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Theoretical Approach for Artificial Intelligence Applications and Sustainable Development

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Abstract:

Sustainable development is a concept that has evolved through numerous stages to successfully balance economic development and environmental protection. In the presence of a widespread imbalance, these objectives have impacted all facets of life on Earth: water, air, soil, fauna, and flora,which are profoundly influenced by ongoing and escalating pollution. Scientific and technological research, negotiations, and coordinations are all aimed at limiting global warming to below 1°C. If the disturbances continue with severity, the 1.5°C threshold will be surpassed by 2030.

A new element has consistently emerged, alongside multiple paradigms, known as artificial intelligence. This technical advancement may serve as a strategic asset for sustainable development, or conversely, it could exacerbate greenhouse gas emissions through the extraction of its components and its operational processes. This study aims to address this issue from a multidisciplinary perspective.

Keywords: Artificial Intelligence Applications, Standards and Regulations, Sustainable Development.

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Introduction:

In the era of Industrial Revolution 4.0, certain economic sectors are expanding while others are waning, due to digitalization, technology, and automation. Segments of the economy, including the conventional agricultural and manufacturing sectors, are depreciating and progressively vanishing. This does not imply that these industries will cease to exist, rather, they are in transit. They are evolving to incorporate greater technology to deliver more efficient, sustainable, and cost-effective outcomes. Envision a future akin to Kurzweil's 1990 predictions, when advanced technology and automation enhance human existence as it is currently understood. Our daily lives are already affected by these shifts via the various tools we use. Smartphones, virtual assistants, targeted advertising, and numerous more daily behaviors can be referenced. We may ponder: what enables numerous tools to facilitate our daily lives? The answer is artificial intelligence. This technology seeks to emulate human behavior through purported intelligent activities. It is omnipresent, often unnoticed.

When conducting an internet search for flights, numerous adverts and flight offers are presented, irrespective of our subsequent online search. This artificial intelligence analyzes our preferences via these searches and curates material that aligns with our interests. Nonetheless, individuals are not the sole users of artificial intelligence for the enhancement of life organization. Companies as well are investing in artificial intelligence systems that can enhance their operations. Our primary focus is the service sector. Companies within the service industry can derive significant advantages from artificial intelligence. Certain operations can indeed be expedited through automation. The services provided can be readily tailored to align with consumer preferences. AI can enhance service quality by diminishing the potential for human errors. These are but three instances of what AI may provide to the service sector. Nonetheless, these provide compelling arguments that should compel companies to incorporate this technology into their operations. Yet, a significant number of companies exhibit either inadequate or no integration of AI.

New lines of contemplation are arising, focusing on the use of artificial intelligence as a pivotal tool for decision-making and, specifically, through its technological diversity, assisting in the mitigation of certain irreversible outcomes. Artificial intelligence evidently challenges certain traditional references, rendering them obsolete upon their emergence. A recent analysis by McKinsey indicates that by 2030, approximately 15% of tasks would be automated, with significant variances per country, ranging from 9% in India to 24% in the USA, and up to 29% in Japan.

Automation implies artificial intelligence, which aids humans in various facets of life. Some authors, including Frederic BARDAGE, assert that enthusiasm should be moderated, stating, “Artificial intelligence certainly has a performative, instantaneous and utilitarian character...the challenge is therefore not limited to the reduction of its environmental damage, but also for its reasoned use." (n.d.). By presenting this perspective, the author advocates for "digital sobriety" in his research guidelines, as the ores and non-renewable resources, such as Cobalt, utilized in the production of these technologies appear to be excessively depleted.

The integration of sustainable development and artificial intelligence presents a genuine dilemma; however, we can endeavor to address it by examining their reciprocal interactions while highlighting the objectives and trajectories of each. Accordingly, this research focuses on specific inquiries: what outcomes can we anticipate regarding the advancement of sustainable development? Have

climatology experts' reports facilitated progress within this paradigm?Is the climatic dimension the sole determining factor, or should other considerations, such as ethics and cultural diversity, be emphasized?The involvement of artificial intelligence is urgently sought; however, to what extent can it effectively contribute as a corrective measure alongside sustainable development to mitigate the pervasive degradation of ecosystems on the brink of collapse?

The notion of sustainable development, which emerged in the 1970s, has evolved, incorporating new perspectives that coalesce around it; specifically, a compendium that is categorized into two distinct directions that this study endeavors to examine:

- Firstly, cultural variety serves as a pivotal principle in the development process.
- Furthermore, employ the diverse applications of artificial intelligence to mitigate the detrimental effects of technology on ecosystems.

I. Interpreting the amalgamation of the sustainable development and artificial intelligence

1. The complex equation of sustainable development:

The tense equation of sustainable development has undergone periodic upheavals in its paradigm since its inception, as various intellectual movements challenge the intricate nature of its mysteries; on one side, the capitalist economy, driven by scientific innovations, promotes excessive and unyielding consumption.Furthermore, developing countries have emerged as significant consumers reliant on innovative products, despite lacking control over their production. This situation creates an inevitable imbalance that impacts all aspects of life on Earth. The urgency of expanding the concept of sustainable development to encompass additional components has been acknowledged in a diachronic and multifaceted manner by international organizations. The factors influencing its evolution have drawn from various levels of knowledge; it is evident that "cultural diversity" among countries is prominently featured in discussions, alongside "the biology of conservation" through protected areas, and various measures aimed at mitigating disturbances caused by human activities (Marie-Hélène Parizeau and Soheil Kash, 2016).

Additional parameters will be incorporated into the framework; economically, we observe the "internalization of negative externalities," which obligates polluters to assume their responsibilities, alongside a range of financial measures (taxes, subsidies, various incentives) that support the combat against pollution. Moreover, "ecosystem services" highlight the issue of diminishing free natural capital, which is essential for human life and well-being, hence influencing the development index. Efforts to associate human advancement with financial metrics take place. Conversely, environmental economics endeavors, via several studies, to present data that underscore the significance of identifying specific elements that can mitigate pollution in the long term. The IPCC (Intergovernmental Panel on Climate Change), established in 1988 under the United Nations, comprises specialized experts whose primary mission is to objectively assess the latest scientific research and modeling concerning climatic phenomena. The annual reports serve as a reference for

decision-makers in climate discussions, comprising syntheses and projections regarding their evolution. Nevertheless, it is important to acknowledge that, despite scientific evidence and incentive policies, growth continues to have catastrophic consequences not only on human, animal, and plant ecosystems but also on the natural resources that include water, land, and air. Additionally, the precious and rare minerals found in both land and sea are regrettably in a state of continual depletion. How can we synchronize all the reflections to achieve a cohesive articulation? The global context demonstrates significant discord, especially regarding the escalation of raw material costs, limitations on economic development, internal regulatory and normative initiatives, and supportive financing for either the promotion of industries with substantial ecological potential or the execution of conservation policy programs.

This articulation necessitates regulatory engineering techniques and scientific and technology advancements that enhance profitability across various sectors while establishing balance thresholds advised by climate specialists. Considering national cultural and anthropogenic particularities informs the formulation of public policy strategies aimed at combating various forms of pollution and advancing sustainable development.

It is evident that the conjunction of the terms development and sustainability is not inherent; rather, it necessitates a substantial escalation of efforts by States regarding strategic planning and the formulation of medium- to long-term actions. This involves a reconfiguration of investment expenditures in accordance with available resources and, crucially, based on clearly delineated priorities, including the identification of activities essential for the execution of sectoral policies and their subsequent adjustments. The comprehensive strategy will demonstrate coherence, aiming to align sectoral policies with foundational objectives and build new development models. Investment in the ecological transition is a critical necessity; the implementation of fiscal instruments, subsidies, rapid resource redeployment, and the reallocation of expenditures towards enhancing environmentally respectful and inclusive public services will significantly optimize state action. The envisioned benefits, tailored to each ecosystem, will undoubtedly facilitate the attainment of a series of successful outcomes. In short, it is imperative to reform State activity through an advanced sustainability framework to mitigate ongoing social, economic, and environmental disparities, as the sustainability equation necessitates comprehensive efforts on both structural and psychological levels. The various principles outlined above have played a role in defining sustainable development, perpetually seeking identity.

Despite the implementation of conventions, strategies, regulations, standards, mechanisms, and structural and cyclical reforms aimed at mitigating inequalities, redistributing wealth, and diminishing environmental degradation, the outcomes remain inconclusive, reflecting a mixed result despite numerous efforts. Recent calamities attributed to climate change, escalating greenhouse gas emissions, and the decline of maple trees compel the astute observer to advocate for the engagement of an evaluator who would enable the adaptation of new granulites for each country. While the endeavor may seem illusory, it could be synergistically linked with emerging technologies that would facilitate its advancement.

2. Artificial intelligence, a valuable resource for sustainable development:

While some advocate for it and others restrict it, artificial intelligence stands as one of the most remarkable advancements of our era. The application of established methodologies across various

domains such as healthcare, management, automation, industry, information technology, agriculture, and services, along with the evident proliferation of its applications to facilitate development, is indisputable. The numerous ongoing initiatives of this augmented technology prompt us to contemplate its potential effects on productivity, economic development, and the environment. It is unequivocal that all sciences are experiencing the onset of a unique paradigm that will pave the way and influence established standards. Given that climate change affects prosperity and future generations by significantly altering cycles and their frequency, which impact all life systems, the use of artificial intelligence aims to alleviate the repercussions of climatic disasters.

The AI competition fosters beneficial transplants, especially in the healthcare sector. “Accompanied by AI and Big data, medicine will make considerable progress and therefore prevent and cure more tries diseases...by bringing establishments together and grouping together data, by merging files, which would facilitate their circulation for research and for more effective care” (AYACHE and DAMASIO,2020), far from the paper version, everything would be stored in servers, which would contribute to safeguard the rest of the thousand-year-old heritage of the forests and consequently reduce the ecological bill. However, beyond the threshold of ethics, the use of transhumanism would raise some concerns and reluctance; certain bio-conservative authors warn against the massive, unregulated use of artificial intelligence via NBIC (nanotechnologies, biotechnologies, computer science and cognitive sciences). Jean-Michel BESNIER warns of the hybridity of the biological and non-biological, which could lead to and "contribute to the advent of a humanity which would operate at two speeds, in which the non-augmented would have only one aspiration: that is to increase?In short, transhumanism presents entirely unforeseen ramifications for the foundation of humanism, necessitating the development of new regulatory frameworks to offset these effects.

Similarly, Laurent ALEXANDRE aptly observes, “NBIC and AI also engender substantial fantasies, complicating rational contemplation further.” Our cognitive biases and the projection of our fears onto AI hinder a rational assessment of risks” (ALEXANDRE, 2019). It is widely acknowledged that the equation of development is to attain a symbiosis that encompasses the various inhabitants and elements of the planet, ensuring sustainability. However, if the acceleration of AI becomes frenetic, certain elements of the delicate equilibrium will be compromised. Human activities have resulted in a 1°C increase in global temperatures relative to the pre-industrial period, causing irreversible effects on both fauna and flora.

The oscillation between periods of intense drought and catastrophic flooding persists in intensifying. Urban planning, coupled with population growth and economic development, exerts escalating pressure on water resources. Equally concerning is the intertwining of the health crisis with a social water crisis, highlighting an issue of water solidarity; insufficient water supply threatens to disrupt the social fabric (TIETENBERG & LEWIS, 2013). Algeria's natural water potential is currently estimated at 18 billion m³ annually. Irrigation constitutes a significant portion of water consumption, accounting for 62% of the country's total demand. In 1987, Algeria's population was 23 million, projected to reach 46 million by 2020, resulting in a drinking and industrial water consumption of approximately 5 billion m³ per year, while current mobilization is merely 2 billion m³.

We are observing a significant decrease in water potential, which imposes further limitations on sustainable management. Artificial intelligence offers a remarkable opportunity in this context;

through sophisticated algorithms, it can accurately calculate the required water volume, pH levels, and specific irrigation data for various tree species, fields, and agricultural perimeters, thereby substantially mitigating water stress. Additionally, in the realm of renewable energy, seawater desalination would further ease the constraints on potable water supply and help preserve hydraulic resources.

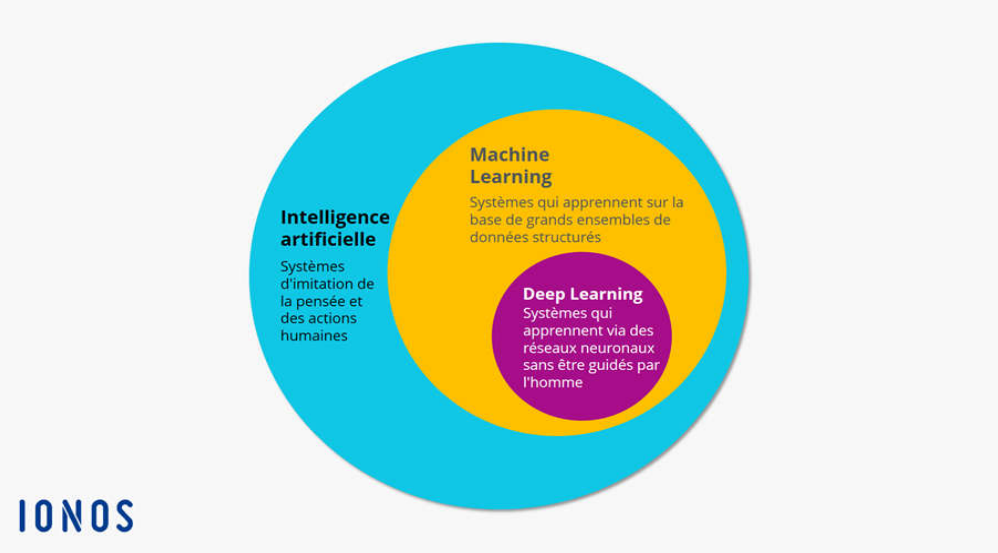
Among the new provisions of law 36-15 of August 10, 2016 bearing water; in the context of water administration, the desalination of seawater, the collection and recovery of rainwater, liquid sanitation (collection, treatment and discharge into the natural environment) and the preservation of aquatic environments are mentioned(Law n°1-16-113 of 6 Dhulkaada 1437, 10 Août 2016, bearing theenactmentof Law N° 36-15 on water). It should be remembered that the structuring technological changes which have marked agricultural activity demonstrate that there is more productivity than in the past, but it is worth noting certain warnings recorded against scientific innovations. In relation to the Earth, these controversies are justified in relation to the links they have with sustainable development. As the foundation of the sustainable development paradigm, it starts from an ecological resonance. Given the extent of the allocation of land by the needs of the population, which is constantly growing, it seems implausible to increase productivity by manipulation of genetics to different degrees, which will certainly contribute to the impoverishment of genetic heritage and consequently to the gradual loss of biodiversity and the amplification of ecological erosion. By 2050, the FAO (Food and Agriculture Organization) warns of the reduction in arable land in the face of the demographic boom. Among the paths proposed by researchers is the possibility of taking advantage of artificial intelligence in order to resolve the inadequacies in agricultural matters in particular: in the improvement of production techniques, in the creation of platforms dedicated to sharing data on weather disturbances, in the event of infestations, fire, specific fertilizers and irrigation or intelligent watering according to the quality and pH of the soil, etc.

Thanks to automation (sensors, drones, three-dimensional technology, satellites), production would be increased in quantity and quality and, above all, in reduced costs. The enormous benefits promised from such technologies will certainly facilitate and support decision-making for smarter agriculture. Indeed, “in the perspective of a third green revolution, the application of modern information and communication technologies to agriculture is of great importance; intelligent agriculture consists of managing water, light, humidity and temperature. Sustainability requires hybrid efforts; the alliance with automation is essential. Like, it is commonly recognized that economic development requires excessive exploitation of non-renewable resources, which does not go hand in hand with the process of safeguarding the environment. On another scale, nanotechnology, which is a science whose “conception, production, design and application of structures, devices and systems take place by controlling shape and size at a nanoscale”. (DE FREITAS and MENENZES, 2016, p. 256).

This technology is significantly impactful across various domains: water (decontaminating nanomagnets), agriculture (nanotechnology for soil retention and fertilization), health (detection of parasitic agents), energy (photovoltaics), and the environment at large. A prominent application is its capacity to generate highly recyclable materials.

The forest fire fighting industry uses artificial intelligence through the use of fire simulation software on a virtual level by injecting twinning parameters with reality, which would give ready-made scenarios in real time. “AI combines real-time sensor data on the fire with other data sources on vegetation, topography and wind….andvisualizations of fire movements.” On the global meteorological register, the use of “deep-learning” (BONIFACE, EYROLLES, 2021, p. 21) allows the prevention of the appearance of the phenomenon called “EL NINO” which is known for its power to divert climatic variations from one extreme to another while displacing them towards geographical areas unaccustomed to receiving them. The way AI works is to feed the calculation base with algorithms that combine meteorological data collected over a century.

Fig n°(01): Machine Learning versus Deep Learning: two key components of artificial intelligence. Deep learning can be seen as a subset of machine learning



Source:IONOS Digital Guide 2020

When adeptly employed, biotechnology can aid in environmental preservation. Countries such as Mexico, Turkey, Panama, and Colombia have implemented artificial metallic trees that absorb pollution through an integrated system comprising microalgae, which filter and purify the air in urban areas lacking green spaces or in regions with significant traffic congestion. This device replicates the photosynthesis process of natural trees. In developing countries, the implementation of AI occurs in minimal increments; however, certain pioneering countries exhibit a willingness to innovate while safeguarding biodiversity, as the significance of bees in the floral ecosystem is well recognized for maintaining its equilibrium. Tunisia has advanced through “SmartBee” technology to mitigate the effects of climate change on the bee population, using an intelligent system comprising sensors, a decoder, and a platform that promptly delivers beekeepers information regarding hive ecosystems, including measurements of humidity, temperature, and productivity. This technological solution aims to alleviate the effects of climate change on biodiversity by artificially restoring a conducive environment to prevent bee mortality. The technological advancement in artificial intelligence has notably expanded in the past decade, facilitated by applications, platforms, sensors, and enabling software interconnected within ecosystems. Consequently, integrating new technologies with the environment could yield solutions to mitigate risks; however, vigilance

necessitates caution against the excessive deployment of artificial intelligence in the absence of legal safeguards.

3. Artificial Intelligence, Sustainable Development, What Regulatory Pathway?

The mandates of sustainable development compel states to respond with regulatory instruments, facilitated by regulatory agencies, and primarily through comprehensive efforts to modify cognitive behavior via awareness initiatives and public policy formulation. It is noteworthy that the European Union, cognizant of the imperative to regulate the technological exuberance of AI for the safeguarding of citizens' data and ultimately to mitigate the extensive carbon footprint, has made strides in climate action along diverse trajectories, with ambitious goals. The "green deal" serves as a feasible roadmap, delineating various facets of the sustainability paradigm. Indeed, the objectives are multifaceted, encompassing all social and financial dynamics, alongside economic growth and public policies rooted in renewable energy sources.

The commitment of EU member states to implement measures aimed at halving greenhouse gas emissions is significant, given that Europe possesses substantial industrial and human resources. The expectations are elevated, necessitating regulatory actions to attain ecological neutrality, initially targeted for 2050. This effort should leverage a range of natural allies, including the gradual restoration of biodiversity, as well as advancements in scientific research across agriculture and biology, and technological innovations that minimize carbon impact, particularly through the adoption of energy-efficient artificial intelligence reliant solely on clean energy sources. This challenge necessitates financial support for regions impacted by the ecological transition, aimed at diminishing their reliance on fossil fuels to achieve a 40% reduction in greenhouse gas emissions by 2030, with an estimated requirement of 1 trillion Euros. The objective is to attain equitable consumption to realize carbon neutrality via carbon offsetting.

The European Union aims to assert itself as a global leader by positioning itself as an innovative community and continent in the formulation of international regulations governing artificial intelligence, thereby safeguarding citizens' data confidentiality, privacy, health, and public interest. The standards that underpin artificial intelligence will significantly contribute to the development of a global framework. The risks associated with the extensive and audacious deployment of artificial intelligence, absent safeguards, may conflict with the foundational principles of the European Union. Consequently, it is imperative to identify the risks and repercussions involved and to implement subsequent measures and sanctions based on the responsibilities of companies that develop and use artificial intelligence for manipulative ends or that exploit marginalized groups. The reflections of intellectuals advocate for vigilance against automatism; all technological innovations must be accompanied by rigorous research regarding their future implications for human rights and planetary equilibrium. The findings will determine the regulatory limits to be imposed through a cohesive framework of regulations.

Elon Musk candidly articulates his concerns:

“We need to be very careful with artificial intelligence applications. They are potentially more dangerous than nuclear weapons. I hope we are not just the biological boot disk for digital super-intelligence. Unfortunately this seems more and more likely.” (ALEXANDRE & COPE, 2019). MUSK's concerns highlight the sanctity of the "humanity" aspect, particularly in relation to

transhumanism, which aims to enhance life expectancy through hybridity; however, it is highly probable that this could disrupt the natural balance. Man 2.0 would require additional rare minerals, used in the composition of hybrid implants and their controls, to enhance their functionalities. The extraction of rare earth elements, including cobalt, cerium, and scandium, necessitates substantial consumption of water and energy during the extraction process. These are utterly excessive circumstances regarding sustainability (RABHI & DUQUESNE,2021).

This inequitable equation necessitates increased consultation among states regarding new legislative and regulatory frameworks, as well as innovative methods of coordination and negotiation with the digital entities. It is not unexpected that Denmark appointed an ambassador to GAFAM, given the significant stakes involved, which pertain to all fundamental rights. Chancellor Angela Merkel asserted that "the potential to infringe upon freedom of expression is restricted to the parameters established by law and cannot arise from the unilateral decision of a private corporation." Similarly, in 2018, Germany took the initiative by enacting a law mandating platforms to eliminate content that incites hatred, racism, misogyny, violence, or any potentially illegal information, under the threat of fines reaching up to 50 million euros.

II. An essential comprehensive policy response:

1. The European strategy: a global response

In September 2017, Vladimir Putin asserted, “artificial intelligence is the future not only of Russia, but of all humanity [...] whoever becomes the leader in this field will be the master of the world.” This declaration, though unexpected from the president of a country lacking notable aspirations in this domain, underscores the significance of the topic for global geopolitics. Furthermore, AI is central to the rivalry between China and the United States. In response to this artificial intelligence revolution, the European Union has formulated a strategy and action plan.

In order to adequately prepare for the impending technological revolution and position itself in the AI competition, Europe must respond. Although various Member States have implemented individual strategies, a cohesive European initiative is essential. While the Union lacks specific competencies in this domain, the rapporteurs firmly believe that only collective action among all Europeans can prevent dependency on external technologies and societal models. Who will support this endeavor? It involves countering superpowers and cultivating our own framework for intelligent machines. European countries cannot accomplish this in isolation.

The Senate has consistently lamented that the European Union functions as a colony within the digital realm. It must not constitute a colony of artificial intelligence. It offers considerable advantages for this purpose. Nevertheless, it must respond swiftly, decisively, and thoroughly. This is likewise the course adopted by the European Commission. In October 2017, the European Council requested the Commission to formulate a European strategy for artificial intelligence. The declaration of cooperation on AI, signed by 25 European countries on April 10, 2018, exemplifies a robust commitment to a unified European strategy for artificial intelligence. In response, the European Commission released a communication on April 25, 2018, titled “Artificial Intelligence for Europe” (COM, 2018,p. 237). It observes that artificial intelligence is an existing phenomenon,

capable of delivering solutions and facilitating social transformations to enhance quality of life and economic advancement. Consequently, it is a discipline of strategic significance for Europe.

The Commission asserts that AI transcends various sectors and will revolutionize our society and industry. A robust European framework addressing socio-economic, legal, and ethical dimensions is essential. The Commission promotes a unified strategy by the European Union in collaboration with Member States to maximize the benefits of AI. The European Commission identifies tangible assets within the Union, including advanced research laboratories, esteemed universities, innovative start-ups, and advancements in robotics technology. The Union has the potential to emerge as a leader in artificial intelligence, aligned with its values-driven vision. The aim of the European artificial intelligence strategy is to enhance competitiveness, facilitate the digital transition, and create a European framework for its development and application. This framework will be grounded in European values to ensure that AI serves the interests of both citizens and society at large. The strategy put forth by the European Commission is founded on the following pillars:

Enhancing the Union's industrial and technological capabilities while garnering support from public and private stakeholders: The objective is to guarantee that the economy reaps advantages from advancements in AI technologies. The Commission aims to elevate public and private investment in the European Union to 20 billion euros annually by 2020, in contrast to 5 million in 2017. The Union will fund initiatives using AI across various sectors, notably in health, transportation, digital technology, and industry. The initiative aims to assist countries through the European Innovation Council pilot project by fostering the creation of AI centers of excellence that will operate within a network.

To foster AI adoption throughout Europe, an "AI platform on demand" will be established to enhance accessibility for all potential users. The Commission intends to allocate a total investment of 1.5 billion euros from the European Horizon 2020 research budget. Additionally, private entities and the European Fund for Strategic Investments (EFIS) are being solicited, with the potential to contribute 500 million euros during the 2018-2020 period. This investment mobilization aims to mitigate the risks of lost opportunities presented by AI, brain drain, and reliance on externally developed solutions.

Anticipate economic and societal transformations: Artificial intelligence technologies will effectuate significant alterations in society, including changes in the nature of employment. Automation, robotics, and artificial intelligence can facilitate daily life by assisting with laborious tasks, enabling the processing of substantial data volumes, and aiding in the management of disabilities, especially physical ones. New jobs will consequently be generated, although their emergence remains unpredictable, while others will be supplanted. The Commission has identified three significant challenges in adapting to the disruptions caused by artificial intelligence. Initially, it advocates for the societal preparation by fostering the acquisition of fundamental digital competencies and by promoting engagement in activities that are challenging to replicate, specifically those that require distinctly human abilities such as reflection and creativity. It suggests offering assistance to employees whose positions are at high risk of being replaced or eliminated, particularly by facilitating access to social protection. The third challenge involves training a substantial number of AI specialists and establishing an appealing work environment to prevent brain drain.

The Commission will allocate €2.3 billion from the European Structural and Investment Funds to support national training programs aimed at acquiring digital skills through the European Social Fund. The "New Skills Agenda for Europe" and "Digital Education Action Plan" initiatives seek to equip workers and students with essential digital competencies. The quantity of individuals educated in AI must be augmented to address the deficiency of specialists, employing an inclusive and non-discriminatory methodology. To mitigate the exodus of young qualified researchers from Europe, it is imperative to create a compelling environment for AI development. The European Institute of Innovation and Technology provides master's and doctoral programs to address the requirements of the digital transition. The Digital Skills and Jobs Coalition also advocates for partnerships between business and education. The Commission emphasizes that the primary mechanism for action resides within the education and training sectors, which fall under the jurisdiction of the States. The aim is to guarantee that artificial intelligence serves the greatest number of individuals, and contemplation on the significant social changes anticipated is advocated.

Guarantee an appropriate ethical and legal framework: The European Commission aims to establish a robust ethical and legal framework to foster trust and accountability in the development and utilization of artificial intelligence, adhering to a sustainable and inclusive model. It plans to implement stringent safety standards and product reliability requirements. Ethically, the Commission advocates for algorithmic transparency, ensuring that explanations are comprehensible to all, thereby informing consumers whether they are interacting with a human or a machine. Additionally, there will be an examination of the capacity of machines to make autonomous decisions and the associated accountability. The General Data Protection Regulation (GDPR) will be applicable to AI, particularly concerning the right to not be subjected solely to decisions derived from automated processing without human intervention.

The strategy endorsed by the European Commission received validation from the Council in June 2018. According to the rapporteurs, it merits recognition for its equitable and balanced assessment of the purported advantages and disadvantages of emerging technology, while promoting a proactive stance. The Union must reestablish itself as a significant force in global technological advancement. It possesses the requisite capabilities and must allocate the necessary resources.

2. Artificial intelligence is crucial in global competition

Regarded as the forthcoming technical advancement globally, artificial intelligence has inherently emerged as a geopolitical concern. The United States and China lead the international rivalry, underpinned by two distinct types of artificial intelligence.

Alongside these two major powers, the past 18 months have witnessed numerous countries implement strategies to advance the utilization and development of AI: Canada, Japan, India, Mexico, South Korea, Singapore, Taiwan, and the United Arab Emirates; in Europe, in addition to France and more recently Germany, there are also the United Kingdom, Italy, Sweden, Denmark, Finland, and the Baltic states.

2.1. The American approach

The United States is presently the unequivocal global leader in artificial intelligence, attributable to the economic dominance of GAFAM, which has facilitated a significant technological advantage.

These substantial entities, which have amassed power and wealth through the expansion of the Internet, wield greater influence than numerous states and aspire to be the primary providers of artificial intelligence. To achieve this, they have implemented a strategy of extensive data accumulation, advanced equipment acquisition, and research enhancement, particularly by recruiting the world's foremost specialists. According to the European Commission, 240,000 Europeans were employed in Silicon Valley in 2017. The financial allocations that GAFAM dedicate to research and innovation are immense, with Amazon investing $16 billion in 2017. In addition to these major corporations, Silicon Valley is home to between 12,000 and 15,000 start-ups focused on AI. In 2016, the United States was the leading recipient of AI investments, accounting for 71% of the total.

These substantial entities extend their influence beyond national borders through a dual approach. Firstly, they consistently acquire innovative AI companies to enhance their capabilities and suppress competition. Furthermore, they exert their influence (soft power) to advance their interests in international standardization and regulatory forums, akin to their strategies within technical regulatory bodies of the Internet. They sustain their dominance by enforcing standardization predicated on the technologies and software they offer. Additionally, they strive to shape global discourse on AI ethics.

Moreover, we must acknowledge the contributions of American public authorities, specifically through three agencies: the National Science and Technology Council, tasked with formulating a strategic roadmap; DARPA (Defense Advanced Research Projects Agency), renowned for its financing of disruptive innovation; and the Advanced Research Projects Agency-Energy (ARPA-E), affiliated with the US Department of Energy. The latter two agencies offer significant and pivotal funding for the development of new technologies. Additionally, the country boasts premier and highly innovative research institutions, such as MIT.

In May 2018, the Trump administration delineated four objectives for artificial intelligence: preserving American preeminence; aiding the American workforce; fostering public research; and eliminating obstacles to innovation.

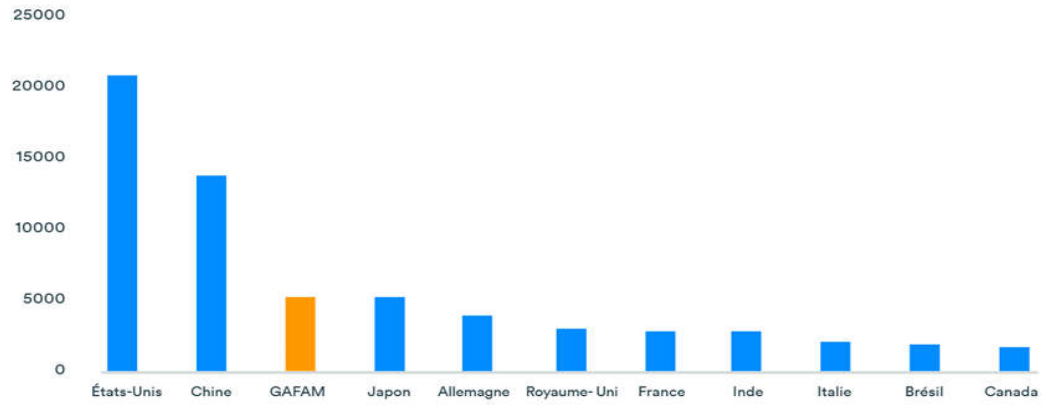
The United States possesses a de facto dominance underpinned by the GAFAM groups. As leaders in the global economy, these entities face significant risks from the advent of new technologies. Nevertheless, they maintain a substantial reservoir of resources through the data they collect daily. Consequently, they are leveraging their financial clout to invest vast amounts in AI research, positioning themselves at the forefront of innovations driven by artificial intelligence, thereby ensuring the United States retains its status as a leading global power.

Over time, GAFAM ascends in a distinctive ranking that evaluates companies and countries. In 2017, GAFAM occupied the fifth position, trailing Germany. By 2018, they advanced to fourth place, just behind Japan, and in 2020, the aggregate market capitalization of GAFAM surpassed 5,000 billion dollars, positioning them immediately behind China in the ranking.

Some may argue that our discussion pertains solely to market capitalization, asserting that the figures are ultimately detached from reality; however, we can consider alternative comparative elements. The 2020 budget of the French Ministry of Higher Education, Research and Innovation

amounts to 25.49 billion euros, whereas the research and development expenditures of GAFAM surpass 60 billion euros. Amazon alone could nearly match France's budget.

Fig n°(02) : Comparison of GDP in 2018 and the stock market valuation of GAFAM (May 2020)



Source:GAFAM: One of the world's major economies, 2020

2.2. The Ambition of China

In July 2017, China unveiled an ambitious national strategy for artificial intelligence, perceiving it as a technological revolution that will facilitate economic revitalization and address significant challenges such as industrial restructuring, climate change mitigation, pollution control, healthcare, and the rise of a substantial middle class. Consequently, Chinese authorities announced an investment of 22 billion euros in AI by 2020, escalating to 59 billion by 2025, with the objective of narrowing the gap with the United States. Furthermore, China aspires to attain global leadership in AI by 2030, with the market projected to reach $15.7 trillion.

To execute the approach suggested by the central authority, China can depend on substantial private Chinese digital groups, BATX (Baidu, Alibaba, Tencent, and Xiaomi), which now rival American groups significantly.

They depend on the domestic Chinese internet market, comprising 750 million users, and on the authorities' provision of user data. They can now invest significantly in AI research, exemplified by Tencent, which established a machine learning laboratory in 2016, and Alibaba, which allocated 15 billion dollars to a three-year research initiative primarily focused on AI. Furthermore, these entities have successfully conquered certain Asian and African markets.

To fulfill its ambition, China must address two significant challenges. The first is its reliance on the United States for high-performance processors (and to a lesser degree, chips essential for AI). This poses a substantial obstacle, prompting efforts to acquire American or European companies to obtain these technologies.The second challenge pertains to human resources: China must simultaneously attract talent and train engineers in large numbers. Regarding this latter aspect, progress appears to be occurring, as Françoise Soulié-Fogelman claimed. The Chinese have

established a significant university in Tianjin and can now offer their expatriate nationals salaries equivalent to those in Silicon Valley.

Numerous analysts concur that China has shifted from a strategy of imitation to one of innovation. Previously reliant on replicating Western technologies, China is now engaged in original invention. Furthermore, it has successfully developed world-class high-performance computing systems. The synergy between public and private sectors, minimal regulation of personal data, and the populace's endorsement of technological advancement are all advantages that position China as the primary competitor to the United States.

2.3.Other global participants

Should the two hyperpowers dominate the realm of artificial intelligence, other stakeholders also warrant consideration.

Contrary to its president's assertions, Russia has not exhibited significant ambition regarding artificial intelligence, nor has it implemented a national strategy. While AI is included in its technological policy alongside big data and neurotechnologies, the focus appears primarily on non-commercial applications: civil uses in health and education, as well as security concerns related to weaponry and facial recognition.

Russia possesses exceptional academic training in mathematics; however, it encounters numerous challenges that impede its progress. Its isolation on the international stage has facilitated the development of indigenous digital platforms, yet accessing capital remains arduous. A significant portion of its foremost researchers reside in the United States or Britain. Furthermore, it currently trails in patent filings and scientific publications related to artificial intelligence. In the near term, it does not represent a significant entity in the global AI landscape.

In the Middle East, the United Arab Emirates distinguishes itself in the realm of artificial intelligence. In October 2017, the region established a Ministry of Artificial Intelligence, tasked with two primary objectives: enhancing government services through artificial intelligence and formulating a national strategy encompassing nine priority sectors: transportation, healthcare, renewable energy, space, water management, education, technological industries, environmental sustainability, and automotive traffic.

Canada is a leader in artificial intelligence, as noted by CNRS President Antoine Petit. It boasts several pioneering unicorns, distinguished researchers, and a favorable environment. Additionally, it is actively engaged in global ethical discussions.

Conclusion:

The application of artificial intelligence on unregulated platforms demonstrates a disregard for the fundamental rights of all societal strata, as certain notifications can produce catastrophic consequences. AI applications significantly alter societal variables; the standards that previously defined modes of production and economic and social organizations are now obsolete, overwhelmed by a compressed algorithmic framework, which hinders development, leads to job losses, undermines competition law, and diminishes state sovereignty.

An existential crisis, akin to the paradigm of sustainable development, has permeated all other paradigms. It is increasingly imperative to modulate institutions and regulatory frameworks, which are pivotal in integrating artificial intelligence within the broader context of sustainable development. There is a necessity for the coordination of all powers—those of countries and major tech corporations (GAFAM and BATX)—to amplify efforts significantly in order to align and direct standards and regulations towards genuine sustainable development. The reformation of contemporary capitalism is contingent upon the establishment of international cooperation. New legislation and international institutions must be created to ensure compliance with the environmental objectives agreed upon by each country through consultation.

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