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REGULAMENTATION IN ARTIFICIAL INTELLIGENCE: AN ANALYSIS OF THE IMPLICATION AND CONSEQUENCES OF THE AI REGULAMENTATION AT CHINA, EUROPEAN UNION AND BRAZIL

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ABSTRACT

At this article the regulamentation of Artificial Intelligence (AI) between Brazil, China and the Union European was analysed to comprehend the investments at AI are been made. By the literature review and the analysis of legal documents about Artificial Intelligence, and its investments not only in promoting technology, but also at the educational field, it was concluded that China and the Union European are still investing billions of dollars in centers of research, technology and higher education and are major international players. On the other hand, Brazil's investments are lower compared to these other states, and is far from been a strong player.

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INTRODUCTION

The main objective of this article was to comprehend how the *Estratégia Brasileira de Inteligência Artificial (EBIA)* could reflect at the governmental decisions, thus to the society impact and how it the plans of becoming a digital player when the dominance of few players causes anticompetitive concerns (Peng, Lin, and Streinz 2021). Therefore, this article analysed other nations that were ahead at the Artificial Intelligence application, principles and regulations, as China and the European Union. These study exposes how different were the plans and law's approach for the AI regulamentation between China, Brazil and EU. In principle, Artificial Intelligence is a relevant subject to the law and international affairs since that it has been modifyingthe way the economic relations are played, because of the gross impact that it has at social medias, digital and the economic production; besides the regulations can also affect agreements at the humanitarian field and have a great power in influencing other countries (Mannes 2020; Filho 2018; Peng, Lin, and Streinz 2021). The methodology used is the qualitative theoretical analysis and the bibliographic review of Brazil, EU and China's AI legislation to understand the results of the AI's application in consonance with the historical, social and educational perspective; and the quantitative perspective with the comparison of the GDP's investment at educational and technological field.

The first topic develops the introduces what is AI, as a machine that simulates human intelligence and resolves problems in a much greater speed than humans could not ever imagine, by which the main toll is the large amount of data transmitted and used, which due to Covid-19 had increased exponentially (Forradellas and Gallastegui 2021; COM (2020) 65 2020; Straus 2021, 148). This change implies an impact at the economic and competitive activities as the increase of the company's profits (Bughin et al. 2018). For this reason, at that same topic a discussion over governance and what is actually been done to keep a competitive level at the international field, because the high effectiveness of the AI will change the governmental structure and affairs. The next three topics demonstrates how each of these States are acting on the AI theme. The second topic, delve the China and CCP's regulations by the influence of the 13th and 14th plan at an authoritarian government which uses soft power and it's on agenda of what is democracy, human rights and spirituality in order to expands their technological and influence internationally. This perspective enlarged positively its trade balance, due to the continuous positive balance in GDP and increased the AI patents and technological advances, in addition to investment in education and the expansion of research centers. The third topic, on European Union regulation is under the premises of the European Commission which indicates a robust and good analysis of how AI affects all the EU within a democratic and human oriented context. Their debate shows that the investments are aligned with ethic, values and principles that are the

same as ONU's principles. As well, these investments have the objective to become a HUB reference and an AI player (COM (2020) 65 2020). The fourth topic describes how Brazil have been adopting regulatory measures to go further at the AI discussion and to have some place between the big players (as EU and China). This topic shows how Brazil have been discussing it by a shor period of time and with an effort that it does not surpass the EU or China's effort or objectives. Brazil has few laws and public discussions that stablishes principles over the digital governance, and few projects over the AI theme. The main AI guide that Brazil has is the EBIA, and while China and EU have been investing billions, Brazil only spends millions to develop this technology (Secretaria Executiva do Comitê de Governança da EBIA 2021). The last topic the comparison between GDP and the AI investments made by these 3 States illustrates that China is ahead with the implementation of centers and scholar for AI, the investments at master and doctors in general and it is possible and to comprehend, analyzing the numbers of patents and influence that China has, with this perspective, that it is gaining at the economic field, becoming the top player, instead of EU and Brazil. Therefore, this paper wants to contribute with the perspective of why some nations thrive at there objective of becoming top player at some technologies and what can be done by the others, especially Brazil, to be part of this new digital world as producer, instead of becoming only a consumer. Consequently, a national, economic and educational growth is a political decision that can only be made by those in power, so this analyse has the intention to clarify the different strategies and how it affects this technology that is affecting populations worldwide and is changing the consumption and social relations.

Regulation and Artificial Intelligence: This topic debates what artificial intelligence is, how and why this is a pertinent discussion of national to have, when it can modify profoundly the way the states interact internationally and economically with each other. Artificial Intelligence (AI) is, according to Barros (2020), and in a similar idea, Forradellas and Gallastegui (2021) theysay that:

> Artificial intelligence (AI) can be understood as the simulation of human intelligence by machines and is defined as the ability of a machine to perform cognitive functions normally associated with the human brain, such as perceiving, reasoning, learning, evolving with experience, solving problems, interacting with the environment, and even exercising creativity.

This concept was formed in1956, when McCarthy, Mavin Minsky and Nathaniel Tochester created the term *Artificial Intelligence* (Russel 2019; Straus, 2021), "meaning "that computers will be 'as smart as humans in every aspect and capable of performing all intellectual tasks humans can'"(CCP and CSET 2020; Carvalho 2021). By 2011, a technic called *Machine Learning* was invented and changes happened, the "method of data analysis, uses algorithms that interactively learn from data, […] which allows computers to find hidden insights without being explicitly programmed where to look […]" (Bratko 1994, apud Straus 2021). Programmers went further and created the *deep learning techniques*, "a form of machine learning that enables computers to learn from experience and understandthe world in terms of a hierarchy of concepts" (Su and Flew 2020), and it "began to produce dramatic advances in speech recognition, visual object recognition, and machine translation – three of the most important open problems in the field"(Russel 2019). This engineering improved the capacity of data absorption and the generation of a condensed and organized information that helped to make better and useful decisions, by not only collecting and analyzing, but also learning (Filho 2018). Nowadays, with the internet increasing and after Covid-19 the "world creates an unprecedented amount of data every day, feeding algorithms the raw material needed to produce new insights." (Bughin et al. 2018), as one of theimportant international discussions was about *data protection*; such augmentation amplified the need to AI regulation, because the "International Data Corporation estimates that there may be 163 zettabytes (one trillion gigabytes) of data by 2025, or ten times the data generated in 2016" (CCP and CSET 2020). The impact of AI changes all the global value chain, according to Bughin et al (2018, 49–50), at the macroeconomic factors as labor substitution, product and service innovations and "an adjustment in foreign direct investment for the reinvestment capacity of profit flows, and a trade adjustment in the effect on competition".

In this sense, when Artificial Intelligence becomes part of international discussion, and the "massive acceleration of technological evolution itself "driven by a massive expansion of our ability to store, process and communicate information using electronic devices"(CCP and CSET 2020), in a cheaper and faster way (COM (2020) 65 2020), it is important to discuss the economic and "regulatory components" (Marques 2019; Parasol 2018). To some nations the focus at artificial intelligence implicates an economy growth, the defense of human rights or the possibility to increase its power range (Mannes 2020; Cheng, Chang 2013 apud Filho 2018). Consequently, the artificial intelligence brings the relations affairs to a new level, ignites the oldest questions and new ones about influence, power and how all the regulations (patents, technology, robots, programs, ways of analysis, etc.) are being extremely thanked through to protect nations governance, its people, its beliefs, and its spiritual conceptions. By all means, at the international field, theoretically, nations have no superior authority above others, they have sovereigns. Simultaneously, they are willing to proceed in agreement with others, regard some boundaries, and even be part of an international organization, at the exact measure that these objects are part of a pact (Rezek 2014, free translation) with their people's best interest. The fact is that one cannot lose sight of the fact that every policy, whatever it may be, results from an intention, that requires a certain project in which different resources are activated in order to achieve certain goals. A cultural policy, as it should be, is directly related to the objectives of a political project (Marques 2019, emphasis added). Laws, in general, are projected to protect, control and discipline the human's behavior (Mazza 2019), and when it comes to a national regulation, that revolves to the international field, the discussion becomes more relevant, especially at the new AI's application. As Peng, Lin and Streiz (2021) said

> it is a mistake to believe that AI or other digital technologies occupy a virtual space detached from the physical world.", because "governments around the world are contemplating various forms of AI regulation, ranging from "AI ethics" over transparency requirements for public and private algorithmic decision-making to outright bans of certain AI use cases (such as governmental use of facial recognition technology). At the same time, governments are frantically racing to develop nationalAI strategies to develop their digital economies, AI technologies trigger and channel political and economic pressures, as evidenced by intensive lobbying and engagement in different governance venues for and against various regulatory choices, including who and what will be regulated, for what purpose, by whom, and how.

Therefore, the next four topics will analyze how China, European Union (EU) and Brazil are investing time in AI's regulations and AI investments in educations to improve its relevance into the international affairs.

China, Regulation and Artificial Intelligence: In this topic, it will be discussed how China make its politics strategies, regulations and influences for innovation strategies and their perspective of governanceregarding actions and objectives in the implementation of Artificial Intelligence, by analyzing the 13th and 14th plan and their investments in AI education.

- China and Political Strategies Plan: China has been ruled by the Chinese Communist Party for 70 years, it has been under Xi Jinping leadership since 2017. Since 2003, in Hu Jintao period, the Soft Power concept became part of China's national strategy, and it is reenforced at Xi Jinping govern (Filho 2018), to strengthen power into the social norms, values (Mannes 2020) and spiritual field, even though CCP uses hard power into the military, economic and digital

field (Cheng, Chang 2013 apud Filho 2018; Sánchez and Akyesilmen 2021; CCP and CSET 2020) on formal governmental regulation and policy. Likewise, the culture perspective influences China's politics and the core values that are hierarchically used by their actions in the "democratic (elitist) or authoritarian (excluded)" govern (Marques 2019).

By 2016, the 13th Quinquennial Plan was released, and the plan was to build smart cities with the goal to improve its range of technological sage (Internet of Things, cloud computing, big data and spatial geographic information systems), and understand the state's critical infrastructure, which makes cyber security a governmental responsibility to protect key infrastructure and data breaches, as to reinforce the security discourse over their people, but also it can arouse international suspicions of a nascent dystopia (Parasol 2018). In July, 2015, President Xi Jinping said: 'without cybersecurity there is no national security'." (ROBERTS, 2021). This implies not only a connected nation, but as well as a narrative influence inside and outside of its frontier (Marques 2019), for example, the usar of social media influencer to produce posts prizing the regime symbols and the CCP's revolutionary history (King 2017, Filho 2018). In 2020, they released the 14th Five-Year Plan for National Economic and Social Development and Long-Race Objectives for 2035, with a "scientific development concept, […] for a new era as the guide" (CCP and CSET 2020) to be used to "resolutely implement the new concept of innovation-based, coordinated, green, open and shared development; and adhere to the general work principle of pursuing progress while ensuring stability" (CCP and CSET 2020) on socialism with Chinese characteristics, in consort with "teaching of patriotism and strengthening cyber-civilization construction and develop a positive and healthy online culture" (CCP and CSET 2020).

These intents are likewise linked to a "cooperation with other great powers, deepen relations with neighboring countries, […] uphold the international system with the UN at its core an international order with the international law as its foundations, and jointly respond to a global challenge" (CCP and CSET 2020). In unison, they plan to build a cultural diplomacy by enlarging their global presence by international broadcasting, dissemination of Chinese culture abroad and the investment in the *Belt and Road Initiative (BRI)*, with the aim of expand its capacities, technology and power over the international field (Su and Flew 2020). The culture issues are imbricated within the politics at the 14th plan, the intent to become part of a social construction in which their socialists' values and spiritual principals is perpetuated by the setting of international rules and digital field "in the reform of the global economic governance system"(CCP and CSET 2020). To achieve that idea, in "June 2019, China's National New Generation of Artificial Intelligence Governance Committee postulated harmony, fairness and justice, respect for privacy, safety, transparency, accountability and collaboration as ethical principles to control the area of AI development (O'Meara 2019)" (Straus 2021). As the 14th plan (2020) bdefines:

> We will promote deep integration of the internet, big data, AI, etc., in all industries, promote cluster development (集群发展) in advanced manufacturing industries, build a set of strategic and emerging industry growth engines with distinctive features, complementary advantages and rational structures, and foster new technologies, new products, new industrial formats (业态), and new models. We will promote the healthy development of the platform economy and the sharing economy; and will encourage enterprise mergers and restructuring, and prevent low-quality and redundant construction.

Besides the plan is working fast and truly changing the economic balance, the investments that China is making in military material is a concern elsewhere (Straus 2021). Thus far, China is now the nation with more AI patents than any other, including USA (European Commission et al. 2018), they have a more cybersecurity infrastructure more proactive than EU efforts at the same endeavor (Triolo et al. 2021), and the Chinese "economy is characterized by a higher rate of capital reinvestment", even more than European's. This increases AI's value potential, especially because AI will also have a role pushing China into a more sophisticated and consumer-oriented economy" (European Commission et al. 2018).

China, Artificial Intelligence and Investiments: CCP (2020) had been investing hundreds of dollars not only in industries, but also in education and people's development,

> We will focus on aim on artificial intelligence (AI), quantum information, integrated circuits, life and health […]. We will formulate strategy science plans and carry out strategic science resources among research institutes universities an enterprises, and we will promote construction of national laboratories and reorganize the national key laboratory system. We will lay out and construct comprehensive national science centers and regional innovations hubs […]; and we will build national high-end platforms for the exchange of scientific researches papers and S&T information (emphasis added).

By all means, their plan is altogether with development of the AI technology, and it has three steps to make this happen: the first by 2020, "in developing a "new generation" of AI theory and technology", the second up to 2025, "to achieve a "major breakthrough" in AI technology and the application of it, which will lead to "industrial upgrading and economic transformation"; and the last one, "between 2025 and 2030 sees China become the world leader in AI, with the industry worth 1 trillion yuan." (ITSRIO 2020). Likewise, China was planning to build 50 graduation and postgraduation centers worldwide, 50 open courses, 50 Universities of AI and research institutions, 2 organizations focused in AI at National University of Defense Technology to train more than 200 researchers, have a partnership with enterprises focused in AI studies and build a technological center with US$ 2,1 billions, at Beijing (ITSRIO 2020). Since the 13th plan, the nations have been seeing an enlargement of China's economy, the GDP has been positive, even with the Covid-19. This will be better described at the last topic of this article. That being said, China's policy increases their geopolitical force with the expansion of their presence, by enlarging their actions and increasing technology and specific AI (Bijos 2016; Filho 2018; CCP and CSET 2020; BBC 2019) law regarding:

> "pursuing a range of products and applications of AI; cultivating an AI industry; including an extensive government funding and investments along with a focus on attracting and developing leading talents in AI. By 2020, China plans to have achieved major progress in next generation AI technologies, including big data, swarm intelligence, hybrid enhanced intelligence and autonomous intelligent systems" (European Commission et al. 2018).

China is economically and technologically distant from the most of nations, because of its political capacity of plan's implementation at a great performance, even if its governancehas been fundamentally Marxist-Leninist, differing from the others.

European Union, Regulation and Artificial Intelligence: The European Union (EU) emerged subsequentlyat the end of the Second World War when the European nations felt unsafe and powerless between the US and USSR, at Cold War. For this reason, the European states integrated themselves economically and politically in order to seek the securitization of its people (Bijos 2016; Franco 2013). In 1992, the states signed the Maastricht agreement where three pillars were central for the EU: human rights and cooperation as a permanent objective; international cooperation's by the shared objectives and principles; and peace as an evaluative framework within the scope of the UN system. These pillars werebased on fundamental principles: democracy, the rule of law, the universality and indivisibility of human rights and fundamental freedoms and respect for the principles of the Charter of the United Nations and international law (Martin 2012 apud Franco 2013). By 2009, they renewed the accord and signed the Lisbon agreement, making the EU more cohesive by extinguishing some internal divisions as the three

pillars of Maastricht, and uniting areas and political actions in only one force: a single institutional structure. At the same time, the European Commission was created with the main objective to "shape the EU's overall strategy, propose new EU laws and policies, monitor their implementation and manage the EU budget" (Franco 2013; Bijos 2016). After this changes, the EU nations developed a higher sense of political engaging between themselves. Not only they were preoccupied with security, but also with a new international order based in the in effective multilateralism, and one of the principal themes is the democratic governance throught out the world (Franco 2013; Wan 2006).

Since the EU is integrated with the international field and their preoccupation about security is major, the recent advances with AI became a concern. In 2019, it was reported that China was alluding AI in "military-civil fusion policy", then with a discourse that it was necessary a "legal and ethical qualms" to deal with AI. The G-20 and OCDE decided "to develop new disciplines in regulating the development and use of AI technologies" (MCTI 2021; Wan 2006; Peng, Lin, and Streinz 2021), and the "European Commission realized the necessity to adopt measures to cope adequately with the technological change generated by AI technology" (MCTI 2021; Straus 2021). To the European Commission, the AI regulation is fundamental to achieve the Sustainable Development Goals (SD5GS), especially in the sense of "supporting the democratic process and social rights" (COM (2020) 65 2020), and furthermore, they were preoccupied in "identifying good practices and common strengths on which the EU canreinforce its position as a top AI player at global level" (COM (2020) 65 2020). Additionally, they understood that they were behind at this endeavor with the results of the "Usa-China-EU plans for AI: where do we stand" document (2018). Therefore, principles, values, guides were debated just to develop the ethical foundations of AI to ensure that this technology would be at the service of all Europeans (Cyman, Gromova, and Juchnevicius 2021; COM (2020) 65 2020). They publishing"The European Commission of the European Strategy on AI", in April/2018; the "Guidelines for Trustworthy AI", in April/2019, and an "Assessment List for Trustworthy AI", in July/2020, to "debate the technological and societal implications of AI" (COM 65 (2021)) with 4.000 stakeholders. At the European Commission, 2018, they notice that the AI could "contribute up to EUR 13.33 trillion to the global economy in 2030"; and that China would have gain,in their Gross Domestic Product (GDP) with AI technology, approximately 26,1%and Europe (north and south) approximately 21,4% (Cyman, Gromova, and Juchnevicius 2021; Forradellas and Gallastegui 2021). In 2020, the White Paper exposed "a number of measures to foster an ecosystem of excellence, leading up to today's revision of the coordinated plan" and a "set out policy options for a future EU regulatory framework to safeguard an ecosystem of trust in Europe, setting the scene for today's proposal for a regulatory framework for AI."

In 2021, they organized '*A National Strategies on Artificial Intelligence, A European perspective"* to regulate the basis of the use of artificial intelligence, to ensure that the Europeans citizens could have confidence, in the technology, that the fundamentals rights are protected, at the same time that they are strengthening investments and innovation in AI (Forradellas and Gallastegui 2021).

> On the whole, it is a good starting point to ensure that the development of AI in the EU is ethically sound, legally acceptable, socially equitable, and environmentally sustainable, with a vision of AI that seeks to support the economy, society, and the environment. This is no small ambition, and it will take time and effort to reach a final text that can come close to fulfilling it. Yet, the ambition, like von der Leyen's pledge, remains substantially reasonable because the EU is ideally placed to deliver such a normative framework. […] This is a proposal, and it may take a couple of years before it will be finalized and become binding (the process took 4 years for the GDPR (General Data Protection Regulation 27, 2016), followed by an implementation period (of 2years). (Floridi 2021)

The European Commission continues "to lead progress in the algorithmic foundations of AI, building on its own scientific excellence" (Bijos 2016; COM (2020) 65 2020). They claim to have 32 of the 100 global top AI research institutions; 64 directives and regulations; but they are preoccupied with AI technology's flaws, the development of products and services, and to improve legislative framework (Brasil, Ordinance N° 1.556/2018 2018; Straus 2021). By 2018, the Commission planned to invest "US$ 3.05 billion in 1.000 innovation project and 3.000 at viability, reinforce AI centers of excellence, with public and private investments between US$ 4 billion to US$ 6 billion, a program with innovation center, and the Horizon Research and Innovation Center with US$ 1,7 billion by the end of 2020" (ITSRio 2020). At that same year, they announced they were devoting €1.5 billion to AI research funding through 2020.

Some other projects that EU were compelling at 2020, analysed by Straus (2021):

> "a pilot scheme of €100 millionin Q1 2020 to provide equity financing for innovative developments in AI, […] to support universities and higher education institutes to attract professors and scientist for leading a matersprogrammes in AI, […] and invest about €4 billion under the Digital Europe Programme to support high-performance and quantum computing, including edge computing and AI, data and cloud infrastructure".

By this, it appears that both China and EU have equal plans to enlarge the AI machinery, by investing a high quantity of money at industries, research centers and specialized labor work. That leaves up to the question, how Brazil is working to keep up with the pace?

Brazil, Regulation and Artificial Intelligence: If the EU is behind at AI technological investments and regulations, Brazil is far more distant. Though, Brazil's politics, within the last two decades, is involved with great international themesin the international community. For example, the established dialogue with China, India, Russia and South Africa that formed the BRICS, and the partnershipwithof the Organisation for Economic Co-operation and Development (OECD), that guides some of the Brazil's regulations, such asthe Artificial Intelligence theme. Those relations benefits Brazil from the connected global power shifts (Leia Bijos 2016), it simplified the changes at financial markets, improved the global interaction between Brazil and other countries. This is an important matter, because as some other countries that have issues of global governance, social, economic, political and environmental problems, they are also an international problem that no nation can be unaware of. In addition, as the AI policy decisions emerges, among others technological themes, they are being address to be used on governmental level within the perspective of changing these problems (Bijos 2016).

Nevertheless, the first attempt of Brazil's regulations of AI was only in 2018, to expand its actions worldwide, by increasing the education, commercial, financial, personal at AI and the data flow between other nations (Secretaria Executiva do Comitê de Governança da EBIA 2021). The law project "National Systema for Digital Transformation", decree n° 9.319/2018, followed by the ordinance 1.566/2018, *Estratégia Brasileira para a Transformação Digital*; the legislative proposal nº 21/2020 that stablishes the AI's fundamentals, principles and guidelines to the development and apply it at Brazil; surveyed by the *Estratégia Brasileira de Inteligência Artificial e seuseixostemáticos – EBIA*, ordinance n° 4.617/2021. The law decree n° 9.319/2018 and the law ordinance n° 1.566/2018 dialogs with each other, the first one aligns the executive strategics with the digital era to an economic and social sustainable development, with four pillars: research and innovation, infrastructure, reliability at the digital environment, education and international dimension; the second recommend the elaboration of the long-term strategies for the digital economy. By the combination of these two laws, the EBIA was created. EBIA (2021), a basic guideline for the use of AI, organized these pillars with three thematic axes (legislation and ethics use, AI's governance; international aspects) and six vertical axes (qualification

for a digital future, jobs and capacitation, research and development and innovation, application at the productive sector, application at the state, public security). Therefore, EBIA had just given more details to how implement AI and the importance for its development from a social and economic perspective.

The main focus of EBIA is to guide the improvement of researches, investments in education, development and innovation to AI solutions at the productive and social environment. Ethics and human oriented are other principles observed at this law, as points OECD guidelines for AI (Bijos 2016), also it is similar to what the EU and China are building, regards its differences. As the EBIA does not establish a pragmatic perspective within its principles and fundamentals, neither informs how much it is necessary to invest for the implementation of AI, startups and other competitive technology, it remains without a realistic influence and lacks of social and economic analyses. Brazil is also preoccupied with its international influences, since one of the action's dimensions is to become a leadership at the global forumsrelated to competitiveness, by the presence of national companies abroad and promoting digital economy regional integration (Brasil, ordinance 1.566/2018). Regardless of the openness of global financial markets that augment the global interaction between neighbors and distant lands, Brazil has deep inequalities that needs to addressed, even with the "prospects for achieving prosperity and durable growth" in its AI policy (Bijos 2016). On the other hand, Brazil has already a major agricultural and mining producer industry that could be enrolled at the economic development with AI technologyto improve its economy, since nowadays the "use of artificial intelligence is also the subject of government-level work in Brazil" (Cyman, Gromova, and Juchnevicius 2021).

To be relevant at the international competitiveness, it is necessary that Brazil starts to invest in better and more advanced education, at research centers, and digital business, and the creation of skilled jobs (Cyman, Gromova, and Juchnevicius 2021), as EU and China are doing. Until 2021, China had invested 45 million dollars only in AI's startup, Brazil invested 111 million reais (50 million at innovation projects and nearly 60 million at AI centers, in five years), which is around 22 million dollars, which is relevant for becoming a reference at the Global South. Besides, at BRICS, Brazil has the lowest classification at talent attraction, and professional and technical abilities in all areas, even if at Latin America Brazil's is accountable for more than 2.49 billion dollars investments, in general (Ordinance n° 4.979/2021). By march 2022, the Brazil's Federal Government released a public notice of R$ 820 million reais to invest since AI Startups for agriculture, health, industry, tourism and smart cities sector to Amazônia digital transformation (Edital de R$ 80 milhões, 2022). It shows a major change of perspective, even though this investment is not enough to compare fairly with what China or European Union have been doing over the years.

Comparison Brazil, eu and China: this topic will examine the investments that were made in the education field to AI technology, by analyzing the percentage of GDP in tertiary education, the number of masters and doctor's degree and AI centers or investments through the years, since 2016 to 2019/20.

Moreover, it is pertinent to evoke that the educational investments and the higher gross product maybe be linked to an aspect of the nation's growth, but cannot be looked as the only aspect for a higher or lower nation's incomes, as informs Wan (Kindleberger 1964 apud Wan 2006):

> "Various studies have claimed to show that economic growth cannot take place without an educated workforce, but the exact nature of the causal link between the two remains undetermined. Economic growth may have taken place because of rising education in certain countries such as Germany and Japan, but until a clear methodology can demonstrate that education precedes any economic development, it is equally plausible to suggest that nations which have experienced fast economic growth and increased wealth have consequently been able to invest more in education."

Often is considered that a high investment in education and other areas is sufficient to produce a more equality or a less poor society, and this may not be completely true, for example, in Brazil, 2018, GDP's investment for education was 6%, and still school's performance had not been great (Brazil spends, 2022). Therefore, a national, economic and educational growth is a political decision, with a focused governmental plan, that can only be made by those in power. Thus, these analyses will show how all the political decisions made by the nations above is a matter of good investment with big plans and perspective for its people, nation and economy.

Gross Domestic Product (GDP), Investiments in tertiary education and number of masters/doctor's degree: The GDP is a used analyses method that measures the total market value of the good and services produces to quantify the nation's economic activities. This helps the policy makers to understand how the nation is growing, and in what matters to invest more or less. Therefore, by using the GDP this article bases it itself in a standard measure to understand the nation's AI investments.

Chart 1 - Gross Domestic Product (% annual growth)

Nation	Year					
	2016	2017	2018	2019	2020	2021
China	6,80	6,90	6,70	5,90	2,30	8,1 (estimated)
Brazil	-3,30	1,30	1,80	1,40	-4,10	5 (estimated)
EU	2,00	2,80	2,10	1,60	-6,20	5,2 (estimated)

Source: The World Bank – Data

In principle, it is estimated that China's GDP growth, in 2021, will reach 8,1%, but will decrease to 5,1% between 2022 and 2023, as to Brazil the GDP is estimated to "reach 5% in 2021, but to slow down to 1.4% in 2022 and 2.1% in 2023", and the EU's GDP, in 2021, would be "5,2%, by 2022 it is projected to expand by 4,3% and in 2023 to 2,5%." (OECD 2021). China's GDP remained positive even with the Covid-19 pandemic, despite of its lower value compared to previous years. What made them maintain a good GDP was the "strong reopening of overseas economies and robust investments" (OECD 2021). The next chart shows the GDP's investments at the Tertiary Education. If a country has a high GDP, it seems logical to assume that it can invest more than another that has lower GDP. However, all have the same expenses as health, culture, economy therefore, the investments may be proportionally, because with a higher income even the smallest percentage is a great assume of money, which it can be seen at the Chart 2.

Chart 2. Tertiary Education (% investments of GDP)

Nation	Year		
	2016	2017	2018
China	4,2	4,1	3,6
Brazil	1,39	1,53	1,41
EU	0,8	0,8	0,8

Source: China: Stas, governmental data; Brazil: INEP, open data, educational indicatory (2018); Europe, Eurostat (2021).

It is noticeable that China invests more than the others in higher education, and there is a reason, for CCP's project the eradication of absolute poverty pervades an educational expense (OECD 2022). Wan (2006) affirms that:

> "Chinese scholars generally agreed on the long-term benefits of higher education expansion, in a longer perspective, with the rapid introduction and development of new techniques and technologies, combined with competitive pressures arising from increasingly globalized and integrated economies, it was argued that expansion of higher education would help boost future rates of economic growth."

Brazil, on the other hand, invested more at employment support and health spendings for the past two years, and have been diminishing

the educational investments (Câmara dos Deputados 2021), in principle because of the pandemic situation, but on the other hand, it was a governmental plan to diminish the educational expends through these last four years (Saldaña 2021). This can be seen at the Chart 3, where the number of China and EU's doctors and master are higher than Brazil's. However, the EU's numbers are much higher due to the great number of countries that belong to the block.

Chart 3. Number of former Doctorate and Masters in General

Nation	Year			
	2016	2017	2018	2019
China - Master'sDegree	509.000	520.000	543.600	577.000
Brazil - Master'sDegree	59.614	73.924	66.993	70.071
EU - Master'sDegree	5.405.725	5.484.642	5.605.948	5.669.066
China - DoctorateDegree	55.000	58.000	60.700	63.000
Brazil - DoctorateDegree	20,603	22.056	23.476	24.432
EU - DoctorateDegree	754.750	760.167	771.559	763.204

Source: China: Ministry of Education, the People's Republico of China; Brazil: GeoCapes; Europe: Eurostat (2022).

Unfortunately, to find the number of Tertiary educations, doctors and masters focused solely at AI technology and related was difficult, at Sucupira (Brazil's scientific and educational platform) the division was not that specific, and it is correct to say that for the other nations this statement is still real.

Investiment at Ai's Centers and its Quantity: When it comes to total numbers of AI centers prospected, from the 14th plan, China has planned 2 (two) AI organizations at Nacional University of Defense, 50 (fifth) AI universities and research centers Centros (ITSRio 2020). On the other hand, Brazil planned to create about 8 research centers, by 2020-21 (Chamada 2020), and by 2021 they created an AI program which selected 31 startups to invest (Edital de 80 milhões 2022). And the EU counts if the total amount of 32 technological research centers in its Commission reports (2018). China and EU spend a high quantity of money for technology and development, at AI China had been investing, in average, between US$ 1,7 a 5,7 billion of dollars each year (which is an average of US$ 3,7 billion). "Ultimately by 2030, China aims to become the world's premier AI innovation center and AI industry is targeted to exceed EUR 130 billion, with AI-related fields totaling EUR 1.6 trillion"(European Commission et al. 2018). EU had been investing 5,2 billion dollars, since 2017, and increasing its values at EUR $500 million each year (the values have been converted for dollar). On the other hand, Brazil had been investing around 100 million dollars instead of billions.

Chart 4. AI investiment (US$ billions)

Nation	Year					
	2016	2017	2018	2019	2020	2021
China	3,7	3,7	3,7	3,7	3,7	3,7
Brazil						0,001128
UE		5,2	5,5	6,4	6,9	7,5

Source: China: China's Investment and 14th Plan; Brazil: MCTI (2019/20); EU: Em Compass (2019) and European Commission (2018).

The numbers of doctor and masters, nonetheless, is impressively different with one another, as so as to the investments and the necessity of making a difference at this field. Then, if this is true, what is seen is that from this point further the difference in AI advances is going to be profounder. Consequently, this tendency shows that China an EU are closer to the objective of becoming real AI players at the international field than Brazil will ever be.

CONCLUSION

Artificial Intelligence is a hot topic and is changing every day's lives with the automation and the creation of products that did not exist a few years ago. Al is particle and resolves problems that are complex for a human mind, but easier and faster for a computer. The impact of AI is changing the global value chain and increasing the profit flows to some nations. The comparison between Brazil, China and EU, not only by the applications of AI, but also the way the governance influences this technological submission, demonstrates that it is not a great idea to retain for too long only in plans and not apply AI in the economic field, since the social changes and the enlargement of profits is not only real, but then again needs to be tangible. While at Brazil the spends at education are reduced, at EU or China the spends are higher and well applied. Nonetheless, when a nation decides to invest at a new technology the spends may be high, but it is showed by China's GDP that the return is major, the AI technology contributes to the construction of an international market power and influence (Bughin et al. 2018). On the same hand, the investments of educational programs are a continuous project to sustain the AI technological agenda and the economic growth that have been presenting. Then, again, what is seen is that from this point further the difference in AI advances is going to be profounder, and China will be a real international AI player, compared to the others. This paper is part of something bigger, because considering that Artificial Intelligence is already a reality and a major change at society, it calls for more studies that deepen in how this application will interfere or increase the human bias, due to the fact that this technology is made substantially by men (Soares 2001), also how it will affect fake news and increase the inequality between states. It is necessary to have a strong discussion over the legal parameters and ethical applications to guide the development of the AI technologies (SAMPAIO et al. 2020; MCTI 2019).

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