

DEVELOPMENT OR ECOCIDE? SOCIOTECHNICAL IMAGINARIES AND CONTESTED INFRASTRUCTURE IN THE “TREN MAYA” CONTROVERSY

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ABSTRACT: This article examines the controversy surrounding the Tren Maya railway megaproject in Mexico’s Yucatán Peninsula through the lens of sociotechnical imaginaries. We argue that the Tren Maya, much more than a technological intervention, came to embody differing visions of desired futures. Initially promoted by the López Obrador administration as a State-led reindustrialization program to mitigate social inequalities, the project was engulfed by the nationalist-developmental imaginary of a “Fourth Transformation.” The local impacts that materialized in the construction process, however, sparked significant socio-environmental conflict and mobilized a diverse opposition movement comprising Indigenous communities, scientific experts, and environmental organizations. As the controversy unfolded, protest actors leveraged various legal mechanisms to challenge the epistemic and normative claims underpinning the government’s plans, eventually giving rise to a subversive imaginary that reframed the Tren Maya as a criminal, “ecocidal” enterprise. Our study reveals the intricate interdependencies between material and discursive processes in the (de)legitimization of competing infrastructural imaginaries and their role in mobilizing social forces. In particular, we underscore the crucial yet often-overlooked role of legal channels and institutions in generating, validating, and amplifying imagined futures. By illustrating how social relations and normative ideals are co-produced with technoscientific

knowledge and material facts, this research contributes to a more nuanced understanding of how different sociotechnical imaginaries interact, compete, and gain traction in the context of infrastructural transformations.

Keywords: co-production; environmental impact assessment; social resistance; environmental justice; environmental law; science and technology studies.

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1. INTRODUCTION

In Gabriel García Márquez's magical realist masterpiece *One Hundred Years of Solitude*, the construction of a railroad through the tropical rainforest marks a critical turning point for the village of Macondo. Suddenly connected to the outside world, foreigners and goods start flocking in, transforming Macondo from a sleepy hinterland community into a bustling town. This process is further accelerated by the arrival of the "American Fruit Company," bringing economic prosperity but also increased segregation and social tensions to Macondo. The upheaval heralded by the train finds a bloody ending when the military opens fire on striking plantation workers—a massacre that is immediately erased from history and is only remembered by its sole survivor, José Arcadio Segundo.¹

Infrastructures are often primarily defined by their material and technological characteristics. This conventional perspective, which emphasizes the function and composition of physical components (e.g., railways, carriages, stations), tends to overlook the complex social dynamics that infrastructures incorporate and engender. The development of infrastructural artifacts and interventions must be sustained over extended periods to actualize the profound societal and environmental changes they profess.² Hence, these undertakings do not merely result from technical decisions; they also require political and economic backing from critical actors, such as governments, communities, and investors, who propel their implementation and address the technical dilemmas and social controversies that emerge along the way. While organizational, material, and technical resources are crucial for constructing and operating large-scale infrastruc-

¹ García Márquez (1967) 2007. The fictional episode is inspired by the 1928 Bananeras strike in Colombia's Magdalena region. See Elías Caro 2011, 99.

² Picon 2018.

tures, mobilizing imaginative resources is equally decisive for inserting them into the social fabric.³

Mirroring the fictional fate of Macondo's railroad in García Márquez's novel, the controversy surrounding the so-called "Tren Maya" (Mayan Train) epitomizes the dilemmas that arise from infrastructural megaprojects. In 2018, the newly elected Mexican government announced the construction of a 1,500-kilometer railroad through the jungle of Southeast Mexico's Yucatán Peninsula to connect various tourist destinations. The project became the emblem of López Obrador's presidency and its ambitious plans to revitalize the country's notoriously neglected southern regions. Initially regarded as an auspicious development opportunity, however, the Tren Maya's environmental and sociocultural impacts soon elicited criticism and resistance. In the face of mounting opposition, the government downplayed concerns, deployed a nationwide media campaign, and even transferred responsibility for the project to the military to ensure its timely completion. Against this repressive backdrop, protesters began to appeal to legal mechanisms and vocabularies to advance an alternative narrative of the Tren Maya.

This article analyzes the Tren Maya controversy as a clash between two opposing sociotechnical imaginaries—that is, collective visions of desired (or disputed) futures materialized in technoscientific undertakings and large-scale infrastructure projects.⁴ On the one hand, the Tren Maya encapsulates the nationalist-developmental vision of the "Fourth Transformation," a State-led reindustrialization program to mitigate social inequalities by encouraging economic growth. On the other hand, Indigenous communities and environmentalist groups re-articulated the socio-environmental impacts wrought by the project through the alternative frame of "ecocide." We examine the co-production of these imagi-

³ Picon 2018.

⁴ Jasanoff and Kim 2009.

naries through a symmetrical perspective that draws out the mutual dependencies between material and discursive construction processes in (un-)making the Tren Maya. How do different sociotechnical imaginaries emerge, interact, and compete in the context of the Tren Maya project, and what weight do legal institutions and practices carry in legitimizing or delegitimizing these visions? To address this key question, we adopt a qualitative case study approach, drawing on a comprehensive analysis of primary and secondary sources, including government press releases, policy instruments, impact assessments, judicial documents, activist publications, and existing academic literature.

The article is structured in four parts. We begin by presenting the analytical framework of sociotechnical imaginaries and their co-production in and with infrastructure mega-projects. This perspective is then applied to reconstruct how the Tren Maya controversy unfolded. We start with the project's historical context and embedment in the "Fourth Transformation" (3.1), which sparked first, if still largely disarticulated dissent (3.2). After construction commenced, the resistance intensified and increasingly undermined the governmental narrative of a benign development project (3.3). One particular protest strategy focused on challenging the Tren Maya's environmental and social impacts in the courts through legal means (3.4). The government responded by handing the entire project over to the military and declaring it a matter of national security to shield it from further judicial scrutiny (3.5). In this increasingly repressive climate, protesters launched an appeal to the civil society-organized International Rights of Nature Tribunal, whose verdict authorized an alternative vision of environmental and social justice encapsulated in the notion of "ecocide" (3.6). In section 4, we revisit and conjoin these elements to reflect on the role of legal institutions in (de)legitimizing sociotechnical imaginaries.

Our analysis highlights the importance of legal institutions in validating and amplifying infrastructural imaginaries.

ies. Interestingly, the case of the Tren Maya suggests that this potential is not limited to State-backed institutions but can also hail from quasi-legal civil society initiatives in contexts where the official legal system has lost its legitimizing force. More broadly, our findings contribute to a closer examination of the contentious processes whereby multiple socio-technical imaginaries interact, and eventually, prevail over one another. Encompassing science and technology studies, political sociology, and socio-legal scholarship, this article underscores the importance of adopting a transdisciplinary and integrative perspective when analyzing the entangled social and material dimensions of large-scale infrastructure projects.

2. INFRASTRUCTURES AND IMAGINARIES

Our world is defined by a set of “critical” infrastructures that sustain the ordinary operation of social, political, and economic systems—from electricity grids and transport networks to digital platforms.⁵ Traditionally, such infrastructures have been viewed as complex material-technological artifacts that connect people, knowledge, and objects across space and time.⁶ This conventional perspective, however, overlooks the intricate social dynamics that infrastructures both embed and engender. Recent transdisciplinary scholarship has brought these social dynamics to the forefront, recasting infrastructures as “technical-social assemblages infused in politics and power relations.”⁷ While infrastructure mega-projects are shaped by scientific and technological expertise, practical exigencies, and policy considerations, they critically depend on social, political, and legal resources for their realization and sustained operation. Mobilizing these resourc-

⁵ Scholz, Schauer and Latzenhofer 2022.

⁶ Larkin 2013.

⁷ Kingsbury and Maisley 2021.

es—from local community support to political endorsements and regulatory approvals—is crucial. Equally decisive is the mobilization of imaginative resources for embedding infrastructures into the social fabric and shaping their meaning for collective life.

Previous research has evidenced how megaprojects like hydroelectric dams,⁸ nuclear plants,⁹ and gasoline-powered vehicles become entangled with utopian fantasies that exalt their societal benefits, from achieving international peace to dominating nature.¹⁰ These fantasies permeate popular culture, fueling political and social support for their deployment. At the same time, they frequently obscure or brush over technological limitations, budgetary constraints, political risks, or the uneven distribution of economic, social, and environmental costs.

To capture the epistemic significance of this domain, Sheila Jasanoff and Sang-Hyun Kim have coined the notion of “sociotechnical imaginaries” as “collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of advances in science and technology.”¹¹ This concept builds on a longstanding theoretical tradition that has examined the role of imagination and fiction in social life.¹² Benedict Anderson, for instance, famously argued that nations cohere around narratives, creative styles, and knowl-

⁸ Hommes, Hoogesteger and Boelens 2022.

⁹ Jasanoff and Kim 2009, 119-146.

¹⁰ Sovacool and Brossmann 2013, 204-212.

¹¹ Jasanoff 2015, 6.

¹² The concept of socio-technical imaginaries, particularly in its application to infrastructures, bears a family resemblance to the older idea of “Large Technical Systems” (LTS). See, e.g., Sovacool, Lovell and Ting 2018, 1066-1097. One of the key differences between the two concepts is their understanding of agency. While socio-technical imaginaries direct attention to different practices of imagining in all their manifestations and varieties, LTS are more focused on the deterministic and systemic features embedded in technological artefacts.

edge that recreate a shared sense of collectivity—despite the impossibility of their members knowing each other personally and developing “real” bonds.¹³ Similarly, Charles Taylor has traced how modernity emerged through moral and institutional transformations grounded in new social imaginaries.¹⁴ As these studies show, imagination can no longer be seen as an aesthetic illusion, escapism, or alienation; instead, it emerges as a vital domain for understanding how societies organize and cohere.

According to Jasanoff, sociotechnical imaginaries emerge through the “co-production” of knowledge practices, technological artifacts, social representations, and political manifestations.¹⁵ In other words, the collective visions undergirding megaprojects take shape in a hybrid process that assembles scientific expertise, engineering prowess, cultural meanings, and institutional policies. Together, these heterogeneous elements configure an interlinked domain of social and material reality as the frameworks informing collective representations become entwined with built infrastructures. Once embedded in organizations and decision-making, imaginaries publicly manifest in policy and technical choices. They reflect and sustain a shared understanding of possible life forms and social orders whose materialization hinges upon scientific and technological initiatives.¹⁶ In this sense, sociotechnical imaginaries are an integral part of infrastructure: They are not externally imposed or retrospectively applied but co-produced alongside material constructions through a reiterative and recursive process.

This lens illuminates how, with the onset of modernity, science and technology, encapsulated in large-scale infrastructure projects, have emerged as primary means for driving societal change, thereby acquiring both social and

¹³ Anderson 1983, 2.

¹⁴ Taylor 2003.

¹⁵ Jasanoff 2004, 1-13.

¹⁶ Jasanoff and Kim 2009.

political salience as vehicles for fulfilling hopes of a better, shared future. In turn, it also emphasizes how influential actors instrumentalize science, technology, engineering, and technical expertise to advance political and economic projects, whether public and private (or, indeed, hybrid).¹⁷ Examples range from the monumental national electrification, highway, and telecommunications projects that consolidated the authority of “modern” Nation-States in the twentieth century to contemporary initiatives like the Trans-European Transport Network, China’s Belt and Road Initiative, and the United States’ Build Back Better Plan, all of which involve colossal investments in transport, energy, and digital grids. These grand undertakings operate as performative scripts that amalgamate diverse values, interests, and regulations—performances that, in turn, embed large technological and infrastructure networks in shaping and making the sociopolitical order.

The co-production of sociotechnical imaginaries is not a deterministic process, however. When these imaginaries are translated into local contexts, they often clash with alternative visions that extol different economic and social virtues. This clash, and the subsequent interaction between *multiple* imaginaries, can take on either a constructive or a conflictive dynamic. Consider, for instance, the merger of environmentalist demands and capitalist logic into a ‘green growth’ agenda, as espoused by the European Green Deal and many other initiatives. However, more often than not, dominant visions, backed by powerful institutions and interests, tend to suppress dissenting voices and displace or downgrade subaltern perspectives and practices. This is where socio-technical struggles emerge, leading to the formation of resistance movements. In a competition for epistemic hegemony, influential imaginaries emanating from governmental or corporate actors are countered by subversive imaginaries propelled by social movements envisioning alternative infrastructural

¹⁷ Barandiarán 2019.

and collective futures.¹⁸ David Hess's pioneering review of the anti-dam movement in Brazil, for instance, demonstrates the extent to which protest actors foster alternative technological options and underscore community needs to bolster their narratives—successfully modifying the design of hydraulic infrastructures in the process.¹⁹

What, then, decides which imaginary—and to what extent—gains an edge over others and becomes stabilized? Clearly, imaginative resources must find traction beyond their original epistemic community in order to become collectively sustained and unfold their full force.²⁰ Institutional actors, such as legislatures, courts, the media, or other centers of power, play a pivotal role in this contest. As Jasanoff observes,

It often falls to legislatures, courts, the media, or other institutions of power to elevate some imagined futures above others, according them a dominant position for policy purposes. Imaginaries, moreover, encode not only visions of what is attainable through science and technology, but also of how life ought, or might not, to be lived; in this respect they express a society's shared understandings of good and evil.²¹

Therefore, sociotechnical imaginaries are inherently normative, seeking to actualize particular visions of a just, desirable, and virtuous society. This normativity is deeply intertwined with legal institutions and vocabularies, which offer a powerful medium for these imaginaries to solidify, materialize, and reproduce. The legal realm is not merely a passive reflection of sociotechnical imaginaries but an active site of co-production where these are negotiated, transformed, and realized.²² When an imaginary is articulated in legal terms, it

¹⁸ Gugganig 2021.

¹⁹ Hess 2018; Hess 2015.

²⁰ Mutter and Rohrer 2021.

²¹ Jasanoff 2015, 6.

²² Lee, Natarajan, Lock and Rydin 2018.

acquires a new dimension of institutional authority. Courts, in particular, emerge as crucial arenas where imaginaries compete and are reconfigured—not only resolving concrete disputes but also validating or challenging particular visions of development and shared future.

The relationship between sociotechnical imaginaries and the legal sphere is multifaceted and dynamic. First, dominant imaginaries about the supposed benefits of developmental enterprises are often codified in regulations and laws, with notable implications for the developmental trajectory and characteristics of technologies, industries, and infrastructures. Barandiarán, for instance, demonstrates how distinct sociotechnical imaginaries about lithium have shaped regulations in Bolivia towards a State-led model, in Argentina towards a mixed model, and in Chile towards greater State control with private participation, each seeking different benefits from the industry's development.²³ Second, once internalized in laws and regulations, these imaginaries legitimize and reproduce specific development schemes over other possibilities. The soybean imaginary in Argentina illustrates this phenomenon, where the regulatory framework rooted in a particular understanding of progress normalizes this industry's social and environmental costs.²⁴ Third, the law can also serve as a platform to challenge established imaginaries and promote alternative visions of “infrastructural justice.”²⁵ For instance, in 2019, a Kenyan court granted a petition launched by residents and annulled the government's permit for the construction of a coal power plant linked to China's Belt and Road Initiative.²⁶

Despite this literature underscoring the importance of legal institutions and practices in shaping sociotechnical imaginaries, the empirical processes through which these visions

²³ Barandiarán 2019.

²⁴ Giraudó and Grugel 2022.

²⁵ We borrow this term from Kathiravelu 2022.

²⁶ Bogojević and Zou 2021, 35.

are translated into legal vocabularies and appeals to legal authority remain poorly understood. This gap raises several critical questions: Who is engaged in this process, and why? What is lost and what is gained when contests between socio-technical imaginaries shift onto legal terrain? How do legal controversies impact the co-production of infrastructure's material and social dimensions? Furthermore, are binding standards and judicial decisions necessary to solidify these imaginaries, or is the mere invocation of legal arguments and language sufficient to confer institutional legitimacy?

Addressing these questions requires a sustained interdisciplinary dialogue between science and technology scholars, political sociologists, and legal academics.²⁷ Our analysis of the controversial Tren Maya megaproject aims to initiate this crucial conversation. By examining how competing socio-technical imaginaries are articulated and contested through legal processes, we seek to shed light on the complex interplay between technical visions, legal institutions, and societal transformations in the context of large-scale infrastructure development. This approach not only contributes to a more nuanced understanding of the role of law in shaping socio-technical futures but also offers insights into how diverse stakeholders navigate and influence the legal landscape to advance their preferred visions of progress and development.

3. CO-PRODUCING THE TREN MAYA

The following section sketches the formation and evolution of two competing sociotechnical imaginaries around the Tren Maya. In particular, we examine how these imaginaries mobilized social forces in favor of envisioned futures and how they clashed within and beyond legal arenas. Our analysis builds on previous scholarship that casts the scientific and

²⁷ For a laudable opening of such a debate, see Vanhala 2020.

technical claims underlying environmental controversies as contingent upon ingrained values, interests, and political positions.²⁸ Rather than attempting to adjudicate the veracity of conflicting factual claims, then, we adopt a symmetrical perspective that addresses these controversies as constructed through the arguments and assertions of various social actors.²⁹

Methodologically, we employ a process tracing approach to investigate how the actions and decisions of various differentially positioned actors resulted in specific discursive and material outcomes. Following an inductive logic, we collected and analyzed two main categories of sources: (i) primary materials, including official statements, communiqués, policy documents, and stakeholder positions; and (ii) secondary literature, encompassing academic studies, policy reports, and technical analyses. Based on this empirical foundation, we identified and reconstructed the chain of critical decisions and actions that shaped the controversy's trajectory. As such, our research benefits from the wealth of empirical attention the Tren Maya has attracted among scholars, journalists, NGOs, consultancies, international organizations, and activists. While this reliance on openly accessible sources may introduce some availability bias, the breadth, variety, and triangulation of materials analyzed mitigate such concerns.

The case study is structured around six critical junctures, with particular attention paid to the emergence of and interactions between two critical imaginaries: the "Fourth Transformation" and the notion of "ecocide." In line with the coproductionist idiom, our account juxtaposes technological and social elements to elucidate the interactions between these dimensions. Our primary objective is not to unearth novel details about the Maya Train controversy per se (see, Appendix: benefits, impacts and irregularities, in the digital

²⁸ Sarewitz 2004; Fischer 2000.

²⁹ Callon, Lascoumes and Barthe 2011.

version of this article)³⁰, but rather to offer an alternative interpretation that unmask its concomitant sociotechnical imaginaries and provides insights into the processes through which this large-scale infrastructure project becomes legitimized and contested.

3.1 Developmental Dreams and the “Fourth Transformation”

The tropical climate and fertile land of the Mexican Yucatán peninsula have long ignited the infrastructural imagination. Towards the end of the nineteenth century, the government of Porfirio Díaz erected an extensive rail network in the region to support the booming sisal (henequén) industry (an agave species mainly used to produce fiber). Industrialized agricultural production—most of the henequén fibers were exported to Europe—had disastrous effects on the rich local ecosystems. Biodiverse primary forests were logged to make space for monoculture plantations and transport corridors. Meanwhile, the economic benefits of this boom accrued mostly to landowners of European descent and brought little prosperity to most of the local Indigenous population. Indeed, the encroachment of plantations on Indigenous land sparked the so-called Caste War between 1847 and 1901, when independent Mayan communities revolted against the influx of and exploitation by Hispanic settlers. During that war, the existing rails were also used to transport Mexican army troops and weapons.³¹

Ultimately, during the mid-twentieth century, demand for henequén was displaced by plastic materials, the plantations disappeared, and the railway infrastructure slowly fell into disrepair. From the 1970s onwards, the peninsula grad-

³⁰ The Appendix to this article is available in the corresponding issue and article of the electronic version of the journal: <https://forointernacional.colmex.mx/index.php/fi/index>

³¹ For a detailed account of this history, see Wells 1992.

ually developed a tourism-centered economy built around Yucatán's unique ecosystems, pristine beaches, and rich cultural heritage. To boost the growing tourism sector in one of Mexico's poorest regions, various politicians have proposed new rail projects over the years that would connect the region's cities with its beaches and cultural sites. In 2012, the administration of Enrique Peña Nieto (2012-2018) revealed plans to build a "trans-peninsular" train across Yucatán, but the proposal was quietly dropped amidst budget shortfalls.³²

In 2018, a month after his election, Peña Nieto's successor, President Andrés Manuel Lopez Obrador (also known by his acronym AMLO), announced another attempt at revamping Yucatán's infrastructure: the Tren Maya. The proposed megaproject foresaw the construction of roughly 1,500 km of railroad tracks, subdivided into seven sections across five Mexican states (Chiapas, Tabasco, Campeche, Yucatán, and Quintana Roo) and was initially expected to cost between USD 6 and 9 billion, more than three quarters of which was to be raised from the private sector. It was also conceived to connect with other major regional infrastructure projects, such as a railway across the Isthmus of Tehuantepec, projected as an alternative to the Panama Canal. Although the proposal had not featured in his electoral campaign, it quickly became one of the president-elect's priority policies for his upcoming six-year term.³³

More specifically, the Tren Maya assumed a crucial place in the developmental-nationalist imaginary promoted by the López Obrador government as the "Fourth Transformation" ("*Cuarta Transformación*").³⁴ The Fourth Transformation—half political manifesto, half socio-economic development program—projects a future in which comprehensive, State-led reindustrialization and national development of critical infrastructure deliver economic prosperity, reduce the stark

³² De la Rosa 2015.

³³ Gobierno de México 2019.

³⁴ Puga Espinosa 2021.

inequalities plaguing the country, and regenerate the Mexican nation. In an ostentatious claim to historical grandiosity, the “Fourth” Transformation references three pivotal periods of disruptive protest and social upheaval in Mexico’s history—the struggle for independence between 1810 and 1821, the reform policies and secularization pursued by President Benito Juárez between 1858 and 1872, and the Mexican Revolution between 1910 and 1920.³⁵

The political regime emerging after the Mexican Revolution was characterized by the hegemony of the Institutional Revolutionary Party (*Partido Institucional Revolucionario*, PRI). The PRI emanated directly from the years of armed struggle and embodied revolutionary demands for social justice. This historical tie to the foundational process of modern Mexico constituted an important source of legitimacy for the Fourth Transformation, as did the uneven economic growth and political stability that the country experienced over much of the twentieth century. In this context, advances in industrialization enabled the formation of new business constituencies linked to the State that benefited from PRI policies promoting economic development. Such State-driven growth, in turn, lent popular support to the regime by gradually improving living standards across broad population sectors. Within this political framework, State investment in large-scale infrastructure projects (hydroelectric dams, highways, ports, among others) projected an image of national progress and technical prowess by the PRI regime. Likewise, it served as a clientelistic tool and provided leverage for political control in times of crisis. Thereby, the economic expansion enabled by the PRI’s model of stabilizing development functioned both as a validation of its supposed competency and as a pillar propping up its prolonged grip on power.³⁶

In the 1980s, the neoliberal shift initiated under President Miguel de la Madrid (1982-1988) caused the first major

³⁵ Puga Espinosa 2021.

³⁶ Moreno-Brid and Ros 2009.

schism in PRI history. In response to this change, in 1987, the party's Democratic Current faction, which represented its more nationalist wing and advocated for a more direct State economic role, broke away from the PRI, alleging that the neoliberal pivot contradicted longstanding party principles on economic policymaking.³⁷ This rupture gave rise to the most prominent contemporary leftist political figures such as Cuauhtémoc Cárdenas, son of iconic President Lázaro Cárdenas (1934-1940), followed later on by Andrés Manuel López Obrador.

The subsequent administration of Carlos Salinas de Gortari (1988-1994) fully embraced the neoliberal policy trinity of trade openness, sweeping deregulation, and globalization. Consequently, it forged ahead with the broad privatization of State enterprises across strategic sectors such as telecom and banking; enacted severe budget cuts in areas like public infrastructure, agriculture subsidies, and industrial development; and rolled back the State's historical function as the steward of the economy and direct engine of growth and industrialization.³⁸ This structural overhaul catalyzed a radical shift in Mexico's economic model, from one centered on State-managed entrepreneurship and top-down technological upgrading, toward a minimalist role for the State as market overseer, regulator, and facilitator of private interests. Such realignment converged with Latin America's ascendant political and economic neoliberal paradigm in that era.

The articulation of the *Tren Maya* as a centerpiece of the "Fourth Transformation" thus reveals the multifaceted nature of sociotechnical imaginaries in the context of infrastructure megaprojects. By positioning it as a counterproposal to the neoliberal shift and invoking a past marked by State-driven growth and expansion, the Fourth Transformation serves as a powerful tool of "governmentality"³⁹—a State-sponsored

³⁷ Hernández Rodríguez 2020.

³⁸ Moreno-Brid and Ros 2009.

³⁹ Foucault 2007.

imaginary perpetuated through institutional arrangements, political practices and historical accounts, which posits that social progress and governability fundamentally relies on nationalist development. As Jasanoff warns, “Such visions, and the policies built upon them, have the power to influence technological design, channel public expenditures, and justify the inclusion or exclusion of citizens with respect to the benefits of technological progress.”⁴⁰

In this context, the López Obrador administration, by intertwining the Tren Maya with Mexico’s historical narrative of social transformation, proposed not merely an engineering project but an initiative that would materialize the resurgence of State-led national progress. This articulation, inscribed into the National Development Plan 2019-24, established symbolic and affective connections with the cultural legacy of post-revolutionary nationalism while delineating the place that this physical infrastructure would occupy in a shared future. The government argued that the Tren Maya would boost national manufacturing and construction industries, create tens of thousands of jobs, and bring economic benefits to a part of Mexico still marked by high inequality, poverty, and social marginalization (see Appendix, Table A. Benefits of the Project, in the digital version of this article.)⁴¹

As such, the case study illustrates how large-scale infrastructure projects can transcend a utilitarian cost-benefit calculus to become tangible embodiments of broader socio-technical imaginaries, encapsulating aspirations for national development and societal transformation. However, as will become clear, the materialization of these imaginaries is inherently fraught with challenges, reflecting the politically charged and contested nature of visions for technological and social development.

⁴⁰ Jasanoff and Kim 2009.

⁴¹ Gobierno de México 2019.

3.2 The Planning Process and the Indigenous Consultation

Initially, the “transformational” imaginary constructed around the Tren Maya enjoyed widespread support. López Obrador had won the 2018 presidential elections in a landslide, and his governing coalition enjoyed a comfortable parliamentary majority in the national congress. The President’s image as a self-stylized “outsider” and “man of the people” fueled hopes that the Fourth Transformation could mitigate the poverty afflicting one of Mexico’s most marginalized and neglected regions. Many residents wanted to give the project a chance, attracted by hopes of better jobs and economic opportunities. Business actors, too, welcomed the train as an auspicious occasion to expand their operations and increase their revenue. This wave of support allowed the government to mobilize significant resources in favor of its developmentalist vision and downplay the technological, economic, and legal difficulties that arose during the planning stages.

From a technological perspective, the Tren Maya was an extremely ambitious venture. Subdivided into seven sections, it involved refitting 600 km of existing rail tracks between Palenque and Valladolid (sections 1, 2, and 3) and building approximately 900 km of new tracks, much of them in complex, earthquake-prone terrain dominated by dense vegetation (sections 4, 5, 6 and 7).⁴² The construction process for the new sections required clearing a 60 m wide corridor through the jungle; condensing the porous, unstable soil; and laying various layers of foundations for the rails to rest on. Moreover, bridges, overpasses, touristic infrastructure, shopping malls, and around 20 train stations had to be erected. The network further required installing a modern system of signals and controls as well as electric overhead lines for almost 700 km of rail. According to initial plans, 75 hybrid diesel-electric train carriages with a carrying capacity of 300-500 persons each would transport over 8000 pas-

⁴² Gobierno de México, n.d.

sengers per day at top speeds of 160 km/h—in addition to increased freight service at maximum speeds of 120 km/h.⁴³

Before the technological intervention could begin, however, several bureaucratic hurdles needed to be cleared. Social and environmental concerns were raised early on in the project, since the train passes through Indigenous land and residential areas around large urban centers, as well as protected ecological reserves and sites of cultural importance.⁴⁴ These concerns activated an arsenal of national and international laws and regulations requiring comprehensive social and environmental impact assessments to be conducted, and prior informed consent to be obtained from affected communities.⁴⁵ Moreover, it was initially unclear if and to what extent the proposed public-private funding model would succeed in attracting sufficient investment, or whether the project would be economically viable in the mid- to long-term.⁴⁶ Despite all these challenges, the government ambitiously scheduled the entire planning and authorization phase to be completed in less than two years (by 2020) and for the train to commence operations before the end of the President's non-renewable mandate in the summer of 2024.

To make good on these exorbitant promises, the López Obrador administration elevated the project to become one of its flagship policies and invested significant amounts of political and financial capital in its success. Soon after the project was announced, and still before formally taking office, President López Obrador privately organized a nationwide “citizen consultation” on November 24 and 25, 2018, in which he subjected ten of his projects—including the Tren Maya—to a “popular vote”. The Tren Maya was approved by roughly 90% of respondents, although only less than 1% of eligible voters participated (the other nine projects each

⁴³ Gobierno de México, n.d.

⁴⁴ Cámara de Diputados (Comisión Asuntos Frontera Sur) 2019.

⁴⁵ “Los 8 requisitos legales...” 2018.

⁴⁶ Reyna Quiroz 2018.

passed with more than 90% approval, as well).⁴⁷ Backed by this supposed demonstration of popular approval, President López Obrador symbolically inaugurated the project mere days after taking office in December 2018 with a Mayan ritual. The responsibility was initially assigned to the National Tourism Promotion Fund (*Fondo Nacional de Fomento al Turismo*, Fonatur), a public institution under the aegis of the Ministry of Tourism (*Secretaría de Turismo*, Sector).

Throughout 2019, Fonatur elaborated detailed plans for the Tren Maya's timely development and execution. Since the agency lacked the expertise and resources to handle a task of such proportions, however, it relied on external assistance. In addition to UN-Habitat (the United Nations Human Settlements Programme), which provided technical advice, the government also contracted a host of private consultancies, such as PricewaterhouseCoopers, to assess the project's economic, accounting, and legal aspects. During this preparatory phase, the original plans experienced initial changes with regards to the project's financing and the exact route of the train, among other aspects.⁴⁸

Interestingly, for all its ambition, the Tren Maya was a highly opaque project from the outset. While it was praised by the government as the “most important infrastructure, socioeconomic development, and tourism project of its six-year term,”⁴⁹ it was never specified comprehensively in any single executive document. Feasibility studies and legally required social and environmental impact assessments were either lacking entirely or only submitted long after the planning stage had been concluded. This lack of transparency and information made it difficult for a larger public to assess the project independently during the preparatory stages and initially shielded the government from political and legal scrutiny.

⁴⁷ “Consulta ciudadana de AMLO...”, 2018.

⁴⁸ De la Rosa and Vázquez 2019.

⁴⁹ Gobierno de México 2019.

Yet, not long after the project was announced, observers began to draw attention to the train's potential impacts on local communities, and in particular the government's obligation to obtain the free, prior, and informed consent of affected Indigenous communities as mandated by the International Labour Organisation Convention 169 (Indigenous and Tribal Peoples Convention) as well as by national law.⁵⁰ To satisfy this crucial legal requirement, the government hastily set up a regional consultation process. During November and December 2019, 30 assemblies were held in 15 Indigenous regions across the five affected states. The first round of assemblies was "informative" in character, whereas the second was aimed at "consultation." As part of the consultative stage, residents of 84 municipalities directly affected by the Tren Maya's proposed route were invited to vote on December 14 and 15, 2019. However, only 100,900 voters, or 3.6% of those eligible, responded to this appeal, of which 92% approved the project.⁵¹

While the government interpreted these numbers as unanimous approval and regarded its legal duty as having been fulfilled, local and international observers heavily criticized the faulty manner in which the entire process had been carried out.⁵² As an assessment by the Office of the United Nations High Commissioner for Human Rights in Mexico noted, the information presented at the regional assemblies was heavily biased towards the Tren Maya's positive impacts and mainly served to confirm the project without significant modifications; many details, such as the precise trajectory, were still uncertain; and no social or environmental impact assessments had been conducted prior to the consultation.⁵³ The short timeframes, deceptive materials, and outstanding

⁵⁰ Amnesty International 2018.

⁵¹ ASF 2020, 19.

⁵² For a critique of the consultation procedure in general based on another Mexican infrastructure project, see Dunlap 2018. See also De Castro 2019.

⁵³ See OCHCR Mexico 2019. The information material presented to the communities can be consulted at Gobierno de México s.f. b.

uncertainties led many Indigenous collectives to boycott a process they saw as a mere farce to legitimize the López Obrador administration’s political program.

Initial critiques voiced by civil society were all but ignored by the government. Instead, Fonatur sought to create a mandate by launching an initial round of project financing and awarding the first construction contracts in early 2020. With this step, the Tren Maya became engulfed by a powerful political economy with vested interests in the project’s execution. International investors saw an auspicious opportunity to reap strong returns, manufacturing companies from around the world competed for the lucrative construction contracts, and even business actors with no direct stake in the train’s development stood to benefit through lower transportation costs.⁵⁴ Ultimately, the construction was entrusted to a host of public and private, international and Mexican actors (see Figure 1).

FIGURE 1
Map of the Tren Maya’s route,
subdivided into seven sections



Source: Webber and Stott 2021.

⁵⁴ “El Negocio del Tren Maya...” 2020.

Hence, at this initial stage there were already flaws in the developmental dreams and engineering prowess coalescing around the Fourth Transformation. The project's planning and consultation process exposed the complexities inherently involved in actualizing sociotechnical imaginaries, with remote bureaucracies, technical experts, and economic elites having to confront the material, political, and socio-cultural unruliness of specific locales. Significantly, early criticism arose not so much from the national political debate—dominated by the near-total political hegemony of López Obrador's governing coalition—but from local and international spheres. It was primarily Indigenous communities and other residents on the one hand, and dispersed international voices on the other, that questioned the government's ambitious planning and rushed implementation. Simultaneously, the governmental imaginary became politically embedded through the enrollment of powerful business actors.

This discrepancy between governmental vision and the concerns of Indigenous and local communities underscores the tensions that emerge between dominant imaginaries—often ideated in faraway offices—and local views rooted in lived experiences and cultural relationships that unfold in concrete places. It also illustrates how planning, information, and consultation processes, far from being mere technical exercises, become crucial arenas where predefined visions of development and progress are privately negotiated and publicly performed to enhance their legitimacy.

3.3 Construction Commences, Contention Consolidates

In June 2020, construction officially commenced on sections 1, 2, and 3 of the Tren Maya, initiating a series of tangible interventions including expropriations, demolitions, land clearing, and deforestation. These material modifications, coupled with the government's dismissal of critiques raised during the planning stages, catalyzed a process of co-produc-

tion that intensified and consolidated opposing forces (see Table 1). As the project's concrete impacts became increasingly apparent, the emerging backlash coalesced around three primary themes that challenged the dominant socio-technical imaginary of the Fourth Transformation (see, Appendix: Table B. Impacts of the Project, in the digital version of this article).

First, the Tren Maya was denounced for its disproportionate social impact on marginalized Indigenous groups. It was not just the hastily and superficially conducted consultation procedure that sparked public outrage. Another critical dispute concerned territorial rights. More than half of the new constructions occurred on *ejidos*—a type of usufruct right on communal land granted to peasants by the government that became widespread after the Mexican Revolution.⁵⁵ Initially, the government proposed to bundle the *ejidos* in a fund to be traded on the stock exchange, with the *ejidatarios* becoming shareholders. As this market-based solution would have required extensive privatization and exposed the *ejidatarios* to market fluctuations, the plans were ultimately discarded in favor of indemnified expropriation. In addition to communal lands, more than 30,000 private households in cities like Campeche were expropriated, leading to accusations of forced displacement.⁵⁶ Indigenous collectives such as the Regional Indigenous and Popular Council of Xpujil (*Consejo Regional Indígena y Popular de Xpujil*, CRIPX) also alleged that the influx of international businesses and mass tourism as a result of the Tren Maya presents a threat to their cultural identity and risks destabilizing the social fabric.⁵⁷

Second, the project affected various sites and artifacts of historical and cultural value. There are more than 30 publicly accessible archaeological areas located along the train's route, some of which (Palenque, Calakmul, and Chichén

⁵⁵ Torres-Mazuera 2023.

⁵⁶ Morris 2023.

⁵⁷ Camargo and Vázquez-Maguirre 2021.

Itzá) are listed as world heritage sites by UNESCO. The expected arrival of or increase in mass tourism to sites like Calakmul raised concerns not only about the sites' physical integrity but also surrounding cultural practices. Moreover, excavations carried out in conjunction with the construction works brought to light more than 25,000 artifacts, speaking to the archeological riches buried in adjacent areas and potentially damaged by the train. Although the National Institute of Anthropology and History (INAH) and UNESCO accompanied the project to minimize its effects, the rush to conclude works before 2024 allowed little time for detailed archeological appraisals and impact assessments.⁵⁸ Further, the project's disastrous impacts on the peninsula's world-famous underground caves—the *cenotes*—led Indigenous groups such as the Assembly of Defenders of the Mayan Territory Múuch' Xíinbal (*Asamblea de Defensores del Territorio Maya Múuch' Xíinbal*) to stress the cultural and spiritual importance of these places in Mayan culture.⁵⁹

Third and finally, public outcry was fueled by the environmental impacts of erecting a massive infrastructure amid a highly biodiverse and vulnerable ecosystem. Initially, López Obrador had promised that “not a single tree would be felled.”⁶⁰ This aspect quickly became central to the controversy, given the need to build new tracks through hundreds of kilometers of dense rainforest. The project passes through 22 protected natural areas (one of which, the Calakmul Reserve, is recognized as a mixed cultural and natural world heritage site by UNESCO), threatening deforestation, habitat loss, species extinction, noise and chemical pollution, and water contamination. The affected zones include the second largest tropical rainforest in Latin America, mangroves, and coastal dunes on top of a karst topography, whose limestone rocks have created *cenotes* that harbor unique forms of life.

⁵⁸ Ureste 2022.

⁵⁹ Gómez Durán 2022.

⁶⁰ Gobierno de México 2018.

Although the precise effects will likely become apparent only in the years to come, it is estimated that over 9 million trees have already been cut and an area of more than 6,000 hectares deforested.⁶¹

These increasingly tangible social, cultural, and environmental impacts were at odds with the government's promise of a better life for all through infrastructural development and awakened increasing resistance to the Tren Maya. At the beginning, the resistance was mostly led by local collectives and Indigenous communities. Although Indigenous communities had generally supported President López Obrador and had played an important role in his historic election in 2018, relationships quickly soured after the mishandled consultation process and the government's dismissal of claims to Indigenous self-governance. Following failed mediation attempts throughout 2019, the Chiapas-based Zapatista Army of National Liberation (*Ejército Zapatista de Liberación Nacional*, or EZLN) and the National Indigenous Congress (*Congreso Nacional Indígena*) began to actively denounce the government's "capitalist megaproject".⁶² In a December 2019 speech, Zapatista spokesperson Comandante Moisés vouched to "defend [their territories from the Tren Maya] to the death, if necessary."⁶³ Protests took various forms—from creating leaflets and artistic artifacts (see Figure 2)⁶⁴ to landowners and *ejidatarios* refusing to cede their properties, to activists blocking roads and obstructing constructions.⁶⁵ Moreover, in November 2020, the CRIPX delivered a petition with 268,000 signatories—more than twice the number of those who had approved the project in the 2019 consultation—asking the government to suspend the Tren Maya.⁶⁶

⁶¹ Kishwari 2023.

⁶² Castellanos 2019.

⁶³ Mariscal 2020.

⁶⁴ González Austria Noguez 2024, 158-177.

⁶⁵ Rodríguez Wallenius 2023, 95-113; Greenpeace Mexico 2022b; Gasparello and Núñez Rodríguez 2021.

⁶⁶ Méndez 2020.

FIGURE 2
Poster protesting the Tren Maya



Gran OM & Co. (Kloer). 2019. *No al Tren Maya*. 60 cm. × 90 cm. (offset printing).

With the onset of initial material interventions on the peninsula, a broader coalition of national and international actors began to voice their opposition to the government's plans. In June 2020, more than 150 Mexican civil society organizations signed a letter to the President that denounced the project's various risks and shortcomings in great detail.⁶⁷ Only three months later, a joint communication by six UN Special Rapporteurs alleged a severe risk of human rights violations concerning the project and called upon the government to cease, investigate, and remediate any such violations.⁶⁸ International NGOs such as Greenpeace or *Salva la Selva/Rettet den Regenwald* joined the struggle and assisted local organizers through petitions, information campaigns, and fundraising. Protest activities even occurred abroad, such as when activists sprayed "Stop Tren Maya" on a Berlin building owned by the German railway corporation *Deutsche Bahn*, which was involved in the project's development.⁶⁹

The alliance between local and Indigenous collectives on the one hand and more conventional civil society organizations on the other was complemented by a host of scientific experts from the fields of ecology, geology, archeology, and anthropology. The latter was particularly relevant to contest the knowledge claims underpinning the Tren Maya's developmental imaginary. For instance, in 2022, the collective *Sélvame del Tren* was formed as an alliance between residents and academic experts to document and publicize the train's catastrophic impacts on local hydro- and ecosystems. With the involvement of well-known Mexican intellectuals, scholars, and even public celebrities such as singer Natalia Lafourcade, the opposition was able to reach new constituencies among more affluent social classes in urban centers, many of whom had been suspicious of previous claims to In-

⁶⁷ See Greenpeace Mexico 2020.

⁶⁸ OUNHCHR 2020.

⁶⁹ Blut 2023.

digenous self-determination and anti-system rhetoric. The enrollment of epistemic and social elites in the anti-train coalition, in turn, elevated critiques of the Tren Maya from a local grievance to an issue of national political importance.

In sum, the inception of construction work on the Tren Maya initiated a process of co-production whereby material changes on the ground not only concretized the dominant sociotechnical imaginary of the Fourth Transformation but also furnished the substrate for oppositional claims and shaped dissident interpretive frameworks regarding the project's societal role. The project's tangible impacts on local environments and communities transmuted abstract critiques into concrete problems spanning territorial rights, cultural heritage, and environmental degradation. This concretization not only bolstered the claims of local opposition groups but also broadened and diversified critical voices to encompass scientific experts, multilateral institutions, and international NGOs (see Table 1). The enrollment of such elites enabled the project's contestation on technical grounds and augmented the public visibility of its local implications.

TABLE 1
Actors involved in the Tren Maya's co-production (not exhaustive).

<i>Type of Actor</i>	<i>Name</i>	<i>Scale</i>	<i>Agenda</i>	<i>Involvement</i>
Indigenous	Consejo Regional y Popular de Xpujil	Local	Defending Indigenous Mayan territory and culture	Coordinating local opposition to the project, local protest activities, amparo litigation
	Asamblea de Defensores del Territorio Maya, Múuch' Xímbal	Local	Defending Indigenous Mayan territory and culture	Coordinating local opposition to the project, protest activities, amparo litigation, participation in the IRNT
	Congreso Nacional Indígena	National	National representation of Indigenous voices and interests	Coordinating Indigenous opposition at a national level
	Ejército Zapatista de Liberación Nacional	Regional	Anti-capitalist and anti-globalist, pro-Indigenous (armed) struggle	Public criticism and protest activities
Environmental NGOs	Greenpeace	International/ national	Environmental protection	Participation in the MIA process
	Salva la Selva	International/ national	Rainforest protection	Organizing an online petition
	Sélvame del Tren	National	Stopping the Tren Maya	Conducting scientific studies of impacts, media appearances, celebrity involvement
	Centro Mexicano de Derecho Ambiental	National	Environmental litigation	Amparo litigation

<i>Type of Actor</i>	<i>Name</i>	<i>Scale</i>	<i>Agenda</i>	<i>Involvement</i>
Expert organizations	Consejo Civil Mexicano para la Silvicultura Sostenible	National	Rural development and protection of forests	Conducting scientific studies, participation in the IRNT
	SOS Cenotes	Local		Conducting geological studies
	Individual academics	National	Expert analysis of select aspects of the Tren Maya	Conducting scientific studies, media appearances
Executive	Presidential Office of Andrés Manuel López Obrador (2018-2024)	National	Fourth Transformation	Ideation and executive control over the Tren Maya project
	Fonatur	National	Promotion of tourism	Project planning and implementation (before 2023)
	Semarnat	National	Ensuring compliance with environmental laws	Execution of MIAs
	Se-dena	National	Military implementation of executive goals and projects	Project implementation (after 2023)
	INPI	National	Coordinating State-Indigenous relationships	Organization of the Indigenous consultation
Judiciary	Poder Judicial de la Federación	National	Sanctioning violations of federal legal norms	Adjudicating legal claims/amparos
	International Rights of Nature Tribunal	International/local	Ecocentric law reform	Organizing the Tren Maya hearing, verdict denouncing the project as “ecocide and ethnocide”

<i>Type of Actor</i>	<i>Name</i>	<i>Scale</i>	<i>Agenda</i>	<i>Involvement</i>
International organizations	UN Habitat	International	Urban development support	Assisting Fonatur in initial stages of project planning and implementation
	UN Special Rapporteurs	International	Human rights compliance monitoring	Public criticism of alleged human rights violations
Business	PriceWaterhouseCoopers	International	Consultancy services	Providing economic and financial consultancy in the planning stages
	China Communications Construction Company	International	Infrastructure construction	Constructing rail infrastructure
	Alstom	International	Rail manufacturer	Manufacturing train carriages

Source: Prepared by the authors.

As the emergence of a broad coalition against the Tren Maya shows, the sociotechnical imaginaries constructed around large infrastructure projects are inherently fragile and open to contestation. Their materialization concretizes dominant developmentalist visions but also catalyzes the formation and consolidation of opposition and dissident perspectives. The tensions between dominant imaginaries and local realities that emerge during the implementation of megaprojects are not merely articulated *within* different epistemic and political communities, however. They are also mediated through a set of institutional structures with decisive implications for the resolution (or transformation) of infrastructural controversies.

3.4 Mobilizing the Law

With the consolidation and diversification of resistance in the wake of the first construction-related interventions, the Tren Maya grew in political salience from a local problem to an issue of national or even international proportions. In 2021, the governing coalition incurred some losses in the midterm elections, and the first signs of resistance against the project began to form within the Mexican Congress of the Union. *Sélvame del Tren*, in particular, managed to set the topic on the agenda of the parliamentary opposition, first within the Senate and later within the Chamber of Deputies.⁷⁰

However, this strategy faced significant challenges from the start. The opposition parties, which were predominantly aligned to the right of López Obrador's governing coalition, were an unlikely ally for the anti-train coalition. These conservative parties had historically shown little sympathy for the political demands of environmental activists and Indigenous collectives. Furthermore, they had been involved in pushing similar infrastructure projects in past administra-

⁷⁰ García 2022.

tions or at the state level.⁷¹ As a result, their parliamentary criticism was limited to specific aspects of the project, such as its exorbitant costs. Moreover, the government's comfortable majority prevented any legislative intervention in the executive branch's project, highlighting the limitations of the opposition's influence.

Other federal organs, such as the Superior Court of Auditors of the Federation (*Auditoría Superior de la Federación*)⁷² also attempted to rein in the government's fervor but lacked participatory avenues as well as the mandate to dispel the Fourth Transformation. Political resistance at the state level was similarly futile, since Mexico's federal presidential system granted the executive branch wide-ranging powers over national infrastructure. International organizations such as the United Nations Special Rapporteurs voiced legal concerns, but their distance from local circumstances and lack of enforcement powers failed to influence the project. The impasse in the political sphere accorded increasing significance to the judiciary in an attempt by the resistance to locate new institutional spaces to give credence to their epistemic critiques of and political disagreements with the Fourth Transformation.

Almost simultaneously with the commencement of construction, the first legal challenges started pouring into state and federal courts (see Appendix: Table C. Irregularities and Controversies, in the digital version of the article). These lawsuits benefited from the dense tapestry of rules and standards governing the execution of infrastructure projects. On paper, the Mexican legal system features a progressive canon of environmental and human rights protections. Mexico is party to most relevant international conventions, including the Convention on Biological Diversity, the UN Framework

⁷¹ See, for instance, the dominant role of the PRI in instigating the modernist-developmental policies of the twentieth century, as described in section 3.1.

⁷² ASF 2020.

Convention on Climate Change—including the Kyoto Protocol and Paris Agreement—, the World Heritage Convention, the American Convention on Human Rights, and the recently concluded Escazú Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean.⁷³ In addition to international commitments, the Mexican Constitution contains multiple articles dealing with environmental protection, the rights of Indigenous people, and individual human rights. Environmental protections are implemented through the comprehensive General Law of Ecological Equilibrium and Environmental Protection of 1988 and have been further strengthened in a strand of environmental rulings by the Mexican judiciary and the Inter-American Court of Human Rights over the past decade.⁷⁴

Next to substantive provisions dealing with the protection of environmental, Indigenous, and human rights, Mexico's legal system also contains a powerful procedural tool to remedy these rights—the *amparo*. The *amparo* is a constitutional legal instrument that allows individual citizens and collectives to file a lawsuit before the federal judiciary if the State has violated its fundamental rights, granting broad rules of standing—any natural or legal person with a “legitimate interest,” whether individual or collective, can bring a claim. If successful, the tribunal seized can compel public authorities to implement comprehensive injunctive or remedial measures. While the *amparo* has been criticized for its procedural inaccessibility,⁷⁵ it remains an unrivaled sword for experienced litigators and individuals with access to competent legal expertise.

⁷³ The Escazú Agreement, which imposes stringent transparency and participation obligations on governmental authorities, did not come into effect until April 2021. Its impact on litigative practice in the Tren Maya controversy and elsewhere thus remains to be seen.

⁷⁴ Revuelta Vaquero 2022, 111-143.

⁷⁵ Pou Giménez 2014.

Between 2020 and 2023, dozens of *amparos* were brought against various aspects of the Tren Maya. Some of these were filed by Indigenous collectives who alleged that the faulty consultation procedure clearly violated the participation rights enshrined in Article 2 of the Mexican Constitution as well as in international treaties. Others hailed from environmentalists and civil society organizations like the Centro Mexicano de Derecho Ambiental (CEMDA) denouncing violations of the constitutional right to a clean and healthy environment. At least one suit mentioned Indigenous people's right to health, which was alleged to be threatened by works on the train continuing throughout the COVID-19 pandemic and the consequent risk of outside workers infecting vulnerable local communities. Yet another class of complaints—this one predominantly brought by urban dwellers along the route—relied on the right to property and the prohibition of forced displacement.⁷⁶

Besides rights-based claims, many *amparos* also alleged widespread violations of administrative rules and procedures. Legislation such as the 2018 Federal Sustainable Forest Development Law requires the government to conduct and approve detailed environmental impact assessments (*Manifestaciones de Impacto Ambiental*, MIA) before making any interventions. To comply with this requirement, the first MIA for sections 1 to 3 was published by the Ministry of Environment (*Secretaría de Medio Ambiente*, Semarnat) in June 2020 and approved in December 2020; the MIAs for sections 4 and 5 were presented in August 2021 and May 2022, respectively, and approved by Semarnat in August 2022; and the MIAs for the ecologically most vulnerable sections 6 and 7 were published in August 2022 and approved only one month later by the Ministry of Defense (*Secretaría de Defensa Nacional*, Sedena). Environmental associations such as Greenpeace and the Regional Council of Xpujil (*Consejo Regional de Xpujil*) criticized this process as deeply flawed, however, alleging that the assessments omitted crucial information and included false statements. Moreover,

⁷⁶ Bonilla Padilla 2023.

the public consultation requirements mandated by legal regulations were barely met. Non-governmental organizations were occasionally given only a few days or weeks to revise hundreds of pages of technical documents and submit their observations.⁷⁷ To complete the picture, construction work had often commenced long before the publication of the relevant MIAs. In the face of such blatant disregard for established norms and obligations, several of these lawsuits resulted in legal victories. At the bequest of judicial authorities, construction works on different sections of the Tren Maya were repeatedly suspended between 2020 and 2023.

Taken together, the legal mobilization against the Tren Maya demonstrates the pivotal role that law and courts assume in the co-production of infrastructure projects. Beyond adjudicating concrete disputes between conflicting perspectives, judicial venues can serve as a crucial forum to contest and (de-legitimize) dominant sociotechnical imaginaries and their proposals for shared development and future. Petitioning the courts thus constituted a fruitful strategy to scrutinize the claims of expertise underlying the Fourth Transformation through the external normative framework provided by law. On a practical level, the legal actions resulted in a flood of injunctions that temporarily halted construction work. More significantly, however, the judicial proceedings confirmed violations of the rights of Indigenous communities and affected residents, as well as transgressions of environmental norms and established evaluation and consultation procedures. In this way, litigation conferred juridical legitimacy upon the opponents' claims and critiques.

Yet shifting the controversy onto legal terrain ultimately proved insufficient to undermine the powerful imaginary produced and propelled by the government. To begin with, the technical language of administrative prescriptions and the inaccessibility of legal arenas and modalities to outsiders circumscribed the scope of litigation strategies to a relatively

⁷⁷ Greenpeace Mexico 2022a.

small circle of legal elites. Furthermore, the limited nature of the *amparo* system meant that only select aspects of the project could be challenged, rather than the broader vision enshrined in the Tren Maya as a whole. Finally, many of the legal provisions in question focused on procedural obligations and risk assessments –such as whether the government had undertaken diligent efforts to mitigate negative adverse or whether the MIAs had been conducted in a timely manner—rather than on their material outcomes. This procedural focus enabled the government to comply with the letter of the law by implementing additional safeguards without abandoning its larger developmentalist vision or addressing the broader socio-environmental implications of the project.

Paradoxically, then, the judicial interventions also allowed the government to address, albeit partially, the project's impacts and criticisms, mediate with opposition groups, and formally restore the project's legal legitimacy in the collective imaginary. This dynamic exemplifies the intrinsic tensions in deploying legal mechanisms to challenge dominant imaginaries: While they provide a space for contestation, they simultaneously offer avenues for reaffirming and adapting these imaginaries within existing legal frameworks.

3.5 Militarization and Securitization

Soon after construction commenced, the government began to perceive the burgeoning public and legal resistance to the project as a threat to the Fourth Transformation's overall success. Rather than address substantial criticisms, it adopted a militarization strategy that framed the Tren Maya as a security issue. From 2020 onwards, López Obrador's administration gradually transferred the project's responsibility from Fonatur to the Defense Ministry, or Sedena. This process was completed in September 2023 when the Tren Maya corporation was officially subsumed under Sedena, which has since then been in charge of the project's entire construction, op-

eration, and commercial exploitation. The government justified this step as an anti-corruption and anti-privatization measure, but critics feared that the move served to further strengthen the power of the military—which had already been put in charge of other pivotal infrastructure projects, such as Mexico City’s Felipe Angeles Airport—and to intimidate dissident voices.⁷⁸

The governmental response to the legal backlash shows a similar strategy of escalation. While the authorities initially defended their projects in court, they soon began to appeal unfavorable sentences in order to delay their coming into effect. Eventually, they ignored rulings altogether, continuing construction work in clear violation of judicial instructions. Moreover, in late 2021, the López Obrador administration officially declared the Tren Maya a “national security” issue in order to shield it from further judicial scrutiny. This move—heavily criticized by civil society actors—allowed the government to take legal and bureaucratic shortcuts and to release even less information to the public. After the Mexican Supreme Court denounced the government’s act as unconstitutional, President López Obrador accused the judiciary of a “technical coup d’etat” that sought to “neutralize the executive branch.”⁷⁹

The escalating conflict with large swaths of civil society and the judiciary branch increasingly threatened to derail the Tren Maya’s timely completion. To ensure the full realization of its flagship project, the government attempted to mobilize additional imaginative resources and swing public discourse in its favor—fully aware that the project continued to enjoy substantial support among business actors and a majority of Yucatán’s residents.⁸⁰ In a memorable press conference in August 2020, President López Obrador accused civil society organizations of being steered by “neoliberal” foreign powers and “exposed” donations they had received

⁷⁸ Centeno 2022.

⁷⁹ Carrillo 2023.

⁸⁰ Kishwari 2023.

from international foundations.⁸¹ As journalistic investigations later revealed, Sedena actively monitored the Zapatista Army of National Liberation to prevent attacks against the train's infrastructure.⁸² Meanwhile, the construction process continued relentlessly, bolstered by a social media campaign under the hashtag *#súbetealtren*. As the project neared its final stretch, the government additionally launched a further USD 13 million publicity campaign in August 2023 to promote the project more widely (see Figure 3).⁸³

The first part of the new route between Campeche and Cancún was officially inaugurated in December 2023, while the remaining sections are currently projected to be in operation by late 2024. Ultimately, the project's costs rose from a projected USD 9 billion⁸⁴ to USD 27 billion,⁸⁵ that is, roughly three times the initially envisaged amount. Contrary to earlier plans of mixed investment, this sum was paid entirely out of the public pocket.

FIGURE 3
Tren Maya Advertisement in the Mexico City Metro



Photo: Daniel Bertram.

⁸¹ Cedillo 2020.

⁸² García 2022.

⁸³ Fonatur 2023.

⁸⁴ *Efectos sociales del Tren Maya* 2020.

⁸⁵ De la Rosa 2023.

The militarization and securitization of the Tren Maya reveal another tension between the constraining effects of liberal legal safeguards and the exercise of executive power. Though politically and legally controversial, the government's actions were supported by legal mechanisms that shielded the Tren Maya from further scrutiny, reminiscent of Carl Schmitt and Giorgio Agamben's reflections on the "state of exception" where the law is applied by being dis-applied.⁸⁶ By legally requalifying its flagship infrastructure project as a national security issue,⁸⁷ the administration of López Obrador effectively suspended legal regulations related to the disclosure of public information, institutional procedures, and even the jurisdiction of the judiciary branch.

Through the lens of sociotechnical imaginaries, these actions illustrate the government's determination to safeguard the vision of the future embodied in the Fourth Transformation. Only by resorting to a logic of exceptionalism was it able to surmount institutional and social obstacles and ensure the project's materialization by the end of López Obrador's term in 2024. However, this strategy had unforeseen consequences for the Tren Maya's co-productive dynamics. As an exercise of power intended to produce a specific reality, it simultaneously galvanized opposition and generated new forms of resistance, exemplifying the complex interplay between dominant imaginaries and emergent counter-narratives. Faced with closing institutional and legal avenues to challenge the Fourth Transformation and an increasingly aggressive countermobilization, opponents were compelled to resort to spaces and vocabularies that transcended established institutional and legal structures.

⁸⁶ Schmitt 1921; Agamben 2003.

⁸⁷ In fact, related infrastructure projects such as the airport of Palenque in the state of Chiapas were also included in the government's decree.

3.6 *Re-Imagining the Tren Maya as Ecocide*

By the summer of 2022, the progress of conventional legal mobilization efforts to stall the project and the government's exceptionalist and militarization tactics left the opposition movement scrambling for alternative means to counter the governmental vision and its ongoing materialization. While the Tren Maya continued to be discussed critically on national media—partly due to the public disapproval of the government's claims voiced by various Mexican celebrities—executive, legislative, and judicial interventions to stop the project had, by and large, lost their bite.

In this context, the Indigenous community organization *Asamblea Defensores del Territorio Maya Múuch' Xíinbal* and the Mexican NGO *Consejo Civil Mexicano para la Silvicultura Sostenible* decided to launch an appeal to the International Rights of Nature Tribunal (IRNT) in June 2022. Both organizations had participated in regular litigation before the Mexican courts with growing disappointment. The IRNT, by contrast, seemed to offer an alternative to the formal Mexican court system that would allow the claimants to retain the symbolism and normative authority of the law without the restraints imposed by the *amparo* mechanism.

Founded in 2014 by the transnational Global Alliance for the Rights of Nature, a network of various organizations committed to promoting eco-centric legal reforms that recognize the inherent rights of nature, the IRNT is not a permanent judiciary body but an ad-hoc civil society initiative. It draws inspiration from a long tradition of citizen tribunals held by public intellectuals in order to provide a forum to disseminate marginalized visions of law and justice.⁸⁸ Previous iterations of the IRNT had focused on cases in Chile, Peru, and Ecuador with similar profiles to that of the Tren Maya—extractive industries and developmental projects that had sparked socio-environmental controversies and affected

⁸⁸ Krever 2023.

Indigenous communities in particular. Upon inspecting the Mexican complaint, the IRNT Secretariat (run by GARN) decided to take up the Tren Maya as its tenth case.

While embracing a culture of legal formalism as a preferred mode of mediating the conflicting visions manifesting around the Tren Maya, the IRNT differed significantly from the official court system. For starters, there was little doubt about the Tribunal's ideological affinities. Over the past decade, GARN has grown into a major international player on the "deep green" side of the environmentalist spectrum, having successfully advocated for legal reforms in several countries, from Ecuador to Bolivia and New Zealand. As such, despite the appearance of a neutral judicial process, the point of the Tribunal was to elevate the profile of an eco-centric legal paradigm and its application to real-world scenarios. Moreover, since the government declined an invitation to participate in the proceedings, the traditional adversarial dynamic between claimant/prosecutor and defendant was replaced by a unilateral process in which the opposition could voice its concerns uncontested.

The IRNT's composition and procedure, moreover, stood in stark contrast to the federal judicial system. To generate publicity and legitimacy, GARN had involved various academic experts and intellectuals from Mexico and abroad. Jorge Fernández Mendiburu, an academic and experienced human rights lawyer, was appointed the "Land Prosecutor." Another Mexican academic and outspoken critic of the Tren Maya, Giovanna Gasparello, acted as lead plaintiff. The Tribunal itself was composed of five judges: Maristella Svampa, Argentinian sociologist and activist; Raúl Vera López, a Mexican friar known for his social justice activism; Yaku Pérez, an Ecuadorian politician and Indigenous rights activist; Francesco Martone, a former member of the Italian Senate, and Alberto Saldamando, a Chicano lawyer based in the US.

To assess the claims raised by the Tren Maya protestors, the Tribunal organized an extensive in-person hearing in the city of Valladolid from March 9 to 12, 2023. During this hear-

ing, the judges visited three communities directly affected by the Tren Maya, inspected the ongoing construction work, and heard the testimonies of 22 representatives from Indigenous collectives and scientific bodies. Next to GARN and the Asamblea Defensores del Territorio Maya Múuch' Xíinbal and the Mexican NGO Consejo Civil Mexicano para la Silvicultura Sostenible, the Tribunal also invited other NGOs such as Sélvame del Tren and Cenotes Urbanos to contribute their expertise and perspectives. Crucially, the testimonies provided were not only drawn from institutionalized scientific methodologies but also from ancestral knowledge and lived experience.⁸⁹ For instance, a Maya woman lamented that the project was destroying the habitat of medicinal plants and had strongly polarized the Indigenous community, resulting in an increase in violence.⁹⁰ Through this participatory exercise, the Tribunal not only managed to involve a wide variety of actors in the proceedings but also allowed diverse epistemic traditions to contribute to the legal evaluation. The hearings thus differed strongly from the performative governmental consultations and the highly limited participatory spaces of the traditional courts.

As a final element, the Tribunal assessed the information presented not exclusively against the normative backdrop of positive Mexican and international laws, drawing on a far more comprehensive range of normative materials. One crucial instrument in this regard was the Universal Declaration of the Rights of Mother Earth, a non-binding civil society declaration adopted at the World People's Conference on Climate Change and the Rights of Mother Earth in Cochabamba, Bolivia, in April 2010. The Tribunal further considered legal developments in other jurisdictions that recognized the rights of nature, such as Bolivia, Colombia, and Ecuador.⁹¹

⁸⁹ A recording of the testimonies is available at GARN 2023.

⁹⁰ IRNT 2023, 26.

⁹¹ IRNT n.d., 3. See also Kotzé and Villavicencio Calzadilla 2017, 401-403; Boyd 2017; O'Donnell, Poelina, Pelizzon and Clark 2020, 403-427.

The recourse to these and other normative registers—including the “Wild Law” notion pioneered by South African jurist Cormac Cullinan⁹²—led the judges to embrace a much more eco-centric outlook than could be derived from existing and applicable legal canons. While the verdict took note of the amparos decided by and pending before the Mexican judiciary, it directly criticized the seized courts’ “restrictive” interpretations of environmental protection and justice.⁹³ Championing the normativity harbored among the various actors opposing the Tren Maya and privileging them over positive Mexican law, the Tribunal repudiated the normative force of the State-sanctioned rules and institutions that had thus far proved unable to challenge the Fourth Transformation.

In July 2023, the Tribunal handed down a comprehensive seventy-five-page sentence,⁹⁴ which carefully reviewed the charges brought in light of the evidence presented. The judges ultimately found that the Mexican government’s actions not only violated the rights of nature and the “biocultural” rights of the Maya people but that these transgressions also amounted to “crimes of ecocide and ethnocide.”⁹⁵ In doing so, the verdict not only managed to confirm and bestow institutional legitimacy upon the dissidents’ claims of knowledge and normative orientations but also unified and reconfigured these diverse perspectives around an alternative interpretive framework. As such, the IRNT’s intervention can be read as a crucial turning point in the Tren Maya’s sociotechnical co-production.

Throughout the project’s preparation and execution, resistance was focused not solely on disagreements over the

⁹² Cullinan 2011.

⁹³ IRNT n.d., 44–45.

⁹⁴ IRNT n.d.

⁹⁵ IRNT n.d., 204. The IRNT is not the first citizens’ tribunal to push the ecocide envelope. Another tribunal organized (not by GARN) to scrutinize the environmental practice of the chemical producer Monsanto (now Bayer) in 2018 came to a similar conclusion, although the context of that case was a different one. MacCarrick and Maogoto 2018.

project's expected costs and benefits and their fair distribution. Indigenous groups, in particular, rejected the very identity of the Tren Maya, arguing that it was neither a train nor was it Maya.⁹⁶ They highlighted that the project was more than a simple transport scheme—it was closely linked to expanding airports, wind and solar power installations, shopping centers, and even agricultural development programs. As such, the Tren Maya symbolized and heralded a radical change in the lives of Yucatán's inhabitants.⁹⁷ Critics feared this development would lead to overtourism, gentrification, economic inequalities, and ultimately, a loss of social cohesion and cultural belonging. In other words, it threatened the essence of Indigenous identity. Indigenous opposition was thus not merely *political*—relating to the distribution of costs and benefits—or even *epistemological*—disputing the claims of knowledge underlying the Tren Maya—in character. Instead, it extended to an ontological level, rejecting the forms of life authorized and prioritized by the government's envisioned future.⁹⁸

The avenues available to challenge the Fourth Transformation, however, including the federal courts, only allowed select aspects of the infrastructure project to be attacked, thus preventing the emergence of a unified alternative imaginary that could do justice to the ontological proportions of the opposition's critiques. Against this dearth of imaginative engagement, the Tribunal's "ethno-/ecocide" pronouncement provided a powerful instrument to join the project's material impacts with normative visions of desired futures. This was particularly true for the "ecocide" finding, which resonated better with environmentalist organizations than the seemingly human-centric accusation of "ethnocide". As one of the witnesses appearing before the Tribunal, Indig-

⁹⁶ Capote 2021.

⁹⁷ González Austria Noguez 2024.

⁹⁸ Giraldo 2022.

enous lawyer and researcher Francisco López Bárcenas,⁹⁹ explained:

Another manifest effect of the Tren Maya is ecocide, expressed through the violation of Indigenous peoples' right to their territory and the natural goods existing therein. As presented in the testimonies we have heard, Indigenous people do not distinguish between society and nature. This is a distinction imposed upon us by capitalist modernity to convert our natural goods into merchandise. On the contrary, Indigenous peoples understand themselves as being part of nature and consider the Earth their mother. They do not use her as a resource but maintain reciprocal relationships with her.¹⁰⁰

Ecocide hence served as a discursive hook to re-envision the Tren Maya as a criminal enterprise aimed at eliminating local forms of knowledge, social organization, and convivial futures. The penal aesthetic conjured by the analogy to the widely prohibited crimes of genocide, homicide, or femicide configured a criminal framework that positioned the government as an outlaw and renegade. This condemnatory narrative differed substantially from the cold and complex technicalities that had characterized previous legal mobilization efforts.

At the same time, the Tribunal's verdict connected local struggles against the Tren Maya to longstanding, transnational academic and policy debates among lawyers, criminologists, and public intellectuals over the scope and definition of the ecocide concept.¹⁰¹ In fact, the past decade has seen a steep rise in interest in the term as both an analytical tool and a legal category. Activists and legal experts around the Stop Ecocide International campaign, for instance, have managed to place the criminalization of ecocide on the agenda of vari-

⁹⁹ IRNT 2023, 27.

¹⁰⁰ TIDN 2023, 28.

¹⁰¹ See, e.g., Lindgren 2018; Crook, Short and South 2018.

ous national and international institutions such as the European Union.¹⁰² Although the judges did not explicitly reference these current and prior engagements with ecocide, the concept's application in the context of the Tren Maya also served to concretize such abstract debates and ground them in the experiences of local stakeholders.

The ecocide verdict thus established claims to justice that derived legitimacy from a grassroots level—through the interactive and participatory process of the Tribunal's hearing—as well as from transnational debates in academic and policy spheres. By extending its roots into these diverse communities and basing itself in the material conditions on the ground as reported and inspected by the Tribunal itself, the concept of ecocide managed to condense, at least partially, the claims of various opposition groups and was consequently endorsed and reproduced by an extensive and heterogeneous network of dissident actors and groups. Framing the Tren Maya as an ecocide not only offered a novel interpretation of this infrastructure as a criminal enterprise but also sowed the seeds of an alternative vision for the region's future. This vision rejected the project's implications for the environment, local communities, and their relationship with nature in ways that conventional legal arguments had failed to articulate.

Starting with the Tribunal's verdict, the ecocide imagery became widely distributed through Mexican and international media and was taken up by protest actors. For instance, the collective *Sélvame del Tren* began to frame the Tren Maya as an ecocide in on-site protests and external communications.¹⁰³ The Tribunal's verdict was also signed by “honorary judges” with national and international renown, including former Mexican Supreme Court Judge José Ramón Cossío Díaz or actor Gael García Bernal. Perhaps even more astonishing, a mere four days after the IRNT verdict, a congresswoman from the opposition party PRI intro-

¹⁰² Bertram 2024.

¹⁰³ “Ecocidio del Tren Maya...” 2023.

duced a bill seeking to add ecocide to the federal criminal code.¹⁰⁴ Suddenly a ubiquitous feature of the Tren Maya controversy, the ecocide label succeeded in capturing public interest and imagination as a recalcitrant challenge to the Fourth Transformation at large.

Unsurprisingly, the military refused to respect the construction ban imposed by the IRNT—just like it ignored the injunctions issued by federal courts—and relentlessly continued construction work. Despite its inability to put a halt to the Fourth Transformation’s material embodiment, however, the ecocide imaginary managed to bridge different symbolic and material facts in a cohesive framework and establish itself as a powerful and relatively stable reference point in the Tren Maya controversy. In doing so, it reshuffled the protest practices on the ground and allowed new alliances to form. While ecocide did not fully replace the Fourth Transformation as a dominant expression of infrastructural futures, it contested its legitimacy and laid out a localized alternative built around environmental justice, self-government, post-development ideas, and socio-environmental conviviality.

The dynamics engendered by the IRNT demonstrate that appealing to State institutions is neither necessary for, nor necessarily conducive to, the contestation of dominant sociotechnical imaginaries. Even civil society-led initiatives like citizen tribunals may spur the collective imagination if they ground their legitimacy in a broad participatory process and retain at least a symbolic cloak of institutional authority. In contrast to the epistemically and politically constrained spaces of formal legal fora, the Tribunal allowed protest actors to freely formulate their claims and visions. These expressions were then unified and connected to legal and normative categories through the Tribunal’s judgment. The Tren Maya is thus also illustrative of the shifting terrain on which infrastructural conflicts are being fought. Finally, the IRNT’s “ecocide” findings and its subsequent proliferation also illus-

¹⁰⁴ Cámara de Diputados, LXV Legislatura 2023.

trate how processes of international norm diffusion interact with and concretize in local struggles. While the concept of ecocide was discussed at a relatively high level and gained little traction among various social actors in Mexico before the Tribunal was held, the Tren Maya controversy gave abstract definitional debates a concrete meaning and catalyzed its development in a national context.

6. CONCLUSION

The Tren Maya case offers a revealing prism to examine the complex interplay between imagined futures, material realities, and legal processes in the context of controversial mega-projects in Latin America. Our analysis illuminates how these elements co-produce one another, shaping the development and contestation of large-scale infrastructures in ways that challenge conventional conceptions of progress, wellbeing, and environmental justice.

First and foremost, the Tren Maya vividly exemplifies the dynamic and contested nature of sociotechnical imaginaries. Initially conceived as an emblem of the “Fourth Transformation,” the project embodied a nationalist-developmental imaginary that promised not only economic progress and regional revitalization but also a profound transformation of social and economic relations in the Yucatán Peninsula. This utopian vision materialized in ambitious plans to construct 1,500 kilometers of railway, traversing five Mexican states and connecting major tourist hubs and archaeological sites. It was never a universally shared vision, however. From early on, local communities rejected and resisted the future projected by the Fourth Transformation. This opposition intensified after the government failed to involve local voices in the design and planning stages, its increasingly authoritarian handling of critique and judicial challenges, and its militarization tactics. As the project neared completion, the dispersed and diverse protest narratives gave way to

a powerful counter-imaginary that reframed the train as an “ecocidal” enterprise. As a result, this emergent understanding challenged the dominant vision while imbuing the Tren Maya with new signifiers of imposition, irreparable loss, and struggles that redefined its place in social and natural orders in a way that fundamentally altered the basis of its legitimacy.

The genesis and consolidation of this “ecocide” imaginary is particularly revealing of the co-production processes at play. Rather than emerging simply as a discursive reaction to governmental propaganda, it formed through close interaction with the project’s material realities and the social and legal mobilizations these engendered. The tangible impacts of the Tren Maya—from deforestation in protected areas to discovering archaeological sites during excavations—provided the empirical and symbolic substrate for articulating this counter-imaginary. For instance, the felling of millions of trees in the Mayan jungle, in direct contradiction to the government’s initial promises that “not a single tree would be felled,” became a powerful symbol of the ecological damage associated with the project. Similarly, the alteration of *cenotes* and underground water systems raised not only environmental concerns but also touched deep cultural chords, given the spiritual importance of these sites for Mayan communities. As such, the legitimacy of the “ecocide” imaginary was constructed through the interplay between scientific knowledge, community activism, and legal processes. Scientific and environmental groups provided technical evidence of the project’s ecological impacts, while Indigenous and local communities contributed first-hand testimonies about the threats posed to their territories and ways of life. This convergence of expert and local knowledge was crucial in shaping and lending credibility to the counter-imaginary.

Crucially, our study illuminates the central role of legal institutions and processes in this co-production dynamic. Courts, environmental impact assessments, and even alternative forums such as the IRNT emerged as crucial arenas where these imaginaries competed and were reconfigured. The se-

ries of amparos (constitutional challenges) filed against various aspects of the Tren Maya illustrates how the legal system became a battleground for these competing imaginaries. Each legal claim questioned technical or procedural aspects of the project while implicitly suggesting an underlying alternative vision that remained only partially articulated. For instance, the amparos alleging violations of Indigenous consultation rights sought to enforce a legal obligation and, simultaneously, affirmed an understanding of participatory governance and respect for Indigenous self-determination. The government's response to these legal challenges, including declaring the Tren Maya as a matter of "national security," reveals another crucial aspect of the co-production of imaginaries. This legal maneuver aimed to shield the project from judicial and public scrutiny and, in doing so, reinforced a particular understanding of national development in which infrastructure megaprojects are conceived as strategic imperatives, superseding environmental considerations or local rights. Thus, far from being a mere arbiter, the law revealed itself as an active site for the co-production of imagined sociotechnical futures.

The central role of legal institutions and processes in the co-production of sociotechnical imaginaries has thus far remained understudied in both conceptual and empirical terms. While previous research focused on the political and discursive contestations evolving around imaginaries, our analysis demonstrates how law and judicial institutions constitute an active sphere to articulate, legitimize, and transform imagined futures. In other words, these spaces assume their own dynamic, at least partially separate from, e.g., party politics or media discourse. The legal battles surrounding the Tren Maya were not mere reflections of pre-existing conflicts but active arenas for the co-production of competing imaginaries. Environmental impact assessment processes, Indigenous consultations, and constitutional litigation not only mediated between opposing visions but also provided the languages and frameworks through which these imaginaries took shape and gained or lost legitimacy.

One critical insight to underline is the pivotal role of marginalized actors, especially Indigenous communities, in using legal mechanisms to challenge dominant imaginaries. The Tren Maya case vividly demonstrates how these groups are not merely passive recipients of technical and political decisions but actors engaged in the co-production of alternative imaginaries. Their ability to navigate between different legal systems—national and international, formal and informal—and translate their worldviews into legal language reveals new dimensions of political agency in the era of mega-projects. For example, Mayan communities’ appeal to the IRNT was not primarily aimed at scoring a (symbolic) legal victory but at generating an institutional space to enact a possible socio-material reality grounded on Indigenous conceptions of the relationship between humanity and nature. This legal “forum shopping” act demonstrates how marginalized actors can creatively leverage pluralistic legal structures to give voice to their visions of the future.

Extrapolating to the current (geo)political context characterized by a revival of large-scale public infrastructure projects as a method of consolidating the legitimacy and power of the Nation-State, our study offers valuable insights into the interaction between development discourses, environmental concerns, and legal processes in the Global South. Although the Tren Maya controversy is specific to contemporary Mexico in many ways, it exemplifies the broader tensions inherent in pursuing economic growth in the context of growing environmental awareness and recognition of Indigenous rights. How these imperatives were mediated through legal and political processes offers important lessons for other contexts where similar megaprojects are underway.

Specifically, our case study illuminates the intersection between sociotechnical imaginaries and emerging notions of environmental law and justice. The articulation of the Tren Maya as an act of “ecocide” and a violation of “biocultural rights” was not merely a rhetorical strategy but an attempt to redefine the legal and ethical parameters within which

infrastructure projects are evaluated. This discursive move challenged the anthropocentric bases of conventional legal systems and aligns with ongoing eco-centric law reform efforts worldwide, from the growing recognition of the “rights of nature” to the criminalization of “ecocide.” As such, the Tren Maya shows how evolving international norms crystallize around and are concretized in specific locales and struggles.

The above analysis also provides important insights into how the legitimacy of megaprojects is negotiated in contexts of high biocultural diversity. The Tren Maya demonstrates that legitimacy is not simply derived from nominal compliance with legal procedures but involves a continuous and multi-scalar negotiation of meanings, values, and future visions. Doing so suggests the need to rethink infrastructure planning and governance processes to accommodate this complexity. As such, the Tren Maya raises fundamental questions about the nature of both technical and plebiscitary democracy in the Anthropocene era.

First, it reveals the limitations of traditional consultation and participation processes when dealing with large-scale projects with long-term and wide-ranging ecological impacts. The controversy surrounding the Indigenous consultation illustrates this issue: Although it formally complied with legal requirements, it was widely criticized for its superficiality and lack of adequate information. Second, the government’s widely publicized reliance on alleged majority support—mainly impersonal, detached, and distilled through surveys—for distant development visions and their abstract benefits shows how a thin understanding of plebiscitary democracy can be instrumentalized as a popular mandate to advance large-scale projects. In the case of the Tren Maya, this mandate was used to impose a dominant vision and justify overlooking the appreciations, desires, and rights of people and communities who will directly experience these transformations and their consequences. Finally, the emergence of alternative forums, such as the IRNT, hints at the potential for more creative and

fluid forms of citizen participation and public deliberation in shaping technological futures. These unorthodox institutional innovations offer ample opportunities to articulate and legitimize alternative imaginaries that may be excluded and marginalized in more conventional institutional spaces, potentially bridging the gap between abstract majoritarian support and technocratic rationale on the one hand, and experiential/situated knowledge on the other.

Ultimately, the Tren Maya invites us to fundamentally rethink how we conceive, plan, and execute infrastructure projects in a world of rapid sociotechnical and normative change. It challenges us to imagine new transformations that reconcile aspirations for greater collective welfare with environmental protection and respect for local worldviews and sensitivities. For policymakers and project planners, our study emphasizes the importance of adequately recognizing and incorporating the multiplicity of views from the initial stages of the project, seeing legal processes not as obstacles but as opportunities for dialogue and co-creation, and developing more flexible and adaptive mechanisms for infrastructure governance. The Tren Maya reminds us that megaprojects are not mere engineering exercises but profound interventions in complex socio-ecological systems. Navigating the stakes and tensions inherent in these projects requires a new paradigm of governance that is more inclusive, adaptable, and sensitive to the diversity of visions that shape our societies. Only then can we aspire to build infrastructures that are not only technically sound but also socially just and environmentally sustainable.

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