

Sustainable Development as a Wicked Problem: The Case of the Brazilian Amazon Region

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ABSTRACT

The global importance of the Amazon rainforest is abundantly evident. It is the world's largest tropical rainforest, home to incredible biodiversity, and arguably an essential part of the earth's already fragile climate system. Exploiting the Amazon beyond planetary boundaries, in other words, beyond a threshold the forest cannot regenerate itself from, may have catastrophic, global impacts. Conversely, Brazil is an industrialized yet developing country far from realizing its potential to become an economic superpower. To this day, millions of Brazilians still live below the poverty line. Hence, Brazil cannot afford to ignore the economic potential of the Amazon's vast resources. The issue becomes how to use those resources effectively and efficiently for economic development. The key is perhaps a sustainable development approach. Considering the diversity of internal (i.e., Brazilian) and external (i.e., foreign) stakeholders, there is no agreement of what sustainable development would mean when it comes to the Brazilian Amazon Region (BAR). The challenge is the fact that environmental and social problems are not just complex problems. According to Brown et al (2010), they are very hard to properly define. Buchanan (1992) concluded these types of problems do not fit within any specific subject matter. In this research, we propose the sustainable development of the BAR as a wicked problem (Rittel and Webber, 1973). The main purpose of this study is to conduct an analysis of stakeholders to confirm this hypothesis. This study employs systems thinking, specifically Peter Checkland's (1989) Soft System Methodology as the conceptual foundation of the analysis of evidence from the field. Preliminary findings are summarized, and conclusions with conceptual and practical considerations are provided. Limitations and opportunities for future studies are also included.

Keywords: sustainable development, wicked problems, Brazilian Amazon, system thinking, soft system methodology.

1. Introduction

The Amazon is the world's largest tropical rainforest, home to incredible biodiversity (Wood and Morais, 2021), and arguably an essential part of the earth's already fragile climate system (Heckenberger et al. 2007). Exploiting the Amazon beyond planetary boundaries, in other words, beyond a threshold the forest cannot regenerate itself from, may have catastrophic, global impacts. Conversely, Brazil is an industrialized yet developing country far from realizing its potential to become an economic superpower. To this day, millions of Brazilians still live below the poverty line. Hence, Brazil cannot afford to ignore the economic potential of The Amazon's vast resources. To make the context even more tangible, the earth's climate approaches an irreversible tipping point - the 1.5 degrees of temperature increase threshold (Shurer et al, 2017). The threat to biodiversity is at its peak, and frequent reports of abuse and exploitation of local communities in the Amazon region are well-known world-wide (Southgate and Runge, 1985). The path for economic development of the Brazilian Amazon Region (BAR)

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appears to be that of a sustainable economic development path. Although definitions of sustainable economic development are widely available and there is agreement about the overall concept, we argue that from the perspective of stakeholders, internal (i.e., Brazilian) and external (i.e., international) there is neither an agreement about what sustainable development means nor there is an agreement if there is a problem with the way the BAR is developing. Moreover, those who think there is a problem cannot agree about what the problem is. The challenge is the fact that environmental and social problems are not just complex problems. According to Brown et al (2010) they are very hard to properly define. Buchanan (1992) concluded these types of problems don't fit within any specific subject matter. In the same line of thought, Checkland (1989) calls them soft systems, and argues they cannot be dealt with the same approach we deal with hard systems (e.g., building a bridge across the river following engineering principles and traditional project management approaches). They are what Rittel and Webber (1973) may call a wicked problem. In this research, we propose the sustainable development of the BAR as a wicked problem. To fulfill the purpose of this paper we complete a summary literature review on sustainable development, wicked problems, and system thinking. There is also a brief historical background on the economic development of the BRAR. Then, using Checkland's soft system methodology as an overarching framework we investigate influential organizations that represent internal and external stakeholders. Furthermore, preliminary findings and conclusions related to the paper's main propositions are discussed. Lastly, limitations of the study, and opportunities for future research are also proposed.

2. Previous research

a. Sustainable development and the environment

i. Climate change

The concept of sustainable development has evolved over time, encompassing a wide range of environmental, economic, and social issues (Rasiah et al., 2018). The challenge of achieving sustainable development is further complicated by the fact that it requires the integration of multiple perspectives, including those of government, business, and civil society (United Nations, 2002). Additionally, the effects of human actions are often unpredictable and can have unintended consequences, making it difficult to foresee the outcomes of various sustainability initiatives. One of the most important unintended consequences of economic development has been climate change (United Nations, 1987).

Climate change is an issue that has called worldwide attention. Political leaders are putting differences aside to unite and present collaborative efforts to reduce the environmental impact caused by human activity itself. The causes of the phenomenon are already public knowledge. According to a report presented by the United Nations (n.d.), fossil fuels are responsible for 75% of greenhouse gas emissions generated mainly by power generation, manufacturing goods, and using transportation, being the biggest aggressors of the environment.

The population has been feeling the effects and suffering the consequences of climate change. Increasingly, sea level rise and land sinking are being reported, putting humanity itself at risk, especially the poorest who have their homes in areas unsuitable for

construction (Lu et al., 2019). Conversely, according to Halsnæs et al. (2008), most development policies will not lead to a sustainable development pattern since they insufficiently address climate change. It is still possible to see social inequality and the lack of provision of basic services to the population in today's world, and this aspect is treated as a high priority in some countries. Government projects tend to give these basic rights, such as access to electricity, to the most remote and poor areas, increasing carbon gas emissions. For this reason, as well observed by Harry & Morad (2013), climate change, unsustainable development, and poverty can be considered the same problem, since they are connected.

ii. Biodiversity

The Amazon has extensive biodiversity as a tropical forest and The Region is the largest hydrographic basin in the world with a large concentration of terrestrial species (Wood and Morais, 2021). It contains approximately a quarter of the world's fresh water. Also, the Amazon has over one-third of the Earth's known species and is one of the world's most critical reservoirs of biodiversity (Heckenberger et al. 2007). With an area of over 4 million km², The Amazon's biome represents 50% of the Brazilian territory. Its rich biodiversity includes groups of species, such as birds, butterflies, fishes, and mammals that are extremely diverse; no other place in the world has such variety. The understanding of the Amazon's diversity is an ongoing process with new species being discovered every year (Prado, 2021). Over the past years, the region has become a symbol of biodiversity and is generally recognized as one of the most biologically diverse macro-regions on the planet. Still today, a remarkable variability of plants and exotic fauna is discovered (Heckenberger, 2007). However, the forest has also suffered as the area has been increasingly threatened regarding ecological balance (Laurance et al. 2001).

iii. Social impacts

According to studies highlighted by Tucker et al (2016), the BAR has been a worldwide focus, a remarkable biological and cultural region and the main source regulating global biogeochemical and atmospheric cycles. However, considering its economic growth potential and large-scale development, the region has been impacted in the past decades. A conflict of interests is set as national and international policies invest in economic development, impacting the environment and the rainforest ecosystem.

People living in the rainforest are now highly affected by socio-environmental impacts that cause diverse threats. The lands are threatened by deforestation, forest degradation, agriculture, wildfires, mining, livestock, and the construction of dams and highways (Wood and Morais, 2021). According to Lefebvre (1991), it is understandable that such life changes violate human rights, may change lifestyles, and even impact the health and education systems. Deterritorialization affects not only physical but also psychological. Over time, people build affective and symbolic connections with a place. Lastly, and importantly, economic development can have negative impacts on communities and local populations. It is not uncommon to see local communities exploited, facing unsafe working conditions, pollution, and sometimes forced to relocate from their homes (Rodrigues and de Oliveira, 2012; Campos et al., 2008).

b. Wicked problems

Humans are hardwired as problem-solvers. Professional education offers approaches that enable us to solve the most complex problems, provided we have the correct amount of time, resources, and effort. Professional and technical prowess enabled us to achieve incredible outcomes (Rittel & Webber, 1973). Nevertheless, according to Westley and Antadze (2010) the traditional, disciplinary-based, scientific approach has done a very poor job addressing social and environmental problems. They particularly fail to perceive interconnections amid the multiple variables. The professional, Newtonian, cognitive style is not in line with the contemporary notion of interacting, open systems. Essentially, such an approach mimics the cognitive style of scientists and employs the approach of engineering to problem-solving (Rittel & Webber, 1973). Truthfully, if we compare the world of today with the world of 100 years ago, we will easily see how far we have gone. However, according to Brown et al (2010) and Martin (2007) the future is bleak. Environmentally speaking, our monolithic solutions cannot secure access to food, shelter, and energy in the future without unexpected consequences. The challenge is the fact that environmental and social problems are not just complex problems. According to Brown et al (2010) they are very hard to properly define. Buchanan (1992) concluded these types of problems don't fit within any specific subject matter. Checkland (1989) calls these kind of contexts soft systems and argues they cannot be dealt with the same approach we deal with hard systems (e.g., building a bridge across the river following engineering principles and traditional project management approaches). They are what Rittel and Webber (1973) would call a wicked problem. Kolko (2012) added they involve incomplete or contradictory knowledge, many diverging opinions, they impose a broad economic burden, and they naturally display interconnectivity with other problems.

c. System thinking

System thinking is a way of approaching problems and issues by looking at them as part of a larger system rather than as isolated, disconnected elements. It is a way of thinking that emphasizes the interdependence and interconnectedness of various components of a system and their relationships with each other (Jackson, 1991).

Over time, complex problems have produced effects globally and we cannot expect that a simple, linear cause-effect will determine one exclusive solution for everything (Hodgson, 2020). From an environmental perspective, critical thoughts, approaches to dialogue, and sustainability principles are part of several problem-solving strategies and programs (Martin et al., 2005). Looking for underlying patterns, future changes, multiple solutions, and opportunities may be indicated. Hopefully, multi-perspective analysis and vast amount of data will provide details that suggest the direction of future changes and how to move forward through systems thinking (Lee, 2023).

A celebrated approach to system thinking is one proposed by Peter Checkland (1989). Checkland's approach to system thinking is called Soft Systems Methodology (SSM), which emphasizes the importance of understanding the human element in any system. SSM involves a seven-stage process that begins with identifying the problem or issue and ends with proposing solutions to mitigate problems and issues. The key to SSM is to recognize that any system is made up of people with different viewpoints and perspectives, and that these perspectives must be considered when developing solutions.

Complementarily, Mike Jackson's work (1994) has focused on the practical application of system thinking in a variety of contexts. His approach emphasizes the importance of understanding the structure and behavior of complex systems and using this understanding to develop effective solutions.

This research employs a combination of Checkland's and Jackson's system thinking approaches to outline the significance of comprehending both the human aspect and the structure and behavior of soft systems, wicked problems in the case of the sustainable development of the BAR. This leads to a more comprehensive approach to problem definitions and solving that acknowledges the interconnectedness and interdependence of various components within the said system.

3. Research methodology

Firstly, it is important to outline this study as the initial step of a longer effort. For this reason, we must clearly define the scope of the study. Even though only 60% of the Amazon is in Brazil, we have defined the BAR as the unity of analysis for this study. Secondly, we opted not to employ an ethnographic or similar approach. In this first stage, we will not visit or interview the general population and stakeholders. Our research will be primarily focused on influential organizations that represent stakeholders (Table 1 exemplifies the more than 40 Brazilian and international organizations we are investigating as part of the study). Data collection will be composed of primary data from corporate websites, corporate publications, newsfeeds, annual reports and so on. The data collection process will also include secondary data from government publications, literature review, statistical databases, news outlets, and so on.

Table 1: Sample Organizations Investigated in the Study

Organization	Category	Website	What do they do?
Brazilian Annual Land Use and Land Cover Mapping Project - MapBiomas	Brazilian	https://mapbiomas.org/o-projeto	A product originated from a collaborative network to reveal the transformations in the Brazilian territory through science
Federação de Indústrias do Estado do Amazonas - FIEAM	Brazilian	http://www.fieam.org.br/	Association of industries and businesses in the Amazonas state.
Manaus Free Trade Zone Superintendence - SUFRAMA	Brazilian	https://www.gov.br/suframa/pt-br	Special government entity that manages the economic development of the free zone of Manaus (ZFM).
Ministry of the Environment and Climate Change	Brazilian	https://www.gov.br/mma/pt-br	Ministry of environment and climate change.
SOS Amazonia	Brazilian	https://sosamazonia.org.br/en	Non-Governmental Organization (NGO) stimulating the environmental knowledge of the Amazon.
Climate and Land Use Alliance	International	https://www.climateandlandusealliance.org/	A group of foundations exploring the potential of forests and land use

GEODATIN	International	https://geodatin.com/	A company specialized in spatial data, data intelligence and Geoinformation.
Greenpeace - Canada	International	https://www.greenpeace.org/canada/en/	Non-Governmental Organization (NGO) with the goal of mitigating harmful environmental practices.
ONU	International	https://www.un.org/en/	Organization focused on sustainable development goals and climate change actions against global warming.
World Economic Forum	International	https://weforum.org	International organization for public-private cooperation.

As an overarching framework to analyze and interpret data we will employ Checkland’s Soft Systems Methodology (1989). More specifically, the CATWOE mnemonic was adapted for this research, and it is described in Table2, as follows.

Table 2- CATWOE

Complex Pluralist System (Jackson, 1994) & CATWOE (Checkland, 1989)	
Customers: Who will benefit or be impacted?	Stakeholders or individuals who are directly affected by the system or problem. The system in the study typically addresses issues of customers.
Actors: Who does the work?	Represents the people or entities that play an active role in the system. These are the individuals or organizations responsible for implementing solutions to problems and issues.
Transformation: What needs to be accomplished?	Describes the core activities or processes within the system. It highlights how inputs are transformed into outputs to achieve the system's purpose.
Owner: who is the decision maker?	Refers to the individual or entity that has the authority and control over the system. The owner may be the person responsible for the system's success or ensuring the problem is resolved.
Environment: what are the constraints?	Represents the external factors and limitations that influence the system but are beyond the control of the actors. These constraints shape the boundaries within which the system operates.

The purpose of CATWOE in Soft Systems Methodology (SSM) is to provide a structured and comprehensive way to understand complex systems or problem situations (Checkland, 1989). The mnemonic helps analysts and stakeholders gain insights into different perspectives and viewpoints related to the system or problem at hand. CATWOE facilitates the construction of a "Rich Picture," which is a visual representation of the system that captures its various dimensions and elements.

The process of validation of findings was based on convergence of the several sources to build a strong chain of evidence. In other words, documental data and secondary sources of evidence were combined into a compelling argument that was validated during interviews and field research. In both cases, the convergence of the several sources of information was verified through the method of triangulation (Jick, 1979). More specifically, if three sources of evidence, including qualitative and quantitative data, point to the same fact this fact can be assumed as truth.

4. Historical background: Brazilian amazon economic development

Despite the world's attention and uncountable natural riches, many BAR inhabitants live in poverty and are exploited to this day (Costa et al., 2008). As follows, a summary of the current economic development path of the region.

Discounting exploratory expeditions in the early days of a colonized Brazil, the true process of exploring the riches of the Amazon rainforest began during the 19th century with the exploitation of rubber (Costa et al., 2008). The vulcanization technique generated demand worldwide and a remarkable economic boom (Costa et al., 2008). It is important to emphasize that, as well noted by Tavares (2011), the enrichment of the economy with the exploitation of rubber did not occur in the entire BAR, but only in Belém and Manaus, cities with large, exporting international companies. Subsequently, rubber seeds were taking to places like Malaysia, and competition turned fierce. The advent of plastics made with oil put an end to the rubber boom and with that the regional economy tanked and remained neglected by the federal government for decades.

According to Costa et al. (2008), as a way of kick start the regional economy once more, the federal government created the Zona Franca de Manaus (Manaus Free Trade Zone -MFTZ). The MFTZ was effectively implemented in 1967. Firstly, imported goods were allowed to enter the country without tariffs. Later, companies were encouraged to build operations in the region with tax incentives. There was an initial explosion in commerce, subsequently many international companies (e.g., Honda, Philips, Sony, Xerox) established manufacturing operations in Manaus. In the first years of the policy, the GDP of the state of Amazonas was only U.S.\$500. In 2010 the GDP reached U.S.\$3,570 (Holland et al., 2019). Currently, Manaus is the fifth richest state capital city in Brazil with GDP of over U.S.\$8,400 (IBGE, 2022), which is an impressive outcome from a strictly economic standpoint.

In 1954, The Brazilian national oil company, Petrobras began the search for oil in the Amazon and located it in the city of Nova Olinda, Amazonas state, but due to lack of investments, the extraction process was interrupted and came to be discontinued years later (Ricardo, n.d.). Today, in the Brazilian Amazon, oil and natural gas exploration is limited to moderate levels at the Urucu River site (Gómez et al., 2008). The BAR also has several types of ore such as bauxite, zinc, coal, manganese, and gold. Gold mining raises major concerns when done on a small scale by unregulated companies. The reason is that large companies tend to follow regulatory norms for carrying out their activities, while small gold mining operations do not. Hence, small operations contaminate the area and rivers with mercury, which is a risk for humans, especially members of indigenous tribes, who use the land and rely on fishing for their subsistence (Gómez et al., 2008). The state of Pará has been one of the largest ore producers since the second half of the 1960s, and most of its production is exported (Bentes et al., 2021). Despite boosting the local economy, this wealth does not bring benefits to the local communities and often causes environmental destruction (Bentes et al., 2021) and corresponding social challenges.

All development policies in the BAR have generated an increase in population migration to the region. Manaus, the capital of the state of Amazonas, has more than 2 million inhabitants, and Belém, the capital of Pará, has more than 1.5 million (IBGE, 2021). To support such populations, the government launched policies to encourage the

expansion of agriculture. Government policies played an important role, considering Brazil is an agriculture powerhouse (Walker et al., 2009). The main crop in the Brazilian Amazon, which received the most investment is soy, which represents 71.5% of local production today (Gomez et al., 2008; Serigatti & Possamai, 2021). Moreover, Brazil is a leading country in the production of livestock with 26 million heads of cattle (Gomez et al., 2008). The situation is no different in the Amazon and raising livestock is a major economic activity. Regional agriculture and the production of livestock are essential to support large cities, and these activities contribute to the economic development of the region. Regrettably, they have also been causing great environmental damage, being responsible for 97% of forest deforestation in 2021 (Azevedo et al., 2022).

5. Analysis and Preliminary Findings

In terms of **customers**, it is evident there is a diversity of stakeholders in place. Those with more at stake, and they are aware of that, are those who live in the BAR. They depend on the regional economy and their well-being is directly impacted by local economic activity. However, naturally, many others Brazilian and foreign will benefit from the economic development of the Amazon and will be impacted by it (e.g., climate change). Many others, Brazilian and international organizations have concerns about the impacts the economic development of the Amazon will have on the BAR biodiversity and local communities. For them, clearly, a path to economic development must assure a preservation of the bulk of the existing biodiversity, also assure positive social impact on local populations. When interviewed, Brazilian Minister Maria Silva (2006), one of the advocates for the implementation of policies for sustainable development, stated that protecting Biodiversity is fundamental and a strategy for everyone, since 50% of Brazil's GDP comes from its biodiversity.

The **actors** are naturally all of those engaged in economic activities in the region. Many of the organizations we are investigating represent that. The business community, workers, government, research, and education institutions are examples of that. If the BAR is to develop, it will develop based on the actions of the actors. It is noticeable the overlapping between actors and customers, and that is what makes this system beyond complex. For instance, business owners, who are also residents of the region, lead economically motivated activities that may impact their future quality of life (e.g., heat waves, and poor air quality).

The **transformation** is easy to propose but it clearly means different things to the different customers and actors: the sustainable development of the BAR. To have a thriving economy, high living standards for local populations while assuring similar opportunities for future generations, without causing unintended global impacts. That is incredibly difficult to achieve. It is arguable there are contrasting opposing views at play. For some economic development trumps everything else. More moderate views propose economic development is possible by exploiting only a fraction of the available resources, although nobody appears to clearly define what this fraction is or whether there is still enough room for further exploiting it. Some believe there is a way of rationally exploiting resources within certain thresholds, but nobody is effectively defining what that means either. Lastly, on the other side of the spectrum, some believe all the possible exploiting,

and all the possible populational growth has already happened. It is not possible to exploit or develop any further.

With a broader view of economic development, the private Brazilian multinational company Natura has invested \$400 million since 2010 to support carbon emission reductions. Roberto Marques, CEO of Natura Group & Co, said, "To achieve zero emissions, we need to innovate and monitor the group's entire supply chain and operations. We connect with business, government, and civil society leaders to find sustainable solutions. Furthermore, the climate crisis is the great challenge of our time, and the private sector will be responsible for acting and driving change to achieve the Paris Agreement goals" (Omena, 2021). The three largest private banks in Brazil, Bradesco, Itaú and Santander, started in 2020 the Amazon Plan as a financial effort to promote the sustainable development of the BAR. Sergio Rial, CEO of Santander, defined the program as a small seed for growth. "We had a concrete and transparent dialogue with representatives of the slaughterhouse industry. And we will look for the traceability of the chain in the coming years. That will guarantee that we can understand the whole process and work toward preserving the forest. We know that this is possible," said Rial. The private banks together invested almost \$70 million in the plan. From a fractioned investment perspective, only Santander financed over \$50 million in small businesses (Globo, 2021). JBS S.A., the recognized leading global food company, is investing in projects to contribute to sustainable and economic development in the BAR. Joanita Karoleski and Andrea Azevedo, the President, and the Director of the JBS Amazon Fund program, reported in 2022 that "New supported projects encourage research and development of ingredients and products based on the biodiversity of the Amazon biome, generating business for the region" and "These are innovative projects that will undoubtedly bring great contributions to the Amazonian production chain and local communities." The projects mentioned will increase the production of ingredients, provide better productivity to Amazon producers, and increase local families' income by more than 5% (Exame, 2022). As an incoherent action of the company, later that same year, the company admitted to buying almost 9 thousand cattle from one of Brazil's biggest deforested farms, belonging to a criminal kingpin (Unearthed, 2022).

There is agreement and there is disagreement when it comes to the **worldview**. Most agree there are huge resources and huge potential for economic development in the BAR. Most agree there is a problem with the indiscriminate, predatory exploitation of the forest, and local communities. There is no agreement about what the current situation is, current trends, and the path forward. There are contrasting views that represent a continuum. Some believe most of the forest is intact, and further exploitation is possible for the foreseeable future. Others believe that most of the forest is intact, but the pace of deforestation has accelerated uncontrollably. Lastly, some others believe the forest is already nearly gone or it is close to the point of no return. According to World Wildlife, the annual loss of the Amazon is at alarming levels, but 80% is still intact and it is still possible to take care of this heritage of humanity.

In line with the lack of agreement about economic development and driven by the diversity of Brazilian and international stakeholders, there is no agreement about who the **owners** of the process are, and who should make decisions about the economic development of the BAR. Strictly within the definition of the term, The Brazilian

government and policy makers are the owners of the system. They develop policies and regulations that guide current and future economic activity in the region. However, many of the Brazilian actors believe is their sole right to do as they please and unilaterally benefit from their economic activities with no consequence for how they may impact others. All international actors believe in the importance of the Amazon for the planet; therefore, they believe they are also owners, or rather they believe they have the right to at least influence the decision-making process. To illustrate that, the European Union (EU) has resumed talks about a free trade agreement with the Mercosur, an equivalent trading block of South American countries where Brazil plays a crucial role (Reuters, 2022). One of the conditions for furthering the discussion is a request that Brazil take a more active role in preventing the indiscriminate exploitation of the Amazon (Financial Times, 2023). A contrast between these statements is the pronouncement of former president Jair Bolsonaro (2019) who said, in the UN General Assembly, that “the Amazon does not belong to humanity, but only to Brazil...” Brazil has since, elected a left-wing government that is promising to reset the country’s approach to sustainable development. President Lula da Silva appears to be seeking a collaborative approach to deal with local and international stakeholders. However, there is no guarantee the Brazilian government will implement necessary changes, neither there can be expectations of a consistent, long-term approach. It all depends on who is elected next. If the Country goes back to the hands of right-wing populists, who knows? International organizations, such as the Canadian Green Peace (n.d.) will continue to lobby and influence governments (e.g., Canadian) to terminate any trade agreements with Brazil that could lead to the destruction of the Amazon rainforest. Also, in the case of actors and owners, the boundary between the two is blurry. That is yet another indicator that the problem is beyond complex.

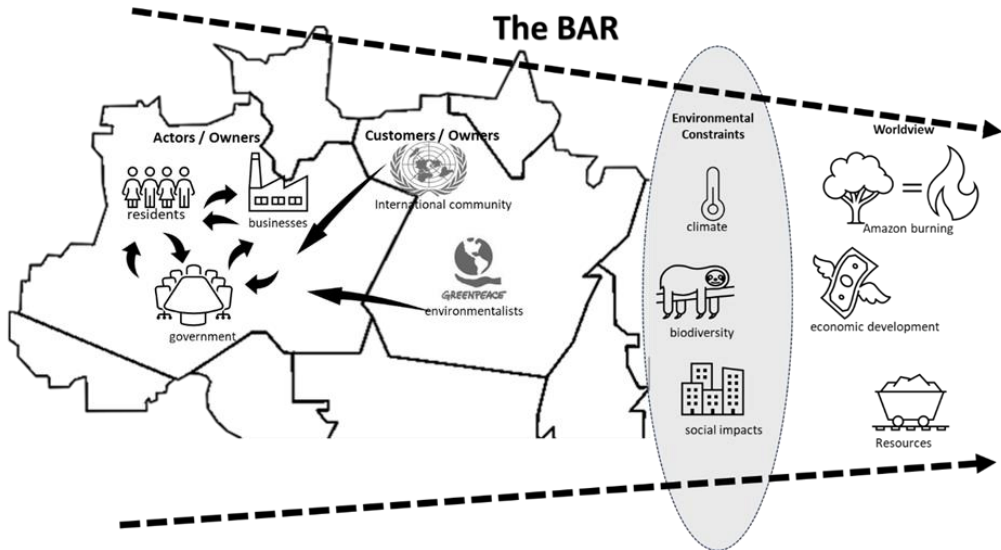


Figure 1. The Rich Picture of the BAR Sustainable Economic Development

In terms of the **environment**, clearly, we must consider constraints related to threats to biodiversity, climate change, and negative social impacts economic development may have on local populations. The need to assess the likelihood and the impact of global risks (e.g., climate change) is equally important.

As proposed by Checkland (1989), the CATWOE described above was used to build a “Rich Picture” of the system and it is represented on Figure 1 as follows. Essentially, actors, customers, and owners constantly influence each other. Environmental constraints combine to build lenses of the sort that in turn define how worldview is perceived.

6. Conclusion

The main proposition of this study was that the sustainable development of the BAR was a wicked problem. The triangulation of insights from many stakeholders employing Checkland’s (1989) SSM provides a robust chain of evidence of that. Firstly, the sustainable development of the BAR is a clear case of an open system with many interconnected variables. The body of knowledge to define and address issues with the system is incomplete and based on contradictory contents. It all depends on who one asks. For instance, botanists, climate scientists, economists, and social scientists each have their own understanding. There is no agreement about what the problem is, or even if there is a problem. What is the baseline? How much of the forest has been destroyed? What is the rate of destruction? How much of it can still be exploited? What rate of exploitation would allow for a safe, natural recovery? If we already reached a threshold beyond which further exploitation will have drastic consequences for the planned and the region, what alternatives would local populations have to continue their path toward economic development? If it is possible to further exploit resources in the Amazon, how to optimize the exploitation of resources to assure the maximum economic output for local populations? Secondly, there are many internal and external stakeholders, frequently with conflicting interests, even within the same group. Most stakeholders are following unilateral, reductionist views.

Thirdly, there is no agreement about who makes decisions concerning the economic development of the BAR. It would be natural to think, the Brazilian government and policymakers do. However, local populations influence the process by voting. Business associations lobby the government and steer policies to their liking. International organizations, and communities can exercise indirect pressure on the Brazilian government, and perhaps they should. What happens in the Brazilian Amazon has planetary consequences. The evidence also shows a perceived distrust of decision makers. To begin, policies are commonly not based on the best available knowledge, but on what will score the most political points. Even if they are based on sound studies, internal actors and customers do not trust the government will follow a predictable and clear approach long-term approach to deal with economic development. Campaign promises are often forgotten or pivoted. Agreements with domestic and foreign partners overturned, depending on who is in power. Local populations often do not trust business leaders to engage in truly sustainable practices. The paper mentions the actions of a food processing

company that talks sustainable investments and sources food from companies with dishonest environmental practices linked to harmful illegal activities.

Consequently, it is clear, no single stakeholder group has the worldview necessary to propose a transformation without drastic, unintended consequences to other stakeholders. It is also clear; no single disciplinary approach will have a complete and terminal knowledge base to define and solve the problem. Ultimately, as further evidence of the sustainable development of the BAR as wicked problem, perhaps this a problem without a clear definition and solution. It is rather a system that needs to be dealt with in a holistic, iterative, and collaborative fashion.

The main theoretical contribution of this study is to apply the theory of wicked problems and system thinking to a timely, and important world problem - the Sustainable Economic Development of the BAR. The main practical contribution of this paper is to offer Brazilian policymakers an approach to contemplate the perspective of others as a guide to their decision-making process and actions. Government officials must understand the impacts of their economic policies in terms of social wellbeing of local populations, climate, and biodiversity. Conversely, business leaders may reflect and be forced to understand the big picture of their strictly business-oriented decisions. Businesses do not operate independently of the environment (natural and social).

The limitations of this study are at the same time opportunities for future studies. This is the initial step of a longer research thread. We have identified more than 41 organizations with a stake in this issue and we believe there are more. The sample should be larger to be more representative. Moreover, a more in-depth study including interviews and observations is necessary. To understand better and to further validate findings, local populations must be surveyed, and interviewed as well. The view from the ground may offer complementary insights. Lastly, the Amazon region includes multiple South American countries, and there is an opportunity to replicate the study regionally. There is even an opportunity for comparative studies. It is also true; the Amazon is not the only important ecosystem in danger in the world. Similar studies can be completed in other regions. A variety of similar studies will further solidify the understanding of sustainable economic development as a wicked problem. The final, and perhaps more impacting possibility is to study, propose, and test approach hes to deal with sustainable development as a wicked problem. In such cases, system thinking may offer the best overarching framework to be employed.

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