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The Economic and Social Impacts of Repaving BR 319 and their Respective Environmental Developments

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Abstract *— BR 319 is a highway of great importance for the state of Amazonas and for other states in the northern region, since the existence of this road directly influences social, economic and environmental aspects of the region. It is noteworthy that many people depend on this highway to move between Manaus and Porto Velho and, consequently, to connect to the rest of the country. This study presents an analysis of the economic and social benefits of the repaving of BR 319 and its respective environmental consequences. On a preliminary basis, it can be said that the reconstruction of the road will contribute to the increase in the generation of jobs and will facilitate the flow of production, favoring regional development. This study also suggests that the reconstruction of the road will result in a reduction in the cost per kilometer travelled, resulting in a decrease in road freight and a reduction in the value of bus tickets between Manaus and Porto Velho. The loss, degradation of natural habitats, fauna trampling, chemical pollution, anthropic invasion and the increase in violence were some of the negative impacts raised in this work.*

I. INTRODUCTION

Beginning the execution of a project that aimed to promote national integration, the BR 319 was officially inaugurated in 1976. Since then, a regular flow of vehicles has existed between cities and towns, along the road, composed by the bus lines that connected Manaus to the bus stations in Porto Velho, Cuiabá, Brasília and São Paulo, playing a fundamental role in the process of territorial integration.

One cannot fail to mention cargo transport, since, despite the navigability of the Amazon and Madeira rivers, a significant portion of the transport of food products and components to the Industrial Pole of Manaus took place by road until mid-1988. Since then, this highway has been an example of abandonment by the government, which alleged a high maintenance cost for its operation. (Silva, 2022).

In recent years, with the increase in pressure generated by public opinion around the subject, recent governments have started new negotiations with the intention of rebuilding the highway, however, there are countless difficulties for the plan of its reconstruction, with the environmental issue being the main reason. main concern, generating several debates and studies.

In mid-2015, road companies returned to open up the federal highway BR-319. However, due to the large number

of quagmires that form during the Amazonian winter, it is practically impossible to travel on this road during the first 6 months of the year. Thus, interstate transport is conditioned to the end of the rainy season in the region.

Currently, there are several studies directed towards the non-recovery of BR 319. Such studies claim that the recovery of that highway will generate a controversial economic development, combined with an unprecedented degradation in the Amazon forest. This controversy unfolds into several debates among environmentalists, stating that the reconstruction of the highway will have the potential to contribute to the formation of a kind of "arc of deforestation" (Fearnside and Graça, 2009). According to the same author, "this arc may even generate a chain effect or domino effect, extending this arc of degradation to neighboring states such as Rondônia and Acre".

It should be noted that the highway that crosses the Amazon is 885 kilometers long, and only the ends close to the capitals of Amazonas and Rondônia are in traffic conditions. The other kilometers, popularly known as the "middle stretch", represent approximately 405 kilometers of unpaved road. Thus, this study sought to present an analysis of the economic and social benefits of repaving BR 319, as well as its respective environmental consequences for the Amazon region.

II. THE AMAZON AND THE NATIONAL DEVELOPMENT AND INTEGRATION PROJECTS

For many centuries, the term "A Great Demographic Void" was frequently used to refer to the Amazon (Louzada, 2014). A mistaken classification according to the author, considering that along the Amazon River, numerous populations lived there, "always well provided with various foods".

Contradicting the "theory of demographic emptiness", Cunha (1994) highlights the existence of a large population contingent in the Amazon region, which could reach a quantity of almost 1.9 million inhabitants, according to the author. Dias, Bombardi and Costa (2020) points out that even today the population density of the region is little known. According to the author, the American Indian population contains numbers that can vary from 8 to 100 million individuals. According to Louzada (2014), even with all the technology available today, it has not yet been possible to accurately estimate the number of people who lived in that region.

Historically speaking, there has always been a concern with the population density of the Amazon, due to its dimensions and its gigantic frontier, with this the public power created occupation and national integration policies after 1964 (Louzada, 2014). According to Soares (2015), the Amazon has always been the object of various superficially inappropriate names. Some examples: untouched, infinite nature, lung of the world, demographic void, poverty region, dependent region and, more recently, lawless land. The referred author points out that all of them were and are produced by social actors who did not historically build the Amazon, by people who are not from the Amazon, although they may be in the Amazon, living off its exploitation while producing such images.

According to Louzada (2014), several policies were created with this bias of integrating the Amazon, such policies had the objective not only of integrating, but of placing Brazil in the category of developed nation, expanding investment in infrastructure works, actions aimed at for extractivism, as well as encouraging agricultural activities. However, these territorial integration policies did not adequately consider the possible consequences, as well as their environmental and social consequences. Lima et al (2017) highlight that in the 60s and 70s of the 20th century, the construction of new road axes would change the occupational profile historically established in the Amazon space. Workers were moving into areas no longer dependent on connections to the great Amazon river basin. Migrants began to look for agricultural colonies created, with state incentives, on the banks of very long highways, such as the Transamazônica and Cuiabá-Santarém.

In the view of Paiva & Pereira (2021) "the implementation of a highway plays a fundamental role in territorial integration, enabling trafficability, and mainly, economic development among the other interconnected cities".

Souza (2020) points out that, after construction, BR 319 played an important role in territorial integration, since, since then, there has been a continuous and constant flow of vehicles along the highway. The author points out that, until the 1990s, it was possible to travel by bus between Manaus, Porto Velho, Cuiabá, Brasília and São Paulo and adjacent cities.

III. SPECIFIC NATIONAL NORMS AND POLICIES RELATED TO HIGHWAYS IN BRAZIL

When it comes to national policies related to highways, since the military regime there has always been a concern to integrate the Brazilian territory, especially the Amazon. Such a policy was based on the creation of several axes of circulation, which in turn enabled interaction between different inland territorial fractions (Neto, 2015).

According to that author, the military regime put into practice this policy of national integration, through several projects aimed at the transport sector in Brazil. Among these projects, we can highlight the Plano Nacional de Viação (1964), instituted through Law nº 5.917, of September 10, 1973.

Within its lines, the respective law brings, in its Art 2, the following statement:

"The essential objective of the National Road Plan is to allow the establishment of the infrastructure of an integrated road system, as well as the bases for global transport plans that meet, at the lowest cost, the needs of the Country, from the multiple economic- social-political-military."

On January 6, 2011, with the enactment of Law 12,379/2011, among others, we have the repeal of Law 5,917, of September 10, 1973 . Within its inference, the new law in its Art. 1 provides for the National Road System - SNV, its composition, objectives and criteria for its implementation, in line with items XII and XXI of art. 21 of the Federal Constitution.

It should be noted that, within the gap between the publication of the National Road Plan (1964) and the present day, there has been the publication of several rules related to road transport. Among these publications, some relevant milestones in the history of policies aimed at the road transport sector can be highlighted, namely: the creation of the National Road Plan (1967), National Road Plan (1973), National Transport Plan (1978), 1st Stage of the Federal Highway Concession Program (1994), 2nd Stage of the Federal Highway Concession Program (2008), National Traffic System (2011), 3rd Stage of the Federal Highway Concession Program (2013), among other policies aimed at the sector (ONLT, 2020).

IV. THE AMAZON GEOGRAPHIC SPACE

Attracted by the various inputs and spices from the Amazon region, numerous expeditions left for the region in the mid-1745s (Louzada, 2014). It is important to highlight that even after four centuries of its "discovery" by the Spaniards, the Brazilian Amazon Forest remained relatively intact according to the author.

Several authors, including Louzada (2014), describe that, in the mid-20th century, migratory movements intensified even more towards the Amazon region. This time, in particular, encouraged by the integration policies of the military government, where about "200,000 northeasterners migrated to the Amazon, in search of land to cultivate and a chance to survive and raise their children", according to the author. In this way, it is very evident that the organization of the Amazonian geographic space that we know today is a consequence of these migratory movements that developed over four centuries. Explaining a little better the dynamics of this migratory movement that expanded towards the Amazon, Soares (1963) describes that the largest displacements were almost always of northeasterners who left for the region in search of opportunities, in particular, attracted by the heyday of rubber, a period of Brazilian history that was marked by the extraction and commercialization of latex.

Regarding the geographical position that the BR 319 has in relation to the Amazon forest, it is known that the aforementioned highway runs about 885 km from Porto Velho, capital of Rondônia, to Manaus, the largest city in the Amazon. It is also worth mentioning that the highway crosses around 13 municipalities that are home to 41 conservation units and 69 indigenous reserves. The area also encompasses territories that are still awaiting demarcation, as well as sites that are home to remote indigenous peoples who live in voluntary isolation from the outside world (Lonova, 2021). It is one of the most conserved areas of the Amazon rainforest according to Ferrante et al (2021).

Ferrante et al (2021) is even more emphatic in his conceptualization of the region, highlighting the fundamental role that the Amazon rainforest plays in controlling rainfall in South America and the global climate. In addition, the author points out that this biome is responsible for sheltering a wide variety of indigenous peoples and biodiversity on the planet".

V. AMAZON FOREST: REALITY AND CHALLENGES

Whenever one talks about the Amazon, one must keep in mind a forest with continental dimensions. Located in the north of South America, the Amazon rainforest is not restricted to the Brazilian territory, as it covers Bolivia, Ecuador, Colombia, Peru, Venezuela and, finally, Brazil (Louzada, 2014).

Brazil holds most of the Amazon Rainforest or Amazon Biome, which coincidentally is the entire northern region of the country, with approximately 4.2 million km², equivalent to 49% of the entire Brazilian territory, covering nine states, which they are: Amazonas, Pará, Mato Grosso, Acre, Rondônia, Roraima, Amapá and parts of the states of Tocantins and Maranhão (GREENPEACE, 2014).

According to Louzada (2014), the Amazon Biome in Brazil is routinely confused with the Legal Amazon, instituted by Law nº 1.806, of January 6, 1953, which discusses in its art. 2nd:

Art. 2nd The Brazilian Amazon, for the purpose of economic planning and execution of the Plan defined in this law, covers the region comprised by the States of Pará and Amazonas, by the federal territories of Acre, Amapá, Guaporé, Roraima and also, the part of the State of Mato Grosso to the north of the 16th parallel, that of the State of Goiás, to the north of Tocantins and that of Maranhão to the west of the 44th meridian. (BRASIL, 1953, p. 276)

No less important, the author also points out that the existence of an extensive hydrographic basin, made possible by the annual rainfall, which comprises a "gigantic forest in size and diversity, makes the Amazon the stage for beautiful spectacles in its landscape".

Regarding the occupation and territorial dimension in the northern region, Louzada (2014) reports two pieces of information that form a paradoxical concept: a gigantic territory, "bigger even than the entire northeast of Brazil and any other region of the country". In the meantime, it is opportune to highlight the demographic density of the state of Amazonas, with an average of 2.23 inhabitants/km ^{2} , as shown in Figure 01, taken from the IBGE website, 2010. In the case of the state of São Paulo, for example, this index rises to 166.23 inhab/km 2, as shown in Figure 02, also taken from the Brazilian Institute of Geography and Statistics (IBGE) website, 2010.

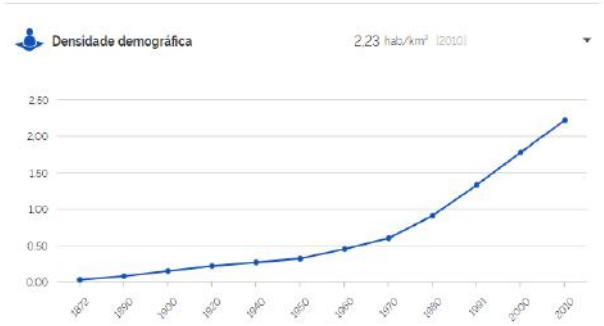

Fig.1: Graph of population growth in the State of Amazonas, since 1872.

Source: IBGE, 2010

Faced with this situation of non-occupation of territory, the author emphasizes that, for many years, the Amazon was conceptualized worldwide as a monotonous region with little compartmentalization. Then, bringing a concept from AB'SABER (1996, p.131): "Finally, a space without people and without history, subject to any manipulation through remote planning, or subject to proposals for pharaonic works, linked there is a false concept of development" (Louzada, 2014).

It should be noted that the Amazon has always been and still remains an object of concern and interest, both nationally and internationally, obviously due to its vast forest, rich in biodiversity, not fully cataloged by scientists and scholars. Faced with this situation, at the beginning of the military regime, Getúlio Vargas took power, prioritizing the national integration and colonization of regions considered uninhabited, such as the Amazon and the Brazilian Midwest (Louzada, 2014).

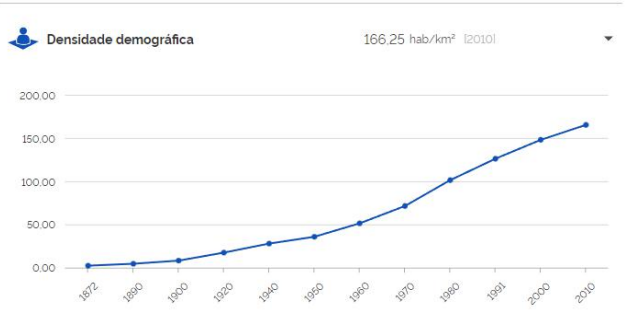

Fig.2: Graph of population growth in the State of São Paulo, since 1872

Source: IBGE, 2010

VI. ROAD MODAL AND ENVIRONMENTAL CONTRIBUTIONS

The road modal has the function of interconnecting regions, promoting their social and economic growth, in order to symbolize the social and economic progress of the population, creating positive environmental effects. However, it has several negative effects on the environment, both in the construction phase and in the operation phase of the highway (Lins et al, 2019).

The construction of highways, although producing positive effects from a socioeconomic point of view, can also have numerous negative effects on the environment, such as vegetation suppression, loss of biodiversity, soil degradation and erosion, as well as the deterioration of the natural drainage system. . Thus, the road construction process must promote environmental conservation through the use of techniques and methods of sustainable construction activities (Lins et al, 2019).

Junior (2014) reiterates that "the impacts caused in the works of a highway start still in its planning, extending to the implementation and construction phases, reaching the operational phase, where the greatest impacts occur.

Although the evaluation of the environmental impacts of highways should include all phases, in Brazil it is still incipient in the operational phase, and the legislation in this phase requires little or nothing, although it may create more impacts, since it lasts longer" (Junior , 2014).

According to Júnior (2014), in Brazil, "only in the 1980s did there begin to be a greater concern with environmental

issues, previously characterized as an obstacle to growth because it was thought that environmental management generated great burdens on the economy. However, experience shows that the legal instruments adopted with the aim of minimizing the impacts generated in road works are not always effective, as liabilities generated as a result of the allocation of the most diverse types of projects are not rare."

However, Lins et al (2019) points out that the environmental area is constantly advancing, considering that every day new technical professionals and a specialized literature on the subject appear, in addition to the environmental legislation that is in constant development. The author also points out that Brazilian environmental laws are of paramount importance for the environment, from which it is defined what can and should be done in order to impact as little as possible, whether in the physical, biotic or sociocultural.

Possessing numerous classifications, road projects, according to the DNIT, can contribute (positively) to the environmental issue, since the design of a highway requires the preparation of several technical studies that, in turn, make it possible to understand the aspects environment, the associated impacts (to the implementation of the project), as well as the planning of mitigating and compensatory actions depending on the definition of the highway route (SILVA, 2012).

Discussions regarding the implementation of a road project facing the environmental issue, focus on deliberating about the degree of impact caused to the environment (natural resources distributed under the physical, biotic and anthropic means). Such discussions have the bias of identifying actions that mitigate impacts, especially those linked with a high degree of environmental aggressiveness (SILVA, 2012).

In this context, SILVA (2012) points out that "the choice of route and the variables inherent to what is understood as potential environmental impacts, are observed according to criteria and standards capable of composing a better alternative with less negative expression to the environment, characterizing each potential impact and correlating the corrective and/or mitigating measure".

In this way, Silva (2012) suggests that depending on the choice of road layout, there are different scenarios and associated environmental impacts, in such a way that these impacts should be characterized in order to propose the best alternative with less negative expression to the environment. and then the appropriate corrective measure is proposed.

Continuing the analysis, Silva (2012) points out that during the process of implementing a road modal there is, in the implementation phase, the description of the mitigating measures due to the reduction of environmental impacts. The author also points out that, within an urban-environmental context, for undertakings of this nature, in a given region, there may be an improvement in the relationship between local development and environmental sustainability.

VII. ROAD TRAVELING ASSOCIATED WITH THE ENVIRONMENTAL THEME IN THE AMAZON

When it comes to the Amazon, one must think about a mode of transport that respects the forest and its biodiversity. In this sense, Silva (2012) highlights the need to consolidate the adoption of a transport mode that results in less environmental impact, as it is the Amazon biome and in the Amazon, correlations between road transport and its interfaces with the natural environment (environment), and, arising issues, have provided in recent years behavioral changes of the State and the market towards the competitiveness and competition that the action underlying the theme promotes in economic and social agents in a given region affected by road 'progress'.

Silva (2012) also points out that the construction of roads will determine the pattern of deforestation in the Amazon biome. In this context, Lupinetti et al (2018) describes a situation that occurs in the Amazon, where the main roads tend to facilitate the exploitation of forest resources and a consequent deforestation towards the interior of the forest, whose deforestation pattern is described by scholars as " Fishbone". Next, in Figure 03, taken from Google Earth (2022), we have a typical example of the fishbone deforestation near Careiro, Amazonas. The opening of branches from the main road accesses forest areas and expands deforestation.

Fig.3: Fishbone pattern deforestation near the Careiro region.

Source: Google Earth (2022).

Silva (2012) highlights numerous road projects aimed at the Amazon, among which stand out the BR-156, BR-401, BR-163, BR-230 (transamazônica) and finally the BR-319, object of this study. In the case of the BR-319 highway, which is 877 km long and connects Manaus to Porto Velho, the beginning of its construction at the time took place through an informal package of public works managed by the then military government. Soon after it was built, the highway was little used by residents and, likewise, little used for commercial purposes to the detriment of other modes of transport, until then considered more advantageous from a financial point of view. In this way, considering the little interest around it, the highway stopped receiving financial transfers that would make its maintenance viable, "which determined its total degradation" (SILVA, 2012).

From 1996 to 1999, the BR-319 became part of the government's plans again, this time with a view to rebuilding it through the "Brasil em Ação" program, but without success. From 2003, through the "Avança Brasil" program, the highway was again included within a package of works, but again without success (Fearnside; Graça, 2009). According to the author, the purpose of the highway would be to transport the production of the factories in the Free Zone of Manaus to São Paulo, however, it would be better served by sending the containers to Santos, in ships. According to Silva (2012) the "high cost to be invested in paving the central section of the BR-319 route would lead to very high expenses, since it would not only be the restoration of the same that would be in question, but the maintenance that would demand greater capital contribution".

Silva (2012) enters yet another problem, which refers to the discourse that the paving of BR 319, if executed, will encourage even more deforestation, with subsequent illegal removal of wood, as well as land grabbing, land conflicts , among other factors that compromise the environmental balance and biodiversity of the region, which even end up contributing directly and indirectly to global warming. Fearnside & Graça (2009) state that the reconstruction of the highway would result in the advance of the "Arc of Deforestation", putting even more pressure on the borders towards the north of the Amazon, as illustrated in Figure 04.

Finally, Oviedo, Lima, Augusto (2020) highlight a recent study prepared by the Instituto Socioambiental (ISA) based on official data from the National Institute for Space Research (INPE). In these studies, it is shown that new municipalities appear on the list of those that deforest the most in the arc of deforestation and press a new frontier of deforestation. The highlight is the BR-163, BR-319 and BR0-364 highways in the state of Acre, which radiate devastation into the interior of the Amazon rainforest like arrows.

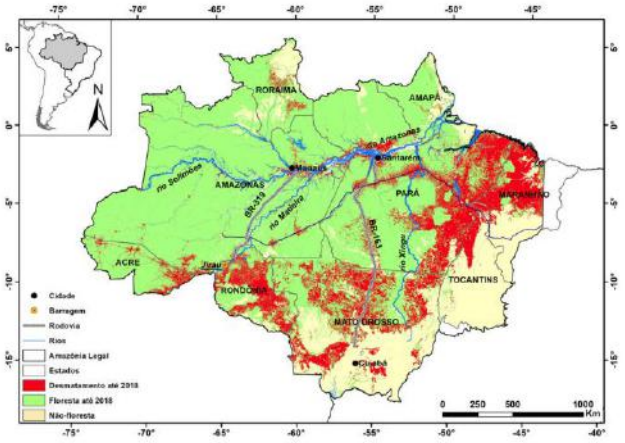

Fig.4: Area of influence of the "Arc of Deforestation" cited by Fearnside (2021)

Source: Fearnside, PM2021

VIII. HIGHWAYS IN THE AMAZON

Since the dawn of time, the Amazon has always been the subject of numerous discussions regarding geopolitical, political, economic, cultural, social and environmental aspects. Such discussions were developed, worldwide, under arguments that the Amazon should be developed, at the same time that it was preserved, including its peoples. "And that is why the highways introduced in this region of the country are the subject of debate, since they are key to economic development in the region" (Barros et al, 2020). during the military regime, numerous road expansion and integration projects were started aimed at the Amazon (Barros et al, 2020).

Paiva & Pereira (2021) highlight the "slow pace" with which the Amazon integrated with the rest of the country, therefore, in order to facilitate the transport of products and people, several integration projects were launched, as discussed in this study. .

According to Barros et al (2020), after the publication of Decree-Law n. 1,106, of June 16, 1970, considered the largest Brazilian program for the implementation of highways. In the same year, the implementation of the National Integration Program (PIN) followed, resulting in the capture of large financial investments, both nationally and internationally.

Barros et al (2020) describe that from this period, some road projects were put into practice, highlighting the BR-174, BR-319 and BR-163. Figure 05 illustrates the main road interconnection axes, results of the numerous projects launched during the implementation of the National Integration Program (PIN):

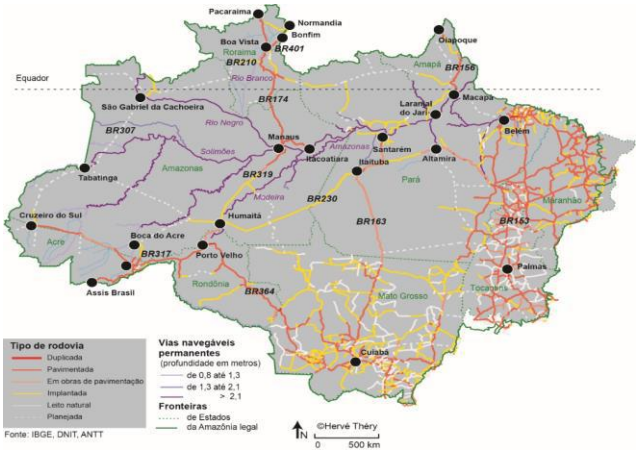

Fig.5: Main road interconnection axes, results of numerous projects launched during the implementation of the National Integration Program.

Source: Neto (2014).

Continuing the National Integration Plan, between 1970 and 1976, construction of other highways began, in addition to those previously mentioned, with emphasis, this time, on Belém-Brasília (BR-010), Cuiabá-Porto Velho (BR-364), BR-230 (Transamazônica –PA/AM), BR-163 (Cuiabá-Santarém), BR-319 (Porto Velho –Manaus), capillarizing accesses, deep into the forest, through highways, and corroborating with policies to encourage the colonization of the Amazon lands, as well as the areas along the roadways (Barros et al, 2020).

Paiva & Pereira (2021), reiterates that the creation of highways enabled the expansion of settlement areas in the Amazon, as well as the expansion of its capital. Another positive impact was the reduction of unemployment in the Northeast.

Barros et al (2020) highlight that the road connection between the cities of Manaus and Porto Velho, through BR-319, was built during the military regime. According to the author, construction work on the highway in question took place between June 1968 and early 1976, and it was inaugurated on March 27, 1976. According to Neto (2014), the newspapers at the time highlighted the highway as one of the most complex road engineering works in Brazil, requiring the construction of 300 kilometers over landfills. "It was the only one in the Amazon completely paved after construction" (Neto, 2014).

IX. THE HISTORY OF BR-319 AND THE DESIRE FOR THE END OF ISOLATION

Composed of seven states, the northern region has an area of 3.9 million square kilometers. In 1985, the region accounted for 4.2% of the national GDP, rising to 5.1% in 2006 (Silva and Páez, 2013). According to IBGE (2021) this percentage of participation already corresponds to 5.7%. In the same sense, Silva and Páez (2013) point out that the population of the northern region also showed significant growth.

According to the author, from the 1990s onwards, the economic and social scenario of the North Region underwent profound changes. In the 1985 census, it was observed that, in percentage terms, the population of this region represented 6.21% of the entire Brazilian population. In 2006, this percentage rose to 8.04%, with an increase of 29.5% in this participation (IBGE, 2008). According to IBGE estimates (2020) this percentage already corresponds to 8.82%, however it can be said that this percentage is relatively low compared to other regions that have the highest demographic density index.

Silva and Páez (2013) point out that "the existence of investments in transport infrastructure that improve accessibility leads to changes in the quality of the location and can induce changes in the patterns of spatial development", while the isolation of a city or region can be considered a bottleneck for its development in an equitable way.

Louzada (2014) reiterates that the BR 319 was conceived in 1970, through the national road plan, with national integration as a priority, as well as facilitating the flow of factory production in the Free Zone. The author points out that in mid-1968 the city of Porto Velho was experiencing a process of population explosion due to the recent interconnection with the state of Cuiabá through the BR-364. In this way, for the state of Rondônia, the construction of BR 319 served as a kind of escape valve within this context of migratory explosion towards the north, often encouraged by the state.

As for the desire to link Porto Velho to Manaus, Louzada (2014) points out that the efforts predate the installation of the Manaus Free Trade Zone, since "In 1955, the Department of Highways and Highways of Amazonas - DER-AM carried out the geometric design of 193 km of the highway, between Porto Velho and Humaitá and, three years later, the deforestation service was carried out in the stretch with a width of 60 meters" (Louzada, 2014 apud UFAM, 2009, vol.1, p.29). With the publication of Decree Law 5,173 of October 1966, the federal government encouraged the territorial occupation of land located 100 km away from the highway margins (FEARNSIDE, 2009d), corroborating the theory of territorial integration encouraged by the state.

Analyzing historical facts regarding the process of Amazonian occupation, it should be noted that at the time when the BR 319 highway was implemented, the debate

about the environmental issue was less extensive than it is today. Louzada (2014) describes that, according to local reports, the implementation of the highway had an immediate impact in such a way that it was possible to hear "the trees crying" during the mechanized felling process. The death of wild animals victimized during the forest clearing process was another major immediate environmental impact (Louzada, 2014).

Still on the construction of the BR, the author also states that, according to reports from local residents, it was common for workers to disappear, possibly victims of jaguar attacks: "when people disappeared, and the people who stayed could not find even the slipper to tell the story". Louzada (2014) also points out that the highway was finished in a hurry, there was barely enough time to pave it, it was already necessary to cover it with a tarp to protect from the rain. Years later, the thin layer of asphalt became almost that a continuous series of holes that get bigger and harder to fix.Over the years this road has become an example of total abandonment by the public authorities (Fearnside, 2009).

However, since its inauguration, the highway remained open until mid-1988, even in poor conditions of use (Louzada, 2014). Meanwhile, according to Fearnside (2009), the factory production of the Manaus Free Trade Zone was exported more cheaply by ship, and even by air.

Today, populated by small farmers, the passable stretch between Porto Velho-RO and Humaitá-AM is an example of what can happen to the rest of the forest. Currently, Humaitá is the scene of great demands for land regularization processes (Louzada, 2014). In contrast, the rest of the Amazon region where the highway where there is no paving has been spared from agrarian conflicts (Fearnside, 2009).

Louzada (2014) highlights the existence of the Project for Monitoring the Brazilian Amazon Forest by Satellite - PRODES (2012), which in turn identified forest loss in the municipality of Humaitá between the years 2000 to 2012. In this study it was found that , within the aforementioned period, in which the city of Humaitá lost approximately 24% of its vegetation layer, the author points out that such a situation could have been repeated along the entire BR-319, if it had not been closed in 1988, putting pressure on the arc of forest deforestation towards the Amazon region.

Today, however, there is a strong interest on the part of the Government of the State of Amazonas in reopening this highway, under the argument of connecting the state to the rest of the country by land. Even if the work is not financially justified (Louzada, 2014).

X. SOCIAL AND ENVIRONMENTAL IMPLICATIONS

With a length of 885.4 km, the BR 319 connects eleven municipalities: Canutama, Humaitá, Tapauá, Manicoré, Beruri, Borba, Manaquiri, Careiro, Careiro da Várzea and Manaus and Porto Velho (Fleck 2009). According to the author, the highway, along its route, has different trafficability conditions, some of which are totally impassable, without asphalt and with problems in its bridges and culverts. However, on October 3, 2020, the Ministry of Infrastructure, through the National Department of Transport Infrastructure (DNIT), authorized the start of maintenance services in three different segments of BR-319/AM, aiming to ensure good trafficability conditions on the highway (DNIT, 2020).

De Paulo (2010) points out that the crossing between Manaus and Porto Velho is not restricted to just a route by land, in several stretches it is necessary to carry out the crossing by means of ferries, the largest of which is the stretch between Manaus and Careiro da Várzea . According to the author, the other crossings are smaller. In order to ensure better traffic conditions, the construction of bridges and other structures of a permanent nature is planned, replacing the existing wooden bridges.

According to Martins and Oliver (2016) the recovery works on the BR-319 started in 2005 and were paralyzed due to the lack of previous studies that include the elaboration of an Environmental Impact Study and Environmental Impact Report (EIA-RIMA). Given the poor condition of the highway, this work came to be considered as a new project and not just simple road maintenance, and soon the preparation of the EIA-RIMA was required. In an attempt to stop the advance of deforestation, in 2006 the Federal Government, with the support of the State Government of Amazonas, defined new Conservation Units along the highway.

According to the author, considering that the repaving of the highway would imply significant damage to the environment, it would be unfeasible for the project to proceed without such studies approved by Organs environmental agencies. In the meantime, an agreement was made in such a way that only the intermediate stretch, between kilometers 250 and 655.7, would be submitted to the EIA/RIMA. The Federal University of Amazonas was involved in the elaboration of the environmental impact study in question, which was delivered, later, in early 2009 (UFAM & DNIT, 2009).

With regard to the preparation of studies and reports of environmental impact, Fleck (2009) states that, at the national level, such studies are insufficiently carried out, often the approved studies only include a qualitative

description and their mitigation measures, not foreseeing the real dimension of the problem, much less the adoption of effective actions to contain environmental damage, especially when it comes to large-scale projects, such as the repaving of BR 319.

Regarding activities related to civil construction, which include the construction of highways within their extensive list, Chagas et al (2021) state that such activities are responsible for most of the environmental impacts, demanding control measures and procedures aimed at prevention, mitigation and correction of impacts with a view to preserving the environment as well as sustainability.

It is known that the construction of highways has a great potential for devastation, especially in the Amazon region, where inspection is precarious. Given this fact, it should be taken into account that the Amazon water in the form of steam transcends the territorial limits of the northern region and turns into rain in other regions of the country, benefiting, from the climatic point of view, the state of São Paulo. Paul. A simple example. Soon, the felling of the forest could impact the rainfall regime not only in the Amazon, but in other Brazilian regions (Fearnside, 2015).

In addition to the aforementioned impacts, Motta (2013) highlights other problems that include: death of animals run over, accumulation of garbage on the sides of highways, in addition to noise pollution, which can often interfere with the reproductive cycle of certain species of fauna.

Rocha (2013) emphasizes that the construction of infrastructure works, which is the case of a highway, tends to facilitate contact between migrants and traditional peoples of that region to be affected by the implementation of such a project. As a result, there has been an increase in the spread of diseases such as flu, malaria and diarrhea. Another situation reported by the author is the need to relocate these traditional peoples in different areas, compromising the well-being and integrity of these traditional peoples.

Thus, despite the advantages brought about by the resurfacing of the BR 319 to the economic sector, the discourse of ease of movement and agility in routes skews the discussion, disguising the short-term and, mainly, long-term harm to the population.

The same author mentioned above reports that, when there is no responsible planning for the construction of highways, there may be a process of residential occupation close to preserved areas, followed by illegal logging, which in turn can contribute to an increase in the number of fires. Chagas et al (2021) reiterates that, during the earthworks phase, the emission of noise emanating from heavy equipment during the construction phase may affect the health of work workers, as well as the local population and native fauna. Barni (2015) reiterates that road construction is known to be one of the main drivers of deforestation, allowing the entry of land grabbers and other types of invaders. Therefore, according to that author, the reconstruction of BR 319 has great potential impact to start a new wave of migration to the most remote regions of the Amazon forest, which would cause unprecedented impacts.

Although there are benefits, specialists claim that this constructive process can bring countless impacts to the environment, especially in its surroundings. During the design stage of a highway, it is extremely important that the professionals involved carry out an adequate study of the region of interest, taking into account all the impacts that may arise in the physical, biotic and anthropic environments (Chagas et al., 2021). Finally, Chagas et al (2021) apud Ferrante (2019) emphasizes that the highway implementation project must comply with environmental legislation.

XI. ECONOMIC AND ENVIRONMENTAL FEASIBILITY OF THE RESUMPTION OF WORKS ON BR 319

According to Fleck (2009), Within the Amazonian territory, the construction and paving of a highway, whenever possible, should be analyzed from a bilateral perspective. Sustained under an optimistic vision, such an undertaking generates numerous benefits such as the reduction of transport costs for certain users and residents located on the sides of the highway.

Within a more pessimistic perspective, the paving of the road will generate an increase in social and agrarian conflicts, as well as the boosting of deforestation and other types of predatory exploitation. Such benefits and harms must be systematically identified and analyzed, in order to seek a rational solution within a sustainable context (Fleck, 2009).

According to Fleck (2009), recent mathematical modeling indicates that the repaving of the road will be able to induce a strong deforestation in the Madeira-Purus Interfluve, with the loss of important natural resources still in excellent condition, if effective policies to contain deforestation are not implemented. are properly implemented. Regarding the feasibility of carrying out the repaving of the BR-319 highway, Fleck (2009) classifies the project as unfeasible from a financial point of view, being capable of generating losses of around 316 million reais, or 33 cents of benefits for each real of costs. Updating these values to current indices, based on the National Civil Construction Index (INCC) for the last thirteen years, we would be talking about an estimated loss of 769.66 million reais.

Within his study, Fleck (2009) estimates that the partial economic cost of deforestation, modeled by Soares-Filho et al. (2006a), could reach approximately 1.9 billion reais, in current values R$ 4.63 billion (890 million dollars). Of these, BRL 3.41 billion (USD 655 million) correspond to the negative effect of the project on global climate change, an amount much higher than the gross benefits generated by the project of BRL 372 million (USD 71 million), considering the indices current.

In the integrated scenario, which includes the environmental costs estimated to the conventional scenario, the project losses would increase significantly and, at that moment, would add up to R$ 5.36 billion (approximately 1 million dollars), or only 15.8 cents of benefits for each real costs generated, in current values. Alternatively, for each real of gross benefits generated, approximately R$30.00 (approximately US$5) of environmental costs would be produced (Fleck, 2009).

This analysis, however, does not incorporate the potential costs and benefits of the recent proposed mitigation measures, mainly related to the creation and implementation of several Conservation Units. Mitigating the environmental costs within these units alone, through investments in their implementation/basic protection, would cost around R$1.142 billion (US$219 million), in current values. This means that, in order to be economically efficient, the road rehabilitation project would have to generate at least around R$1.911 billion (367 million dollars) of additional benefits, which would require that the estimated gross benefits be multiplied by at least 5 ,12 times (Fleck, 2009).

The works considered in the analysis by Fleck (2009) involve the recovery of 405.70 km of the highway and its respective pavement, as well as the reconstruction of culverts and bridges, as well as the construction of new bridge structures over the Madeira rivers. , Igapó-açu, Tupãna and Castanho, now served by ferries. According to the same author, all these figures show that the recovery of the BR-319, at that moment, would hardly represent an efficient investment from a financial point of view.

According to that author, the resources allocated in this project would be better used in alternative public investments that present efficiency and equity. Thus, for the region, investments and incentives for current modes of transport, such as waterways, ports and airports, may become more efficient alternatives for the allocation of financial resources by the State.

XII. MATERIALS AND METHODS

Regarding the repaving of the BR-319 highway, a bibliographic review was carried out through books, magazines, scientific articles and dissertations taken from research portals such as Scielo, Google Scholar, Periódicos Capes. Within its introductory stage, the work approaches historical aspects that involve the construction of highways in the country, as well as its importance in the process of national integration. Then, a bibliographical review is started, addressing topics that involve the decision-making process in large infrastructure works in Brazil, in addition to the Brazilian normative framework on the subject. Deepening the discussion, an approach was made to the environmental issue and highways in Brazil and their relationship with the geographic space and the Amazon forest. Continuing, research was carried out in order to verify the benefits and socio-environmental implications that the reconstruction of the highway could generate and what would be the viability of this project. It should be noted that this type of evaluation takes into account a set of factors that must be analyzed systematically and not in isolation.

XIII. RESULTS AND DISCUSSIONS

1. SOCIAL AND ENVIRONMENTAL IMPLICATIONS

Within this analysis, the recovery and maintenance of Lot A, popularly known as the “middle stretch”, was considered, as well as the construction of current and special works of arts, which are generally culverts and bridges, in that respective order. It should also be noted that, within this analysis, the construction of new bridges over the Madeira, Igapó-açu, Tupãna and Castanho rivers, currently served by ferries, was considered.

According to studies carried out by Martins; Oliver (2016), for the case of the BR-319, a recovery cost of BRL 487,831,257.00 (approximately 93.8 million dollars) was estimated in 2008, values obtained from the General Coordination of Planning and DNIT's Investment Schedule on 11/24/08. In this case, for the year 2022, a financial update was necessary considering the readjustment rates of the National Civil Construction Index (INCC), which within the accumulated period between 2008 and 2022 is equivalent to approximately 161%.

After this survey, followed by a subsequent update using the INCC index, it was possible to verify that the current cost of recovering the highway amounts to R$ 1,273,239,580, 77 approximately 244 million dollars).

With regard to periodic maintenance costs, Fleck (2009) considered that, from the 6th year of operation onwards, it

would be necessary to resurface the entire course of the highway, totaling a total updated cost of R$ 433,077,407.01 (approximately 83 million dollars). According to the author, after 8 years, new maintenance was considered, where the entire carriageway of the highway would be redone, which once again would cost the sum of R$ 433,077,407.01 (83 million dollars) , value adjusted for the year 2022.

In addition to these resurfacing costs, the author has estimated additional costs for routine maintenance, on an annual basis, in the amount of R$ 11,059,624.44 (approximately 2.1 million dollars), amounts already updated for the year 2022.

Regarding the construction of bridges, the author predicted an execution cost of R$ 601,898,625.00 (approximately 115.7 million dollars). Next, Table 04 prepared in 2009 by Fleck (2009) which underwent a process of readaptation and financial updating by the author of the research.

Table 4: Financial Costs of Works Analyzed

Road recovery and maintenance costs			
Activity	Average unit cost ($/km)	Total cost in 2008 (USD)	**Total cost in 2022 (USD)**
Recovery to	USD 231.239,04	USD 93.813.703 ,27	**USD 244.853.765 ,38**
Resurfacing in the 6th year	USD 78.653,27	USD 31.909.623 ,27	**USD 83.284.116, 73**
Resurfacing in the 14th year b	USD 78.653,27	USD 31.909.623 ,27	**USD 83.284.116, 73**
annual routine maintenanc e	USD 2.008,65	USD 814.885,38	**USD 2.126.850,7 7**
Road recovery and maintenance costs			
bridge	Total cost in 2008 (USD)	**Total cost in 2022 (USD)**	Source
On the Tupãna and Castanho rivers c,d	9.387.019,2 3	**USD 24.500.120 ,19**	PAC Managemen t Committee (2008)
Over the Madeira River	34.961.538, 46	**USD 91.249.615 ,38**	DNIT (09/01/08)

THE

Adapted from data obtained from the DNIT's General Coordination of Investment Planning and Programming on 11/24/08. The data originally provided showed an average financial cost of R$1,202,443.33/km (insert this value in dollars in parentheses) for 272.2 km of the highway. We chose to extrapolate this average to the rest of the road, in order to obtain the approximate total cost of the work.

B

Adapted from CVRD & ICOPLAN (apud IME & ENGESUR, 2005), in 2004 reais.

Ç

The original amount of R$71 million also included the bridge over the Igapó-açú River; the value adopted was adjusted to exclude it, as it is included in the highway recovery costs. Adjustment was made based on the relative length of the bridges.

D

This value represents the total value of the work and not the value considered in the analysis, as we seek to exclude the portion of costs related to local benefits not related to diverted traffic.E

Source: Fleck (2009), adapted by the author.

In summary, it can be said that, nowadays, the cost of implementing a large project, such as the BR-319, would generate an initial investment of approximately R$ 1.875 billion (approximately 360 million dollars), which could reach R$ 2.308 billion (approximately 443 million dollars) after the sixth year of its reopening.

According to Nakamura (2018), the existence of an adequate transport infrastructure is a necessary condition for the full development of a region or country. On the other hand, the absence of this infrastructure can be considered as a bottleneck that prevents economic and social development. According to the author, transport, in general, allows the best use of regional productive capacity, providing development and national integration. Only with the existence of a transport network is it possible to better rationalize economic activity.

However, according to that author, transport is not, as a rule, core activity. It is a medium activity, considering that transport allows the movement of people, goods, products,

services and the national integration of the economy. Therefore, in the view of Nakamura (2018), economic development depends on the existence of a transport infrastructure and is fostered by it. Without the transport infrastructure, a region becomes an island, without benefiting from and participating in the economic activity developed by the whole.

In short, it can be said that a highway, for example, can improve employment, schooling, and health indices, as well as serve as a tool capable of promoting the reduction of social inequality, since its absence or precariousness makes access difficult. of subjects to public and private goods and services that foster a better quality of life. Therefore, not providing the necessary infrastructure for a given population causes ineffectiveness of social rights and prevents the economic development of a given region or country (Nakamura, 2018).

According to Macário, Crespo and Rodrigues (2007) , the main benefits arising from transport projects include: reduction in travel time and vehicle operating costs. In addition to these, the author mentions that better traffic conditions tend to reduce the number of accidents and, consequently, medical costs, material costs caused by accidents, in addition to a reduction in administrative costs linked to these specific factors.

Entering this cost analysis, two scenarios were considered: one considering the current state and the other hypothetical, which considers the construction of the BR-319 in the year 2022. According to Table 2, within the current scenario, there are three ways to transport production from the Manaus Free Trade Zone: via cabotage which, according to the author, is characterized as the most economical mode; by road and river along the Amazon River and then along the Belém-Brasília highway; the third option, using the road-fluvial route via the Tocantins Waterway.

In all three cases, the cost is measured in reais per ton transported. For cabotage, the estimated cost was R$716.77 (approximately US$137.7). Using the second route option, via road and river via the Amazon River and then via the Belém-Brasília highway, in current figures, the cost reaches R$1,149.58 (approximately US$220.96). The third option is the most expensive, using the road-fluvial route via the Tocantins Waterway, the estimated value was R$ 1,215.99 (approximately US$ 233.84).

In terms of time, within the current scenario, the road-river via the Amazon River and then the Belém-Brasília highway can be completed in 151 hours, being considered the most efficient.

Within a second scenario, where the availability of BR-319 is considered as an option for transporting cargo, we have a cost of R$ 1,190.80 (approximately US$ 228.84) per ton transported, featuring an additional cost of 66% in relation to the most efficient modal (cabotage).

In terms of travel time, this was reduced to 92 hours, a significant gain in time compared to the previous scenario, since it took 151 hours to transport cargo between Manaus and Brasilia.

Within this perspective, it is evident that in terms of freight costs, cabotage transport can be considered the most efficient. In terms of time spent, the BR-319 highway stands out over the other modes of transport analyzed in Table 05, which does not consider the use of air as a transport option.

Table 5: Current and projected routes and their freight costs and time involved

Route	Length (Km)	Cost (2005 '$/t)	Cost (2022' $/t)	Time (h)	Ratio of cost to the most economical route	prop. of time in relation to the most economical route
current						
cabotage to	6193	60	USD137	164	100%	100%
Waterway via the Amazon River and Belém-Brasília b	4537	96	USD220	151	160%	92%
Waterway via Hidrovia do Tocantins	4888	102	USD 233	199	170%	121%
Projected (estimated year for completion)						

Bus station via BR-319 (2011/2012)	3902	100	USD228	92	166%	56%
Waterway via BR-163 (2010)	3693	BR	BR		BR	BR
Waterway via Hidrovia do Tocantins (with locks of Tucuruí)	4838	68	USD156	212	114%	129%

a The most economical modal/route between the current and projected ones is via cabotage.

b According to the models, this route is more competitive than the Madeira River Waterway (Teixeira, personal comment, 2008).

Source: adapted from Teixeira (2007).

Source: Fleck (2009), adapted by the author.

Continuing with the analysis, there is another study that refers to the financial costs and parameters of passenger transport, as described in Table 3. Within that study, three possibilities of modes were considered to be used as an option for passenger transport (waterway , air and road) and four possible routes (Manaus-Humaitá; Manaus-Lábrea; Manaus-Porto Velho; Manaus-Rio Branco). The main variables analyzed were the average ticket prices and the travel time between the referred sections, considering the different modal options.

Analyzing Table 3, it can be stated that, in terms of time, the air modal stands out among the others as the most efficient in terms of time. On the other hand, the waterway modal is the most inefficient. Road transport, on the other hand, fits as a kind of middle ground between these two.

Table 6: Financial costs and parameters of passenger transport .

Modal	**Average ticket price in 2008 (USD)**	**Average ticket price in 2022 (USD)**	**average time of travel (h)**	**At the. in passengers in 2007**
Travel between Manaus/AM and Humaitá/AM				
waterway	USD 28,84	**USD 75,28**	66.5	2,616
Air	USD 62,69	**USD 163,62**	2.6	3,534
road	USD 14,80	**USD 38,64**	10.7	BR
Travel between Manaus/AM and Lábrea/AM and				
waterway	USD 48,07	**USD 125,48**	116	2,616
Air	USD 89,61	**USD 233,89**	3.4b –	3,534
road	USD 20,76	**USD 54,20**	13.6c –	BR
Travel between Manaus/AM and Porto Velho/RO				
waterway	USD 38,84	**USD 101,38**	84.0 [d]	2,616

Air	USD 80,57	**USD 210,30**	2.3b –	3,534
road	USD 19,42	**USD 50,69**	16.0c –	BR
Travel between Manaus/AM and Rio Branco/AC f				
waterway	USD 96,15	**USD 250,96**	3.8b –	2,616
Air	USD 30,76	**USD 80,30**	21.0c –	3,534

a *Source: data from the THECNA Project (UFAM, 2008) presented in the BR-319 EIA/RIMA (UFAM & DNIT, 2009), and ANAC (2007). The lack of passenger waterway traffic data for Lábrea was overcome by adopting the same number of passengers for Humaitá.*

b *Times taken from Gol, TAM and TRIP; includes 1.1 hours for check-in and disembarkation. TRIP's flight between Humaitá and Manaus is relatively longer than GOL and TAM's on other routes, as their aircraft (ATR) travel at cruising speed.*

c *Add 1h for crossing from Manaus to Careiro da Várzea by ferry.*

d *Alves (2007).*

e *Complete recovery of the BR-230 and construction of bridges between Humaitá and Lábrea by 2011 is assumed, according to PNLT (2007), and its due maintenance over the time horizon of the analysis.*

f *It is assumed that there will be a planned bridge over the Madeira River on the BR-364 by 2012.*

g *We consider that all waterway passengers would opt for land transport due to the lower ticket cost and less time associated with road transport. As for the air modal, we consider that there is a significant portion of passengers whose opportunity cost of time is high enough to offset the savings with the road ticket. In this way, they choose to remain in the air modal.*

Source: Fleck (2009), adapted by the author .

In practical terms, we can observe that a plane trip between Manaus and Humaitá has an estimated time of approximately 2 and a half hours. Already using the waterway modal, this travel time rises to approximately 66 hours of travel. A third option would be the BR-319, if rebuilt, it would allow a travel time of approximately 10 and a half hours, placing it as an efficient option of travel time compared to the waterway modal.

In financial terms, considering current figures, road transport stands out once again as an efficient option for passenger transport. For the section analyzed between Manaus and Humaitá, an air ticket costs approximately R$850.86 (approximately US$163.62), as well as a boat ticket costs approximately R$391.50 (approximately US$75.28). Meanwhile, a road ticket costs around R$200.97 (approximately US$38.94).

In terms of social benefits, Júnior (2014) states that the reconstruction of the road will contribute to an increase in the generation of jobs and will facilitate the flow of production, promoting regional development. Still within the social bias, Fleck (2009) suggests that the reconstruction of the road will bring the benefit of reducing the cost per kilometer traveled both in passenger vehicles and in vehicles for freight transport, resulting in a decrease in road freight and a reduction in the value of bus tickets between Manaus and Porto Velho and adjacent cities. Nakamura (2018) states that transport is not only essential for economic activities, given that the minimum social rights become unfeasible for the population if there is no adequate transport infrastructure. The right to work, education and the reduction of social inequalities is directly influenced by the transport infrastructure.

An infrastructure that allows for efficient transport is a prerequisite for starting, in certain locations, economic activities, job creation and private investment. Without transport infrastructure, there will be no conditions for exercising the right to work, since workers depend on its existence to get to their jobs. Furthermore, with an adequate transport infrastructure, the social strata previously marginalized due to the difficulty of accessing the centers where economic activities are carried out, are able to take advantage of employment and income opportunities (Nakamura, 2018).

Nakamura (2018) also states that the health indices of the population tend to improve with a better offer of transport infrastructure, given that there is a reduction in the number of accidents, resulting in a drop in the mortality rate. The author also mentions that a good infrastructure tends to

provide better access to health services, increasing the efficiency of public health policies. The aforementioned author states that an adequate transport infrastructure tends to promote the reduction of social inequality, emphasizing that the properties of the less favored tend to increase in value due to the construction of a road or railroad, which ends up promoting an asset growth of part of the population. population.

In terms of environmental benefits, it can be said that the reconstruction of the BR-319 highway will enable better performance by inspection bodies such as IBAMA, ICMBIO and the Federal Police, considering that the improvement of the road's trafficability conditions will facilitate the work of the field. It is worth mentioning that such an advantageous characteristic at the beginning also has its dangers, which we will discuss later. In addition, the reconstruction of the highway will enable the implementation of new Conservation Units and Environmental Protection Areas along its route.

According to Saunier (2018), the loss and degradation of natural habitats, fauna being run over, chemical pollution, anthropic invasion and increased violence were some of the resulting negative impacts evidenced after the construction of roads in the Amazon. The aforementioned author also pays special attention to the problem of anthropic invasion caused by road expansion in the Legal Amazon, which is usually accompanied by serious land problems that lead to disorderly occupation, land grabbing, conflicts and the expulsion of traditional peoples.

Lupinetti et al (2018), within his studies, suggests that the reconstruction of the BR-319 will further facilitate the exploitation of forest resources, as well as the creation of new vicinal roads, as previously described as a "herringbone" pattern.

Fearnside & Graça (2009) state that the reconstruction of the highway, if carried out, will make the advance of the "Arc of Deforestation" even more viable, putting even more pressure on the borders towards the north of the Amazon.

Regarding the reconstruction of the highway, Ferrante et al (2021) suggest that an inevitable suppression of the forest layer could cause an unprecedented climate imbalance, since the Amazon forest plays a fundamental role in controlling rainfall in South America and the global climate. .

Within his studies, Louzada (2014) suggests that there has been an increase in illegal deforestation in the stretch between Humaitá and Porto Velho, Lot A. The author also highlights that in the last 10 years the city of Humaitá has lost approximately 24% of its vegetation layer , situation timely after the restoration of the aforementioned section of the highway. The aforementioned author states that such a situation could have been repeated along the entire BR-319, if it had not been closed in 1988, further pressing the arc of forest deforestation towards the Amazon region.

As for the environmental aspect of road freight transport, Soliani; Argoud; Lopes (2017) highlight two phenomena: air pollution and noise pollution. Road freight transport is one of the main causes of air pollution. The emission of gases negatively interferes with air quality and the health of people and animals. The high dependence on road transport in Brazil exacerbates environmental problems and negatively affects people's quality of life .

XIV.CONCLUSION

It is known that BR-319 emerged with this immediate objective: to encourage the road modal in the economic development of the northern region in relation to the rest of the country. The planning, adequacy and infrastructure of a transport route is fundamental for it to fulfill its economic, social and developmental objectives of a region, however, it is essential that such measures are minimally in accordance with the principles and guidelines that guarantee the maintenance and defense of the Amazon.

According to the studies carried out, it can be stated that the restructuring of the BR-319 offers several immediate advantages for the population. Among these advantages, one can mention the reduction in the cost of transporting passengers and cargo, creating direct and indirect jobs, encouraging tourism and a consequent increase in economic activities.

Regarding the environmental damage related to the construction of this highway, it was evident that most of them are due to the high potential for deforestation in the region, with a large participation of loggers, but negative effects are not restricted to this. The restructuring works on the BR-319 highway, in addition to having a marked capacity to induce deforestation in the Amazon, have great potential to promote changes in water quality and soil properties, induction of erosion processes, loss or reduction of habitat, reduction of wildlife, disorderly occupation in the surroundings, increase in criminal fires and the consequent compromise of essential ecosystems, among other unaccounted costs.

In summary, it can be stated that the data presented show several socio-environmental impacts, some of them positive and most of them negative, both in the project implementation area and in the physical, biotic and socioeconomic environments.

Conclusively, it is stated that the benefits generated by the restructuring of the BR 319 are discreet, compared to the

numerous environmental damages caused by an eventual total recovery of the road.

If executed, countless damages would be caused to fauna, flora and human life. Thus, it is quite evident that connecting Amazonas with the rest of the country will have a high environmental cost, certainly unsustainable, and may even compromise the quality of life of future generations.

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REFERENCES

[1] CUNHA, Manuela Carneiro da. The future of the indigenous question. Advanced Studies, v. 8, p. 121-136, 1994.

[2] DA SILVA, Rafael Vieira. Environmental management in the process of rebuilding the BR-319 highway (Manaus-Porto Velho): an analysis of the EIA/RIMA from the perspective of avoided deforestation and environmental sustainability in the Amazon biome. 2012. Doctoral Thesis. Master's Dissertation, Federal University of Rio de Janeiro–Polytechnic School and School of Chemistry, Environmental Engineering Program, Rio de Janeiro, RJ, Brazil.

[3] DA SILVA, Renilson Rodrigues; PAEZ, Antonio. The geoeconomic isolation of municipalities in the northern region of Brazil: a proposal to quantify it. Brazilian Journal of Regional and Urban Studies, v. 7, no. 1, p. 1-18, 2013.

[4] DAS CHAGAS, Thalia Nascimento et al. Environmental impacts caused by the implementation of the BR-319 highway. Civil Engineering: Innovation and Technology in the Context of the Contemporary Era, Volume 3, p. 74.

[5] DE LIMA, Aline Ribeiro et al. MIGRATION IN THE AMAZON., sep.2017

[6] National Department of Transport Infrastructure (DNIT).2020. Available at: https://www.gov.br/dnit/pt-br/assuntos/noticias/br-319-am-rodovia-recebe-servicos-de-manutencao-visando-boa-trafegabilidade . Accessed on: June 19, 2022 at 7:06 pm.

[7] DIAS, Camila Loureiro; BOMBARDI, Fernanda Aires; COSTA, Eliardo Guimaraes da. Size of the indigenous population incorporated into the state of Maranhão and Grão-Pará between 1680 and 1750: an order of magnitude. History Magazine (Sao Paulo), 2020.

[8] FEARNSIDE, PHILIP M. Flying rivers and the water of São Paulo 1: The question raised. CRH notebook, v. 25, no. 64, p. 87-98.

[9] FEARNSIDE, Philip M.; DE ALENCASTRO GRAÇA, Paulo Maurício Lima. BR-319: The Manaus-Porto Velho highway and the potential impact of connecting the arc of deforestation to the central Amazon. New NAEA notebooks, v. 12, no. 1, 2009.

[10] Fearnside, PM2021. https://amazoniareal.com.br/o-desmatamento-da-amazonia-brasileira-9-estradas/ . Accessed on: June 23, 2022 at 6:35 pm.

[11] FERRANTE, Lucas; ANDRADE, Maryane BT; FEARNSIDE, Philip M. Land grabbing on the BR-319 highway: 3–Spearhead of deforestation in the Amazon.

[12] FERRANTE, Lucas; FEARNSIDE, Philip M. Brazil's new president and 'ruralists' threaten Amazonia's environment, traditional peoples and the global climate. Environmental Conservation, vol. 46, no. 4, p. 261-263, 2019.

[13] FLECK, Leonardo C. Economic efficiency, risks and environmental costs of rebuilding the BR-319 highway. Lagoa Santa: Strategic Conservation, 2009.

[14] GONÇALVES. Carlos Walter Porto. Amazon, Amazons. 1st Ed. Sao Paulo: Context, 2001.

[15] IPEA – Institute of Applied Economic Research. Brazilian Highways: Bottlenecks, Investments, Concessions and Concerns for the Future. Series Axes of Brazilian Development. No. 52 – May 24, 2010. Available at: http://repositorio.ipea.gov.br/bitstream/11058/5305/1/Comunicados_n52_Rodovias.pdf Accessed on September 27, 2022.

[16] KUWAHARA, Nelson; MACHADO, Waltair Vieira; SANTOS, Márcio Peixoto de Sequeira. Decision Making in Transport Infrastructure Investments: Case Study for the Industrial Pole of Manaus. In: Article presented at the XXII Congress of Research and Teaching in Transport. 2008.

[17] LINS, Eduardo Antonio Maia et al. ANALYSIS OF ENVIRONMENTAL IMPACTS ON A HIGHWAY – CASE STUDY OF PE-063. In: South American Congress on Solid Waste and Sustainability. 2019. p. 2019.

[18] LOUZADA, Camila de Oliveira et al. The major works for the reopening of BR 319 and their impacts on the riverside locations of the Solimões River: Bela Vista and Manaquiri, in Amazonas. 2014.

[19] LUPINETTI, Artur et al. The effect of roads on the dynamics of forest cover in Atlantic Forest fragments. In: Proceedings of the 5th Evolution and Diversity Workshop. 2018. p. 64-72.

[20] MACÁRIO, Rosario; CRESPO, Fernando; RODRIGUES, Maria Joao. Estimation of real costs and benefits for the economic evaluation of road investment projects. XXI ANPET, Rio de Janeiro, 2007.

[21] MARTINS, Fernando; LOURENÇO, Ricardo; OLIVER, Ignancia. Road infrastructure in Brazil: where are we going? BR Bain&Company, Inc. 2016. Available at: https://www.bain.com/contentassets/7e48e0824a0e4f2ba4542d36c130cef1/infraestrutura-rodoviaria-no-brasil-para-onde-vamos_pt.pdf Accessed on: September 27, 2022.

[22] MOTTA, Claudio. On highways, 14.7 million animals are run over each year. O Globo, 15 Jan. 2013. Available: https://oglobo.globo.com/saude/ciencia/revista-amanha/nas-rodovias-147-milhoes-de-bichos-sao-atropelados-cada-ano-7292788 . Accessed on: November 12, 2022.

[23] NETO, Thiago Oliveira. Transamazon Highway: did the integration project work?. Management & Public Policy Magazine, v. 5, no. 2, p. 284-308, 2015.

[24] National Transport and Logistics Observatory (ONTL).2021. Available at: (https://ontl.epl.gov.br/principais-marcos/)

(source: national transport and logistics observatory). Accessed on: June 2, 2022 at 21:12.

[25] OVIEDO, Antonio; LIMA, William Pereira; AUGUST, Cicero. The bow of deforestation and its arrows. 2020.

[26] PAIVA, Abraão Fernandes; PEREIRA, Igor Nonato Almeida. Socio-environmental impacts generated by the implementation of the BR-319 highway. Brazilian Journal of Development, vol. 7, no. 5, p. 50315-50330, 2021.

[27] ROCHA, Ana Flavia. The defense of socio-environmental rights in the Judiciary. CEJ Magazine, p. 116-117, 2003.

[28] SAUNIER, Henrique, 2018:Study shows impacts of BR-319 in municipalities of Amazonas. Available at ://idesam.org/noticia/estudo-mostra-impactos-da-br-319-em-municipios-do-amazonas/#:~:text=A%20perda%20e%20degrada%C3%A7%C3%A3o%20de,antr%C3%B3pica%20as%20other%20worrying factor%20 . Accessed on: July 10, 2022 at 6:41 pm.

[29] SILVA, Joel BR 319. BR-319/EP. 10. Marks of destruction. The globe doesn't show it, but the work is happening. July 4, 2022. Available at: https://www.youtube.com/watch?v=CD7Qwk2GRMw Accessed on: September 27, 2022.

[30] SOLIANI, RODRIGO DUARTE; ARGOUD, ARTT; LOPES, LINEIA JOLLEMBECK. Sustainability in road freight transport in Brazil. XXVII SIMPEP, 2017.

[31] SOUZA, Adna Luana da Costa. The BR 319 and its strategic importance for National Defense. 2020.