



Roadmap for Sustainable Infrastructure in the Amazon

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INTRODUCTION

Quality infrastructure in sufficient quantity reduces the costs involved in producing and providing of basic services to the population, thus stimulating economic growth and a better quality of life. This is especially relevant in a post-Covid world. With this in mind, the Brazilian government intends to promote investments aimed at a comprehensive portfolio of projects, some of which are in the Amazon. This includes recent projects as well as projects inherited from the country's national integration and occupation plans put in place over the last fifty years.¹

Land transport infrastructure is one of the drivers of deforestation in the Amazon;² until 2006, approximately 95% of deforestation was within 5.5 km of a road.^{3,4} In the state of Pará alone, our major federal investments of this kind are planned: the Ferrogrão railroad as well as the BR-155/158, and BR-163/230/MT/PA, and BR-230/PA highways. These have the potential to generate 6,989 km² of deforestation over thirty years.⁵ More than ninety state roads are also planned in Pará. **Reversing this link between infrastructure and deforestation is critical, both because the region is much more isolated than the rest of the country⁶ and because of the sharp increase in deforestation in the region in recent years.⁷**

The current development of infrastructure in the Amazon calls for an urgent debate, especially in an election year, to come up with a development strategy for Brazil that recognizes infrastructure as a powerful tool for meeting the country's goals and also considers the future of the Amazon and how its natural resources are used. Creating new infrastructure investments, in what is the world's largest tropical forest and an essential provider of ecosystem services for the Brazilian society and economy, will require improving the socio-environmental analysis of projects, above and beyond environmental licensing, in order to prevent and mitigate their potential negative impacts.

Researchers from Climate Policy Initiative/Pontifical Catholic University of Rio de Janeiro (CPI/PUC-Rio) have mapped the main phases of the life cycle of land transportation infrastructure projects. They have addressed the decision-making process with reference to the planning and feasibility phases, as well as challenged how the areas of influence have traditionally been defined for these projects and the quality of their socio-environmental studies, and developed methods to map projects' economic and environmental impacts.

1 PPI. *Projetos*. nd. bit.ly/3HNqklb. Access date: December 16, 2021.

2 Berenguer, Erika et al. *Drivers and Ecological Impacts of Deforestation and Forest Degradation*. Science Panel for the Amazon (SPA), 2021. bit.ly/3xOTeDo. Access date: December 16, 2021.

3 Ahmed, S. E., Carlos M. Souza, Julia Ribeiro et al. "Temporal patterns of road network development in the Brazilian Amazon". *Reg Environ Change* 13 (2013): 927-937. bit.ly/3zRd5Eo. Access date: December 16, 2021.

4 Christopher P. Barber, Mark A. Cochrane, Carlos M. Souza, and William F. Laurance. "Roads, deforestation, and the mitigating effect of protected areas in the Amazon". *Biological Conservation* 177 (2014): 203-209. bit.ly/3OeOLRo. Access date: December 16, 2021.

5 Bragança, Arthur, Luiza Antonaccio, Brenda Prallon, Rafael Araujo, Ana Cristina Barros, and Joana Chiavari. *Governance, Area of Influence, and Environmental Risks of Transport Infrastructure Investments: Case Studies in the State of Pará*. Rio de Janeiro: Climate Policy Initiative, 2021. bit.ly/3p7q1Pk.

6 Araujo, Rafael, Arthur Bragança, and Juliano Assunção. *Accessibility in the Legal Amazon: Measuring Market Access*. Amazônia 2030, 2022.

7 INPE. *Monitoramento do Desmatamento da Floresta Amazônica Brasileira por Satélite*. nd. bit.ly/3zV4C3e. Access date: December 16, 2021.

This analysis has yielded **twelve recommendations** that can help steer the decision-making process and reduce project execution risks, as well as improve the quality of land infrastructure. Although they apply to projects throughout Brazil, these recommendations are especially relevant to the development of land infrastructure in the Amazon since the socio-environmental impacts of projects in the region are typically greater than in the rest of the country. These recommendations are presented here in the form of a **roadmap for the future of land infrastructure in the Amazon** (Table 1).

The roadmap is based on three pillars: anticipating socio-environmental analysis in the decision-making process of public administrators; quality of socio-environmental studies; and transparency.

These three pillars are interrelated. The decision-making process currently lacks defined steps and clear-cut competencies, which hinder the earlier socio-environmental analysis that would make a project more robust and even viable by the time it reaches the environmental licensing phase. The poor quality of the socio-environmental studies creates uncertainty about the viability of a project and its potential negative impacts, preventing public authorities' ability to act earlier to prevent and mitigate those effects. Finally, transparency is a core pillar and must be increased so improvements on the other pillars can be more effective.




For each pillar, this roadmap proposes concrete actions and indicates the government entities responsible for driving improvement, as shown in Table 1.

This document summarizes the importance of making improvements to the three pillars shown above (the decision-making process, socio-environmental studies, and transparency) to improve the quality of land transportation infrastructure in the Amazon.

Table 1. Action Plan

Responsible Entities

- Ministry of Infrastructure
- ANTT and/or DNIT and/or VALEC
- Ministry of the Environment
- Ministry of the Economy
- IBAMA
- National Congress
- PPI Council

	RECOMMENDATIONS	RESPONSIBLE ENTITIES
 Decision-making Process Aiming for Earlier Socio-environmental Analysis	1. Define the steps of the decision-making process.	● ● ● ● ●
	2. Establish a requirement to conduct the EVTEA before the EIA.	● ● ●
	3. Introduce the pre-feasibility phase as a new step in the decision-making process.	● ● ●
	4. Institute clear-cut competencies for public authorities.	● ● ●
	5. Include socio-environmental components in the infrastructure sector's short-, medium- and long-term planning.	● ● ● ●
 Quality of Socio-environmental Studies	6. Establish a method for delimiting the boundaries of an area of influence which considers the areas where the economic, social, and environmental dynamic is affected by the implementation of a project.	● ● ●
	7. Guarantee that the studies comply with their own terms of reference.	● ● ●
	8. Include the analysis of socio-environmental components indicated by sectoral manuals and international best practices.	● ● ●
 Transparency	9. Implement an open and unified database and code base.	● ● ● ●
	10. Build and maintain a geographic information system (GIS) that includes the location and condition of infrastructure as well as the delimited boundaries of conservation units, indigenous territories, <i>quilombola</i> and traditional communities, settlements, private areas, and undesignated public lands.	● ● ● ● ●
	11. Establish a verifiable method for delimiting area of influence which can be used within the GIS.	● ● ● ● ●
	12. Publish EVTEA approval minutes.	● ● ● ●

Source: CPI/PUC-Rio, 2022

PUBLIC ADMINISTRATORS' DECISION-MAKING PROCESS – ANTICIPATING A SOCIO-ENVIRONMENTAL ANALYSIS

The decision-making process lacks linearity. Current legislation establishes which steps must be completed by infrastructure project stakeholders, and which ones require acts of public administration. Each step includes an objective that may be met to a greater or lesser extent depending on the order in which it is executed. This means that, for example, a project might already have been through the bidding process but still be working on its environmental impact assessment (EIA) and Technical, Economic, and Environmental Feasibility Studies (*Estudos de Viabilidade Técnica, Econômica e Ambiental* - EVTEA). In this example, although the steps are indeed being completed, the order of execution is not effective for meeting the objective of each step.

The first recommendation thus concerns the need to explicitly define the steps of the decision-making process for an infrastructure project, from the planning phase through the operational phase, and identify what order the steps must follow.

This would improve the decision-making process, since explicitly ordering the steps can lead to decisions that are more thorough and more technically based. It also has the potential to increase transparency, reduce risks, and attract investors by making it easier to track the projects. Finally, it strengthens the viability phase because sequencing the steps tends to improve the technical consistency of projects, beginning with the planning phase, moving through the feasibility studies, and into the environmental impact assessments and environmental licensing.

A previous study by CPI/PUC-Rio also addresses the steps of the decision-making process and identifies an overlap of around 30% between the topics covered by the EVTEA's environmental diagnosis and the EIA.⁸ In other words, a dialogue between the EVTEA and the EIA, which is currently non-existent, would make the decision-making process more efficient. As such,

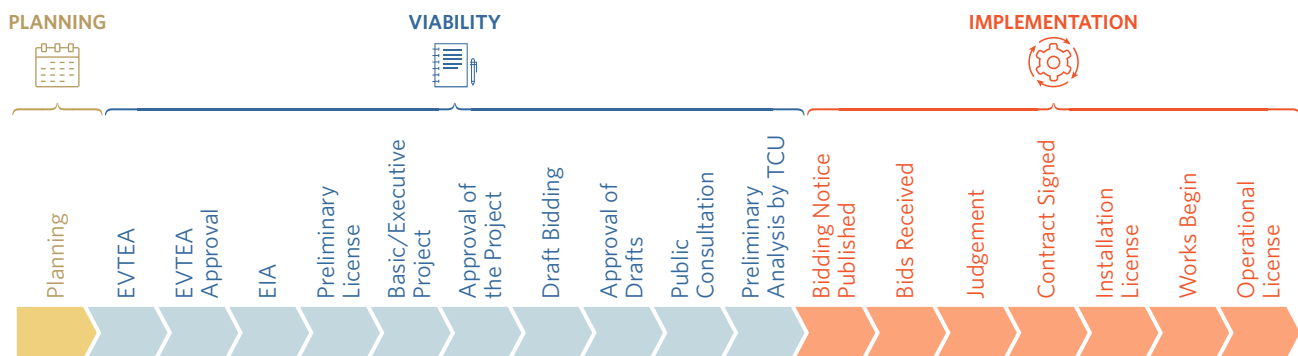
The second recommendation is for the EVTEA to be conducted before the EIA and considered by the EIA.

This would enable the EVTEA to conduct earlier socio-environmental analyses — albeit only partial ones — which would otherwise only be conducted as part of the EIA during the environmental licensing process.

CPI/PUC-Rio analyzed the objectives of each phase of the life cycle of federal land transport infrastructure concessions, beginning with current legislation and current practices, particularly for the feasibility phase, and has proposed a new sequence that would make it possible to conduct socio-environmental analyses even earlier than the environmental licensing phase (Figure 1).

⁸ Antonaccio, Luiza and Joana Chiavari. *Strengthening Environmental Studies for Federal Land Infrastructure Concessions*. Rio de Janeiro: Climate Policy Initiative, 2021. bit.ly/3ylSHTQ.

Figure 1. Proposed Life Cycle for Land Transport Projects



Source: CPI/PUC-Rio, 2021

This additional improvement to the decision-making process with the potential to bring even more technical consistency — not only to the EIA and licensing, but also to the EVTEA — makes up

The third recommendation that calls for adding a pre-feasibility phase to the decision-making process in the project life cycle.

In this phase, a project would be described and analyzed based on pre-existing information, with the guidance of structuring questions along with an analysis of the socio-environmental complexity, focusing on aspects of territorial, environmental, and social governance. Finally, the project would be evaluated by an independent commission. If approved, the EVTEA could then be conducted, taking into account the prior analysis.⁹

This sequencing between the pre-feasibility phase, EVTEA, EIA, and licensing would provide more granular reviews as the projects' progress through the various stages to prevent low-quality projects (due to inertia or political economy) from reaching a point of almost no return. Such a procedure would allow for the coordination of government efforts as well as for the territory.¹⁰ The introduction of the pre-feasibility phase can be made through the regulating decree of the New Bidding Law.¹¹ Figure 2¹² illustrates how this new phase would be integrated into existing phases.

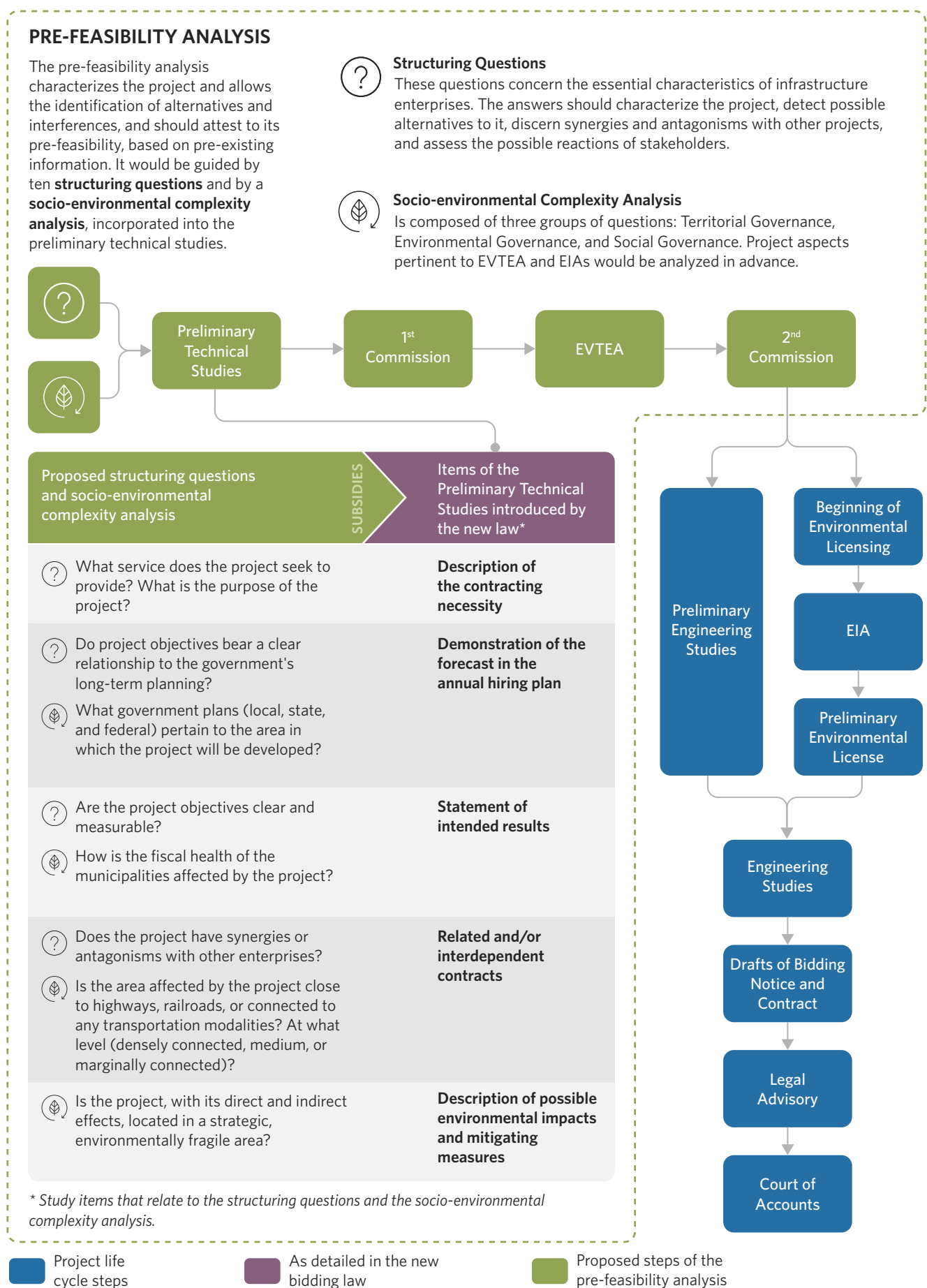
⁹ Cozendey, Gabriel and Joana Chiavari. *Environmental Viability of Land Transport Infrastructure in the Amazon*. Rio de Janeiro: Climate Policy Initiative, 2021. bit.ly/3yFhpVb.

¹⁰ Chiavari, Joana, Luiza Antonaccio, Ana Cristina Barros, and Cláudio Frischtak. *Brazil's Infrastructure Project Life Cycles: from Planning to Viability. Creation of a New Phase May Increase Project Quality*. Rio de Janeiro: Climate Policy Initiative, 2020. bit.ly/3O4C3Ug.

¹¹ Cozendey, Gabriel and Joana Chiavari. *The New Bidding Law Offers Opportunities to Improve Infrastructure Projects and Prevent Socio-Environmental Impacts*. Rio de Janeiro: Climate Policy Initiative, 2021. bit.ly/3RI76bt.

¹² Ibidem.

Figure 2. Proposal for Incorporating a Pre-feasibility Study into the Pre-bidding Phase under the New Bidding Law



Source: CPI/PUC-Rio, 2022

Adding onto the importance of defining the steps of the decision-making process and introducing pre-feasibility studies,

The fourth recommendation is to better define the competencies required of public authorities who participate in decision-making throughout the project life cycle.

It is important, for example, that there be an explicit definition of the competencies required for granting prior approval for the feasibility studies at the beginning of a project. This competency formally falls to the council of the Investment Partnership Program (*Programa de Parcerias de Investimentos* - PPI), according to its own by-laws. However, a study by CPI/PUC-Rio¹³ shows that for 10 federal concessions in the Amazon – 5 railroads and 5 highways –¹⁴, either no council decision existed, or none was available, which means that the studies were analyzed primarily at the end of the feasibility phase – in other words, too late – by the Federal Court of Accounts (*Tribunal de Contas da União* - TCU). This results in the studies reaching the TCU with inconsistencies, which can lead to project delays and wasted public resources since the studies and concession documents must be redone.

Ideally, the competencies and the flow of the project life cycle would be defined by legislative changes for the sake of stability, but other impactful actions could also be taken within the regulatory framework, such as explicitly defining the competencies required to grant prior approval for the feasibility studies at the beginning of a project. Finally,

The fifth recommendation addresses the need to include the analysis of socio-environmental components in the short-, medium- and long-term planning of the infrastructure sector.

Although the Long-Term Integrated Plan for Infrastructure (*Plano Integrado de Longo Prazo da Infraestrutura* - PILPI) was published in December of 2021¹⁵ and addresses the need for a long-term plan for the sector, the opportunity was lost during its conception to consider important socio-environmental questions that could determine project viability and attract investment, especially investment focused on socio-environmental issues. The same has happened with the National Logistics Plan 2035 (*Plano Nacional de Logística 2035* - PNL),¹⁶ which restricts socio-environmental analysis to estimates of carbon emissions. Assessing socio-environmental impacts beyond CO₂ emissions by mode of transport, and considering the deforestation potential of projects and the specificity of each biome is key to a more robust analysis and a more informed decision-making process when it comes to deciding whether to include a particular project on the government's agenda. These plans could be adjusted or reworked without the need for a law.

13 Cozendey, Gabriel and Joana Chiavari. *O Papel do Tribunal de Contas da União para a Gestão de Riscos Socioambientais das Concessões Federais de Ferrovias e Rodovias*. Rio de Janeiro: Climate Policy Initiative, 2021. bit.ly/OPapeloTCU.

14 Rail projects analyzed: Ferrogrão, Ferronorte (Aparecida do Taboado – Rondonópolis); Ferronorte (Rondonópolis – Lucas do Rio Verde – Sorriso); Ferrovia de Integração do Centro-Oeste (FICO) (Mara Rosa – Lucas do Rio Verde); Ferrovia Norte-Sul (FNS) (Açailândia – Barcarena); FNS (Açailândia – Palmas); FNS (Porto Nacional – Estrela D'Oeste); Estrada de Ferro Carajás (EFC); EFC, Ramal Ferroviário do Sudeste do Pará (EFC RFSP). Road projects analyzed: national highways BR-153/TO/GO; BR-364/MT/GO; BR-364/MT/RO; BR-163/230/MT/PA; BR-163/MT.

15 Adopted in December 2021. See: Casa Civil. *Resolução nº 03*. 2021. bit.ly/3HSVMoh. Access date: December 23, 2021.

16 Adopted in October 2021. See: Boletim de Gestão de Pessoas. *Resolução GM/MINFRA nº 6*. 2021. bit.ly/3NiykCg. Access date: December 15, 2021.

QUALITY OF SOCIO-ENVIRONMENTAL STUDIES

Socio-environmental studies lack quality. Specific actions can be taken to improve the EVTEA and EIA, primarily with respect to delimiting the area of influence and improving the socio-environmental components analyzed during the studies.

The area of influence indicates where and at what depth the developer must focus efforts to analyze, mitigate, and compensate for the direct and indirect impacts of a project. It also lets authorities know where and how they must act. The accurate delimitation of a project's area of influence is thus key to identifying and managing its socioeconomic and environmental risks, as well as to guiding the integration of policies that help guarantee the rights of the populations that are directly and indirectly affected.

Areas of influence are classified as either direct or indirect. A direct area of influence takes into account the impacts of installing and operating the infrastructure. An example of a direct area of influence is the stretch of land where the tracks for a rail project are to be laid, and the deforestation required to lay the tracks can be considered a direct impact.

Meanwhile, there is no official method for defining the indirect area of influence. It would include the area impacted, for example, by the deforestation that comes with occupying the space surrounding a highway, which thus has no direct relation to a project's installation or operation. The indirect area of influence is generally defined by estimating buffers to the left and right of a railroad or road, which can reach dozens of kilometers in width, but it is unclear what technical criteria are used to guide the delimitation of these areas.

Researchers at CPI/PUC-Rio have therefore developed an innovative approach to delimit indirect area of influence: the application of the approach is known as market access. With this approach, it is possible to estimate the areas that are economically affected by a project, as well as to assess in what ways the changes to the economic dynamic could drive deforestation – even in areas not in the path of the project – and to calculate, finally, the economic and environmental impact of the projects in terms of tons of carbon.^{17,18}

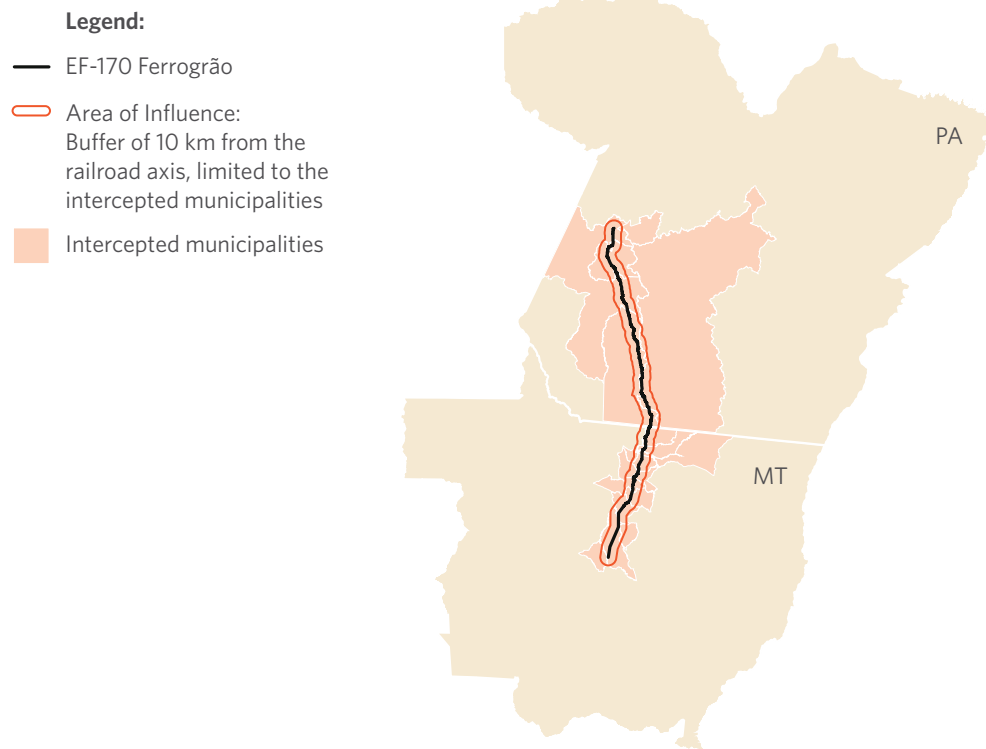
In the case of the Ferrogrão railroad project, for example, the indirect area of influence is much smaller when defined using only buffers around the project than when using the market access approach. This has direct implications for the predicted impact on deforestation and the estimated carbon emissions of the project.¹⁹

17 Antonaccio, Luiza, Ana Cristina Barros, Arthur Bragança, and Joana Chiavari. *The Need to Better Define and Delimit Area of Influence for Infrastructure Projects*. Rio de Janeiro: Climate Policy Initiative, 2020. bit.ly/3RDwX4d.

18 Bragança, Arthur, Rafael Araujo, and Juliano Assunção. *Measuring the Indirect Effects of Transportation Infrastructure in the Amazon*. Rio de Janeiro: Climate Policy Initiative, 2020. bit.ly/3z81xf5.

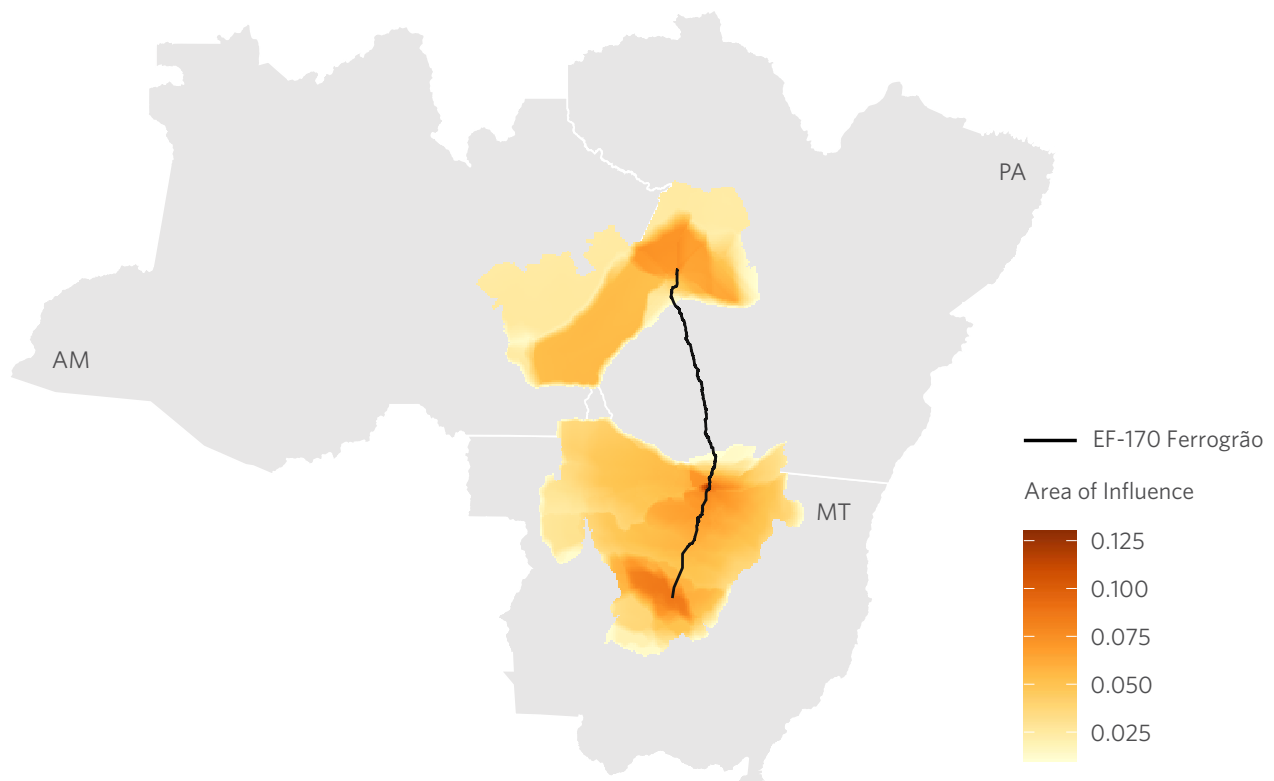
19 Ibidem.

Figure 3. Area of Influence from the Socioeconomic Environment Defined by Buffer



Source: CPI/PUC-Rio with data from *Relatório de Impacto Ambiental da Ferrogrão* by MRS Ambiental, 2022

Figure 4. Area of Influence Defined by Market Access



Source: CPI/PUC-Rio, 2022

The sixth recommendation is thus to improve the delimitation of the indirect area of influence for land infrastructure projects, using an approach that takes into account the area where the economic, social and environmental dynamic is affected by the implementation of the infrastructure project.

The hope is that the area of influence is dynamic in nature and will be improved upon throughout the project life cycle as a result of discussion. But agreeing on a well-defined initial approach contributes to transparency and makes it easier to predict a project's impacts from the very beginning, during the pre-feasibility phase.

It is worth highlighting that, according to a CPI/PUC-Rio study, the EVTEA and EIA frequently fully or partially fail to consider the analysis of socio-environmental components laid out in their own respective terms of reference, and they also often fail to follow the appropriate sectoral manuals. Half of the EVTEA previously analyzed by CPI/PUC-Rio did not comply with their terms of reference, and none of the EIA analyzed completely complied with theirs. EVTEA compliance must therefore be evaluated, not only with respect to their own terms of reference, but also with respect to the manuals for the sector.²⁰

The seventh recommendation on this roadmap, then, is to guarantee EVTEA and EIA compliance with their own terms of reference and with sectoral manuals.

Finally, researchers at CPI/PUC-Rio found that the EVTEA and EIA terms of reference do not call for the analysis of socio-environmental components that international guidelines on best practices cite as essential for acceptable impact assessments.²¹

The eighth recommendation thus aims to include, in the EVTEA and EIA terms of reference, the analysis of the socio-environmental components cited by international guidelines as the most important for the impact assessment of land infrastructure projects.

²⁰ Antonaccio, Luiza and Joana Chiavari. *Strengthening Environmental Studies for Federal Land Infrastructure Concessions*. Rio de Janeiro: Climate Policy Initiative, 2021. bit.ly/3yISHTQ.

²¹ Ibidem.

TRANSPARENCY

Infrastructure planning and development in Brazil lacks transparency. CPI/PUC-Rio researchers analyzed ten federal rail and road concessions in the Amazon and found that over half (57%) of the primary documents and information concerning these projects were either unavailable or possibly did not even exist.²² More specifically, among the documents that were available, there was not a single approval for EVTEA. Even after an active search and hundreds of requests made to the appropriate governmental bodies under Brazil's Access to Information Law,²³ researchers were unable to obtain the documents and information. Another research challenge was the fragmented and contradictory information on the websites of different governmental bodies and entities.²⁴

The Ministry of Infrastructure centralizes a great deal of the information on Brazil's transportation network. But this information is incomplete. No data exist, for example, on the state road networks, while the data on changes to the federal road networks are available only by decade. So, if there was an important project in 1995, for example, the available data for it would only be accounted for in 2000. The data on railroad stations are not entirely compatible with the data on changes to the rail network, which is only available by decade as well. All the data include observations containing incomplete information, a problem aggravated by the lack of a dictionary of variables. Without historical and current data, estimates of the impact of future projects are less precise or even impossible to make.

Moreover, CPI faced difficulties in accessing georeferenced data and open codes to obtain the locations and condition of land infrastructure projects as well as the boundaries of conservation units, indigenous lands, *quilombola* and traditional communities, settlements, private areas and undesignated public lands. As such,

The ninth recommendation of the roadmap is to implement a single publicly available database and code base for infrastructure projects.

This proposal has, in fact, already been established by the New Bidding Law,²⁵ so implementing it would not require any further legislative action.

²² Cozendey, Gabriel and Joana Chiavari. *Environmental Viability of Land Transport Infrastructure in the Amazon*. Rio de Janeiro: Climate Policy Initiative, 2021. bit.ly/3yFhpVb.

²³ Casa Civil. *Lei nº 12.527*. 2011. bit.ly/39Kv055.

²⁴ Websites of the National Land Transportation Agency (*Agência Nacional de Transportes Terrestres* - ANTT), the Planning and Logistics Company (*Empresa de Planejamento e Logística* - EPL), and the PPI give contradictory information on federal land projects. Once the inconsistencies were pointed out to federal authorities, the websites were updated. For example, see the ANTT site: bit.ly/3Nf8iQ1.

²⁵ Secretaria-Geral. *Lei nº 14.133*. Art. 25, § 3; Art. 54; Art. 174, I; Art. 174, § 2, III and V; and Art. 174, § 3, VI, 'd'. 2021. bit.ly/3NayeMI. It would be important for future decrees regulating the new law to create a specific requirement for this database to release the following documents from the preparatory phase of bidding for infrastructure projects: preliminary technical studies; EVTEA; pre-feasibility studies by independent commissions, when implemented; the basic project; and an assessment of the preparatory phase by legal advisory bodies, with the understanding that the law already creates a general obligation to release attachments.

The tenth recommendation, which would ideally integrate this database, is to build and maintain a geographic information system (GIS) that includes the location and condition of infrastructure projects along with details on conservation units, indigenous lands, quilombola and traditional communities, settlements, private lands, and undesignated public lands.

Once the GIS is operational, the eleventh recommendation is to establish a verifiable method for delimiting area of influence, operable within the GIS.

These actions would allow the government, investors, academic institutions and civil society to track the implementation of infrastructure projects and monitor their socio-environmental impacts in sensitive regions such as the Amazon.

In May of 2022, the Ministry of the Economy launched the Investment Monitor (*Monitor de Investimentos*) platform in partnership with the Inter-American Development Bank (IDB), to bring more transparency to investments in the infrastructure sector: energy, transportation and logistics; sanitation; urban mobility; and telecommunications.²⁶ But the platform does not serve as a georeferenced database, or as a database of documents relevant to specific projects.

Finally, as mentioned above, among the documents that should have been available, researchers at CPI/PUC-Rio did not have access to any EVTEA's approval, even after an active search and hundreds of requests sent to the appropriate bodies under the Access to Information Law.²⁷ So

The twelfth recommendation is to publish EVTEA's approval.

CONCLUSION

Investment in land infrastructure is key to improving the quality of life of the people in the Amazon and can help drive economic growth in the region. However, it is critical to prevent infrastructure from leading to an increase in deforestation, considering how essential the ecosystem of this biome is to the Brazilian society and economy.

In October of this year (2022), Brazil will hold its presidential elections. It is vital that there be discussion of a development strategy for the country that recognizes infrastructure as a powerful tool for meeting national objectives and considers the future of the Amazon.

This roadmap offers paths to quality transportation infrastructure in the Amazon, and points to concrete actions that will increase transparency, improve the decision-making process by implementing earlier socio-environmental analyses, and enhance the quality of socio-environmental studies. The President of the Republic, the Ministry of the Economy, the

²⁶ Ministério da Economia. *Monitor de Investimentos*. bit.ly/3Ou6Ryj. Access date: May 18, 2022.

²⁷ Cozendey, Gabriel and Joana Chiavari. *Environmental Viability of Land Transport Infrastructure in the Amazon*. Rio de Janeiro: Climate Policy Initiative, 2021. bit.ly/3yFhpVb.

Ministry of Infrastructure, the Ministry of the Environment, as well as the PPI, the National Land Transportation Agency (ANTT), *Engenharia, Construções e Ferrovias S/A* (VALEC), the National Department for Transport Infrastructure (DNIT), the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), and the National Congress must act to promote these improvements.

Implementing these recommendations could have positive spillover effects on the mobilization of resources for the land infrastructure sector in the region. Reducing the risks and conflict associated with projects could have two effects. The first is lower costs for implementing projects, which would increase public and private return on investment in the sector. The second is that it would attract more qualified private investors to invest in the land infrastructure sector, increasing the flow of private capital and the quality of projects as well as their execution.

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