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Artificial Intelligence in Geopolitics: Opportunities and Challenges for National Power

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Abstract

In early September 2017, Vladimir Putin, the President of Russia, brought artificial intelligence from the laboratories of Silicon Valley, universities, and the basement of the Pentagon to the forefront of international power. He stated that artificial intelligence is the future not only for Russia but for all of humanity. This phenomenon is accompanied by vast opportunities but also presents threats that are difficult to predict. Whoever becomes the leader in this field will become the ruler of the world. Accordingly, artificial intelligence has been prioritized by countries as an instrument for enhancing national power. The aim of this article is to examine the opportunities and challenges of artificial intelligence as a tool of national power for countries in economic, political, scientific, and military dimensions. To achieve this aim, a descriptive-analytical method was employed. The findings indicate that artificial intelligence, across economic, military, political, and scientific domains, can enhance both material capabilities (such as growth in gross domestic product, number of publications, production of high-technology products, and undetectable drones) and nonmaterial capabilities (such as increased public participation, rational political decision-making, and combating racial and political discrimination). These enhancements contribute to increasing countries' capacity for international competition and securing the global digital sphere. However, insofar as geopolitical relations among countries are shaped by interactions, conflicts, and rivalries, concerns regarding military, economic, political, and technological superiority will persist. These concerns have the potential to affect national security and international relations due to the volume of big data being generated. Therefore, although artificial intelligence represents a significant potential geopolitical advantage for national power, it may also pose a distinct challenge to the current balance of power.

Keywords: Artificial intelligence, military power, political power, economic power, scientific-technological power

1. Introduction

The world is currently witnessing the Fourth Industrial Revolution (Amaresh, 2022; Rotatori et al., 2021; Schwab, 2015). The emergence of technologies such as artificial intelligence (AI), robotics, big data analytics, and the Internet of Things (IoT) has produced a wave of transformations in military, political, economic, and scientific power, prompting reassessments of how activities from the individual to the global level have traditionally been conducted (Rotatori et al., 2021). Indeed, artificial intelligence has introduced a new arena of competition in geopolitical relations and, consequently, in the national power of states in the international arena. In this regard, Vladimir Putin, President of Russia, stated in 2017 that "whoever becomes the leader in this field will rule the world," a statement reflecting strategic thinking consistent with concerns raised about AI

dominance (Bostrom, 2014). Since then, numerous public and private actors have issued statements on how artificial intelligence will push society toward better or worse outcomes, emphasizing infrastructural progress, military applications, and its impact on jobs and human relations. Some of these statements outline concrete plans for addressing AI-related challenges, whereas most maintain principled positions on limiting risks associated with disruptive technologies (Jobin et al., 2019; Ulnicane et al., 2020).

As recognition grows that algorithmic processing and machine learning tools generate significant shifts in national power, governments face increasing pressure to utilize these tools to ensure citizen welfare and maintain their political legitimacy (Taeihagh, 2021).

From a historical perspective, empires have been defined by three main features: (1) exercising authority over vast territories, (2) relative inequality between the central authority and administered regions, often accompanied by expansionist tendencies, and (3) implementing a political project through economic, institutional, and ideological influence. Contrary to the popular belief that the digital revolution inherently leads to economic decentralization, artificial intelligence may actually reinforce a broad trend toward centralized power concentrated among a small number of actors. These "digital empires," empowered by AI, will benefit from economies of scale and accelerated centralization of power across economic, military, and political domains. They will become dominant poles governing international affairs and revert to a "logic of blocs." These emerging public-private digital empires will expand to a continental scale, particularly in the cases of the United States and China, while other actors, such as Europe, may adopt non-aligned strategies. Understanding the transformative implications of AI is therefore critical for analyzing its geopolitical and national power dimensions.

This technology, through its integration into various sectors of society, gradually shapes the flows associated with national power, from U.S.–China technological rivalry to rising interest in intelligent warfare among major powers worldwide. National power derived from information production—of which AI is a prime example—encompasses all dimensions of the economy, society, and government. In the digital revolution era, artificial intelligence helps determine the geopolitical order for the coming decades, intensifying and accelerating the long-standing cycle in which technology and power mutually reinforce one another. It will transform established assumptions about power through new relationships among territory, space-time, and place (Miailhe, 2018). Furthermore, dominant powers view AI as a tool for enhancing their relative position within the geopolitical system in economic and military terms. In this context, Xi Jinping, General Secretary of the Chinese Communist Party, emphasized China's commitment to focusing on national strategic needs and advancing cutting-edge science and technology to secure leadership in core technologies (Bloomberg, 2023). Additionally, in 2023, U.S. President Joe Biden highlighted the profound implications of artificial intelligence for humanity, noting: "We will see more technological change in the next 10 years—and maybe the next five—than we have seen in the past, and AI is driving that change" (Biden, 2023). These remarks underscore the growing geopolitical consensus that artificial intelligence is a transformative force with far-reaching implications for the future of national power across political, economic, scientific, and military domains.

In effect, artificial intelligence has become the key to controlling geographic space and all five domains—land, sea, air, space, and cyberspace—encompassing the nature of warfare and interoperability. Recent advances in AI suggest that this emerging technology will have a decisive and potentially transformative influence on military power, strategic competition, and global politics more broadly. These new power dynamics relate to overt competition over who can control sources of power, while also fostering forms of convergence among actors (Pauwels, 2019). Based on these dynamics, this article seeks to examine the opportunities and challenges arising from the influence of artificial intelligence across different dimensions of national power as a tool that may either strengthen or diminish it. Therefore, the main research question is as follows: What are the opportunities and challenges stemming from the adoption of AI in economic, scientific, political, and military domains of national power?

2. Theoretical Foundations

2.1. National Power

Power is the quality of an entity that enables it to act in accordance with its preferences and pursue its objectives. In the context of national power, scholars have proposed various definitions examining its components and manifestations from multiple perspectives. One perspective states that when power is viewed at the level of a society or nation and manifested through the structure of a political state, it is referred to as national power. Such power results from the combined positive and negative elements that constitute a state's power foundations, possessing dynamism and being intelligible relative to other nations.

National power refers to the ability, capability, and capacity of a nation and state to utilize its resources to pursue national interests and objectives. It is essentially a geopolitical concept reflecting collective attributes of a nation while simultaneously manifesting as an individualized characteristic of a state. When viewed at the societal level, national power emerges from the aggregate of a society's capacities, appearing as the general and comprehensive power of that collective. Consequently, this power forms within the human-made structure of the political state, representing the composite outcome of multiple combined forces.

A state with high national power can achieve its objectives without obstruction. Some states possess such great power that they exert influence beyond Earth's boundaries, while others are so weak that they struggle to meet even basic needs. States interact with one another to fulfill their interests and exert their will, and the nature of their behavior—cooperation, competition, or conflict—is shaped by their level of power. These dynamics are influenced by economic capabilities for wealth production as well as scientific and technological capacity. States face difficult and sometimes crisis-ridden conditions when pursuing their interests relative to others, and their ability to navigate these conditions depends on their level of national power. Stronger states reshape crisis environments to their advantage, whereas weaker states must endure setbacks and often compromise on their interests.

2.2. Artificial Intelligence

Intelligence can be described as the capacity to acquire and use effective strategies for problem solving and goal attainment, taking into account situational characteristics in a world that is inherently uncertain and constantly changing. A robot is a device that may be fully pre-programmed, versatile, precise, and reliable, yet still lack intelligence. However, the emergence of conversational artificial intelligence is usually traced back to Alan Turing's seminal 1950 article "Computing Machinery and Intelligence," in which he laid the conceptual foundations of the field. Turing, often regarded as the father of computer science, posed the question: "Can machines think?" and proposed a test that later became known as the Turing Test. In this experiment, a human attempts to distinguish between the written responses of a machine and those of another human; if the evaluator cannot reliably tell which is which, the machine is said to pass the test (McCarthy, 2007). Although the test has been extensively scrutinized since its publication, it remains an important part of the history of artificial intelligence as well as a persistent concept in philosophy because it draws deeply on ideas related to language and linguistic performance (Education, 2020).

According to Dick, the history of artificial intelligence is more than a record of machines trying to imitate or replace human rationality; rather, it is a complex intellectual and socio-technical trajectory that cannot be reduced to a single invention or breakthrough (Dick, 2019). Consequently, artificial intelligence is not a discrete invention, despite what the dominant narrative often suggests (Dick, 2019). Building on this broader view, Russell classifies definitions of AI in light of its global implications for systems and organizations (Garrido-Hidalgo et al., 2020; Russell & Norvig, 2021). He organizes them along two axes: (1) thought versus behavior and (2) human versus rational. This two-dimensional scheme echoes the logic of the Turing Test (Njegomir, 2020). When faced with a human interrogator, a computer successfully passes the test if the person cannot determine whether the answers are being generated by a machine or by another human. Subsequently, Stuart Russell and Peter Norvig published *Artificial Intelligence: A Modern Approach*, which has become one of the most influential books in AI research and education worldwide (Mhlanga, 2023). In this work, they present four goals or alternative definitions of AI that

distinguish computer systems according to whether they are designed to think or act, and whether they are oriented toward human-like or rational performance (Mhlanga, 2023).

Based on Russell and Norvig's perspective on the relationship between artificial intelligence and human behavior, a computer system should possess several core capabilities: natural language processing to facilitate communication; knowledge representation to store what it knows or perceives; automated reasoning to answer questions and derive new conclusions from stored data; and machine learning to adapt to changing conditions, recognize patterns, and extrapolate trends (Salminen et al., 2016). Because of its cross-sectoral reach, strong impact, rapid diffusion, and contribution to competitiveness, AI has enormous transformative potential from technological, economic, environmental, and social viewpoints (Heylighen, 2017). John McCarthy defines artificial intelligence as the science and engineering of making intelligent machines, especially intelligent computer programs. This notion is related to using computers to understand human intelligence, but AI as a field does not need to restrict itself to methods that are biologically or physiologically observable in humans (Sutton, 2020).

Artificial intelligence is often described as an enabling technology, like the steam engine or electricity, with the capacity to increase the efficiency of almost any process to which it is applied (Qin et al., 2023). In another widely used definition, AI refers to systems that display intelligent behavior, can perceive their environment, and act autonomously to achieve specific goals (Hunter, 2018). All of these points together underscore the value of developing AI policies that allow governments to structure their digital transformation efforts and provide a clear and attractive reference point for both the public and private sectors (Bui & Nguyen, 2023).

3. Research Method

This article employs an analytical–descriptive methodology, relying on library sources, documents, and statistical reports to examine and explain the opportunities and challenges of artificial intelligence as a tool of national power for states.

4. Findings and Results

4.1. Opportunities and Challenges of Artificial Intelligence and the Economic Power of States

The role of AI tools and techniques in global trade and the world economy has become a major topic of discussion in light of recent advances, demonstrated capabilities, and the proliferation of AI-based products and services. The widespread use of these technologies has fueled speculation that artificial intelligence may fundamentally alter how people live and work. Gradually, AI is becoming an essential technological support for everyday social life and economic activity (Naimi-Sadigh et al., 2021). Its remarkable contribution to sustainable economic development across industries is rapidly becoming apparent, making it an immediate focus of attention in industrial, academic, and even governmental arenas (Heylighen, 2017). AI-related activities will undoubtedly serve as a driving force for further economic development, leading to major changes in production structures and strategies, as well as in the quantity and quality of consumption.

At the same time, artificial intelligence has significant potential to reshape global economic activity and induce structural change in production systems. The composition of global output has already shifted, as evidenced by trade data showing that (1) the relative stagnation in world output of physical goods has been offset by the growth of high-technology manufacturing in export baskets, and (2) modern, high-tech services exports have become the fastest-growing segment of global trade, thus contributing substantially to economic growth (Ghani et al., 2016). Relative stagnation in manufacturing is a global phenomenon. Empirical evidence suggests that, on average, export shares of goods by technological content changed markedly between 1980 and 2000, but since then the share of high-tech manufacturing has remained roughly constant (Ghani et al., 2016). Globally, there has been only a limited shift from primary production to high-tech manufacturing. While regions differ sharply in how their merchandise exports are distributed across technology categories, changes since 2000 have been modest. At the same time, technological change has made production more capital- and skill-intensive, further reinforcing these structural shifts (Ghani et al., 2016).

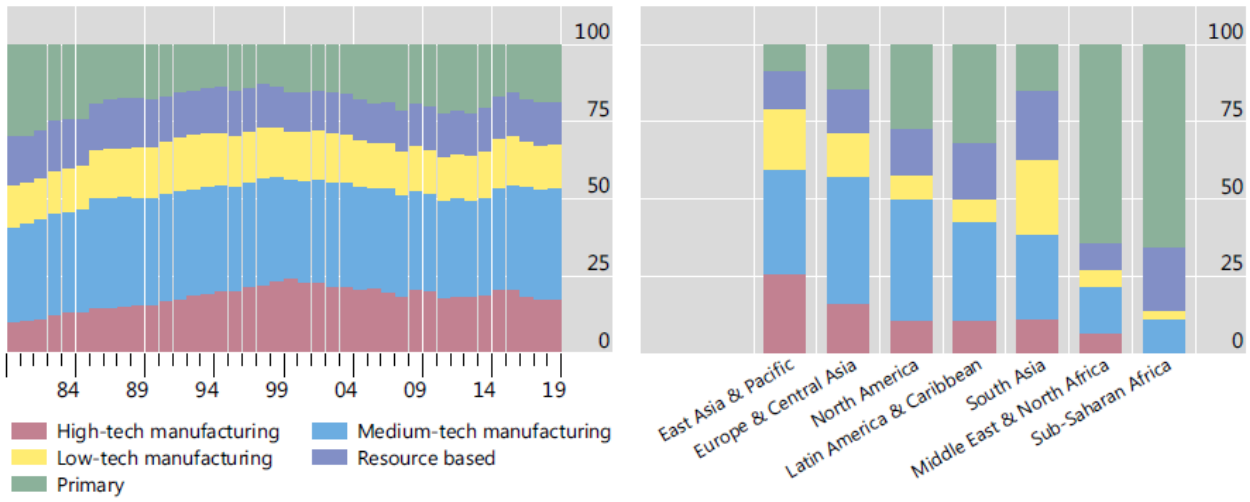

Figure 1: Temporal and Regional Distribution of Global Merchandise Exports

In many developing countries, a form of premature deindustrialization appears to be under way (Cadot & Gourdon, 2016; Rodrik, 2015). For example, in several African economies, the share of manufacturing—which once drove rapid development in East Asia—has risen during recent growth episodes but may soon plateau without a more fundamental transformation (Ghani & O'Connell, 2014). The globalization of technology has led to labor-saving and productivity-enhancing advances in production, reshaping comparative advantages and competitive dynamics (Rodrik, 2015). Because artificial intelligence functions as a service deeply intertwined with structural change, it can significantly influence the economic power of states.

Advanced economies have undergone considerable changes in their production structures since World War II, first shifting from agriculture to manufacturing (Herrendorf et al., 2014). Subsequent technological changes have increased the use of digital labor in both manufacturing and services, in parallel with broader globalization (Gallipoli & Makridis, 2018; Mishra, Tewari, et al., 2020). The emergence of digital technologies has driven a migration of workers from manufacturing toward high-tech services. Crucially, the modernization of the services sector helped prevent a decline in GDP, at least in the United States, where services were traditionally associated with low productivity (Gallipoli & Makridis, 2018). For instance, artificial intelligence has enabled companies such as Google and Amazon to dominate multiple economic sectors (Bessen, 2022; Brynjolfsson et al., 2023).

Artificial intelligence, combined with advancing robotics, the Internet of Things, and other technologies, can generate rapid productivity gains and innovation across all sectors of the economy. It can improve public services and enable more efficient resource allocation. While AI augments human capabilities and creates new types of jobs, it also displaces parts of the workforce as various kinds of tasks—both low-skilled and high-skilled—become increasingly automated. Emerging technologies such as AI are transforming the characteristics of the services sector. Service activities, like goods, can now be unbundled and distributed along global value chains. These technological shifts fuel demand for complex, technology-intensive services whose capabilities—such as the fast, low-cost transmission of information in binary bits—enhance the value of many goods (Mishra, Clark, et al., 2020). Modern services like AI are digitally intensive and intangible (Mishra, Clark, et al., 2020). Similar to high value-added manufacturing, they may generate substantial knowledge spillovers and create pathways for discovering new specializations with related capabilities (Anand et al., 2012; Loungani et al., 2017). For example, machine translation systems have significantly boosted international trade conducted on online platforms (Brynjolfsson et al., 2019).

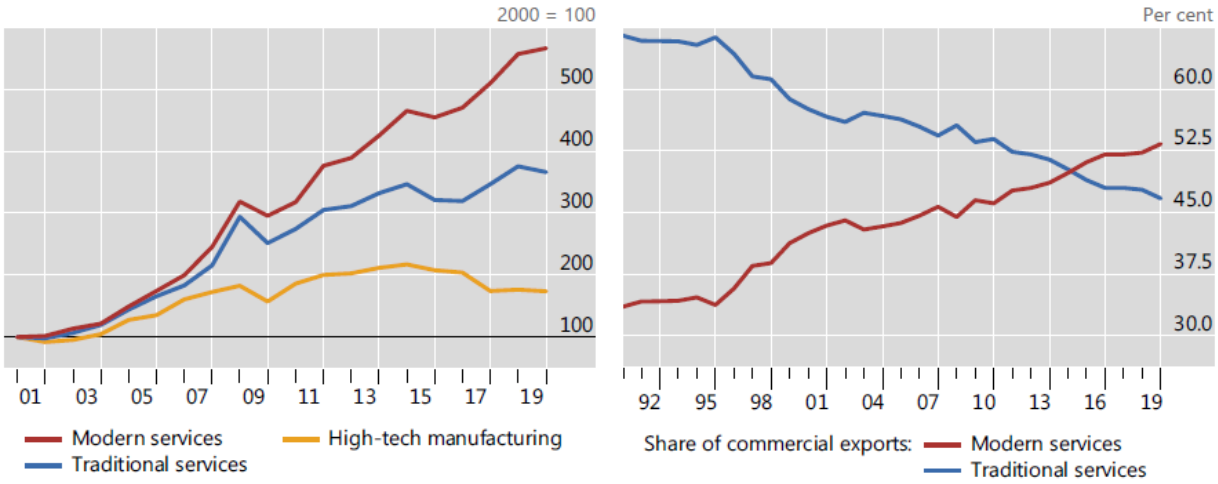

Figure 2: The Rise of Modern Services

Figure 2 (left panel) illustrates the components of global exports of modern services and exports of high-technology manufacturing industries, indexed to the year 2000. It shows that modern services exports have increased fivefold since 2000, while exports of high-tech manufactured products have stagnated or declined. The right panel highlights structural shifts in global services exports from traditional to modern services, with potential implications for rising inequality (Mishra, Clark, et al., 2020).

Artificial intelligence can also strengthen the power of corporations over individuals and even over states. Although theoretical advances in the current wave of AI began in universities, commercial firms are now at the forefront of practical applications, further development, and large-scale deployment of these systems (Ahmed et al., 2023; Metz, 2021). Over time, innovation leadership in AI may shift from public to private actors, weakening democratic oversight and regulatory control by formal legal institutions. These challenges are clearly visible in the attempts of the United States and the European Union to design regulatory frameworks for AI development and use (Criddle & Murphy, 2023; Espinoza & Johnston, 2023).

Moreover, the rapid advancement and widespread adoption of AI have created enormous opportunities, transforming sectors and generating unprecedented potential for growth. Yet alongside its transformative capabilities, AI brings significant disruptions and challenges that reverberate throughout the global economy. A key economic challenge lies in the changing dynamics among countries, firms, and individuals. As AI continues to evolve and penetrate diverse industries, it produces winners and losers and exacerbates existing disparities across countries and companies. Actors at the forefront of AI innovation and implementation leverage these capabilities to secure competitive advantages in economic growth, productivity, and efficiency. By contrast, organizations that fail to adapt and adopt AI may struggle to compete and remain relevant in an increasingly AI-driven world.

Artificial intelligence also poses unique challenges for the workforce. The automation and augmentation capabilities of AI technologies have the potential to profoundly transform the nature of work and labor markets. Although AI can raise productivity and streamline operations, it can also substitute for certain job tasks, raising concerns about widespread job displacement and the need for workers to upskill or reskill. This makes it essential to reassess the skills required in future labor markets and to introduce proactive measures that ensure a smooth transition for workers affected by automation (Acemoglu & Restrepo, 2022; Gallego & Kurer, 2022).

While broad adoption of AI may boost economic output in the short term (Goertzel et al., 2017), in the long term excessive reliance on AI is likely to generate several potential threats, including higher unemployment, ethical dilemmas, and risks to personal privacy frequently noted by researchers (Kak, 2018; McClure, 2017). Technical bottlenecks in AI development also contribute to a significant gap between theoretical research concepts and their implementation in real-world practice (Qin et al., 2023). Economic theory further warns that technological progress tends to create both winners and losers (Korinek & Stiglitz, 2019). As long as these winners and losers are located within the same country, domestic policy instruments can at least in principle compensate those who are disadvantaged. However, when technological advances worsen a country's terms

of trade and erode its comparative advantage, entire national economies may end up worse off—unless winners in one country compensate losers in others, which is politically highly unlikely (Korinek & Stiglitz, 2019).

Another major economic challenge arises from the ethical and regulatory issues associated with artificial intelligence. As AI systems become more autonomous and capable of making high-stakes decisions, concerns about privacy, data security, fairness, and accountability move to the forefront. Governments and regulators must develop appropriate frameworks and policies that strike a balance between fostering innovation and guarding against potential risks (Li et al., 2023; Mehrabi et al., 2022; Ulnicane & Aden, 2023). Failure to address these challenges adequately can destabilize economic power, erode public trust, and slow the adoption of AI technologies.

4.2. Opportunities and Challenges of Artificial Intelligence and the Political Power of States

The growing availability of data across an ever-expanding range of domains, together with new analytical opportunities enabled by artificial intelligence, has raised hopes for new predictive capabilities in societies. AI not only highlights the weaknesses of individual politicians but also amplifies the power of expertise. It creates new opportunities for modelling and forecasting political trends, political decision-making, political freedoms, party dynamics, and more, promising experts improved predictions of how people will behave in response to regulatory or governmental interventions. While the actual quality of these approaches remains open to question, they carry strong rhetorical and legitimizing power. They enhance the authority of experts, who sometimes genuinely and sometimes rhetorically rely on AI-supported models to make recommendations about how societies should act in the face of broad political challenges. This visible increase in expert power to guide rulers' responses can shrink the space for democratic decision-making and shift the question from whether the people should decide for themselves to whether they can do so. In such a scenario, artificial intelligence may enable a move from autonomy to technocracy, thereby weakening democracy. Governments have also begun to rely on AI-based service providers to support core executive functions such as policing and security (Jungherr & Schroeder, 2023).

At the same time, AI distinguishes between individuals on the basis of observable criteria by predicting how they are likely to behave under different conditions using past data. This entails the risk of reinforcing existing social biases and even projecting discriminatory social, legal, and political patterns into the present and future (Mayson, 2019; Mehrabi et al., 2022; Mitchell et al., 2021). A widely discussed 2016 ProPublica investigation showed that software used in U.S. courts to predict future criminal behaviour assessed Black defendants as being at higher risk of reoffending (Angwin et al., 2016). Research on gender classification algorithms using facial analysis datasets found that individuals with lighter skin tones—and men in general—had the best classification performance, whereas darker-skinned women had the worst outcomes (Buolamwini & Gebru, 2018). Debates on bias in AI often refer to two understandings: a narrower technical one focused on data and statistics, and a broader socio-technical perspective that situates bias within historical and political contexts (Kordzadeh & Ghasemaghaei, 2022; Ulnicane & Aden, 2023). This makes ongoing monitoring and auditing of AI deployments critically important. How individuals are "seen" by AI depends on how their pasts are represented in data. AI struggles to identify people belonging to groups that are underrepresented in the datasets on which it is trained. For example, minorities that have traditionally been absent from datasets may simply become invisible to computational systems. This general pattern is highly relevant to democracy: the systematic invisibility of particular groups means that they are diminished or erased in any AI-based representation of the political body and in predictions of its behaviour, interests, attitudes, and grievances. As a result, people who have already experienced disenfranchisement may face further deprivation and discrimination when governments design public services or policy programmes based on preference modelling. AI can also make some individuals excessively visible. Historically marginalized groups have often been overrepresented in criminal records, and AI-based policing or security approaches can amplify these negative effects on group members (Ferguson, 2017). In countries such as the United States, where voting rights for people with criminal records vary by state jurisdiction, systemic policing biases and AI-mediated sentencing may, over time, reinforce structural discrimination against historically disadvantaged groups.

AI-based approaches can also profoundly affect electoral redistricting and related processes (Jungherr & Schroeder, 2022). Participation in shaping one's own destiny is closely tied to the idea that people should be able to make informed decisions for

themselves and their communities. This depends at least in part on the informational environment in which they are embedded (Jungherr & Schroeder, 2022). Artificial intelligence directly influences these informational foundations: it shapes how people are exposed to and can access political information, how they express their views and concerns, and how these informational structures may expand or constrain opportunities for participation (Jungherr & Schroeder, 2023). AI can evaluate and model the potential consequences of policy decisions, thereby enabling diplomats and decision-makers to assess different courses of action (Moore, 2023). AI-based tools can support conflict resolution and negotiation processes, with virtual assistants and chatbots handling routine diplomatic correspondence and queries (Meleouni & Efthymiou, 2023). In addition, diplomats and government officials use AI tools to monitor social media for public sentiment and respond with diplomatic initiatives, thereby shaping political choices and public diplomacy efforts (Sakhri, 2023).

Algorithmic curation of digital information environments based on inferred preferences or predicted behavioural responses raises serious concerns (Kitchens et al., 2020). The key issue is that people may be exposed primarily to information with which they are likely to agree, thereby losing opportunities to engage with opposing political viewpoints. Empirical findings, however, suggest that some of these fears may be overstated (Kitchens et al., 2020; Ulnicane et al., 2020).

In fact, in digital communication environments, individuals may encounter more political information from opposing sides than in other information spaces, and they may strongly disagree with it. This can be particularly problematic for partisan citizens because it may intensify political conflict. AI is driving advances in information flows and analysis, with strongly ambivalent opportunities and challenges. These include, for example, massive volumes of highly targeted content, autonomously generated (real or fake), and the possibility of ubiquitous automated surveillance of faces and speech. For democratic states, a core challenge is to protect open, representative democracy from disinformation, including foreign disinformation, that can be generated and amplified at greater scale and speed. For non-democratic states, the priority is often to protect state control through ever more sophisticated surveillance and censorship. These contrasting imperatives are crucial not only for the internal health of political systems centred on democracy but also for their ability to promote and defend their political models abroad.

Thus, AI can grant governments unprecedented surveillance power over citizens. It can amplify misinformation and deepfakes while simultaneously improving tools for countering such media. AI may undermine democratic values by perpetuating and intensifying social inequalities, further eroding trust and the social contract. It also challenges policymakers and political communicators by disrupting work, employment, and the broader economy. Overall, artificial intelligence has significant potential to influence strategic and political communication, but it is essential that these effects are properly understood and managed to ensure that AI is used ethically and effectively. The impact of AI on politics ultimately depends on how it is developed and deployed. Policymakers must carefully weigh its potential risks and benefits and take appropriate measures to ensure that AI is used in ways that strengthen political values and protect human rights.

4.3. Opportunities and Challenges of Artificial Intelligence and the Scientific Power of States

Artificial intelligence (AI) is shaping a future more powerful than any other invention of the past century. Anyone who does not understand it will soon feel left behind and wake up in a world full of technologies that increasingly resemble magic (Maini & Sabri, 2017). Therefore, as governments struggle for survival, they must acquire power—especially in the domains of science and technology. However, the old formula of first developing economic power and then converting it into military capabilities has become ineffective, because complex modern science and technology are now a necessary precondition for achieving both economic and military advancement (Brooks & Wohlforth, 2016). Moreover, as scientific complexity increases over time, copying knowledge from other countries in order to build power becomes increasingly difficult (Gilli & Gilli, 2019). Consequently, the pressure of international competition and the sophistication of scientific progress force states to expand and strengthen their own scientific ecosystems (Taylor, 2016). The implicit agency involved in innovation processes is one of the main reasons for structural change in the international power system: although decisions are taken by individual governments, they generate emergent systemic properties shaped by complexity, in which science becomes a key dimension of power. System-level changes influence actors' decisions and lead them to recognize more intense competition and intensify their

domestic efforts (Taylor, 2016). Hence, the complexity of the international power system allows us to better understand the relationship between agency and structure. For some scholars, the identity of actors is central not only to debates on international power and technology but also to questions of agency and structure. As shared constructed ideas, identities shape and are shaped by technology (McCarthy, 2015), meaning that not all actors develop and use power and technology in the same way. Returning to Wendt's classical example that the United States does not perceive five nuclear weapons in Iranian hands the same way it perceives 500 in British hands, a similar analysis can be imagined regarding AI capabilities (Granados & De la Peña, 2021).

The study of intelligent machines has a long history, and the debate over whether they can offer insights into scientific power has continued since the emergence of AI. Scientific progress has become closely intertwined with the development and deployment of artificial intelligence. The history of scientific discovery shows that scientists rarely advance far beyond what they can observe and measure, and those who do are often considered pioneers of new fields. Artificial intelligence now makes it possible to transform data derived from observable realities in ways that accelerate the growth of science, such that many individual and interpersonal behaviours in physical and virtual spaces are continuously being digitized, creating a fertile ground for scientific research. Recently, there has been strong interest in exploring the potential of AI in research policy. Like any new tool, technique, or technology, AI brings both positive and negative consequences for research, researchers, and education, at both collective and individual levels. It is commonly regarded as useful for information gathering and for providing decision support to enhance impact. However, using AI as a tool to accelerate article production and metrics-driven processes may reinforce negative aspects of academic culture. The growing involvement of AI in writing, generating, and producing research articles has attracted substantial attention in academic and research communities and health organizations in the past year (Ali et al., 2023; Li et al., 2023; World Health, 2021).

From an agentic scientific perspective, the role of AI in scientific discovery reflects a transformation in the range of actors involved in advancing knowledge. For example, the Hubble Space Telescope sends roughly 120 gigabytes of scientific data back to Earth each week, whereas the James Webb Space Telescope transmits around 50 terabytes per week—more than 400 times Hubble's output (PopSci, 2022). The number of journal articles doubles approximately every nine years, with about 3.5 million papers published in 2017. At the same time, it is estimated that about 60% of the world's top AI researchers live and work in the United States (MacroPolo, 2022). AI is also a pervasive technology that has been extensively exploited in the education sector. Various AI technologies are used in education (Nemorin et al., 2022), including plagiarism detection and exam integrity tools (Ade-Ibijola et al., 2022), chatbots for enrolment support, learning management systems, automated lecture transcription, advanced online interaction, student performance analytics, and academic research support (Nakitare & Otike, 2022). In addition, data from Georgetown's CSET indicate that 90% of Chinese AI doctoral graduates who completed their PhDs in the United States chose to remain there for at least five years after graduation, often working for U.S. technology companies and research institutes (Mozur & Myers, 2021).

There is no doubt that AI technology is highly significant, and its role during the recent COVID-19 pandemic has been evident (Cavus et al., 2021; Torda, 2020). Many researchers agree that AI can be used in education (Ahmad et al., 2023; Sayed et al., 2021), but this does not mean that it is always beneficial or free from ethical concerns. For this reason, many scholars focus on the development and use of AI while keeping ethical considerations clearly in view (Justin & Mizuko, 2017). Some argue that even if the intentions behind AI in education are positive, that alone is not sufficient to establish its ethical acceptability (Whittaker & Crawford, 2018). Stephen Hawking once said that success in creating AI would be the greatest event in human history—but, unfortunately, it might also be the last, unless we learn how to avoid its risks (Köbis & Mehner, 2021).

However, AI and machine learning also bring significant concerns and challenges for the education sector, with security and privacy among the most serious. New AI technologies increase the risk of fabricating scholarly works and make such forgeries harder to detect. The current lack of fully reliable AI-detection technologies heightens the danger of fostering an environment that encourages fraudulent research (Owoc et al., 2021; Petousi & Sifaki, 2020). The risks associated with AI-generated

research include the misuse of such work to influence and shape new healthcare policies, standards of care, and therapeutic interventions. The production of research using AI-based technologies may be driven by motives such as financial gain, desire for recognition, academic career advancement, and the need to strengthen curricula vitae, especially among early-career researchers facing intense competition (Elali & Rachid, 2023). While AI-based tools can streamline routine research processes, they also risk contaminating the scientific landscape and undermining the credibility of genuine scholarly outputs.

At the same time, AI is capable of processing large-scale and complex datasets, helping researchers analyze empirical data and discover new knowledge. AI algorithms can be used to predict the outcomes of scientific experiments or to simulate complex phenomena. By leveraging AI methods, discovery and innovation processes in science and technology are accelerated, enabling researchers to take greater risks and test novel ideas. AI also plays an important role in the energy sector, from optimizing energy use to forecasting energy demand in order to improve the efficiency of smart energy systems. It acts as a key driver of new technological developments in multiple scientific fields, including medical research, mechanical exploration, advances in energy technologies, and many others. In areas such as disease diagnosis, drug design, and the improvement of healthcare systems, AI can make substantial contributions. Finally, intelligent translation systems can facilitate information exchange and access to international knowledge. Overall, artificial intelligence is a powerful tool for accelerating the scientific advancement of states, helping researchers and scientists identify hidden patterns in data and rapidly evaluate scientific experiments.

4.4. Opportunities and Challenges of Artificial Intelligence and the Military Power of States

Artificial intelligence has attracted the attention of policymakers and defense analysts due to its immense potential in the defense sector. For example, recent advances in AI have brought transformative shifts in hybrid warfare. The United States National Security Commission on Artificial Intelligence (NSCAI) stated that AI "will be a source of enormous power for the companies and nations that harness them" (Gorman). The potential applications of AI in defense are generally divided into three categories: (1) support and logistics, (2) hostile and non-kinetic uses, and (3) hostile and kinetic applications (Taddeo et al., 2021). Support and logistics refer to the use of AI to enhance support functions such as operations and military supply chains (Taddeo et al., 2021). Hostile and non-kinetic applications include cyber-defense as well as adversarial cyberattack capabilities. Kinetic applications refer to the deployment of AI systems in battlefield operations, such as using AI to identify targets and enabling lethal autonomous weapons systems (Taddeo et al., 2021).

Seven major AI patterns in military power have been identified: goal-oriented systems, autonomous systems, conversational/human interaction systems, predictive analytics, hyper-personalization, and decision-support systems. These patterns have revolutionized military operations in recent years, producing new capabilities for tasks such as object detection, decision support, and conversational interaction. The decision-making component of hyper-personalization plays a particularly significant role in military capabilities. This is especially visible in unmanned aerial vehicles (UAVs), commonly known as drones. UAVs are equipped with a wide range of sensors, cameras, and data-collection tools that enable them to gather large volumes of real-time data about their environment and potential targets. Hyper-personalized decision-making systems can analyze this data in real time, provide actionable insights to military commanders, and enable more informed decisions (Sha et al., 2021).

The modern era has also witnessed a revolution in conversational AI systems, including military-relevant chatbots. One example is WeChat, a major instant-messaging platform used across several influential digital societies. A notable system is ABDUL—developed in 2008 by Artificial BudDy U Love—a conversational agent that uses an instant-messaging protocol to retrieve information across devices and platforms (Klopfenstein et al., 2017). In conversational AI, no dataset is as valuable for military communication as the vast datasets generated through conversational models themselves. Soldiers in unfamiliar environments, for example, rely on immediate information and clear instructions. Research on conversational AI for the military thus focuses heavily on developing systems that can operate in such scenarios. Many countries have made progress using conversational AI for battlefield applications. With the deployment of a military conversational agent, soldiers performing repetitive tasks can receive rapid and appropriate responses with significantly less effort and cost (Chuang & Cheng, 2022; Gao et al., 2019).

For battlefield data collection, military teams can deploy UAVs, cameras, and sensors through the Internet of Things (IoT) to scan and monitor the battlefield. Armed drones can provide real-time data to command centers, capture live imagery, and track enemy positions and terrain. These technologies also assist in identifying and locating adversaries (Johnsen et al., 2018). IoT sensors may collect fingerprints, iris scans, and other biometric data to identify individuals who may pose a threat. Smart military bases use IoT devices to improve functionality and operational efficiency (Rashid et al., 2023).

IoT technologies are also widely used to monitor the health and well-being of soldiers. Sensors embedded in military uniforms track physical and psychological conditions, including heart rate, body temperature, thermal distribution, and behavioural indicators such as speech patterns. Effective military operations depend on the efficient delivery of personnel, ammunition, and regular maintenance of military vehicles (Akbar et al., 2017). IoT-connected sensors and analytics allow military forces to track supplies from their origin to battlefield locations where they are needed.

Although the technical feasibility of AI is the focus of extensive research and development across multiple defense sectors (Walsh, 2021), concerns regarding trust, ethics, and legality present significant challenges. Effective deployment of AI-enabled defense capabilities requires strict conditions, especially when AI systems may make life-or-death decisions beyond the direct control of human operators (Morgan et al., 2020). Additional concerns arise from the potential for AI-supported decision-making to misjudge targets that human operators might correctly identify, raising risks of misclassification and unintended harm (Morgan et al., 2020). Ethical considerations influence public attitudes and shape broader perceptions of AI in defense contexts.

Many countries have begun addressing these concerns by committing to transparent and ethical uses of AI in defense. For example, the United Kingdom's Ministry of Defence (2022) acknowledges fairness, bias, and reliability concerns in its latest Defense AI Strategy. Fairness relates to the challenge of designing automated decision-making systems aligned with human values, and highlights the need to retain human oversight. Bias in machine-learning processes can disproportionately affect certain groups, including military personnel, while reliability refers to the consistent and error-free functioning of AI systems. These concerns intersect closely with human accountability for both developers and operators. Ensuring accountability requires managing enormous volumes of complex data processed within extremely short time frames.

The strategy also emphasizes the need for public trust in AI, aligning closely with commitments expressed in the UK government's broader national AI strategy. As an essential component of such efforts, public engagement is critical to ensure that ethical commitments regarding defense-related AI technologies are clear to those who are responsible for governing their use (Morgan et al., 2020).

5. Discussion and Conclusion

One of the most important new factors in national power is its connection to the Industrial Revolution, that is, the moment when machines began to operate. In 1919, the father of geopolitics, Halford John Mackinder, summarized his "Heartland Theory" of geopolitics by stating that whoever controls Eastern Europe controls the core of the interconnected continents of Asia, Africa, and Europe, and whoever controls the Heartland commands the world. In the age of artificial intelligence, this theory may need a software-style update: control over digital heartlands. Key digital infrastructures, data centers, internet choke points, and satellite launch facilities may ultimately become the most decisive factors in determining the fate of states. As Vladimir Putin has famously remarked, whoever leads in AI will rule the world. From a geopolitical perspective, the revolutionary potential of artificial intelligence is reshaping global power relations. The creation and strategic use of AI technologies affect surveillance capabilities, economic competition, information warfare, and military power. States that lead in AI research and development possess a clear advantage in exerting influence, projecting power, and navigating complex geopolitical landscapes.

For this reason, developing new conceptual tools for decision-makers and geopolitical analysts is essential to understanding how AI technologies affect political–spatial structures and national power. In the long term, these technologies will generate significant changes in the configuration of national power. Thinking about long-term competition within an evolutionary framework highlights how major technological shifts alter the landscape of power: how AI-based technologies can create new elements of power, change the relative importance of existing elements, and reshape the objectives that states pursue in

competition. Gaining a clearer sense of AI's impact on each of these components will be vital for major powers. AI technologies may transform not only what states are capable of doing, but also which activities they seek to undertake. Major innovations can fundamentally alter the goals that governments prioritize. For example, promoting democracy may become linked to shaping AI technologies themselves—for instance, supporting the development of AI systems that rely less on centralized data, and accelerating the adaptation of social and economic institutions to the information generated by AI systems.

At the same time, the effects of technological change are highly asymmetric: new options, altered agents, and shifting goals can manifest very differently across countries. This implies the need to learn from rivals without simply imitating them, and to share insights with allies before assuming that their policies must mirror one another in a symmetric fashion. Advances in artificial intelligence have also accelerated global commercial competition and transformed the international security environment. The reach and influence of foreign digital platforms pose risks to societies and require careful scrutiny of their origins and purposes. Meanwhile, AI technologies amplify several existing national security threats and change how governments seek leverage over adversaries and exercise coercion and influence in other societies. The open nature of free and democratic societies, combined with their growing dependence on often weakly secured digital networks, makes them particularly vulnerable.

In the military domain, AI has the potential to enhance cyber, conventional, and nuclear capabilities in ways that make it harder to predict and manage security relationships among rivals and to limit escalation. Even as they compete, rival states must carefully examine the limits and vulnerabilities of AI capabilities.

On the other hand, while population growth remains relevant to national power, AI technologies—like many other technologies of the past century—may further reduce its relative importance. Scientists and engineers who exploit new technologies, both by developing them and by accessing frontier innovations, are crucial instruments for enhancing national power. AI can act in both roles and operate as a force multiplier; this raises the importance of productive scientists and engineers. AI applications can reduce the cost for researchers to access up-to-date knowledge in almost any field. They can directly contribute to new discoveries and engineered systems, especially in areas that involve searching large design or data spaces; they can automate the physical work of science and engineering—for example, through autonomous laboratories that carry out experimental procedures robotically; and they can make global scientific knowledge more accessible to humans by extracting insights from millions of articles, including those in multiple languages.

Ultimately, a long-standing debate in the philosophy and sociology of science asks whether scientific progress is driven more by new ideas or by new tools. AI technologies appear capable of contributing to both, and in the long run may enable novel and more creative forms of knowledge generation, functioning as a guide or extension for the human mind.

The broad penetration and success of AI have the potential to alter the current balance of power among states. Countries that do not allocate sufficient resources to AI may find their future military and economic dominance eroding. For example, despite a difference of some 300 billion dollars in defense budgets between the United States and China, China invests roughly as much in AI as the United States. Key concerns about AI use are tied to ethical and regulatory issues. In the private sector, the easy availability and successful deployment of AI have given technology giants control over vast resources, which can readily be channelled into AI weaponization. Major powers such as China invest heavily in these technologies and export them to dozens of countries.

Ethical challenges include problems of data access, since the availability or openness of data is a basic prerequisite for enabling AI systems. Data protection regulations and protocols must be designed to allow specific open-data resources for research while safeguarding sensitive information. Bias in data—such as unbalanced datasets or racially skewed samples—can significantly affect the performance of AI algorithms and raise serious ethical concerns. In image-classification software, for instance, discriminatory or biased information in training data can lead to misidentification of faces. Because of the "black box" nature or opacity of many AI algorithms, it can be difficult for decision-makers to understand how particular outputs are generated, raising questions about the criteria employed in automated decision-making and deepening distrust of AI-driven decisions.

Another unresolved issue is the absence of international regulation governing the development and deployment of AI-enabled weapons systems, including lethal autonomous weapons systems (LAWS). This regulatory vacuum facilitates great-power competition and risks intensifying arms races. In cases where AI-enabled systems malfunction and human lives are lost,

the question of accountability becomes central. Accordingly, formulating policies and standards that guide and constrain the use of AI systems is essential.

Artificial intelligence is transforming virtually every sector of national economies and accelerating globalized competition among digital platforms and services. The stakes for future welfare and long-term national competitiveness are therefore extremely high. The security environment is likewise undergoing profound change across a wide spectrum of national and international security challenges, from low-intensity conflicts to major-power confrontation. AI amplifies cyberthreats and disinformation, reshaping how governments conduct targeted political operations against opponents. In the middle of this spectrum, warfare between conventional armed forces is likely to involve faster actions and more delegated decision-making, which may make conflict management and escalation control more difficult. At the highest level, AI-enabled military and intelligence capabilities could disrupt the basic foundations of nuclear deterrence in ways that undermine strategic stability.

Taken together, these trends demand a comprehensive national strategy for the coming decade—one that both safeguards the benefits of global leadership in AI for economic prosperity and security, and mitigates the substantial risks it poses for the future of national power and international order.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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