

## Industry sector role in the Brazilian GDP and Exportation Share

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### ABSTRACT

With the advent of more complex technologies, a new industrial revolution has approached, which leads to changes in several processes and the industrial sector might have a crucial role in the present days since the advanced products the society uses are all manufactured and need well develop industrial plants to be produced. At the same time during the last 20 years, the world experienced the economical emergence of new countries, and among them one was Brazil. The current essay intends to investigate the powers behind the Brazilian growth during this period, dividing the GDP composition and comparing it with other similar countries. The focus will be the manufacturing sector's role in the Brazilian economy, and whether the country is walking towards the modern advancements in society.

## 1. Introduction

### 1.1. Brazil

Brazil is the biggest country in South America, both in population terms as in territory. According to the World Bank, the country is the 6th most populous nation in the world, with a population of more than 210 million people, its gross domestic product (GDP) belongs to the top 10 world economies (World Bank, 2019). The importance of the country also relies on the richness of natural resources still found there, being the most notorious the Amazon forest, the greatest forest of the world, whose natural diversity is still yet not totally comprehended. Fortunately, despite many countries had already destructed and explored most of their nature, Brazil still has a massive number of forests, which extends to approximately 60% of the total area of the country today (Serviço Florestal Brasileiro, 2010).

Despite these good features, the country has been suffering from a severe economic crisis, as observed in Figure 1, after the GDP increased tremendously from the 1990s to the 2010s, the national GDP since 2011 has shrunk going close to levels of 10 years before. It impacts not only the economic area but other structures also such as social and political have been diversely changed in Brazil in recent years. This scenario raises many hypotheses linking a myriad of possible causes to the current bad scenario faced in the Country (Klafke et al. 2018).

Given the emergence of a new Industry Revolution and the importance it has been on process of developing countries throughout history, the present study intends to analyse the participation of the industry sector in the national Brazilian GDP and in the international trade seeking to understand the course the country's production is following, observing the trends each sector has in the last years and compare with other countries.

### 1.2. Industry

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The industry role and its impacts on our society have been more discussed since the concept that the society now is shifting from the third industrial revolution to the fourth one. How the countries can prepare themselves to this new era has also been a matter since the introduction of the Industry 4.0 idea firstly appeared in 2011 at the Hannover fair in Germany. The core idea behind it is to explore the potentials of the new technologies applying them within the manufacturing field. Some of these applications are the integration of processes in the companies, digital data collection, and the use of the internet to connect the production systems, allowing the identification, tracking, monitoring, and optimization of the processes in real-time (Rojko 2017).

The first revolution, or the creation of the industry, began with the invention of mechanical production facilities which operated using steam engines, replacing the hard and manual work. The second transformation happened when the electricity started taking place on the manufacturing process, therefore it allowed the emergence of mass production system. The next leap occurred with the production automation, aided by the development of digital technologies such as the programmable logic controllers (PLCs), recently triggered by the large use of internet and the use of cyber-physical systems (CPS) the world is experiencing the advent of the next industrial revolution (Botos et al. 2019, Xu, Xu & Li 2018, Zolotová et al. 2020). Others may say that this is not the starting of a new one, but a leap caused by the technology development that occurred in the Third one since many of the tools used were invented some years ago (Celani 2020). Despite these theoretical divergences, the use of technology, particularly sensors and the internet, in the manufacturing context has been deepened during the last ten years and presented a fast evolution, generating new solutions and technologies with an exponential pace.

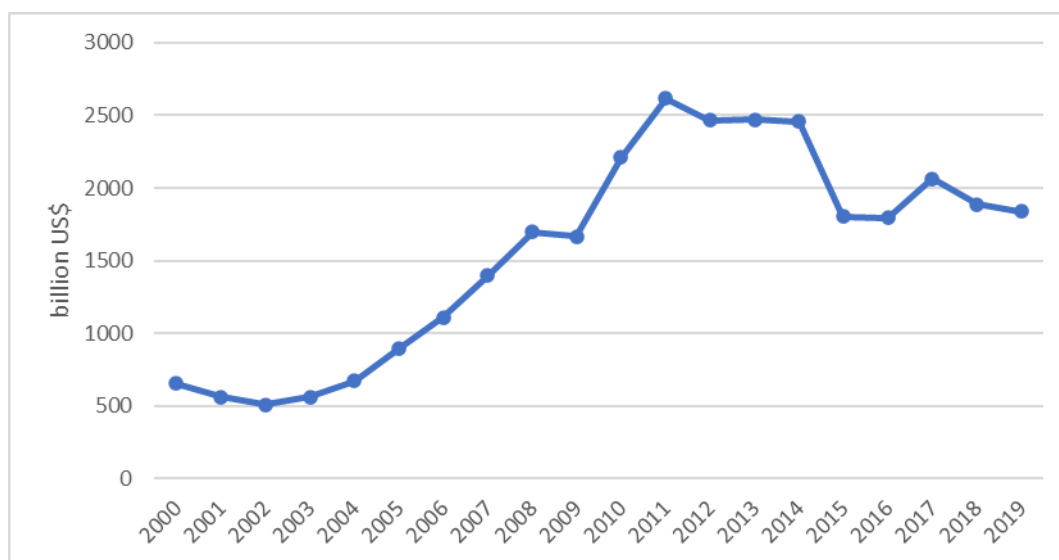
Technology can mean loss for ones but benefit for others, so it is important to any organisation be adapted to the current global trends, the industry sector is not different, otherwise it can mean loss in competitiveness. A literature research concluded that the most common benefits associated with the implementation of the technology within the manufacturing context are cost reduction in production process and project development, increasing the production quality and, reduction in production process time (Arromba et al. 2020, Füzési et al. 2020).

The process of changing the share of each sector activity in the economy is known as the structural transformation, the broad sectors studied are agriculture, manufacturing, and services, so the dynamic of each one of these is considered critical for modern economies, figuring among one of the six main features of modern economic growth (Herrendorf, Rogerson & Valentinyi 2014, Duarte 2020).

The sectoral reallocation of economic activity is claimed to be inefficient, thereby some suggest that this process should have a governmental intervention (Herrendorf, Rogerson & Valentinyi 2014). Some countries are already concerned with the new approaches in manufacturing, in addition to be the first place where the concept appeared, in 2013 Germany was also the first country where the government announced official plans to take care of these trends (Xu, Xu & Li 2018). This pioneering spirit seems not surprisingly since they have been investing much money in the manufacturing sector and have strongly supported this sector throughout recent decades (Rojko 2017). Nevertheless, other countries have already realized the importance of applying the industry 4.0 principles and some of them already have planned governmental investments and incentives to allow the flowering of this new concept. China in 2014, France and United States in 2015 also launched official programs to take care of the new industrial trends (Xu, Xu & Li 2018, Rojko 2017, Grangel-Gonzalez et al. 2016). In Brazil, the government also launched an own project aiming to encourage the modernisation of the Brazilian industry. The program called “Towards Industry 4.0” (Rumo à Indústria 4.0) was the result of a partnership between the Brazilian Agency for Industrial Development (ABDI–Agência Brasileira de Desenvolvimento Industrial) together with other initiatives of the Ministry of Industry, Foreign Trade and Services (MDIC–Ministério da Indústria, Comércio Exterior e Serviços) (Dalenogare et al. 2018).

There are three significant indicators that are most used to evaluate the sectorial level activity: employment shares, value-added shares, and final consumption expenditure shares. Although some works have considered the three as interchangeable when a study is being carried out it is relevant to indicate a basic difference among them. The final consumption expenditure as the name suggests,

encompasses the consumption behaviour of a given society, whereas the first two are associated with the production economic aspect (Herrendorf, Rogerson & Valentinyi 2014). Since the present analysis is more focused on the production aspects the value-added will be more used throughout the essay.



**Figure 1.** Brazilian GDP (current US\$) (WORLD BANK, 2020)

### 1.3. International Trade

The investigation of the trade of a given country is justified by its consequences on the development process. With the increase of the interconnection among the countries a solid and diverse international trade structure can lead to enormous benefits, especially as a way to emerge developing countries and upgrade the quality levels of their citizens, in other words, it is an alternative to advancement, once studies have shown that international firms outperform companies which limit their trade nationally. This fact has been experienced in many countries, including Brazil (Torres Mazzi, Foster-McGregor & Estefânia de Sousa Ferreira 2021, Bernard & Bradford Jensen 1999).

According to (Ossa 2015) a diverse trade, composed of different products of different sectors can enhance the benefits from international commerce, this is particularly true when the exports are being compared, whereas the imports do not matter so much in the case of this analysis unless a total shutdown is made. Given the limited time and resources for the present study will focus more on the examination of the Brazilian exports.

Gross exportation is not the same as value-added exportation, since some products require more specialization to be done than others, thus it is valuable to consider the composition of the exportations. The added value for different categories has evolved differently over time, the manufacturing products experienced a reduction in the total value-added, partly explained by the more globalized supply chain where many components come from other countries consequently decreasing this index (Johnson 2014). Although some analyses diverge about whether manufacturing or services has the greatest value-added, manufacturing products still have greater value-added when compared to agricultural items (Johnson & Noguera 2017, Johnson 2014).

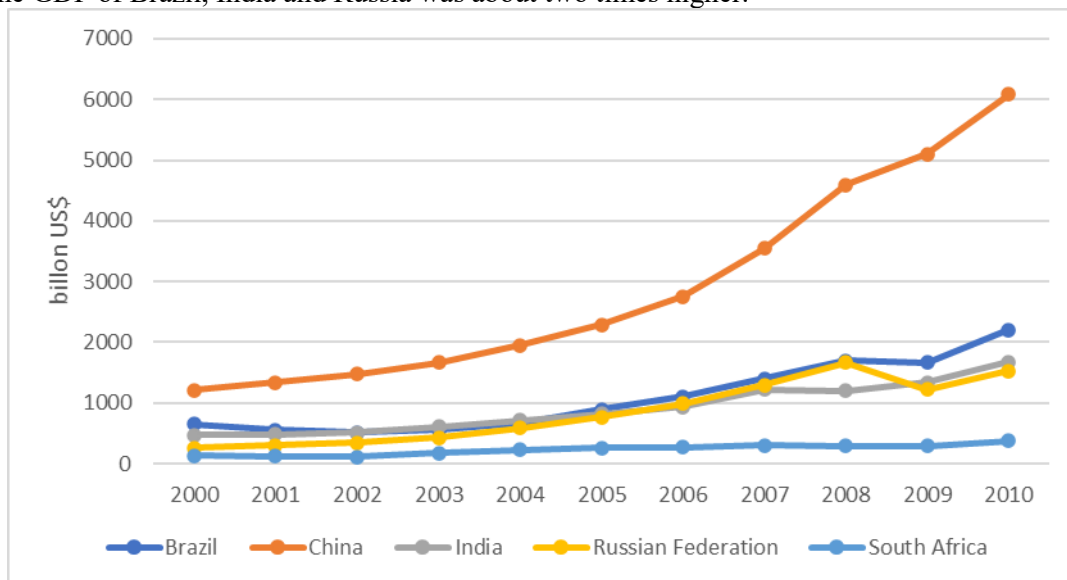
## 2. Discussion

As presented in Figure 1 the Brazilian GDP had a significant rising during the first decade of the XXI century, some call this period an “economic miracle” since in ten years the GDP value was five times its value in 1999. Nevertheless, this “miracle” has been questioned since the development trend changed from 2015 onwards.

According to (Magacho, McCombie & Guilloto 2018) Brazil based its economy on primary resources which in turns generate an expansion in the economy, however in the long run this strategy

may lead to a constraint for the economy development, which partly would explain the behaviour of the internal product after its peak in 2011. Based on this indication, some may argue that the growth during this period was a mere contingency insofar as many other countries similar to Brazil in economic terms experienced parallel patterns. Given that common sense knowledge, this point can be showed analysing the Brazilian economic situation compared with the economy of other countries during this period.

Indeed, in 2009 during the economic rising in Brazil, a union of countries called BRICS was formed. This name is an acronym representing the initials of each nation (Brazil, Russia, India, China, and South Africa). These countries experienced a substantial economic emergence during the first years of the twenty-first century, thus the nation leaders aimed to create this group seeking to associate and thight the relations among the countries. In Figure 2 is possible to observe this similarity, since the GDP of all the countries, apart from South Africa, behaved similarly to a ramp, growing considerably. These countries shared some similarities, huge population, moderate climate, abundance of natural resources and the fact these nations were not developed countries in 2000. As is possible to observe all of them had a GDP between 0.5 and 1 trillion US\$, which given the population of them was not an outstanding performance, nevertheless at the end of the decade China was producing six times more and the GDP of Brazil, India and Russia was about two times higher.

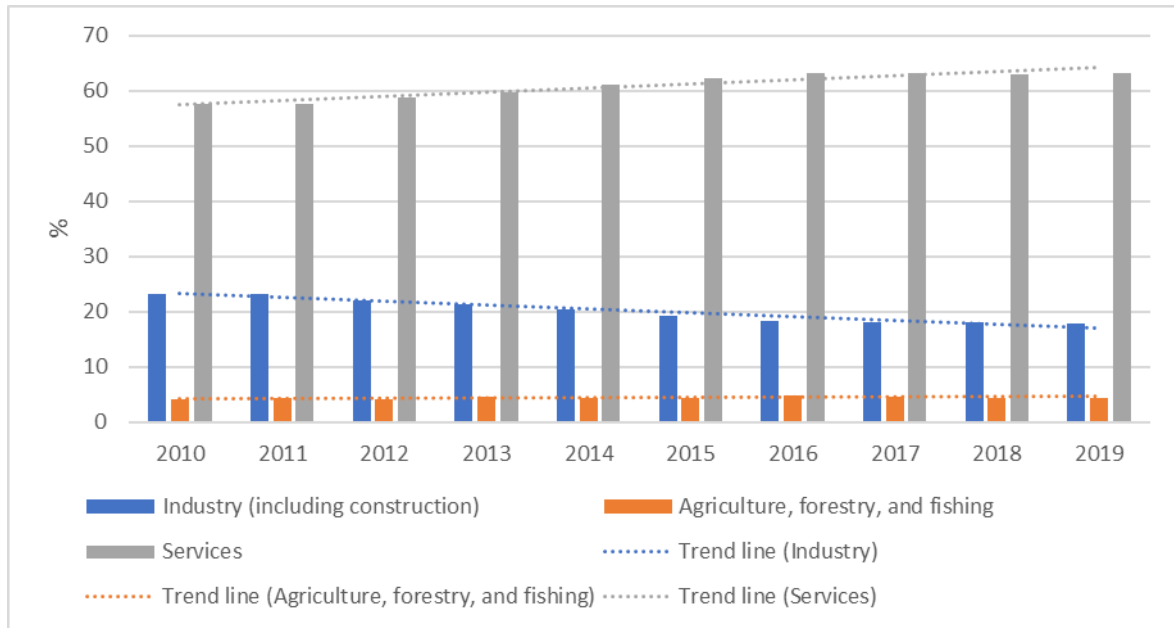


**Figure 2.** GDP of BRICS countries (current US\$) (WORLD BANK, 2020)

After having set the pairs for the Brazilian economy and realizing other countries also witnessed a similar economic pattern, in order to go deeper into the Brazilian case, it is interesting to make a stratification of the Brazilian GDP to understand the base ground for this phenomena, observing which sector impacted the most to this.

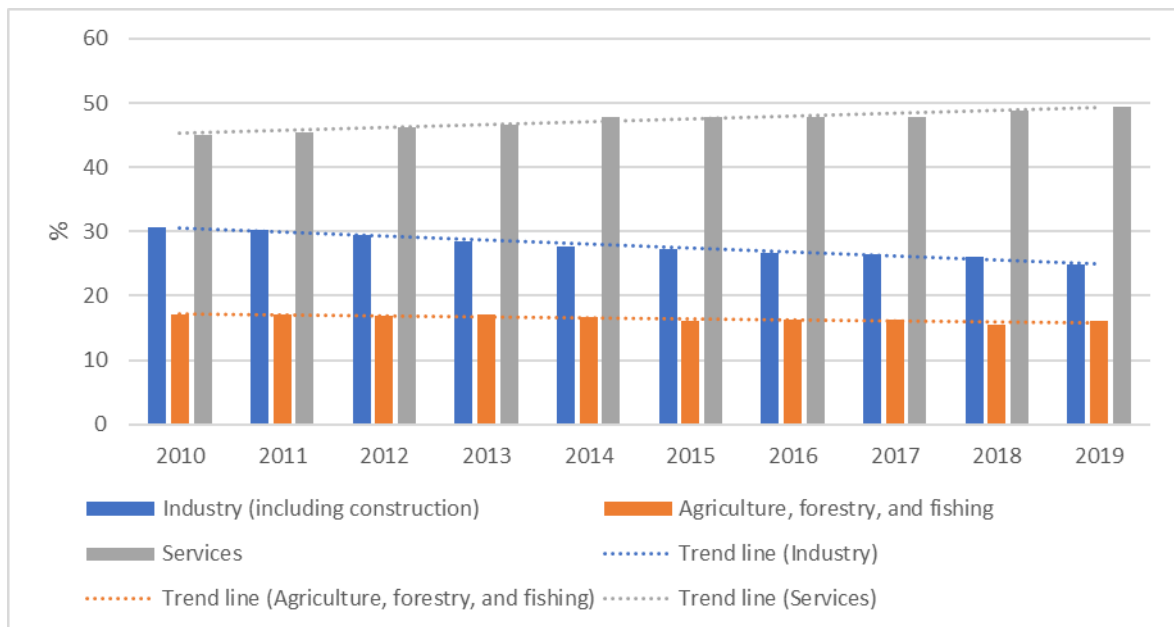
Figure 3 depicts the percentual each economical sector impacted in the total GDP, as is possible to observe, despite Brazil be a country full of natural resources, the agriculture sector did not increased its participation in the production share, the agricultural participation was kept around 4%. The sector which more contributed to the growth was the Service sector, its participation increased around 5% percent, from 58% to 63%, this can be more impressive when one thinks in absolute terms, since this increase is relative to the total GDP, which had increased dramatically as already shown in Figure 1.

Figure 3 also shows the linear trend line for each sector, it helps to observe the tendency each sector is pursuing during the last decades. It is notorious for the shrinking importance of the industry sector in the Brazilian GDP. The manufacturing category had around 23% in 2000 whereas the most recent data shows that in 2019 this number is only 17%.



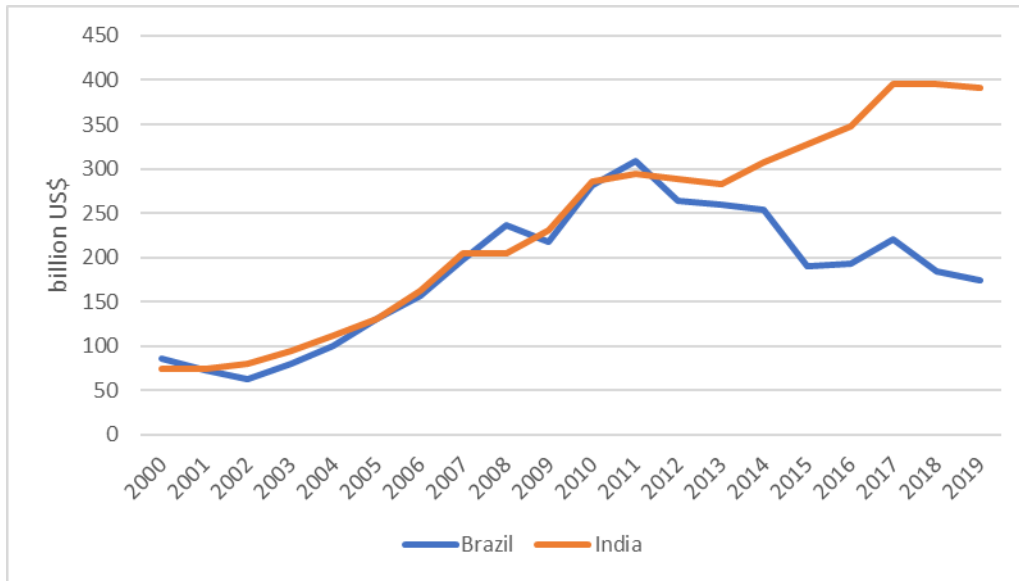
**Figure 3.** Share of economic sectors in Brazilian GDP (%), (WORLD BANK, 2020)

This fact alone shows the different proportions each sector had during the recent years, in other words, it reinforces the argument that the manufacturing sector lost importance in Brazil, which can have a particular effect that will be discussed later. To have a broader comprehension, it is interesting again to compare these indexes with a nation alike. Based on Figure 2, India and Russia had an almost identical growth trajectory compared to Brazil, but since the data available from Russia has some missing years and some can argue about the transparency about the information, the Indian data was chosen to be analysed in more detail, as displayed in Figure 4.



**Figure 4.** Share of economic sectors in Indian GDP (%) (WORLD BANK, 2020)

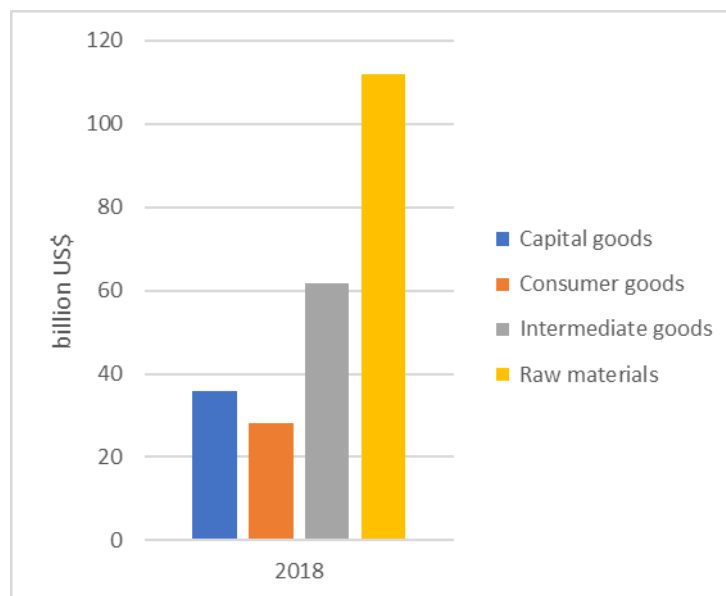
As is possible to observe a similar pattern was found in the Asiatic country. The services sector gained space in the total production meanwhile the industry lost some. Notwithstanding this number can be misleading since it depicts the relative participation, therefore Figure 5 compares the absolute values for the manufacturing sector in current value US\$. It is possible to see both countries had a similar pattern from 2000 until 2011, although from this year the Brazilian Industry observed a successive reduction in the absolute values for production.



**Figure 5.** Manufacturing value added US\$ in Brazil and India (WORLD BANK, 2020)

The Brazilian behaviour is partly in accordance with the conclusion of Herrendorf et al. (2014) and Duarte (2020) which after the examination of historical data from different countries observed a common pattern: the continuously decreasing in the relevance of the agricultural sector through the years, a growth of the service sector and a hump-shaped pattern of the industry, nevertheless it is usually associated with a process of mature development of a country, what is not the case detected in Brazil.

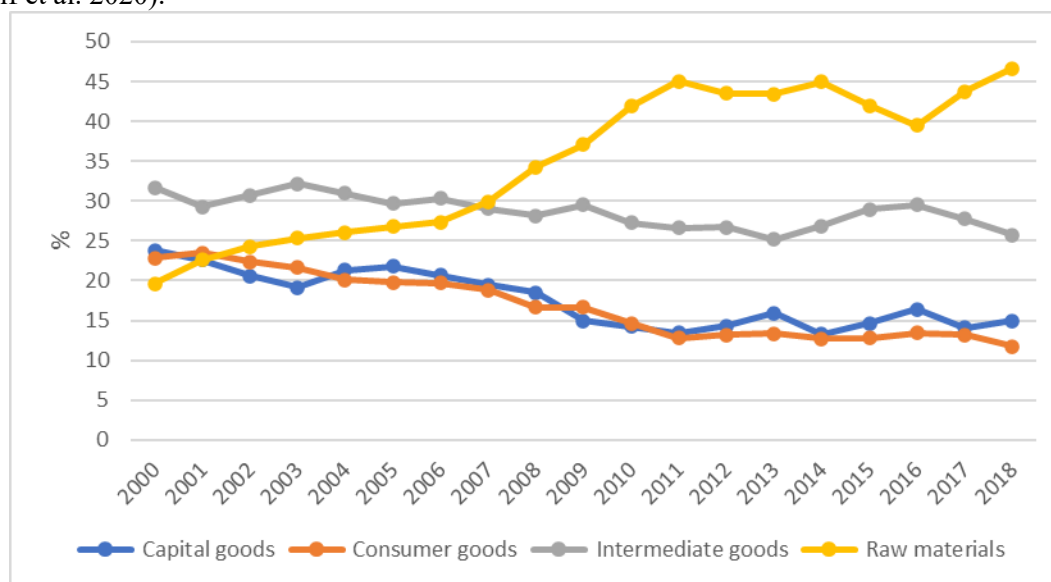
Another way to diagnose the production of a country us examining the exportation data and trace a parallel of the evolution perceived in the country and sometimes compare with other nations. When the data from the Brazilian exports are analysed the prominence of its natural resources and climate can be noted, labelling the products exported by the stages of processing, in other words, classifying the products according to the number of processes involved in making a good, the main type of product exported is categorized as raw materials, representing almost half (46.62%) of the exportations and almost two times more than the second category, intermediate goods (WITS, 2018), as observed in Figure 6.



**Figure 6.** Brazilian exports by stages of processing in 2018 (WITS, 2020)

Notwithstanding this was always the case, the notoriety of the raw materials trade is a relatively new fact in the Brazilian scenario as is possible to see in the Figure 7. In 2000, this category represented only 20% of the international trade exportation of the country, consequently is possible to conclude during the last 20 years the most basic group of products has doubled its importance constituting now half of all the income earned from selling to other countries. The observance of the patterns in Figure 7 goes towards the argument some countries' development relied on the increment of the primary products, both by the rise of the prices of these products as well as a governmental strategy to grow (Magacho, McCombie & Guilhoto 2018).

As it is known not only the volume of products sold matter, but it is also valuable to observe the value added to produce the goods. The value-added of more complex products is also higher than simpler products, therefore a nation can profit more for each unit sold by investing in the production of advanced items. Another side-effect associated with the propensity of producing more complex products is the duration of the growth (Berg, Ostry & Zettelmeyer 2012). Consequently, the fall in Brazilian growth can be correlated with this theory since the Brazilian international trade leaned strongly towards simpler products during the last years. A complementary point of view attributes the Brazilian economic stagnation in the recent era to three main factors: first, the overvaluation of the Brazilian currency; second, the focus returning the attention on exporting primary commodities; and third, the low degree of Brazil's trade openness and the high real interest rates prevailing in the period (Nassif et al. 2020).



**Figure 7.** Evolution of Brazilian exports by stages of processing (WITS, 2020)

The pattern found in Brazil, where the country focused on the substitution of more complex products such as consumer and capital goods for raw materials is contrary to the findings some studies have shown for a sustained growth. After the examination of data from different countries in the period 1950-2005 was concluded manufacturing has been vital for the growth in countries not completely developed yet (Szirmai 2012).

A complementary point of view states that Brazil is facing a regressive specialisation process, in other words, the country is walking towards the production and exportation of products with lower technology. This conclusion came out after the investigation of the effects of globalization on the international trade of Brazil for 20 years (Nassif & Castilho 2020). The trade concentration on low technologies and the stagnation of the international trade can affect not only the society on the economic and financial level but even on other social aspects. In areas that experienced higher rises in exposure to international competition a reduction in the racial wage gap of almost 20% was observed, consequently the broader contact with external entities the more social development a country might have, building then a virtuous cycle (Hirata & Soares 2020).

Throughout the different industrial revolutions different countries could benefit from the new emergent technologies and consequently these countries have developed their economies and improved many other social indicators. Notwithstanding, after the analyse of the data presented in this work it is possible to conclude Brazil has not being led by this well-known governmental strategy and the country is not aligned with the most recent trend in the manufacturing, the industry 4.0.

### 3. Conclusion

After the investigation of the recent economic Brazilian indicators and the comparison with some similar countries is possible to perceive that despite the great growth experienced during the first decade of the 21<sup>st</sup> century, the South American country is not leaning towards the strategy of sustainable development, basing most part of the economic success in the exportation of primary products and the in the rise of the service sectors. These both patterns were already observed in the literature and are extensively described. The former leads to short-term growth but at the same time is associated with the Dutch disease and does not provide a last-long alternative unless some other investments are made (Cherif 2013, Szirmai 2012). Whereas the second is more presented after a mature development stated is achieved (Berg, Ostry & Zettelmeyer 2012, Duarte 2020).

The start of a new industrial revolution is a change of the used technologies but also an opportunity to newcomers emerge and play a more important role in the global scenario, in other words, the investment towards modern technologies and the adaptation to the Industry 4.0 principles can be a driver to a nation develop its production and consequently improve social aspects. Nevertheless, it seems Brazil has lost this opportunity so far and the country is not performing a solidification in the manufacturing sector but on the contrary, the sector is facing a decrease in importance both in the exportations and in the GDP share.

The current essay intended to display an overview about the scenario of Brazilian production during the recent years and diagnose the problems behind the subtle fall in the growth witnessed since 2015. Some other studies are necessary to be made, mainly aiming to provide a deeper investigation about the causes related to the deindustrialization faced and to suggest possible actions to be done in order to change the scenario.

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