parts of the world will benefit the most from AI?

REGION	TOTAL IMPACT (USD)
North America	3,7 Trillion
Latin America	0.5 Trillion
North Europe	1,8 Trillion
Southern Europe	0,7 Trillion
China	7 Trillion
Developed Asia	0,9 Trillion
Others	1,2 Trillion

Source: Rao & Verweij, 2017, p. 9

Moreover, the report points out that with the effect of AI, a %21increase is expected in the service sector, including health, education, public services, and a %15 increase in retail and wholesale trade, accommodation, and food services. AI will lead to breakthrough changes in the economy by creating new business lines. (Rao & Verweij, 2017). Similarly,

(Purdy & Daugherty, 2017) mentioned that AI can double annual global economic growth rates by 2035. Moreover, AI will drive this growth in three primary ways: First, AI will enhance labor productivity through innovative technologies that enable more efficient time management related to the workforce. It is estimated that this increase will be around 40%. Second, AI will create a new virtual workforce capable of solving problems and self-learning. Finally, AI will also benefit

from the spread of innovation (such as 5G, IoT) that will affect different industries and create new revenue streams (Purdy & Daugherty, 2017). AI has significant potential to increase economic growth and productivity. However, it also carries serious risks such as labor market polarization, increasing inequality, structural and unemployment (Szczepański, 2019).

1.6.3. The Future of Jobs

According to Oxford Economics report (2019), the number of robots used worldwide has tripled in the last two decades to 2.25 million. Trends show that the global robot stock will grow even faster over the next 20 years, reaching 20 million by 2030. This situation also indicates that significant unemployment will occur in the manufacturing sector. The rise of robots will increase productivity and economic growth. However, Oxford Economics report (2019) emphasized that current business models in many sectors will deteriorate seriously, and 20 million unemployed will emerge in the manufacturing industry alone. Similarly, Hawksworth & Berriman (2018) stated that 3% of jobs will be automated by AI within a few years, and by the 2030s, 30% of employment and 44% of low-wage workers will be at risk. Today, AI has already begun to be used extensively in routine and repetitive tasks (Korinek & Stiglitz, 2017; Makridakis, 2017; McClure, 2018). Because AI reveals more efficient results at a lower cost than humans in regular work. Furthermore, in the first ten workforce groups that will have a decrease in the number of jobs until 2025;

> "Data entry officers, administrative and executive secretaries, bookkeepers, accountants and auditors, factory workers, business services, customer information, and customer service employees, general and operations managers, mechanics and machine repairers, material registration and stock-keeping officers" (World Economic Forum, 2020).

Nevertheless, while some jobs are destroyed due to AI technologies, new job opportunities also emerge (Anderson & Smith, 2014).

With the widespread use of AI applications, new professions that did not exist a few years ago began to emerge. About ten years ago, there was no job description such as mobile application developer or Youtuber. These have become one of today's high-income professions. Furthermore, data analyst has become one of the most demanded job titles in recent years. Although AI has a superhuman intelligence capacity in computation and mathematics, it still needs human direction. Despite advances in neural network studies, there is still a need for a "mentor" to show machines how to learn. In this context, there will be professional groups such as AI trainers, machine

learning engineers, and AI ethics specialists, among the future jobs (Cerebro, 2018). Accenture (2019), a study commissioned with the AI revolution, examined the new jobs that will emerge as a result of AI technologies. As a result of the study, it has been observed that some completely new and original works have appeared directly related to the use of AI technologies. Examples of new professions classified in three groups as "Trainer" "Explanatory" and "Sustainer" are shown in Table 6.

Table 6. The Future of Jobs in the Era of Artificial Intelligence

Job Categories	Future of AI related Jobs
Trainers	Customer-language tone and meaning trainer
	Smart-machine interaction modeler
	Worldview AI trainer
Explainers	Context designer
	Transparency analyst
	AI usefulness strategist
Sustainers	Automation ethicist
	Automation economist
	Machine relations manager

Source: Schmidt & Kane, 2019

Education policy needs to be reconsidered in order to reduce the devastating impact of AI technologies on the workforce. With the changing technological conditions, a technology-compatible and convenient education system should be re-designed. For this reason, governments should focus on an education policy that is suitable and prepared for the rapidly increasing automation. The education trend of the future should be on digitalization. In accordance with the age of AI, policymakers necessitate designing innovative education policies instead of the traditional education model.

1.6.4. Artificial Intelligence Race and Digital Authoritarianism

Many scientists, futurists, and even state leaders have almost agreed that AI will play a decisive role in shaping the future of humanity. As a striking example, Russian President Vladimir Putin points out that "whoever becomes the leader in this sphere will become the ruler of the world" (Onder et al., 2020). Global leadership in different areas of basic and applied research in AI has emerged as a strategic priority for large corporations and nation-states. AI development is typically associated with the race for technological supremacy (Cave & ÓhÉigeartaigh, 2018). This race, which is increasingly heated today, has the potential to transform from an "AI race to an AI arms race in the future". AI will use more of its products, models, technologies, and

algorithms for military and intelligence issues in the future. AI will also play an essential role in the power capacities of future armies. This situation will affect the balance of power between countries.

Nowadays, races or competitions in AI development primarily take place in narrow spaces of AI. These are not currently an existential threat to humans. More concern for its existential risks to humanity is in the race to develop an AGI. According to Naudé & Dimitri (2019), whichever high-tech firm or state laboratory succeeds in inventing the first AGI, it will potentially acquire a technology that dominates the world. The AGI will have the opportunity to suppress any other AGIs that arise, whatever the first occurrence. The state that creates the first AGI will act on the "winner takes all approach" or "first mover advantage" (Bentley et al., 2018; Naudé & Dimitri, 2019; Yudkowsky, 2008).

On the other hand, AGI can pose a threat to all humanity in the hands of a malicious terrorist group or interest group. Dafoe (2018) mentioned that countries that come to the fore in the AI race can try practices that ignore values such as "security, transparency, accountability, and democracy" to gain an advantage. This situation causes a transition from "artificial intelligence to "autocratic intelligence" (Scharre, 2019). For example, China, the largest country in the world in surveillance technologies, can find people's faces, names, and government identification numbers with the camera and facial recognition systems used in many parts of the country. (Demchak, 2019) For example, with its Social Credit Score policy, China monitors the daily movements of its citizens. The Chinese government makes this monitoring process through face recognition applications, CCTVs, We-Chat and Ali Baba Pay application data, and social media interactions (Langer, 2020). In China, which has the largest population globally, the power of AI is used in online censorships (Erixon & Lee-Makiyama, 2011) and the surveillance of the citizens. Therefore, most of China's digital investments are made in the field of AI. Besides, China has made it a mission to become a Global Leader in AI by 2030. China comes from the top of the countries that implement surveillance applications. On the other hand, surveillance practices are becoming increasingly common outside of China. In this context, AI surveillance applications are used in three ways globally: "smart city app", "face recognition systems", and "smart policing" (Feldstein, 2020).

Especially in the post-COVID-19 outbreak, many countries have increased their AI investments and prioritized their strategic investments in this area. In particular, competition for AI investment between the USA, EU, and China is already heating up (Armstrong et al., 2016; Dafoe, 2018;

Geist, 2016). Center for Data Innovation's (2021) latest report compares the AI race of China, the European Union, and the USA, examining six measurement categories such as: "talent, research, development, adoption, data, and hardware". The USA stands out as a leader in four of the six measurement categories (talent, research, development, and equipment) that this report examines. On the other hand, China surpassed the USA on two criteria (adoption and data), while the EU is not the leader in any of them. Among the 100 total points in the scoring methodology of this report, the USA is ahead with 44.2 points, followed by China with 32.3 points and the European Union with 23.5 points. According to the report, it is stated that the USA is still the absolute leader in the field of AI. In the USA's leadership, valuable tech companies such as Apple, Microsoft, and IBM and the innovative startup culture have an essential role. However, China made significant progress in a short time and increased its competitive power. It was emphasized that China has a significant advantage in terms of access to data.

Table 7. Artificial Intelligence Race Between China, EU and USA in Several Categories

Category	USA	EU	CHINA
Talent	1	2	3
Research	1	2	3
Development	1	2	3
Adoption	3	2	1
Data	2	3	1
Hardware	1	3	2

Source: Castro et al., 2021

Considering the current contributions of AI to the US and China's economy, military, security, and surveillance capacities, AI will undoubtedly significantly impact the capabilities that an intense state of the future should have. In this respect, Darıcılı (2020) stated that AI will mainly shape the power structure of the future armed forces, rapid decision making, renewal, high-performance capabilities, training and surveillance, logistics. With the plans, official documents, institutional structuring, and budget increases in recent years, China has reached a capacity that challenges the USA in AI sectors (Laurent Probst, Bertrand Pedersen & Dakkak-Arnoux, 2018). Furthermore, there is a power struggle between the US and China to gain the leadership of the global AI industry (Cave & ÓhÉigeartaigh, 2018). It can be easily predicted that this power struggle will continue to accelerate in the post-coronavirus period. Especially in recent years, China has been making great efforts to develop the AI industry. Within these efforts, China has officially accepted that its investments in AI sectors will be 150 billion dollars by 2030(Allen, 2019). AI technologies will emerge as a crucial hard power instrument in the post-coronavirus era(Eager et al., 2020; Gozes et al., 2020).Indeed, international standards, soft law rules, and

regulations are needed so that the AI race between countries does not cause a global crisis. The public administration discipline plays a significant role in AI regulations and governance.

1.6.5. Technological Singularity

Singularity is a term that often comes across in the science of physics in the Black Hole and the Big Bang. The singularity is expressed as the "inexplicable point" that arises in any known physics theory. Everything in the universe is part of a process and has a starting point. It then accelerates and reaches the point where it cannot proceed further (Kurzweil, 2005; Shanahan, 2015).

Gordon Moore (1965) made a prediction that would determine the pace of the modern digital revolution. Observing the rising trend, Moore predicted that the computing power or engine would increase significantly at an increasing speed, and the relative cost would decrease. Known as Moore's Law, this view has become the golden rule for the electronics industry and the motivation for innovation. According to Moore's law, the number of transistors in microprocessors (chips) will double every twenty-four months. Thompson & Parthasarathy (2006) mentioned "Moore's law is the empirical observation that component density and performance of integrated circuits doubles every year, which was then revised to doubling every two years" According to this law, computing processing capacity doubles every two years. According to the Stanford University report, before 2012, AI results closely followed Moore's Law, with computing capacity doubling every two years. However, pos- 2012, compute has doubling every three or four months (Perrault et al., 2019).

Technologies and technological developments created by humanity are also a part of the technological process. Technological singularity gained popularity with an article published by author and mathematician Vernor Stephen Vinge in 1993. However, Technological singularity has become a popular concept with Ray Kurzweil's book "The Singularity Is Near" published in 2005. The idea of "technological singularity" is used to describe this hypothetical situation. The speed of technological developments has reached a point that cannot be followed, adapted and controlled by today's institutions, methods, tools and the mental capacity of today's people (Goertzel, 2007; Kurzweil, 2005; Potapov, 2018). Technological singularity draws attention to the fact that human intelligence cannot be distinguished by lagging behind AI due to the advancement process in super AI technology. In other words, it is described as the idea that machines can reach a point where they will be more intelligent than humans. According to

(Kurzweil, 2005) Singularity is that all developments in technology, especially AI developments, inevitably change human civilization. (Kurzweil, 2005) mentioned that an upgradable intelligence tool will improve itself by entering a continuous development cycle. Similarly, (Shanahan, 2015) stated that "When the thing being engineered is intelligence itself, the very thing doing the engineering, it can set to work improving itself." The singularity is that all advances in technology, especially AI, inevitably change human civilization. In this perspective (Potapov, 2018) defines a singularity "...any scenario with the creation of any kind of superintelligence".

Kurzweil's (2005) definition of singularity is that all these developing technologies reach the subtleties of human intelligence first; then, information-based technologies increase and surpass human intelligence by sharing information rapidly. The increase in computing speed is a product of technological developments and paving the way for the development of new AI applications, expert systems, and other tools that will increase the speed of technology and scientific development. At this point, the relationship between AI and singularity is revealed. Like information processing capacity, AI applications and AGI can be both a result and a cause of the path towards technological singularity. Some futurists argue that technological singularity can occur within decades. Others, the technological singularity was only possible in the 2300s (Goertzel, 2007). According to Kurzweil (2005), technologies such as computers, genetics, nanotechnology, robotics, and AI are developing exponentially, and this situation is expected to continue. Kurzweil predicts that by 2029, computers will have human-level intelligence, and a singularity will occur by 2045. These predictions are based on mathematical calculations related to technological developments.

Elon Musk, Bill Gates and Steve Wozniak, one of the pioneers in science and technology, have warned of the technological singularity. Elon Musk states that "AI can potentially be even more dangerous than nuclear weapons". There are thoughts that the possible superintelligence machine will pose a threat to humanity and destroy humanity. However, Kurzweil (2005) mentioned that the technology that will make AI more intelligent will also make people smarter. Additionally, Kurzweil (2005) claims that our brains will integrate with computer systems to solve many diseases and even immortality is possible when we live in a cybernetic society. Along with the technological singularity, "transhumanism", "cyborg" and "Humanity 2.0" approach is a thesis that has recently come to the fore in scientific circles. According to Bostrom (2005) "Transhumanism is the bold view that humans should exploit technological inventions that improve, lengthen, and yes, possibly change the lives of humankind." The concept of technological singularity is the last point in discussions on the future of AI. Thus, nobody can

predict what will happen after the technological singularity. There are no AI systems that are formed in the capacity of human intelligence yet. However, it is expected that in the following decades, AI will reach human capacity. On the other hand, it is thought that super-intelligent machines will emerge before the 2050s. Although it is one of the important agendas of the technological future, it is an issue that should be discussed today. If the technological singularity is near, interdisciplinary studies should be conducted on transhumanism, cybernetics and cyborg systems (human-machine combination). The public administration discipline should be prepared for the consequences of the technological developments.

CHAPTER II

ARTIFICIAL INTELLIGENCE IN THE PUBLIC SECTOR

Governments are the main coordinators of technologies and controllers of the general activities of modern society. Thanks to the advancement of ICT, civic services transform, and digital citizenship has become possible. Data is a power, and AI makes it possible to easily transform a range of modern technologies, existing methods of provisioning, procuring or upgrading infrastructure and utilities. AI and big data hybridization open and stretch the limits of the old conception of e-government by becoming a kind of continuously more smart governance (Jimenez-Gomez et al., 2020). From the mid-1990s, governments have started moving their services to the internet and then the age of smartphones began. Most services are now transferred to mobile platforms in the form of apps. However, many governments are not yet fully adapted to the internet-based system and are far from the transition of systems to complex algorithms. The AI revolution deeply affects not only our daily lives but also the public sector mechanisms. The transformation that AI will bring to the public sector will be examined in this chapter.

2.1. DIGITALISM IN GOVERNMENT

“Scientia potential est” or “Knowledge is power” said Francis Bacon; it has particular importance not only for philosophy but also for public administration perception. The understanding of public administration based on data, that is, information, is getting stronger day by day. The provision of public services and the decision-making process on public policies to be implemented have been reshaped with the administrative reform wave since the 1980s. Technological transformation is considered the driving factor of the reform movement in public administration (Jreisat, 1988).

Big Data, data mining, and AI applications require a new transformation in the public administration discipline. Recently, ‘data-driven policy-making and algorithmic governance are one of the main focuses of the public administration now. The transition process to the information society has existed in the axis of the development of technology. The information society constitutes a technical, social, economic, and political infrastructure where the information and services provided by the ‘‘electronic government’’ can be produced and consumed. In the last two decades, ICT has dominated and changed different facets of government, governance, and service delivery. Digital knowledge and service have exploded in variety and volume and have become the norm today (Ben Dahaou, 2020). In this context, the ICT area of e-Government 1.0 are organizational infrastructures, while for e-Government 2.0, it

is social media, citizens' involvement, open and big data; e-Government 3.0 focuses on analytics, modeling, AI, and Internet of Things (Charalabidis et al., 2019).

In the agricultural, industrial, and internet revolutions, the necessity of people to adapt to the developing technology has acted. The fourth wave will not only transform people, but also a major transformation within machines. AI, IoT and big data are thought to be the main tools of the fourth wave. The digital age has brought profound transformations in many areas. These transformations deeply affect public administration and policies and research in these areas. According to OECD report (2014),

> "Digitisation is the conversion of analogue data and processes into a machine-readable format. Digitalization is the use of digital technologies and data as well as interconnection that results in new or changes to existing activities. Digital transformation refers to the economic and societal effects of digitisation and digitalization".

Before the 'rise of the internet and the widespread use of personal computers, the key goals of technology use in government were to improve public agencies' management efficiency, increasing government productivity. Until then, the primary use of technology in government agencies was limited to the automation of mass transactions (Yildiz, 2007). With the widespread use of the internet worldwide and computers able to communicate with each other the use of technology in management, which is related to the administrative processes within the organization, has become inter-organizational. Moreover, the rapid spread of the internet has enabled public reforms to be implemented globally (Ho, 2002).

With the millennium era, public administrators and experts are harnessing the power of ICT while trying to understand socioeconomic and technological transformations and diversifying citizen demands (Gül, 2018). Digital transformation is a holistic effort to revise core processes and services of government beyond the traditional digitization efforts (Mergel et al., 2019). Austin & Callen (2008) emphasize that state and local governments struggle to develop strategies and plans regarding information technology (IT). Although there are some aspects that digital technologies tend to offer great potential, little attention has been paid to recognizing or understanding what kinds of weaknesses may also be inherent in those innovations. Similarly, Holden, (2003) argued that given the significance of effective management of IT to the basic functioning of most government services, policy sophistication, theory and practice in this area must evolve rapidly. The use of ICT in public administration has caused radical changes in the understanding of public

administration. However, the use of new management tools has brought new solutions and problems. Brewer et al. (2006, p. 474) describe this dilemma:

> "Public administration is a mediator between existing political structures and the citizens they serve. As a result, the information revolution and other developments make public administration's role in governance more difficult. Paradoxically, IT is both a major source of the problem and a major part of the solution."

The biggest debates on digital transformation have been shaped by the continuous development of digitalization and ICT. From the beginning of internet use, there has been a remarkable transformation as the internet of things (IoT) today. This transformation necessitates a continuous dynamism and change in accordance with the requirements of the age in the provision of public services. According to the OECD (2020), the digital government points to a multi-layered structure as summarized in Figure 6. These structures complement each other. On the other hand, the lack and failure of one of these components affect the digitalization motivation in public. For this reason, it is necessary to evaluate each dimension of digitalization in the public sector separately. The digitalization trend in the government, which has been revived with the e-government approach, has adopted a data-oriented approach today.

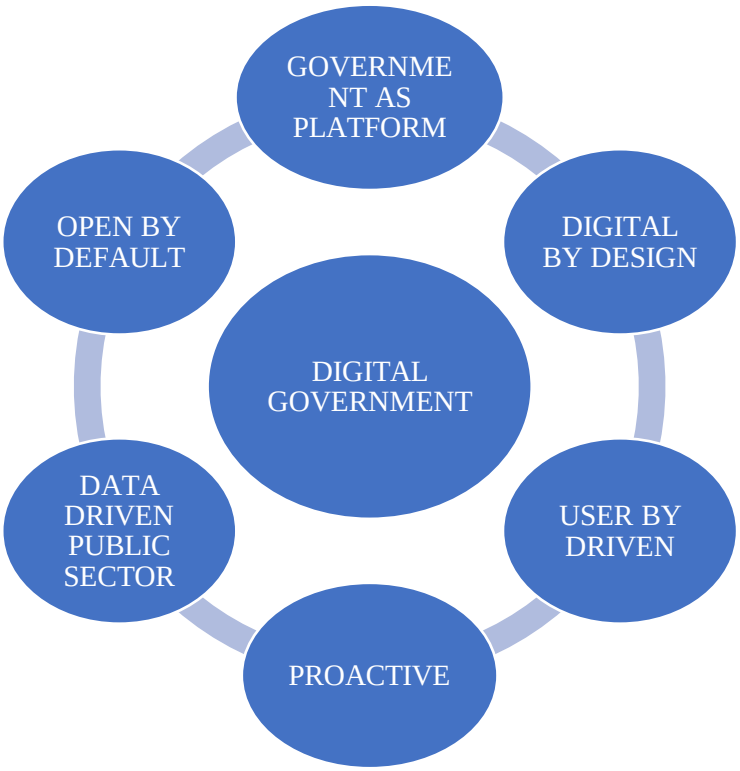

Figure 6. Six Dimensions of Digital Government

Source: Adapted from OECD (2020)

2.1.1. E-Government

In the public administration literature, e-government applications are shown as the most concrete form of the digital transformation realized in public services. The concept of e-Government can be defined as the use of ICT both in the provision of public information and services and in the fulfillment of political functions and processes such as participation, transparency and accountability in management (Layne & Lee, 2001; Yildiz, 2007; Yıldız & Leblebici, 2018). The administrative dimension of e-government is that actors such as public institutions and organizations and local government units provide public information and services to all actors who can benefit from such information and services, especially citizens, state institutions and private sector, by using information and communication technologies. The political dimension of the concept of e-government is the use of these technologies by the state to increase participation and transparency in public administration, control and accountability of the administration. (Yildiz, 2003)

E-Government includes a broad spectrum such as connecting organizations and databases to each other, improving the speed and quality of public services, increasing efficiency and effectiveness in management, increasing the interaction between the administration and the managed, and building a decentralized, transparent, and accountable management system. Therefore, e-Government is like an umbrella concept that includes all these dimensions of change in the management system. Welch et al. (2005, p. 377) emphasized that “electronic government is now a significantly prominent facet of governance”. In these perspectives, the development of the e-government contributes to governance, decentralization and democratization. The development of e-Government, which is a dynamic process, has been studied mainly with the help of stepped models. Layne and Lee (2001) developed a four-step e-Government development model based on integrating e-Government applications with other applications and their technical and organizational complexity. In this context, “four stages of a growth model for e-government: (1) cataloguing, (2) transaction, (3) vertical integration, and (4) horizontal integration” (Layne & Lee, 2001, pp. 123–124).

Table 8. Dimensions and Stages of E-Government Development

STAGE	DIMENSIONS		
1. cataloguing	Online presence	Presentation	Downloadable Forms
2. transaction	Services and Forms online	Working database supporting online transactions	
3. vertical integration	Local systems linked to higher level system	Within similar functionalities	
4. horizontal integration	System integrated across different functions	Real one stop shopping for citizens	

Source: Adapted from Layne & Lee (2001)

The experience and knowledge gained by states with e-government are worthwhile to adapt to the following technology processes. The future of e-government will involve the processing of collected data and data-driven policymaking.

In this context, it seems that data and algorithms will be the new engine of the electronic/digital government which networks are linked to massive, ever-increasing volumes of various data types derived from different and distributed sources (Androutsopoulou et al., 2019). Governments should develop e-government mechanisms to motivate big data and algorithms. Because a new data-driven era is beginning.

2.1.2. Data-Driven Government

The transition from the industrial society to the information society (Dwivedi et al., 2019) has increased the importance of information by accelerating the production, storage, processing, and sharing of data with technological developments. In addition, Kitchin (2014, p. 3) define as “data are a key resource in the modern world.” Developments in ICT, especially the internet, have entirely changed the way people and institutions produce, consume, and interact with content. This change has accelerated the transformation of public services and digital policies. Data is at the center of these digital policies. Big data, datasets, and data mining are the main factors in the digital reform of the state. (Jetzek et al., 2014, p. 101) mentioned that "Data have become part and parcel of modern times." Today, there are many virtual tools that public institutions apply for online user applications. These tools result from digitalization in public and an element that reveals the effective service delivery of institutions. During the daily routine operations of public institutions or communication technologies by citizens receiving service from the public, very high volumes of data emerge. Data-driven governance can become part of the internal functioning of government (OECD, 2018).

E-Government ecosystems are correlated with massive, ever-increasing volumes of various data sources obtained from various and distributed sources (Androutsopoulou et al., 2019). Another fundamental feature of the pervasive digital age is the formation of enormous data sets due to AI, ML, sensing technologies, and the IoT. Therefore, data governance encompasses the public sector's readiness to adopt data-driven strategies. Governments can then use data to predict the needs of the public and offer improved programs, enhance policy delivery, and measure their performance (OECD, 2019b). According to Gang-Hoon et al., (2014, p.83), "Governments expect big data to enhance their ability to serve their citizens and address major national challenges involving the economy, health care, job creation, natural disasters, and terrorism." In OECD report (2019b, p. 16) data-driven public sector was defined as "the importance of data as a foundational enabler for public sector organizations to work together in forecasting needs, shaping delivery, and understanding and responding to change."

With the introduction of fourth wave technologies in public institutions, the public sector has become the owner of a significant amount and variety of data in the electronic environment. As a result of digital technologies, data processing and storage costs have decreased big data has started to be used more and more widely for effective policy design for the public sector. On the other hand, Hemerly (2013), a public policy and government relations analyst at Google mentioned that the data-driven policy structure should balance data flow as freely as possible while ensuring individuals' privacy and security. Governments generate and collect large amounts of data through their daily activities such as tax collection, national health systems, traffic data control, cybersecurity, and issuing official documents (Munne, 2016). Besides, "data mining" is one of the most important defense mechanisms of governments in crisis management, for example, in extraordinary situations such as fighting pandemics or terrorism. Moreover, data mining, which is an essential tool in analyzing big data, has become more frequently used to develop data storage tools, barcode and sensor technologies since the 1990s.

The public sector, which produces large amounts of data in different service areas, can share data for citizens' participation in public administration and democratic governance. The accessibility and availability of data have increased tremendously, with demand on all kinds of public organizations to release their raw data (Janssen et al., 2012).

The use of the internet in the public sector has revealed a data-oriented government understanding of big data and data mining in the 2010s. Data sets and various volumes/velocity of increasing data day by day bring the need for automation in data analysis. Industry 4.0 components such as

the IoT, smart cities, and machine learning can continue to transform public sector understanding. Data and algorithms may be at the center of this transformation soon. Data and algorithms may be at the center of this transformation in the near future.

2.1.3. Algorithmic Government

Algorithms are a set of instructions and rules that machines use to solve problem which are the cornerstone of modern computing and intelligent machines; they perform calculations, process data, perform automatic reasoning tasks, and convert data into outputs. Since the 1980s, computers' data processing capacity and power have increased rapidly, and computers have become learning machines. Big data emerged in parallel with the development of the IoT and sensors in the 2000s (Cordella & Dodd, 2019; Gasser & Almeida, 2017). However, big data also increased the need for advanced algorithms. In this framework, algorithms, the last step of digitalization reforms in public administration, are thought to have a determining role in the future of public administration(Janssen & Kuk, 2016; Veale & Brass, 2019). Höchtl et al., (2016) pointed out that our society is affected by three driving forces:

- First, the speed of processing current information has dramatically increased with digitization and statistical systems. All data related to inputs, outputs, productivity, and processes have become computable.
- Secondly, integrated systems have been developed for connection and sharing data.
- Third, AI applications with algorithms and machine learning systems on data and complex networks are becoming widespread. In order to draw meaningful results from complex connections and data sets, algorithms are considered the new technological trend of our age.

After the 2010s, the data-driven government enables the use of new tools in public administration. With an enormous data set, administrations create more effective and cost-effective management mechanisms with industry 4.0 tools. In this context, algorithms that perform data mining automatically, AI and ML systems, chatbots, and supercomputers constitute the essential components of algorithmic management. According to the European Union Parliament report, the algorithm defines as "an unambiguous procedure to solve a problem or a class of problems." Algorithms, by definition, typically consist of a set of instructions or rules that take some input data and return outputs (Castelluccia & Métayer, 2019, p. 3). The report "Government by Algorithm: Artificial Intelligence in Federal Administrative Agencies" prepared by the US Administrative Conference defines algorithmic government as follows: "The use of AI-based

tools to support government decision- making, implementation, and interaction called "algorithmic governance" (Engstrom et al., 2020, p. 9). According to the report, "nearly half (45%)" of the federal agencies surveyed in the US are trying to adapt to this digital transformation with AI and machine learning (ML) tools (Engstrom et al., 2020, p. 6). The algorithmic government involves the use of integrated technological systems in the public sector due to the digital revolution. Public data sets, which increased with e-government applications, popularized technological automation tools in the public sector. The new data technologies that form the essential components of algorithmic governments are shown in Table 9.

Table 9. Algorithmic Government Component

	DATA TECHNOLOGIES	**OUTPUT**
1	Government data facilities	• Public data portals
2	Internet of Things (IoT)	• Sensors • Devices • Network connectivity
3	Artificial Intelligence (AI)	• Machine Learning (ML) • Deep Learning • Chatbots
4	Big Data Analysis	• massive and heterogeneous data • patterns • correlations
5	Blockchain	• distributed ledger • smart contracts • national coin

Source: Author

Agencies and departments are rapidly utilizing automation and augmentation technologies at all levels of government either to improve the performance of public sector operations or to facilitate strategic decision-making on complicated policy issues and strategies (Veale & Brass, 2019). AI algorithms and techniques can process and learn with the enormous amounts of data collected from the linked IoT devices to create public services and value (Kankanhalli et al., 2019; Wirtz & Müller, 2019). IoT-enabled AI technologies can be implemented in critical places of smart government primarily to enhance the efficiency of administration as well as the quality of life of people (Chatfield & Reddick, 2019). In addition, algorithms can significantly contribution to data analysis (Reis et al., 2019), policy modeling and simulation. Moreover, algorithmic decision-making offer options for making management decisions more efficient, accountable and transparent (Castelluccia & Métayer, 2019). In this context the effects of algorithms on the public sector are categorized various dimensions in Figure 7.

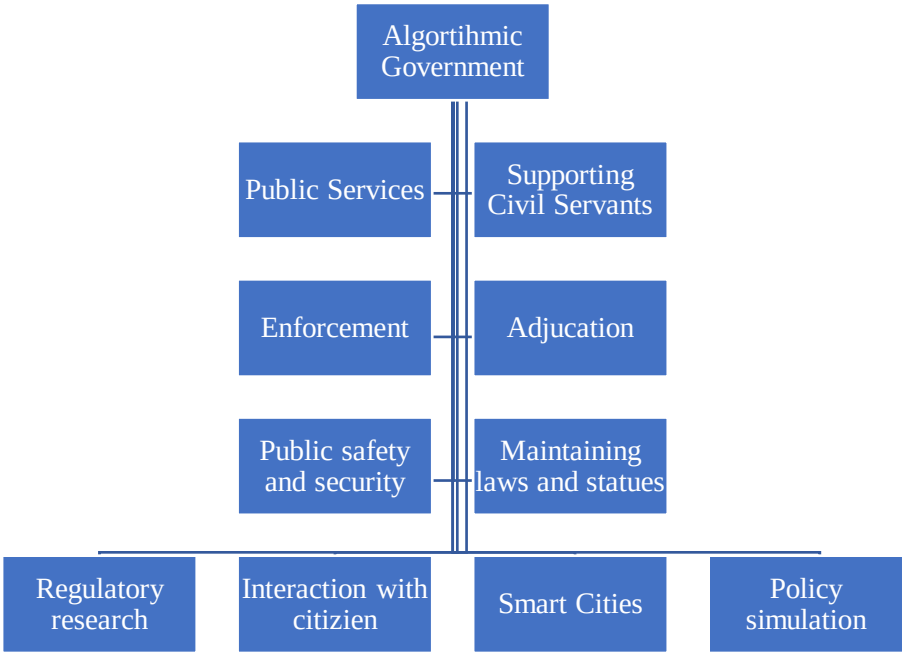

Figure 7. Use and Contribution of Algorithms in the Public Sector

Source: Adapted from Castelluccia & Métayer, 2019; Engin & Treleaven, 2019; Valle-Cruz et al., 2019; Engstrom et al., 2020

Algorithms have started to be used in many areas of the public sector, from security to local government services. In the use of algorithms, states have objectives such as increasing administrative efficiency, improving citizen experience, and accelerating economic development (Algorithm Watch, 2019). Algorithmic government can also provide the coordination and integration between government offices and bureaus as required by organizational goals undertaken by middle-level managers in bureaucratic structures. Moreover, the algorithm-based system improves the use of e-government (Al-Mushayt, 2019), IoT (Ma et al., 2019), and AI system (Valle-Cruz et al., 2019) and their interaction with citizens. However, governments are faced with how these new technologies, which are developing rapidly, will integrate or adapt to the public sector. Governments are faced with uncertainties arising from issues such as planning difficulties brought about by rapidly changing technologies, confusion caused by legal issues, increased cyber risks. Therefore, In the next section, the adaptation of AI to the public sector will be discussed.

2.2. ARTIFICIAL INTELLIGENCE IN PUBLIC ADMINISTRATION

AI is transforming not only technological or engineering innovation but also sociological, political, and administrative environment. Public administration plays a crucial role in developing

and adopting AI (Misuraca & Van Noordt, 2020). AI is already adapting to various areas of the public sector (Androutsopoulou et al., 2019; Ojo et al., 2019; Sun & Medaglia, 2019). Although this integration process differs from country to country, AI applications are becoming increasingly common in several functions of government (Sousa et al., 2019). The current development of AI is supported by changing technological conditions by offering optimum factors. The changing structure of AI technologies now affects large parts of society, encompassing social interactions, human-government relations and business systems and also offers multifarious opportunities in the public policy perception (Önder & Saygili, 2018). With the use of emerging technologies such as AI and data analytics, aspects of public policy are fundamentally evolving, and these technologies include receiving various types and amounts of feedback and enhancing the ability to participate reflecting informed policy content.

Early studies with the reflections of AI on public administration have considered AI technology as a new level of a computing system. Since the end of the 1980s, studies on AI and public administration have begun to take place in the academic literature. The first studies in the literature were shaped around expert systems and new level of computing systems. In this framework, Hadden (1989) pointed out that expert systems will improve the decision-making process and increase productivity in public administration. Similarly Shangraw (1987) argued that expert systems are an opportunity to operationalize the public policy-making process. On the other hand, (Duffy & Tucker, 1995) examined the use of AI in political science perspective. Duffy and Tucker (1995) argued traditions and meanings can be challenging in modeling AI for political problems. However, scholars emphasized that machine learning systems, election simulations and expert systems can be used frequently in policy modeling in the future. Similarly, Barth and Arnold (1999) having one of the first studies in the context of AI and public administration addressed the implications of AI on the government and several dilemmas in the field, such as usage of "administrative discretion, responsiveness, judgment and accountability" innovations in governments. In both articles, attention was drawn to the need of trained experts on AI and computer system in public sector.

In the last decade, multiple technological advancements were made and AI continued to evolve to AI 2.0 (e.g. Big-data-based AI, internet crowd intelligence, human-machine hybrid-augmented intelligence, autonomous-intelligent systems) (Pan, 2016). Therefore, after the 2010s, AI started to be studied by academics as a "hot topic" in public administration and public policies. Investments in AI-based technology in many countries have become one of the important public policies at different levels of government (Sousa et al., 2019b).The capabilities offered AI are

wide-ranging. Center for Public Impact (2017) offers four specific AI capabilities that can be used to improve the functions of public sector. These capabilities are listed below.

1. **Predictive analyses**: AI can make predictions using massive data sets. This situation can be used in various fields of the public, from health to criminal potential. AI can help both policymakers and frontline civil servants to make predictions in a way that is more comprehensive and less subject to human bias.
2. **Detection**: AI works in recognizing anomalies and crises. Moreover, it can be used to detect problems within complex data sets.
3. **Computer vision:** Computer vision AI systems enables the collection and processing of data obtained from various sources as well as the analysis of computer vision, satellite and CCTV images. In this way, complex public works are automated. AI-based computer systems will become even more important in the future, especially in the development of safety and health policies.
4. **Natural language processing (NLP):** The NLP can be used at various stages of public policy. Effective analysis of citizens petitions and public documents and chatbot systems can be useful at local and central level. NLP enables machines to process and understand voice and text data to automate tasks such as translation, interactive dialogue and sentiment analysis.

The use of AI has already created demand for new skills beyond technology and technical skills in the public sector (Buren et al., 2020; Eggers et al., 2017). AI requires a technology ecosystem integrated with many other technologies. For this reason, the use of AI in the public sector includes effective use of e-Government systems, coordination with data centers and cybersecurity.

Adaptation of AI to public administration requires a strong digital infrastructure. In addition to the integrated e-government system, the data ecosystem is necessary to integrate AI into the government. Chen et al., (2019) discussed integrating AI into the public sector in four stages. Figure 8 shows AI on public administration is as follows:

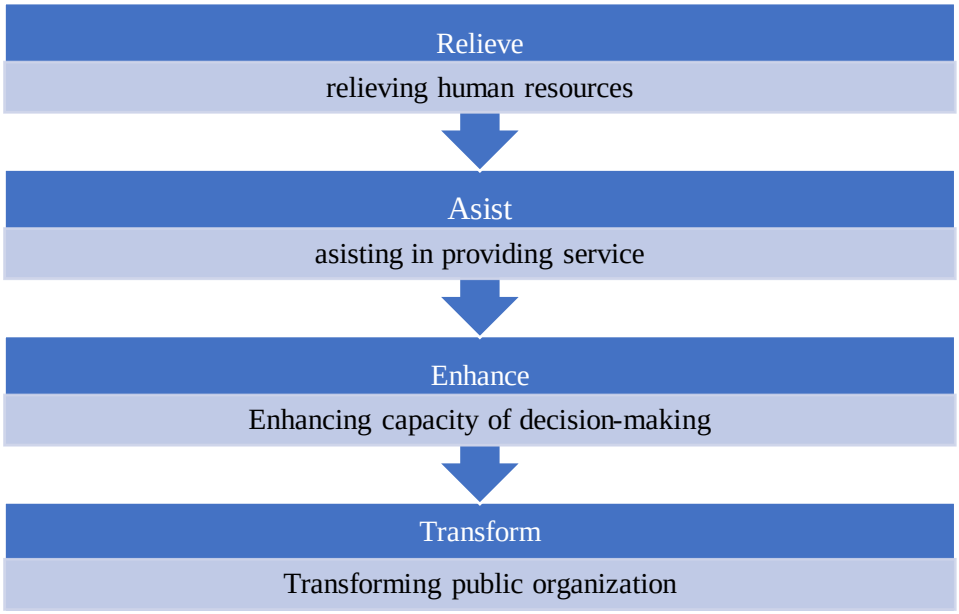

Figure 8. Four Stages of Artificial Intelligence in Public Sector

Source: Adapted from Chen et al., 2019, p. 109

Scoping the OECD Principles report (OECD, 2019a) mentioned that governments should perform three functions in AI adaptation. First, governments must provide funding to support the development and adoption of emerging technologies. These supports may include actively pursuing various funding schemes concerning R&D project calls or pilot tenders. Second, governments can act as smart buyers of existing solutions through innovative procurement practices or co-developers through public-private partnerships (PPP) and forms of collaboration to create new solutions. Governments should support a multi-stakeholder ecosystem in the adaptation of AI in the public sector. Finally, governments as rule makers and policy-makers need to address the accelerated innovation cycles of emerging technologies, the types of policy and regulatory tools used.

Today, AI has started to be used in various service delivery in the public sector. Eggers et al. (2019) examined the usage examples of AI in the public sector in various dimensions. Figure 9 shows the rates of AI used in the public sector.

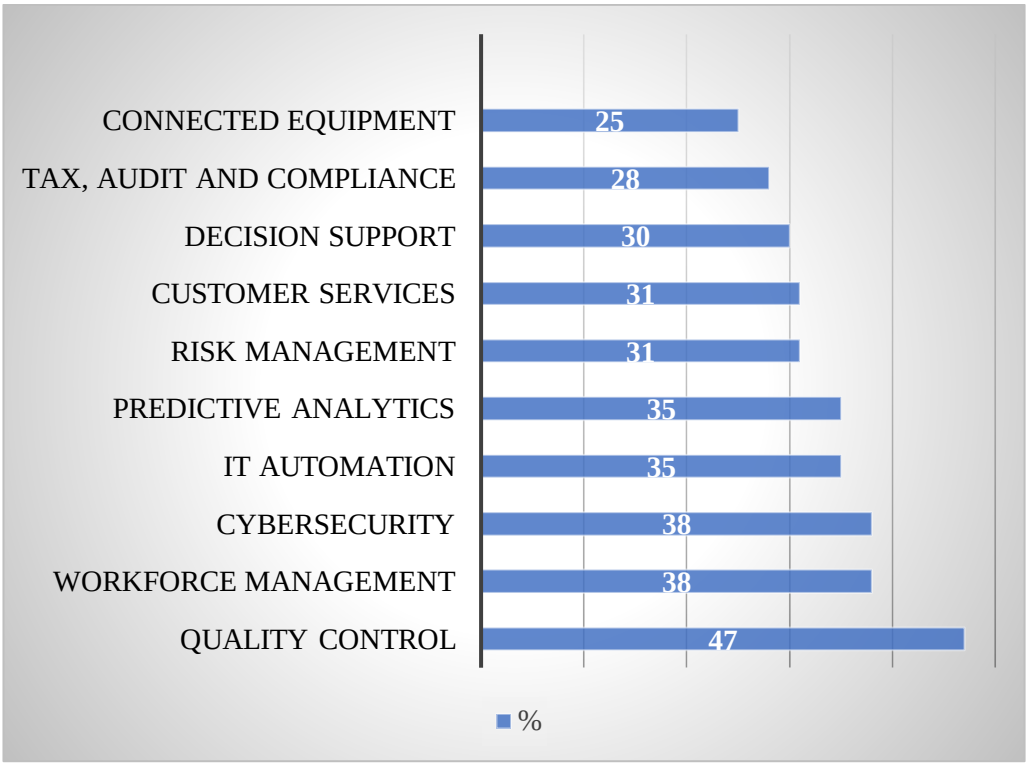

Figure 9. The Top Artificial Intelligence Uses Cases in The Public Sector

Source: Adapted from Eggers et al., 2019

Similarly, Capgemini Consulting report (2017) stated that the implications of an AI-driven public sector have two perspectives. To begin with, AI has huge economic potential which boosts efficiency and secondly, AI has a greater part of public service to be delivered. Public sector organizations can increase their productivity by automating operations and complex tasks, and also using AI for rational decision making. Eggers et al. (2017) showed that automating activities already performing regularly could free up millions of working hours per year out of a total of 4.3 billion. Moreover, this report predict that automation will save 1.2 billion hours a year, saving $41.1 billion. Overall, it is clear that the use of AI in the public sector is increasing day by day. In particular, AI applications provide an important optimization in accelerating “paperwork”. AI has significant results in scanning documents, managing the workforce and increasing citizen satisfaction.

2.3. ARTIFICIAL INTELLIGENCE STRATEGY

The main effort in adapting AI to the public sector is the existence of strategy documents. While determining the AI strategy of the countries, determining their priorities and focus is an essential element of AI strategies. The preparation of strategies and plans brings along the need for legal

regulations and laws related to AI technology. Governments aim to prepare an AI vision and strategy compatible with their organizational goals (Buren et al., 2020). Strategy documents have been influential in the public sector's recognition of AI. Governments have identified frameworks for AI that are beginning to "showcase" this new development. The integration process of AI into the governments requires a particular process. When examined in the strategic documents of the countries, a series of common themes draw attention (Okçu & Akman, 2020). However, the AI strategies of the countries are beyond the scope of this thesis. For this reason, in this section, instead of summarizing AI strategies, the common themes in AI strategies and the role of strategy documents in the adaptation of AI to the public sector will be summarized.

AI strategy in the countries studied is shaped according to the priority areas and policies of the countries. AI will transform the strategy studies of the future (Ayoub & Payne, 2016) because AI is formed by the combination of many different parameters and technologies. There is no clear solution for how this multi-dimensional technology cluster can be used or integrated into the public sector. However, AI will transform the governments of the future. For this reason, the integration of AI into the public sector requires a multi-dimensional strategy. First of all, supranational institutions such as OECD and EU prepare broader strategy documents regarding the integration and implication of AI into the public sector. These structures offer an international perspective with informative reports and documents about understanding the AI innovation approach (Önder et al., 2020).

On the other hand, some governments have prepared their national strategy documents from an AI perspective. These governments determine their adaptative, supportive, and preventive policies against the AI technology trend at the national level following their economic, political, and even social structures. Moreover, global private sector companies also provide recommendations regarding the use of AI in the public sector. These documents provide a framework for determining the adaptation strategy of AI to the public sector and the risks to be faced. Governments act on the axis of their priorities while preparing AI strategies Nevertheless, the AI strategies of countries focus on different aspects of AI policy such as scientific research, talent development, skills and education, public and private sector adoption of AI, ethical standards and regulations, data, and digital infrastructure(Allen, 2019). For example, South Korea has one of the main goals, such as pioneering global AI R&D investments. India aims to use AI for inclusive growth, to store data related to AI, and make it accessible. US and China, two countries of the global artificial intelligence competition, make significant investments in this field. The US prioritizes using AI in the military and training the next generation's workforce.

However, China attaches importance to data mining and integrate AI into all aspects of citizen life. The United Arab Emirates aims to reduce government costs and increase government performance through AI. Japan's goals are to achieve success in robotics and improve productivity with AI. The European Union's AI approach, which focuses on three main points: to encourage procurement and to create a pioneering mission for technological developments, preparing for socio-economic changes, creating an ethical and legal framework. It is seen that each country and cross-country organization adopts an AI strategy. Differences and similarities in AI an important output in the analysis of AI motivation of countries. Fatima et al. (2020) claimed that AI strategy provides insights into a country's agenda to leverage artificial intelligence and the cluster of related technologies. On the other hand, Fatime et al (2020) mentioned, it provides insights into how each country considers the various public policies and economic issues surrounding AI technologies. Additionally, these strategic plans outline how each country will coordinate investment and implementation efforts, both inside and outside the public sector, to leverage AI for the public good. Fatima et al., (2020) study categorized 34 different countries into various codes and themes in strategy documents that reach 1700 pages. As a result of the study, divided the national strategy documents into six themes.

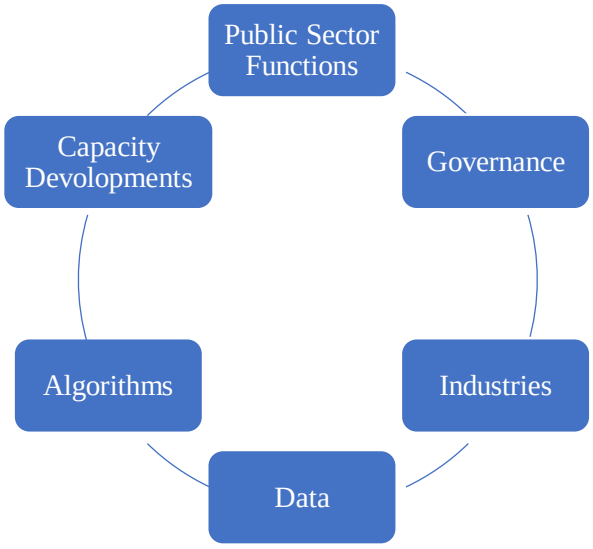

Figure 10. National Artificial Intelligence Strategic Plan Themes

Source: Fatima et al., 2020, p. 188

According to Figure 10, countries' AI strategies include a variety of common themes. Similarly, the report published by the India-based Observer Research Foundation in Pursuit of Autonomy: AI and National Strategies report discussed national AI strategies. The report reviewed 12

national AI strategy documents and consequently identified the main responsibilities that should be included in the national AI strategy (Samir et al., 2018):

- New labor policy for automatic economy,
- Creating new business areas,
- Creating a data ecosystem,
- Determining the ethics and regulation of AI principles,
- Determining the R&D investments.

While the US AI strategy supports new business areas and methods in the private sector and the growth motivation, the European Union strategy aims to present a framework compatible with the socio-economic and ethical principles of the European Union. On the other hand, China's AI strategy focuses on the effects of AI on global economic competition and arm race aspects (Allen, 2019). Finally, each country's AI strategy is different from each other; it focuses on topics such as scientific research, digital transformation, skills and education, public and private sector adoption of AI. Moreover, ethics, participation, standards, and regulations, and digital infrastructure are crucial for AI strategy settings.

2.4. ARTIFICIAL INTELLIGENCE OPPORTUNITIES IN THE PUBLIC SECTOR

AI applications are used in many areas of our daily life. Smartphones, smart home systems, virtual assistant, chatbots, social media applications and online platforms are equipped with AI algorithms. AI algorithms have the capacity to even predict which product we need more. However, AI has revolutionized major transformations in many industries that increased production capacity and quality and efficiency and reduced cost. There are limited researches in the literature on the possible opportunities of AI in the public sector. This is because the number of governments integrating AI into the public sector is very limited. As a result, there is insufficient analysis of the future of AI in the public sector. On the other hand, the possible opportunities of AI in the public sector are examined within the framework of the following questions (Cath, 2018c; Eager et al., 2020; Joao Reis et al., 2019; Susar & Aquaro, 2019; Wirtz et al., 2019):

- What are the possible opportunities of AI in the public sector?
- How will AI change the future of the public sector?
- What kind of investments should be improved to increase possible opportunities of AI in the public sector?

AI has the potential to improve productivity in public sector organizations. Automation capabilities will assist government agencies at simplifying complex tasks, eliminating redundancies, and improving productivity for increased throughput. This quality of AI can be used to unlock a range of advantages such as supply chain management, better decision-making, and waste reduction, resulting in a substantial improvement in total production and economic activity. Mehr (2017) divided AI case studies on citizen services into five categories:

- Answering questions,
- Filling out and searching information,
- Routing requests,
- Translation,
- Paper drafting.

Complex AI technology have arisen as the public sector develops solutions to improve service delivery and government processes (Androutsopoulou et al., 2019). These cases are mostly focused on digital information provided by governments such as big data set about citizens, chatbots, and data analytics. With the increased availability of massive datasets and computation power in recent decades, new AI approaches based on data rather than algorithms have been developed (Sousa et al., 2019a). AI has the power to make public services more efficient. On the other hand, AI has the potential to improve the “decision-making” quality of the public sector. In this context, the possible opportunities of AI in the public sector are shown below.

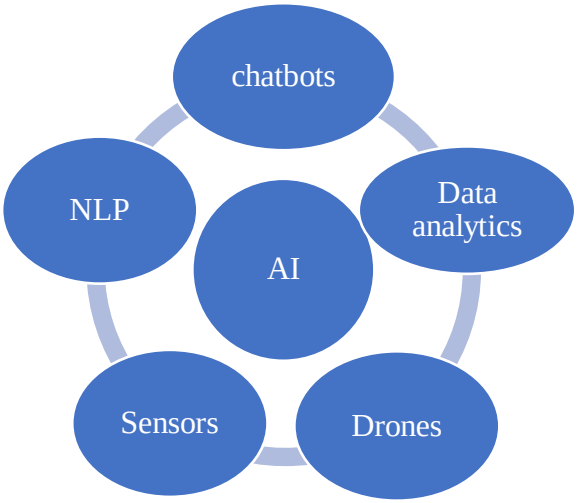

Figure 11. Using Artificial Intelligence Technics in the Public Sector

Source: Author

Table 10. Artificial Intelligence: Potential Opportunities in Public Sector

AI Application	Potential Opportunities	Public Sector Uses Cases
Chatbot	Improve citizen services and Public Relations	• answering citizens' questions, automated AI-based customer support systems, • knowledge processing services • getting citizens' input and routing them to the responsible public administration office, (Androutsopoulou et al., 2019; Aoki, 2020; Mehr, 2017)
Big Data Analytics	Predictive Analytics	• Determine high crime-risk situations • Predicting the possibilities of diseases early (COVID-19) • Predicting traffic conditions, car accidents(Wirtz et al., 2019)
Robotics & Autonomous Systems	Workforce Benefit	• use of robots in dangerous jobs (disaster response, space exploration, nuclear waste etc) • surgical robots in the healthcare system • automatic smart systems of paperwork
Natural Language Generation (NLG)	Recommendation System	• Analyze public feedback • Enhance policy analysis • Improving forensics investigations(W. D. Eggers et al., 2018)
Natural Language Processing (NLP)	Speech Analytics	• Real Time translation • Transcription • Filling out forms • Assisting administrative search
Cognitive Security Analytics	Cyber Security and public security	• Predicting a crime and recommending optimal police presence • Surveillance • Monitoring (Bonin & Malhi, 2020; Fuster, 2020; Wirtz et al., 2019)
Autonomous Drones	Defense	• assist air defense support • protection of borders and soldiers

Source: Author

2.5. ARTIFICIAL INTELLIGENCE THREAT AND CHALLENGES IN THE PUBLIC SECTOR

AI offers various windows of opportunity in the public sector. The use of AI requires a strategic action process to take advantage of the opportunities presented by it (Mehr, 2017). Despite AI's economic and societal potential in the public sector, there is no rose without a thorn. New technologies pose a number of concern (Capgemini Consulting, 2017). However, some prominent figures such as physicist Stephen Hawking and Elon Musk, the founder of Tesla and SpaceX, argue that AI has the potential to be very harmful to humanity. Musk claimed that the "AI is more dangerous than nuclear weapon" (Clifford, 2018). However, it is frequently discussed in the literature that if AI technology continues to develop at this growth rate, it will cause major problems in "income distribution" and "employment" (Osborne, 2017). Although governments have initiated initiatives for AI applications and strategies, AI still poses a number of threats especially for the public sector. Possible threats to be caused by AI are analyzed in various dimensions in the literature (Agarwal, 2018; Sun & Medaglia, 2019a; Wirtz et al., 2020). According to Wirtz et al. (2018) these threats are "threats to be caused AI applications", "uncertainties in AI laws and regulations", "threats related to AI ethics", and "social problems". In a similar way, Agarwal (2018) underlined that AI will expose governments to some threats in the future. Agarwal (2018) warns that if public administrators are not prepared for the threats of AI, industry giants such as Facebook, Google and Microsoft may be more effective than the public authorities. According to Agarwal (2018) AI can cause threats related to employment (job losses), revenue shortfall, privacy and safety. Similarly, Sun and Medaglia (2019) argued that there are social, economic, ethical , managerial and organizational challenges in the use of AI in the public sector.

Every technological revolution has had an effect on the business system. However, the growing economy after every technological revolution has not benefited everyone. The rapid and uncontrollable growth of AI poses a number of threats. First of all, AI systems have as much capacity as present data. Data is the main driving force and motivation of current AI systems. In this context, low-quality data and data that cannot be accurately measured pose a security threat to organizations. Incorrect or weak data causes major errors. In the successful integration of AI in the public sector, it is necessary to collect unbiased and accurate data (Bannister & Connolly, 2020).

One of the most important threats to AI is undoubtedly the impact of AI on the workforce (Brynjolfsson & Mitchell, 2014; Makridakis, 2017; McClure, 2018). AI, which has replaced humans with robots in the workforce, poses a major threat to both public authorities and societies.

The AI revolution will bring about major changes in the workplace and business ecosystem in the next decade (Makridakis, 2017; McClure, 2018; Su, 2018). It is emphasized that AI will offer new business opportunities as well as destroy some professions. PwC (2018) report estimated that AI technologies can contribute up to 14% to global GDP by 2030. This was equivalent to about 15 trillion dollars in today's values (Hawksworth & Berriman, 2018). However, in Future of Jobs 2020 Report, the World Economic Forum (2020) estimates that, AI will create 97 million new jobs and 85 million jobs will be displaced until 2025. In particular, the COVID-19 pandemic shows that digitization is no longer an option for the business system, but a necessity. According to World Economic Forum report (2020), “data analysts” are at the top of the list of occupational groups that will be valued until 2025. Data analysts are respectively followed by “AI and machine learning experts”, “big data specialists”, “digital marketing and strategists”, “digital transformation experts”, “information security experts”, “software and application developers”, and “IoT experts”. As it is seen, almost all of the new occupational groups emerge due to the technological transformation experienced. According PwC's research (2018), AI has the ability to automate 3% of jobs over the next few years. Enhanced digital transformation as a result of COVID-19 might speed up this process. Therefore, 30% of the jobs and 44% of the workers with poor education will be at risk of automation by the mid-2030s, when AI progresses and becomes more autonomous (Hawksworth & Berriman, 2018). Some businesses and industries will be more affected by automation. Public administrators are required to produce public policies related to these sectors according to the risk ratios. The following figure lists potential jobs with high automation risk.

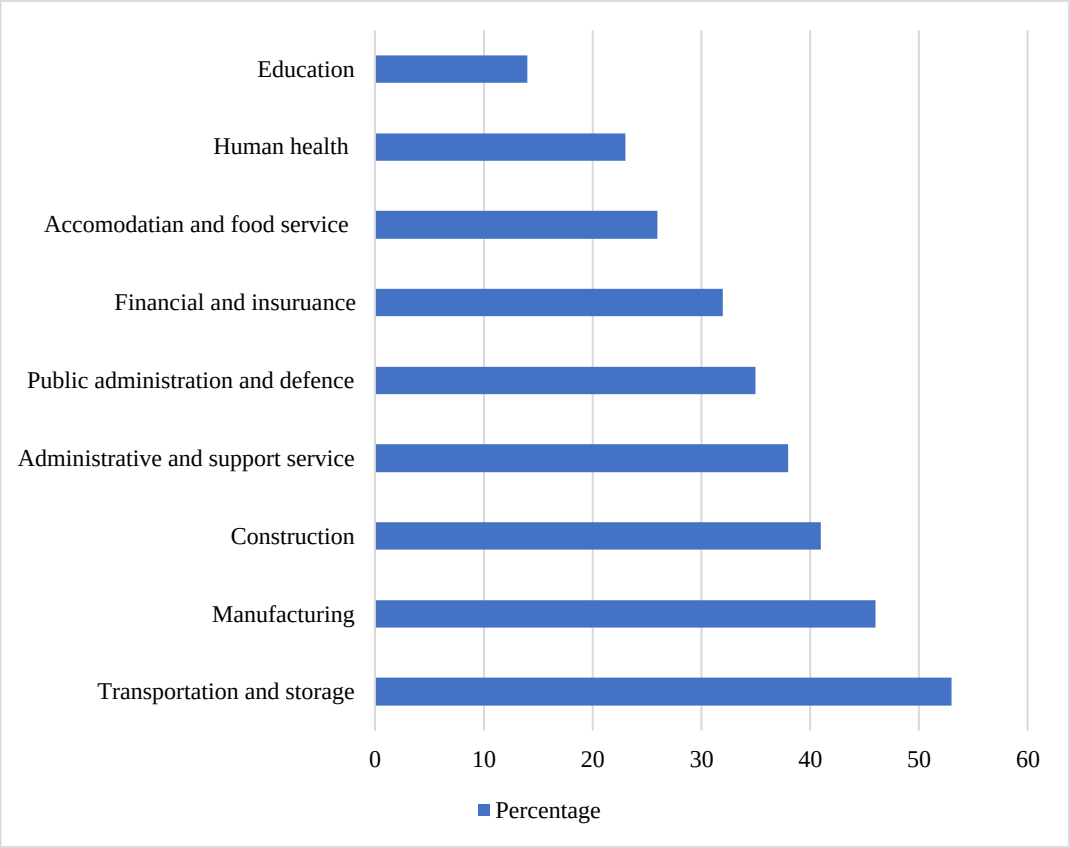

Figure 12. Potential Jobs at High Risk of Automation

Source: Adapted from Hawksworth & Berriman, 2018, p. 3

As seen in figure 12, AI threatens many business lines and jobs. Public administration is also among the threatened jobs. Working in a government is perceived as a "dream job" in many countries. However, in the near future, office personnel and paperwork officers are likely to be replaced by complex algorithms. In the next topic, theoretical and practical approaches to the possible threats of artificial intelligence will be discussed and the future agendas of AI and the public sector will be evaluated.

2.6. ARTIFICIAL INTELLIGENCE IN THE PUBLIC SECTOR: PROSPECTS FOR THE FUTURE

2.6.1. Universal Basic Income

Industry 4.0 and AI revolution has begun to accelerate the automation in the works, and this will result in large employment losses in many business sectors. It is foreseen that especially "transportation and manufacturing" will be done completely by robots in the next 30 years.

Economics studies have been examining “technological unemployment” since the beginning of the 20th century. Especially the automation process experienced after the industrial revolution brought the concept of technological unemployment to the public agenda. Keynes (1930) explained technological unemployment as follows:

> “We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come - namely, technological unemployment. This means unemployment due to our discovery of means of economizing the use of labor outrunning the pace at which we can find new uses for labor”.

Classical School of Economics representatives emphasize that the imbalance in the labor market due to technological change is temporary. According to the classical economists, the imbalance in the labor market could be eliminated through some compensatory mechanisms in the long run. While in some sectors, as a result of technological development and change, machines replace the workforce. However classical scholars foresee that new business lines and jobs will emerge in some sectors (Cengiz & Şahin, 2020). The automation process today is much more than it was in the past. How governments will find solutions to this technological unemployment has been discussing by academics in the literature. In the literature, it is emphasized that one of the most effective solutions to prevent AI-based job apocalypse is “universal basic income” which offers a solution to prevent these negative effects of welfare crises(Furman & Robert, 2018; Goolsbee, 2018). Basic income has now become not only a social and moral obligation, but also a necessity for the sustainability of the current economic system, due to structural unemployment caused by automation and robots.

Universal Basic Income (UBI) includes regular cash assistance using public resources to all citizens of a country or those with an income below a certain level. The state guarantees that the citizens of the country receive an income that can meet their basic human needs (Hoynes & Rothstein, 2019; McClure, 2018; Wispelaere & Stirton, 2004). It is on the agenda of many countries, like Canada, USA, Finland, Switzerland, to alleviate the effects of unemployment caused by technological developments and to eradicate poverty. How basic income can be defined and applied is a different matter. It consists of a regular (monthly or weekly) cash income payment made by the nation state. Like other social support examples, it refers to an income that is paid without being based on needs assessment or working conditions. The right to benefit from basic income is acquired by being a member of a society and it is defined over the rights and responsibilities of a citizen. This point emerges as a separate research and discussion subject, especially considering the increasing international migration mobility in the recent period. Each

individual in the community (not on a family / household basis) is paid at the same level (Beken, 2020). According to Hoynes and Rothstein (2019) universal basic income (UBI) is described by three characteristics:

1. It offers a sufficient cash gain to survive on in the absence of other sources of income.
2. It does not phase out or phases out only slowly as earnings rise.
3. It is accessible to a large majority of the population rather than being limited to a small demographic (e.g., poor people).

UBI proposes a redistribution that guarantees the opportunity for all individuals to live above the poverty line. Scholars who support universal basic income argued that this situation will allow the distribution of welfare in the society equally (Goolsbee, 2018; Hoynes & Rothstein, 2019).

The basic income proposal was first brought to the agenda in 1797 by Thomas Paine. The insecurity, which has increased as a result of the negative impact of technological developments on employment, has revived the idea of basic income since the early 2000s (Erdoğdu & Akar, 2020). The concept of basic income is defined in the literature as "unconditional basic income" (Parijs, 1991). In recent years, unconditional basic income has been brought to the agenda by CEOs of technology companies such as Elon Musk, Mark Zuckerberg and Bill Gates as a measure against the negative effects of the Industrial Revolution 4.0.

Opinions supporting basic income are categorized as "social justice", "freedom", "security" and "economics". Sustainable economic growth is supported as an automatic stabilizer, protecting against large-scale unemployment caused by disruptive technological change (Beken, 2020). On the other hand, there are also concerns about basic income. On the basis of these concerns, it is widely discussed that basic income will cause "new migration waves". In addition, it is claimed that basic income is likely to increase inflation (Rasoolinejad, 2019).

The UBI concept has become more popular with the COVID-19 pandemic crisis. The crisis has deeply affected the low-income population in many countries. The wide-ranging public health crisis has brought the UBI discussions to the agenda in many European countries. Consequently, automation and robotization continue to replace jobs around the world. UBI can still be perceived as a utopian world. However, it is predicted in the literature that UBI will be one of the urgent agendas of public administration in the axis of the welfare state in the coming decades.

2.6.2. Digital Weberianism

With the automation of e-Government tools, the need for low-level bureaucrats in central and local governments will start to decrease. Whether AI effects of street-level bureaucrats is unclear. In the literature, the use of industry 4.0 applications and especially "big data sets" in the public has been expressed as "Digital Weberianism". The old hierarchical order is unlikely to be able to handle the age of AI. New approaches are needed in bureaucratic models. In this perspective, Muellerleile and Susan (2018) suggest that, the characteristics of Weber's political bureaucracy, such as *efficiency, objectivity, and rationality*, have transformed into a less visible, but no less efficient digital bureaucracy. According to Muellerleile & Susan (2018:4):

> "…the digital bureaucracy is a world of data in motion, given direction and shape by new kinds of digital infrastructures from codes to algorithms to platforms, whose digital footprint replaces the material archive, and whose experts are the new data scientists".

Weber's primary observation was that public organizations are socio-technical structures in which well trained, qualified, and impersonally appointed officials are assembled in a corporate and systematized organizational configuration, along with the written papers and guidelines necessary to conduct the operation. Vogl et al. (2020) argued that, public employees' engagement with ICT in emerging corporate configurations now serves to define the Digital Weberian bureaucracies as socio-technical systems. In particular, the public use of AI applications, such as chatbots, predictive analytics, cognitive robots, overlaps with Weber's legal rational bureaucracy model. The concepts of the Digital Weberian approach differ from the classical bureaucratic model. This differentiation is shown in Table 11.

Table 11. A Comparison of the Classical and Digital Weberian Concept

Weberian Bureaucratic Concept	Digital Weberian Concept
Knowledge	Dataset
Bureau/Office	Platforms
Professional	Data scientist
Rule	Code
Procedure	Algorithm
Archive	Digital footprint
Officers	Chatbots

Source: Author

As shown in Table 11, the classical bureaucratic understanding changes and transforms greatly with digitalization and data use. Although the basic principles of Weberian digitalism continue, new models of technology and especially the axis of AI are needed. Bozeman et al.(2020)

indicated that “Robotic bureaucracy entails refers to administrative communications and compliance requests being con- ducted on the basis of automated, highly structured, computer-based interactions that usually originate with a robotic email”. All in all, “robotic bureaucracy” or “automated bureaucracy” will be one of the debates on the axis of public administration and bureaucracy in the next decade.

2.6.3. Artificial Intelligence and the Future of Cities

The population living in cities is increasing day by day. Therefore, it is necessary to produce smart solutions to meet the needs of citizens in mega cities of the future. Smart technologies are at the core of these smart solutions. AI technologies support major changes not only in the central government but also in local governments. New developments in ICT point to a versatile and holistic change in the economic, social and cultural life, architecture, political and even administrative structure of local units. Today, the concept of “smart city” is widely used to describe the changing process (Batty, 2018). When the current literature and applications are examined, very different definitions and related applications are seen on the subject of smart city. However, although there is no standard definition, it can be considered as a “modernization” effort that enables cities to use their resources more effectively and provide better service to city residents. According to European Commission (2021) perspective, “A smart city is a place where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business”. There are various approaches in the literature and practice in regard to planning the transformation process into smart cities and monitoring the transformation process. Among different approaches, Cohen's “Smart Cities Wheel” (2012) methodology stands out. According to Cohen’s approach (2012), smart cities consist of six components: “smart mobility”, “smart living”, “smart governance”, “smart environment”, “smart economy” and “smart people”. These components should be addressed in a holistic way in smart city design.

Smart cities are described as a collection of instruments that characterize multiple scales and are linked by various channels which provide continuous data on the mobility of people and resources in terms of the flow of decisions on the cities (Batty et al., 2012). However, smart city refers to solutions provided by ICT, focusing on people, designing cities based on the principles of participation, openness and sustainability, providing local services and developing policies together with urban stakeholders(Srivastava et al., 2017). It is expected that innovative solutions

in ICT will be articulated to the management of cities and therefore urban problems will be solved quickly through more effective and participatory methods.

Smart cities have seen a tremendous increase in data produced, including real-time and Big Data, with the increased use of digital technology, sensors, and the Internet of Things (IoT). The amount of data, when integrated with machine learning and deep learning, will recognize trends, assist in event prediction, provide more personalized services, optimize resource utilization, and improve evidence-based analytical capability for policymaking and enforcement.

Open data can be produced in many areas such as crime and justice, health, education, transportation and infrastructure, real estate and space, science and research, demography and migration, market and development. When considered in terms of smart cities, many data such as water, energy consumption, natural disasters, weather and climate, real estate, transportation and public transportation essential form of smart city applications (Perc et al., 2019).Smart cities provides more effective and efficient use of urban resources, urban planning, urban infrastructure and traffic (Chang et al., 2019). Big data and data mining solutions are developed in which objects are integrated with innovative technologies such as internet, cloud computing, sensors, machine learning and visualization. Smart city applications also have important advantages in terms of effective and efficient use of public resources (Janssen & Kuk, 2016). Thanks to IoT, large amounts of data are collected in cities with sensors and other tools. Storing, processing and converting data sets into information reveals possibilities for effective decision making.

Smart cities are cities that produce and process data. Data sets obtained from the Internet of Things, sensors and CCTV will be the fuel AI application. Moreover, smart cities include AI integration that will automate citizens' feedback and process data.

Cities digitalized rapidly from the early 2000s. First, e-government systems and models were transferred to local governments. In this way, municipalities opened their online services to the residents of the city. In 2010, e-municipality was integrated into smart phone applications. By the 2020s, the concept of smart cities came to the fore in many parts of the world. New concepts such as eco-city, governance, solid waste management, big data and digitalization have emerged within the scope of the smart cities approach. The rapid urbanization trend, the impact of the globalization process on cities and the active use of smart technologies require the smart city approach to be put on the agenda. However, there are several examples of smart city applications such as smart traffic applications, smart recycling applications, smart building and infrastructure,

geographic information systems, CCTV security camera, especially in mega cities such as Tokyo, Beijing and New York. AI technology and big data constitutes basic components of smart cities. In the future, as the amount of data collected and stored about cities (sensors, internet of things and mobile applications) increases, AI and machine learning will be used more actively. The following figure summarizes the use of AI applications in smart cities.

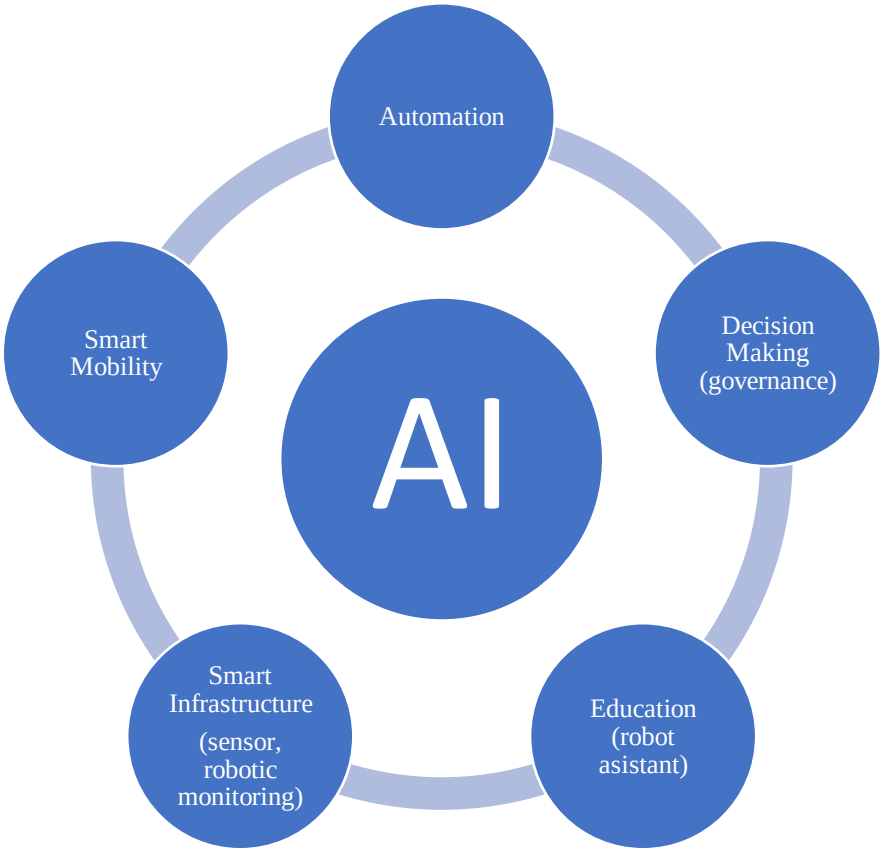

Figure 13. The Use of AI in Smart Cities

Source: Adapted from Golubchikov & Thornbush, 2020

CHAPTER III

ARTIFICIAL INTELLIGENCE AND PUBLIC POLICY

AI technology also has the potential to bring about changes in public policy analysis and the public policy cycle. Evidence-based policy-making, especially data-driven public policy-making, will undergo a new evolution with the combination of AI technology. In this chapter, integrating AI into public policy will be discussed with its various dimensions. On the other hand, AI driven policy-making process and AI policies are also examined.

3.1. PUBLIC POLICY ANALYSIS: MAIN DEFINITIONS AND BASIC FRAMEWORK

Policy refers to a broad situation that include future goals and aspirations, and guides in achieving those goals. The etymological origin of the word politics goes back to ancient times. According to the Aristotelian tradition, politics began simultaneously with human history. Cambridge Dictionary (2021) defines policy as “a set of ideas or a plan of what to do in particular situations that has been agreed to officially by a group of people, a business organization, a government, or a political party”.

The Age of Enlightenment led to the claim that public problems could be solved with analytical efforts. However, policy studies started to define the relationship between government and citizens as a new field of study after World War II (Howlett & Ramesh, 2003). The primary duty of the politicians who come to power by elections is to meet the citizens' demands and minimize social conflicts by reconciliation. One of the main outputs of this essential task is public policy. The process of public policy-making is a political, bureaucratic, technical, multi-actor, highly interactive, and complex process. Negotiation, participation of the main actors, conflict management, reconciliation seeking, contingency planning, and harmonization play essential roles in this process (Dror, 2017).

Public policy is a concept that emerges in meeting the demands of citizens, in the execution of services and ensuring public order, as well as improving all functions of services and order. In meeting the demands of a citizen for an issue or problem, public policies are created to respond to these demands and to find solutions to problems. The intervention against demands and problems is carried out in the political power and the state organs attached to it. In this respect, public policy can be considered as the work and action of a public institution or a public official

who has an authority on any subject that the authority power of the state from the laws permeates (Weiss, 1977). The process of public policy formulation is a systematic method of making the complex structure of public policy more understandable, which includes the comprehensive and multi-faced connections of state institutions, private and legal entities, citizens, social groups, and private sector organizations, both within their structures and in their relations with each other. Due to the dynamic nature of this process, the multiple varying connections and factors affecting it, scientists could not set clear and precise boundaries about the scope of the public policy process in the historical development of the field, and the field has gradually expanded(Gordon et al., 1993). It can be argued that there is a desire to solve social problems and respond people's requests in the background of public policies. On the other hand, public policies vary significantly since social needs are related to different policy fields. Therefore, public policy deals with a wide variety of fields such as defense, energy, environment, foreign affairs, education, welfare, security, highways, taxes, housing, social security, health, economic opportunities, urban development (Dye, 2017).

3.1.1. Public Policy Analysis: Definitions

There are many definitions made by various academics and experts in the public policy literature. Defining public policy is too complex for some people and straightforward for the others (Howlett & Ramesh, 2003). For example, the phenomenal definition made by Dye (2017) defines public policy as “whatever governments choose to do or not to do”. Anderson (2003) has defined public policy as a “relatively stable, purposive course of action followed by an actor or set of actors in dealing with a problem or matter of concern”.

Based on the several definitions in the literature, the characteristics that define public policy can be listed as follows (Dunn, 2018; Hill, 2016):

- Public policy is goals and objectives oriented, not accidental,
- Public policies are established, implemented and evaluated by officials in the political system,
- Public policy refers to a process or the whole of government actions and decisions designed to solve specific societal problems,
- Public policy includes both acting and non-acting,
- Many internal and external actors are involved in the formulation, implementation, and evaluation of public policies, ranging from politicians to international organizations.

Public policy is a field of study that does not have a single definition and includes many factors. From the Ancient Inscriptions to AI regulation policies, public policy is one of the tools of the relationship between government and citizen. With the increasing involvement of technology in public administration since the mid-20th century, public policy has adapted to this new process. Decision-makers and policymakers use technology in drafting public policies. One of the main focuses of this thesis is the effect of AI on public policy, the creation of public policies related to AI, and the integration of AI in the public policy process.

3.1.2. Public Policy Framework

Public policy analysis has an important place in public policy studies. In public policy analysis and research, efforts are made to contribute to the better execution of public policies created to serve citizens, solve problems, achieve specific goals, and produce more effective and productive results. Therefore, public policy analyses aim to enable policymakers to suitable decisions by understanding the facts, possibilities, requests, resources, needs, and demands of public policy and processes in a data-based perception (Dror,2017).

Policy analysis is a scientific study conducted to understand the policy-making process better and obtain reliable information about the socio-economic conditions that have significant effects on the actors that make policies. A policy analysis is concerned with who will gain what with the policies and how these gains make a difference. It is a study about which policies governments should follow, why, and what kind of effects the results of these policies will have. Public policy analyses show how policy is carried out or will be defined at different stages (Babaoğlu, 2018). On the other hand, evaluating public policies informs whether the programs implemented are desired and thought (Howlett & Ramesh, 2003). Within the framework of public policy analysis, analyzing the stages of public policy formulation and implementation depends on obtaining data regarding the applications made at these stages and processing and evaluating these data. In a policy analysis, the multidimensional focus is on benefit, cost, options and preferences, principles, actors, relationships, behaviors, beliefs, meanings, values, metrics, performance, and outcomes. Dunn (2018) designed policy analysis is to provide policy-relevant information on five types of questions. There are “policy problems, expected policy outcomes, preferred policies, observed policy outcomes and policy performance” (Dunn, 2018: 5).

In a public policy analysis, the actors are concerned with determining the problems related to society, forming policies to solve the problems, and their implementation and evaluation. In this

framework, public policy analysis studies can be examined in two main dimensions: first, the analysis process and second, it can be handled in terms of the public policy actors playing a role in this process. A public policy analysis includes a multidimensional analysis process such as positive and negative results, externalities and implementation of solution alternatives (Yıldız, 2013). In this framework, the process of public policy analysis is examined in the literature as a "cyclical process".

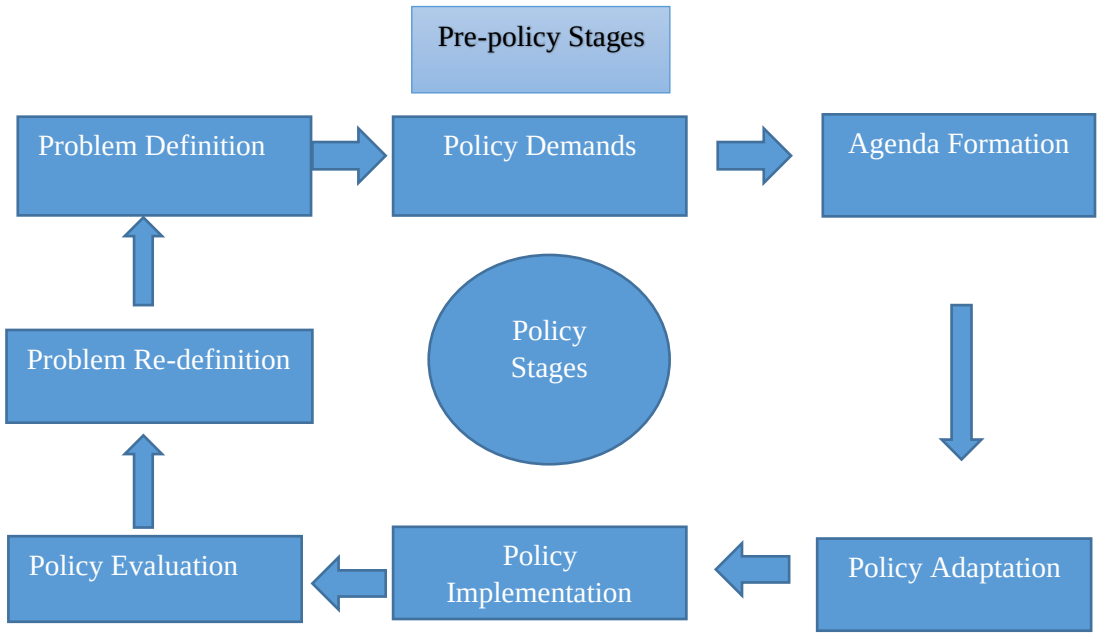

Figure 14. Public Policy Stages

Source: Adapted from Cochran et al., 2010, p. 10

In the 21st century, technological developments have affected and changed both the public policy-data relationship and the policy-making process. Big data has become a tool that can be used effectively in all policy-making processes. Collect data, process, and decision making was gathered in one step, and instant decisions were made possible. In addition, instead of the use of these data only by decision-makers or policymakers, the data were opened to both academic and civilian fields, enabling the development of "pluralist decisions" and "alternative policies". With the development AI and data mining, rational public policy decisions that are not limited to the human mind have been paved(Munne, 2016; Provost & Fawcett, 2013). In this process, it is prioritized to obtain data regarding the practices and processes carried out at the stages of public policy. There is a need to process and evaluate these data. Therefore, many analysis methods and techniques are used in public policy research and analysis(Veenstra et al., 2018). In this context, science and technology policies offer a new frame window of opportunity in public policy

analysis. In this part of the thesis, public policies will be discussed in the axis of evidence-based policy to data driven policymaking.

3.2. EVIDENCE-BASED POLICYMAKING TO DATA DRIVEN POLICYMAKING

There is an ongoing interaction between evidence and public policy while the existence of this relationship varies widely with the policy area (Nutley & Webb, 2000). Brownson et al. (2009) mentioned that evidence derives from legal contexts in the legislation of Western cultures; so, it means that it comes in the form of government reports, police testimony, expert judgments, and forensic science. All quantitative (epidemiological) and qualitative results are essential for policy-relevant evidence. The evidence-based public policy provides an output for "real" policy expectations.

The criteria for effective and efficient governance with NPM's trends have fostered information on outcomes. This trend has provided the potential for applicable social science, including program evaluation, quality of implementation, and emerging methods to solve complex issues using new policy systems and techniques that served the core concept of evidence-based policymaking (Head, 2008). Evidence-based policy analysis represents a contemporary and analytical approach to public policy making. With an evidence-based approach, governments can develop reforms and restructuring solutions in line with public policies. Evidence is initially motivating the policymaking process (Howlett, 2009).

The use of "evidence-based policymaking" technics in policy processes started to increase thanks to the ICT which is developed after the 1970s (Busch & Henriksen, 2018). Since the early 2000s, most of the governments in developed countries have started to use evidence-based public policy, from agricultural policy to health policy. With the spread of the internet throughout the world and the decrease in data storage costs, the understanding of evidence-based public policy has turned into a data-based public policy. In this transformation process, the mentality of using information and communication technologies has increased in the public policy process. Furthermore, the developments in ICT, more efficient use of resources have come to the agenda since the demands for rationality, reliability, and transparency in public policy decision-making processes have increased. Managers and public servants have had to include technology in their information processing processes. Technological advances have accelerated the transition from evidence-based public policy to data-based public policy. Berg (2020) has historically summarized the transition to public policy through digitalization in several periods.

Table 12. The Evolution of Public Policy and Technology

Time Period	Policy Making	Technology
Until 1850	Based on autocratic rule	Written sources
1850-1900	Based on ideologies, group-interests	First Industrial Revolution: steam engine
1900-1930	Informed by modern statistics	Second Industrial Revolution: electric power
1930-1970	Modern social planning, technocratization	Electric power
1980's	Adaptive policies, incremental learning	Third Industrial Revolution: internet
1990's	Evidence-based policymaking	Internet
2010-	**Data-driven policymaking**	Big Data and AI

Source: Adapted from Berg (2020)

3.2.1. Data Driven Public Policy

People generate upwards of 2.5 million bytes of data per day (Margetts & Dorobantu, 2019). Digital platforms and social media allow customers and citizens to easily express and share their opinions while making it easier for them to proclaim their common demands and participate in management quickly. As a result of the transformation and digitalization in technology, decision-making and policy-making processes from top to bottom in traditional centralized power and management structures transform, and more participatory mechanisms are formed (Linkov et al., 2018; Sousa et al., 2019a). However, the contributions of digitalization in reaching managers and politicians can put pressure on decision-making and policy-making processes. Public officials and policymakers should analyze and respond their citizens' demands with the same speed and detail (Thierer et al., 2017) Otherwise, the problems cannot be solved on time and crises arise. For these reasons, the public sector and governments concentrate their capacities and capabilities to analyze and respond to requests transmitted in large volumes of data. Provost and Fawcett (2013) mentioned that data science and data mining include the process of automating public policies. In this perspective, data-driven policy-making improves the automatic decision-making process. The multiplication and processing of data sets necessitate a developing governance mechanism and establishing a data-driven decision-making system (Provost & Fawcett, 2013). There are several benefits of using big data in the public policy cycle. In Figure 15, Pencheva et al. (2018a) has evaluated the contributions of big data to the public policy cycle in terms of various policies in stages. Pencheva et al. (2018a) mentioned that big data not only improve policy analysis but also offers better decision-making and increases productivity.

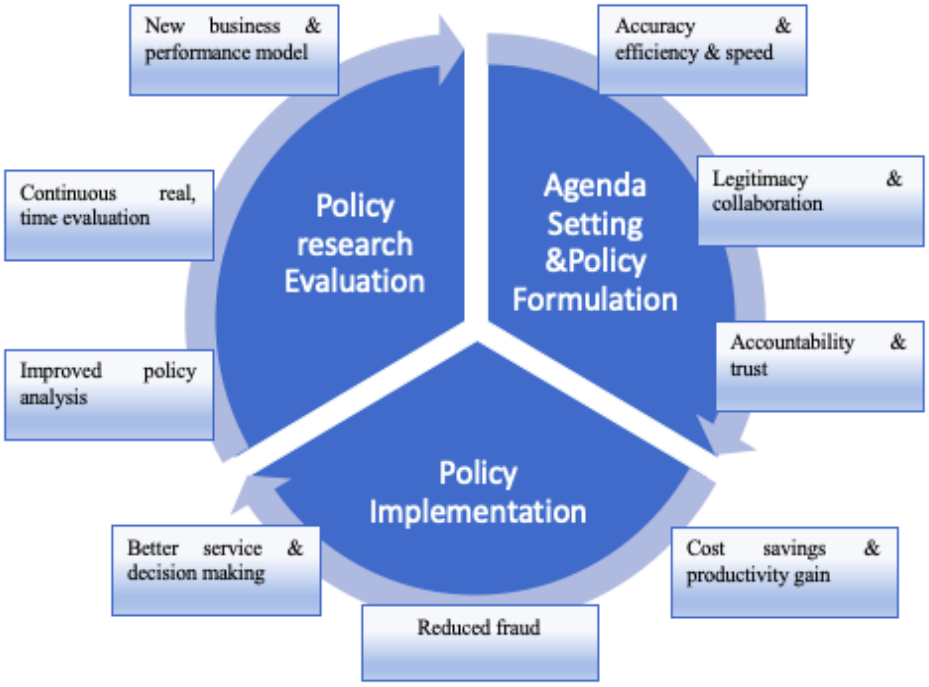

Figure 15. Benefits of Big Data in Policy Cycle

Source: Pencheva et al., 2018, p. 8

Data-driven policy analyses are possible with AI technologies because data is the "fuel power" of artificial intelligence. AI technologies such as machine learning and deep learning develop a computer-based solution for processing and categorizing large volumes of data and analyzing complex data patterns. Furthermore, AI contributes to the velocity of data by facilitating data analysis and making new data-driven decision making. Data-driven public policy is primarily concerned with massive and open datasets in policymaking and policy co-creation through citizen participation. Not only is data-driven decision-making supposed to contribute to decision making, but it also seeks to create legitimacy (Veenstra et al., 2018). On the other hand, as Jimenez-Gomez et al. (2020) argued, "the potential of public value increases when data are taken as a core element in those public organizations looking for a data-driven digital government".

The traditional policy cycle allows for changes only after results have been evaluated. This situation is insufficient for 21st-century public policymakers in terms of both time and efficiency. Höchtl et al. (2016) propose a newly formed policy cycle in which public policy evaluation takes on an ongoing rather than at the end of the process. This approach has occurred as an opportunity for repetition and reassessment of policy process. Therefore, its perception suggests that the data-driven policy process would remove evaluation from its place at the end of the policy-making

process and instead make it an integral part of all other policy-making steps. In Figure 16, Höchtl et al. (2016) illustrated the continuous evaluation of policy at all levels of the data-driven public policy cycle minimizes policy-making inefficiencies by encouraging solutions or early exits from proposed policies.

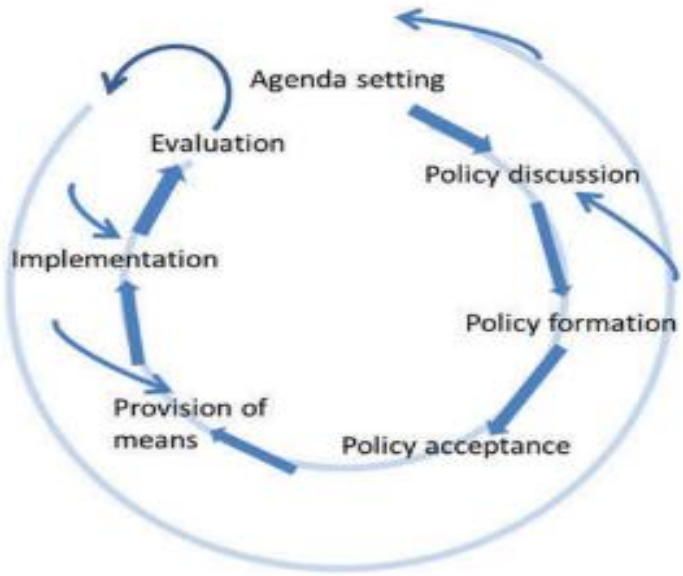

Figure 16. Data Driven Policy Making Cycle

Source: Höchtl, J, Parycek, P., & Schöllhammer, R. (2016).

It is possible to see more data-based and evidence-based innovative policy-making processes and results in all areas of life, supported by new technologies and ways of doing business. For this reason, the policy making process of AI technologies will continue to be one of the important discussions of policymaking process in the future.

3.2.2. Public Policy Making to Public Policy Making 2.0

In recent years, specialization areas related to technological developments have been discussed in public policy. "Public policy and technology studies" have become even more critical at the intersection of public policy analyses and e-government studies. The process of analyzing public policy and the increasing use of ICT in raising and solving public problems are linked, and a synergy has occurred between these two areas(Ferro et al., 2013; Misuraca & Viscusi, 2015, Yıldız, 2020).With the increase in the internet access and the widespread use of social media applications, a new era has started in public policy-making. This new era started being studied as

"public policy-making 2.0" (Ferro et al., 2013; Misuraca et al., 2014) or "government 2.0" (Chun et al., 2010) in the literature. This process expresses the evolution of ICT in public administration.

The ICT innovation has changed daily lives and the relationships between governments and citizens. Digital governance or electronic government has begun to promote and reshape new and current information, connectivity, and transaction-related connections between stakeholders (Chun et al., 2010). The emergence of e-government as a public policy and its adoption in different countries took place after 1980. Public services or some management processes of public institutions that occur by using computers and web-based technologies have played an essential role in the transition from paper-based transactions to digital transactions. However, this is a one-way relationship in which information only flows from governments to citizens. There is a need for an information mechanism flowing from citizen to public. The widespread use of social media and software development providing instantaneous communication and comprehensive technical support for citizen participation have increased. Thanks to the expansion of this kind of principles and the rise of social media and interactive communities, the emerging model of "web 2.0 (social media sites, blogs, wiki's, RSS.)" offers a chance to people to learn and discuss their interactions online (Bonsón et al., 2012). Therefore, "open government" approach signifies the transition to the more participatory and transparent government 2.0. With the spread of the understanding of open government, social media and explosion of citizens' data, there was a transition from the traditional digital government to government 2.0 (Bonsón et al., 2012; H. Chen, 2009; Chun et al., 2010). The comparison of these two understandings is shown in the table below.

Table 13. A Comparison of Traditional Government and Government 2.0

Traditional digital government	Gov 2.0
Information provision (information sink) model	Information source (creation) model
Service provision model	Service demand model
Policy enforcement model	Policy making and negotiation mode
Agency internal decision making/governance model	Shared governance

Source: Adapted from Chun et al. (2020)

Similar to the transformation of government 2.0 with web 2.0 tools, the same situation has been experienced in public policy-making. Evidence-based public policy-making has developed in harmony with ICT. In this process, the understanding of evidence-based public administration has evolved into a data-driven public policy approach.

With the use of “social media and big data” in public policy making, the “policy-making 2.0” approach has started to be discussed in the literature (Ferro et al., 2013; Koussouris et al., 2015; Misuraca et al., 2014). Various approaches have been put forward towards policy-making 2.0. Misuraca et al. (2014, p.173), refer to this phenomenon as “policy-making 2.0”by identifying it as a collection of policy-making technology methods and technical solutions. This umbrella term shows the interaction between various technologies and ICT-based modeling used to achieve the participatory, evidence-based government and the associated organizational and social structures.

Ferro et al. (2013) drew attention to the inadequacy of traditional public policy in responding to social problems and changes. Technological transformations have necessitated a more participatory and citizen-centered new policy-making approach. In this context, the understanding of policy-making 2.0 has been developed around of the usage of social media and the feedback from citizens (Ferro et al., 2013). For instance, Ferro et al. (2013) developed the policy-making 2.0 approach based on the European Commission project called PADGETS. Under the PADGETS initiative, a centralized cross-platform approach for the use of social media by government agencies in their public policy-making processes was developed. It is based on the notion of “policy gadgets” described as resources developed by a policymaker, usually instantiated through a central framework within different social media activities.

Koussouris et al. (2015) explained the policy-making 2.0 approach in the context of a collaborative and evidence-based public policy-making process. Advanced simulations facilitate the cooperation among various actors, thus simplifies the decision-making process even in the most complex and challenging conditions. Figure 17 illustrated common points of public policy-making 2.0 approaches in the literature that is “open government, web 2.0 tools, and data-driven policy” layers.

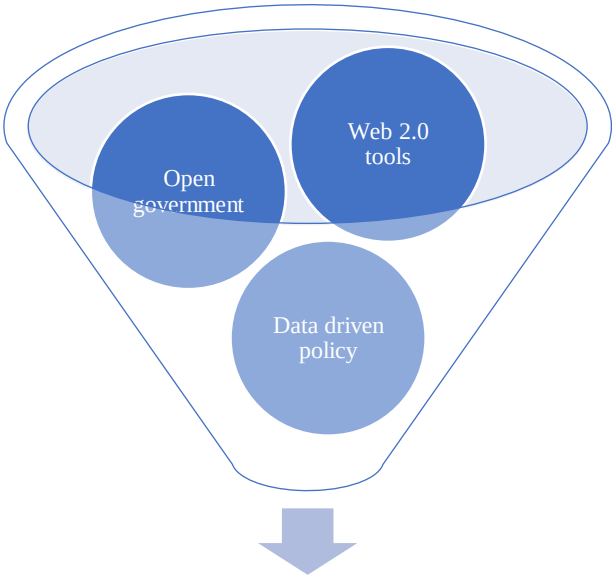

Figure 17. Policy-Making 2.0

Source: Author

Big data and data science have created a turning point in public policy-making. The public policy 2.0 approach is developed by the principles of good governance and massive innovation of ICT. Therefore, the primary purpose of the public policy-making 2.0 approach is to involve citizens more in the public policy-making process. From this point on, the perspective of public policy-making 2.0, which consists of big data and online networks, constitutes the current form of evidence-based public policy making. At this point, an important question arises: what will happen with AI being included in this process?

3.2.3. Machine Learning and Public Policy Making: Policy Making 3.0

The development of technology has accelerated the flow of time. Even an hour is a long time now in solving public problems. For this reason, governments have to act quickly in defining public problems, agenda-setting, and public policy implementations. Data-driven approaches, data mining, and statistical linear regression analyses have become important in the public policy-making process. According to Thapa (2019, p.8),

> "Data-driven government refers to the use of new digital data technologies in public administration, such as algorithmic decision-making, artificial intelligence, big data or machine learning and the subsequent social and organizational transformation of government".

In this context, data-driven public policy-making shows new trends in parallel with technological developments. For this reason, new models and systems are needed to model millions of unique data from different sources.

Machine learning algorithms are described as algorithms that allow computers to perform cognitive operations without being programmed. Building models and relationships between data sets, machine learning systems can create predictive models of citizens needs and future public issues. Moreover, clustering algorithms, which gain more importance under the machine learning system, include pattern recognition, speech recognition, image and sound processing, citizen preferences, geographic conditions, and demographic structures, social network analysis revealing the trend topics. Clustering algorithms are used to identify groups and subgroups with similar characteristics or reveal their differences in the big data analysis, as in data mining techniques. With the clustering method, common public problems of a particular group can be predicted and a solution can be developed for this situation.

Machine learning systems, which optimize existing data sets and raw data, allow policymakers to improve prediction capacity in solving problems. However, unlike data processing, machine learning methods are able to learn very flexible and versatile functional models from data without being directly defined by programmers. If enough training data is provided to machine learning techniques, it can adapt more dynamic and complex relationships between independent and dependent variables (Steuer, 2018). Moreover, trained data sets provide predictable outputs. Machine learning predictive techniques give effective results in various local and central government departments, from security to pandemic management (Athey, 2017).

Machine learning techniques originated primarily with computer science and engineering. Versatile methods, such as the development of web search engines, image classification methods, natural language processing, and text analysis have enabled machine learning systems to be used in the public sector (Buchanan & Miller, 2017). Machine learning and data mining have several benefits to the public sector. The contribution of machine learning to the public sector can be examined in various dimensions (Charalabidis, 2020):

- Efficiency: Automates analysis of big government data,
- Accuracy: Machine learning and data mining techniques offer automatic rationality without human intervention,
- Performance: Machine learning offers automatic classification of government data sets and reducing cost and complexity,
- Multidimensional: Machine learning provides the opportunity to classify, categorize and mining various sizes and complexities of data sets.

Based on the key benefits of the machine learning system in the public sector, examples of machine learning in public policy making can be addressed in various dimensions of flexibility, from detecting the tendency of domestic violence to immigrant integration. Machine learning systems can make essential predictions in a matter of seconds. In this aspect, the machine learning system can be used at various public policy stages. Jurisdiction is one of the most important examples of using machine learning systems in the public sector. Berk et al. (2016) claimed that machine learning provided significant findings in predicting domestic violence. According to Berk et al. (2016), the machine learning system can predict whether domestic violence will happen again based on old data sets and cases. A similar study about jurisdiction questioning how to use machine learning tools to analyze the texts of court proceedings. Machine learning systems show a 75% success rate in legal text reviews (Medvedeva et al., 2020). On the other hand, machine learning systems can explain poverty and scarcity with a scalable model. For example, Jean et al. (2016) demonstrated how a convolutional neural network can be learned to recognize picture (satellite imagery) components that can demonstrate up to 75%of the variance in regional economic outcomes.

The healthcare industry includes various electronic healthcare records, laboratory results, imaging studies, diagnostic codes, and genetic tests. Health datasets provide an opportunity to make better diagnoses and get to know diseases by using the previous information about them. Machine learning is one of the efficient tools used to integrate and make sense of healthcare data at this scale. The machine learning method has been used to make optimistic-neutral and pessimistic predictions about the size and peak time of an outbreak. This situation has provided an important gain in predicting how the epidemic will spread and how quickly (Brueckner, 2020). Machine learning has also been used in various fields since the early days of the fight against the COVID-19 pandemic. As an example of these fields, machine learning techniques have been used in the spread of the epidemic, monitoring the epidemic and mobilization of citizens, and predicting the

place where the epidemic transmission will increase. On the other hand, machine learning systems are actively used to find drugs for diseases (Buchanan & Miller, 2017). Beyond its economic dimensions, the machine learning system provides an important insight for observing demographic change (Bansak et al., 2018). The machine learning model uses a combination of supervised machine learning and optimum matching to explore and exploit synergies between refugee and resettlement locations. This machine learning model using the US and Swiss refugee data proposes optimum results regarding finding jobs for refugees. However, machine learning system does not always provide positive outcomes. Ackermann et al. (2018) analyzed the implementation of a machine learning early intervention system for police officers. This research determined that the machine learning system-based early intervention system caused various problems such as "technical implementation, trust, governance and cost of use". The study draws attention to the importance of the reliability and sensitivity of the data used.It is likely to see more machine learning systems in the policy-making process in the near future. However, before this system is integrated into the public sector, the data culture should be made aware of the level of public and citizen. Machine learning systems will constitute one of the important tools of data-driven policy-making because machine learning algorithms can initiate a policy-making process that will "automating automation" (Brynjolfsson & Mitchell, 2014). Thus, there are various progression methods for machine learning adaptation to the public sector. In this framework, the adaptation of machine learning is associated with the realization of various vectors. Figure 18 illustrated the five vectors of machine learning using in policy-making.

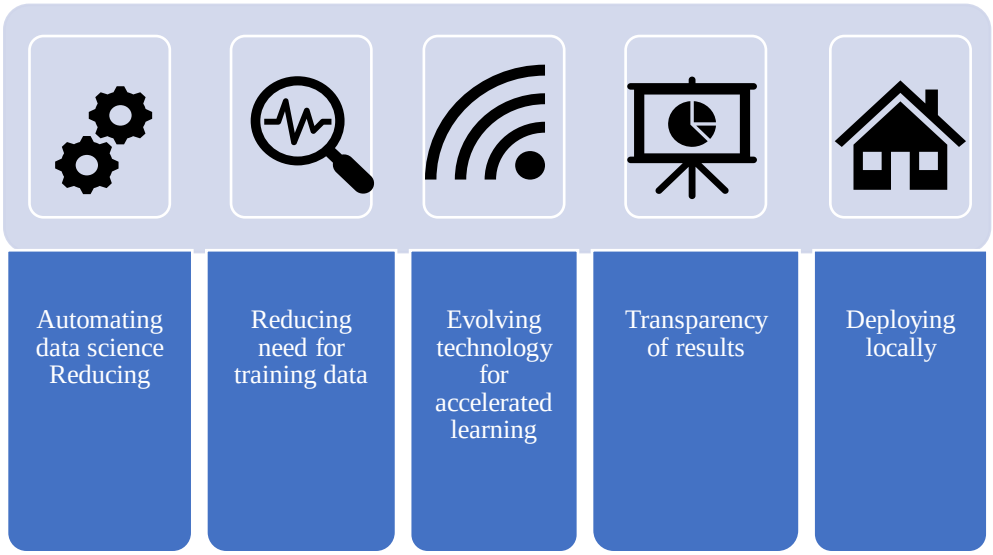

Figure 18. Five Vectors of Progress

Source: Adapted from (Schatsky & Chauhan, 2015)

3.3. ARTIFICIAL INTELLIGENCE AND PUBLIC POLICY

Public policy deals with “the public and its problems” (Dewey, 1927). The direction, structure, actors, and functioning of public policies transform with the development of technologies. ICT is constantly in a process of renewal in social and administrative terms. Technological developments have created some new opportunities to facilitate people's lives, and also “problem identification” “agenda setting”, “decision-making”, “policy implementation”, “policy adoption” and “policy-evaluation” opportunities in the field of public policies for public administrators and managers (Yıldız, 2020). In the last twenty years, technology has become more accessible with the widespread use of the internet, the development of smartphones and 3G and 4G infrastructures, and e-government tools. Technology is more included in the determination, implementation, and decision-making processes of public policies. The nature of technology also feeds this dialectical relationship. While problem-solving is an essential point of public policies, technology exists to produce faster and practical solutions for problems (Busch & Henriksen, 2018; Head, 2008). Governments have the reflex of being a structure that renews itself and adapts to today’s conditions. This situation necessitates the adaptation of changing technologies to the governments. With the increase in digitalization and intelligent systems, citizens' expectations from public services are also changing and transforming. Citizens' demand to do all kinds of transactions in the public sector quickly and to handle their transactions digitally without going to any institution is among the motivation of using new technologies in public policy.

Today, technologies and innovative applications are becoming essential tools of public policies. While the developments in technology reveal some new opportunities that will make people's lives easier, it offers various opportunities for public administrators, such as better planning, decision-making, feedback mechanism, reaching more citizens with fewer resources. In this context, how developments in ICT effect the public sector and public policy processes such as planning, implementation and evaluation should be monitored and analyzed.

AI will create a great transformation compared with agriculture or the industrial revolution (Dafoe, 2018). From this point on, it is clear that AI in public policy is not a choice, but a necessity. In this perspective, AI technologies, which are described as the future technology by many scientists and leaders, constitute a question of how the whole will be handled in public policy analyses or where it will take place in the "public policy cycle". After 2010, AI started to shape public policies regarding digitalization. On the other hand, creating public policy through digitalization is only possible with "data-based policy". For these reasons, after 2010, AI became common by the private sector and the data-based policy-making processes of the governments

(Valle-Cruz & Sandoval-Almazan, 2018; Veale & Brass, 2019). The public policy formulation process includes defining the problem, setting the agenda, creating policies, realizing policy legitimacy, implementation, and evaluation. New technological perception and approaches such as AI techniques and data mining offer significant potential in implementing and evaluating public policies. On the other hand, the preparation process of public policies is as necessary as the policies implemented. AI might constitute a problem identification tool at the preparation stage of public policy. It is controversial at what stage AI will take part in this multifaceted process. Considering the role of AI in the policy-making stages, as the predictive capacity of AI improves, the government will be allowed to create a more predictable agenda in the interests of its citizens. In this context, the use of AI in the policy-making phase can reveal making more accurate and reliable decisions. The main driving forces of public policy for AI should be solving crucial and urgent problems, crisis management, responding to sophisticated problems, contributing to decision-making processes, and promoting economic progress. However, the handling of AI in public policy contains various questions. These big questions discussed in the literature draw an essential framework for handling AI in public policy.

Table 14. Big Questions of Artificial Intelligence and Public Policy

Authors	Questions
(Valle-Cruz & Sandoval-Almazan, 2018)	• "What is government's AI policy?"
(Ojo et al., 2019)	• "What are the mechanisms, outcomes & challenges associated with AI use in the public sector?" • "To what extent are AI solutions implemented within post- NPM initiatives?"
(Brundage & Bryson, 2016)	• "How can government agencies protect consumers and citizens from unethical, unsafe or unsound use of AI systems employed in critical contexts such as healthcare, finance, or employment by companies or individuals?"
(Calo, 2017)	• "What constitutes best practice in minimizing discriminatory bias and by which mechanism (antidiscrimination laws, consumer protection, industry standards) does society incentivize development and adoption of best practices?" • "How do we ensure that the risks and benefits of AI are evenly distributed across society?"
(Naudé & Dimitri, 2020)	• "How can government policy reduce competition in the race for an AGI and raise the importance of administrative capability?" • "Should AI be taxed?"
(König & Wenzelburger, 2020)	• "How capabilities of AI affect the informational requirements of the democratic policy process?"

Source: Author

There are uncertainties regarding the new AI revolution. However, governments must do research on the future of AI and find a way to develop AI policy. Thus, governments can be prepared for uncertainties that may arise in the future. When the questions in the literature are examined, there are various approaches in the context of AI and public policy. These questions are likely to expand over time. However, this thesis section generalizes on the following big questions about AI and public policy. The big questions on AI can be summarized as follows:

- How can AI be integrated into the public policy process?
- What are the AI applications that transform public policy?
- Where is AI used in the public policy-making cycle?
- What kind of problems can AI technology pose in public policy-making?
- What opportunities can AI technology offer in public policy-making?

3.3.1. Artificial Intelligence: Policy Pattern

Public institutions and agencies are seeking to use advanced data collection forms to provide better services. These initiatives consisted of digital infrastructure improvements are designed to "improve the experience of the citizens", "making government more effective", and "boasting economy" (Veale & Brass, 2019). Similarly, Valle-Cruz and Sandoval-Almazan (2018) brought out that "AI in government is represented by intelligent software and sophisticated hardware to boost smart government, reducing costs, errors, and corruption; increasing transparency, openness, and interoperability". Kankanhalli et al. (2019) also emphasized that AI methods and tools will evaluate and improve the massive volumes of data collected from the linked IoT devices to establish public services and value. Correlatively, AI technologies can provide facilitators of improved productivity by optimizing cognitive activity, freeing up high-value tasks, increasing decision-making, computational capacities, and enhancing citizen demand services (Dwivedi et al., 2019a; Eggers et al., 2017; Sun & Medaglia, 2019a). Likewise, Allam and Dhunny (2019) argued that the collection of data through AI will allow a better quality of livability; through cleanliness, wellbeing and desirable conditions for people to live and operate without the urban of emissions and chaotic problems.

Ayoub and Payne (2016) claimed that AI will profoundly affect the execution of the strategy in the near future and will disrupt the current balance of power. However, it is necessary to define strategies, principles, and policy sets to integrate AI before starting public policy-making. Public

policy actors and policy-makers should address AI public policies with specific frameworks and principles. In the literature, the points to be considered in the formulation of public policy regarding AI have been determined.

The proposed public policies on AI are quite varied. Some studies in the literature mentioned that public policies about the economic impact of AI (Agarwal, 2018; Agrawal et al., 2019; Buchanan & Miller, 2017; Goolsbee, 2018), while others suggest that policies to minimize and regulate the negative effects of AI (Naudé & Dimitri, 2020; Scherer, 2015; Sun & Medaglia, 2019). The other several studies on AI public policy focus on government communication policy among citizens (Androutsopoulou et al., 2019). “Ethics”, “legality”, “human values”, and “accountability” are some of the frequently discussed themes for AI-based public policies in the literature (Cath, 2018a; Dignum, 2017; Floridi et al., 2018). The main focus of AI public policy studies is to improve the "delivery of public services," "provide public services quickly," "improve agencies," "save on expenditures," and "help citizens navigate government services" (Buchanan & Miller, 2017; IBM, 2018; Intel, 2017; Mehr, 2017; Shrum et al., 2019). According to IBM report (2018), “AI is more than a technology. It is a road to transformation. In the coming years, AI will become more routine in government”. For this reason, governments should make public policies compatible with AI. In this framework, governments should necessarily develop public policies that will project the future about AI's economic, social, ethical, and legal dimensions. In the table below, essential AI articles and reports in the literature are categorized within AI policies and political patterns.

Table 15. Artificial Intelligence Policy Areas

Author	AI Policy	Policy Pattern
(Agrawal et al., 2019)	Economy Policies	• privacy, trade, and liability policies
(Goolsbee, 2018)		• policy for the job market and for inequality taking
		• pricing, data property rights and antitrust policies
(Agarwal, 2018)		• consumer protection, privacy and jobless policies
(B. Buchanan & Miller, 2017)	Investment and human resource training policies	• incentivize and funding policy
(Shrum et al., 2019)		• expert training and talent enhancement policies on AI
(Naudé & Dimitri, 2019)	Legal and Public Adoption Policies and Regulation	• taxing policies on AI and addressing patenting by AI policies
(Calo, 2017)		• Certification
(Scherer, 2015)		• flexibility, reactive and regulation policies
(Sun & Medaglia, 2019b)		• adaptive governance policies AI, • data integration policies

(Cath, 2018a)	Ethical and Responsive AI policies	• ethical, legal and technical policies of AI
(Dignum, 2017)		• responsive AI policy (human values and accountability)
(Floridi, Cowls, Beltrametti, Chatila, Chazerand, Robert, et al., 2018)		• bioethics and digital ethics policies
(Mehr, 2017)		• privacy policies
(Androutsopoulou et al., 2019)		• chatbots and communication policies of AI
(IBM, 2018)		• multi stakeholder AI policymaking • cybersecurity policies • reliability of AI
(Intel, 2017)		• foster innovation and open development • liberate data responsibly

Source: Author

Public policies or regulations regarding AI should focus on a specific pattern. It is necessary for AI to be integrated into the public sector and to be used in public service delivery, and public policies should adopt specific approaches. This situation underlines that the artificial intelligence policies to be created in the literature should be multi-dimensional. Figure 19 summarizes the policies regarding AI that should be prioritized. These policies include various policy approaches such as certification policies, privacy policies, and adaptation policies. Policymakers should refer to these approaches in AI studies.

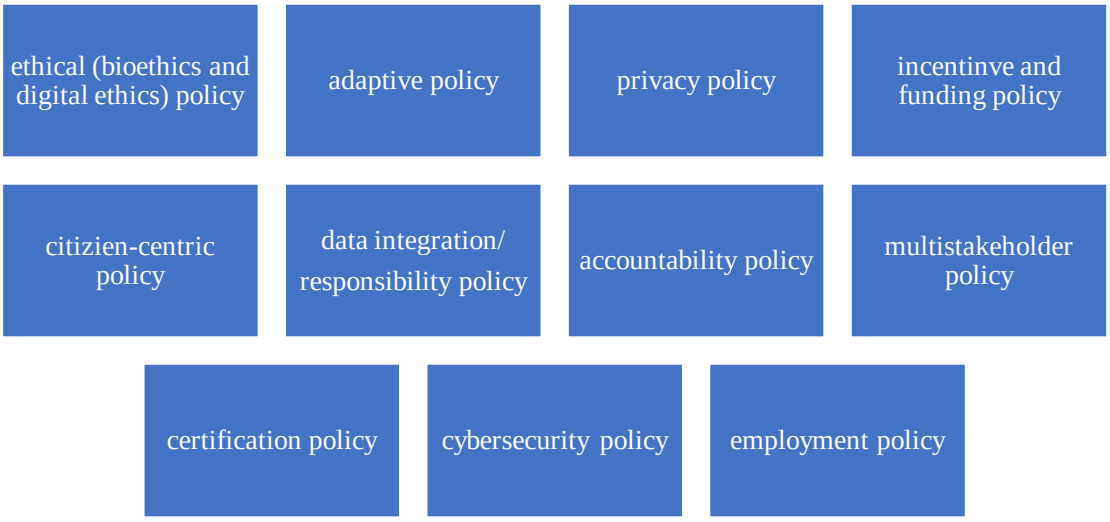

Figure 19. What Kind of Policies Should Be Followed Regarding AI?

Source: Author

On the other hand, Bostrom et al. (2019) have drawn a framework for developing global AI policy and concrete public policy options. Moreover, their study has considered various directional changes of AI as a vector field. Within this framework, Bostrom et al. (2019) developed a policy proposal based on four crucial policies (efficiency, allocation, population, process). All four essential policy proposal aspects contain sub-policy themes in themselves. Figure 20 shows AI policies around four approaches.

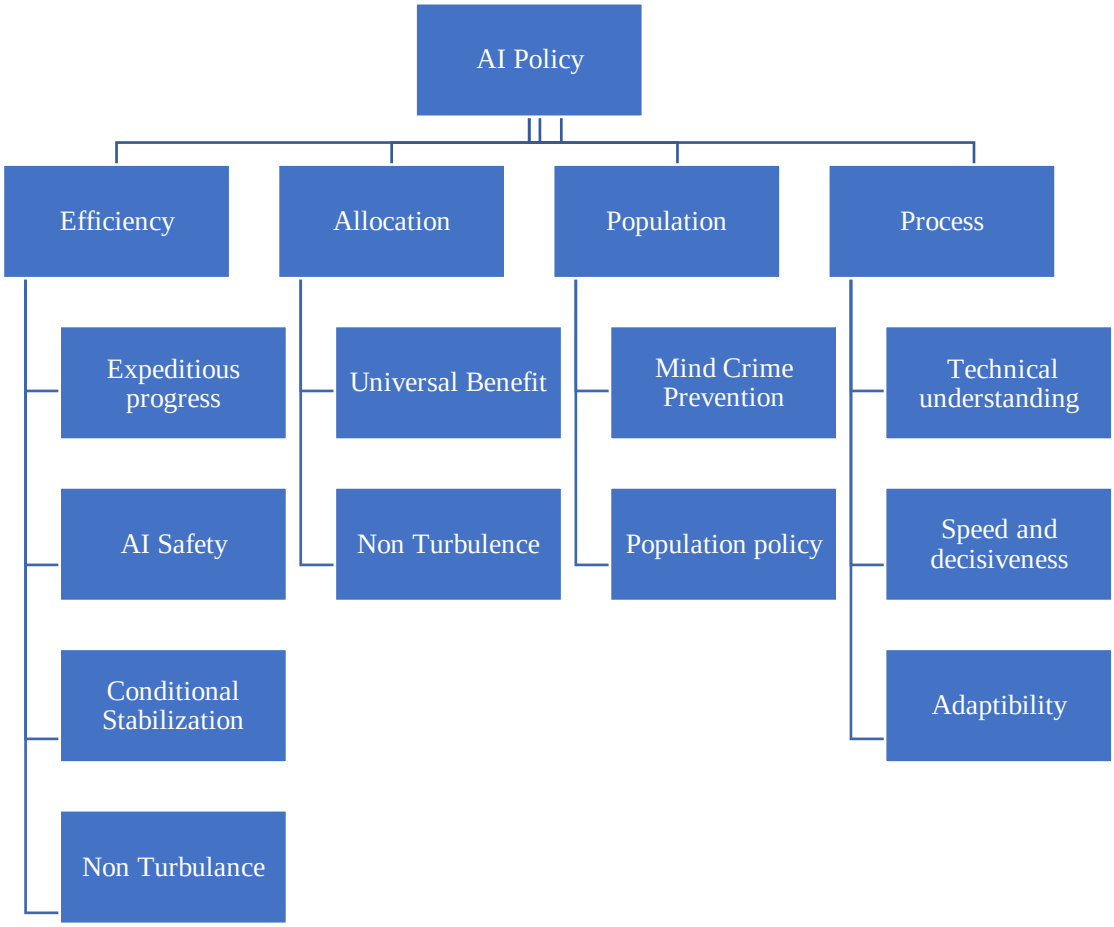

Figure 20. AI Policy on Four Essential Policy Perception

Source: Adapted from Bostrom et al., 2019

3.3.2. Artificial Intelligence in Policy Cycle

Public policy analysis is a problem and action-oriented, multi-method and multi-disciplinary research and application area for the determination and solution of public problems by using many information sets such as political science, law, economy, and sociology, especially public administration. On the other hand, public policy analysis is an analytical decision-making technique that focuses on public issues. In this framework, this section will focus on how AI will affect this cycle.

Policy-making is a cyclical process that is done once and never finished. However, the literature on AI in the public policy cycle is scarce. It is a new emergent discipline field that does not have much empirical research (Valle-Cruz et al., 2020). AI can improve various facets of administration, including operations, citizen engagement, delivery of services, decision-making, implementation and evaluation of public policy (Sun & Medaglia, 2019b; Valle-Cruz et al., 2020). Hence, in this process, up to the desired result area, the cycle is repeated multiple times (Howlett & Ramesh, 2003). Starting from this point, another important question arises: how will the involvement/integration of AI in the public policy cycle affect public policy analysis?

ICT continue to impact the policy-makers and citizens' interaction with each other throughout the policy-making process. Open government data, a series of advanced analytics and AI technology, shape interactions between policy-makers and citizens. The integration of new technologies into public policy-making has brought about changes in the policy-making process (Janssen et al., 2020). Collecting and analyzing content from dispersed sources and the effective use of AI tools to problem definition of public problems and understand the behavior of actors. Therefore, the use of AI methods requires a change in the public policy cycle for policy-makers.

The public policy cycle is a dynamic process that consists of stages that affect each other. The public sector must adapt to new governance and policy-making methods to keep pace with the speed of change in the private sector and citizens' growing demands and not remain static in traditional decision-making structures. The realization that no single monolithic decision-maker deals with public policy issues are differentiated when using ICT, Big Data, and AI technology (machine learning, deep learning, natural language processing, computer-based simulations) in the policy process. It introduces a multifaceted policy cycle model. Therefore, this approach also motivates policy-makers to make more evidence-based policies (Höchtl et al., 2016).

Responding to complex problems and crises requires a dynamic public policy process. Dynamism in the public policy cycle produces better solutions to complex problems in a more efficient and human-centered manner. Thanks to AI, massive data processing, and simulations, every stage of the public policy cycle can offer faster, more accurate, and lower cost. In this way, the use of AI in the public policy process can enable inclusive efficient solutions to public problems. On the other hand, AI has the potential to automate simple/paperwork in the public sector. Moreover, AI contributes to public policy-making working more efficiently and effectively. In addition, AI can automate repetitive tasks, allowing people to do new creative things and improve their public capacity (Valle-Cruz et al., 2019).

It has also become technically better for new ICT to interact with the substance of policy-making, mainly how policies are assessed, and new solutions and alternatives are discussed, to focus on the outcomes of policy-making. Through the use of emerging technology, policy-making process are progressively evolving. AI based policy making involve obtaining various kinds and volumes of data, improve the frequency of feedback and participation mechanism, and enhancing the ability to reflect publicly informed policy knowledge. This framework may need change and innovation in the traditional policy cycle (Janssen et al., 2020; Janssen & Helbig, 2018). In Figure 21, Janssen and Helbig (2018) illustrated the change of traditional public policy cycle with ICT and AI technology. The new public policy cycle includes new statuses such as conceptualism, data collection and experimenting.

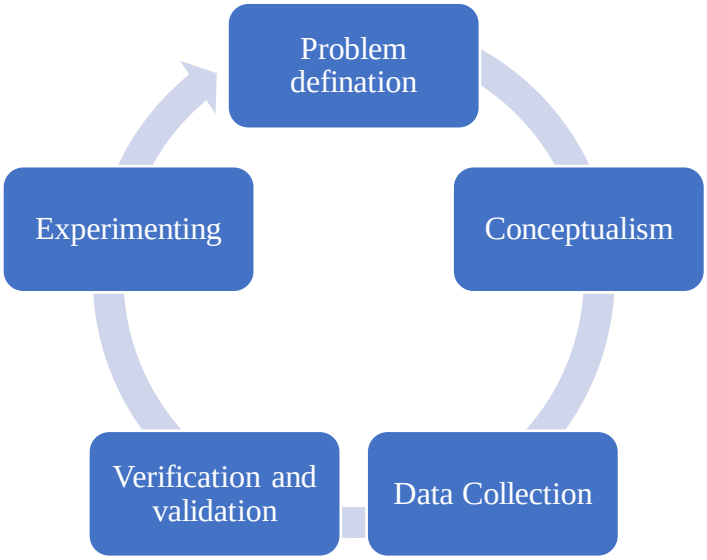

Figure 21. New Modelling of Public Policy Definition

Source: Janssen & Helbig, 2018

Similarly, Valle-Cruz et al. (2020) have proposed a new approach in the public policy cycle called the “Dynamic Public Policy Cycle (DPPC)”. This approach refers to ongoing changes at different stages of the AI-based policy-making process. Valle-Cruz et al. (2020) mentioned that the unique cycle of steps follows the policy cycle in the age of AI. The effect of AI would grow in a horizontal and spiral manner, rather than the previous conception of a single cycle, which needs many variations to create a public policy. Feedbacks will be provided at each point of the cycle, analyzing data with AI methods and simulations. In order to provide outcomes for evaluation, there will be no need to wait until the implementation phase. Figure 22 shows that, rather than the linear cycle, the spiral form reflects a cumulative analysis of each step of the policy cycle. DPPC approach provides rapid adaptation to the particular needs of citizens, natural and pandemic crises, and changing needs and demands. Therefore, AI can be used in every stage of the public policy cycle, promoting efficiency, accuracy, and credibility. The dynamism in the public policy cycle produces better solutions to complex problems in a more efficient and human-centered manner. Moreover, DPPC, which is integrated with AI, has a more efficient and faster response system. For example, Fernandez-Cortez et al. (2020) claimed that the use of AI in public budgeting policy enables dynamic decision making. Thus, a changing future can be predicted with the use of AI technologies and strategies in government. More and more sophisticated tools are emerging in all areas of public policy and administration. The dynamic public policy process of AI will reveal changes in problem identification, agenda-setting, and policy evaluation. Continuous data entry will feed the level of knowledge and response mechanism in the DPPC.

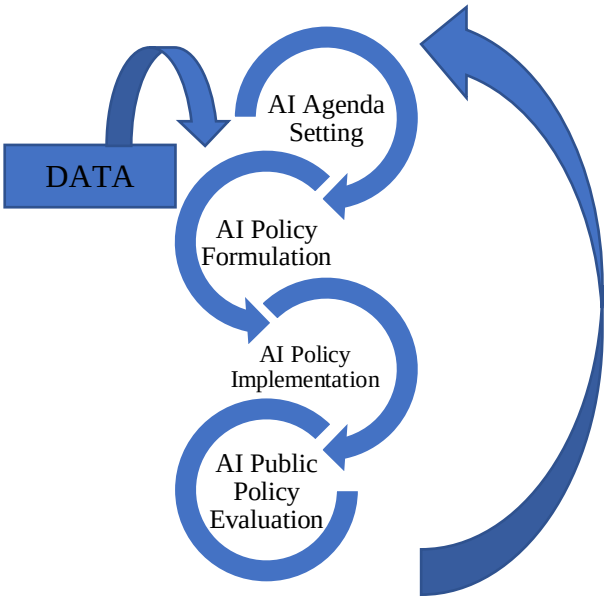

Figure 22. Dynamic Public Policy Cycle in the AI-Enabled Age

Source: Adapted from Valle-Cruz et al., 2020, p. 9

The methodology of the public policy cycle covers multiple phases when AI applications may impact the operations of government organizations. The use of AI in the public policy cycle encompasses interrelated phases of agenda-setting, policy formulation and decision-making, policy implementation, and policy assessment (Pencheva et al., 2018; Valle-Cruz et al., 2019). AI offers significant opportunities within the framework of the "public policy cycle". The active use of AI in the public policy cycle can provide an appropriate opportunity to understand the complexity of public decision-making processes and the actors involved in these processes. On the other hand, AI can exert a data-driven empirical impact in the public policy cycle (Thierer et al., 2017). By using new social media technologies and big data at the point of agenda-setting, AI can offer an opportunity to set the agenda that frames social problems, crises and aligns them with the attention of policymakers. Some examples for this situation are given as follows:

- Governments can react instantly to the problems that arise in social media through data mining and AI technics.
- AI offers the opportunity to define citizens 'preferences more accurately and to improve the scope of citizens' involvement in the decision-making process.
- AI as a public policy tool can offer a remedial opportunity for accuracy, efficiency, and functionality.
- On the other hand, AI can increase the legitimacy of public policies by giving governments a chance to engage in a more inclusive dialogue with citizens.
- AI provides a continuous feedback system during the policy evaluation phase, providing the opportunity to evaluate what has been done in real-time from the beginning of the policy.

Table 16. Artificial Intelligence in Policy Cycle

Policy Cycle	Role of Artificial Intelligence
Agenda Setting	• By giving policymakers the ability to promote more open and dynamic dialogue with citizens, AI will raise the integrity of agenda-setting. • By helping policymakers to collect and evaluate the expectations of the population through multiple settings, AI may improve the development of the agenda. • By predicting emerging socioeconomic crises, AI will contribute to agenda-setting, enabling appropriate policies to sit one step ahead of crises
Policy Formulation **Policy Decision Making**	• In consolidated servers, AI, big data can assist in formulating policies to create customized, localized solutions. • AI may recognize persons, organizations, territories, or other causes more quickly in the highest need for assistance or at the greatest risk of a specific problem. • As the discussion on various policy alternatives goes forward and data and statistics on the topic comes to the fore, AI can also have a noticeable influence. • As governments need to be more accountable for the decisions adopted and the policy choices chosen, AI will help to improve transparency.
Policy Implementation	• AI can help decide which people or regions need increased policy focus; • AI will help customize the nature and design of government communications with the public with policy implementation to optimize the effect.
Policy Evaluation	• Since the very beginnings of implementation, AI will make assessments that are provided in real-time, giving birth to the notion of continuous assessment in governments and public authorities. • In relation to data-based results, AI policy evaluations in real-time will require faster policy evaluations, as well as policy iterations.

Source: Adapted from Center for Public Impact, 2017; Höchtl et al., 2016; Onder et al., 2020; Valle-Cruz et al., 2020

As seen in Table 16, the use of AI in the public policy preparation cycle has created various opportunities. The inclusion of AI in public policy automatically leads to the evaluation of different technologies along with AI in public policy. For example, integrating AI into the public policy process makes the social media data of citizens more valuable. In addition, using AI can make the use of e-government tools more effective and active. The benefits of AI in the policy cycle can be discussed in various dimensions. Figure 23 shows the opportunities of AI in the public policy-making process.

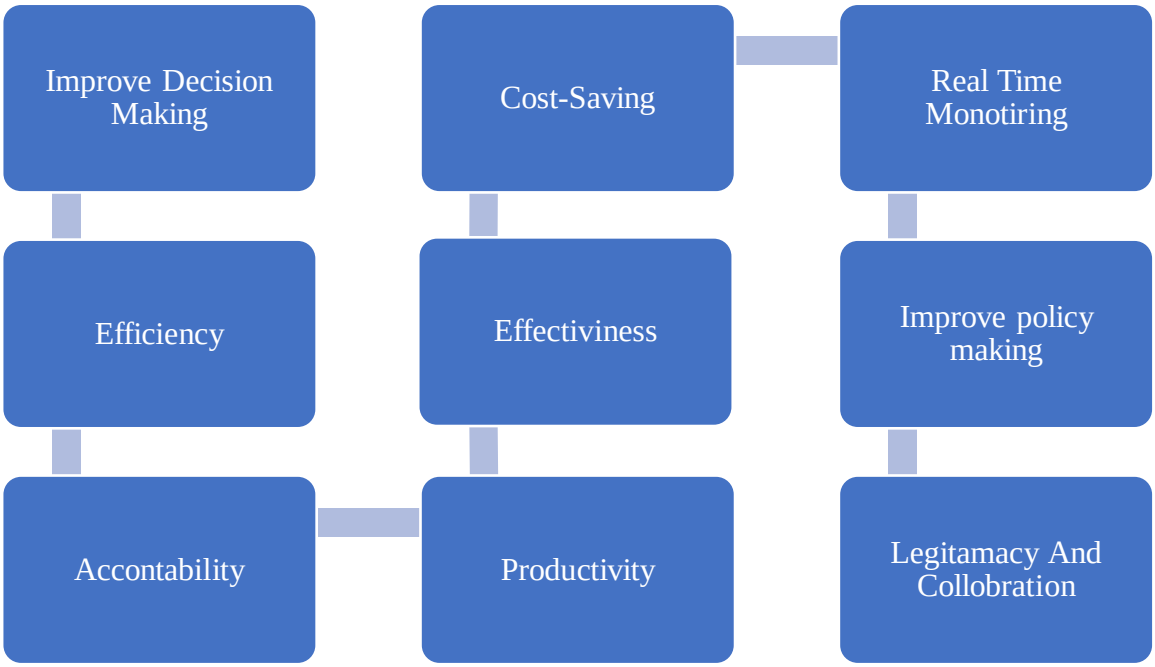

Figure 23. Artificial Intelligence Opportunities of Public Policy Cycle

Source: Author

However, Perry and Uuk (2019) discussed using AI in the public policy-making cycle through the "risk" and "governance" dimensions. Separate questions have been generated for each stage of the public policy-making cycle in reducing AI risk. With these questions, Perry and Uuk (2019) argued that the place of AI in the public policy-making cycle and its effect on AI governance should be investigated. In this context, Perry and Uuk (2019) highlighted the policy-making process considerations for AI governance and an ideal vision for AI risk reduction.

3.4. OPPORTUNITIES OF THE USE OF ARTIFICIAL INTELLIGENCE IN PUBLIC POLICY

AI has massive potential including "education, physical infrastructure, logistics, telecommunications, data monitoring, and compliance, financial, sanitary, R&D policies, law-making" and so forth (Sharma et al., 2020; Sousa et al., 2019b; Valle-Cruz et al., 2019; West Darrell, 2019). Furthermore, AI affects many domains of the smart government. Accountability, transparency, ethics, justice, privacy and security, sustainability, and interoperability are the basic principles of AI policies. Supporting these principles with appropriate regulations and policies will help to solve the challenges (Kankanhalli et al., 2019). In this context, AI-driven public policy-making offers an opportunity for various dimensions. In terms of fixing and overcoming public problems in the future, introducing AI methods in the day-to-day operation of public

administration is crucial. Through the use of machine learning techniques or data management software, public authorities and entities aim to improve the scale, efficiency, and performance of information collection by ensuring effective and sustainable distribution of public resources and managing citizens' relations with higher velocity and consistency, as well as promoting access to public services. In addition, AI can be used in public administration to accelerate demand, care, evaluation, and resolution (Chen et al., 2019; Dwivedi et al., 2019; Wirtz et al., 2019). Many studies on the use and applications of AI in the public sector (Engstrom et al., 2020; Ulnicane et al., 2020; Valle-Cruz et al., 2019; Veale & Brass, 2019). In the literature, policies with AI have been examined in the context of various public policies such as healthcare, transportation, service, and crisis management. The Table 17 below summarizes the use of AI in the public sector and the various dimensions of AI policies in the literature.

Table 17. Artificial Intelligence Policy Areas

AI Policy Areas	AI Mechanism	Objective	Citation
Digital channels of communication between citizens and government	Chatbots Speech analytics Text Mining	• Improvement of communication between government and citizen • Answering questions • Enhancement of citizen knowledge	(Androutsopoulou et al., 2019; Capgemini Consulting, 2017; Mehr, 2017)
Predictive analytics and data visualization	Machine Learning	• Control and performance monitoring in public areas • Determine risk or emergency issues	(Engin & Treleaven, 2019; Jiang et al., 2020; Maciejewski, 2017; Steuer, 2018; Wirtz & Weyerer, 2019)
Enhancing decision-makers capabilities	Data analytic Artificial Neural Network Deep Learning	• AI improves the quality of decisions by enabling governments to make fast and accurate. • Data using AI to reach quick and reliable decisions.	(Allam & Dhunny, 2019; Ojo et al., 2019)
Improving service delivery	Cognitive robotics and autonomous systems	• AI in government systems and internal functions have the capacity to boost policy decisions and provision of services to citizens. .	(T. Chen et al., 2020; Misuraca, Gianluca; Van Noordt, 2020; Veale & Brass, 2019)
Health & Safety	Machine Learning	• Understand and help prevent workplace injuries and illnesses	(Barth & Arnold, 1999; Berk et al., 2016; Kankanhalli et al., 2019;)

Source: Author

Overall, ICT makes it easier to solve problems and enable solutions through different policy choices. Furthermore, it provides opportunities such as more information flow, evaluation of different ideas, and cooperation opportunities by enabling improved services and citizen-oriented management. In this context, data-driven policies are an innovation that has many advantages in terms of “better decision and better management”.

The amount of dataset is growing exponentially day by day. Public authorities have to develop new solutions in data mining and data analyses. Data-driven policy-making contributes to citizen participation in decision-making processes while increasing public values. The motivation based on new opportunities presented by AI in the public sector stems from the data-oriented nature of AI. On the other hand, AI systems facilitate data analysis and support 'data-oriented' decisions. Today's governments have big datasets about their citizens thanks to their e-government systems. Evidence-based policy-making and data-driven policy-making, which have been frequently discussed in the public policy literature in recent years, will become more popular with AI in the policy-making process. Integrating AI into the public policy process will provide an "automatic" and "dynamic" process. However, the integration of AI into the public policy process is linked to many issues such as security, privacy, and ethics. The use of AI in the public policy-making process is closely related to AI governance. In the next section of the thesis, AI governance will be examined in various dimensions.

CHAPTER IV

ARTIFICIAL INTELLIGENCE GOVERNANCE

Besides the rapid development of the complex AI ecosystem, it also brings many challenges and risks. The effort to tackle the challenges that AI will bring requires AI governance. In theoretical context, governance requires multi-stakeholder decision-making and participation. AI governance, which is a part of the Digital Age Governance, is also a hot topic that has just started in the literature. However, in the coming years, AI governance perception will become one of the "sine qua non" for governments agenda. In this section, AI governance will be discussed with its many dimensions.

4.1. CONCEPTUAL FRAMEWORK OF GOVERNANCE

Since the beginning of the 21st century, there has been a rapid and interactive change in technological, economic, political, social, and cultural fields. However, the requirements of this process cannot be answered with an administration approach from the 19th century. Technology changed the essence of management understanding with the innovations it brought. In this context, the management approach should be evaluated from a historical perspective.

4.1.1. From Traditional Public Administration to New Public Management

First of all, traditional public administration began to develop both practically and theoretically in the late 19th century, became formal between 1900 and 1920, and remained essentially constant in many western countries until the last quarter of the 20th century (Lynn, 2001). Traditional public administration maintained this feature and structure depending on a historical rule and political culture from the 18th century to the 20th century under conditions specific to modernism. The traditional public administration approach included industrialization problems, urban growth, the rise of the growing economy, trust in research, confidence in development, and concerns about potential systemic issues.

Most of the constructive history of government responses to the First World War, the Great Depression, and the Second World War tended to reinforce the traditional public administration's support and strengthen government trust (Bryson et al., 2014). However, the traditional public administration paradigm began with Weber's bureaucracy theory, and Wilson's principles were the subject of deep questioning and criticism in the late 1970s. The strict bureaucratic system,

rigid hierarchy, and the centralism perception became insufficient to meet the requirements of the globalized era (Dunleavy & Hood, 1994). The consequences of the post-1970 economic crisis, neo-liberalism cited as the reason for its evolution. Developments in public administration have begun to appear in the public sector organization in changes in both management understanding and structures (Gary, 2006).

The new public management (NPM) paradigm that emerged within this framework offers a new approach based on postmodernism, openness, and flexibility. In this context, the need for a public organization in which the information age requirements reduce the hierarchy has emerged. There are political, socio-economic, and cultural reasons for developing this paradigmatic transformation in the public administration discipline after the 1980s (Hood, 1991). For instance, Fordism, which is identified with modernism, and the rigid production-accumulation process have developed into a flexible production-accumulation process in the form of Post-Fordism with postmodernism (Hirst & Zeitlin, 1991; Jessop, 1995).

The NPM reforms carried out tend towards a "market-driven" neoliberal understanding rather than providing services with the traditional bureaucratic structure (Osborne, 1993). In the traditional public administration fields managed according to the state understanding of the modern age, our post-modern and globalization dynamics started to represent the "new right" trend in the early ‘80s.

Neo-liberal policies come to the fore, primarily through the international commercial, economic and cultural developments experienced with the spread of globalization (Hood, 1995). The NPM approach increasing public-private sector cooperation and eliminating the differences, emphasizing the principles of efficiency, effectiveness and performance management regarding private sector perception. In this context, Osborne (1993) summarized the management culture of the new public administration approach in six principles.

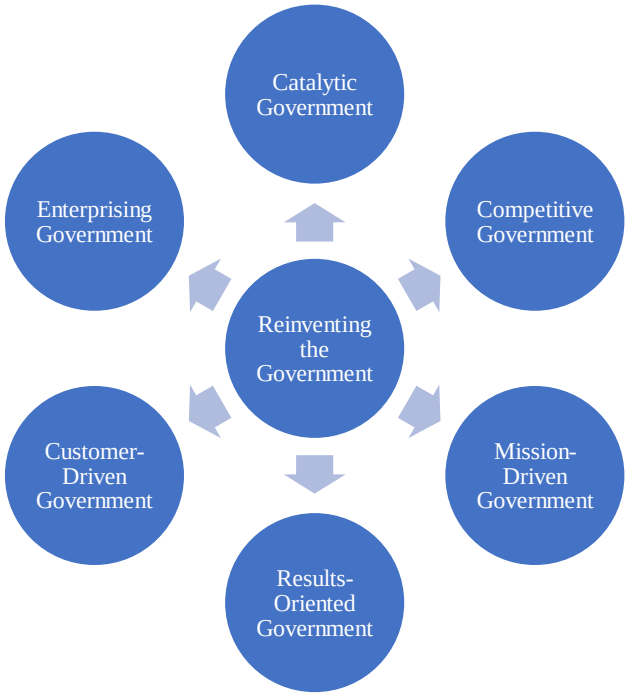

Figure 24. Reinvention of Government

Source: Adapted from Osborne, 1993

In the traditional government, concepts such as social justice, equality, public good, social responsibility, and social solidarity have been replaced by concepts such as limited or minimal state, privatization, competition, volunteering, individual responsibility, profitability, and efficiency (Dunleavy & Hood, 1994; Dunn & Miller, 2007; Hood, 1995; Klijn, 2012). This change is considered as a re-definition of the role of government.

NPM has emerged as a model that serves countries' public administrations for global competition by transforming them from a structural and organizational perspective. Several factors have contributed to the change in the role of government. Indeed, technological developments, together with globalization, are one of the fundamentals of paradigm-shifting in public administration.

4.1.2. The Birth of a New Paradigm: Governance Toward To E-Governance

Since the 1990s, there has been an increase in the criticism of the theoretical and practical dimensions of NPM. The reforms and practices of NPM, which started in the 1980s and entered the agenda of many governments worldwide, have created paradoxes, contradictions, undesirable and even counter-effects (Weiss, 2016). Pollitt (2002) drew attention to the fact that NPM policies and practices, which are defined as a global movement and thought to cause convergence between

countries, actually convergence only at the discourse level. Since the mid- 1990s and the early 2000s, the NPM approach, which aims to manage the state as a business, sees citizens as customers, and ignores the public interest, has been criticized, and new approaches have emerged (Ayhan & Önder, 2017). Governance discourse is a political /managerial theory supported by different disciplines, trends, and theories beyond the NPM approach that left its mark in the 1980s.

Unlike the traditional concept of bureaucratic management, governance offers a model based on "synergy", "participation", and "cooperation" between various actors in determining public policies by having cultural integrity with post-modernism perception (Vigoda, 2002; Woods, 1999). On the other hand, governance emerged as a democratic extension of neo-liberal discourses in the 1990s of the market-oriented principles and policies of the NPM based on organizational efficiency and performance in the field of public administration. In this framework, the governance model differs from NPM, which is based on ''democratization and participation'' in public administration (Klijn, 2012; Osborne, 2006). There are various definitions in the literature on governance. According to Kettl (2002);

> "Governance is a way of describing the links between government and its broader environment political, social, administrative. It is also a way of capturing the initiatives that governments around the world have deployed to shrink their size while struggling to meet their citizens' demands."

Similarly, Weiss (2016) argued the concept of governance is the collection of the many aspects in which individuals and organizations, public and private administer their common dealings. The restructuring in management approach has evolved into a multi-stakeholder structure consisting of private sector, civil society, international actors, and public institutions. The concept of governance, which refers to the network of relationships (Osborne, 2006) in mutual interactions between stakeholders or actors, brings to the agenda the inclusion of non-governmental organizations, non-profit organizations, private entrepreneurs, pressure groups, media, and citizens in management processes, together with central and local government structures. Another aspect, The United Nations Development Program (UNDP) (1997) emphasized that

> "Governance is a system of values, policies, and institutions that a society uses to carry out its political, economic and social affairs in the context of relations with the public, private and voluntary sector".

In this regard, governance represents the whole of rules, practices, and institutions that limit or encourage the behavior of individuals, institutions, and companies. Based on UNDP's governance approach, Graham et al. (2003) summarized the basic principles for good governance.

Table 18. Five Principle of Good Governance

The Five Good Governance Principles	**Concepts**
Legitimacy and Voice	• Participation
	• Consensus orientation
Direction	• Strategic vision
Performance	• Responsiveness
	• Effectiveness and efficiency
Accountability	• Accountability
	• Transparency
Fairness	• Equity
	• Rule of Law

Source: Adapted from Graham et al (2003) (Graham et al., 2003)

Governance perception includes “co-regulation”, “co-management”, “co-production”, and “public-private cooperation” (Feiock, 2013; Kjaer & Vetterlein, 2018). Therefore, the concept of governance is a system that envisages managing together instead of a one-sided management style from top to bottom, and participation is the main factor in the system. The primary characteristics of governance can be summarized as follows:

- Encourages the "participation" of social actors, stakeholders, and citizens in decision-making processes,
- Think “strategically” and act democratically,
- There is a “horizontal organization” and distribution of power that requires “cooperation” between social actors,
- To consider not only rational criteria and productivity but also “human values”,
- “Accountability” and “transparency” are essential phenoma of management.
- Providing services to citizens, not customers (Denhardt & Denhardt, 2000; Graham et al., 2003; Klijn, 2012).

The rapid use of the internet globally, digital transformation reforms of governments, and e-Government tools have contributed to digitalization and governance. Heeks (2001) mentioned that “New information and communication technologies can significantly contribute to the achievement of good governance goals”. The rapid digitalization of the state has enabled all kinds of communication and interaction between citizens, businesses, non-governmental organizations,

and the state to take place increasingly in an electronic environment. This situation paved the way for various restructuring and transformation in management. All the developments have led to the emergence of various newest concepts such as "e-government", "e-democracy", and "e-governance" (Bannister & Connolly, 2012).

In theoretical perception, "e-governance", which arises from the hybridization of digitalization and governance, is essentially network governance that provides inter-network communication (Höchtl et al., 2016; Saxena, 2005). Moreover, e-governance defines a management model integrated with the society, including civil society and the private sector, supported by ICT (Madon, 2009; Saxena, 2005). In other words, e-governance can be defined as the use of ICT to encourage the participation of state and non-state actors in public policy processes and to ensure cooperation, interaction, and coordination between them (Bannister & Connolly, 2012).

E-governance refers to an effective administration model that delivers substantially from public transaction costs by promoting the use of electronic tools in the provision of government services, regulation of public services, taxes and penalties to be paid by citizens to the state, access to information, and submission of applications, permits and licenses and tenders (OECD, 2018). On the other hand, E-governance understanding demonstrated an "ethical", "accountable," and "responsive" management (Bannister & Connolly, 2012; Madon, 2009). In addition, e-governance offers a comprehensive infrastructure accessible twenty-four hours a day and seven days a week at the service level, better convenience, the opportunity to receive government services without attending government departments, and lower service prices (Saxena, 2005). Similarly, Madon (2009) emphasized that the E-governance approach is closely related to development.

Since the beginning of the 2000s, the digitalization and governance trend has frequently been on the agenda, further increasing the criticism of the NPM approach. In the context of the criticisms directed to the inadequacies of NPM, a new public administration paradigm has emerged in the axis of e-governance. The focus of these discussions is that digital era governance perception, which came to the agenda with Dunleavy, Margetts, Bostov, Tinkler and their article "*New Public Management Is Dead—Long Live Digital-Era Governance"* published in 2005. In the next section, the digital age governance approach will be discussed in a conceptual framework.

4.1.3. Digital-Era Governance: Criticism of New Public Management Approach

The Welfare State understanding in the 1970s brought up the public administration reform debates in the 1980s. NPM, a dominant paradigm between 1980-2002, based on managerialism, focuses on disaggregation, deregulation, promoting privatization and competition, and performance management (Dunleavy et al., 2005). However, the NPM understanding has caused some problems in the concerns of coordination and democracy. In a remarkable study in the field, Dunleavy et al. (2005) analyzed the NPM approach from the 1980s to the early 2000s in Australia, Canada, Japan, New Zealand, the United Kingdom, and the United States. As a result of the analysis Dunleavy et al., (2005, 2011) emphasized that the NPM reforms were far from achieving the targets, such as increased service quality, competition, effective and efficient government management. Moreover Dunleavy et al., (2005, 2011) and Margetts & Dunleavy (2013) argued that the NPM approach and reforms brought some social, economic, and administrative problems. Based on this approach, they claimed that NPM as a paradigm began to lose its former "popularity" (Yavuz, 2015). According to Dunleavy et al., (2005, 468) "The intellectually and practically dominant set of managerial and governance ideas of the last two decades, NPM has essentially died in the water".

Dunleavy et al. (2005) draw attention to the fact that ICT developed to perform transformations in public administration in the early 2000s. Furthermore, developments in e-Government mechanisms, the internet, e-mail, and web systems transformative impact not only to business processes but also to complex changes in civil society and government relations (Dunleavy et al., 2005). ICT, which plays a vital role in the digitalization of the public sector, has improved information processing capacity. In addition, ICT can obtain quick decision-making and respond quickly to needs (Dunleavy & Margetts, 2010; Welch et al., 2005). These changes have the potential to replace NPM with an alternative paradigm. This new paradigm is structured around three essential features has included "reintegration", "need-based holism" and "digitization" (Dunleavy et al., 2005).

Reintegration symbolizes the transformation towards integration that has started with the widespread use of ICT in the public sector. The concept of "reintegration" stands out against the problems caused by the motivation of the NPM reforms to "disaggregation" central bureaucratic structures into small institutions/units (Dunleavy et al., 2006). As a result of the NPM reforms, the "disaggregation" of centralized bureaucratic structures and the formation of small institutions caused coordination and communication problems between institutions. However, with the widespread use of ICT in public institutions, effective communication has been restored.

Reintegration aims to transform into institutional structures that can cooperate, build coordination, and obtain quick decisions according to e-governance principles. ICT has played a leading role in the formation of this process. Thanks to the e-Government transformation, citizens can easily access to any information interactively from a single website. Moreover, reintegration has pointed at “end-to-end restructuring”, “flexibility,” and “simplification”. It also focuses on developing an “agile government” (Dunleavy et al., 2005, p. 480).

Digitalization has been the main driving force of the new paradigm. According to the DEG understanding, the existing public organization structures and citizen-state relations have been redefined with the digitalization of service delivery. The theme of digitalization is identified with the e-Government approach. Dunleavy et al. (2005, 2011) emphasized that digitalization and electronic tools have a transformative effect beyond being complementary to traditional public administration. Therefore, Dunleavy & Margetts (2015) mentioned that:

> “Digital Era Governance is based on the complete digitalization of paper and phone-based systems; a citizen-based holism where services are reorganized around digitally enabled citizens; and a reintegration of governmental organizations fragmented after years of NPM change”.

The DEG approach, which is defined under three themes, reintegration, need-based holism and digitalization, includes various complements. Dunleavy et al. (2011) mentioned these supplements in various dimensions and discussed the concepts that will come to the fore in the continuity of the paradigm within the framework of themes.

Table 19. Key Components of Digital-Era Governance

Reintegration	**Joined Up Governance**
	Re-governmentalization
	Re-strengthening central process
Need- Based Holism	Interactive information
	Needs-based reorganization
	Data ware housing
	Agile government processes
Digitalization	e-government and electronic service delivery
	Web-based utility computing
	Open book government
	Active channel and feedback mechanism

Source: Adapted from Dunleavy et al., 2011, p. 229

Digitalization continued to expand and be integrated into Web 2.0 applications, such as social media, blogs, cloud systems. Therefore, Margetts & Dunleavy (2013) emphasized that, in the 2010s, a second wave started in the DEG approach. According to the DEG pioneer, originally a powerful administrative modernization tool in the 1980s and 1990s, NPM first ossified and then faced vital crises in the early 2000s. The first wave of DEG changes represented the solution to government modernization and NPM crises. Since 2010, social media developments have contributed to the main modernization route bending more than NPM models, and the three DEG themes differentiate more strongly from the previous quasi-paradigm (Dunleavy & Margetts, 2010; Margetts & Dunleavy, 2013). Therefore, the DEG model has gained a new face since the 2010s and become the pioneer of a different public administration reform. The financial crisis in 2008 shook the confidence in the NPM understanding. As a result, governments have had to rethink their austerity policies (Christensen & Lægreid, 2011; Margetts & Dunleavy, 2013).

On the other hand, the DEG approach moves further away from NPM, incorporating Web 2.0 applications, reinforcing its digitalization goals (Yavuz, 2015). At the same time, DEG emphasizes new practices and transformation of the state-citizen relations. In addition, DEG perception has emphasized "e-governance" components, such as "e-democracy".

The DEG2 perception claimed that the transformative effect of information and communication technologies will continue in the coming years. On the other hand, Margetts and Dunleavy (2013) mentioned that ICT adaptation is the primary driver of reintegration and modernization of government. Indeed, digitalization and e-Government tools in the first wave have gained a new momentum in the second wave with Web.2.0 tools.

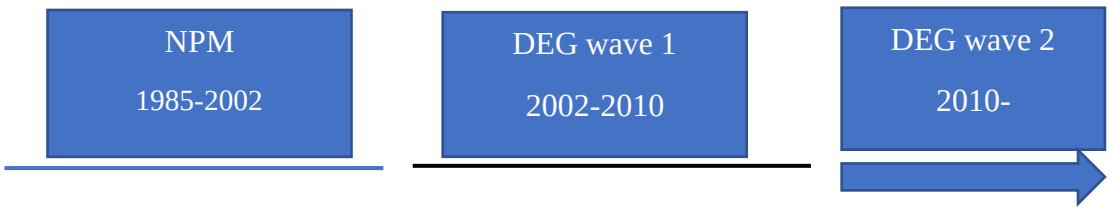

Figure 25. Shaping of the First and the Second Wave of Digital-Era Governance

Source: Adapted from Margetts & Dunleavy, 2013, p. 3

Figure 25 shows the transitions between the NPM to DEG approaches. The NPM approach maintains its trend until the early 2000s. However, it has been claimed to have been discredited since the early 2000s. DEG, which has developed as a new paradigm, has been claimed to continue its development depending on digitalization and reintegration process. Moreover, DEG

have been a wave from Web 1.0 tools to Web 2.0 tools. In this context, important issues have started to be questioned, such as "what will be the position of the DEG approach regarding AI and big data" or "will Web 3.0 (semantic web) tools (AI, 3D printing, smart phone) originate a new wave in the DEG3 approach?".

As a result, digitalization and governance have been shaped around the DEG approach as a theory. However, the DEG approach offers significant findings to the understanding of AI governance. The themes of "reintegration, need-based holism, and digitization" discussed within the framework of DEG governance will be handled within AI governance. However, AI governance needs beyond these three essential features. This thesis suggests that AI governance will create a new wave in the Digital-Era Governance approach. Within this framework, the AI governance model in accordance with the principles of good governance will be discussed in the next section.

4.2. BIG QUESTIONS OF AI GOVERNANCE

The fundamental motivation of this section is to present the questions examined in the discussion of AI governance within the framework of public administration and public policy. The articles, reports, and other academic resources (videos and online meetings) examined the different tiers to AI governance. Moreover, the questions asked by scientists from many different disciplines (engineering, science and technology studies, philosophy, security etc.) are to provide answers in the axis of AI and public administration. In this context, the big questions on AI governance are shown in the table below. Based on Behn's approach (1995) to big questions, the questions that are sought to be answered in the relevant literature shed light on the future discussions on the perspective of AI governance. Questions about AI governance draw attention to various dimensions of governance. When the questions in the literature, AI governance is examined in a broad framework covering AI ethics, AI regulations, integration into the public sector and AI safety.

Table 20. Questions about Artificial Intelligence Governance

Authors	Questions
(Veale & Brass, 2019)	• "What are the drivers and logics behind the use of ML in the public sector?" • "How should we understand it in the contexts of administrations and their tasks?" • "Is the use of ML in the public sector a smooth continuation of 'e-Government', or does it pose fundamentally different challenges to the practice of public administration?"

(Dafeo, 2018)	• "How will countries respond to potentially massive increases in inequality and unemployment, and how will these responses support or hinder other global governance efforts?" • "What are the ideal governance systems for global AI dynamics?" • "What potential global governance systems--including norms, policies, laws, processes, and institutions can best ensure the beneficial development and use of advanced AI systems?" • "What are the specific interests of powerful stakeholders, and what institutional mechanisms exist to assure them of the desirability of a candidate governance regime?"
(Schiff et al., 2020)	• "Who is creating these ethics documents?" • "Why are they being produced?" • "What impacts might these documents have on global AI governance?"
(Gasser & Almeida, 2017)	• "What extent can AI systems be designed and operated to reflect human values such as fairness, accountability, and transparency and avoid (new) inequalities and biases?" • "How do we define and validate safety thresholds — for instance, through standard-setting and certification?" • "What are the privacy implications and new privacy threats of next-generation technologies?" • "What are the effects of AI on public finances if robots don't pay taxes?"
(Wang & Siau, 2018)	• "What should be the AI governance, policies, and regulations?" • "How can AI governance, policies, and regulations mitigate and alleviate the negative aspects of AI advancement?" • "How will AI governance, policies, and regulations impact the future of work and the future of humanity?"
(Kuziemski & Misuraca, 2020)	• "How the use of AI in the public sector can be intensifying existing power asymmetries and governance practices?" • "Is AI facilitating the power shift between the public sector and citizens or merely intensifying existing distribution?" • "Is the use of AI in the processes of governance changing the way power is exercised?"
(Perry & Uuk, 2019)	• "How can humanity best navigate the transition to advanced AI systems?"
(Shearer et al., 2020)	• "How ready is a given government to implement AI in the delivery of public services to their citizens?"
(ÓhÉigeartaigh et al., 2020)	• "How we should develop and deploy AI systems, given their potential impact on wellbeing and other deeply held values such as autonomy or dignity?"
(Ulnicane et al., 2020)	• "How governance frame is used in policy rhetoric as a way to overcome controversies surrounding AI development"
(João Reis et al., 2020)	• "How does the scientific research on AI in the member states of the EU contribute to the political governance of the Union?"
(Cihon, 2019)	• "How to govern and regulate AI, particularly at the international level?"
(Yeung et al., 2020)	• "Why 'human rights-centered design, deliberation and oversight' of AI?"
(Theodorou & Dignum, 2020)	• "How to develop and deploy AI systems that are aligned with fundamental human principles and our legal system, and that serve the common good?"

Source: Author

The different dynamics of AI governance have been discussed with the questions in books, articles, and reports in the literature. Global governance, ethical values, and regulation themes were frequently emphasized in the questions. On the other hand, some questions dealt with AI governance within a regional or transnational cooperation framework (UN-EU), while some questions analyzed AI and governance relation based on human rights/human values perspective. However, "future-oriented" questions such as "How will artificial intelligence be developed, deployed and implemented?" (Daly et al., 2019) stand out as the common theme in the questions.

In the theoretical framework, AI governance conceptualization is a reference to the future of AI technology. Furthermore, AI governance encompasses reliable, responsible, and human-centric AI themes. For this reason, legislators, policy-makers, and public administrators should put AI governance and related AI regulations/standards on their agenda against the risks and threats related to AI. Hence, AI governance seems to be one of the most important discussions soon (Bostrom et al., 2019; Dafoe, 2018). In this perspective, how will AI governance be handled in the context of public administration? A holistic AI governance approach requires an integrated AI governance model. Therefore, in the following section, AI governance will be discussed in a holistic perspective.

4.3. ARTIFICIAL INTELLIGENCE GOVERNANCE

The AI technologies are developing rapidly day by day. This situation is also evaluated by looking at the predictions and concerns of leaders, futurists, academics, policymakers and politicians. AI will change the world, that's for sure. But when and how? This is the question that raises issues related to AI governance.

4.3.1. Why Artificial Intelligence Governance?

AI applications and technics are developing to spread to all sectors. On the other hand, the AI ecosystem is increasingly becoming the striking subject of global competition. Countries closely follow the opportunities offered by AI and produce comprehensive policies to transfer the benefits of AI into industry and economy. This framework is necessary to establish broad AI governance principles at national and international levels.

Gordon Moore (1965) predicted that Moore's Law would determine the pace of the modern digital revolution. Observing the rising trend, Moore predicted that the computing power or engine would improve significantly faster, and the relative cost would decrease. Moore's Law has become the

golden rule for the electronics industry and the motivation for innovation (Intel, 2017). According to Moore's Law, the number of transistors in microprocessors (chips) will double every twenty-four months. Thompson and Parthasarathy (2006) mentioned that "Moore's Law is the empirical observation that component density and performance of integrated circuits doubles every year, which was then revised to doubling every two years". Similarly, Stanford University (2012) reports, before 2012, AI results closely followed Moore's Law, with computing capacity doubling every two years. However, since 2012, compute has doubled every three or four months (Perrault et al., 2019).

This rapid increase in capacity brings along some concerns. Coping with the concerns on AI requires an AI governance at the global, national, and even local levels. Hence, AI governance performs a critical role in minimizing the risks of AI and ensuring reconciliation between the emerging technology and humankind. In this part of the thesis, various dimensions of AI governance will be discussed.

4.3.2. Definition of Artificial Intelligence Governance

The technology governance and digital governance concepts have been discussed in the literature since the 1990s (Zimmerman, 1995). Technology governance is a dynamic area of research that focuses on science and technology studies, policymaking, innovation studies, economics, and political science principles and ideas. Recognition of the mutual shaping and co-creation of technology and society is one of the main aspects of technology governance (Ulnicane et al., 2020).

The understanding of digital governance defines citizens' direct access to information and services through technological means. According to the understanding of digital governance, it prioritizes considering citizens as partners in government affairs rather than serving them as customers (Dunleavy & Margetts, 2015). Furthermore, digital governance is a "network governance" that enables inter-network communication. With a horizontal coordination structure, digital governance encourages all interested parties to participate in public administration within network type organizations and uses local information networks (Linkov et al., 2018; Ojo et al., 2019).

Floridi (2018) described digital governance as "the practice of establishing and implementing policies, procedures, and standards for the proper development, use, and management of the infosphere". Moreover Floridi (2018) emphasized the relationship between "digital ethics", "digital regulation", and "digital governance". Similarly, AI governance has shared common

themes with digital governance and technology governance. However, debates on AI governance have reached a new dimension on technology governance.

AI governance leads to more complex discussions. For this reason, it is necessary to deal with more than one dimension of AI governance. On the other hand, AI governance is a concept discussed on a national scale and comes to the fore with international scale. For this reason, it is not possible to make a single definition of AI, nor a single definition of AI governance. Kuziemski and Misuraca (2020) emphasized that

> "AI governance is a multi-level game characterized by the systemic resistance to steering, due to the sheer volume of actors, the velocity of change and the perceived inevitability of the very technology at stake".

The academic literature on AI governance has just begun. Academics and AI experts, who became aware of AI governance at the end of the 2010s, define various dimensions of the subject. The contribution of think tanks and institute reports is crucial for the formation of the AI governance literature. On the other hand, AI governance comes to the fore as a multi-disciplinary discussion including science and technology studies, public policy, computer engineering, philosophy, security studies, sociology, law, and international relations. However, AI technology has also expanded the meaning of the governance concept. Therefore, AI governance refers not only to the actions of states but also to transnational/global governance, which includes norms and regulations originating from AI tech companies, investors, NGOs, and other relevant actors (Bostrom et al., 2019).

In this context, Dwivedi et al. (2019) emphasized that AI governance means providing the "right value" to AI systems. Similarly, Dafoe (2018) discussed that AI governance is often paired with "AI safety" and both focus on helping humanity to develop "a beneficial AI". However, AI governance focuses on institutions and contexts in which "how AI is built and used". According to Butcher & Beridze (2019), AI governance can be defined as a "range of instruments, solutions, and levers that influence the development and applications of AI". AI governance is also defined as "tackling the challenges and risk posed by AI" (Wirtz et al., 2020).

On the other hand, some scholars express the concept of AI governance as AI regulation (Almeida et al., 2020; Gasser & Almeida, 2017; Thierer et al., 2017; Wang & Siau, 2018). For example, Gasser and Almeida (2017, p. 59) pointed out that "When considering future governance models for AI, it might be helpful and necessary to move beyond such lists and consider some of the

larger structural challenges associated with the ‘regulation’ of AI-based technologies”. Similarly, Almeida et al., (2020) also remarked that establishing regulations and standards is an integral part of AI governance. In addition, Almeida et al. (2020) drew attention to “soft governance principles” such as “certification” and “procedure”. One of the most critical studies in the literature on AI governance is the 'Government AI Readiness Index' report, which Oxford Insight has been publishing since 2017. The main motivation of the report summarized with this sentence: “For the majority of the world's governments, where the use of AI in public services is still in its infancy, we believe that understanding readiness is crucial” (Shearer et al., 2020).

Figure 26. The Pillars and Dimensions of the Government Artificial Intelligence Readiness Index

Source: Shearer et al., 2020, p. 10

Government AI, Readiness Index report (2017) presents key findings on AI governance, including country comparisons perspective. The report, which analyzes the AI strategies of the countries in various dimensions and pillars, offers a broad spectrum of analysis from “responsible use of AI”, “AI adaptation capacity” to “human capital”. On the other hand, the report includes analyses at the global, regional, and country levels. In this respect, the ‘Government AI Readiness Index’ report provides important outputs to understand the countries’ AI policies and governance

analyses. The report is detailed around three essential hypotheses, each of which forms the fundamental pillar of government AI readiness (Shearer et al., 2020):

1. "The Government needs to be willing to adopt AI, and able to adapt and innovate to do so;
2. The Government needs a good supply of AI tools from the technology sector; and
3. These tools need to be built and trained on high quality and representative data and need the appropriate infrastructure to be delivered to and used by citizens."

Kettl's (2002) definition of governance overlaps with AI governance. According to Kett (2002), "governance is the result of politics, policies, and programs". Therefore, AI governance includes long-term processes and focuses on goals rather than rules. Based on this approach, AI governance has a great importance in the future policy of AI. Standards, regulations, and solutions to be prepared for AI governance require a multi-dimensional analysis. In addition, global collaborations and interdisciplinary discussions are also a part of AI governance (Cihon, 2019).

Thus, the definitions in the literature address various aspects of AI governance both nationally and globally. The main discussions about AI governance from a global perspective are:

- Consensus-driven AI standards,
- Responsible AI principles,
- Human-centered and democratic values development,
- Solutions (Butcher & Beridze, 2019; Cath, 2018a; Floridi, Cowls, Beltrametti, Chatila, Chazerand, Dignum, et al., 2018a; Pomeras & Abdala, 2020; Renda, 2019).

However, national AI governance refers to the adaptive and innovative AI policy, regulatory policies, data governance, and minimizing the risks, barriers, and threats posed by AI. Consequently, both nationally and internationally, AI governance requires multi-stakeholder cooperation by the spirit of governance.

4.4. INTEGRATED ARTIFICIAL INTELLIGENCE GOVERNANCE

AI governance is a multidisciplinary concept and has become a discussion that has already gone beyond "engineering" and "coding". Each discipline evaluates AI governance with different

themes (Dwivedi et al., 2019). While economists (Manyika et al., 2018) analyze the sectoral impact of AI governance, philosophy (Floridi, 2018) deals with the ethical perspective.

Public administration and public policy are also at the core of AI governance discussion. However, the approach of the public administration field to AI governance is different from engineering, economics or philosophy. From this point forth, the elements of integrated AI governance are analyzed from the public administration framework.

The primary purpose of public administration is to prepare and develop laws and policies and provide public goods and services to citizens. When viewed from this aspect, governments have some roles in AI governance. Although these roles are broad, they have a great impact on the creation of various opportunities. On the other hand, AI governance reduces the risk and challenges of AI. In terms of public administration context, "the main purpose of governance is to enable institutions, society and other stakeholders to work together and achieve policy objectives in a dynamic and changing environment" (Wirtz et al., 2020). Governance also refers to the capacity to keep up with "changes and transformations".

In the literature, AI governance has been studied in various layers and dimensions. These layers deal with the various dimensions of governance separately. Firstly, Dafoe (2018) specified AI governance framework with three different research layers: "the technical landscape", "AI politics", and "AI ideal governance". The technical landscape reflects the technical inputs and restrictions of AI. In addition, AI politics refer to competing interests of different stakeholders, the mutually destructive complexities that might emerge between them, and strategies to solve these interactions by cooperation. Ideal governance includes considering how the optimal environment can be developed using technology, laws, regulations, standards and implementing potential development plans to promote consensus on a shared good vision (Dafoe, 2018, p. 11).

Wirtz et al. (2020, p. 6) examined AI governance in a five-layer perspective. These layers are: "AI technology, services, and applications layer, "AI challenges layer," "AI regulation process layer", "AI policy layer," and "Collaborative AI governance layer". Wirtz et al.'s (2020) layer model handles AI governance in terms of "regulations". Therefore, Wirtz et al. (2020) regarded regulations as the essential dynamics of AI governance. Furthermore, Perry & Uuk (2019) considered the policy-making process as a layer of AI governance and emphasized the significance of "AI risk policies". In this context, "reducing AI risks" is also within the theme of AI governance. Moreover, Perry & Uuk (2019) stated that reducing AI risk will be possible with

an “AI policy-making strategy”. Perry & Uuk (2019, p.3) defined AI policy-making strategy as “a research field that analyzes the policy-making process and draws implications for policy design, advocacy, organizational strategy, and AI governance as a whole”.

A similar AI governance layer structure has been put forward by Gasser & Almeida, (2017), discussed the heterogeneity, complexity, and degree of technological autonomy of AI governance. According to Gasser and Almeida’s model (2017), the implementation of governance structures for AI and algorithmic decision-making systems can occur in multiple layers and include mixed approaches. In this context, “social and legal”, “ethics”, and “technical structure” are proposed as a three-layered model (Gasser & Almeida, 2017, p. 4). This model encompasses the formation of the governance infrastructure related to AI. The infrastructure of AI standards and regulations is based on the harmony between layers. Moreover, Gasser & Almeida (2017) drew attention to an “information asymmetry” between the developers of AI systems and the consumers. This situation will become even more controversial in the next decades, as AI includes a large number of “black boxes”. The key to these black boxes is AI governance.

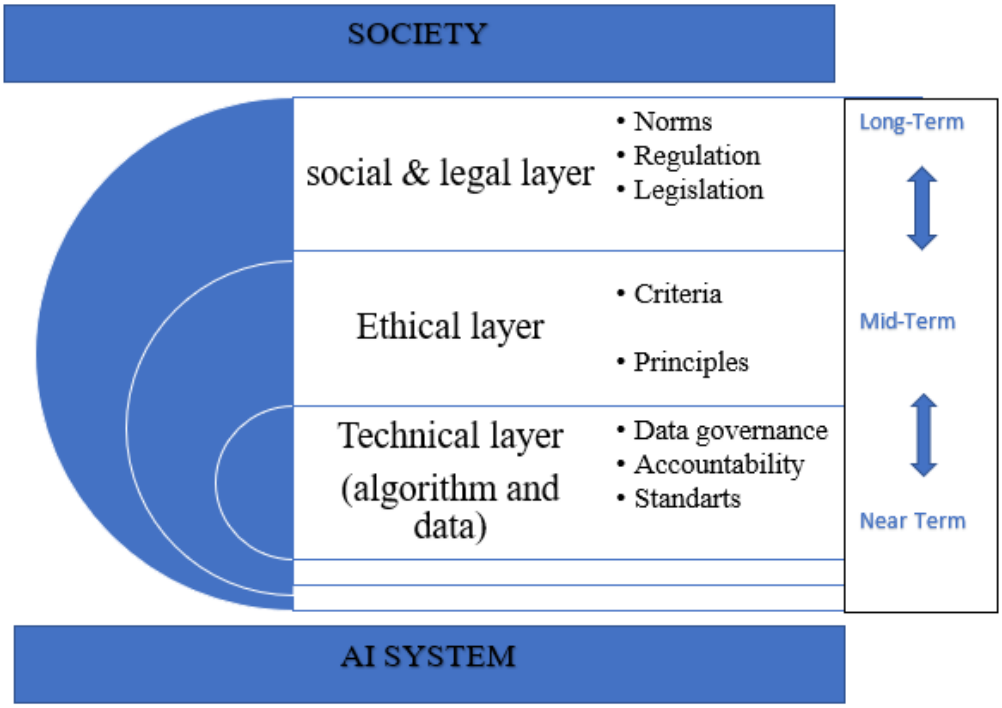

Figure 27. Layered Model of Artificial Intelligence Governance

Source: Adapted from Gasser & Almeida, 2017, p. 5(Gasser & Almeida, 2017, p. 5)

Gasser & Almeida's AI governance model (2017) are formed in near, medium, and long term. Firstly, the model focuses on the development of AI standards in the near term. In the medium and long term, regulations, criteria, policies, and laws are emphasized. Hence, this model suggests a structure that emphasizes co-working across layers for opportunities and challenges posed by AI. Multiple governance designs and framework layers exist and include unified/integrated models.

Governance consists of a multi-stakeholder structure. There are several forums, research centers, institutes, and think tanks that research AI governance. For instance, the AI 4 People forum was launched in 2018 with the support of the European Parliament, which has designed a model for AI governance and determined priority policies regarding AI. In the report published by AI 4 People (2018), the 'SMART' coordination model for AI governance was put forward. The explanation of the model is shown in the figure below.

Figure 28. S.M.A.R.T Model for Artificial Intelligence Governance

Source: Adapted from Floridi, Cowls, Beltrametti, Chatila, Chazerand, Dignum, et al., 2018b

The SMART model organizes the boundaries of AI governance around five principles. On the other hand, SMART perception emphasizes the “coordination and risk assessment” of AI governance. Both top-down and bottom-up models will become less effective as technical issues become increasingly complicated (Pagallo et al., 2019). Based on this approach, it is understood that AI governance should not be handled within traditional public administration understanding. New technologies are complex and require a holistic perspective. Therefore, AI governance

should be considered as a holistic approach. Various layers, dimensions, and fundamentals of AI governance are discussed in approaches in the literature. Figure 29 shows a holistic perspective of AI governance approaches. In this context, the integrated AI governance model synthesizes AI governance approaches from the literature and presents a multi-layered model.

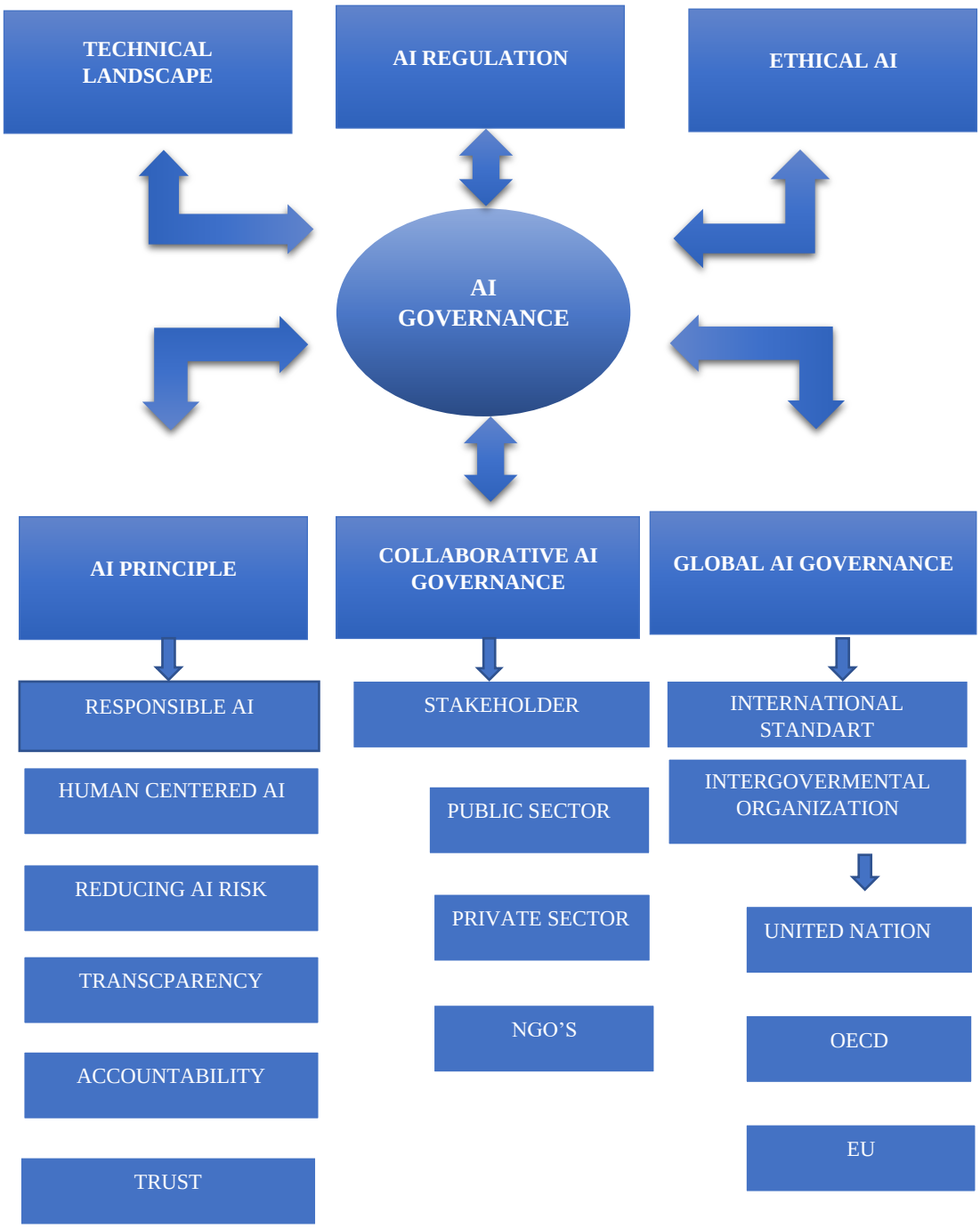

Figure 29. Integrated Artificial Intelligence Governance Model

Source: Author

Therefore, the model put forward by the thesis presents an integrated AI governance model that addresses both the technical landscape, collaborative perspective and policy dimensions of AI governance.

4.4.1. Technical Landscape of Artificial Intelligence

Technology governance itself is a complex process. Because of the ecosystem of AI, technology includes many technical processes. Complex technologies, such as AI, require an interrelated technical governance process. That's why the indispensable focus of AI governance is the "technical layer of AI". Designing a "good AI governance" requires attention to the technical structure of AI (Dafoe, 2019). The technical layer expresses a holistic perspective on AI technology. On the other hand, AI technical layer is based on "data and algorithm". For this reason, the technical landscape of AI includes not only AI governance but also data governance and algorithmic governance.

There are different methods to the technical landscape of AI governance. First, according to the OECD (2019a) report, the technical layer of AI is explained with the "definition of AI," "various types of AI", and "technical development". OECD (2019a) examined the researches related to AI within the technical scope. On the other hand, Gasser & Almeida (2017, p. 61) mentioned that "The technical layer is the foundation of the AI governance ecosystem the algorithms and data out of which it is built AI". In other respect, Dafoe (2018) considered that the technical landscape aims to understand the technical structure of AI, technical development, possibilities, and constraints for AI, providing a basis for other components of AI governance (regulatory AI policies, ethical debates, AI response). However, Dafoe's approach (2018) on the technical landscape of AI also divided it into several layers. First, "mapping technical possibilities" attempt to creatively envision longer-term transformation capabilities and the character of AI. The second layer, "assessing AI progress," aims to be more precise and quantitative in assessing current and future progress in AI. Lastly, "AI safety" focuses on the technical challenges of building advanced AI systems that are "safe and beneficial" and Dafoe (2018) defined it as a technical layer like "hospital procedures are giving patients the right medication". Thus, the technical layer of AI governance refers to the AI ecosystem. Algorithms, data collection and processing, and application areas of the AI ecosystem are the components of the technical part. On the other hand, the technical layer covers the development of AI systems and AI research. After all, the technical layer is where AI governance begins and is more than "a combination of ones and zeros".

4.4.2. Artificial Intelligence Regulation

AI has become an essential part of human life which has an enormous transformative impact in various sectors. However, “artificial super-intelligent” continues to develop by increasing its information and data processing capacity every moment. The rapid and uncontrolled development of AI causes some concerns. In order to determine the limits of AI, regulations come to the fore, which is currently becoming a significant concern for AI governance (Reed, 2018). Governance is essential to minimize negative experiences, secure confidence, and achieve long-term social cohesion using existing instruments and implementation plans. Well-designed regulations do not stifle innovation; instead, they promote it by enhancing both socio-legal and technological monitoring enforcement (Theodorou & Dignum, 2020).

4.4.2.1. A Theoretical Approach to Regulatory Governance

Regulation and governance have different meanings, but a new concept has emerged from combining these two concepts. OECD (2001) described regulation as “the diverse set of instruments by which governments set requirements on enterprises and citizens” (Ferris, 2001). Levi-Faur (2011) pointed out that the concept of regulation is perceived differently in every discipline and which have multiple meanings. For example, in the field of law, regulation is considered as a form of institutionalized norm enforcement (Levi-Faur, 2011, p. 5). Political scientists define the concept of regulation differently according to the ideological approach. Regulation is emphasized as one of the mechanisms that governments have to balance the market economy. The effects of market failures distorting the resource allocation in the economy necessitate public interventions and regulation (Kjaer & Vetterlein, 2018). There are inclusive definitions of regulations in the axis of public administration and public policy. One of the most comprehensive regulation definitions in the literature is expressed by Colin (2001, p. 3):

> “Regulation as any process or set of processes by which norms are established, the behavior of those subject to the norms monitored or fed back into the regime, and for which there are mechanisms for holding the behavior of regulated actors within the acceptable limits of the regime.”.

In this context, in a broad sense, regulation refers to all kinds of constitutional, legal and institutional instruments and public policies and practices implemented by the government for social and economic purposes. Regulations considered as a part of governance are defined in various aspects in the literature. For instance, Ferris (2001) described regulatory governance as “the governance in the area of regulation”. Similarly, the “new governance” concept introduced

by Lobel (2012) draws attention to the importance of “effective and legitimate regulation”. Similarly, Levi-Faur (2011) claimed that governance encompasses a set of regulations that include “rulemaking, monitoring and enforcement”. However, Kjaer and Vetterlein (2018) argued that the regulatory governance approach would provide a framework to encompass the inter-relationships between the structural participatory aspects of governance and thematic processes in the emergence and functioning of regulation. Levi-Faur (2011, pp. 7-11) focus three essential questions about regulatory governance as follows:

- Who are the regulators?
- What is being regulated?
- How is regulation carried out?

“The policy- actors involved in making the regulation (state-market-civil)”, “cooperation between stakeholders”, “participatory role of NGO's” and similar issues are questioned under the first question. Secondly, “what is being regulated” is examined under many subheadings. Levi-Faur (2011, p.11) stated that regulation applies to eight aspects of the governance system: “entry”, “exit”, “behavior”, “costs”, “content”, “preferences”, “technology and performances”. Finally, the ways to regulate are considered as a "hybrid model". This model includes “co-regulation”, “enforced self-regulation”, “meta-regulation”, and “multi-level regulation” (Levi-Faur, 2011, pp. 10-11).

4.4.2.2. Regulatory Artificial Intelligence Governance

Adapting to technological change has never been obvious for society. Numerous examples can be cited from the emergence of printing press to the beginning of motor vehicles in history. However, with AI, technology and human interaction have reached a more severe level. Many scientists and experts worry that AI will turn into a dangerous technology to humanity like autonomous weapons in the near future. Recently, AI research reveals many findings of the dark side of AI beyond futuristic fiction (Feijóo Et Al., 2020; Mannes, 2020; Wirtz et al., 2020). The challenges of AI require a regulatory AI governance. Measures to be taken against the “dark side of AI” can reduce AI risks by a regulatory governance approach. There are various hypotheses about AI regulations that have been discussed in the literature in recent years. In this section, questions about AI regulations in the literature will be examined.

Table 21. Questions about Artificial Intelligence Regulations

Questions	Citation
"How should we regulate AI?"	(Almeida et al., 2020; Ebers, 2019; Košmerlj et al., 2019; Reed, 2018; Turner, 2019; Wirtz & Müller, 2019)
"Should AI be regulated?"	(Etzioni & Etzioni, 2017)
"How should the legal regulations regarding AI be?"	(Hoffmann-Riem, 2019)
"What, when, and how the us es and applications of AI should be regulated?"	(Almeida et al., 2020)
"What can and should policymakers do to ensure that we reap maximum benefits and avoid hazardous pitfalls of AI?"	(Brundage & Bryson, 2016)
"Who will make the regulations regarding AI?" and "who should be responsible for regulating AI"	(Rodrigues et al., 2020; Turner, 2019)
"How AI challenges regulation?"	(Rodrigues et al., 2020)

Source: Author

AI regulation is discussed in the broad sense of questions in the literature. Among these questions, the most repeated one is "how should we regulate AI?". Turner (2019) emphasized the need for a framework including law, standard and principles on AI regulations. On the other hand, Turner (2019, p. 209) pointed out that "these frameworks formulated by public authorities not the private sector". Governments lead the creation of AI regulation. However, regulatory AI governance process should depend on multi-actor collaboration and knowledge sharing in the formulation of regulatory policies (Hoffmann-Riem, 2019).

Regulatory AI governance consists of a process similar to the public policy cycle. Wirtz et al. (2020) examined regulatory governance as a process consisting of four stages. The process of regulation begins with the framing of the problem. Stakeholders participating in the regulation of specific problems gather in this planning phase to develop a shared view of the issue and define the policy steps they want to implement. Secondly, assessing risks, benefits, and costs is the next step in the regulation process. Stakeholders collect the data necessary for risk assessment. Thirdly, the collected data is analyzed after the evaluation is completed. The risks and benefits are evaluated in this assessment to see who would be affected in which way. The risk management phase is the final stage of the operation.

The appropriate regulation is enacted and applied to defeat the challenges and improve the benefits (Wirtz et al., 2020). It also has the potential to minimize any emerging risks which AI might pose. However, weak enforcement has the potential to stifle the development and application of effective AI technologies, particularly by improving protection and control (Reed, 2018). Therefore, regulatory governance requires a multi-layered process. In addition, regulatory governance should be considered within a broad framework, including laws, principles, and regulatory agencies related to AI. AI regulation is handled in three axes, as shown in the figure below (Brundage & Bryson, 2016; Košmerlj et al., 2019; Rodrigues et al., 2020; Scherer, 2015).

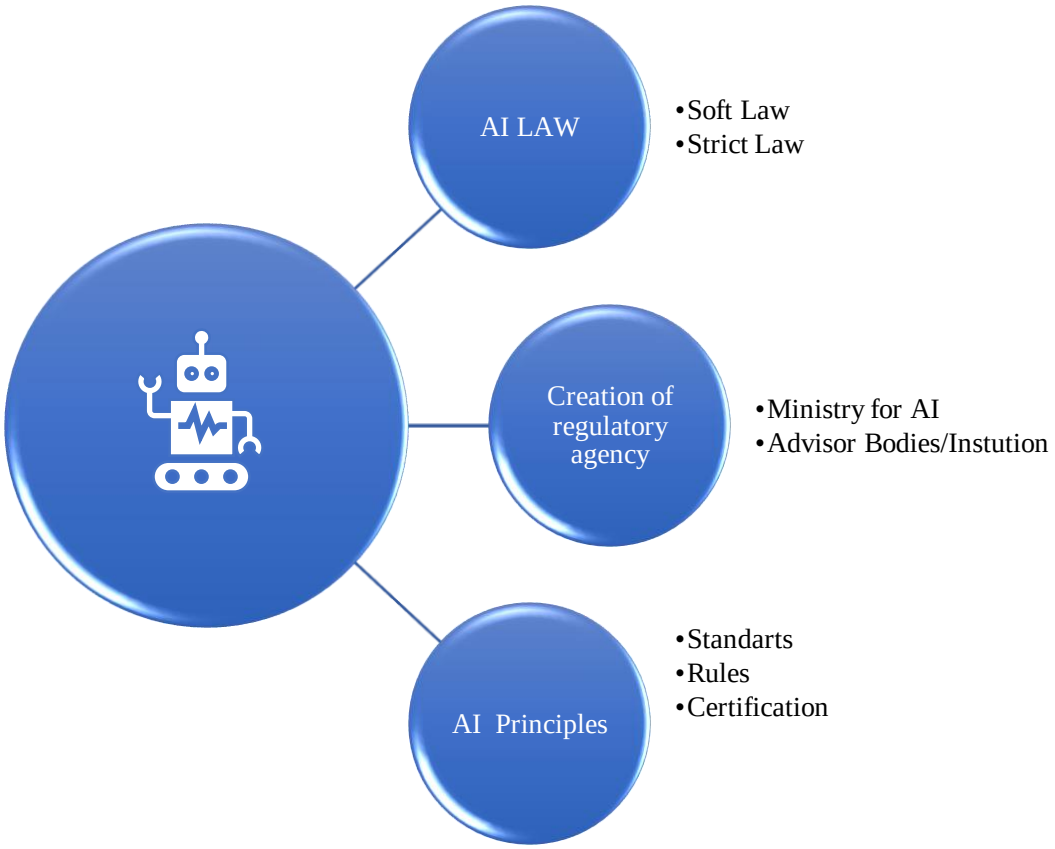

Figure 30. Regulatory Artificial Intelligence Governance

Source: Author

Regulatory AI governance is frequently discussed in the literature around AI governance (Almeida et al., 2020; Buiten, 2019; Smuha, 2019; Yeung, 2018). However, there is no consensus on how AI regulation should be. Several organizations have already developed declarations of the principles or values that should drive the development and implementation of AI in government (Floridi et al., 2018). Although AI regulations have been discussed on the government's agenda

recently, this issue has been explored especially in Sci-Fi literature. For instance, in 1818, Frankenstein dealt with a creature created by a human but got out of control after being formed (Mccauley, 2007). Similarly, one of the issues frequently discussed in the science fiction literature deals with the fact that AI, particularly robots, has consciousness like a human. The common point in movies, TV series, and literature is that AI acts with a consciousness that manipulates or harms humanity (Dicarlo, 2016). In 1968, the movie “2001: A Space Odyssey”, directed by Stanley Kubrick, raised whether AI will one day destroy humanity. Similarly, The Terminator (1984), a famous movie series, also includes SKYNET, a robotic technology that seeks to destroy the world. However, recent Hollywood movies Ex Machine (2014) and Her (2013) are fictionalized on the manipulation of humans by AI (Solum,2014). In the process, AI acts to manipulate people's emotions by making people fall in love with it or similarly, instead of directly harming people. In this perspective "AI versus human" or "Frankenstein complex" approach, which is frequently processed by Sci-fi or futuristic perception, raises the question of whether there should be a regulation about AI. Regulatory AI governance involves enacting a particular law (soft and hard) about AI in the literature. On the other hand, establishing a ministry related to AI is also on the government’s agenda. In this regard, the ministry for AI was established in the United Arab Emirates in 2017. Countries have started to establish laws, standards, and principles concerning AI regulations. Although each country's AI action plan and strategy are different from each other, there are common points regarding regulations. The common points can be summarized under two headings: “autonomous vehicles” and “lethal autonomous weapons system”. AI regulations of countries and international organizations are summarized in Table 22 (Library of Congress, 2021).

Table 22. Regulations on Artificial Intelligence

UN	**UNICRI and Centre for Artificial Intelligence and Robotics**
	Convention on Certain Conventional Weapons and Lethal Autonomous Weapons Systems
	Amendments to the 1968 Vienna Convention on Road Traffic
EU	European Parliament’s Resolution on Civil Law Rules on Robotics
	High-Level Expert Group on Artificial Intelligence
	Declaration of Cooperation on Artificial Intelligence
	European Supervisory Authorities’ Report
	Connected and Automated Vehicles
	Lethal Autonomous Weapons Systems
USA	Federal Legislation and Regulatory Action
	John S. McCain National Defense Authorization
	Testing Autonomous Vehicle (Nevada, Florida, California and Arizona Act)
	Guidance for Regulation of Artificial Intelligence Applications

GERMANY	Data Ethics Commission
	Autonomous Vehicle Regulation
	Lethal Autonomous Weapon Systems
UK	Centre for Data Ethics
	Alan Turning Institution
	National Cyber Security Centre
CHINA	Lethal Autonomous Weapons Systems (LAWS)
	Long Term and Three-Year Action Plans
	Facial Recognition
	Autonomous Vehicle Testing
JAPAN	The Strategic Council For AI
	Contract Guidance on Utilization of AI and Data
	Regulation of Self Driving Cars
ISRAEL	Autonomous Vehicle Regulation
	Knesset Parliamentary Oversight Coordination Unit
INDIA	Draft Protection of Personal Data Bill
	Motor Vehicles Act
	Ministry of Electronics and Information Technology Committees
SOUTH KOREA	AI Promotion Policy
	Autonomous Vehicle Testing
UNITED ARAB EMIRATES	Establishment of a Ministry
	National Council of AI

Source: Adapted from Library of Congress (2021)

4.4.3. Artificial Intelligence Law

Rapid transformations in smart technology require smart legal regulations. Developing technology has legal consequences. Regulating AI will eventually require restricting any AI-based solutions in various industries (Bertolini, 2020). Data security emerges as a more prominent concept than ever before. On the other hand, innovative ways for cybersecurity come to the fore in the national agenda. Furthermore, legal regulations and laws have begun to be established in AI and especially in robotics. Harre (1996) pointed out that AI laws necessitate multi-disciplinary and historical debates. However, Petit (2017) remarked that the legal framework of AI should combine sophisticated solutions rather than just addressing AI in general. For example, AI law will have multiple legal consequences, such as intellectual property, tax law, and consumer protection. Governments should establish a multi-layered comprehensive legal framework for AI regulations and standards (Petit, 2017). Regulations regarding AI also affect data governance.The first of the necessary components for regulatory AI governance is a “specific AI law”. The advancement of AI is progressing rapidly, but the legal framework cannot keep up with its pace.

Especially, the liability of AI issue, there are gaps in the existing legal framework in defining the legal status of AI. With the widespread use of AI systems such as self-driving cars, autonomous vehicles, there is a need to regulate legal liability for the possible damages caused by AI (Yeung, 2018). However, regulation of the "legal liability" of AI is a sensitive issue (Cath, 2018; Mikhail et al., 2018). Because ill-prepared legal regulations can frustrate many beneficial practices. On the other hand, it is necessary to determine how to judge the damages or harms caused by AI. For all these complex problems, we need specific AI laws. Despite the recent discussions in the literature, the background of AI laws is based on the past. Realizing the Frankstein Complex (Mccauley, 2007), the prominent representative of science fiction literature Isaac Asimov made a groundbreaking contribution to AI philosophy. In his science fiction novel "I Robot" written in 1950, Asimov envisioned the new human-robot relationship by predicting that robots would significantly conflict with our lives. His novels and stories are in a way based on the application of these laws and human-robot relations. Asimov (1942) determined three laws that robots must obey in his work "Runaround":

1. "A robot may not harm a human being, or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law.
3. A robot must protect its existence, as long as such protection does not conflict with the First or Second Law."

Asimov's robot laws, which are engraved in the history of science fiction, have been adopted by many writers and academics and began to develop the main issue of stories, novels, and films written on robots. The importance of Asimov's "three laws" vision is that they are immutable and explicit. Asimov envisioned a very complex robot brain that humans could only build at a mathematical level. However, in mathematical terms, it was encoded directly into the core of robot brain. This coding could not change significantly over the life of a robot. According to Murphy & Texas (2009) "Asimov's *laws are based on functional morality, which assumes that robots have sufficient agency and cognition to make moral decisions".* In this perspective, Asimov's approach is not technically meant for today's AI engineers. However, it is still a cornerstone of robot philosophy (Mccauley, 2007). Moreover, AI academics have created alternative laws based on Asimov robot laws (Murphy & Texas, 2009, p. 19):

- “A human may not deploy a robot without the human–robot work system meeting the highest legal and professional standards of safety and ethics”,
- “A robot must respond to humans as appropriate for their roles”,
- “A robot must be endowed with sufficient situated autonomy to protect its own existence as long as such protection provides smooth transfer of control to other agents consistent the first and second laws”.

On the other hand, Asimov’s robot laws are evaluated within the framework of machine ethics. The philosophy put forward by Asimov reveals a framework for the evaluation of robots within the scope of ethics. However, Anderson (2008) argued that Asimov’s robot laws lay an unsatisfactory basis for machine ethics. The framework of Asimov’s robot laws offers a notable aspect for human-computable AI. Robot laws can be rearranged over time and create a universal framework for AI. Asimov’s frame has essential features for a universal regulatory AI governance. Lessons learned from the past have enabled the creation of innovative rules regarding AI. In this context, Pasquale (2020) emphasized that a new law should be enacted regarding AI. Inspired by Asimov's robot laws, Pasquele (2020) defined four innovative robotic laws as follows:

- “Robotic systems and AI should complement professionals, not replace them”,
- “Robotic systems and AI should not counterfeit humanity”,
- “Robotic systems and AI should not intensify zero-sum arms races”,
- “Robotic systems and AI must always indicate the identity of their creator(s), controller(s), and the owner(s)”.

Although legal regulations on AI started in the 2000s, academic debates on AI and law began in the 1980s. The first International Conference on AI and Law (ICAIL) was held in May 1987 in Boston (Bench-capon et al., 2012). In the following years, discussions on AI law continued to be discussed within the framework of the conference. The conference made suggestions on the handling of AI in the legal spectrum. ICAIL aims to produce solutions that will bring together more than two and a half thousand years of classical legal tradition with half a century of AI lessons. In this perspective, a Bench-capon et al. (2012) pointed out that:

> “What better place than Rome could have been chosen to emphasis the promises of bringing together the more than two-and-a-half-millennia of expertise in Law with the lessons of AI's half century of existence? Let us meet in Rome to extend what is possible”.

Another issue in the legal framework on AI is the legal personality (Magrani, 2019; Solaiman, 2017). General AI and super-intelligent can act autonomously. What is meant by autonomy can be defined as making decisions independently without any external influence or control. Thus, AI affects its environment with the decision it takes. For example, the transportation robot or autonomous vehicle with an AI system decides where to pick and place the items and then implements this decision. On the other hand, the existence of inadequate legal regulations on AI causes discussions in compensating the damages caused by AI. To regulate whether AI is given a legal personality or not is one of the most fundamental discussions of the relationship between AI and legal studies. Because AI can become a rightful owner with its actions and enter into a debt with the assignment of a personality to AI in general legal status, if the AI harms another person due to its actions, a responsibility may arise. However, no matter how sophisticated AI will be, it is likely to encounter some specific limitations in its personality status, just like legal entities (Cath, 2018b). However, Bryson et al. (2017) claimed that giving AI a legal identity could easily lead to abuse. The current legal system is a system created by and for people. In this context, Bryson et al. (2017) emphasized that maintaining the consistency of laws and capacity to defend natural persons requires ensuring that purely "synthetic intelligent" entities are never legally or persons.

In the field of legal regulation of AI, there is also an international research collaboration. The European Union is the pioneer in providing legal representation for the use of AI (Yara et al., 2021). The European Commission (2012) launched the "RoboLaw" initiative. The Commission begun to look for solutions that can solve legal problems related to AI and robots in national and European law. The RoboLaw project explores the impact of developing technologies in the field of biorobotics on traditional legal legislation. On the other hand, it investigates the effect of new generation technologies on national and European legal systems (Palmerini, 2012). The main purpose of the research is to understand the legal and ethical consequences of emerging robotic technologies. First of all, it focuses on whether existing legal frameworks are sufficient and applicable in the light of the development and rapid spread of robotic technologies. Secondly, it is to question how developments in robotics affect norms, values and social processes that have human value (European Commission, 2014).

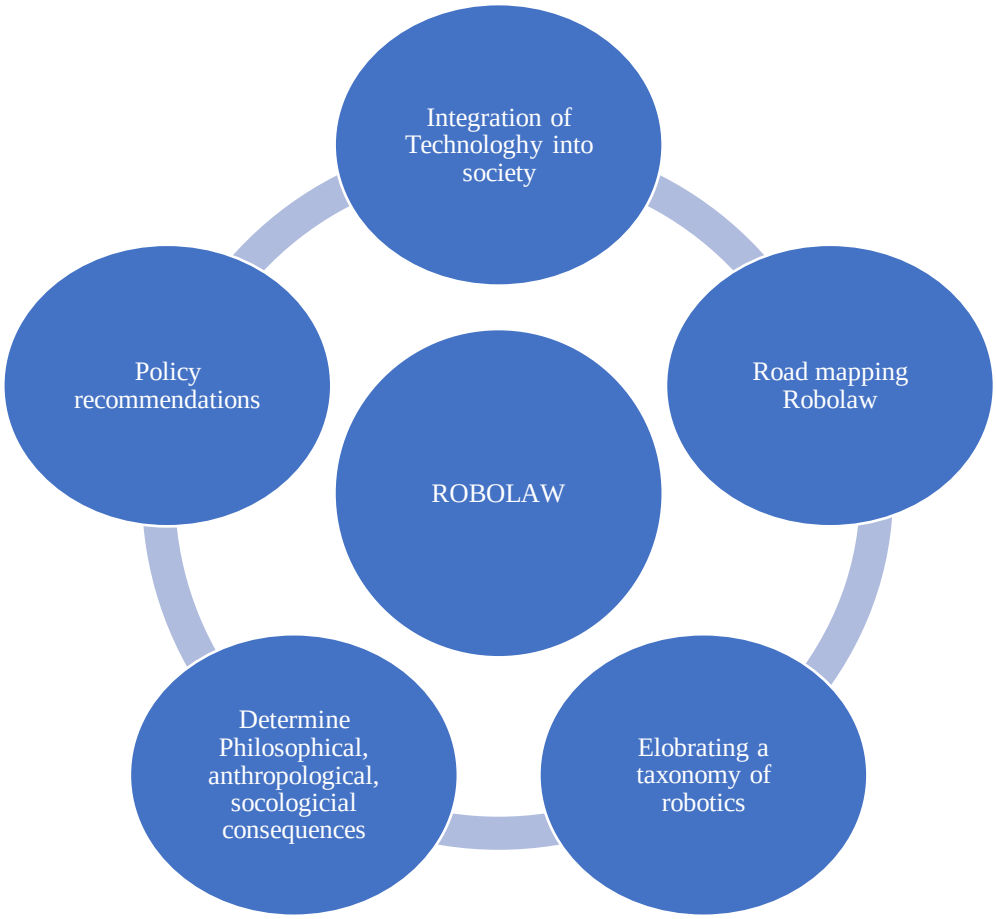

Figure 31. Main Objectives of RoboLaw

Source: Adapted from Palmerini et al., 2014

AI laws can be considered in two axes: “soft law” and “hard law”. In the short run, soft law rules can be applied to filling the governance gap for AI (Gutierrez et al., 2021; Madiega, 2019; Marchant, 2019). In the long run, hard AI laws are needed, which include government rule-making procedures and restrictions such as AI legal entity and criminal and copyright issues (Hagemann et al., 2018). Soft AI refers to governance mechanisms that cannot be directly enforced by the government but determine substantial expectations for the governance of AI. Villanselor (2020), discussed the suitability of soft law for AI from two perspectives. First, the rapid development of the AI ecosystem is far beyond the adaptation capacity of any traditional regulatory system. There are bureaucratic time constraints for the legislative process and administrative rulemaking. AI law should be designed in a flexible structure. Secondly, AI technologies are used in many different sectors, from health to agriculture. On the other hand, there are various types of AI applications. It is difficult to enact a law that will cover all sectors, applications, and actors. Similarly, Gutierrez et al. (2021) mentioned that “AI contains uncertainties and the soft law is an alternative to reduce it”. Marchant (2019) stated that the soft

law instruments of AI include “private standards, volunteer programs, professional guidelines, codes of conduct, good practice examples, principles, public-private partnerships, and certificate programs”. To sum up, as Hagemann et al. (2018) pointed out, soft laws are necessary to deal with difficult obstacles in AI governance. Thus, in the next section, AI soft laws will be discussed within the framework of “principles and standards”.

4.4.4. Artificial Intelligence Principles and Standards

Soft laws constitute an adequate regulation mechanism in controlling AI. International organizations, governments, the private sector, and NGOs have started to design soft laws on AI (Budish, Ryan; Gasser, 2019; Clarke, 2019; Floridi & Cowls, 2019; Schiff et al., 2020). Soft laws are reflected as principles. AI principles define social and ethical considerations for developing the future. AI principles have different aspects that cover different aspects and put different emphasis. None of them can be considered complete (Zeng et al., 2019). A multi-stakeholder structure is necessary in the creation of AI principles. Many organizations have proposed various programs aimed to build principles for the use of beneficial AI (Floridi et al., 2018; Floridi & Cowls, 2019). Transparency, accuracy, accountability, and fairness are the proposed principles for responsible algorithms (Gasser & Almeida, 2017). Technology companies, research institutes, government organizations, and international associations are working on AI principles. Firstly, the world’s largest technology company’s perception is decisive in establishing the fundamental principles of AI. Governments should take into account private sector principles when formulating the principles. Similarly, there are lessons to be learned from non-governmental organizations and initiatives on AI principles.

4.4.4.1. Private Sector Perception: Microsoft, Google and IBM

Companies, which take advantage of technology, are proliferating. In particular, technology giants compete aggressively with each other in terms of developing technologies. AI has long been an urgent focus for technology leaders in many industries. Large companies in every industry, from retail to agriculture, are trying to integrate machine learning into their products. The Future Computed report published by Microsoft (2018) pointed out that AI will have a massive result on manufacturing. In this context, it is predicted that AI will accelerate the digitalization process. With the digitalization, Microsoft company (2018) proposes several principles suitable for “responsible AI”. On the other hand, Google (2020) also created AI principles that can solve complex problems and help people in their daily lives. Moreover, Google

emphasized the human-centered AI framework, and developing AI should be “clear, thoughtfully, affirmatively and careful” (Google AI, 2020). New questions have arisen regarding AI, such as privacy, data management and security. IBM, one of the biggest technology companies from past to present, is designed to develop and increase human capacity and potential. IBM (2018) handles AI principles in an “ethical” and “trust” structure. IBM (2018) argued that AI should enable all of us better at the workplace. The advantages of the AI era should impact everyone, not just the elites (IBM, 2018). The AI Ethics report (2018) published by IBM Program Design Office drew attention to AI for social benefit. In addition, the report emphasized “data security” and “algorithmic values”. While preparing IBM principles, the main focus is on a framework for developers and developing designs. There are some differences and common points in the approach of three big technology companies in terms of AI principles (Cutler et al., 2018). In order to better examine these approaches, AI principles and priorities of companies are shown in Table 23.

Table 23. AI Principles of Companies

Microsoft	**Google**	**IBM**
Fairness	Beneficial	Transparency
Reliability& safety	Avoiding creating or reinforcing unfair bias	Value alignment
Privacy& security	Safety	Accountability
Inclusiveness	Accountability	Data protection/safety/security
Transparency	Privacy	Explainability
Accountability	Scientific excellence	Fairness

Source: Author

The AI principles of each technology giant are shaped around their own priorities. However, their common point is that companies improve their AI investments every year to guarantee their future. In addition, innovative companies as Apple, NVIDIA, or Amazon are increasing the competition in the AI industry. Therefore, for the future of AI technology, these companies’ AI policies/principles constitute a great importance. How governments can control these tech-giants is a big question mark. However, the principles that are components of AI governance require a multi-stakeholder structure. For this reason, the principles created by tech giants should be followed.

4.4.4.2. Artificial Intelligence Principles of International Organizations

The role of international organizations in the preparation of universal common AI principles is remarkable. Wright and Schultz (2018) suggest extending the international effort to promote and strengthen the principles focusing on the digital ecosystem. Beyond that, international organizations can build a balancing structure for the AI competition among states. Moreover, international organizations are likely to be the pioneer in defining the AI roadmap and principles of nations.AI development poses global challenges and risks. National AI strategies to encourage increased AI research within national borders result in globally fragmented AI standards and principles (Cihon, 2019). In this context, international actors play an important role in defining the standards, principles, and regulations regarding AI.

International AI principles and standards are essential in two respects. First, the agreed framework for AI is determined globally, reducing the differentiation in AI principles between countries. Common themes are significant for designing a human-centered AI. Secondly, global AI standards and principles are beneficial in guiding underdeveloped and developing countries in establishing their AI policies. Even though AI is the heart of the investments of developed countries, most of the world still does not have internet access. In this way, international organizations compose an AI template for undeveloped and developing countries. The global AI principles and standards include “ethical design of AI”, “human rights centered AI”, “building capacity in AI research”, and “trustworthy of AI” (Cihon, 2019; Daly et al., 2019; Schiff et al., 2020). On the other hand, the global AI principle develops suggestions and policy actions for the future challenges of AI.

The Recommendation on Artificial Intelligence (2019), which is the first intergovernmental consensus on AI, was entered into force at the ministerial level by OECD Council on the recommendation of the Committee on Digital Economic Policy (CDEP). The recommendation aims to promote a progress and transparency in AI by fostering the sustainable management of reliable AI while maintaining the protection of human rights values and democratic principles. The AI principles put forward by OECD (2019) are the first initiative on AI signed by governments. Beyond OECD members, other countries have adopted these AI principles, including Argentina, Brazil, Colombia, Costa Rica, Peru, and Romania. Complementing the existing OECD standards on aspects such as accountability, data security, risk mitigation, and sustainable business operation, the recommendation highlights issues specific to AI. The recommendation provides an enforceable and flexible policy to meet the time test in the rapidly changing environment (Yeung, 2020). The Recommendation of OECD contain five value-based

principles and five recommendations for international policies and international cooperation. These recommendations make remarkable recommendations for OECD member countries (OECD, 2021). The recommendations are summarized as follows:

- Facilitate public and private investment in research & development to spur innovation in trustworthy AI.
- Design accessible AI ecosystems with digital infrastructure and technologies and mechanisms to share data and knowledge.
- Create a policy environment that will open the way to the deployment of trustworthy AI systems.
- Equip people with AI skills and support employees to ensure a fair transition.
- Co-operate across borders and sectors to share knowledge, improve standards, and work for responsible stewardship of AI.

On the other hand, the OECD AI principle is mainly shaped by the "trustworthy of AI" perception. In this perception, OECD also proposed a shared understanding of fundamental principles relating to AI.

Figure 32. OECD Principles of Artificial Intelligence

Source: OECD (2019a)

G20 countries have also taken action to establish the fundamental principles of AI. The G20 Summit in Osaka, which Japan chaired in 2019, addressed many issues related to the digital transformation. The steps to be taken for a human-centered future society and governance innovation were evaluated under various headings. In this context, G20 countries drew attention to the importance of OECD principles for a human-centered AI (G20, 2019).

The G20 summit report mentioned that AI innovation would help foster sustainable economic development and offer enormous advantages to societies and empower entities. According to the G20 approach, the responsible production and use of AI may be a driving force to influence SDGs and construct a positive prosperous and egalitarian society. The benefits of responsible use of AI will enhance workplace atmosphere and quality of life and provide a possibility for a human-centered world with opportunities for everyone in the future, including women, children, and disadvantaged groups. In this context, G20 (2019) recommend five principles for national policies and international cooperation for trustworthiness:

1. Investing in AI research and development (long-term public investment, and encourage private investment in open data sets and R&D),
2. Fostering a digital ecosystem for AI governments,
3. Shaping an enabling policy environment for AI (Governments should promote a policy environment and regulatory frameworks.),
4. Building human capacity and preparing for labor market transformation,
5. International cooperation for trustworthy AI (multi-stakeholder, consensus-driven global technical standards, internationally comparable metrics to measure AI research).

G7 countries also set 12 standards for a human-centered AI in the “Charlevoix Common Vision for The Future of Artificial Intelligence” declaration made in Michigan in 2018. At the basis of the G7 summit, concepts such as human-centric AI, multi-stakeholder structure in the development of AI, the use AI in economic growth, and AI in the workforce were mentioned (G7, 2018).

The United Nations (UN) has constituted a neutral platform for international dialogue to develop a shared understanding of the development of AI technologies. The UN discussed AI in various dimensions in the “United Nations Activities on Artificial Intelligence (AI)” report published by the International Telecommunication Union (ITU). The report explains how AI is used rapidly to

address many of the world's most pressing problems, such as contributing to humanitarian emergencies to addressing climate change (ITU, 2019). The ITU, in association with the UN Family, coordinates the annual AI for Good Global Summit (2020), which focuses on developing a collective awareness of the potential of emerging AI technology. ITU's AI approach (2020) is categorized by many sub-initiatives in focus groups perspective:

- AI for Health,
- Machine Learning and 5G,
- AI for Autonomous and Assisted Driving,
- AI for Environmental Efficiency,
- AI and Data Commons.

According to the UN perception, AI can present an opportunity for complex problems, such as global warming, environmental pollution, and even for gender equality or crime prevention. UNI Global Union is a global union federation bringing together national and regional unions. UNI Global Union (2017) emphasized that there should be international principles against rapidly developing technologies. The UNI Global Report (2017) proposed a series of essential criteria for openness and the deployment of AI to unions, shop managers, and staff. AI developers and managers will tell the value of worker integration. For this reason, UNI Global Union defined ten principles in the report (UNI Global, 2017). In the principles explained, the priority is given to the protection of the worker rights.

Table 24. UNI GLOBAL Principles for Artificial Intelligence

1	Demand That AI Systems Are Transparent
2	Equip AI Systems With an “Ethical Black Box
3	Make AI Serve People and Planet
4	Adopt a Human-In-Command Approach
5	Ensure a Genderless, Unbiased AI
6	Share the Benefits of AI Systems
7	Secure a Just Transition and Ensuring Support for Fundamental Freedoms and Rights
8	Establish Global Governance Mechanisms
9	Ban the Attribution of Responsibility to Robots
10	Ban AI Arms Race Lethal

Source: Adapted from UNI Global (2017)

The EU also tackled AI standards and regulations on a multi-stakeholder platform. Stakeholders are addressed within the framework of seven critical ethical requirements when developing AI systems in the EU. Moreover, these concepts are emphasized as ensuring the reliability of AI. (Madiega, 2019). These seven ethical requirement concepts are shown in Figure 33 with their contents.

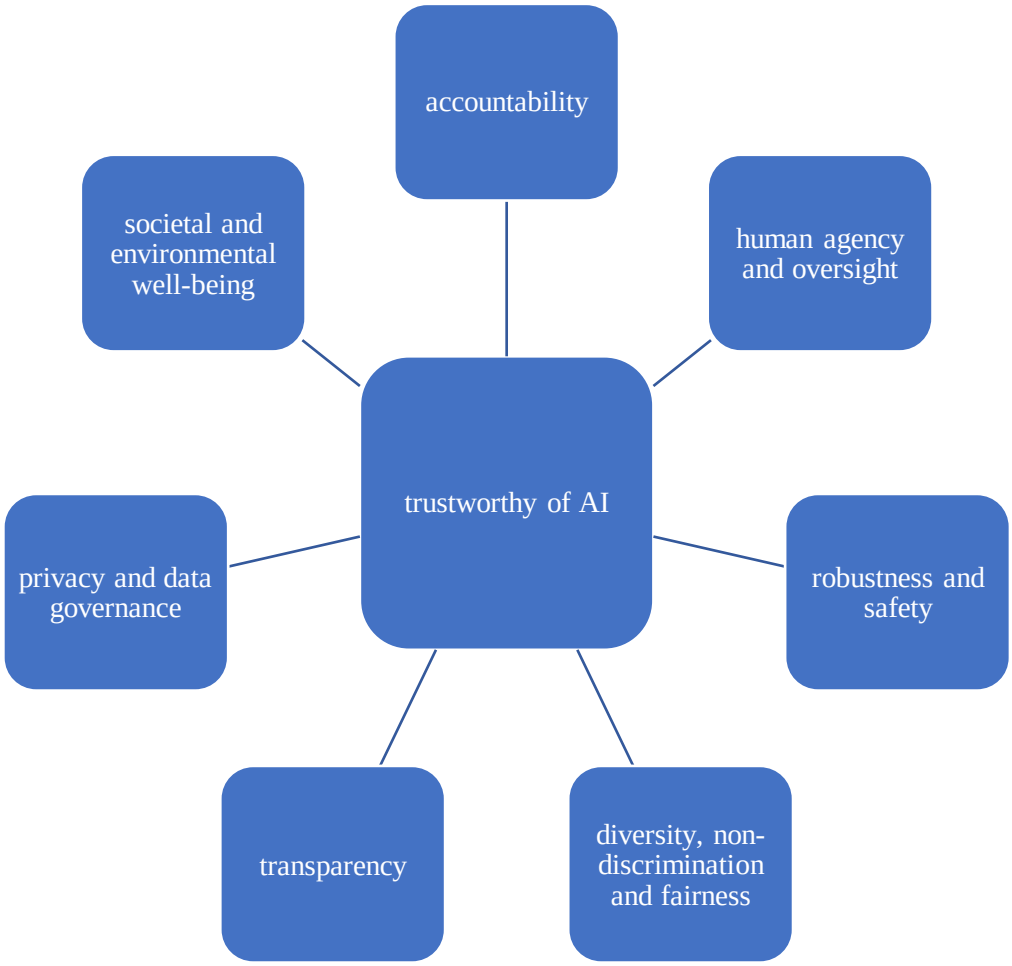

Figure 33. Seven Key Ethical Requirements for Artificial Intelligence

Source: Madiega, 2019, pp. 3–5

Madiega (2019) argued that the core of the seven EU ethical guidelines is regard for human autonomy and fundamental rights. Similarly, In the European Commission's '*Ethics Guidelines for Trustworthy AI*' (High-Level Independent Group on Artificial Intelligence (AI HLEG) report (2019), the attention was drawn to the necessity of establishing common ethical standards regarding AI. According to the report, four principles were put forward for a reliable AI. These principles are respect for human autonomy", "prevention of harm", "fairness", and

“explicability”(AI HLEG, 2019). Similarly, European Commission prepared a statement at the formation of European Group on Ethics in Science and New Technologies (EGE), which aims to initiate a procedure that would lead the way for the design, development regulation of AI, robotics, and autonomous systems to become a standard, universally accepted ethical and legal structure. EGE directs focus to the concerns associated with uncoordinated, unbalanced AI and autonomous technology, especially autonomous weapon control approaches (EGE, 2018).

World Commission on the Ethics of Scientific Knowledge and Technology (COMEST), an affiliate of UNESCO, discussed robot-ethics in the “techno-pessimism”, “ethical dilemmas” and “codes of ethics” perspective. According to COMEST (2017), in the development of robotics technology, three dimensions of responsibility need to be clarified: “responsibility”, “transparency”, and “accountability”. The fundamental responsibility framework is the common thread that unites the various principles set out in the report: “human dignity; the value of autonomy; the value of privacy; the principle of ‘do not harm’; the principle of responsibility; the value of beneficence; and the value of justice”.

As a result, international organizations propose a multi-stakeholder and multi-disciplinary principle related to AI. In addition, “transparency”, “reliability”, “ethical”, “openness” and “human-centered” principles are essential subjects of the international approaches of AI.

4.4.5. Ethical Perspective of Artificial Intelligence

AI ethics is at the core of recent debates on AI, which is evidence of that AI is an interdisciplinary field of study. Robotics and AI ethics have been transformed from a niche interest of several engineers, philosophers, and legal academics into an international debate (Winfield et al., 2019). In this thesis, AI ethics will be studied in the general framework. However, it should be noted that AI ethics is a broad field of study.

AI laws, principles, standards, and regulations cannot be considered aside from ethical debates. For this reason, AI ethics is considered a part of AI governance (Butcher & Beridze, 2019; Floridi et al., 2018; Winfield et al., 2019). Cath (2018a, p. 2) defined ethical AI governance as “focusing on the most pertinent ethical issues raised by AI, covering issues such as fairness, transparency, and privacy, the allocation of services and goods”. However, Floridi (2018, p.4) argued that “Digital ethics shape digital regulation and digital governance through the relation of moral evaluation”.

Ethical rules have a particularly relevant concept in people's lives from past to present. In general, the concept of ethics is based on good and bad, and as well as concepts such as will, responsibility, freedom, morality, conscience, virtue, happiness, and duty. Therefore, various scholars and philosophers have put forward different opinions on ethics. Ethical governance covers equity, openness, privacy, and moral governance. Ethical framework constitutes the cornerstone of the regulation to be established regarding AI (Winfield, 2019; Yu et al., 2018).

AI ethics includes a set of values, principles, and techniques that use widely accepted standards of right and wrong to guide moral behavior in developing and applying AI technologies (Renda, 2019; Schiff et al., 2020; Yu et al., 2018). However, robot ethics concentrates on the behavior of ethical robots and how ethical robots should be designed. Robo-ethics deals with concerns and moral dilemmas, such as whether robots will threaten humans in the long run (Ebers, 2019; Hagendorff, 2020; A. Winfield, 2019).

The primary focus of AI ethics is machine ethics on how autonomous systems adapt to ethical values. Different organizations of initiatives and AI experts have published remarkable reports or articles on ethics topics. The Future of Life Institute (2017) initiated one of the pioneering efforts advocating for responsible AI development. It has resulted in the formulation of “Asilomar AI Principles”. Hundreds of stakeholders signed the list of 23 fundamental tenets to drive AI research and application. In 2017, a heterogeneous meeting of AI experts, public authorities, and non-governmental organizations gathered around the principles of Asimov. As a result, the Asilomar AI Principles has adopted 23 principles based on four basic questions (Future of Life, 2017):

1. “How can we make future AI systems highly robust so that they do what we want without malfunctioning or getting hacked?
2. How can we grow our prosperity through automation while maintaining people's resources and purpose?
3. How can we update our legal systems to be fairer and more efficient, to keep pace with AI, and to manage the risks associated with AI?
4. What set of values should AI be aligned with, and what legal and ethical status should it have?”

An ethical framework is required so that AI does not threaten human autonomy and make decisions against humanity in decision-making processes. In this context Floridi (2019, p.700)

referred to a unique aspect as four traditional bioethics, beneficence, non-maleficence, autonomy, justice and principles, and adds an extra one, “explicability”. The last added “explicability” complements the other four bioethical approaches. This model is demonstrated in Figure 34.

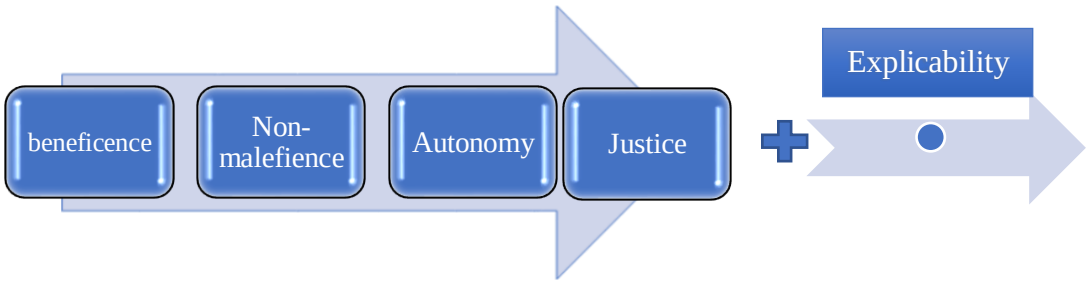

Figure 34. A Bioethics framework for Artificial Intelligence

Source: Adopted by Floridi (2019)

Similarly, The IEEE Global Initiative (2017) published a comprehensive report on AI ethics, mainly related to “Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems”. An ethical design for autonomous vehicles and intelligent systems (A/IS) was discussed with hundreds of researchers worldwide. The IEEE Committee on General Standards aims to express high-level ethical values that all forms on autonomous and intelligent devices. In this context, The IEEE Global Initiative (2017) motivated for AI developed an ethical standard for AI system:

1. “As a superposition of civil rights, they represent the highest principles of civil beneficence.
2. Prioritizing the advantages of the use of A / IS for humanity and the natural ecosystem. Note that both should not be at odds; one relies on the other.
3. Mitigate threats and adverse consequences’’, including abuse, as socio-technical frameworks develop as A / IS.”

They are responsible and open by ensuring A/IS (The IEEE Global Initiative, 2017, p. 20). Thus, the IEEE approach to AI ethics is based on five principles: human right, prioritizing well-being, accountability, transparency and awareness of misuse. These principles are shown at Table 25.

Table 25. The IEEE Ethically Aligned Design for Artificial Intelligence

Principle	Definition
Human Rights	Ensure they do not infringe on internationally recognized human rights
Well-being	Prioritize metrics of well-being in their design and use
Accountability	Ensure that their designers and operators are responsible and accountable
Transparency	Ensure they operate in a transparent manner
Awareness of misuse	Minimize the risks of their misuse

Source: Adapted from The IEEE Global Initiative (2017)

An initiative of Université de Montréal, Declaration for Responsible AI Development (2018) was addressed to any person, organization, and company that attempts to engage in the responsible development of AI. This declaration is to participate scientifically or technically in the improvement of new initiatives to the development of standards, regulations, and codes.

There are three essential purposes of the Declaration for Responsible AI Development (Montréal Declaration Responsible AI, 2018):

1. "Developing an ethical structure for the design and implementation of AI,
2. Direct the digital transformation so that this technological revolution benefits humanity,
3. To collectively achieve fair, equitable, and ecologically sustainable AI development, open a national and international platform for debate."

Social, cultural, and legal contexts were evaluated while establishing the principles of the Montreal Declaration. In this context, Montreal Declaration outlined ten principles to help guide the development of AI towards morally and socially desirable goals.

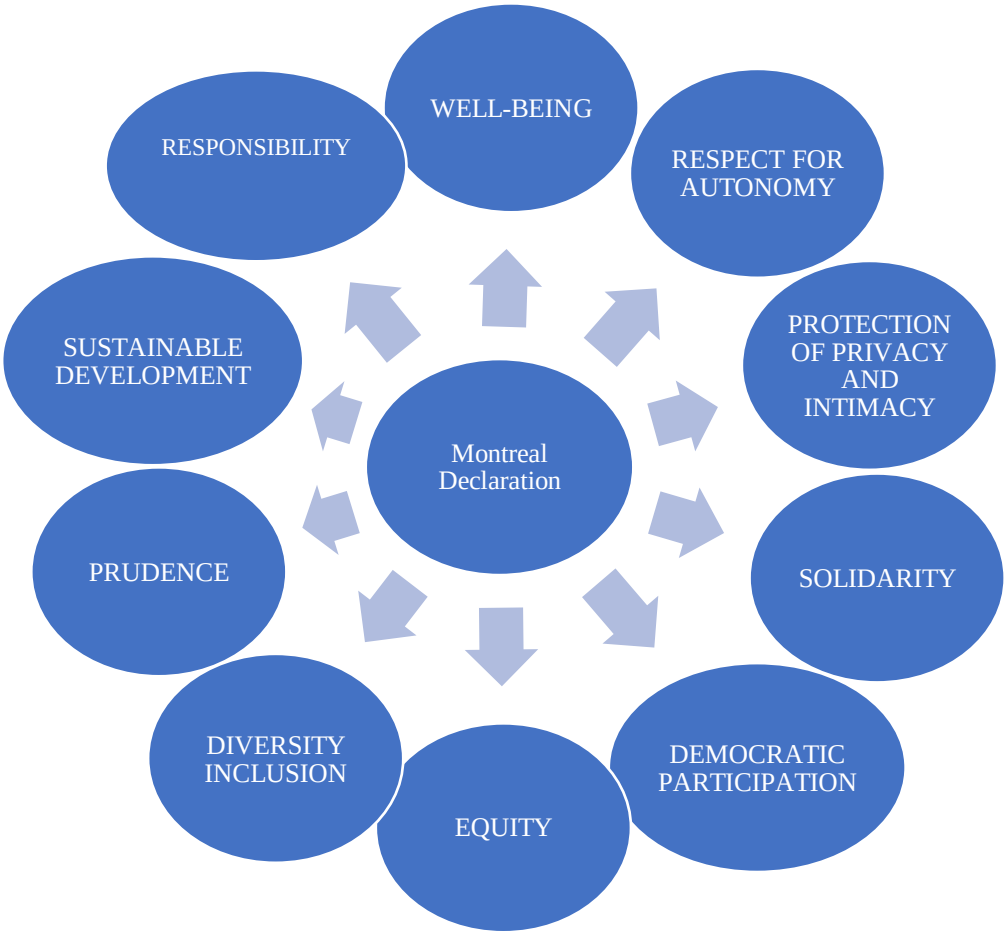

Figure 35. Ten Principles of Artificial Intelligence in Montreal Declaration

Source: Montréal Declaration Responsible AI (2018)

Thus, the ethical dimension of AI cannot be ignored in establishing standards, norms, legal rules, and regulations regarding the adaptation of AI to the public sector and AI governance. In the reports and documents examined, supranational or international commissions, AI expert group initiatives and universities have taken different approaches from AI ethics. However, there are also common principles at the point of AI ethics. Determining the standard codes or principles in the reports (Montreal, IEEE, The Future of Life Institute, EU/EGE, AI4People and COMEST) develops an ethics standard. For Montreal Declaration (2018), the adoption of AI should essentially facilitate the well-being of all sentient beings. At the same time, IEEE emphasizes the need to prioritize human well-being in all design techniques as an outcome (Floridi & Cowls, 2019). There are similarities and convergences among the ethical approaches in the literature. Five principles stand out on the cornerstone of AI ethics. In this context, prominent themes and principles in AI ethics are shown in Figure 36.

Figure 36. Common Patterns of Artificial Intelligence Ethics

Source: Adapted from Cath, 2018b; Dignum, 2017; Floridi & Cowls, 2019; Mcevoy, 2019; A. F. Winfield et al., 2019

Table 26. Artificial Intelligence Ethics in The Literature: Principle Themes

Report/Documents	Number of Principles	Principle Themes			
Ethics Guidelines for Trustworthy AI	4	respect human autonomy	prevention harm	fairness	explicability
EU guidelines on ethics in artificial intelligence	7	human agency and oversight	robustness and safety	privacy and data governance	transparency
		diversity and fairness	wellbeing	accountability	
AI, Robotics and 'Autonomous' Systems	9	human dignity	autonomy	responsibility	justice, equity, and solidarity
		democracy	rule of law and	security, safety, mental integrity	sustainability
		data protection privacy			
Good AI Society'	5	beneficence	non-maleficence	autonomy	justice
		explicability			
Report of COMEST On Robotics Ethics	7	human dignity	the value of autonomy;	privacy	do not harm
		responsibility	beneficence	justice	
IEEE Ethically Aligned Design	5	human right	prioritizing well-being,	transparency	misuse and awareness
		accountability			

Table 26. (continues) Artificial Intelligence Ethics in The Literature: Principle Themes

Montreal Declaration for Responsible AI Development	**10**	well-being democratic participation	respect for autonomy	protection of privacy and intimacy	solidarity
		democratic participation	equity	diversity inclusion	prudence
		responsibility	sustainable development		
Asilomar AI Principles	23	science-policy link	beneficial goal	beneficial use	common good
		failure transparency	safety	race avoidance	research culture
		judicial transparency	responsibility	value alignment:	human values
		personal privacy	liberty and privacy	shared benefit	shared prosperity
		human control	non-subversion	avoid ai arms race	capability caution
		importance	risks	recursive self-improvement	
TOTAL:	70				

Source: Author

Seventy different principles have been analyzed from different ethical documents and reports. The general ethical principles in Table 26 have been determined by the standards, action plans, strategies, and rules for AI at the national and international level.

4.4.6. The Global Governance of Artificial Intelligence

With the emerging technology and changing paradigms, global governance discussions are rapidly becoming cross-border. Advancements in ICT have moved beyond boundaries and fostered global governance. The concept of global governance frequently comes to the fore, particularly in crises like environmental problems, such as global warming, global health crises, and also financial crises (2008). However, global governance draws attention as one of the noticeable issues related to AI governance. A global framework for AI governance is urgently needed (Jelinek et al., 2020; Wallach & Marchant, 2019).

AI experts and researchers emphasize that AI governance requires a global consensus rather than national-level decision-making. Today, there is an AI race among developed countries. Countries like the USA, China, and India are aiming to become the global leader in AI technology and have already mentioned this goal in their national AI strategy documents (Schiff et al., 2020). For this

reason, there is an AI race among countries in the context of AI investments and the spread of AI applications.

AI is a technological revolution with the ability to develop advanced civilizations. It is progressively considered a primary strategy by governments and international organizations. Global AI governance is emerged to govern AI on international power imbalances, economic value distribution, and legitimacy (Bostrom et al., 2019; Schiff et al., 2020). The is a gap between the public, private sectors, and NGOs in order to provide policymakers with the resources they need to manage a diverse, technological, and global AI policy environment. Global AI governance is addressed in three main aspects: globalization (Dafoe, 2019), AI systems compatible with universal human rights or humanitarian AI (Madiega, 2019), and ethical integration (Daly et al., 2020).

Despite the national AI strategies and documents, governance approaches of AI are still unclear for many countries because non-developed and developing countries have limited capacity and lack of technical know-how in AI technology. However, establishing international governance regarding AI requires a dialogue and consensus mechanisms among countries (Butcher & Beridze, 2019). Thanks to AI dialogue mechanisms, countries can discuss AI challenges internationally.

In specific, North America, Europe, and East Asia have invested significantly for both fundamental and applied AI (ÓhÉigeartaigh et al., 2020). However, there is a parallel phenomenon (principles, standards, regulation etc) of localizing AI values in various parts of the world. International organizations, such as OECD, EU, and UN, have policy groups and research centers on AI. For example, the OECD AI Principles represent a widespread awareness of the need for global coordination and collaboration to facilitate reliable AI (Newman, 2020). All 36 OECD member states and a few non-member countries have also signed the OECD AI Guidelines.

Similarly, The EU and European Commission have established principles regarding “AI ethics” and “reliability of AI” from the European perspective. Stix (2020) stated that the European Commission had conducted a large-scale pilot implementation process for several months, seeking feedback from hundreds of stakeholders in Europe. Important policy recommendations regarding AI were also presented at the G20 summit in Japan in 2019. The multi-stakeholder approach for AI and the importance of controllable and interoperable AI understanding without

creating new threats and conflicts were highlighted at the G20 summit. Jelinek, Wallach and Kerimi (2020) briefly recommended to G20 for the establishment of a Coordinating Committee for the Governance of Artificial Intelligence (CCGAI) to better organize the detection and prevention of direct cyber-physical risks and long-term systemic imbalances on a worldwide platform.

Wallach and Marchant (2019) proposed establishing an international governance coordination committee (IGCC) for international coordination on AI governance and comprehensive monitoring of the area and its impacts. IGCC can function as a consensus or mediation tool among various stakeholder groups. IGCC can fill in the gaps, such as outlining "best practices" for various national and regional institutions, taking into account the soft and hard laws most appropriate for various cultures (Wallach & Marchant, 2019, p. 508). Pomeras & Abdala (2020, p.91) mentioned that "Global processes are valuable, even when they do not result in integrated systems, because inequality tends to get the upper hand in the absence of common standards". In this context, humankind needs a consensus for global AI principles. The principles to be established regarding AI should be observed in humanitarian and ethical values that will encompass all the world. Global AI governance must be urgently placed on the agenda of governments to prevent global mistakes made in nuclear weapons in the past. So, AI creates threats as well as opportunities. Considering that autonomous weapons will become more complex in the coming years, global AI governance is a priority issue than AI governance at the national or local level.

CONCLUSION: BIG QUESTIONS OF AI IN PA & PP

Technological developments have been the cornerstone for humanity since ancient times. Today, AI technology is in the forefront of a new revolution after the agricultural and industrial revolution. Scientists, AI experts, and futurists emphasize that AI will bring about a remarkable transformation in economic, social, and even political aspects. However, this transformation also generates some risks and opportunities. With the AI revolution, various big questions emerge, such as “Could AI help solve complicated, even wicked global problems, such as global warming, poverty, and cancer?” or “Could AI lead to the end of humankind?”. These questions are varied for each discipline and contain many uncertainties. AI has been transforming the future but also posing various social, economic, and governmental threats. This thesis focuses on the big questions of AI in public administration to better understand and explain the use of AI in public administration for years to come.

The lack of consensus on the essential issues of public administration is the basis of why paradigmatic progress in the discipline has been halted in our discipline. The field of public administration needs to clearly define some of the "big questions" and then begin to answer them(French, 2009). The big questions approach emerged with this motivation as a great debate in the public administration community in the 1990s. Behn (1995) emphasizes that if public administration is to be accepted as a discipline, it must consider its own big questions. Neumann (1995) argued that big questions must address the fundamental nature of a discipline. The big questions have been handled in the micro and macro perspective on the axis of public administration. While the first scholars who gave direction to big questions focused on macro questions, in the following years, researchers focused on big questions in micro fields (democracy, e-Government, education, public values) in public administration. Yıldız (2013) mentioned that big questions effectively build a research community and set a research agenda. These questions and their alternative answers require not to be accepted by all members of a research community. However, big questions are critical to the advancement of a discipline. In this context, one of the most prominent issues on the agenda of future governments is undoubtedly AI which, by its nature, contains many questions. This thesis has examined the AI questions in the literature with various dimensions.

Firstly, the concept of AI has been imagined by people since the birth of humanity. Philosophers and story-tellers throughout history fantasized about autonomous machines which can think and act like humans. Since the beginning of the 20th Century, AI has been one of the biggest fantasies

of the science fiction literature. In 1968, the movie “2001: A Space Odyssey”, directed by Stanley Kubrick, raised the question of whether AI will one day destroy humanity.

AI has already gone beyond being a science fiction fantasy. Although AI has not reached the capacity of human intelligence, it has gone far beyond human potential in some specific tasks, such as healthcare and security. Today, AI continues to transform our world in many ways. However, AI not only play chess better than humans, but it also transforms the workplace ecosystem. Many professions’ existence is at stake as a result of AI automation.

In the historical context, the term “artificial intelligence” is a concept that was presented in the 1950s to realize human-level intelligence in software and hardware. About 70 years ago, the vision of AI was to build machines that can think, learn, and reason like a human. However, it has never been easy to reach human intelligence right away. For this reason, the focus of AI research has turned to solve particular, narrow intelligence problems. In the first wave of AI, the increase in datasets has fed machine learning systems over time. Although AI research in the modern sense started 70 years ago, breakdowns in AI occurred in recent years. The rapid developments in recent years are due to the enormous quantity of datasets and the progress in computing capacity. Since the beginning of the 2000s, the second wave of AI has been experienced, with vital progress in deep learning and artificial neural networks. Artificial neural network algorithms have started to be being developed based on human learning processes. Furthermore, in the third wave of AI, Artificial Narrow Intelligence (ANI) transition to Artificial General Intelligence (AGI) is expected. AGI, “strong AI” or “human-level AI”, means that the computer system is more successful than human or at the same level as human in all tasks. On the other hand, AGI can solve complex problems, make decisions in uncertain situations, and draw on previous experience evaluating the current situation. However, AGI can be possible with the combined use of many AI techniques.

AI has been interacting with several disciplines throughout its evolution. AI is an “umbrella” concept that encompasses various technologies and techniques. In this context, AI technology covers many sub-fields such as robotics, computer systems, machine learning, expert systems, artificial neural networks, computer vision, and natural language processing. Today, AI is not only a cognitive science or computer science topic, but it also is an interdisciplinary field of research. The disciplines that contribute to the advancement of AI include mathematics, physics, electronics, linguistic, psychology, philosophy, and even fine arts. Nowadays, AI is widely used in healthcare and medicine, automation, manufacturing and industrial systems, aircraft and space

technologies, finance, and various services. On the other hand, AI is evolving into a "transdisciplinary" research area. The public administration discipline leads AI to determine public policies related to AI, designing national AI strategies, and the AI governance framework.

In the theoretical aspect, the new public management (NPM) approach was the dominant paradigm in public administration from 1980s to 2000s. However, since the early 2000s, the NPM approach has been highly criticized in the public administration literature. This situation has led to the Digital Era Governance (DEG) approach that emerged from the synthesis of e-government and governance.

Rapid technological advancement and widespread use of ICT revealed essential changes in the provision of public services. The most critical reform movement observed in public administration since the 1990s is the implementation of e-Government models and ICT tools. With the digitalization in public administration, public organizations move away from the traditional inefficient and cumbersome structure and turn into a brand-new structure which is more compatible with the expectations of the information age. The digitalization of public administration enhances participation and enables service delivery models through innovative networks, partnerships, and collaborations. The DEG understanding have redefined citizen-government relations. The online delivery of public services has removed the barriers posed by different hierarchical structures between citizens and governments. The first wave of DEG included ICT and e-government tools and gained new momentum in the second wave with Web.2.0 tools and social media. On the other hand, in parallel with today's technological advancements, new transformations are taking place in the e-government approach. The transformation process to the information society has existed in the axis of the advancement of industry 4.0 pillars, such as big data analytics, IoT, cloud computing, and augmented reality. AI is a component of advanced digitalization technologies that undoubtedly reshape the public sector. Furthermore, a third wave is expected in the DEG understanding to adopt AI and big data tools in public administration systems. The thesis discusses the third wave of digitalization in public administration within the framework of AI and big data.

AI technologies contribute to effective optimization in public policy-making and decision-making processes from a public administration perspective. On the other hand, the public administration discipline determines the boundaries of AI by leading the AI governance and the formulation of AI regulations. In this context, the thesis points to the mutual or interactive link between AI and public administration.

AI is a recent debate in the public administration literature. Although first studies related to AI in the literature started in the 1990s, systematic studies on AI have emerged from 2015 on. Today, AI is discussed in public administration mostly within the context of national AI strategies and AI policies. Moreover, AI will probably be one of the "hot topics" in public administration literature over the next decades. In this thesis, the big questions of AI are evaluated within the framework of public administration discipline and this thesis sheds some light on possible future studies on AI in public administration.

Studies on AI in the public administration literature have been discussed in various dimensions. Firstly, public administration scholars considered integrating AI into public administration as a part of digitalization in the public sector and e-Government perspective. The adaptation of AI technologies to the discipline of public administration contributes significantly to increased administrative efficiency, improved service delivery and performance capacity. In this context, AI can automate the decision-making processes in bureaucracy, generate effective solutions to improve public services, and help governments to communicate with citizens in the public sector. Additionally, AI has the capacity to perform crisis management, simulations, and predictive analyses in law enforcement and police services. AI also assists human resources in the public sector. Today, AI mechanisms can directly communicate with citizens, answer questions and contribute to the citizen's knowledge thanks to chatbots. AI also improves the delivery of services. AI promotes public administration mechanisms in delivering several public services such as health, security, and education. Thanks to AI technologies, service delivery becomes faster and less costly.

Secondly, the use of AI in public policy making and multiple stages of the public policy cycle consisting of problem definition, agenda-setting, policy formulation is among the current discussions in the public administration literature. Thanks to e-government, AI mechanisms, such as machine learning, deep learning, chatbots, are used to process massive amounts of big datasets. The data-driven policy-making is one of the vital turning points for the public sector. AI promotes data-driven and evidence-based policy-making processes, which can transform and improve the traditional public policy cycle. The dynamic use of AI in the public policy cycle contributes to decision-making processes. The "Public Policy Making 2.0" approach, which is emphasized as creating public policy making integrated with ICT, evolves into the "Public Policy Making 3.0" approach that uses machine learning in public policy making. Machine learning systems that optimize existing datasets and raw data allow policymakers to advance their predictive capacity to solve complex problems. With the Public Policy 3.0 approach, public policy making is

automated with trained data sets. Integrating AI into the public policy process will provide an "automatic" and "dynamic" process. Indeed, AI-driven public policy making. "Public Policy Making 3.0" has the potential to enhance evidence-based decision-making capacity. However, the integration of AI into the public policy process is linked to many issues such as security, privacy, and ethics. The use of AI in the public policy making process is closely related to AI governance.

The integration of AI into public administration and public policy allows a variety of opportunities. However, AI technology also contains various threats and risks in economic, social, and political structure in the long run. In order to deal with the possible threats and minimize the risks, governments require to take actions related to AI, which is evaluated within the context of AI governance. AI governance involves some solutions and instruments for governments that can promote the advancement and spread of AI. One aspect of AI governance involves the design, development, and beneficial use of AI. On the other hand, AI governance includes a legal framework, regulations, and reasonable, transparent, explainable, human-centered principles, ethical standards, which determine the boundaries or limits of AI. In this framework, AI governance is a multi-layered process and includes multi-disciplinary approaches from philosophy to engineering. The thesis has formed an "Integrated AI Governance Model" that offers a holistic perspective for AI governance.

There is a wide variety of approaches to AI governance in the literature. These approaches deal with AI governance from a narrow perspective. However, the one-disciplinary strategy for AI governance is insufficient to explain AI governance because governance is a multi-dimensional process that can be made possible by "harmonization of various components". In this context, this thesis explores the integrated AI governance model around six dimensions and consists of a synthesis of several approaches of AI governance. The model combines the technical perception of AI, AI regulations, AI ethics, AI principles, stakeholders of AI, and global AI governance. Therefore, "Integrated AI Governance Model" offers a multi-layered and multi-stakeholder perspective on the big questions of AI by the spirit of governance.

AI governance has been on the agenda of governments for the past few years. The thesis reveals that AI governance will be much more crucial for governments' agendas and international organizations in the coming years. It is clear that there is a requirement for international agreements and frameworks regarding AI governance. Similarly, governments require a roadmap on AI governance at the national level that will benefit from governance mechanisms in shaping

AI, designing AI strategies, and combating the dark side of AI. The rapid evolution of AI also causes some ethical and administrative issues. Coping with the problems and risks posed by AI necessitate a trans-disciplinary and multi-dimensional strategy.

The "age of artificial intelligence" has just begun but it has already contained numerous unknowns and concerns. AI has many benefits and risks because of its dynamic nature. According to Stephan Hawking, "AI will be 'either best or worst thing' for humanity" (Hern, 2016). With the rapid progress of AI, "technological singularity", "transhumanism," and "humanity 2.0" approaches have started to be discussed frequently in the literature. AI could be the most vital breakthrough in human history because this discovery can take man beyond the galaxies and or destroy humankind. That's why AI needs inspection and regulatory mechanisms. The needed regulations should be on the axis of AI governance, which the public administration approach will coordinate. The thesis shows that the public administration discipline is also at the core of the discussions regarding AI. Thus, public administration performs a supervisory role in managing AI development and being aware of AI risks and challenges.

As a result, today's AI decisions will shape tomorrow because the future is closer than we think. Therefore, leaders, policy-makers, politicians, and public administrators need to be ready for the age of AI. In this context, this thesis offers several policy recommendations for the future of the AI agenda.

Accelerating the data ecosystem

Data is "new oil" and therefore fuel of AI. The primary requirement for integrating data with AI technology is to design a data ecosystem. Data are one of the essential components of the information society. Within the framework of public administration, data contribute to strengthening participation and cooperation in administrations and the development of innovation, effectiveness, and efficiency in public services. The recent "Cambridge Analytica" scandal demonstrates the power of data. The company used voters' social media data to broadcast personalized political advertising and manipulative news by micro-targeting. The concept of a data ecosystem includes the collection, processing, and analysis of data. In order to develop the data ecosystem, it is necessary to strengthen data security infrastructures and to increase investments in open data portals. In addition, legal infrastructures should be designed for big data owners such as Google, Facebook, and Twitter.

Integrating AI into the public policy-making cycle

Governments use AI to improve service delivery, control crises, and design public policies. Furthermore, AI offers significant advantages in evidence-based policy-making. Today, large datasets are the backing of evidence-based policy-making. Governments have massive datasets thanks to e-government and social media tools. AI and machine learning systems are required to make the datasets meaningful and obtain the output. AI can support the policy-making process that ensures that decisions concerning society are made rationally and without consideration. The policy-making process is a long and complex process consisting of several stages including agenda setting and policy formulation. AI systems have the potential to transform the policy-making cycle into a dynamic form. In this way, policymakers can provide more data-driven policies in a short time. On the other hand, AI can evaluate public policy simulations and improve decision-making capacity. It goes without saying that it is not easy to immediately integrate AI into the public policy making process. However, pilot projects related to AI-driven policy-making can be tried.

Establishing AI Regulations

AI regulations are yet another essential component of AI governance. Regulations should be designed to prevent high risks derived from AI. In other aspects, AI regulations should be put forward to advance the progress of the AI ecosystem. AI regulations organize the main measure of control and supervision related to AI. The primary regulations about AI should be within the framework of "soft law" (standards and principles). Regulations can encourage AI laws to take effect. AI regulations can be initiated in autonomous vehicles and robotic applications. However, every AI application may require a specific regulatory requirement. In general, AI regulations should be developed within the framework of human-centric, ethics, accountability, and transparent and responsible AI principles.

AI is transforming the work ecosystem. Public policies should be prepared for workforce transformation.

One of the biggest threats to AI is the transformation it will replace in the workforce. However, it is not possible to measure this effect from now on. World Economic Forum (2020) estimates that AI will generate 97 million new jobs, and 85 million jobs will be displaced until 2025. Today, the number of industrial robots is increasing day by day. AI experts claim that AI will shake the business ecosystem deeply in the following decades. Especially in the labor market, AI is less

costly and more efficient than human beings. However, the impact of AI on the workforce will primarily be seen in the blue-collar sector. There will be a broad replacement, particularly in the transport, manufacturing, and telecommunications sectors.

Governments should develop various regulations and public policies for the possible changes in the labor market. The universal basic income (UBI) approach will enter the agenda of many governments. Moreover, the perception of "AI takeover" will rise in society in the long run, which refers to the replacement of human beings with AI and the fact that AI becomes more dominant than human in the world.

On the other hand, with the AI revolution, new lines of business will also emerge. In particular, the demand for data analytics and AI specialist will increase. Governments encourage businesses that support the business ecosystem designed by AI. Moreover, educational policy needs to be reconsidered to reduce the devastating impact of AI technologies on the workforce, and a technology-compatible and innovative education system should be designed. For this reason, governments should focus on an education policy that is suitable and prepared for the rapidly growing automation.

Designing a Specific Public Institution on AI

Governments are the first users and pioneers of technology. The AI strategy of governments should be formed in a planned and coordinated manner. Therefore, a specific national agency or institution within the central government should design decisions regarding AI. A particular AI institution is necessitated to introduce a national AI strategy to coordinate and monitor investments linked to AI. The institution can be in the form of a ministry, office, or presidency. However, the specific national AI institution should be the most influential actor and in the center of policy-making design, regulations, and strategies related to AI.

The priority and requirements of each public institution regarding AI may vary. However, a specific AI institution is served to execute national decisions on AI, determine policy priorities, and raise public awareness about AI technology. When the value of AI technology begins to be taken into account, the bureaucratic burden of establishing a specific AI institution should not be stand out. Establishing a specific institution related to AI facilitates cooperation between sectors and institutions. On the other hand, a specific AI institution can allow an effective AI dialogue with the public, private and civil sectors. The institution should be designed in a multi-stakeholder behavior consisting of several discipline such as engineering, law, philosophy, and private sector

representatives. Some countries have made a breakthrough towards establishing an AI Ministry. However, in Turkey, the Department of Big Data and Artificial Intelligence Applications under the Presidency's Digital Transformation Office is responsible for coordinating AI strategy. However, the scale of the department remains insufficient when considering the AI concept**.**

Prioritizing AI in Cyber Security Policies

Cybersecurity is a critical issue for companies, organizations, and governments. Increasing cyber-attacks day by day pose significant dangers for national security as cyber-attacks directly cause data theft. With the advancement of AI technology, cybersecurity has become more critical because AI cyberattacks have become automated. In this context, the issue of cybersecurity stands out as one of the prominent issues in national security.

AI is a game-changer for both cybersecurity and cyber-attacks. The use of AI in cybersecurity provides a range of capabilities that can contribute to the detection, prediction of cyber threats, and rapid response to these threats in real-time. However, the results of AI-based cyber-attacks are likely to reach a very destructive and even life-threatening dimension. These attacks, which target and damage data integrity, lead to the loss of confidence in organizations, the occurrence of system malfunctions, and even systems collapse. On the other hand, AI-based attacks can detect information about people quickly by “social engineering” and conduct an identity analysis. Government should consider its investments and security strategies in the axis of AI and machine learning technics.

Improving AI Collaborations

The state is not the only actor in developing countries and the functioning of the public sector, increasing technology literacy and spreading the use of information and communication. This requires a collective model of participation and coordination in which public, private and civil society work together. Universities and tech-giants must take part in AI partnership. Increasing collaboration on AI will strengthen AI governance. On the other hand, there is a requirement for a multi-stakeholder partnership model and dialogue between stakeholders to diversify AI investments, supporting start-ups and unicorns. For example, The Alan Turning Institute in the UK is the center of AI collaboration and research. Governance mechanisms that encourage AI participation can be supported.

After all, this thesis presents a research agenda for future studies in the public administration and public policy. In addition, this study, which is one of the first research in Turkey in terms of examining the relationship between AI and public administration, aims to contribute to Turkey’s strategic AI vision. Future studies on AI may focus on sub-components of AI governance such as AI regulations, AI principles, and AI collaboration. It should not be forgotten that today's decisions regarding AI are also crucial for our future generations. It is no longer possible to slow down the progression of AI. However, policies must be taken to be prepared for the transformation that the AI revolution will bring. It is necessary to consider what kind of government and public administration understanding the age of AI requires.

REFERENCES

Agarwal, P. K. (2018). Public Administration Challenges in the World of AI and Bots. *Public Administration Review*, *78*(6), 917–921. https://doi.org/10.1111/puar.12979

Agrawal, A., Gans, J., & Goldfarb, A. (2019). Economic Policy for Artificial Intelligence. *Innovation Policy and the Economy*, *19*(1), 139–159. https://doi.org/10.1086/699935

Akay, E. Ç. (2018). A New Horizon in Econometrics: Big Data and Machine Learning. *Social Sciences Research Journal*, *7*(2), 41–53.

Al-Mushayt, O. S. (2019). Automating E-Government Services with Artificial Intelligence. IEEE Access, 7, 146821–146829. https://doi.org/10.1109/ACCESS.2019.2946204

Allam, Z., & Dhunny, Z. A. (2019). On Big Data, Artificial Intelligence and Smart Cities. *Cities*, *89*(November 2018), 80–91. https://doi.org/10.1016/j.cities.2019.01.032

Allen, B. G. C. (2019). *Understanding China ' s AI Strategy : Clues to Chinese Strategic Thinking on Artificial Intelligence and National Security*. *February*.

Almeida, P., Santos, C., & Farias, J. S. (2020). Artificial Intelligence Regulation: A Meta-Framework for Formulation and Governance. *Proceedings of the 53rd Hawaii International Conference on System Sciences*, *3*, 5257–5266. https://doi.org/10.24251/hicss.2020.647

Amazon. (2021). What is Artificial Intelligence (AI)? — Amazon Web Services. Retrieved 9 June 2021, from https://aws.amazon.com/tr/machine-learning/what-is-ai/

Anderson, S. L. (2008). Asimov ' s " three laws of robotics " and machine metaethics. 477–493. https://doi.org/10.1007/s00146-007-0094-5

Androutsopoulou, A., Karacapilidis, N., Loukis, E., & Charalabidis, Y. (2019). Transforming the communication between citizens and government through AI-guided chatbots. *Government Information Quarterly*, *36*(2), 358–367. https://doi.org/10.1016/j.giq.2018.10.001

Aoki, N. (2020). An experimental study of public trust in AI chatbots in the public sector. *Government Information Quarterly*, *37*(4), 101490. https://doi.org/10.1016/j.giq.2020.101490

Araujo, T., Helberger, N., Kruikemeier, S., & de Vreese, C. H. (2020). In AI we trust? Perceptions about automated decision-making by artificial intelligence. *AI and Society*, *0123456789*. https://doi.org/10.1007/s00146-019-00931-w

Arf, C. (1959). Makineler Düşünebilir mi ve Nasıl Düşünebilir? In *Atatürk Üniversitesi 1958-1959 Öğretim Yılı Halk Konferansları* (Issue 1, pp. 91–103).

Armstrong, S., Bostrom, N., & Shulman, C. (2016). Racing to the precipice: a model of artificial intelligence development. AI and Society, 31(2), 201–206. https://doi.org/10.1007/s00146-015-0590-y

Austin, E. K., & Callen, J. C. (2008). Reexamining the Role of Digital Technology in Public Administration: From Devastation to Disclosure. Administrative Theory & Praxis, 30(3), 324–341. https://doi.org/10.1080/10841806.2008.11029646

Ayas, M. (2018). Yapay Zekâ- insandan Öte., STM.

Ayhan, E., & Önder, M. (2017). Yeni Kamu Hizmeti Yaklaşımı: Yönetişime Açılan Bir Kapı. Gazi İktisat ve İşletme Dergisi, 3(2), 19–48.

Ayoub, K., & Payne, K. (2016). Strategy in the Age of Artificial Intelligence. Journal of Strategic Studies, 39(5–6), 793–819. https://doi.org/10.1080/01402390.2015.1088838

Babaoğlu, C. (2017). Kamu Politikası Analizine Yönelik Kavramsal ve Kuramsal Bir Çerçeve. Yönetim Bilimleri Dergisi, 15(30), 511-532.

Bannister, F., & Connolly, R. (2012). Defining e-Governance. *E-Service Journal*, *8*(2), 3–25.

Bannister, F., & Connolly, R. (2020). Administration By Algorithm: A risk Management Framework. *Information Polity*, *25*(4), 471–490. https://doi.org/10.3233/IP-200249

Barry, B. (2009). Public Values Theory: Three Big Questions. *International Journal of Public Policy*, *4*(5), 369–375. https://doi.org/10.1504/IJPP.2009.025077

Barth, T. J., & Arnold, E. (1999). Artificial Intelligence And Administrative Discretion: Implications for public administration. *American Review of Public Administration*, *29*(4), 332–351. https://doi.org/10.1177/02750749922064463

Batty, M., Axhausen, K. W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., Ouzounis, G., & Portugali, Y. (2012). Smart cities of the future. *European Physical Journal: Special Topics*, *214*(1), 481–518. https://doi.org/10.1140/epjst/e2012-01703-3

Batty, Michael. (2018). Artificial Intelligence And Smart Cities. *Environment and Planning B: Urban Analytics and City Science*, *45*(1), 3–6. https://doi.org/10.1177/2399808317751169

Baumgart, B. G. (1975). Polyhedron Representation for Computer Vision. AFIPS Natl Comput Conf Expo Conf Proc, 44, 589–596.

Behn, R. D. (1995). The Big Questions of Public Management. *Public Administration Review*, *55*(4), 313. https://doi.org/10.2307/977122

Beken, H. G. (2020). 21 . Yüzyilda (Evrensel) Temel Gelir Tartişmalari. *Marmara Üniversitesi İktisadi ve İdari Bilimler Dergis*, *42*(2), 180–201.

Bench-capon, T., Micheal, A., Ashley, K., Katie, A., Bex, F., Borges, F., Bourcier, D., Gordon, T. F., Governatori, G., Leidner, J. L., Thompson, P., Tyrrell, A., Verheij, B., Walton, D. N., & Wyner, A. Z. (2012). A history of AI and Law in 50 papers : 25 years of the international conference on AI and Law. *Artif Intell Law*. https://doi.org/10.1007/s10506-012-9131-x

Bengio, Y. (2009). Learning Deep Architectures For AI. Foundations and Trends in Machine Learning, 2(1), 1–27. https://doi.org/10.1561/2200000006

Bentley, P. J., Brundage, M., Häggström, O., & Metzinger, T. (2018). Should we fear artificial intelligence? In European Parliamentary Reseach Service. http://www.ep.europa.eu/stoa/

Berk, R. A., Sorenson, S. B., & Barnes, G. (2016). Forecasting Domestic Violence: A Machine Learning Approach to Help Inform Arraignment Decisions. *Journal of Empirical Legal Studies*, *13*(1), 94–115. https://doi.org/10.1111/jels.12098

Bertolini, A. (2020). Artificial Intelligence and Civil Liability. In European Parliament's Committee on Legal Affairs (Vol. 13, Issue July). https://doi.org/10.22364/jull.13.10

Bonin, A. Von, & Malhi, S. (2020). *The Use of Artificial Intelligence in the Future of Competition Law Enforcement*. *June*, 18–21.

Bonsón, E., Torres, L., Royo, S., & Flores, F. (2012). Local e-government 2.0: Social media and corporate transparency in municipalities. Government Information Quarterly, 29(2), 123–132. https://doi.org/10.1016/j.giq.2011.10.001

Bostrom, N. (2005). Transhumanist Values. Philosphy Documentation Center, 3–14. https://doi.org/10.4324/9781003063704-7

Bostrom, N. (2016). Superintelligence: Paths, Dangers, Strategies, Reprint ed.

Bostrom, N. (2019). The Vulnerable World Hypothesis. Global Policy, 10(4), 455–476. https://doi.org/10.1111/1758-5899.12718

Bostrom, N., Dafoe, A., & Flynn, C. (2019). Public Policy and Superintelligent AI : A Vector Field Approach. Ethics of Artificial Intelligence, 1(2018), 1–29.

Boyd, M., & Wilson, N. (2017). Rapid Developments in Artificial Intelligence: how might the New Zealand government respond? Policy Quarterly, 13(4), 36–43. https://doi.org/10.26686/pq.v13i4.4619

Bozeman, B., Youtie, J., & Jung, J. (2020). Robotic Bureaucracy and Administrative Burden: What Are the Effects of Universities' Computer Automated Research Grants Management Systems? *Research Policy*, *49*(6), 103980. https://doi.org/10.1016/j.respol.2020.103980

Brewer, G. A., Neubauer, B. J., & Geiselhart, K. (2006). Designing and implementing E-government systems: Critical implications for public administration and democracy. Administration and Society, 38(4), 472–499. https://doi.org/10.1177/0095399706290638

Brownson, R. C., Chriqui, J. F., & Stamatakis, K. A. (2009). Understanding Evidence-Based Public Health Policy. American Journal of Public Health, 99(9), 1576–1583. https://doi.org/10.2105/AJPH.2008.156224

Bruchansky, C. (2019). Machine learning: A structuralist discipline? *AI and Society*, *34*(4), 931–938. https://doi.org/10.1007/s00146-017-0764-x

Brueckner, R. (2020, March 19). Inside HPC. https://insidehpc.com/2020/03/alibaba-cloud-offers-ai-cloud-services-to-help- battle-covid-19-globally/ (accessed 18 April 2021)

Brundage, M., & Bryson, J. (2016). *Smart Policies for Artificial Intelligence*. https://arxiv.org/pdf/1608.08196.pdf

Brynjolfsson, E., & Mitchell, T. (2014). What can machine learning do? Workforce implications. *Science*, *358*(6370), 1530–1534. https://doi.org/10.1126/science.aap8062

Bryson, J. J., Diamantis, M. E., & Grant, T. D. (2017). Of, for, and by the people: the legal lacuna of synthetic persons. *Artificial Intelligence and Law*, *25*(3), 273–291. https://doi.org/10.1007/s10506-017-9214-9

Buchanan, B. G. (2005). A (very) brief history of artificial intelligence. *AI Magazine*, *26*(4), 53–60.

Buchanan, B., & Miller, T. (2017). *Machine Learning for policy makers* (Issue June). https://www.belfercenter.org/sites/default/files/files/publication/MachineLearningforPolicymakers.pdf

Budish, Ryan; Gasser, U. (2019). What are the OECD Principles on AI? | Berkman Klein Center. Bergmann Klein Center, March, 1–2. https://cyber.harvard.edu/story/2019-06/what-are-oecd-principles-ai

Buiten, M. C. (2019). Towards Intelligent Regulation of Artificial Intelligence. European Journal of Risk Regulation, 10(1), 41–59. https://doi.org/10.1017/err.2019

Buren, E. Van, Chew, B., & Eggers, W. (2020). *AI readiness for government*. www.deloitte.com/insights

Busch, P. A., & Henriksen, H. Z. (2018). Digital discretion: A systematic literature review of ICT and street-level discretion. *Information Polity*, *23*(1), 3–28. https://doi.org/10.3233/IP-170050

Butcher, J., & Beridze, I. (2019). What is the State of Artificial Intelligence Governance Globally? *RUSI Journal*, *164*(5–6), 88–96. https://doi.org/10.1080/03071847.2019.1694260

Calo, R. (2017). Artificial Intelligence Policy: A Roadmap. *SSRN Electronic Journal*, 399–435. https://doi.org/10.2139/ssrn.3015350

Cambria, E., & White, B. (2014). Jumping NLP curves: A review of natural language processing research. IEEE Computational Intelligence Magazine, 9(2), 48–57. https://doi.org/10.1109/MCI.2014.2307227

Cambridge Dictionary. (2021). artificial intelligence. Retrieved 9 June 2021, from https://dictionary.cambridge.org/dictionary/english/artificial-intelligence

Campbell, M., Hoane, A. J., & Hsu, F. H. (2002). Deep Blue. Artificial Intelligence, 134(1–2), 57–83. https://doi.org/10.1016/S0004-3702(01)00129-1

Capgemini Consulting. (2017). Unleashing the potential of Artificial Intelligence in the Public Sector. In *Capgemini*. https://www.capgemini.com/consulting/wp-content/uploads/sites/30/2017/10/ai-in-public-sector.pdf

Caruana, R., & Niculescu-Mizil, A. (2006). An Empirical Comparison of Supervised Learning Algorithms. ACM International Conference Proceeding Series, 148, 161–168. https://doi.org/10.1145/1143844.1143865

Castelluccia, C., & Métayer, D. Le. (2019). *Understanding algorithmic decision-making - Publications Office of the EU* (Issue March). PRS | European Parliamentary Research Service. https://op.europa.eu/en/publication-detail/-/publication/ca808eed-90af-11e9-9369-01aa75ed71a1

Castro, D., McLaughlin, M., & Chivot, E. (2021). Who Is Winning the AI Race: China The EU or The United States? Center for Data Innovation, January, 1–84. www.technologyreview.com/s/608112/who-is-winning-the-ai-race/

Cath, C. (2018). Governing Artificial Intelligence: Ethical, Legal and Technical Opportunities And Challenges. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *376*(2133). https://doi.org/10.1098/rsta.2018.0080

Cave, S., & ÓhÉigeartaigh, S. S. (2018). An AI Race for Strategic Advantage: Rhetoric and Risks. AIES 2018 - Proceedings of the 2018 AAAI/ACM Conference on AI, Ethics, and Society, 36–40. https://doi.org/10.1145/3278721.3278780

Cengiz, S., & Şahin, A. (2020). Teknolojik İlerlemenin İstihdam Yaratmadaki Rolü ve Önemi: Türkiye Örneği. *Karadeniz Uluslararası Bilimsel Dergi*, 160–172. https://doi.org/https://doi.org/10.17498/kdeniz.657015

Center for Public Impact. (2017). *Destination unknown: Exploring the impact of Artificial Intelligence on Government* (Vol. 8, Issue September). https://publicimpact.blob.core.windows.net/production/2017/09/Destination-Unknown-AI-and-government.pdf

Chang, M., Zhu, Z., Chen, Y., Hu, C., Jiang, M., & Chiang, C. (2019). *AI City Challenge 2019 – City-Scale Video Analytics for Smart Transportation*. 99–108.

Chatfield, A. T., & Reddick, C. G. (2019). A framework for Internet of Things-enabled smart government: A case of IoT cybersecurity policies and use cases in U.S. federal government. Government Information Quarterly, 36(2), 346–357. https://doi.org/10.1016/j.giq.2018.09.007

Chen, S. H., Jakeman, A. J., & Norton, J. P. (2008). Artificial Intelligence Techniques: An Introduction To Their Use For Modelling Environmental Systems. *Mathematics and Computers in Simulation*, *78*(2–3), 379–400. https://doi.org/10.1016/j.matcom.2008.01.028

Chen, T., Guo, W., Gao, X., & Liang, Z. (2020). AI-Based Self-Service Technology In Public Service Delivery: User Experience And Influencing Factors. *Government Information Quarterly*, *May*, 101520. https://doi.org/10.1016/j.giq.2020.101520

Chowdhury, G. G. (2003). Natural Language Processing. Annual Review of Information Science and Technology, 37, 51–89. https://doi.org/10.1002/aris.1440370103

Christensen, T., & Lægreid, P. (2011). Democracy and administrative policy: Contrasting elements of New Public Management (NPM) and post-NPM. *European Political Science Review*, *3*(1), 125–146. https://doi.org/10.1017/S1755773910000299

Christopher Hood. (1991). A Public Management for All Seasons? Public Administration, 69(1), 3–19. http://dx.doi.org/10.1111/j.1467-9299.1991.tb00779.x

Cihon, P. (2019). Standards for AI Governance: International Standards to Enable Global Coordination in AI Research & Development. In *Future of Humanity Institute, University of Oxford* (Issue April). https://arxiv.org/pdf/1802.07228.pdf

Clifford, C. (2018). Elon Musk: 'Mark my words — A.I. is far more dangerous than nukes'. Retrieved 9 June 2021, from https://www.cnbc.com/2018/03/13/elon-musk-at-sxsw-a-i-is-more-dangerous-than-nuclear-weapons.html

Cohen, B.: What Exactly Is a Smart City? September 19, 2012b, online at: http://www.fastcoexist.com/1680538/what-exactly-is-asmart-city (accessed 26 may 2021).

Cutler, A., Pribić, M., & Humphrey, L. (2018). Everyday Ethics for Artificial Intelligence. In IBM www.ibm.com/legal/us/en/copytrade.shtml%0Ahttps://www.ibm.com/watson/assets/duo/pdf/everydayethics.pdf

Copeland, B. (2020, August 11). Artificial intelligence. Encyclopedia Britannica. https://www.britannica.com/technology/artificial-intelligence

Cordella, A., & Dodd, C. (2019). It takes two to tango: Bringing together users and artificial intelligence to create public value. *ACM International Conference Proceeding Series*, 389–397. https://doi.org/10.1145/3325112.3325228

Dafoe, A. (2018). AI Governance: A Research Agenda. In Future of Humanity Institute, University of Oxford.

Dafoe, A. (2019). Global Politics and The Governance of AI. Journal of International Affairs Editorial Board, 72(1), 121–126.

Daly, A., Hagendorff, T., Li, H., Mann, M., Marda, V., Wagner, B., Wang, W., & Witteborn, S. (2019). Artificial Intelligence, Governance and Ethics: Global Perspectives. *SSRN Electronic Journal*, *June*, 20–21. https://doi.org/10.2139/ssrn.3414805

Demchak, C. C. (2019). China: Determined to dominate cyberspace and ai. Bulletin of the Atomic Scientists, 75(3), 99–104. https://doi.org/10.1080/00963402.2019.1604857

Deng, L., & Yu, D. (2013). Deep learning: Methods and applications. *Foundations and Trends in Signal Processing*, *7*(3–4), 197–387. https://doi.org/10.1561/2000000039

Denhardt, R. B. (2001). The Big Questions Of Public Administration Education. *Public Administration Review*, *61*(5), 526–534. https://doi.org/10.1111/0033-3352.00125

Denyer, D., & Tranfield, D. (2009). Producing a systematic review. In *The Sage handbook of organizational research methods* (pp. 671–689). SAGE. https://www.mendeley.com/catalogue/0ff0533c-01f2-338e-a1a9-6f60a28fa801/?utm_source=desktop&utm_medium=1.19.4&utm_campaign=open_catalog&userDocumentId=%7B8b821bd1-4e6e-4cce-8efd-130b29a0bf5b%7D

Desjairdens, J. (2019). How Much Data Is Generated Each Day?. Retrieved 15 May 2021, from https://www.weforum.org/agenda/2019/04/how-much-data-is-generated-each-day-cf4bddf29f/

Dewey, John (1927). The Public And Its Problems. Les Etudes Philosophiques 13 (3):367-368.

Dey, A. (2016). Machine Learning Algorithms: A Review. International Journal of Computer Science and Information Technologies, 7(3), 1174–1179. www.ijcsit.com

Dicarlo, C. (2016). How to Avoid a Robotic. IEEE Technology and Society Magazine, December. 1932-4529/16©2016IEEE

Dicarlo, C. (2016). How to Avoid a Robotic. IEEE Technology and Society Magazine, December. 1932-4529/16©2016IEEE

Dignum, V. (2017). Responsible Artificial Intelligence: Designing AI for Human Values. *ICT Discoveries*, *1*, 1–8. http://hdl.handle.net/20.500.11948/2177https://www.itu.int/en/journal/001/Pages/default.aspx

Dilmegani, C. (2021). 995 experts opinion: AGI / singularity by 2060 [2021 update]. Retrieved 9 June 2021, from https://research.aimultiple.com/artificial-general-intelligence-singularity-timing/

Dobbs, R., Manyika, J., & Woetzel, J. (2015). The Four Global Forces Breaking All The Trends. In McKinsey Global Institute. https://doi.org/10.18311/sdmimd/2015/2659

Dror, Y. (1983). Public Policy Making Reexamined (1st ed.). Routledge. https://doi.org/10.4324/9781315127774

Duffy, G., & Tucker, S. A. (1995). Political Science: Artificial Intelligence Applications. *Social Science Computer Review*, *13*(1), 1–20.

Dunleavy, P., & Hood, C. (1994). From old public administration to new public management. *Public Money and Management*, *14*(3), 9–16. https://doi.org/10.1080/09540969409387823

Dunleavy, P., & Margetts, H. (2010). *The second wave of digital era governance*.

Dunleavy, P., Margetts, H., Bastow, S., & Tinkler, J. (2006). New Public Management Is Dead - Long Live Digital-Era Governance. *Journal of Public Administration Research and Theory*, *16*(3), 467–494. https://doi.org/10.1093/jopart/mui057

Dunleavy, P., Margetts, H., Bastow, S., & Tinkler, J. (2011). Digital Era Governance: IT Corporations, the State, and e-Government. In *Oxford University Press*. https://doi.org/10.1093/acprof:oso/9780199296194.001.0001

Dunn, W. N. (2018). Public Policy Analysis An Integrated Approach (Sixth). Routledge. http://library1.nida.ac.th/termpaper6/sd/2554/19755.pdf

Dunn, W. N., & Miller, D. Y. (2007). A Critique of the New Public Management And The Neo-Weberian State: Advancing A Critical Theory Of Administrative Reform. *Public Organization Review*, *7*(4), 345–358. https://doi.org/10.1007/s11115-007-0042-3

Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., Duan, Y., Dwivedi, R., Edwards, J., Eirug, A., Galanos, V., Ilavarasan, P. V., Janssen, M., Jones, P., Kar, A. K., Kizgin, H., Kronemann, B., Lal, B., Lucini, B., … Williams, M. D. (2019a). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, *July*, 0–1. https://doi.org/10.1016/j.ijinfomgt.2019.08.002

Eager, J., Whittle, M., Smit, J., Cacciaguerra, G., & Lale-demoz, E. (2020). *Opportunities of Artificial Intelligence Policy*. *June*, 1–99.

Ebers, M. (2019). Chapter 2: Regulating AI and Robotics: Ethical and Legal Challenges. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3392379

Eggers, D. W., Schatsky, D., & Viechnicki, P. (2017). AI-augmented government. Using cognitive technologies to redesign public sector work. *Deloitte Center for Government Insights*. https://www2.deloitte.com/content/dam/insights/us/articles/3832_AI-augmented-government/DUP_AI-augmented-government.pdf

Eggers, W. D., Malik, N., & Gracie, M. (2018). *Using AI to Unleash the Power of Unstructured Government Data*. 20. https://www2.deloitte.com/us/en/insights/focus/cognitive-technologies/natural-language-processing-examples-in-government-data.html

Engin, Z., & Treleaven, P. (2019). Algorithmic Government: Automating Public Services and Supporting Civil Servants in using Data Science Technologies. *Computer Journal*, *62*(3), 448–460. https://doi.org/10.1093/comjnl/bxy082

Engstrom, D. F., & Ho, D. E. (2020). Artificially intelligent government: a review and agenda. *Big Data Law (Roland Vogl, Ed., 2020 …*, *Query date: 2020-04-16 15:07:09*, 1–20. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3551549

Erdoğdu, M., & Akar, S. (2020). Dördüncü Sanayi Devrimi Çerçevesinde Koşulsuz Temel Gelir: Türkiye İçin Bir Değerlendirme. *Eskişehir Osmangazi Üniversitesi İktisadi ve İdari Bilimler Dergisi*, *15*(3), 903–924. https://doi.org/10.17153/oguiibf.613200

Erixon, F., & Lee-Makiyama, H. (2011). Digital Authoritarianism: Human Rights, Geopolitics And Commerce. ECIPE Occasional Paper, 32(5).

Etzioni, A., & Etzioni, O. (2017). Should AI Be Regulated. *ISSUES*, 32–36.

Fatima, S., Desouza, K. C., & Dawson, G. S. (2020). National Strategic Artificial Intelligence Plans: A Multi-Dimensional Analysis. Economic Analysis And Policy, 67, 178–194. https://doi.org/10.1016/j.eap.2020.07.008

Feijóo, C., Kwon, Y., Bauer, J. M., Bohlin, E., Howell, B., Jain, R., Potgieter, P., Vu, K., Whalley, J., & Xia, J. (2020). Harnessing Artificial Intelligence (AI) To Increase Wellbeing For All: The Case For A New Technology Diplomacy. *Telecommunications Policy*, *44*(6), 101988. https://doi.org/10.1016/j.telpol.2020.101988

Feiock, R. C. (2013). The institutional collective action framework. *Policy Studies Journal*, *41*(3), 397–425. https://doi.org/10.1111/psj.12023

Feldstein, S. (2020). When it Comes to Digital Authoritarianism, China is a Challenge — But Not the Only Challenge - War on the Rocks. Retrieved 15 May 2021, from https://warontherocks.com/2020/02/when-it-comes-to-digital-authoritarianism-china-is-a-challenge-but-not-the-only-challenge/

Fernandez-Cortez, V., Valle-Cruz, D., & Gil-Garcia, J. R. (2020). Can Artificial Intelligence Help Optimize the Public Budgeting Process? Lessons about Smartness and Public Value from the Mexican Federal Government. 2020 7th International Conference on EDemocracy and EGovernment, ICEDEG 2020, 312–315. https://doi.org/10.1109/ICEDEG48599.2020.9096745

Ferris, T. (2001). Regulatory Governance: Improving The Institutional Basis For Sectoral Regulators Of Infrastructure Public Services -- Ireland's Experiences (Issue November).OECD

Ferro, E., Loukis, E. N., Charalabidis, Y., & Osella, M. (2013). Policy making 2.0: From theory to practice. *Government Information Quarterly*, *30*(4), 359–368. https://doi.org/10.1016/j.giq.2013.05.018

Floridi, L., & Cowls, J. (2019). A Unified Framework of Five Principles for AI in Society. *Harvard Data Science Review*, 1–15. https://doi.org/10.1162/99608f92.8cd550d1

Floridi, L., Cowls, J., Beltrametti, M., Chatila, R., Chazerand, P., Dignum, V., Luetge, C., Madelin, R., Pagallo, U., Rossi, F., Schafer, B., Valcke, P., & Vayena, E. (2018a). AI4People—An Ethical Framework for a Good AI Society: Opportunities, Risks, Principles, and Recommendations. *Minds and Machines*, *28*(4), 689–707. https://doi.org/10.1007/s11023-018-9482-5

Francis X. Neumann, J. (1996). What Makes Public Administration a Science? Or, Are Its "Big Questions" Really Big? *Public Administration Review*, *56*(5), 409–415. https://www.jstor.org/stable/977039

French, P. E. (2009). *Eff ective Leadership in Times of Public Health Crises*. 485–487.

French, P. E., Spears, R. A., & Stanley, R. E. (2005). The Fifth Paradigm of Public Administration? Public Organizational Theory as aPossible Solution To The Perennial Big Questions Of Public Administration. *INTERNATIONAL JOURNAL OF ORGANIZATION THEORY AND BEHAVIOR*, *8*(2), 133–154.

Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? Technological Forecasting and Social Change, 114, 254–280. https://doi.org/10.1016/j.techfore.2016.08.019

Furman, J., & Robert, S. (2018). *Furman Seamans 2018 AI and the Economy*.

Fuster, G. G. (2020). Artificial Intelligence and Law Enforcement - Impact on Fundamental Rights. In *European Paliamentary Research Service* (Issue July). http://www.europarl.europa.eu/supporting-analyses

G20 Japan: AI Principles - G20 Insights. (2020). Retrieved 11 June 2021, from https://www.g20-insights.org/related_literature/g20-japan-ai-principles/

G7. (2018). *Common Vision for the Future of Artificial Charlevoix Common Vision for the Future of*.

Gang-Hoon, K., Silvana, T., & Ji-Hyong, C. (2014). Big-data applications in the government sector. *Communications of the ACM*, *57*(3), 78–85.

Gasser, U., & Almeida, V. A. F. (2017). A Layered Model for AI Governance. *IEEE Internet Computing*, *21*(6), 58–62. https://doi.org/10.1109/MIC.2017.4180835

Geist, E. M. (2016). It's already too late to stop the AI arms race - We must manage it instead. Bulletin of the Atomic Scientists, 72(5), 318–321. https://doi.org/10.1080/00963402.2016.1216672

Goertzel, B. (2007). Human-Level Artificial General Intelligence And The Possibility Of A Technological Singularity. A reaction to Ray Kurzweil's The Singularity Is Near, and McDermott's critique of Kurzweil. Artificial Intelligence, 171(18), 1161–1173. https://doi.org/10.1016/j.artint.2007.10.011

Golubchikov, O., & Thornbush, M. (2020). Artificial Intelligence and Robotics in Smart City Strategies and Planned Smart Development. *Smart Cities*, *3*(4), 1133–1144. https://doi.org/10.3390/smartcities3040056

Goolsbee, A. (2018). *Public Policy in an AI Economy*. https://www.uam.es/gruposinv/meva/publicaciones jesus/capitulos_espanyol_jesus/2005_motivacion para el aprendizaje Perspectiva alumnos.pdf%0Ahttps://www.researchgate.net/profile/Juan_Aparicio7/publication/253571379_Los_estudios_sobre_el_cambio_conceptual_

Gordon, I., Lewis, J., & Young, K. (1993). Perspectives on Policy Analysis. In M. Hill (Ed.), *The Policy Process* (pp. 5–9).

Gozes, O., Frid-Adar, M., Greenspan, H., Browning, P. D., Bernheim, A., & Siegel, E. (2020). *Rapid AI Development Cycle for the Coronavirus (COVID-19) Pandemic: Initial Results for Automated Detection & Patient Monitoring using Deep Learning CT Image Analysis*. http://arxiv.org/abs/2003.05037

Graham, J., Amos, B., & Plumptre, T. (2003). Principles for Good Governance in the 21 st Century - Policy Brief No. 15. *Governance An International Journal Of Policy And Administration*, *15*, 1–8.

Grosz, B. J., Altman, R., Horvitz, E., Mackworth, A., Mitchell, T., Mulligan, D., & Shoham, Y. (2016). Artificial intelligence and life in 2030: One hundred year study on artificial intelligence. In *Standford University*.

Gruetzemacher, R. (2018). *Rethinking AI Strategy and Policy as Entangled Super Wicked Problems*. 122–122. https://doi.org/10.1145/3278721.3278746

Gül, H. (2018). Dijitalleşmenin Kamu Yönetimi ve Politikaları ile Bu Alanlardaki Araştırmalara Etkileri. Yasama Dergisi, 5–26.

Gürgüze, G., & Ürkoğlu, İ. T. (2019). Kullanım Alanlarına Göre Robot Sistemlerinin Sınıflandırılması. Fırat Üniversitesi Mühendislik Bilimleri Dergisi, 31(1), 53–66.

Gutierrez, C. I., Marchant, G. E., & Tournas, L. (2021). Lessons for Artificial Intelligence from Historical Uses of Soft Law Governance. SSRN Electronic Journal, 61(1), 1–17. https://doi.org/10.2139/ssrn.3775271

Hadden, S. G. (1989). The Future of Expert Systems in Government. *Journal of Policy Analysis and Management*, *8*(2), 203–208. https://www.jstor.org/stable/3323379

Haenlein, M., & Kaplan, A. (2019). A brief history of artificial intelligence: On the past, present, and future of artificial intelligence. *California Management Review*, *61*(4), 5–14. https://doi.org/10.1177/0008125619864925

Hagemann, R., Huddleston, J., & Thierer, A. D. (2018). Soft Law for Hard Problems: The Governance of Emerging Technologies in an Uncertain Future. Colorado Technology Law Journal, 17(1), 37–130.

Hagendorff, T. (2020). The Ethics of AI Ethics: An Evaluation of Guidelines. *Minds and Machines*, *January*. https://doi.org/10.1007/s11023-020-09517-8

Harre, R. O. M. (1996). AI rules : Okay ? Journal of Experimental & Theoretical Artificial Intelligence, 109–120. https://doi.org/10.1080/095281396147401

Hart, C. (1998). The Literature Review In Research: Releasing The Social Science Imagination. In *Doing a Literature Review* (pp. 1–25). http://www.sjsu.edu/people/marco.meniketti/courses/ARM/s0/Literature-review-Hart.pdf

Hastie, T., Tibshirani, R., & Friedman, J. (2008). Unsupervised Learning. In The Elements of Statistical Learning (pp. 485–585). https://doi.org/10.1007/b94608

Hawksworth, J., & Berriman, R. (2018). Will Robots Really Steal Our Jobs? An international analysis of the potential long term impact of automation. In *PwC*. www.pwc.co.uk/economics

Head, B. W. (2008). Three Lenses Of Evidence-Based Policy. *Australian Journal of Public Administration*, *67*(1), 1–11. https://doi.org/10.1111/j.1467-8500.2007.00564.x

Heeks, Richard (2001), Understanding e-Governance for Development, iGovernment Working Paper no. 11, Available at SSRN: https://ssrn.com/abstract=3540058 or http://dx.doi.org/10.2139/ssrn.3540058

Hemerly, J. (2013). Public Policy Considerations For Data-Driven Innovation. Computer, 46(6), 25–31. https://doi.org/10.1109/MC.2013.186

Hern, A. (2016). Stephen Hawking: AI will be 'either best or worst thing' for humanity. Retrieved 10 May 2021, from https://www.theguardian.com/science/2016/oct/19/stephen-hawking-ai-best-or-worst-thing-for-humanity-cambridge

High-Level Independent Group on Artificial Intelligence (AI HLEG). (2019). Ethics Guidelines for Trustworthy AI. In *European Commission*.

Hill, M. (2016). The Public Policy Process. In Pearson (Fourth Edi, Vols. 06-08-July). Pearson Longman. https://doi.org/10.1145/2967878.2967894

Hirsch, D. D. (2015). the Glass House Effect: Big Data, the New Oil, and the Power of Analogy. *Maine Law Review*, *66*(2), 374–395. http://heinonline.org

Hirst, P., & Zeitlin, J. (1991). Flexible specialization versus post-fordism: Theory, evidence, and policy implications. *Pathways to Industrialization and Regional Development*, *20*(1), 63–101. https://doi.org/10.4324/9780203995549

Höchtl, J., Parycek, P., & Schöllhammer, R. (2016). Big data in the policy cycle: Policy decision making in the digital era. *Journal of Organizational Computing and Electronic Commerce*, *26*(1–2), 147–169. https://doi.org/10.1080/10919392.2015.1125187

Hoffmann-Riem, W. (2019). Artificial Intelligence as a Challenge for Law and Regulation. In T. Wischmeyer & T. Rademacher (Eds.), *Regulating Artificial Intelligence* (pp. 1–29). Springer. https://doi.org/10.1007/978-3-030-32361-5_3

Hood, C. (1995). The "new public management" in the 1980s: Variations on a theme. *Accounting, Organizations and Society*, *20*(2–3), 93–109. https://doi.org/10.1016/0361-3682(93)E0001-W

Howlett, M. (2009). Lessons from Canada. Canadian Public Administration, 52(2), 153–175. https://doi.org/10.1136/bmj.282.6273.1366

Howlett, M., & Ramesh, M. (2003). *Studying Public Policy: Policy Cycles and Subsystems* (Second). OXFORD University Press.

Hoynes, H., & Rothstein, J. (2019). Universal Basic Income in the United States and Advanced Countries. *Annual Review of Economics*, *11*, 929–958. https://doi.org/10.1146/annurev-economics-080218-030237

Hurwitz, J., & Kirsch, D. (2018). Machine Learnings for dummies. In John Wiley & Sons. https://doi.org/10.1002/asi.4630350509

IBM. (2018). The Future Has Begun: Using Artificial Intelligence to Transform Government. In *Partnership for Public Service & IBM Center for The Business of Government*. http://www.businessofgovernment.org/sites/default/files/Using Artificial Intelligence to Transform Government.pdf

Ing, T. S., Lee, T. C., Chan, S. W., Alipal, J., & Hamid, N. A. (2019). An overview of the rising challenges in implementing industry 4.0. *International Journal of Supply Chain Management*, *8*(6), 1181–1188.

Intel. (2017). *Artificial Intelligence The Public Policy Opportunity*.

ITU. (2019). *United Nations Activities on Artificial Intelligence (AI) 2019*. https://www.itu.int/dms_pub/itu-s/opb/gen/S-GEN-UNACT-2019-1-PDF-E.pdf

Janssen, M., & Helbig, N. (2018). Innovating And Changing The Policy-Cycle: Policy-Makers Be Prepared! *Government Information Quarterly*, *35*(4), S99–S105. https://doi.org/10.1016/j.giq.2015.11.009

Janssen, M., & Kuk, G. (2016). The Challenges And Limits Of Big Data Algorithms In Technocratic Governance. *Government Information Quarterly*, *33*(3), 371–377. https://doi.org/10.1016/j.giq.2016.08.011

Jelinek, T., Wallach, W., & Kerimi, D. (2020). Policy Brief: The Creation Of A G20 Coordinating Committee For The Governance Of Artificial Intelligence. AI and Ethics, June. https://doi.org/10.1007/s43681-020-00019-y

Jessop, B. (1995). The Regulation Approach, Governance and Post-Fordism: Alternative perspectives on economic and political change? *Economy and Society*, *24*(3), 307–333. https://doi.org/10.1080/03085149500000013

Jetzek, T., Avital, M., & Bjorn-Andersen, N. (2014). Data-Driven İnnovation Through Open Government Data. Journal of Theoretical and Applied Electronic Commerce Research, 9(2), 100–120. https://doi.org/10.4067/S0718-18762014000200008

Jelinek, T., Wallach, W., & Kerimi, D. (2020). Policy Brief: The Creation Of A G20 Coordinating Committee For The Governance Of Artificial İntelligence. AI and Ethics, June. https://doi.org/10.1007/s43681-020-00019-y

Jiang, X., Coffee, M., Bari, A., Wang, J., & Jiang, X. (2020). *Towards an Artificial Intelligence Framework for Data-Driven Prediction of Coronavirus Clinical Severity*. *63*(1), 537–551. https://doi.org/10.32604/cmc.2020.010691

Jimenez-Gomez, C. E., Cano-Carrillo, J., & Falcone Lanas, F. (2020). Artificial Intelligence in Government. *Computer*, *53*(10), 23–27. https://doi.org/10.1109/mc.2020.3010043

Jreisat, J. E. (1988). Administrative reform in developing countries: A comparative perspective. *Public Administration and Development*, *8*(1), 85–97. https://doi.org/10.1002/pad.4230080108

Kankanhalli, A., Charalabidis, Y., & Mellouli, S. (2019). IoT and AI for Smart Government: A Research Agenda. *Government Information Quarterly*, *36*(2), 304–309. https://doi.org/10.1016/j.giq.2019.02.003

Kettl, D. F. (2002). Administrative Dilmmas. In Public Administration for Twenty-First Century America. The Johns Hopkins University Press.

Keynes(1930), J.K," , Economic Possibilities for our Grandchildren in Essays in Persuasion (New York: Harcourt Brace, 1932), 358-373

Kirlin, J. J. (1996). The Big Question of Public Administration in a Democracy. *Public Administration Review*, *56*(5), 416–423.

Kitchin, R. (2014). The Data Revolution: Big Data, Open Data, Data Infrastructures & Their Consequences. In R. Rojek (Ed.), SAGE.

Kjaer, P. F., & Vetterlein, A. (2018). Regulatory Governance: Rules, Resistance And Responsibility. *Contemporary Politics*, *24*(5), 497–506. https://doi.org/10.1080/13569775.2018.1452527

Klijn, E. H. (2012). New Public Management and Governance: A Comparison (D. Levi Faur (ed.); Oxford Uni, Issue October).

Kolberg, D., & Zühlke, D. (2015). Lean Automation Enabled By Industry 4.0 Technologies. *IFAC-PapersOnLine*, *28*(3), 1870–1875. https://doi.org/10.1016/j.ifacol.2015.06.359

König, P. D., & Wenzelburger, G. (2020). Opportunity For Renewal Or Disruptive Force? How Artificial Intelligence Alters Democratic Politics. *Government Information Quarterly*, *37*(3), 101489. https://doi.org/10.1016/j.giq.2020.101489

Korinek, A., & Stiglitz, J. E. (2017). AI and its implications for income distribution and unemployment. National Bureau of Economic Research.

Köroğlu, Y. (2017). Yapay Zeka'nın Teorik ve Pratik Sınırları.

Košmerlj, A. A., Bratko, I., Musek, J., Söderlund, K., Jakulin, A., Pejič, N., & Plantarič, E. G. (2019). *How To Regulate Ai ? Towards Trustworthy Artificial Intelligence*.

Kumar, M., Husain, M., Upreti, N., & Gupta, D. (2020). Genetic Algorithm: Review and Application. *SSRN Electronic Journal*, *2*(2), 451–454. https://doi.org/10.2139/ssrn.3529843

Kurzweil, R. (1985). What Is Artificial Intelligence Anyway. American Scientist, 73(3), 258.

Kurzweil, R. (2005). The Singularity is Near. In VIKING. https://doi.org/10.1057/9781137349088_26

Kuziemski, M., & Misuraca, G. (2020). AI governance in the public sector: Three tales from the frontiers of automated decision-making in democratic settings. *Telecommunications Policy*, *44*(6), 101976. https://doi.org/10.1016/j.telpol.2020.101976

Langer, P. F. (2020). Lessons from China - The formation of a social credit system: Profiling, reputation scoring, social engineering. ACM International Conference Proceeding Series, 164–174. https://doi.org/10.1145/3396956.3396962

Layne, K., & Lee, J. (2001). Developing fully functional E-government: A four stage model. Government Information Quarterly, 18(2), 122–136. https://doi.org/10.1016/S0740-624X(01)00066-1

Lecun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. *Nature*, *521*(7553), 436–444. https://doi.org/10.1038/nature14539

Levi-Faur, D. (2011). Handbook on the Politics of Regulation. In Handbook on the Politics of Regulation (pp. 1–22). https://doi.org/10.1080/10361146.2012.732989

Liao, S. H. (2005). Expert System Methodologies And Applications-A Decade Review From 1995 To 2004. *Expert Systems with Applications*, *28*(1), 93–103. https://doi.org/10.1016/j.eswa.2004.08.003

Linkov, I., Trump, B. D., Poinsatte-Jones, K., & Florin, M. V. (2018). Governance strategies for a sustainable digital world. *Sustainability (Switzerland)*, *10*(2), 1–8. https://doi.org/10.3390/su10020440

Lobel, O. (2012). New Governance as Regulatory Governance (Legal Studies Research Paper Series, Issues 12–101). http://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=337751

Lynn, L. E. (2001). The Myth of The Bureaucratic Paradigm: What Traditional Public Administration Really Stood For. Public Administration Review, 61(2), 144–160. https://doi.org/10.1111/0033-3352.00016

Maciejewski, M. (2017). To Do More, Better, Faster And More Cheaply: Using Big Data In Public Administration. *International Review of Administrative Sciences*, *83*(1_suppl), 120–135. https://doi.org/10.1177/0020852316640058

Madiega, T. (2019). *EU guidelines on ethics in artificial intelligence: Context and implementation*. *September*, 13. https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/640163/EPRS_BRI(2019)640163_EN.pdf

Madon, S. (2009). e-Governance for Development. *E-Governance for Development*, 53–54. https://doi.org/10.1057/9780230250499

Makridakis, S. (2017). The Forthcoming Artificial Intelligence (AI) Revolution: Its Impact On Society And Firms. *Futures*, *90*, 46–60. https://doi.org/10.1016/j.futures.2017.03.006

Margetts, H., & Dunleavy, P. (2013). The Second Wave Of Digital-Era Governance: A Quasi-Paradigm For Government On The Web. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *371*(1987). https://doi.org/10.1098/rsta.2012.0382

McClure, P. K. (2018). "You're Fired," Says the Robot: The Rise of Automation in the Workplace, Technophobes, and Fears of Unemployment. *Social Science Computer Review*, *36*(2), 139–156. https://doi.org/10.1177/0894439317698637

Mcevoy, F. J. (2019). Political Machines: Ethical Governance in the Age of AI. *Moral Philosophy and Politics*, *6*(2), 337–356. https://doi.org/10.1515/mopp-2019-0004

Mehr, H. (2017). Artificial Intelligence for Citizen Services and Government. *Harvard Ash Center Technology & Democracy Fellow*, *August*, 19. https://ash.harvard.edu/files/ash/files/artificial_intelligence_for_citizen_services.pdf

Microsoft. (2018). *The Future of Artificial Intelligence and its Role in Society*. https://3er1viui9wo30pkxh1v2nh4w-wpengine.netdna-ssl.com/wp-content/uploads/2018/02/The-Future-Computed_2.8.18.pdf

Misuraca, G., & Viscusi, G. (2015). Shaping public sector innovation theory: an interpretative framework for ICT-enabled governance innovation. *Electronic Commerce Research*, *15*(3), 303–322. https://doi.org/10.1007/s10660-015-9184-5

Misuraca, Gianluca; Van Noordt, C. (2020). *Overview of the use and impact of AI in public services in the EU*. https://doi.org/10.2760/039619

Montréal Declaration Responsible AI. (2018). *Montréal Declaration For A Responsible Development of Artificial Intelligence*. https://www.montrealdeclaration-responsibleai.com/the-declaration

Muellerleile, C., & Susan, L. R. (2018). Digital Weberianism: Bureaucracy, Information, and the Techno-rationality of Neoliberal Capitalism. *Indiana Journal of Global Legal Studies*, 92–105. http://cronfa.swan.ac.uk/Record/cronfa39600

Munne, R. (2016). Big Data in the Public Sector. In *New Horizons for a Data-Driven Economy: A Roadmap for Usage and Exploitation of Big Data in Europe* (pp. 195–208). https://doi.org/10.1007/978-3-319-21569-3

Murphy, R. R., & Texas, A. (2009). Beyond Asimov: The Three Laws of Responsible Robotics. *IEEE*. https://doi.org/1541-1672/09/

Naudé, W., & Dimitri, N. (2019). The Race For An Artificial General Intelligence: Implications For Public Policy. *AI and Society*, *0123456789*. https://doi.org/10.1007/s00146-019-00887-x

Nilsson, N. J. (2009). The Quest For Artificial Intelligence: A History Of Ideas And Achievements. Cambridge University Press https://doi.org/10.1017/CBO9780511819346

Nutley, S., & Webb, J. (2000). Evidence And The Policy Process. In H. T. O. Davies, S. M. Nutley, & P. C. Smith (Eds.), What Works? Evidence-based policy and practice in public services (pp. 13–43). The Policy Press. https://doi.org/10.3389/fnhum.2013.00916

OECD. (2014). Recommendation of the Council on Digital Government Strategies. Public Governance and Territorial Development Directorate, July, 12.

OECD. (2018). Open Government Data Report: Enhancing Policy Maturity for Sustainable Impact. In OECD Digital Government Studies. https://doi.org/10.1787/9789264305847-en

OECD. (2019). Hello, World: Artificial Intelligence and its use in the Public Sector. OECD Observatory of Public Sector Innovation (OPSI), 36, 1–148.

OECD. (2019). State of the art in the use of emerging technologies in the public sector. In OECD Working Papers on Public Governance (Issue 31). https://www.oecd-ilibrary.org/governance/state-of-the-art-in-the-use-of-emerging-technologies-in-the-public-sector_932780bc-en

OECD. (2020). Ensuring data privacy as we battle COVID-19. April, 1–4.

OECD. (2020). OECD Open, Useful and Re-usable data (OURdata) Index: 2019. https://doi.org/https://doi.org/10.1787/45f6de2d-en

OECD. (2020). Using artificial intelligence to help combat COVID-19 (Issue April). https://www.oecd.org/coronavirus/policy-responses/using-artificial-intelligence-to-help-combat-covid-19-ae4c5c21/

OECD. (2021). Recommendation of the Council on Artificial Intelligence. In *International Legal Materials: Vol. OECD/LEGAL* (Issue 0449). https://doi.org/10.1017/ilm.2020.5

Okcu, M. & Akman, E. (2020). Yapay zekâ ve kamu politikası. İçinde M. Yıldız & C.Babaoğlu (Ed.).Teknoloji ve Kamu Politikaları (67 -110).Gazi Kitabevi

ÓhÉigeartaigh, S. S., Whittlestone, J., Liu, Y., Zeng, Y., & Liu, Z. (2020). Overcoming Barriers to Cross-cultural Cooperation in AI Ethics and Governance. Philosophy and Technology, 33(4), 571–593. https://doi.org/10.1007/s13347-020-00402-x

ÓhÉigeartaigh, S. S., Whittlestone, J., Liu, Y., Zeng, Y., & Liu, Z. (2020). Overcoming Barriers to Cross-cultural Cooperation in AI Ethics and Governance. *Philosophy and Technology*, *33*(4), 571–593. https://doi.org/10.1007/s13347-020-00402-x

Ojo, A., Zeleti, F. A., & Mellouli, S. (2019). A realist perspective on AI-Era public management. *ACM International Conference Proceeding Series*, 159–170. https://doi.org/10.1145/3325112.3325261

Ongsulee, P. (2018). Artificial Intelligence, Machine Learning And Deep Learning. *International Conference on ICT and Knowledge Engineering*, 1–6. https://doi.org/10.1109/ICTKE.2017.8259629

Osborne, D. (1993). Reinventing Government. Proceedings of the Fifth National Public Sector Productivity Conference, 308(6938), 349–356. https://doi.org/10.1136/bmj.308.6938.1247a

Our Principles – Google AI. Retrieved 11 June 2021, from https://ai.google/principles/

Oxford Economics. (2019). How robots change the world. In Economic Outlook. https://doi.org/10.1111/1468-0319.12431

Oxford. (2021). artificial-intelligence. Retrieved 9 June 2021, from https://www.oxfordlearnersdictionaries.com/definition/english/artificial-intelligence

Önder, M., & Saygili, H. (2018). Yapay Zekâ Ve Kamu Yönetimine Yansimalari. Türk İdare Dergisi, 487(December), 630–668.

Önder, M., Demir, I., Ulasan, F., & Saygili, H. (2020). ULİSA12 Yapay Zeka Stratejileri ve Türkiye. May.

Pagallo, U., Aurucci, P., Casanovas, P., Chatila, R., & Chazerand, P. (2019). On Good AI Governance. AI4People

Palmerini, E., Azzarri, F., Battaglia, F., Bertolini, A., Carnevale, A., Cavallo, F., Carlo, A. Di, Cempini, M., Controzzi, M., Koops, B., Lucivero, F., Mukerji, N., Nocco, L., Pirni, A., Shah, H., & Salvini, P. (2014). *Robolaw*. www.robolaw.eu

Pan, Y. (2016). Heading Toward Artificial Intelligence 2.0. *Engineering*, *2*(4), 409–413. https://doi.org/10.1016/J.ENG.2016.04.018

Parijs, P. Van. (1991). Why Surfers Should be Fed: The Liberal Case for an Unconditional Basic Income. *Philosophy & Public Affairs*, *20*(2), 101–131.

Pasquale, F. (2020). New Laws of Robotics : Defending Human Expertise in the Age of AI. The Belknap of Harvard University Press. https://www.hup.harvard.edu/catalog.php?isbn=9780674975224

Pencheva, I., Esteve, M., & Mikhaylov, S. J. (2018). Big Data and AI – A Transformational Shift For Government: So, What Next For Research? *Public Policy and Administration*. https://doi.org/10.1177/0952076718780537

Pennachin, C., & Goertzel, B. (2007). Artificial General Intelligence.. J. Siekmann (Ed.), Artificial General Intelligence Research Institute. Springer. https://doi.org/10.1002/9783527678679.dg00701

Perc, M., Ozer, M., & Hojnik, J. (2019). Social And Juristic Challenges Of Artificial Intelligence. *Palgrave Communications*, *5*(1), 1–7. https://doi.org/10.1057/s41599-019-0278-x

Perrault, R., Shoham, Y., Brynjolfsson, E., Clark, J., Etchemendy, J., Grosz Harvard, B., Lyons, T., Manyika, J., Carlos Niebles, J., & Mishra, S. (2019). Artificial Intelligence Index 2019 Annual Report. 291. https://hai.stanford.edu/sites/g/files/sbiybj10986/f/ai_index_2019_report.pdf

Perry, B., & Uuk, R. (2019). AI Governance and the Policymaking Process: Key Considerations for Reducing AI Risk. Big Data and Cognitive Computing, 3(2), 1–17. https://doi.org/10.3390/bdcc3020026

Petroff, A. (2018). Google CEO: AI is 'more profound than electricity or fire'. Retrieved 10 May 2021, from https://money.cnn.com/2018/01/24/technology/sundar-pichai-google-ai-artificial-intelligence/index.html

Pomeras, J., & Abdala, M. B. (2020). The future of AI governance. In Global Solutions Journal (Issue 5).

Potapov, A. (2018). Technological singularity: What Do We Really Know? Information, 9(4), 1–9. https://doi.org/10.3390/info9040082

Probst, L., Pedersen, B., Lefebvre, V., & Dakkak-Arnoux, L. (2018). USA-China-EU Plans For AI: Where Do We Stand? Digital Transformation Monitor: USA-China-EU Plans for AI - Where Do We Stand?, January, 1–8. https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM_AI USA-China-EU plans for AI v5.pdf

Provost, F., & Fawcett, T. (2013). Data Science and its Relationship to Big Data and Data-Driven Decision Making. *Big Data*, *1*(1), 51–59. https://doi.org/10.1089/big.2013.1508

Purdy, M., & Daugherty, P. (2017). How AI Boosts Industry Profits and Innovation. Accenture, 1–28. https://www.accenture.com/no-en/insight-ai-industry-growth

Rao, A. S., & Verweij, G. (2017). Sizing The Prize. In PwC. https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf

Rasoolinejad, M. (2019). Universal Basic Income: The Last Bullet in the Darkness. *ArXiv*, 1–9.

Reed, C. (2018). How Should We Regulate Artificial Intelligence? *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *376*(2128). https://doi.org/10.1098/rsta.2017.0360

Reis, Joao, Santo, P. E., & Melao, N. (2019). Impacts Of Artificial Intelligence On Public Administration: A Systematic Literature Review. *Iberian Conference on Information Systems and Technologies, CISTI*, *2019-June*(June), 19–22. https://doi.org/10.23919/CISTI.2019.8760893

Reis, João, Santo, P., & Melão, N. (2020). Artificial Intelligence Research And Its Contributions To The European Union's Political Governance: Comparative Study Between Member States. *Social Sciences*, *9*(11), 1–17. https://doi.org/10.3390/socsci9110207

Renda, A. (2019). Artificial Intelligence Ethics, governance and policy challenges. Report of a CEPS Task Force, February 2019. In *CEPS Task Force*. https://doi.org/10.1016/B0-12-227410-5/00027-2

Responsible AI principles from Microsoft. Retrieved 11 June 2021, from https://www.microsoft.com/en-us/ai/responsible-ai?activetab=pivot1%3aprimaryr6

Rivoltella, P. C. (2019). The third age of the media. Research on Education and Media, 10(1), 1–2. https://doi.org/10.1515/rem-2018-0001

Rodrigues, R., Panagiotopoulos, A., Lundgren, B., Shaelou, S. L., Grant, A., Rodrigues, R., Panagiotopoulos, A., Wright, D., Hatzakis, T., Santiago, N., Rodrigues, R., Rodrigues, R., Grant, A., Lundgren, B., & Rodrigues, R. (2020). *Regulatory options for AI and big data*.

The Royal Society. (2019). Explainable AI: The Basics (Issue November). https://royalsociety.org/topics-policy/projects/explainable-ai/

Rowley, J., & Slack, F. (2004). Conducting A Literature Review. *Management Research News*, *27*(6), 31–39. https://doi.org/10.1108/01409170410784185

Russell, S. J., Norvig, P., & Canny, J. (2003). Artificial Intelligence A Modern Approach. Pearson Education, Ltd., London.

Russell, S.J. and Norvig, P. (2016) Artificial Intelligence A Modern Approach. Pearson Education, Ltd., London.

Sağıroğlu, Ş. (2020). Yapay Zeka ve Büyük veri: Teknolojiler, Yaklaşımlar ve Uygulamalar. In Ş. Sarıoğlu & M. Demirezen (Eds.), Nobel.

Samir, S., Nikhila, N., & Srikumar, M. (2018). In Pursuit of Autonomy: AI and National Strategies, ORF Special Report No:76

Saxena, K. B. C. (2005). Towards excellence in e-governance. *International Journal of Public Sector Management*, *18*(6), 498–513. https://doi.org/10.1108/09513550510616733

Scharre, P. (2019). Killer Apps: The Real Dangers of an AI Arms. Foreign Affairs, 98(3), 135–144.

Schatsky, D., & Chauhan, R. (2015). The Chief Data Officer in Government. In *Deloitte Center for Government Insights*.

Scherer, M. U. (2015). Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies. *SSRN Electronic Journal*, *29*(2). https://doi.org/10.2139/ssrn.2609777

Schiff, D., Biddle, J., Borenstein, J., & Laas, K. (2020). What's next for AI ethics, policy, and governance? A global overview. *AIES 2020 - Proceedings of the AAAI/ACM Conference on AI, Ethics, and Society*, 153–158. https://doi.org/10.1145/3375627.3375804

Schmidt, J., & Kane, J. (2019). The Real Talent Intelligence. Accenture

Seker, S. E. (2015). YBS Ansiklopedi Doğal Dil İşleme. YBS Ansiklopedi, 2(4), 15–22.

Shanahan, M. (2015). The Technological Singularity. The MIT Press.

Shangraw, R. F. (1987). Knowledge Acquisition, Expert Systems, and. *Social Science Microcomputer Review*, *5*(3), 163–173. https://doi.org/10.1016/0377-2217(87)90281-5

Sharma, R., Bhattarai, S., & Rupakheti, M. (2020). *Lockdown caused by COVID-19 pandemic reduces air pollution in cities worldwide*. *April*. https://doi.org/10.31223/osf.io/edt4j

Shearer, E., Stirling, R., & Pasquarelli, W. (2020). Government AI Readiness Index. In *Oxford Insights*. https://static1.squarespace.com/static/58b2e92c1e5b6c828058484e/t/5f7747f29ca3c20ecb598f7c/1601653137399/AI+Readiness+Report.pdf

Shrum, K., Gordon, L., Regan, P., Maschino, K., Shark, A., & Shropshire, A. (2019). AI and Its Impact on Public Administration. In *National Academy of Public Administration*.

Silver, D., Schrittwieser, J., Simonyan, K., Antonoglou, I., Huang, A., Guez, A., Hubert, T., Baker, L., Lai, M., Bolton, A., Chen, Y., Lillicrap, T., Hui, F., Sifre, L., Van Den Driessche, G., Graepel, T., & Hassabis, D. (2017). Mastering the game of Go without human knowledge. *Nature*, *550*(7676), 354–359. https://doi.org/10.1038/nature24270

Simon, H. A. (1995). Artificial Intelligence: An Empirical Science. Artificial Intelligence, 77(1), 95–127. https://doi.org/10.1016/0004-3702(95)00039-H

Simon, H. A. (1996). The Sciences of the Artificial. In MIT Press (3rd ed.). https://doi.org/10.2307/3102825

Smuha, N. A. (2019). From a "Race to AI" to a "Race to AI Regulation" - Regulatory Competition for Artificial Intelligence. SSRN Electronic Journal, 1, 1–27. https://doi.org/10.2139/ssrn.3501410

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, *104*(July), 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Sousa, W. G. de, Melo, E. R. P. de, Bermejo, P. H. D. S., Farias, R. A. S., & Gomes, A. O. (2019a). How and where is artificial intelligence in the public sector going? A literature review and research agenda. *Government Information Quarterly*, *36*(4), 101392. https://doi.org/10.1016/j.giq.2019.07.004

Sousa, W. G. de, Melo, E. R. P. de, Bermejo, P. H. D. S., Farias, R. A. S., & Gomes, A. O. (2019b). How and where is artificial intelligence in the public sector going? A literature review and research agenda. *Government Information Quarterly*, *36*(4), 1–14. https://doi.org/10.1016/j.giq.2019.07.004

Srivastava, S., Bisht, A., & Narayan, N. (2017). Safety and security in smart cities using artificial intelligence - A review. *Proceedings of the 7th International Conference Confluence 2017 on Cloud Computing, Data Science and Engineering*, *6*, 130–133. https://doi.org/10.1109/CONFLUENCE.2017.7943136

Stephen H. Holden. (2003). Public Information Technology: Policy and Management Issues (G. David Garson (ed.)). Idea Group Publishing.

Steuer, F. (2018). *Machine Learning for Public Policy Making How to Use Data-Driven Predictive Modeling for the Social Good* (Issue July).

Su, G. (2018). Unemployment in the AI age. *AI Matters*, *3*(4), 35–43. https://doi.org/10.1145/3175502.3175511

Sun, T. Q., & Medaglia, R. (2019a). Mapping the challenges of Artificial Intelligence in the public sector: Evidence from public healthcare. *Government Information Quarterly*, *36*(2), 368–383. https://doi.org/10.1016/j.giq.2018.09.008

Sun, T. Q., & Medaglia, R. (2019b). Mapping the challenges of Artificial Intelligence in the public sector: Evidence from public healthcare. *Government Information Quarterly*, *36*(2), 368–383. https://doi.org/10.1016/j.giq.2018.09.008

Susar, D., & Aquaro, V. (2019). Artificial intelligence: Opportunities and challenges for the public sector. *ACM International Conference Proceeding Series*, *Part F1481*(2017), 418–426. https://doi.org/10.1145/3326365.3326420

Szczepański, M. (2019). Economic impacts of artificial intelligence (AI). In European Parliamentary Research Service (Issue July).

Szeliski, R. (2011). Computer Vision: Algorithms and Application. In D. Gries & F. B. Schneider (Eds.), Phylogenetic Networks. Springer. https://doi.org/10.1017/cbo9780511974076.010

Szepesvári, C. (2010). Algorithms For Reinforcement Learning. In *Synthesis Lectures on Artificial Intelligence and Machine Learning* (Vol. 9). https://doi.org/10.2200/S00268ED1V01Y201005AIM009

Thapa, B. (2019). Predictive Analytics and AI in Governance: Data-driven government in a free society. European Liberal Forum

The IEEE Global Initiative. (2017). Ethically Aligned Design: A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems, Version 2. IEEE, 1–263.

The Law Library of Congress. (2019). Regulation of Artificial Intelligence in Selected Jurisdictions (Vol. 5080, Issue January). https://www.loc.gov/law/help/artificial-intelligence/index.php

Theodorou, A., & Dignum, V. (2020). Towards Ethical And Socio-Legal Governance In AI. *Nature Machine Intelligence*, *2*(1), 10–12. https://doi.org/10.1038/s42256-019-0136-y

Thierer, A. D., Castillo, A., & Russell, R. (2017). Artificial Intelligence and Public Policy. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3021135

Thompson, S. E., & Parthasarathy, S. (2006). Moore's Law: The Future Of Si Microelectronics. Materials Today, 9(6), 20–25. https://doi.org/10.1016/S1369-7021(06)71539-5

Totschnig, W. (2019). The Problem Of Superintelligence: Political, Not Technological. *AI and Society*, *34*(4), 907–920. https://doi.org/10.1007/s00146-017-0753-0

Turner, J. (2019). Robot Rules Regulating Artificial Intelligence. In Jacop Turner (Ed.), *Springer*. https://doi.org/10.1126/science.343.6172.707-e

Ulnicane, I., Knight, W., Leach, T., Stahl, B. C., & Wanjiku, W. G. (2020). Framing Governance For A Contested Emerging Technology:Insights From AI Policy. *Policy and Society*, 1–20. https://doi.org/10.1080/14494035.2020.1855800

UNDP. (2004). Governance Indicators: A User's Guide. In Development.

UNI Global Union. (2017). Top 10 Principles for Ethical Artificial Intelligence. http://www.thefutureworldofwork.org/media/35420/uni_ethical_ai.pdf%0Ahttp://www.thefutureworldofwork.org/opinions/10-principles-for-ethical-ai/

Valle-Cruz, D., & Sandoval-Almazan, R. (2018). Towards An Understanding of Artificial Intelligence In Government. *ACM International Conference Proceeding Series*. https://doi.org/10.1145/3209281.3209397

Valle-Cruz, D., Sandoval-Almazan, R., Ruvalcaba-Gomez, E. A., & Ignacio Criado, J. (2019). A Review Of Artificial Intelligence In Government And Its Potential From A Public Policy Perspective. *ACM International Conference Proceeding Series*, 91–99. https://doi.org/10.1145/3325112.3325242

Van der Zant, T., Kouw, M., & Schomaker, L. (2013). Philosophy and theory of artificial intelligence. In V. C. Müller (Ed.), *Springer*. http://www.springer.com/series/10087

Veale, M., & Brass, I. (2019). Administration by Algorithm? Public Management meets Public Sector Machine Learning. 1–30. https://doi.org/10.31235/osf.io/mwhnb

Veale, M., & Brass, I. (2019). *Administration by Algorithm? Public Management meets Public Sector Machine Learning*. 1–30. https://doi.org/10.31235/osf.io/mwhnb

Veenstra, A., Kotterink, B., Veenstra, A., Kotterink, B., Making, D. P., & Policy, T. (2018). Data-Driven Policy Making: The Policy Lab Approach. *9th Internaional Conference on Electronic Participation*, 100–111. https://hal.inria.fr/hal-01703333

Vigoda, E. (2002). From Responsiveness To Collaboration: Governance, Citizens, And The Next Generation Of Public Administration. *Public Administration Review*, *62*(5), 527–540. https://doi.org/10.1111/1540-6210.00235

Villasenor, J. (2020). Soft law as a complement to AI regulation. Retrieved 11 June 2021, from https://www.brookings.edu/research/soft-law-as-a-complement-to-ai-regulation/

Vogl, T. M., Seidelin, C., Ganesh, B., & Bright, J. (2020). Smart Technology and the Emergence of Algorithmic Bureaucracy: Artificial Intelligence in UK Local Authorities. Public Administration Review. https://doi.org/10.1111/puar.13286

Walch, K. (2019). Is Artificial General Intelligence (AGI) On The Horizon?. Retrieved 16 May 2021, from https://www.forbes.com/sites/cognitiveworld/2020/07/14/is-artificial-general-intelligence-agi-on-the-horizon-interview-with-dr-ben-goertzel-ceo--founder-singularitynet-foundation/

Wallach, W., & Marchant, G. (2019). Toward The Agile And Comprehensive International Governance Of AI And Robotics. Proceedings of the IEEE, 107(3), 505–508. https://doi.org/10.1109/JPROC.2019.2899422

Wang, W., & Siau, K. (2018). Artificial Intelligence: A Study on Governance, Policies, and Regulations. *Proceedings of the Thirteenth Midwest Association for Information Systems Conference, September*, 40. http://aisel.aisnet.org/mwais2018/40

Weiss, T. G. (2016). Governance, Good Governance and Global Governance: Conceptual and Actual Challenges. *Third World Quarterly*, *21*(5), 795–814.

Welch, E. W., Hinnant, C. C., & Moon, M. J. (2005). Linking Citizen Satisfaction With E-Government And Trust In Government. *Journal of Public Administration Research and Theory*, *15*(3), 371–391. https://doi.org/10.1093/jopart/mui021

Whitley, D. (1994). A Genetic Algorithm Tutorial. Statistics and Computing, 4(2), 65–85. https://doi.org/10.1007/BF00175354

Winfield, A. (2019). Ethical Standards In Robotics And AI. *Nature Electronics*, *2*(2), 46–48. https://doi.org/10.1038/s41928-019-0213-6

Winfield, A. F., Michael, K., Pitt, J., & Evers, V. (2019). Machine ethics: The Design And Governance Of Ethical Ai And Autonomous Systems. *Proceedings of the IEEE*, *107*(3), 509–517. https://doi.org/10.1109/JPROC.2019.2900622

Wirtz, B. W., & Müller, W. M. (2019). An Integrated Artificial Intelligence Framework For Public Management. *Public Management Review*, *21*(7), 1076–1100. https://doi.org/10.1080/14719037.2018.1549268

Wirtz, B. W., Weyerer, J. C., & Geyer, C. (2018). Artificial Intelligence and the Public Sector—Applications and Challenges. *International Journal of Public Administration*, *42*(7), 596–615. https://doi.org/10.1080/01900692.2018.1498103

Wirtz, B. W., Weyerer, J. C., & Sturm, B. J. (2020). The Dark Sides of Artificial Intelligence: An Integrated AI Governance Framework for Public Administration. *International Journal of Public Administration*, *43*(9), 818–829. https://doi.org/10.1080/01900692.2020.1749851

Wispelaere, J. DE, & Stirton, L. (2004). The Many Faces of Universal Basic Income The devil in the detail. *The Political Quarterly*, 266–274.

Woods, N. (1999). Good governance in international organizations. *Global Governance*, *5*(1), 39–61. https://doi.org/10.1163/19426720-005-01-90000003

World Economic Forum. (2020). The Future of Jobs Report 2020 | World Economic Forum. *The Future of Jobs Report*, *October 2020*, 1163. https://www.weforum.org/reports/the-future-of-jobs-report-2018%0Ah

Yavuz, N. (2015). Dijital Çağ Yönetişimi: Kamu Yönetiminde Ihtiyaç Temelli Bütünleşme Çabası. Kamu yönetiminde paradigma arayışları.

Yeung, K., Howes, A., Pogrebna, G., Yeung, K., Howes, A., & Pogrebna, G. (2020). AI Governance by Human Rights–Centered Design, Deliberation, and Oversight. In *The Oxford Handbook of Ethics of AI*. https://doi.org/10.1093/oxfordhb/9780190067397.013.5

Yildiz, M. (2013). Big Questions Of E-Government Research. *Information Polity*, *17*(February), 343–355. https://doi.org/10.1145/2479724.2479763

Yıldız, M. (2020). Yeni Teknoloji ve İş Yapış Biçimlerinin Kamu Politikalarına Etkisi: Genel Bir Çerceve. In M. Yıldız & C. Babaoğlu (Eds.), Teknoloji ve Kamu Politikaları (pp. 1–8). Gazi Kitapevi.

Yıldız, M., & Leblebici, D. N. (2018). Kurumsal Örgüt Kuramı E-Devlet Uygulamalarını Anlamak ve Açıklamak için Yararlı Olabilir mi? Siyasal: Journal Political Sciences, 27(1), 7–22. https://doi.org/10.26650/siyasal.2018.27.1.0002

Yildiz, M. (2007). E-government research: Reviewing the literature, limitations, and ways forward. Government Information Quarterly, 24(3), 646–665. https://doi.org/10.1016/j.giq.2007.01.002

Yildiz, M. (2013). Big questions of e-government research. Information Polity, 17(February), 343–355. https://doi.org/10.1145/2479724.2479763

Yildiz, M., & Sobacı, M. Z. (2013). Kamu Politikası ve Kamu Politikası Analizi. In M. Yıldız & Z. Sobacı (Eds.), Kamu Politikası Kuram ve Uygulama (Second, pp. 17–42). Adres Yayınları.

Yudkowsky, E. (2008). Artificial Intelligence As A Positive And Negative Factor İn Global Risk. In C. M. Bostrom N (Ed.), Global catastrophic risks (pp. 308–345). Oxford University Press.

Zeng, Y., Lu, E., & Huangfu, C. (2019). Linking Artificial Intelligence Principles. CEUR Workshop Proceedings, 2301(IBM 2018).

Zheng, N., Loizou, G., Jiang, X., Lan, X., & Li, X. (2007). Computer vision and pattern recognition. International Journal of Computer Mathematics, 84(9), 1265–1266. https://doi.org/10.1080/00207160701303912