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Governance of artificial intelligence

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ABSTRACT

The rapid advancements in artificial intelligence (AI) and the intensification of AI adoption in fields such as autonomous vehicles, lethal weapon systems, robotics, and other similar fields present governments with significant challenges because they are required to manage the scale and speed of the socio-technical transitions that are taking place. Governance of artificial intelligence is a severely undeveloped topic, despite the fact that there is a growing body of literature on many areas of artificial intelligence. The new uses of artificial intelligence provide prospects for improving economic efficiency and quality of life; yet, they also produce consequences that were not anticipated or intended, and they present new types of hazards that need to be managed for the time being. To maximize the advantages of artificial intelligence while minimizing the hazards associated with it, governments all over the globe need to have a greater understanding of the breadth and depth of the risks that are presented, as well as the regulatory and governance procedures and structures that are necessary to handle these problems. Unpacking artificial intelligence and explaining why governance of AI should be receiving a great deal more attention given the plethora of challenges it provides are the topics that are covered in this introductory essay. After that, it provides a summary of the papers that were included in the special edition and emphasizes the most important contributions made by those pieces. Including emerging governance approaches to artificial intelligence, policy capacity development, exploring legal and regulatory problems of artificial intelligence and robotics, and lingering concerns and gaps that need attention, this special issue presents the many facets of the challenges that are associated with the governance of artificial intelligence. The purpose of this special issue is to provide scholars and practitioners with the opportunity to get a better understanding of the issues and complexity associated with artificial intelligence governance, as well as to identify potential future areas for investigation into this topic.

KEYWORDS: Public policy, governance, artificial intelligence, and robots are all examples of AI.

1. Introduction

The use of artificial intelligence (AI) is causing a significant shift in the way that social interactions and financial transactions are structured in today's society. This includes clinical decision support systems that make medical diagnoses, policing systems that predict the likelihood of criminal activities, and filtering algorithms that categorize and provide personalized content for users (Helbing, 2019; Mittelstadt, Allo, Taddeo, Wachter, & Floridi, 2016). Artificial intelligence

systems and the algorithms that support their operations play an increasingly important role in making decisions that have a significant impact from a societal perspective. AI is distinguished from other technologies by its capacity to imitate or compete with human intellect in the resolution of difficult problems. This ability is essential for many cognitive activities.

There is the potential for robots to replace and even exceed people in

tasks that have historically been undertaken by humans (Bathae, 2018; Osoba & Welser, 2017; Saetra, 2020).

AI applications have the potential to produce unanticipated and unintended outcomes, as well as new types of risks that need to be appropriately controlled by governments. While the technology has the potential to provide beneficial benefits for mankind, it also has the potential to cause these repercussions. Unanticipated situations that the system has not been trained to handle and uncertainties in human-machine interactions can lead to AI systems displaying unexpected behaviors that pose safety hazards for its users (He et al., 2019; Helbing, 2019; Knudson & Tumer, 2011; Lim & Taeihagh, 2019). This is because AI systems learn from data in addition to the rules that have been programmed into them. It has been shown that biases in the data and algorithm of many artificial intelligence systems may produce discriminatory and unjust results for different persons in a variety of fields, such as credit scoring and criminal sentencing (Huq, 2019; Kleinberg, Ludwig, Mullainathan, & Sunstein, 2018). As a result of the autonomous nature of AI systems, there are concerns regarding the possibility of a loss of human autonomy and control over decision-making. This can result in outcomes that are morally dubious in a variety of applications, including caregiving and military combat (Firlej & Taeihagh, 2021; Leenes et al., 2017; Solovyeva & Hynek, 2018). In many legal frameworks, responsibility and liability for harms that result from the use of artificial intelligence applications are still unclear (Leenes et al., 2017; Xu & Borson, 2018). Additionally, the automation of routine and manual tasks in domains such as data analysis, service, manufacturing, and driving, which is enabled by

machine-learning algorithms, chatbots, and driverless vehicles, is anticipated to result in the displacement of millions of jobs that will not be evenly distributed within and between countries (Linkov, Trump, Poinssat-Jones, & Florin, 2018; Taeihagh & Lim, 2019). The management of the volume and pace of artificial intelligence adoption, as well as the hazards that come along with it, is becoming an increasingly priority for governments. Lesnes et al. (2017) and Soteropoulos, Berger, and Ciari (2018) found that in many cases, the people who benefit from new technologies do not face the expenses of the hazards that they pose; rather, these risks are passed to society or governments.

Despite the fact that a substantial body of literature is being produced on a variety of elements of artificial intelligence, the governance of AI is a relatively new yet severely undeveloped field. To maximize the advantages of artificial intelligence while minimizing the negative dangers that it poses, governments all over the globe need to have a greater understanding of the breadth and depth of the hazards that are presented. There is a need to reevaluate the effectiveness of traditional governance approaches such as the use of regulations, taxes, and subsidies. These approaches may not be adequate due to the lack of information and constant changes (Guihot, Matthew, & Suzor, 2017). Furthermore, the rate and scale of adoption of artificial intelligence threatens to outpace the regulatory responses to address the concerns that have been raised (Taeihagh, Ramesh, & Howlett, 2021). As a consequence of this, governments are under increasing pressure to devise and build new regulatory and governance frameworks in order to successfully address these difficulties. The

increasing recognition of AI governance across government, the public (Chen, Kuo, & Lee, 2020; Zhang & Dafoe, 2019, 2020) and industry is evident from the emergence of new governance frameworks in the meta-discourse on AI such as adaptive and hybrid governance (Leiser & Murray 2016; Linkov et al., 2018; Tan & Taeihagh, 2021b), and self-regulatory initiatives such standards and voluntary codes of conduct to guide AI design (Guihot et al., 2017; IEEE 2019). According to Cath (2018), the first half of 2018 witnessed the release of new artificial intelligence strategies from more than a dozen countries, significant increases in the amount of financial support pledged by governments for AI, and the increased involvement of industry bodies in the development of AI regulatory frameworks. These developments have raised additional questions regarding the ideas and interests that are being pursued.

(Hemphill, 2016; Jobin, Ienca, & Vayena, 2019) should be used to influence the governance of artificial intelligence in order to guaranty the inclusion and varied representation of all parts of society.

Including developing governance approaches to artificial intelligence, policy capacity development, and analyzing legal and regulatory difficulties of artificial intelligence and robotics, this special issue examines the many facets of the challenges that are associated with the governance of artificial intelligence. This introduction provides an explanation of artificial intelligence (AI) and explains why the Governance of AI ought to be receiving a great deal more attention given the many issues that it offers.

After that, a summary of the papers that were included in the special edition is offered, and the most important contributions made by those pieces are emphasized. Thanks to the varied collection of articles that make up this special issue, it provides an overview of the current state of affairs in the governance of artificial intelligence (AI) and discusses the outstanding issues and gaps that require attention. The purpose of this issue is to provide researchers and practitioners with the ability to better appreciate the challenges that AI brings and to comprehend the complexities of AI governance as well as potential future avenues for exploration.

2. AI – background and recent trends

The origins of artificial intelligence may be traced back to previous attempts to imitate human intellect via the development of artificial neural networks. Human intelligence can be defined as the capacity to comprehend and acquire knowledge from any given information. In the late 20th century, with the assistance of developments in processing capacity, increasingly complex neural networks were constructed in order to handle issues such as picture and voice recognition (Izenman 2008). Initially, neural networks were intended to analyze the activity of neurons in the human brain. These efforts resulted in the creation of the notion of artificial intelligence, which may be characterized as computer programs (or machines) that are capable of performing prescribed tasks at much quicker speeds and with greater precision. The most recent wave of artificial intelligence developments, which were made possible by advancements in big data analytics, has expanded the capabilities of AI to include computer programs that are able

to learn from vast amounts of data and make decisions without the assistance of a human being. These computer programs are commonly referred to as machine-learning (ML) algorithms (Izenman in 2008). Machine learning algorithms are designed with rules about how to learn from data that involves 'inferential reasoning,' 'perception,' 'classification,' and 'optimisation' to replicate human decision-making (Bathae, 2018; Linkov et al., 2018). This is in contrast to earlier algorithms, which rely on pre-programmed rules to carry out repetitive tasks. These algorithms are fed massive data sets as part of the learning process. From these data sets, the algorithms search for and evaluate complicated mathematical correlations between candidate variables in order to maximize their predictions of a certain result (Kleinberg et al. 2018; Brauneis & Goodman, 2018). Machine learning-driven judgments are largely dependent on the data rather than on pre-programmed rules, and as a result, they often cannot be anticipated well in advance (Mittelstadt et al., 2016). This is because these algorithms adjust their decision-making rules with more experience.

There is a widespread agreement among AI experts and researchers that artificial intelligence (AI) still "falls short" of human cognitive abilities. Furthermore, the majority of AI applications that have been successful to date are examples of "narrow AI" or "weak AI." These terms refer to AI applications that are able to perform tasks in specific and restricted domains, such as chess, image, and speech recognition (Bostrom & Ludkowsky 2014; Lele, 2019b). As a result of their capacity to carry out ordinary cognitive activities at much quicker speeds and with more precision than their human counterparts, narrow artificial intelligence is anticipated to automate and replace a large number of occupations that need a medium level of expertise (Lele, 2019bb; Linkov et al., 2018). In the not too distant future, it is

anticipated that this particular kind of artificial intelligence would ultimately acquire a level of intellect known as "general AI" or "artificial general intelligence."

according to Bostrom and Ludkowsky (2014) and Wang and Siau (2019), artificial intelligence is on par with or even surpasses human intelligence because of its capacity to generalize across multiple settings that cannot be programd in advance. The papers that make up this special issue, as well as its introduction, are focused on applications of limited artificial intelligence.

Industry and governments all over the globe have expressed their excitement about the potential social advantages that may be derived from artificial intelligence (AI), which has resulted in a rapid acceleration of the technology's development and adoption across a variety of fields. Increasing economic efficiency and quality of life, addressing labor shortages, combating aging populations, and strengthening national defense are some of the impetuses for deploying artificial intelligence. These impetuses vary from government to government according to the specific strategic concerns of each nation (Lele, 2019; Taeihagh & Lim, 2019). According to Inagaki (2019), SNDGO (2019), Taeihagh and Lim (2019), and Tan and Taeihagh (2021, 2021b), governments in Japan and Singapore have shown their support for the utilization of assistive and surgical robots in the healthcare industry, as well as autonomous vehicles for public transportation, in order to address the issue of labor shortages and the challenge of addressing the issue of aging populations. According to the World Economic Forum (2018), the primary drivers behind the adoption of artificial intelligence across a variety of industries are cost reductions and higher productivity. This technology is already undergoing a transformation in the manufacturing, logistic, service, and marine industries. There are other

nations like China, the United States of America, and Russia that have made large investments in robotics, drones, and completely autonomous weapon systems for the sake of national defense and geopolitical impact (Allen, 2019; Lele, 2019). These countries have found that AI-based technologies are a strategic military advantage for their respective countries.

3. Understanding the risks of AI

Many academics have brought attention to the potential risks that may be incurred as a result of using AI in a variety of fields. One of the most significant challenges that the majority of AI applications have encountered up to this point is their inability to generalize to different contexts. This means that they are unable to handle unexpected situations that are commonly referred to as "corner cases." These situations are situations that the system had not been trained to handle (Bostrom & Ludkowsky 2014; Lim & Taeihagh, 2019; Pei, Cao, Yang, & Jana, 2017). For instance, tragic accidents have already occurred as a consequence of the system's incorrect interpretation of one-of-a-kind environmental circumstances that it had not before seen during testing. These accidents were caused by the fact that Tesla's partly autonomous cars were being tested. The human designers are unable to cover or even imagine all of the possible scenarios (Bolte, Bar, Lipinski, & Fingscheidt, 2019; Pei et al., 2017). Despite the fact that numerous methods have been developed to detect these corner cases in advance, such as simulating data on a wide variety of driving situations that could pose a threat to autonomous vehicles, there are still some scenarios that cannot be covered. It is difficult for humans to describe or comprehend why and how a choice was taken, which inhibits the detection of corner case behaviors in advance (Mittelstadt et al., 2016). This

is because machine learning processes are more complicated and adaptable than other types of processes. The fact that machine learning choices are largely data-driven and unpredictable means that the system might display dramatically diverse behaviors in response to nearly similar inputs. This makes it difficult to establish 'proper' behaviors and test their safety in advance (Koopman & Wagner, 2016). As a result of the problem of automation bias, which occurs when humans give more credibility to automated decisions due to the latter's seemingly objective nature, humans tend to become complacent and exhibit less cautious behavior when using AI systems (Osoba & Welser, 2017; Taeihagh & Lim, 2019). In particular, academics point out potential safety hazards that can also arise from the interaction between a user and an artificial intelligence system. Therefore, human-machine interactions have a substantial impact on the level of safety, especially in social circumstances that

robots for personal care, autonomous cars, and service providers are examples of examples of technologies that include regular contact with people.

The autonomy of artificial intelligence in making judgments drastically limits the amount of control that humans have over their actions. This results in new issues when it comes to assigning accountability and legal culpability for the damages that AI causes to other people. Existing legal frameworks for the assignment of responsibility and liability for machine operation treat machines as tools that are controlled by their human operator. This is based on the assumption that humans have a certain degree of control over the machine's specification (Matthias 2004; Leenes & Lucivero, 2014). Machines are treated as tools because of this assumption. Because artificial intelligence is mostly dependent on

machine learning algorithms that are able to learn and modify their own rules, people are no longer in charge of the situation. As a result, it is unreasonable to expect humans to constantly be responsible for the behavior of AI. The unpredictability of machine learning decisions implies that many erroneous decisions made by artificial intelligence are beyond the control of and cannot be anticipated by these parties (Butcher & Beridze, 2019; Kim et al. 2017; Lim & Taeihagh, 2019). However, there is a possibility that manufacturers and software designers could be held liable for manufacturing defects and design defects under strict product liability. In light of this, important questions arise concerning the extent to which various parties in the artificial intelligence supply chain will be held liable in various accident scenarios, as well as the degree of autonomy that is sufficient to 'limit' the responsibility of these parties for accidents that were not anticipated (Osoba & Welser, 2017; Wirtz, Weyerer, & Sturm, 2020). It is also widely acknowledged that excessive liability risks can impede long-term innovation and improvements to the technology. This brings to light a significant problem regarding the manner in which governments can structure new liability frameworks that strike a balance between the advantages of promoting innovation and the ethical imperative of protecting society from the dangers posed by emerging technologies (Leenes et al., 2017).

Given the value-laden nature of the choices that are automated by algorithms in numerous sectors of society, artificial intelligence systems have the potential to display behaviors that are in contradiction with social values and norms. This raises concerns over the ethical dilemmas that might occur as a result of the fast adoption of AI. In both the business world and the academic world, the possibility that judgments made by algorithms might be prejudiced and discriminating is one of

the topics that receives the most attention and discussion. In light of the fact that machine learning algorithms are able to learn from data collected from society in order to make decisions, it is possible that these algorithms will not only violate the ethical rules that they were initially programmed with, but they will also reproduce the discriminatory and unequal patterns of society that are contained in such data (Goodman & Flaxman, 2017; Osoba & Welser, 2017; Piano, 2020 respectively). If sensitive personal characteristics in the data, such as gender or race, are used to classify individuals, and it is discovered that certain characteristics have a negative correlation with the outcome that the algorithm is designed to optimize, then the individuals who are categorized with these traits will be penalized more than others who have different group characteristics (Liu 2018). This might result in significantly different results with regard to the exposure to risk as well as the access to social and economic rewards. Bias can also be introduced through the human designer when the algorithm is being constructed. Furthermore, even if sensitive attributes are removed from the data, there are techniques for machine learning algorithms to use 'probabilistically inferred' variables as a proxy for sensitive attributes, which is much more difficult to regulate (Kroll et al., 2016; Osoba & Welser, 2017). A dominant concern that is associated with discussions of fairness in AI governance is the trade-off between equity and efficiency in algorithmic decision-making (Saetra, 2020). The risk of bias and discrimination that arises from the optimization process in AI algorithms is a reflection of this concern. The question of how a balance can be struck to produce socially desirable outcomes that cater to the ethical preferences of various groups is still up for debate.

A significant amount of literature and papers from the government have brought to light concerns over data

privacy and monitoring that may be brought about by applications of artificial intelligence. There have been concerns regarding the potential misuse of personal data by third parties, and there have been increasing calls for more holistic data governance frameworks to ensure reliable sharing of data within and between organizations (Gasser & Almeida, 2017; Janssen, Brous, Estevez, Barbosa, & Janowski, 2020). This is because algorithms in artificial intelligence systems use sensors to collect data, and big data technologies are used to store, process, and transmit data through external communication networks. Utilizing past travel data collected in autonomous vehicles to tailor advertisements to passengers (Chen et al., 2020; Lim & Taeihagh, 2018), using personal and medical information collected by personal care robots and networked medical devices for the surveillance of individuals (Guihot et al., 2017; Leenes et al., 2017; Tan, Taeihagh, & Tripathi, 2021) are examples of how artificial intelligence systems store extensive personal information about their users. This information can be transmitted to third parties in order to profile the preferences of individuals. (Chen et al., 2020; Leenes et al., 2017) There are a number of important problems that have not yet been addressed, including the ownership of such data and the manner in which developers of AI systems should construct these robots in order to comply with privacy rules. There is also a significant concern regarding the use of artificial intelligence in a variety of fields, such as the use of surveillance robots in the workplace to monitor employee performance and the possibility of government agencies using autonomous vehicles to track passenger movements, which could have negative repercussions for democratic freedoms and personal autonomy (Leenes et al., 2017; Lim & Taeihagh, 2018).

In the deployment of artificial

intelligence systems across a variety of industries, ethical considerations may arise due to the autonomy that these systems adopt in order to make choices in lieu of people. Studies have highlighted the potential for personalization algorithms employed by digital platforms to undermine the decision-making autonomy of data subjects. This is accomplished by filtering information shown to users based on their preferences and affecting the choices that they make. Personalization algorithms have the potential to limit human autonomy and, as a result, be viewed as immoral (Mittelstadt et al., 2016). This phenomenon occurs when these algorithms exercise control over an individual's choice and reduce the "diversity of information" that is provided. The use of robots to offer personal care services in the healthcare industry has sparked worries over the possible loss of autonomy and dignity of care receivers. These concerns are based on the possibility that robots may limit patients' movement to an excessive degree in order to prevent unsafe situations (Leenes et al., 2017; Tan et al., 2021). In other scenarios, such as autonomous vehicles increasing mobility for the disabled and elderly (Lim & Taeihagh, 2018) and personal care robots offering patients greater freedom of movement with the assurance of being monitored (Leenes et al., 2017), studies have not yet examined how these risks can be balanced against their potential benefits for autonomy because they have not yet been conducted. In the military, autonomous weapon systems such as drones and unmanned aerial vehicles have been developed to improve the precision and reliability of military combat, planning, and strategy. However, there has been a growing momentum across industry and academia, including prominent figures, highlighting the fact that these systems are not acceptable from an ethical and legal standpoint (Lele, 2019; Roff,

2014). The delegation of authority to a machine to exert lethal force "independently of human determinations of its moral and legal legitimacy" and the lack of controllability over these adaptive systems that could amplify the consequences of failure are at the heart of these concerns. These concerns have prompted fears of a dystopian future in which such weapons inflict casualties and escalate crises on a much larger scale (Firlej & Taeihagh, 2021; Scharre, 2016; Solovyeva & Hynek, 2018 in the United States). Unemployment and social instability as a consequence of the automation of regular cognitive work continues to be one of the problems that is the subject of the most public discussion over the use of artificial intelligence.

Both Frey and Osborne (2017) and Linkov et al. (2018) published their findings. Many industries, including manufacturing, entertainment, healthcare, finance, and transportation, are already seeing the consequences of automation. This is due to the fact that businesses are expanding their investments in artificial intelligence (AI) in order to lower their labor costs and increase their efficiency (Linkov et al., 2018). There are worries that the distribution of employment possibilities is unequal across industries and skill levels, despite the fact that technology developments have traditionally resulted in the creation of new jobs as well. Tasks that are very regular and cognitive in nature, which are typical of many occupations that need middle-level skills, are at a high risk of becoming automated, according to studies. In contrast, tasks with relatively lower risks of automation are those that machines cannot easily replicate – this includes manual tasks in low-skilled, service occupations that require flexibility and ‘physical adaptability’, as well as high-skilled occupations in engineering and science that require creative intelligence (Frey & Osborne, 2017; World Economic Forum, 2018). Automation

has the potential to worsen financial and social disparities (Alonso et al. 2018). This is because professions that need high and low levels of ability are receiving salary premiums that are higher than average, while positions that require middle-level skills are being eliminated.

4. Governing AI

4.1 Why AI governance is important

In order to reap the advantages of artificial intelligence, it is essential to first comprehend and then effectively manage the dangers that are associated with the technology. There are numerous socio-economic benefits that can be derived from artificial intelligence that can propel smart and sustainable development (Agarwal, Gurjar, Agarwal, & Birla, 2015; Lim & Taeihagh, 2018; Yigitcanlar et al., 2018). These benefits include increased efficiency and quality in the delivery of goods and services, increased autonomy and mobility for the elderly and disabled, and improved safety from the use of AI in safety-critical operations such as in healthcare, transportation, and emergency response. Therefore, as artificial intelligence (AI) systems continue to develop and become more complex, the risks associated with them and their interconnectivity with other smart devices and systems will also increase. This will necessitate the development of specific governance mechanisms, such as those for health care, transportation, and autonomous weapons, as well as a more comprehensive global governance framework for AI (Butcher & Beridze, 2019).

4.2 Challenges to AI governance

The high level of unpredictability and complexity of the artificial intelligence landscape presents governments with a great deal of difficulty when it comes to formulating and putting into practice

rules that effectively manage AI. The nature of the issue, which is extremely unexpected, intractable, and nonlinear, is the source of many of the problems that are faced by artificial intelligence (AI). This nature makes it difficult for governments to formulate precise goals in their policies (Gasser & Almeida, 2017; Perry & Uuk, 2019).

Governments have technological hurdles in assuring the accountability of artificial intelligence due to the inherent opacity and unpredictability of machine learning algorithms. According to Lim and Tacihagh (2019) and Mittelstadt et al. (2016), the opaque nature of complicated machine learning algorithms continues to be a significant obstacle to the governance of artificial intelligence. This is because it restricts the degree of transparency, explainability, and accountability that can be accomplished in AI systems. It is hard for the experts themselves to grasp how some algorithmic outputs are produced from its inputs, even when there are prescribed levels of transparency and explainability of algorithms. Moreover, constructing the algorithm to be more explainable decreases the complexity of the algorithm, which has led to a decrease in the number of complicated algorithms.

Felzmann, Villaronga, Lutz, and Tamò-Larrieux (2019) and Piano (2020) have shown that the presence of inaccuracies and poor performance may be detrimental. According to Goodman and Flaxman (2017), this problem is brought to light as a significant constraint brought about by the General Data Protection Regulation of the European Union in terms of enhancing algorithmic transparency to combat prejudice. Because of the complexity of the extensive datasets that machine learning algorithms use, it is nearly impossible to identify and remove all variables that are correlated with sensitive categories of personal data (Carabantes, 2020;

Goodman & Flaxman 2016; Kroll et al., 2016). This is because algorithms are frequently intentionally kept opaque by their developers in order to prevent cyberattacks and to protect trade secrets. This is legally justified by intellectual property rights. It is highly unlikely that the requirements imposed by regulations such as the General Data Protection Regulation (GDPR) for mandated explanations will either inform or empower individuals, given that the majority of people do not possess sufficient technical literacy or the willingness to pay for accessing such expertise to assist them in interpreting these explanations (Carabantes, 2020; Felzmann et al., 2019). A second point to consider is that machine learning conclusions are not predictable since they are formed from the data and might vary dramatically with even minute adjustments to the inputs. It is difficult to assign liability and accountability for harms that caused by software defects because manufacturers and programmers frequently are unable to predict the inputs and design rules that could result in unsafe or discriminatory outcomes (Kim et al. 2017; Kroll et al., 2016). This is because there is no human controllability over the behavior of artificial intelligence systems, which suggests that it is difficult to assign liability and accountability.

Data governance is a crucial topic that is surrounding the discussion on AI governance. This is due to the fact that there are various organizational and technical obstacles that limit effective control over data and attribution of responsibility for choices that are data-driven and made by AI systems (Janssen et al., 2020). An organization's ability to control data flows throughout its entire life cycle is hindered by data fragmentation and a lack of interoperability between systems. Additionally, the chain of accountability and causation between AI-driven decisions and events and the parties

involved in facilitating that decision is clouded by shared roles between different parties in data sharing (Janssen et al., 2020).

Existing governance and regulatory frameworks are also not suited to handle the social challenges that are brought about by artificial intelligence. This is because there is a lack of knowledge that is necessary for comprehending the technology, and regulatory frameworks are not keeping pace with the advancements in AI. When it comes to the regulation of artificial intelligence, major technology companies and AI developers like Google, Facebook, Microsoft, and Apple have enormous informational and resource advantages over governments. This significantly supersedes the traditional role that governments have played in distributing and controlling resources in society (Guihot et al., 2017). According to Taeihagh et al. (2021), the information asymmetries that exist between technology businesses and regulators make it even more challenging for the latter to comprehend and carry out the implementation of new or current regulations in relation to artificial intelligence applications. Regulators are having difficulty filling in these informational gaps and are falling behind as a result of the rapid advancements in technology. This, in turn, leads to the formulation of laws that are "too general" or "vague" and lack the specificity necessary to effectively regulate the technology (Guihot et al., 2017; Larsson, 2020). To be more specific, lawmakers can be dissuaded from outlining specific rules and duties for algorithm programmers. This is done to allow for future experimentation and modifications to code in order to improve the software. However, doing so leaves room for programmers to avoid responsibility and accountability for the behavior that the system causes in society (Kroll et al., 2016). These challenges illustrate how the four governing resources that governments have traditionally utilized

for regulation are insufficient to manage the risks that are arising from artificial intelligence (AI). Additionally, it is necessary for governments to discover new methods of acquiring information and developing effective policies that are able to adapt to the changing landscape of AI (Guihot et al., 2017; Wirtz et al., 2020).

Self-regulatory or "soft law" techniques to governing artificial intelligence design have been more popular among industry groups and governments in response to the problems that have been caused by "hard" regulatory frameworks. However, the efficacy of these approaches is still restricted. The term "soft law approaches" refers to "nonbinding norms and techniques" that are responsible for the creation of "substantive expectations that would not be directly enforceable." Industry organizations have issued voluntary standards, guidelines, and codes of conduct (IEEE 2019), and governments have also established expert committees to develop AI strategies and issued several AI ethical guidelines and governance frameworks (PDPC et al. 2020; AI; Hleg, 2019; Jobin et al. 2019). These initiatives have been taken in response to the growing concern over artificial intelligence (AI). According to Hemphill and Larsson (2020), guidelines have the advantage of being able to be modified and adapted more quickly than conventional regulations, which makes them advantageous in terms of keeping up with technology advancements. In reaction to earlier developing technologies, this approach has been embraced. It has the potential to encourage ethical, fair, and non-discriminatory practices in the creation of artificial intelligence; nonetheless, there are numerous concerns over the effectiveness of these practices. However, due to the fact that self-regulatory efforts are voluntary in nature, it is not possible to guaranty that the principles that have been defined will always be adhered to. This is especially true given that they are often

not subject to standardized enforcement standards (Butcher & Beridze, 2019; Hemphill, 2016). Secondly, if the principles vary across several guidelines and are not well-coordinated with legislation, governments will have the issue of guaranteeing consistent implementation of these guidelines in building the same artificial intelligence technology across diverse sectors (Cath et al. 2018; Guihot et al., 2017). This will be a hurdle that they will encounter. Furthermore, self-regulation on its own could not be adequate and might even be undesirable for the governance of artificial intelligence owing to the fact that it is unable to guaranty inclusion and representation of a wide range of stakeholders. issues have been raised over the dominance of corporate interests in artificial intelligence rules, which has been an ongoing criticism of self-regulatory efforts developed to regulate new technologies in general (Hemphill, 2016). The strong engagement of business players in the development of ethical standards and regulations for AI raises these issues. For example, big technology corporations have been able to exercise a substantial amount of influence over the framing of artificial intelligence (AI) problems and the formation of AI policy. This impact has been realized via lobbying activities and their participation in AI expert groups that have been created by governments (Cath et al. 2018; Jobin et al., 2019). According to research conducted by Guihot et al. (2017), there are studies that have brought to light the potential dangers of artificial intelligence firms capturing regulatory authority. This is because AI developers have considerable informational advantages, which makes their technical knowledge 'especially useful' for regulators. Furthermore, companies have the ability to leverage the 'inscrutable' and extremely opaque nature of machine learning algorithms to legitimize

extensive corporate engagement un artificial intelligence rules. Furthermore, the decisions that are made behind these policies are often done away from the scrutiny of the general public. Because the ideologies and interests of a select few could manifest themselves through the design of artificial intelligence and the decisions that they make in society, the unbridled influence of corporations, as well as key political figures in the landscape of artificial intelligence, could exacerbate power imbalances and social inequalities (Jobin et al., 2019). To ensure greater inclusivity and diversity in the governance of artificial intelligence, additional research is required to investigate the key actors, their roles, the dominant ideas and values promoted in AI policies, whether there is a global convergence in these values across different countries, and the degree to which these values reflect the interests of society or are politically motivated (Jobin et al., 2019; Mulligan & Bamberger, 2018).

4.3 Steps forward for AI governance

However, the issue of framing has not yet been extensively discussed as a key component of AI governance. The conceptual framing of artificial intelligence is a crucial determinant of how the problems introduced by AI are understood, whether they are included in policies, and the degree of priority afforded to the problem in the formulation of public policy (Perry & Uuk, 2019). The complexity of the challenges that artificial intelligence (AI) faces suggests that decision-making in AI systems needs to be carefully conceptualized according to their context of application, and these framing processes should be subject to public debate (Cunneen, Mullins, & Murphy, 2019). This is because AI is still in the process of developing, and

it has the potential to become more prominent and diverse. For instance, the manner in which policymakers frame the relative importance of various ethical principles that arise from a specific application of artificial intelligence, conflicts between ethical principles, and the justification of their importance have critical implications on the trade-offs that result from designing AI systems and the public's compliance with various ethical guidelines (Piano, 2020). A more balanced discourse on what artificial intelligence is, the goals and norms that AI should reinforce in society, and the design requirements to maximize its benefits while minimizing its risks should be promoted instead of amplifying perceived risks and fears surrounding new technologies. This is another reason why the initial framing of AI is so important (Cath et al. 2018; Cunneen et al., 2019).

There are growing calls for the adoption of innovative governance approaches such as adaptive governance and hybrid or 'de-centered' governance (Dafoe, 2018; Linkov et al., 2018b; Pagallo, Casanovas, & Madelin, 2019; Tan & Taeihagh, 2021b). These approaches are being proposed in order to address the governance challenges that are posed by the uncertainty and complexity of developments in artificial intelligence. The decreasing role of the government in directing the allocation of resources within society is a characteristic of both adaptive and hybrid forms of governance. Hybrid governance is described as a blend of state and non-state actors, or the blurring of the public/private difference to varying degrees, where regulation is a combination of industry norms and 'public regulatory monitoring' (Guihot et al., 2017; Hemphill, 2016). This is a definition that can be found in hybrid

governance. It is possible for hybrid governance to take the form of co-regulation, enforced self-regulation, and meta-regulation (Hemphill, 2016). These three types of governance all highlight the growing role that non-state actors are playing and the necessity of conducting a "ongoing assessment of the balance of power" between private and public actors (Leiser & Murray, 2016). In a similar vein, adaptive governance places an emphasis on the necessity of moving away from "command and control" measures (Gasser & Almeida, 2017) and toward more flexible approaches that are characterized by the iterative adjustment and improvement of regulations and policies as new information is gathered (Li, Taeihagh, De Jong, & Klinke, 2021; Linkov et al., 2018; Tan & Taeihagh, 2021b). According to Cihon, Maas, and Kemp (2020), Linkov et al. (2018), and Pagallo et al. (2019), adaptive approaches are intended to be advantageous for proactively identifying and addressing the risks introduced from machine learning systems that are expected to change over time. Additionally, adaptive approaches are believed to be advantageous for raising the public's awareness of artificial intelligence and engaging with the public to identify new issues that have not yet entered the agenda of the government. Furthermore, in order for global AI governance to be applicable across a variety of geographical, cultural, and legal contexts and to be aligned with existing standards of democracy and human rights (Gasser & Almeida, 2017; Wirtz, Weyerer, & Geyer, 2019), flexibility is essential. This is because it enables diverse groups of stakeholders to reach a consensus regarding the norms and trade-offs involved in the design of AI systems.

Some examples of adaptive governance are rules that mandate the conduct of periodical risk assessments of the activity that is being controlled.

Soft law approaches are those that involve working together with the affected stakeholders to develop guidelines, as well as legal experimentation and regulatory sandboxes to test innovative frameworks for liability and accountability for artificial intelligence. These frameworks will be adapted in iterative phases (Cath et al. 2018; Hemphill, 2020; Linkov et al., 2018; Philipsen, Stamhuis, & De Jong, 2021).

According to Gasser and Almeida (2017), new governance frameworks may also be developed from the measures that were used to control emergent technology in the past. Research has been conducted to investigate hybrid governance as a means of regulating the Internet and new digital technologies. For instance, Leiser and Murray (2016) highlight the need to account for the increasing role of non-state actors, particularly private actors such as technology companies that control the exchange of information across the globe, transnational private actors that are developing design principles, as well as the role of civil society groups in ensuring accountability of the former two. When it comes to the administration of artificial intelligence and other new emerging technologies, it is possible to learn from the experiences of controlling prior emerging technologies such as the Internet, nanotechnology, aviation safety, and space law (Butcher & Beridze, 2019; Snir, 2014). These lessons might be used to guide these new technologies. In addition, one of the most important study agendas for

future studies on artificial intelligence governance would be to investigate the particular characteristics of AI technology that call for techniques that are separate from those used for earlier technologies.

There is a growing corpus of research that suggests that artificial intelligence systems should be governed via their design. According to Leenes and Lucivero (2014), this would mean that social, legal, and ethical standards may be imposed through code in order to control the behavior of AI systems. For example, provisions in data protection laws can be translated into technical specifications for robots that are equipped with cameras. These specifications can be used to automatically blur faces in order to prevent the categorization of individuals based on sensitive characteristics such as ethnicity. Additionally, these specifications can be used to remove data after it has exceeded a specified storage timeframe or to restrict third party access to specific categories of data (Leenes et al., 2017). With that being said, there are a number of implementation difficulties that need to be addressed in order to properly regulate AI systems via code. It is not possible to translate many ethical and legal rules into explicit code. This includes "subtle exceptions," which frequently call for value judgments and the consideration of contextual factors for interpretation. Furthermore, the interpretation that is produced by the machine is also dependent on how it was initially designed (Leenes & Lucivero, 2014; Mulligan & Bamberger, 2018). Other risks that governments need to control as a result of such an approach include the possibility of manipulating encoded rules in order to "subvert regulatory

aims." According to Mulligan and Bamberger (2018), this risk is readily concealed due to the opaque nature of machine learning processes.

Recent studies have presented frameworks for artificial intelligence governance that place a focus on maintaining accountability and developing wide social agreement on ethical norms pertaining to AI. However, there is a need for research that investigate how these frameworks might be applied in reality. The framework that Gasser and Almeida (2017) developed is composed of three layers: a technical layer that includes the processes and data structures of the artificial intelligence system; a layer that addresses the ethical design of AI; and a third layer that encompasses the social consequences of AI as well as the role that regulation and law play. In Rahwan's (2018) proposal, the 'human-in-the-loop' strategy is proposed to be expanded to include a more comprehensive 'society-in-the-loop' approach. In this approach, society is first responsible for reaching an agreement on the values that should govern artificial intelligence as well as the distribution of benefits and costs among various stakeholders. Cihon et al. (2020) and Óhéigeartaigh, Whittlestone, Liu, Zeng, and Liu (2020) are two examples of suggestions that focus on the need of increased centralization and cross-cultural collaboration in order to enhance the coordination of national methods. The existing fragmented state is proposed to be centralized by Cihon et al. (2020), who suggest a framework called an examination of the downsides of centralization in comparison to decentralization, including regulatory delays and limited flexibility to quickly emerging dangers, as well as an outline of mechanisms to monitor and coordinate

national approaches to artificial intelligence governance on a global scale at the international level. Among these methods, there is a growing need for the production of more precise specifications on the implementation of these governance frameworks in reality, as well as the identification of the parties within the government that are responsible for leading various parts of artificial intelligence governance (Wirtz et al., 2020).

5. Overview of the special issue articles

The articles that are included in the special issue address the issues of governing artificial intelligence and robotics by means of case studies and comparative analyzes. These analyzes address gaps in the literature that pertain to examining the risks and benefits of deploying AI in various applications and sectors, as well as identifying dominant ideals that are envisioned in the meta-discourse on AI governance and their implications. In addition, the investigation of new legal, regulatory, and governance techniques that have been implemented by a variety of nations and governments in order to regulate artificial intelligence (AI) is carried out, as well as the evaluation of ways that have the potential to improve the implementation of AI and the comparison of AI governance approaches across countries. Through the use of case studies, the authors have investigated the limits and efficacy of various applications of artificial intelligence governance and have drawn essential lessons to promote policy learning. Here is a concise synopsis of the papers that were included in the special issue that was devoted to the Governance of Artificial Intelligence and Robotics.

5.1 Framing governance for a contested emerging technology: insights from AI policy (Ulnicane, Knight, Leach, Stahl, & Wanjiku, 2021)

It is highly dependent on public policies, governance frameworks, and regulation whether artificial intelligence evolves in ways that are advantageous to society or may cause problems for society. Over the course of the last several years, many national governments, international organizations, think tanks, consultancies, and civil society organizations have announced their artificial intelligence (AI) policies. These strategies outline the advantages and hazards of AI, as well as initial management and regulatory frameworks. According to Taeihagh et al. (2021), there are a lot of concerns that need answers about the regulation and governance of developing disruptive technologies. The following inquiry about the administration of artificial intelligence is addressed in this article: In order to enable the advantages of artificial intelligence and to minimize the hazards associated with it, what governance and regulatory approaches are emerging? In the growing governance of artificial intelligence, what roles do various parties play? These actors include governments, international organizations, businesses, academic institutions, and civil society. When it comes to artificial intelligence, do significant technical advancements need drastic or rather gradual improvements in governance? The governance and technological frameworks that are emerging in many nations, regions, and organizations are either converging or diverging, and the reasons for this are discussed.

The researchers Ulnicane et al. (2021)

use a dataset that contains more than sixty different artificial intelligence initiatives from "national governments, international organizations, consultancies, think tanks, and civil society organizations" all across the globe in order to investigate these problems. This article makes use of ideas and methodologies from the fields of Science, Technology, and Innovation Studies, Policy Analysis, and Political Science in order to construct an interdisciplinary study framework to investigate. Two primary pillars make up this structure. To begin, the ideas of policy framing and positive and negative expectations are used in order to investigate the risks, uncertainties, and unintended effects that are associated with artificial intelligence in policy documents. The second objective is to investigate the evolving governance and regulatory structures that are stated in the policy.

Various papers, governance principles, and governance models are used in this process. AI policy documents are analyzed in order to determine how they frame artificial intelligence. Various forms of governance, including market, participatory, flexible, and deregulated, are used in order to conduct an analysis of the evolving governance of artificial intelligence (Peters, 2001). This paper makes a contribution to the study of emerging disruptive technologies by analyzing how the framing of risks and uncertainties associated with artificial intelligence leads to the formation of unique governance and regulatory structures mapping commonalities and differences across nations, regions, and organizations.

5.2 Steering the governance of artificial intelligence: national strategies in perspective (Radu, 2021)

Deep learning, voice and picture recognition, and data analytics tools are the foundation of the most recent wave of breakthroughs in artificial intelligence (AI). These tools are used in a variety of applications, including banking, e-learning, medical diagnostics, and, more recently, smart automobiles (Radu, 2021). The essay conducts an empirical investigation on the responses of governance to breakthroughs in artificial intelligence all across the globe. The purpose of this essay is to investigate contemporary national policies for artificial intelligence all over the globe in order to discover the mechanisms by which regulation is defined at the state level.

There is a comparison of artificial intelligence national programs in this article, which emphasizes the major parts of the leading regulatory discourses. The purpose of Radu (2021) is to identify the articulation of artificial intelligence governance and the co-production of political and socio-technological constructions by analyzing the tactics of a number of different nations via the use of content analysis and comparative approaches. In this study, which is based on empirical facts, the author focuses on how the collective representation of a technological project is specified politically and how it is encapsulated into a vision that is incorporated into the regulation of the relevant sectors of society (Flichy, 2008). In this way, the essay makes a contribution to the policy discourse around artificial intelligence by conceptualizing the arguments and critically assessing the governance of AI and the various implications it will have in the potential future.

5.3 The Governance of Artificial Agency (Gahnberg, 2021)

In his argument, Gahnberg discusses the need of developing new regulatory procedures in order to conceptualize the difficulties associated with managing artificial agency. Throughout the paper, he makes the case that the concept of "intelligence" is an ambiguous measure that may be used to evaluate the effectiveness of the system. He also asserts that the most important quality of an artificial intelligence system is its total capacity to function as an autonomous agent within a particular environment (Gahnberg, 2021). The author of the article makes the argument that while many applications of artificial intelligence (AI) vary from the filtering of spam to the creation of killer robots, they all have one thing in common: they are given the power to carry out activities that are related to a certain aim or objectives.

The article highlights the social and legal limits that are associated with delegating this responsibility to an artificial agent. These constraints include legal and ethical requirements that may preclude the agent from being tasked with pursuing specific goals (for example, carrying out the use of fatal force). Gahnberg (2021) continues to emphasize the role that non-state actors play in the development of governance mechanisms. For example, in the case of the development of standards and best practices developed by the technical community for fail-safe mechanisms, or initiatives such as the Algorithmic Justice League, which aims to mitigate the risks of algorithmic bias through the creation of inclusive training data, non-state actors play a significant role in the development of governance mechanisms. In order to provide light on the ongoing arguments over artificial intelligence governance, the essay takes a look at the difficulties associated with managing artificial agency.

5.4 Governing the adoption of robotics and autonomous systems in long-term care in Singapore (Tan & Taeihagh, 2021)

Autonomous systems and robots have been termed as a feasible technology option to handle the ever-increasing need for long-term care throughout the world, which is worsened by aging populations (Robinson, MacDonald, & Broadbent, 2014; Tan et al., 2021). This demand is posed by the fact that the world's population is becoming older. There are, however, unexpected repercussions and hazards associated with the use of new technologies in long-term care, just as there are with the implementation of any other developing technology (Taeihagh et al., 2021). For instance, the government needs to address concerns regarding safety, privacy, cybersecurity, liability, influence on the existing health workforce, patient autonomy, patient dignity, moral agency, social justice, and trust in order to facilitate the adoption of autonomous systems (Sharkey & Sharkey, 2012; Stahl & Coeckelbergh, 2016; Tan et al., 2021). These concerns are outlined in the following paragraphs. In order to address these risks and ethical concerns, it is necessary to conduct an evaluation of the government's policy capacity (Wu, Ramesh, & Howlett, 2015) as well as the various governance strategies that the government chooses to implement (no response, prevention-oriented, prevention-oriented, control-oriented, tolerance-oriented, and adaptation-oriented) in the process of putting these autonomous systems into operation (Li, Taeihagh, & De Jong, 2018, Li et al., 2021; Taeihagh & Lim, 2019).

By using Singapore as a case study, this article presents a theoretically informed empirical research that investigates the implementation of autonomous systems in long-term care as a policy solution to address the problem of increasing social

care demand as a result of an aging population. The purpose of this article is to examine the many applications of autonomous systems that are now in use as well as those that have the potential to be used in social care and long-term care for elderly persons in Singapore. Following that, it explores the ethical consequences of deploying these systems to users, society, and the economy as a whole, as well as the technical hazards that are associated with doing so. In conclusion, it evaluates the degree to which governance methods have an impact on the policy response that the government of Singapore has chosen to implement, particularly with regard to striking a balance between the need for innovation and the uncertainties that are brought about by the use of various developing technologies in the healthcare sector. The insights that are acquired are essential for the learning of policy, particularly with regard to the knowledge of the governance process of innovative and emerging technologies as potential solutions to solve the demand-supply mismatch in the health sector. The analysis will highlight the interactive dynamics of policy capacity, governance strategies, and policy response as three major components in the governance of emerging technologies. Additionally, the analysis will calibrate the proportions of these three components in order to facilitate the effective implementation of novel technologies in the healthcare sector (Tan & Taeihagh, 2021).

5.5. Exploring governance dilemmas of disruptive technologies: the case of care robots in Australia and New Zealand (Dickinson, Smith, Carey, & Carey, 2021)

Dickinson et al. (2021) are concerned with the unexpected consequences and risks, and their article investigates the use of robots in care services in Australia and New

Zealand. While there are a variety of experiments worldwide that are currently being conducted to apply artificial intelligence and robotics in a variety of care settings (Tan et al., 2021), with high expectations for positive outcomes, Dickinson et al. (2021) are concerned with the unexpected consequences and risks. They made the observation that while there is a growing body of literature on robotics, the most of it focuses on the technical effectiveness, acceptability, or legal repercussions of the technology. They highlight the little attention that has been paid to the incorporation of robots into care settings and the consequences that this has for the formulation of policies.

Informed by semi-structured interviews with policymakers, care providers, suppliers of robots and technology experts, Dickinson et al. (2021) elicit a series of ‘dilemmas’ of governance faced in this space and identify three dilemmas relating to independence and surveillance, the re-shaping of human interactions, the dynamics of caregiving and receiving care illustrating some of the tensions involved in the governance of robotics in care services and draw attention to the issues that governments need to address for the effective adoption of these technologies.

5.6 Law and tech collide: foreseeability, reasonableness, and advanced driver assistance systems (Leiman, 2021)

Since the month of May in 2016, there have been a number of fatalities that have been associated with autonomous cars. These deaths have received a lot of attention. Concurrently, millions of people have suffered significant injuries and lost their lives as a result of accidents that were caused by cars that were piloted

by humans. According to Leiman (2021), many of the wounded or their dependents will not be able to obtain any compensations in countries where compensations are contingent on the determination of blame between the parties involved. The standard of care that is needed in many Australian jurisdictions offers substantial issues when it is applied to vehicles that are partially, heavily, or entirely automated (ibid).

Within the context of determining legal culpability in the instance of motor vehicles, Leiman (2021) investigates the manner in which the present regulatory framework in Australia takes into account perceptions of risk, as well as the question of whether or not this method may be applied to automated cars. A comparison is made between the alternative legislation that was passed by the Parliament in the United Kingdom that imposes responsibility on insurers and the no-fault or hybrid schemes for legal liability that are currently in place in Australia. The article investigates whether the law itself may have an effect on the perceptions of risk in light of the data generated by automated vehicles. Additionally, the article takes into consideration the effectiveness of these schemes. In addition to this, Leiman examines other options addressing the role of the government in ensuring the safety and fault of automated cars.

5.7 Co-regulating algorithmic disclosure for digital platforms. Di Porto and Zuppetta (2021)

In their study, Di Porto and Zuppetta (2021) investigate the growing capacity of IT-mediated platforms to adopt algorithmic decision making. They also investigate whether disclosure self-regulation, in its current form at the EU level, is an appropriate

strategy to address the risks that are posed by the growing adoption of algorithmic decision making by private entities. However, despite the fact that the General Data Protection Regulation (GDPR) mandates that platforms must self-evaluate the risks of data breaches and provide information regarding the treatment of personal data by artificial intelligence systems, there is no mention of the various capacities of the entities that are receiving the data to comprehend the significance of algorithmic decisions and the consequences of those decisions.

The article makes the case that the disclosure self-regulation ought to be rethought in light of the recent developments in artificial intelligence. It also highlights the fact that final consumers and small and medium-sized enterprises (SMEs) are not aware of the technical foundations of these platforms and the value of personal data, which is why the regulators ought to intervene and address this matter. Additionally, as platforms have become more adept at using artificial intelligence and big data, they have acquired the capability to manipulate the information that they generate, which has the effect of diminishing the credibility of the decisions that consumers and small companies make (Di Porto & Zuppetta, 2021). In order to empower consumers, the authors advocate for the regulators to address information asymmetry, low bargaining power, and incorrect information. Additionally, they support an enforced co-regulatory approach that allows platforms and consumers to participate, as well as the development of personalized disclosures based on the requirements of consumers.

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