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Carajás Corridor in Brazil: Could an SEA Have Reconciled Shared-Use Infrastructure and Environmental Protection?

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**DEVELOPMENT
CORRIDORS
PARTNERSHIP**

IMPACT ASSESSMENT FOR CORRIDORS: FROM INFRASTRUCTURE TO DEVELOPMENT CORRIDORS

Edited by:
Jonathan Hobbs and Diego Juffe Bignoli
2022

The Development Corridors Partnership

The Development Corridors Partnership (DCP) is a research and capacity development initiative. It is a collaboration between institutions from China, Kenya, Tanzania and the UK. The main objective is to deliver effective research and capacity-building to help improve corridor planning and management. It aims to ensure that development corridor decision-making is based on sound scientific evidence and effective use of available planning tools and procedures, to ensure that risks are

avoided and opportunities exploited. The DCP comprises partners from the University of York, the University of Cambridge, London School of Economics, Sokoine University of Agriculture, the University of Nairobi, as well as the UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), African Conservation Centre, the World Wide Fund for Nature (WWF), the Chinese Academy of Agricultural Sciences and the Chinese Academy of International Trade and Economic Cooperation (CAITEC).

DCP Partners:



For the purposes of this publication, DCP collaboration was extended to experts representing Netherlands Commission for Environmental Assessment, the Centre for Energy, Petroleum and Mineral Law and Policy at the University of Dundee, the University of Queensland, the Columbia Centre on Sustainable Investment, the GOBI

Framework for Sustainable Infrastructure Initiative (comprising the University of Oxford, University of Central Asia and the Independent Research Institute of Mongolia), The Biodiversity Consultancy, the Wildlife Institute of India, the Endangered Wildlife Trust and Ecotecnia Ingenieros Consultores SRL.

Expert Organisations:



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Foreword

In the course of a long and varied working life, I have been privileged to work with, or learn from, a stimulating panoply of individuals who are committed to contributing to the economic, social, and environmental development of all aspects of the United Nations Sustainable Development Goals.

Jon Hobbs and Diego Juffe-Bignoli are, thankfully, two of these individuals. I was delighted to learn that they had come together to produce, for the Development Corridors Partnership, a rich and stimulating collection of research reports, case studies and assessments relating to the array of efforts made under the rubric of 'development corridors'. They were determined to express the conviction that decisions made, primarily by governments, regarding the planning and building of Corridors, really must be informed by an evidence-based understanding of the consequences - positive or negative - of these decisions. And they have succeeded. But Jon Hobbs will never read these words. He was hospitalized after the bulk of the work was complete, and, to the deep sadness and regret of all who knew him, he passed away at the end of September, 2021.

Jon and Diego sought out and recruited a daunting array of researchers, scholars and stakeholders to shed light on the processes currently underlying the world of development corridors today. They certainly succeeded.

The work was initiated before the onset of the COVID-19 pandemic, and as governments turn to the formidable challenge of restoring

economic vitality without further damage to the climate, it becomes even more imperative that impact assessment be understood, embraced and improved. Jon and Diego have shown us the way forward for a journey which absolutely must be embarked upon.

They would be first to recognise that the Development Corridors Partnership as a whole must be commended for showing - in many different ways and places - that, not only is the need for impact assessment clear and present, but so are the skills and commitment of researchers, scholars and stakeholders. These are to be found in an impressive coming together of universities, civil society organizations and business groups, and communities.

All are part of an outstanding initiative, funded by the UK Research and Innovation Council, and managed by the UNEP-WCMC. This initiative has been embraced by some of the best minds that have been turned to the task of ensuring that - while we attempt to bring economic and social benefits to people, in line with the United Nations Sustainable Development Goals - we do not risk significant environmental and social costs, and thus actually undermine long-term development successes.

So, I urge you to read this book, and figure out how you might improve your own contribution to the challenges ahead. Jon and Diego have set out a case. It needs to be taken up, not set aside; acted on, not just talked about. It is in your hands.

John Harker

Chair of the Development Corridors Partnership Independent Advisory Board,
Nova Scotia, Canada.

Dedicated to the memory of Jon Hobbs
who was the architect and driving force of this book

Executive Summary

Driven by increasing globalisation, the development aspirations of nations, and the need to access resources, an infrastructure boom is impacting many regions of our planet. New infrastructure projects are traversing diverse landscapes over hundreds of kilometres, often crossing international borders and penetrating into remote areas previously unaffected by industrialisation and urbanisation. These large-scale projects, mostly spanning several regions in a same country, but often linear and transnational in nature, are generically called corridors. Depending on the nature and objectives, they can be transport, infrastructure, growth, resource or economic corridors.

The rapid development of corridors globally presents environmental planning professionals with numerous challenges. **The primary need is to ensure that decisions about these developments are informed by an evidence-based understanding of their consequences - both positive and negative.** This will enable infrastructure development to meet development needs without adversely impacting ecological systems or human welfare. Improving the quality of infrastructure policies, plans, programmes and projects, by ensuring they include the necessary environmental and social scrutiny, is urgently required now - and will be for the foreseeable future. This challenge is the unifying theme of this publication.

Using insights from Africa, Asia and South America, this sourcebook compiles 24 contributed papers written in 2021, covering many facets of the

opportunities and challenges presented by the rapidly growing number of infrastructure and corridor developments around the world. Prevailing planning practices are reviewed through case studies along with the efficacy of some of the available tools to conduct systematic and comprehensive impact assessments. The latter includes Strategic Environmental Impact Assessment (SEA) and Environmental Impact Assessment (EIA).

As the title suggests the underlying thesis of this publication is that, where they are justified, **there are significant benefits in ensuring that corridors that contain single purpose infrastructure developments (utility, infrastructure or transport) progress through a carefully planned sequential process of diversification and expansion to ensure the maximisation of benefits in full-blown 'development corridors'.** In this book, development corridors are therefore aspirational. They comprise areas identified as priorities for investment to catalyse economic growth and development. They should be developed with multiple stakeholders and social, economic and environmental interests and interdependencies in mind. With the integration of sustainability principles and appropriate environmental and social standards, development corridors could become true '(sustainable) development corridors'. They should be planned to maximise positive opportunities and minimise negative risks. Without this, today's short-term successes will become tomorrow's challenges and long-term human welfare and ecosystem integrity will be undermined.

Overview of contents

This book brings together a wide range of perspectives from experts, researchers, and practitioners around the world with the purpose to foster greater collaboration and increase our global understanding of corridors and their benefits and potential negative impacts. 13 of the 24 chapters are written by independent experts and researchers from Australia, Bolivia, Brazil, China, India, Kenya, Mongolia, South Africa, Tanzania, UK, and the USA. The book also includes 11 chapters containing material gathered by the Development Corridors Partnership, a programme of work led by UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and funded by the UK Government via their Global Challenges Research Fund.

The collection of papers in this sourcebook is divided into five sections. First an introductory section where we introduce some key terms and definitions that underpin this work ([Chapter 1](#)). We then explore some key principles and aspirations of corridors such as delivering the Sustainable Development Goals ([Chapter 2](#)), ensuring theory and practice align ([Chapter 3](#)), ensuring financial sustainability ([Chapter 4](#)), properly assessing environmental sensitivity ([Chapter 5](#)) respecting human

rights ([Chapter 6](#)), or maximising, co-benefits ([Chapter 7](#)).

In the next three sections, we present 15 case studies from three continents: Africa, Asia, and Latin America. These case studies explore key challenges and lessons learned from specific planned, ongoing, and already implemented developments. They are presented as individual stories that readers can explore.

The final and fifth section aims to summarise lessons learned from a 4-year research and capacity building programme specifically aiming to understand the key challenges and opportunities around corridors and that has been the major driving force of this work: The Development Corridors Partnership project (DCP). DCP is a collaborative partnership across UK, Kenya, Tanzania and China, funded by the UK Research and Innovation Global Challenges Research Fund (see [Chapter 23](#)).

The book finishes with an overview of the lessons learned from the contributed papers included in this book and develops ten principles for corridor planning and delivering a meaningful and comprehensive impact assessment ([Chapter 24](#)), which we summarise here as ten key messages.

Key messages

1

Corridors must seek to achieve positive sustainability outcomes:

The mindset underwriting environmental planning of most infrastructure developments has been to mitigate negative impacts. The planning of few existing corridors is based on their role in supporting a sustainability vision for a country or region in which they are situated. Corridor developments must therefore be based on sustainability principles and support progress towards national, regional and international sustainable development goals. A true development corridor will seek to do good, as well as to mitigate negative impacts.

2

Integrated and inter-disciplinary approaches are needed:

Corridor developments are extensive, complex, multifaceted features traversing many landscapes. They can bring about significant transformational change to physical, economic, social, and cultural systems, and serve as interconnecting features. Yet engagement in corridor planning is often constrained by limited disciplinary and institutional involvement, with projects often superimposed upon communities. Corridor developments need diverse expertise and experience in their planning and management, including local stakeholder knowledge, avoiding disciplinary, institutional, or sectoral silos, that can result in policy conflicts, contradictions, and inconsistencies.

3

Corridor proponents should clearly demonstrate consideration of alternatives:

Corridor options should not be limited to a preferred proposal favoured by an elite. Corridor developments must consider all feasible alternatives (including maintenance of the status quo and no corridor development) and make the risks and opportunities of each option explicit and transparent through meaningful consultation. An important requirement in all corridor planning is to justify the need for a wide choice of options and an explanation of the potential benefits it will bring and to whom, in comparison with the alternatives. Any necessary trade-offs and how any significant potential negative impacts will be effectively managed, and opportunities created must be explained.

4

Public participation and stakeholder engagement should be at the core of corridor planning:

Corridor planning frequently fails to include meaningful participation of all stakeholders. Corridors can profoundly affect the lives and rights of indigenous peoples and local communities, potentially for generations. A common failing is that the first opportunity for local stakeholders to engage arises only after all strategic decisions have already been made and the only option remaining is for them to react negatively to a fait accompli. The meaningful engagement of all stakeholders is necessary to ensure their role is more than reactive. The way corridors are viewed by different stakeholders must be identified, understood, and addressed. Corridor developments must ensure that all interested and affected people are provided with adequate information about a proposal and have meaningful ways to engage in decision-making processes from the outset of strategic planning.

5

Mainstreaming and tiering are fundamental for corridor success:

Corridor planning requires a tiered assessment process, ensuring that environmental and social issues are considered alongside financial and technical considerations from the start of strategic planning or programme development, right through to project specifics. Conceptual corridor planning is frequently dominated by technical and financial suitability criteria with environmental, social, cultural, and human rights sensitivity issues being considered, at best, as externalities, retrospectively, once issues and problems arise. Strategic planning is important because it is when the full range of options is still open for discussion. It also establishes the parameters that will frame and implement a corridor plan or programme. Environmental and social considerations (and the interactions between them) should be considered early in strategic decision-making alongside (and to inform) technical, financial, and economic considerations.

6

An iterative process is needed:

Corridors exist in dynamic environments and need to be responsive to changing circumstances and priorities. Planning must adjust as circumstances and available information changes. The process should identify, map, and engage all interested and affected stakeholders from the earliest stage of corridor planning and throughout the planning and management of the corridor. New concerns and evidence will likely emerge as a corridor development progresses. Corridor planning frequently places undue emphasis on the production of a report (Environmental Impact Report) and its influence on the decision to proceed. The process may not be so linear in nature. It may involve many adjustments and decisions as new evidence emerges and predictions improve. A good-quality report and recommendations is necessary, but they are dependent upon a comprehensive process of ongoing dialogue and engagement with all stakeholders.

7

Corridors must ensure effective use of available tools:

Many corridor environmental impact assessments fail to meet required international standards. Corridor planning and management should make systematic and adequate use of available impact assessment procedures, methods, techniques, and tools to ensure good-quality decisions. The available procedures discussed in this publication (notably Strategic Environmental Assessment and Environmental Impact Assessment) and their associated methods, tools and techniques should be used when appropriate to help ensure that a systematic process identifies all significant potential benefits and development outcomes, and that they outweigh the costs and risks to affected people and their livelihoods and environments. The objectivity and quality of corridor decisions are dependent upon the effective use of the available tools.

8

Plan corridors with resilience and adaptability in mind:

Prevention will always be better than cure in addressing the negative impacts of corridors, and this should be the priority. However, some circumstances dictate an inevitability of negative impacts. Corridors, therefore, need to be designed to be made resilient to anticipated changes and adaptation measures may be necessary as 'coping' mechanisms or to offset unavoidable impacts, such as the impacts caused by climate change. The suitability of measures will require ongoing monitoring and adaptation as needs arise.

9

Seek impact, influence, and implementation capacity:

The decision to proceed with a corridor is ultimately the responsibility of decision makers. They are usually the representatives of all stakeholders' interests and custodians of their natural resources. Any impact assessment report must provide adequate information to ensure sufficiently good-quality decisions. If they are to be effectively implement the recommendations provided. Attempts to improve the performance of planning and associated assessment processes of corridors must tackle the ways in which outcomes are shaped by political contexts and institutional capacities. Approaches to working on assessment processes should integrate political economy analyses and institutional capacity assessment from the outset and on an ongoing basis. Resulting insights should inform the design and implementation of interventions intended to improve planning practice.

10

Evolve from Infrastructure to Development Corridors:

The prospects for linear infrastructure projects to evolve into comprehensive development corridors are often left to chance and spontaneity. Infrastructure projects are often developed in isolation and in an incremental way. For infrastructure projects to progress and become true development corridors, the transition must be systematically sequenced into planning from the start. Assessments must include consideration of potential induced, secondary, synergistic, transboundary, and cumulative impacts likely to result from the corridor development. The progression from infrastructure to development corridors must be based on a systematic, comprehensive, and integrated assessment of the potential positive environmental, social and economic opportunities and the rigorous avoidance or management of negative impacts.

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Latin American Case Studies



Carajás Corridor in Brazil: Could a SEA have Reconciled Shared-use Infrastructure & Environmental Protection?

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ABSTRACT

The 998km Carajás railway corridor connects the world's largest iron ore mine, operated by private mining company Vale S.A. (Vale) in Brazil's northern state of Pará (PA), to the company's maritime terminal in São Luís, the capital of the northeastern state of Maranhão (MA). Carajás is one of the few integrated railway corridors financed by a mining company that, apart from transporting the iron ore that made the infrastructure investments viable, also transports general cargo and operates passenger services along the corridor. This corridor was born from the Brazilian government's plans in the mid-1950s that foresaw the iron ore reserves of Carajás to be among the anchor investments to develop agriculture and industrial production in the Amazon region and help attract migrants from other parts of the country. As such, third-party access (i.e. shared use¹⁷⁴) to infrastructure investments was a fundamental part of the regional development plans. When these plans were created, environmental and social considerations of those living within and beyond the corridor's region played a secondary role, which helps explain the conflicts that can still be observed along the corridor and the impacts in other parts of the country (Brauch et al., 2020) (see Section 20.1.) The Carajás corridor has facilitated enormous economic development for this otherwise very poor region of Brazil, but at a high environmental risk for an environmentally sensitive area. Neither Environmental Impact Assessments (EIAs) nor Strategic Environmental Assessments (SEAs) were undertaken. The industries that were attracted are the most prone to engaging in deforestation: large-scale farming and pig iron factories fuelling themselves with charcoal. In addition, apart from municipalities hosting mining activities or port operations at the end points of the corridor and certain urban centres along the corridor, the development indicators of smaller and poorer municipalities along the corridor have not improved more than outside the corridor. Among communities in those smaller and poorer municipalities, there is widespread perception of the negative environmental impacts of the railway corridor, including air, noise, soil and water pollution. Perceived environmental problems resulting from the corridor were again evidenced throughout the recent expansion and duplication of the tracks of the Carajás railroad (Brauch et al., 2020) (see Section 20.2.) This state of affairs begs the following questions. Was the environmental cost worth it? Could a rigorous SEA framework have led to better environmental outcomes? We answer these questions in Sections 20.3 and present our conclusions in Section 20.4.

¹⁷⁴ Shared use consists in sharing an infrastructure under a multi-user or multipurpose arrangement. Shared use differs from co-benefits, which are the economic benefits emerging from shared use.



20.1 Historical background and current status of shared use of the Carajás corridor

In 1953, Brazil's federal government created the Superintendence for the Economic Valorization of Amazonia (SPVEA) to formulate five-year plans to develop the agriculture, livestock, mining and industrial sectors in the Amazon. Starting in 1964, the military governments accelerated plans to populate and develop the region and ensure control over its territory, and replaced SPVEA with the Superintendence for the Development of the Amazon (SUDAM), which still exists.¹⁷⁵

Encouraged by incentives offered by the federal government – including tax exemptions and subsidized credits for land acquisitions – foreign companies flocked to the Amazon in search of mineral deposits. On 31 July 1967, during an exploration flight, US Steel discovered the Carajás deposit, with 17 billion metric tons of high-grade iron ore (Vale, 2012.)

In addition to public investments in power

and transportation infrastructure, the government redistributed land for agriculture and livestock and promoted migration of small-scale farmers from other regions of the country. The focus of land allocation in the 1970s turned to large-scale, export-oriented investments. Land allocation led to conflicts – many of which still exist – between the government, Indigenous and traditional communities, and small- and large-scale farmers.

The Greater Carajás Program (PGC), established on 24 November 1980 (*Decree-Law No. 1813*. Federative Republic of Brazil. Presidency of the Republic, 1980), covered an area of roughly 900,000km². Considered the largest-ever integrated development plan undertaken in a tropical rainforest area, the PGC foresaw US\$ 62 billion (in current prices) in public and private investments throughout one decade to develop the Carajás iron ore mine, two integrated bauxite and aluminium projects, and the hydroelectric dam in Tucuruí

¹⁷⁵ This section is based on Brauch et al. (2020), with additional references specifically indicated.

(PA). Through tax exemptions and reductions and subsidized electricity prices, the PGC sought to attract large-scale agriculture, infrastructure and mining investments.

Vale, then a state-owned company called Companhia Vale do Rio Doce (CVRD), financed the initial US\$ 3.1 billion investment (in 2021 prices) in a mine-railway-port infrastructure complex through bonds and loans from Europe, Japan, the Soviet Union, the USA and the World Bank. The Carajás Railroad (*Estrada de Ferro Carajás* [EFC]) would not only serve to transport iron ore produced in Carajás, but would operate under a multi-user, multipurpose shared-use arrangement to transport downstream products (such as pig iron and ferroalloys), general cargo and passengers.

Brazil's Ministry of Agriculture also implemented the US\$ 1.18 billion (in 2021 prices) Greater Carajás Agriculture Program (PGCA), aimed at leveraging the railway corridor to develop export-oriented agriculture projects, including soybean, sugar cane, beef cattle and eucalyptus plantations to produce charcoal for the pig-iron complexes. However, because of issues including low soil fertility and quality, topography, climate, lack of funding and political wrangling, the PGCA led to few large-scale agriculture projects in the region.

Construction of the EFC was completed in 1985, and the plans advanced to connect the EFC to the North-South Railroad (*Ferrovia Norte-Sul* [FNS]) from Açailândia (MA) to Anápolis (state of Goiás [GO]). The connection between the two railroads – which allowed agricultural production from the interior of the country to be transported to and shipped out of the port of Itaqui, in São Luís (MA) – bolstered grain production in the northern Cerrado region (to the south and southeast of Carajás), which did not face the agronomic constraints of the Amazon.

Vale's mineral production has been the dominant cargo transported on the EFC – roughly 190 million metric tons in 2019. Even so, other users have increasingly used the EFC and its connection to the FNS to transport significant volumes of soybean and soybean meal, corn, pulp and pig iron (roughly totalling 9 million metric tons in 2019). The EFC and FNS were also used to transport beverages, cement, trucks, wood, gas, sand, bricks and fertilizers in the past.

The EFC is also Brazil's longest railroad with passenger services. The passenger train has five stations and ten stops, runs three times per week each way (interior-coast and coast-interior), and transports around 1,200 per trip, amounting to a total of 270,000 passengers in 2019 (see map of the Carajás corridor in Fig. 20.1.)





Brauch et al. (2020, p. 15).

Therefore, in addition to the EFC's core use for Vale's mining operations, shared-use opportunities have generated economic benefits for third-party users within and outside the corridor and for local communities. As

discussed in the following section, however, these economic benefits have been accompanied by significant social and environmental impacts.

20.2 Long-term social and environmental implications of a pro-economic development agenda

When the mandates of the SPVEA and SUDAM were established in the 1960s, Brazil did not have a legal framework on EIAs. Only in the early 1970s did the first EIAs emerge in Brazil, spurred on by the World Bank's conditionality in financing large hydroelectric power plants. The EIA framework, however, was only developed a few years later. The Brazilian Congress enacted the law on the National Environmental Policy in 1981 (*Law No. 6938. Federative Republic of Brazil. National Congress, 1981, Art. 9[III]*), the government detailed its implementation by federal decree in 1983 (*Decree No. 88,351. Federative Republic of Brazil. Presidency of the Republic, 1983; Decree No. 99,274. Federative Republic of Brazil. Presidency of the Republic, 1990*), and in 1986 the National Environment Council issued a resolution, making EIAs a mandatory requirement in certain environmental-permitting processes (*Resolution No. 1. Federative Republic of*

Brazil. National Environment Council, 1986).

Therefore, when the Brazilian government started to implement the PGC in the early 1980s, the EIA framework was being developed. By the time the framework was fully in place in 1986, the EFC had already been operational (since early 1985). Though the World Bank requested that CVRD indicated its plans to manage the environmental impacts of the Carajás corridor project, no EIA was required or ultimately undertaken (Redwood, 1992).

SEAs were even farther from becoming a reality in development policymaking in Brazil at the time. They were still in their infancy in Europe and the USA (Fischer, 2007). Brazilian law did not, and still does not require SEAs, which authorities only run on a voluntary basis and with no clear framework and guidance (Fonseca et al., 2017).

As a consequence of the absence of a strong environmental and social protection framework, the development of the Carajás corridor triggered significant environmental and social impacts felt to this day, despite Vale's mitigation efforts, whether mandated by law or resulting from the company's voluntary corporate social responsibility (CSR) activities in the region.

Social conflicts along the Carajás corridor include those arising from the land interests of Indigenous peoples, residents of communities of Afro-Brazilian slave descendants (*Quilombolas*), and small- and large-scale farmers. Many conflicts predate the EFC and may be more closely related to broader changes in the socioeconomic and environmental landscape of the region since the 1980s. Perceived negative environmental and health impacts of the passage of trains, economic activities enabled by the railroad (such as pig-iron smelting), and the construction works for its double-track expansion have led to dissatisfaction (Penha and Nogueira, 2015; NEEPES et al., n.d.; International Articulation

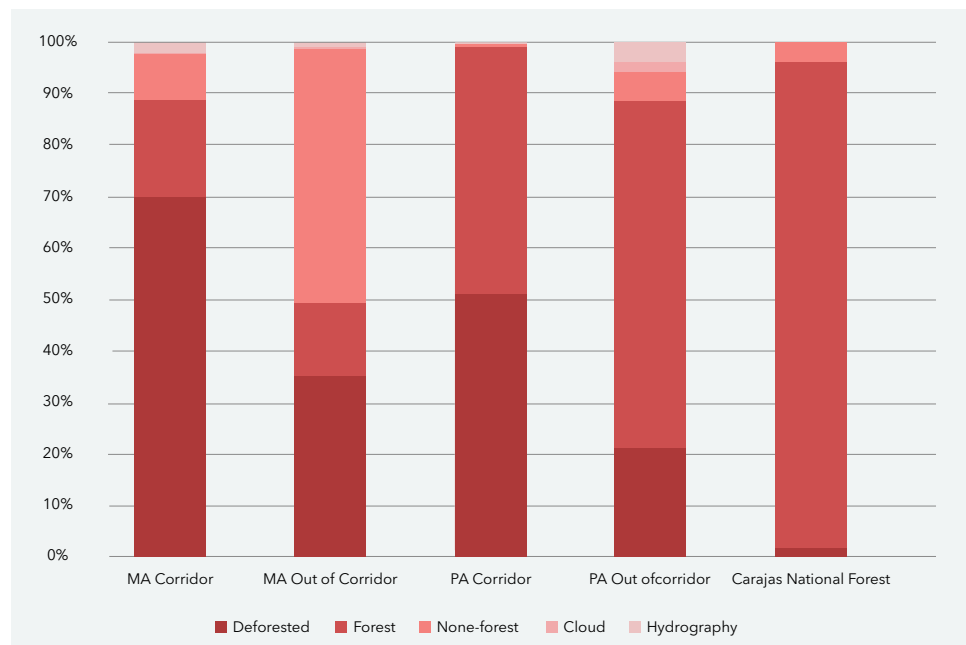
of those Affected by Vale, 2015; Coelho and Monteiro, 2007; Faustino and Furtado, 2013). Protesters sometimes block the tracks, though often for reasons unrelated to the railroad.

Carajás is in a precarious position from an environmental standpoint: one of the richest mineral reserves, it is located within the extremely important and vulnerable Amazon biome. Despite Vale's significant efforts and expenditure in mitigating direct environmental impacts from its mining and logistics operations, certain activities enabled by the corridor's development and shared use – particularly urbanization, large-scale agriculture and pig-iron smelting – have led to cumulative indirect impacts, including deforestation and biodiversity loss in areas not under Vale's management and otherwise not protected as conservation units (Castaneda, 1992; Reis, 2001). Fig. 20.2 illustrates the stark difference in forest conservation rates in the Carajás National Forest (where Vale operates) on the one hand and, on the other, in the municipalities of the MA and PA states along the corridor.

Figure 20.2 Deforested areas and forest coverage Pará, Maranhão and the Carajás national forest, 2019

Figure 34:
Percentage of
deforested areas
and forest coverage
in Maranhão and
Para municipalities
and in the Carajas
National Forest
(2019)

Source: prepared
by the authors
based on INPE
data.



Source: Brauch et al. (2020, p. 68).

Local communities perceive and report additional environmental impacts, such as the loss of wetlands and wildlife; insufficient rainwater drainage systems, leading to flooding; pol-

lution of the air, soil and water from pig-iron smelters and from dust and iron ore particles falling from trains; damaged buildings, roads and wells caused by vibrations from passing

trains; and fragmentation of ecosystems cut

by the tracks (Castaneda, 1992; Reis, 2001).

20.3 Could a SEA have reconciled shared-use and environment protection in Carajás?

Given the social and environmental cost of the economic development spurred on by the open-access Carajás corridor, this case study is rich in lessons for governments attempting to deploy shared use as an instrument of economic development. While we have been advocating for this approach as opposed to an enclave model, whereby concessionaires develop infrastructure to exclusively serve their operational needs, the Carajás corridor is a cautionary tale, particularly for those regions that are as socially and environmentally sensitive as the Amazon.

As noted above, no EIA was conducted to respond to the sensitivities. However, even if a high-quality, project-based EIA had been undertaken, it may have failed satisfactorily to capture siting and technology alternatives and to consider indirect, cumulative and synergistic impacts of the PGC within the area of influence of the Carajás corridor, as well as in the broader Amazon region and in the Cerrado region to the south. These inherent limitations of EIAs are among the reasons why policymakers turn to an SEA instead of, or in addition to, an EIA (Sánchez, 2017).

An SEA goes beyond an EIA's direct assessment of the environmental effects of project specifics to address the policies, plans and programmes that frame them (Partidario, 2012). As stated in the SEA Performance Criteria developed by the International Association for Impact Assessment, "a good-quality SEA informs planners, decision makers and affected public on the sustainability of

strategic decisions, facilitates the search for the best alternative and ensures a democratic decision-making process. This enhances the credibility of decisions and leads to more cost- and time-effective EIAs at the project level" (2002). (See Introduction for more context on SEAs and its relation to EIAs.)

In this context, we ask whether an SEA could have led to better decision-making and social and environmental outcomes in the Carajás case, thereby enabling the maximization of the benefits from shared use, while minimizing harm. To answer this question, we take a bird's-eye view on how an SEA might have input into the decision-making process of Brazil's federal government in the development of the Carajás corridor, as part of the PGC. Entering the details of the history of the Carajás corridor development and exploring the intricacies of a SEA lie outside the scope of this chapter. Rather, our narrower goal is to schematize how conducting a SEA could have influenced decision-making and outcomes.

For this exercise, we use as a starting point the generic checklist for all SEAs included in the good practice guidance on SEAs published by the Organisation for Economic Co-operation and Development (2006). At the core of these checklists sit five principles that, had they been followed, could have changed the social and environmental impact of the Carajás corridor. Table 20.1 provides a summary of our analysis, on which we elaborate in the following sections.

Table 20.1 How applying SEA principles could have improved the social and environmental outcomes of the Carajás corridor

OECD principle	How a SEA could have changed the social and environmental impacts of the Carajás corridor
1. Predicting and analysing the potential direct, indirect and cumulative negative and positive effects of the proposed corridor	<ul style="list-style-type: none"> » Improved forecasts and planning insights regarding cumulative pressures for deforestation resulting directly or indirectly from the corridor activity » Better understanding of potential negative and positive impacts of the corridor on agricultural production and exports in the region and beyond » Prediction of the need to double-track the railway due to the growing production of iron ore
2. Minimize direct, indirect and cumulative negative social and environmental impacts to maximize positive impacts and opportunities	<ul style="list-style-type: none"> » More careful design of the railway to avoid damaging biodiversity hotspots and protect communities from negative impacts » Improved understanding of the impacts of pig-iron production, leading to stronger regulation and the banning of the use of charcoal » Better consideration of incentives for responsible agriculture practices, sustainable water use solutions » Better evaluation of potential co-benefits of the railway that may have been left untapped for lack of planning
3. Building the data collection capacity necessary to inform and monitor design and implementation	<ul style="list-style-type: none"> » Better data and forecasts for the use of the railway by all actors » Anticipation of the scope and impact of shared use over time, to deploy avoidance or mitigation measures for risks and enhancement mechanisms for co-benefits
4. Integrating the views of civil society, particularly affected communities and enabling their influence in the development of the PGC	<ul style="list-style-type: none"> » Consideration of concerns from Indigenous peoples, traditional peoples, and local communities, leading to greater efforts to provide alternative and suitable livelihoods and compensation » Relevant private sector actors heard, allowing exploration of benefits from shared-use arrangements and their associated co-benefits
5. Establishing an environmental policy framework and authority to manage and regulate the use of natural resources	<ul style="list-style-type: none"> » Understanding about the long-term ramifications of the corridor to put in place appropriate mitigation measures and the institutional and legal framework to enforce them » Development of environmental protections and stronger analytical, monitoring and enforcement capacities of Brazil's nascent Ministry of Environment

20.3.1 Predicting and analysing the potential direct, indirect and cumulative negative and positive effects (short-, medium- and long-term; environmental and social, including climate change considerations) of the proposed corridor¹⁷⁶

A SEA would not have looked narrowly into the impacts of the Carajás corridor in its immediate vicinity, in existing and mining-related sectors, and in the short- and medium-term. Rather, based on broader geographic, economic and time horizons, it would have led to better forecasts and planning insights. A broader outlook would have considered the corridor's impacts not only along its spinal cord, the EFC, but in the broader Amazon

region and the Cerrado, as well as across economic sectors. It could have predicted the cumulative pressures of deforestation resulting from pig-iron production, urbanization and other economic activities, from the short to the long term. Given that the connection of the EFC to the FNS was already projected at the time, a SEA would have examined the potential negative, as well as positive, impacts of the creation of the corridor as an outlet for grains and other exports produced in the Cerrado region and beyond. It would also have forecast the growing production of iron ore and the ultimate need to double-track the railway in the 2010s. (Fig. 20.3 situates the Carajás corridor within its broader regional and national geographic context and at the edge of the so-called Arc of Deforestation, where 75 per cent of the deforestation in the Amazon region is concentrated.)

Figure 20.3 The Carajás corridor and the arc of deforestation



Source: Brauch et al. (2020, p. 65).

¹⁷⁶ The OECD (2006, p. 70) elaborates on this with the following questions: "Have the potential indirect and cumulative (short, medium and long term) environmental and social impacts of the investment been evaluated, have relevant mitigating measures been identified and included in the design of the investment and its companion programs? Are there major risks from the investment that have potential significance beyond the immediate project area? Is the investment under risk from environmental degradation created outside the project's influence?"

20.3.2 Seeking to minimize direct, indirect, and cumulative negative social and environmental impacts (by identifying alternatives or mitigation measures) and to maximize positive impacts and opportunities

A SEA would have led to more careful design of the railway to avoid damaging biodiversity hotspots or particularly sensitive ecosystems, as well as to protect communities from negative impacts. Foresight of the deforestation, health and other impacts of pig-iron production could have resulted in discouraging or limiting the activities of the sector, tightening control over its operations, or at the very least banning its use of charcoal. A better understanding of the urbanization and rural development trends resulting from the development of the shared-use corridor could have justified more incentives for responsible agriculture practices, sustainable water-use solutions or other support to public services that came under tension with the growing population and in-migration. In addition, a SEA could have led to evaluating and enabling other uses and users of the railway that may have

been left untapped for lack of planning, for example, small-scale farmers and other firms transporting products besides extractives and grains along the line, whether for export or not.

20.3.3 Building the data collection capacity necessary to inform and monitor the design and implementation of the PGC

Conducting a SEA and implementing the damage-mitigation and benefit-enhancement measures, it is suggested, would have required an effort to generate economic, social and environmental data in the region, serving as a baseline for monitoring. The data collection effort could have included demand forecasts for the use of the corridor, not only for Vale and its cargo, but also for small- and large-scale producers of agricultural and other products. The datasets generated could have been used to anticipate the scope and impact of shared use over time, and deploy the appropriate avoidance or mitigation measures identified for risks and enhancement mechanisms for environmentally benign opportunities.



20.3.4 Integrating the views of civil society, particularly affected communities, and enabling their influence in the development of the PGC

Had an inclusive and regulated SEA process been in place, social conflicts along the railway might not have been completely avoided,¹⁷⁷ but concerns from Indigenous Peoples, *Quilombolas*, and local communities could have been heard and accommodated by efforts to provide alternative and suitable livelihoods – and, where appropriate, compensation – and protect ecosystem services supporting them. Furthermore, the needs of private sector actors within the corridor and from its broader area of influence could have been heard from the outset, allowing them to benefit from shared-use arrangements and their associated co-benefits sooner.

20.3.5 Establishing an environmental policy framework and authority to manage and regulate the use of natural resources, accountable for responding to any problems that might arise

A strong SEA process could have helped equip Brazil's government with the necessary understanding of the long-term ramifications of the corridor to put in place the right mitigation measures, as well as the institutional and legal framework to enforce them. Conducting a SEA for the PGC and other regional development plans for Carajás could have fostered the development of environmental protections enshrined in laws on biodiversity protection and forest conservation, as well as strengthened the analytical, monitoring and enforcement capacities of Brazil's nascent Ministry of Environment.

Having gone through some of the advantages that an SEA could have brought to the Carajás context, we must not neglect the political economy of the development of the corridor. Even if SEAs were already being used as global best practice, it is unlikely that the military dictators who governed Brazil when the PGC was created would have committed to a SEA process, and particularly one that would have been genuinely participatory, giving the public a meaningful opportunity to participate and effectively change the course of policy and plan design. Brazil's military governments considered the PGC to be strategic for the country's economic development (Martins de Sousa and Fonseca, 2020), and it may be naïve to think that having their eyes opened about any of the project's negative social and environmental impacts would have dissuaded them from going ahead with it any differently.

Even under a democratic regime, Brazil is failing to leverage this important process to balance the trade-off between infrastructure development and environment. Several Brazilian academic studies have documented the limited use of SEA and the ineffectiveness of those that have been conducted (Sánchez, 2017). The main reasons stem from using SEA as an instrument to “fill the gaps of the environmental licensing process, using the same approach as that of regular project EIAs,” and, as such, being deprived of alternatives analysis, social participation and impact on decision-making (Oliveira et al., 2013; Margato and Sánchez, 2014). Other analyses have mentioned that the purpose and scope of SEAs is not legally and institutionally defined in Brazil, and that policymakers and project proponents manipulate SEAs to legitimize projects and fast-track EIA processes (Sánchez and Silva-Sánchez, 2008). While SEAs should be a tool to optimize sustainable development, the Brazilian experience reveals that SEAs can be perverted, just like EIAs (see [Chapter 3](#)), if there is no widespread political support and understanding of its use.

¹⁷⁷ Sánchez (2017, p. 177–178) notes that, in plans and programs in the transportation sector including projects with high potential for impact, conflicts with local communities and judicialization often occur even if socio-environmental concerns are considered at the early stages of planning.”



20.4 Conclusions

As explained in the Introduction of this volume, as opposed to a logistic corridor centred on a railway from pit to port, shared use along infrastructure corridors anchored on mines can help directly contribute to sustainable development and, in particular, it can help achieve 10 out of the 17 SDGs (Toledano and Maennling, 2018). At the same time, as the Carajás corridor case study demonstrates, shared use can also be detrimental to SDGs 13 (climate action) and 15 (life on land) through damage to ecosystems and through deforestation.

However, the international community has developed a formidable tool to enable the reconciliation of economic development goals with environmental protection goals: the SEA, “a governance tool that attempts to ensure

that environmental issues, and their interplay with social and economic considerations, will not be treated as an afterthought” (Hobbs, 2020.)

Thinking through how the Carajás corridor could have looked different had a strong SEA process been conducted leads to findings that are applicable to any shared-use plans. An SEA – if appropriately built and implemented – can enable policymakers to reintegrate the mining sector into the long-term vision of the responsible economic development of the country. Within this vision, shared use rises as one of the mechanisms that can translate depletable resources into long-term assets that work for the economy, the environment and society.

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