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ARTIGO

Applying grounded theory to the macro-level analysis of Brazil–China interaction in green value chains

Aplicando a teoria fundamentada em dados à análise em macroescala da interação Brasil–China nas cadeias de valor verdes

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Resumo

A expansão global dos veículos elétricos, liderada pela China, redefine cadeias produtivas e intensifica a relação econômica sino-brasileira. O objetivo do trabalho é examinar como os investimentos chineses nesse setor influenciam as políticas públicas e o vínculo bilateral. Metodologicamente, empregou-se análise qualitativa com teoria fundamentada e codificação em software especializado, aplicada a 41 documentos oficiais de alto nível, abrangendo o período de 2004 a 2025, entre planos, atas e memorandos da cooperação Brasil-China. Os resultados indicam que a matriz energética aparece fortemente articulada com mineração e infraestrutura, ao passo que a mobilidade elétrica figura de modo periférico e episódico. A sustentabilidade e a transição energética são tratadas de forma utilitária, mais como moldura discursiva para legitimar obras logísticas e acesso a minerais estratégicos do que como eixo organizador das ações. Verificou-se um predomínio de códigos ligados à exportação de matérias-primas e à dependência de insumos, sem contrapartida concreta em transferência tecnológica ou diversificação industrial. Considera-se, assim, que as iniciativas bilaterais, embora carreguem retórica verde, reforçam um padrão neoextrativista que mantém o Brasil em posição subalterna como fornecedor de recursos naturais, evidenciando que o discurso da sustentabilidade funciona como envoltório programático para a continuidade de dinâmicas extrativas e infraestruturais.

Palavras-chave: Neoextrativismo; Setor Elétrico; Mineração Brasil-China; Comércio Internacional; Medidas não tarifárias; Regulamentações Ambientais

Abstract

The global expansion of electric vehicles, led by China, redefines production chains and intensifies the Brazil-China economic relationship. The objective of this study is to examine how Chinese investments in this sector influence public policies and the bilateral bond. Methodologically, qualitative analysis with grounded theory and coding in specialized software was employed, applied to 41 high-level official documents covering the period from 2004 to 2025, including plans, minutes, and memoranda of Brazil-China cooperation. Results indicate that the energy matrix appears strongly linked to mining and infrastructure, while electric mobility figures in a peripheral and episodic manner. Sustainability and energy transition are treated in a utilitarian way, more as a discursive frame to legitimize logistics projects and access to strategic minerals than as the organizing axis of actions. A predominance of codes related to raw material exports and input dependence was found, without concrete counterpart in technology transfer or industrial diversification. It is thus considered that bilateral initiatives, although carrying green rhetoric, reinforce a neo-extractivist pattern that keeps Brazil in a subordinate position as

a supplier of natural resources, showing that the sustainability discourse functions as a programmatic envelope for the continuity of extractive and infrastructural dynamics.

Keywords: Neo-extractivism; Electric Power Sector; Brazil-China Mining; International Trade; Non-tariff Measures; Environmental Regulations.

1 INTRODUCTION

The development towards an ecologically more stable world constitutes an unavoidable reality of the 21st century (Irena, 2025). Among the central vectors of this transformation, the decarbonization of the transport sector has concentrated state efforts and investments particularly intensely, materializing in the accelerated replacement of fossil-fuel-powered vehicles by electric and hybrid propulsion alternatives. Data from the International Energy Agency (Iea, 2025a) reveal that, in 2024, global electric car sales exceeded 17 million units, accounting for more than 20% of new vehicles sold and recording growth of over 25% compared to the previous year. China, with 11 million units, accounted for nearly two-thirds of these sales, while the global electric fleet reached 58 million vehicles, sufficient to displace more than 1 million barrels of oil per day. Although growth stagnated in Europe and cooled in the United States, emerging markets expanded by about 40%, totaling 1.3 million units (Iea, 2025a). This trend is reinforced by the recent prominence of hybrid vehicles, which have consolidated as the best-selling electrified category globally (Nexo Jornal, 2026).

Within this logic, it is undeniable that there is an international and political movement behind such factors (Reuters, 2024). The political influence of different States in a globalized world presents itself as an important determinant for demonstrating explicit and implicit power relations (Sovacool; Brisbois, 2019). The modern State is a network of influence where diverse power networks intersect and interact, crystallizing in specific forms that differ from one another. Mann believes that the manner in which power is applied within a society can be, mainly taking into consideration the nature of a capitalist State, through infrastructure, which has the capacity to penetrate and naturalize the exercise of power within territories.

The tools of power through which the elite manages to exert its influence and maintain power within a State are mainly realized through legislative instruments, such as the constitution, or specific public policies. Mann argued that power is at once explicit and implicit (Mann, 1993; Sovacool; Brisbois, 2019). The implicitness of power is constitutional, which

serves as an "entrenchment", making the institutional barriers originally created by the elites something difficult to change. This ultimately happens due to the elite's capacity to infiltrate and colonize agendas and state infrastructure to ensure functioning equivalent to regional economic oligarchies (Mann, 1993; Sovacool; Brisbois, 2019). However, this does not prevent the State from being in a global network, and the subjectivities of power still exert considerable influencing factors. Oligarchies, even if regional, due to the very logic of the State, money, and power, still form part of the global capitalist dynamic (Hiratuka; Sarti, 2017; Sovacool; Brisbois, 2019).

In Brazil, it is no different. The Brazilian State specifically possessed a large oligarchy related to the maintenance of power by automotive companies and manufacturers. The reality of national development in the 1950s in Brazil forced the hand of the State (or the State was forced by the hand, which is still a debate), to develop a network of commercial logic intricately connected with vehicle producers based on developmentalist economic logic (Hiratuka; Sarti, 2017).

For a long time, these oligarchies (also understood here as industrial conglomerates) enjoyed the fruits of an integral relationship both with the State, evidenced by various economic subsidies, and with the Brazilian car culture itself, which is very strong and highly developed. However, as descriptively demonstrated by Mann (1993), local oligarchies found themselves in check when confronted with the relentlessness of global capitalist commercial logic. This happens specifically in Brazil with the large-scale advent of electric vehicle technology (Rocha; Silva, 2025; Irena; CPI, 2025; Sovacool; Brisbois, 2019).

Currently, China is inexorably one of the most important players specifically in the electric sector, and to this end we can present various pieces of information that corroborate this. In 2024, the country accounted for almost two-thirds of global electric vehicle sales, with more than 11 million units sold and growth of almost 40% compared to the previous year (IEA, 2025a). Moreover, since July of that year, monthly sales of electric vehicles surpassed those of conventional vehicles in the Chinese market, bringing the share of electrified vehicles close to 50% of total new cars. The geopolitical projection of this leadership also manifests itself in the massive presence of Chinese imports in emerging markets: over 85% of the electric vehicles sold in Brazil and Thailand in 2024 originated in China, whereas in Indonesia, imports of

Chinese electric vehicles increased 18-fold in the same period (IEA, 2025a). Added to this is the strategy of installing local factories by automakers such as BYD, Geely, and GWM in countries that progressively reintroduce import tariffs, evidencing an industrial diplomacy that expands Chinese influence over the global value chains of electric mobility.

China, as a major commercial partner of Brazil, has also undertaken considerable efforts to expand its specific technological capacity in the electric sector and its commercial capacity specifically for these products. More recently, in the year 2026, there was a formal announcement of an increase in the local production of Chinese electric batteries at the BYD manufacturing plant located in Bahia, within a project that is part of an investment expansion strategy amounting to 1.08 billion dollars, with the explicit aim of reducing taxes levied by the Brazilian government on the manufacturing of these products; concurrently, a large-scale infrastructure project valued at 98 million dollars was also publicly announced by BYD in order to increase the country's electric storage capacity and to provide the necessary electricity for the vehicles involved in this process (Reuters, 2026).

Another noteworthy point to be observed is that the BYD factory in Camaçari replaces, both in physical terms and in symbolic terms, the former Ford factory that once operated there and contributed to the mass employment of numerous local inhabitants. In 2024, sales of electric vehicles reached a total of 170 thousand units, which represented an 85% increase in comparison to the preceding year (Associated Press, 2025). In 2025, the growth rate was somewhat smaller, yet it remained higher than that recorded in 2024, with overall sales figures reaching 223,912 units (ABVE, 2026).

There is a completely ambiguous movement regarding the national electric automotive production chain. It is one of the sectors most sensitive to the entry of external “players”, with 80% of sales directly depending on the unique and exclusive relationship with China (Oliveira *et al*, 2025). This movement of investments (not necessarily only electric investments in the sector, but also Chinese investments in Brazil), has continued clearly since 2010, where there was a confluence between Chinese economic growth and a planning of foreign policy evolution aimed at accessing inputs essential to its economic development (Oliveira *et al*, 2025). But what is observed, parallelly and contrarily, is the lack of a national strategy since the beginning of

Lula III for the reindustrialization of the production chain, especially in these cases of electric vehicles (Oliveria *et al*, 2025).

Thus, the following work seeks to analyze and gain a better understanding of how these specific Chinese-Brazilian investments may have affected both the relationship and the development of national public policies. In order to achieve this established objective, the work makes use of a qualitative analysis approach, combined with grounded theory, documentary analysis, and semantic coding similarity, with the aid of the study software tool called Atlas.ti.

This paper presents findings derived from the application of Grounded Theory, supported by the qualitative data analysis software Atlas.ti, to the examination of agreements and negotiations that constitute Brazil–China economic interaction. More specifically, the thematic focus is on electric vehicles and green value chains within the context of policy incentives for the energy and ecological transition. The research question guiding this analysis is as follows: how does macro-level documentary evidence reveal the structuring logics of Brazil–China economic interaction in green value chains?

The documents analyzed were selected at the regulatory level defined as macro, in accordance with the three-level matrix (macro, meso, and micro) developed by Michelle Sanchez Badin and Fábio Morosini (2021). The materials included in this regulatory level cover the period from 2004 to 2025 and consist of international and normative instruments. The selected corpus comprises memoranda, joint action plans, and meeting minutes, particularly those related to COSBAN (Comissão Sino-Brasileira de Alto Nível de Concertação) and the China–Brazil High-Level Coordination and Cooperation Committee.

This study contributes to the literature in three ways: first, by empirically demonstrating the gap between green rhetoric and material outcomes in Brazil-China cooperation through systematic documentary analysis; second, by extending the neo-extractivist framework to the analysis of energy transition governance, demonstrating how green transition discourses can coexist with and even facilitate continued resource dependency; third, by methodologically innovating through the integration of AI-assisted selection with Grounded Theory in legal-policy analysis.

This article is organized as follows. The first section outlines the principles of Grounded Theory and the coding procedures. The second section presents the document survey and the

construction of the database, that is, the formation of the macro-level regulatory corpus. The final section presents the findings and discussion.

2 THEORETICAL FRAMEWORK

It is important to understand what specifically is the analytical coding logic used in the project. This defines in itself the findings and guides the qualitative analysis as a whole. To this end, it is pertinent to expand, explain, and clearly define how the research was conducted, in order to then discuss the clear analytical findings within the project.

The construction of the project is based on the broad tradition of content analysis. Originating from the 20th century, with studies of newspapers and advertising, mainly from the beginning of 1915, being formally systematized by Berelson and Lazarsfeld in the 1940s (Bardin, 2016 apud Menezes; Filho, 2022). Its classical formulation is defined as "a research technique whose purpose is the objective, systematic, and quantitative description of the manifest content of communication" (Bardin, 2016, p. 19). This legacy serves as a backdrop for the work carried out, since the research distanced itself from purely quantitative elements. The research, however, adopts a qualitative and interpretative epistemology, focusing on latent meanings, discursive constructions, and emerging patterns from the interaction between the text and the analytical capacity of the researcher (something that the group found necessary, given the theme of electric mobility, energy transition, and sustainability public policies).

Operationalizing this logic, the research integrates some analytical strategies in a complementary manner. Initially, Thematic Analysis (TA), specifically the one systematized by Braun and Clarke (2006), is used as a preliminary technique. TA is flexible and has a broadly structured set for analyzing and reporting patterns of meaning in qualitative data. TA was useful in determining and organizing the analytical corpus, in addition to the initial coding procedures, giving the analyst the capacity to map the recurrent thematic groupings related to electric mobility, energy transition, and geopolitical supply chains, without necessarily adopting a fixed theoretical framework for analysis.

Alongside this initial and important coding stage, Grounded Theory (GT), specifically the theoretical foundations defined and systematically analyzed by Strauss and Corbin (2008), was subsequently adopted. GT is in itself the dominant methodology owing to its considerable

potential to code without generating direct precedents, creating the capacity for coding directly from the data itself, simultaneously within an inductive and iterative analytical process. Deductive approaches typically test pre-existing theoretical hypotheses. This is not the case with GT, which effectively establishes a direct link between data collection, analysis, and theoretical formulation, consequently providing the researcher with raw data (or at least the closest possible approximation in a qualitative context), which in turn enables clear analytical explanations originating directly from the corpus and from the textual evidence present. More specifically, Strauss and Corbin (2008) understand that this particular stage of the research is particularly important because the object of study involves formal documents within the specific field of Law, in addition to the inclusion of jurisprudential texts (legislative texts, resolutions of regulatory agencies, and public policy guidelines and directives), thus demanding a systematic, transparent, and rigorously detailed tracking of the codes, which consequently serve to define the overall analytical rigor of the research.

GT is in itself a scientific act of abstraction. As Strauss (1969, apud Strauss & Corbin, 2008, p. 106) profoundly argues, “any object can be named and thus located in countless different ways”. The nature and the very essence of the object are not inexorably situated in the object itself, but rather in how it is concretely defined. Such a perception is also something that carries profound epistemological implications. Trying to abstract a given empirical phenomenon from its physical and situational reality is, paradoxically, difficult to accomplish, but it also brings researchers a significant gain in analytical power. Naming and defining something effectively transforms it into another concrete and contextualized thing in a way that makes it scientifically manipulable, thereby allowing the analyst to move from raw description to theoretical interpretation, which consequently allows the scientist to ask the analyzed phenomena themselves the question of why certain specific things occur (Strauss; Corbin, 2008).

Abstraction is possible in a clear and scientific manner based on conceptualization and operationalized through a specific 3-level coding process. The most fundamental is the first stage, also defined as open coding. Open coding is an initial reading stage, in which the deconstruction of the corpus and its definition occur simultaneously, transforming it into analyzable material (Strauss; Corbin, 2008). The idea is to approach the text with an inquisitive

mindset, breaking the data down into analytical units. For example, when analyzing a bill on tax incentives for electric vehicles, researchers might create codes such as “tax exemption”, “industrial location”, “importation”, “infrastructure”, etc. This stage allows for the grouping of similar phenomena under conceptual labels and for an in-depth familiarization with the analyzed themes. The coded segment constitutes a unit of meaning, which Bardin (2016, p. 132) calls the “recording unit”. The code, therefore, functions as the crucial epistemological bridge that connects the raw material upon which the analysis is carried out to the theoretical construction produced by the researcher, thus distinguishing qualitative coding from mere data reduction.

The next step is axial coding, which consists of understanding the emerging categories in an interdependent and complementary manner in order to deal with the totality of the analyzed phenomenon within its specific context (Strauss; Corbin, 2008). The analysis is carried out around a central category, an “analytical axis”, which seeks to associate it with other categories, defining their properties and dimensions. For example, if the object of study were “drug use by adolescents”, the open code could be “using drugs”, while the subcategories could include “heavy”, “recreational”, or “assisted”. Axial coding begins to allow contextual analysis, consequences associated with each type of coding, and contextualization. The transposition of this logic to the present research is that the central analytical axis would be the intersection of national industrial policy, international geopolitical constraints, macroeconomic strategies, and public policies. The subcategories of “fiscal incentives”, “supply chain dependencies”, and technological transfer agreements are systematically connected around this central axis, allowing the analyst to effectively reconstruct the complex webs of causality of international relations and international law.

The third stage would be selective coding, which involves the systematic refinement of categories around the central and unifying explanatory concept. At this stage, the researcher analyzes which central category has the greatest explanatory power and relates it to other categories, which ultimately generates a unified theoretical scheme, directly responding to the exploratory question of the article. The result is a grounded theory that describes and provides a deep understanding of the reality of international policy and public administration, explaining the dynamics of mobility and modern sustainability in contemporary Brazil and elucidating how

these processes integrate into the broader global geopolitical and economic context. It is important to emphasize that the theory generated here is not intended as a grand and universal theory, but rather as a substantive theory with high contextual relevance and practical applicability.

To ensure the adequate development of the project, it constantly went through successive stages of coding and recoding of the material. This movement of returning to the data is what makes Grounded Theory capable of identifying gaps, inconsistencies, and the necessary and continuous deepening for the proper abstraction of conceptualization. This creates a comparative logic, which serves as a quality control mechanism, while guiding the search for theoretical saturation, indicating when the theoretical framework has reached a stable and comprehensive explanatory state (Strauss; Corbin, 2008). The methodological choice is justified by its adequacy to the nature of the research design and to the very essence of the object of study.

The text also has a strong Latin American tradition, grounded primarily in the logic of dependency theory alongside the concepts of neo-extractivism (Gudynas, 2015; Acosta, 2013). Neo-extractivism, unlike the classical model, is based on resource extraction in an even more intense manner within the logic of liberal and progressive governments, often justified by discourses of sustainability (Svampa, 2019). Eventually, the text analyzes the context of Brazil-China relations within a neo-extractivist logic, reinforcing how these relations can be asymmetrical in nature. Svampa (2019) argues that this relationship occurs through three interconnected analytical logics.

Firstly, there is the commodification of nature, which occurs largely due to the high demand for natural resources arising essentially from the various technological advances that society and the market seem intent on pursuing. The result is the creation of sacrifice zones, areas where extreme environmental degradation and the loss of human lives are accepted as inevitable costs of progress. This implementation is frequently marked by deterritorialization and by the phenomenon of land grabbing. Next, there is territorial implementation, which follows a clear logic of re-signification of spaces, that is, a place that previously held specific value for a given ancestry comes to have a meaning grounded in the premises of the State and capitalist logic. Within this stage, it is discursively understood that the industrial and extractivist

logic is an inevitable "destiny" for the region, grounded in the developmentalist illusion that the abundance of natural resources will enable the rapid attainment of modernity and well-being. Both culminate in the discursive legitimation of extraction, whether through documents or discourses themselves. The work is situated within this logic, but it does not present arguments that corroborate those raised by Svampa. Rather, it presents arguments that show a legal framework close or similar to what is observed in the state relations described by Svampa (2019).

Webley (2010, p. 928) argues that empirical research in the field of law cannot be strictly confined to "normative exegesis and mere cataloging". It is fundamentally necessary to investigate the "law in action" by employing systematic procedures for the collection, coding, and subsequent interpretation of data. Fischer (2003, p. 42) argues that "the interpretative analysis of public policies specifically demands profound engagement with discourses, textual artifacts, and institutional narratives, so as to unveil the deeper meanings which are subjacent to normative choices". In this sense, the present work began with thematic analysis operations to map recurring themes, simultaneously recording analytical memos and initial codings; subsequently, the typical procedures of Grounded Theory were applied. The flexibility of thematic analysis ensured a robust identification of themes and analytical transparency, while the subsequent procedures of Grounded Theory ensured that the explanatory depth and coherence between the descriptive and interpretative levels were maintained, as advocated by the aforementioned authors for studies that specifically articulate law, public policy, and empirical evidence.

This methodological combination, aligned with the specialized literature on qualitative methods applied to law and public policies, confers substantive relevance upon the study for the comprehension of legal and political phenomena in their institutional and discursive concreteness. The coding process, the decision criteria for the inclusion and exclusion of categories, and the protocols for dealing with discursive nuances are documented in the research diary, ensuring the reliability and transferability of the methodological procedures. The specific operationalization of this framework, including the criteria and the selection process of the documentary corpus, is detailed in the following section.

3 METHODOLOGICAL PROCEDURES

For the historical period defined, 2004 to 2025 inclusive, a total of 117 files concerning the relationship between Brazil and China were identified. These documents are publicly available and were accessed either through official government websites or by means of formal requests filed under the Access to Information Law. The compilation of these files was organized in a digital online drive and also in physical form through printing and systematic cataloguing.

Following this initial survey, documents selected for detailed analysis were chosen with the support of artificial intelligence tools, specifically ChatGPT and NotebookLLM. Within ChatGPT, different approaches to formulating requests were tested in order to ensure that the system received sufficiently precise instructions to be useful for the selection task. The request applied to ChatGPT is reproduced in full below:

> I require that NotebookLLM select for me a set of texts which I will incorporate into its database. My research concerns documents related to Brazil and China, the documents are bilateral and macroeconomic in nature. I specifically need documents that address matters related to the energy transition. The object of the research is the value chains of electric vehicles, accordingly all documents that deal explicitly and directly with electric power as an alternative energy source are of primary interest. Additional topics that directly mention joint investment funds or mutual investment vehicles for energy sector infrastructure between the two countries are also relevant. The principal requirement is to ensure that the documents selected treat the topic directly, rather than mentioning energy in a generic or metaphorical manner. How should I formulate this request for NotebookLLM so that the system applies selective criteria, prioritizes direct relevance, and returns items that can be validated and incorporated into the macro database without extensive preliminary filtering?

In response to the request, ChatGPT provided the following:

> Select only bilateral documents between Brazil and China of a macroeconomic nature that deal directly with themes related to the energy transition. Include documents that address the value chains of electric vehicles, that mention electric power as an alternative energy source, or that describe mutual investment funds for energy sector infrastructure between the two countries. Exclude documents that refer only to generic cooperation without direct reference to energy or electric vehicles, as well as documents that are exclusively political or diplomatic in nature without economic or energy content. Return only the documents that satisfy these criteria. Do not limit the analysis to ten documents at a time. Return only a single final list containing the documents that meet the criteria, without displaying the full content.

Considering ChatGPT and a first reading of the documents from the initial survey, NotebookLLM was used. However, the expected results from NotebookLLM were unsatisfactory, insofar as documents regarded as essential were not being selected by the AI as important for the analysis. For example, the Chinese five year planning documents (Five Year Plans) were not categorized as important by NotebookLLM[1].

The hypothesis raised to explain the NotebookLLM error was that the request developed with ChatGPT was not adequate. The tests were repeated in ChatGPT, resulting in a new request, whose application produced satisfactory results. The text of the request applied in the research is as follows:

> Instrução curta — SELECIONE SOMENTE documentos de ALTA RELEVÂNCIA para "transição energética" e cadeias produtivas de veículos elétricos (analise TODOS os ficheiros da base):
> Definição ALTA RELEVÂNCIA (incluir só se uma das condições for cumprida):
> - Trata DIRETAMENTE de cadeias produtivas de VE (baterias, lítio, terras-raras, plantas de montagem, fornecedores-chave, sistemas de controle).
> - Trata DIRETAMENTE de infraestrutura elétrica com implicação operacional/financeira (HVDC, transmissão, smart grids, armazenamento) e refere projetos/políticas/contratos.
> - Descreve FUNDOS / mecanismos de cofinanciamento / compromissos financeiros direcionados a infraestrutura energética Brasil–China (ex.: Fundo Brasil-China, acordos BNDES/NDB, Banco Popular da China).
> - É um PLANO ESTRATÉGICO NACIONAL (ex.: Five-Year Plan, Plano Decenal) que define metas/políticas explícitas que impactam produção, investimento ou exportação/cooperação em VE/infraestrutura elétrica.
> Exclusão: não retorne documentos de relevância média/baixa (menções retóricas ou protocolares sem conteúdo acionável).
> Saída exigida (CSV-like Markdown, ordenada por date desc):
> columns = filename, date(YYYY-MM-DD or YYYY), document_type(bilateral/unilateral_plan/multilateral/financial/relatório/outro), topics_matched (lista), relevance(=High), justification(1 frase), confidence(0-100).
> Também retorne, separadamente, até 10 arquivos **ambíguos** (flagged) com requires_review=yes e 1 linha justificando a ambiguidade — mas **não** inclua esses ambíguos na tabela principal.

[1] China's Five Year Plans are central instruments of state planning that define economic, technological, social, and environmental priorities in five year cycles, functioning as strategic guides to orient the action of the Communist Party, the central government, and local governments. Unlike the rigid plans of classical socialist economies, contemporary Chinese plans operate as mechanisms of macrostructural coordination that combine indicative targets, industrial guidelines, innovation policies, and regional development objectives, influencing decisions on public investment, state financing, sectoral regulation, and incentives for the private sector. They were important as a whole to the economic strategy of the Chinese government, but they were not considered as part of the macro analytical level. Instead, they are being considered as important for the meso analytical level. Nonetheless, it was necessary for the AI to flag these documents as important for the analysis as a whole.

No topo da resposta informe: total_processed, total_selected_high, total_flagged_ambiguous
Use keywords para matching: ["veículo elétrico","bateria","lítio","terras-raras","HVDC","transmissão","smart grid","armazenamento","hidrogênio","bioenergia","biocombustível","SAF","energia nuclear","Fundo Brasil-China","financiamento","Five-Year Plan","COSBAN"].[23]

This request was applied in NotebookLLM, assisting in narrowing the initial survey database to 41 documents. After a new reading and confirmation of each document's importance for the analysis, the documents were renamed and attached to the qualitative analysis software Atlas.ti. This is Computer Assisted Qualitative Data Analysis Software (CAQDAS) that facilitates the process of applying the Grounded Theory methodology, which is explained below.

The application of Grounded Theory to the 41 documents selected with the assistance of Artificial Intelligences allowed the identification of indications of how the Sino-Brazilian relationship has been developing in the defined historical period. 250 unique codes were produced in Atlas.ti, whose understanding depends on knowledge of two preliminary concepts:

[2] When this prompt was applied, results similar to the following were received: "2004-05-24_memorandum of understanding on cooperation.pdf 2004-05-24 bilateral bioenergy, infrastructure, energy, High, Establishes cooperation in areas of trade, transport infrastructure and energy, and mutual investments. 85"

[3] The prompt originally written in Portuguese may be translated into English as follows. We did not conduct prompt tests in the English version, it should only be considered to illustrate the methodological development of the study: "Short instruction, SELECT ONLY documents of HIGH RELEVANCE for energy transition and electric vehicle value chains, analyze ALL files in the database. Definition of HIGH RELEVANCE, include only if one of the conditions is met. Directly addresses EV value chains, batteries, lithium, rare earths, assembly plants, key suppliers, control systems.Directly addresses electrical infrastructure with operational or financial implications, HVDC, transmission, smart grids, storage, and refers to projects, policies, or contracts.
Describes FUNDS, co-financing mechanisms, or financial commitments directed to Brazil China energy infrastructure, for example Brazil China Fund, BNDES or NDB agreements, People's Bank of China. Is a NATIONAL STRATEGIC PLAN, for example Five Year Plan, Decennial Plan, that defines explicit targets or policies impacting production, investment, or export or cooperation in EV or electrical infrastructure.
Exclusion, do not return documents of medium or low relevance, rhetorical or protocol mentions without actionable content. Required output, CSV like Markdown, ordered by date desc. columns equals filename, date in the format YYYY MM DD or YYYY, document_type bilateral, unilateral_plan, multilateral, financial, report, other, topics_matched list, relevance equals High, justification one sentence, confidence from 0 to 100. Also return separately up to ten ambiguous files, flagged, with requires_review equals yes and one line justifying the ambiguity, but do not include these ambiguous files in the main table. At the top of the response report total_processed, total_selected_high, total_flagged_ambiguous. Use keywords for matching, vehicle electric, battery, lithium, rare earths, HVDC, transmission, smart grid, storage, hydrogen, bioenergy, biofuel, SAF, nuclear energy, Brazil China Fund, financing, Five Year Plan, COSBAN."

a) **Groundedness** indicates how many times the codes were used in the database, that is, the frequency;
b) **Density** indicates how many times the code was used together with other codes in the same segment of a document, which helps in understanding the nature of the interconnection between codes and, consequently, between concepts.[4]

The codes with the highest groundedness were: Cooperation (71), Context (70), Energy (39), Infrastructure (39), Mining (37), Sustainable Development (30), Sustainability (30), Cooperation in the Areas of Energy and Mining (23), Oil (22), Renewable Energy (19).

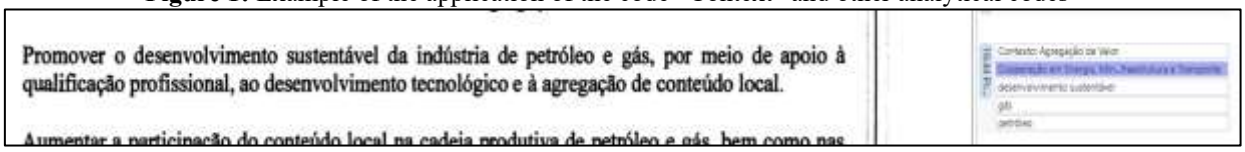
The codes with the highest density were: Sustainability (23), Cooperation (20), Bilateral Cooperation (12), Solar Energy (12), Biotechnology (10), Cooperation in Science, Technology and Information (10), Biofuel (10), Electric Energy (8), Wind Energy (8), Renewable Energy (8).

By interpretation, it is understood that the nature of the documents is cooperation according to the code "Cooperation" as the code of greatest groundedness. Given the different forms of carrying out cooperative activities, this code allows subdivisions or subcodes to be created. The subdivisions of the code "Cooperation" were made either by actor or by the theme of the cooperation: Commission for the Coordination of Space Technology Cooperation Projects, agricultural cooperation, bilateral cooperation, commercial cooperation, economic cooperation, Cooperation in Science, Technology and Innovation, Cooperation in Energy, Mining, Infrastructure and Transport, Cooperation on Economic and Commercial Matters, Cooperation on Financial Matters, financial cooperation, international cooperation, multilateral cooperation, Cooperation in the Area of Agriculture, Cooperation in the areas of Energy and Mining, cross border cooperation, Brazil-China Cooperation Fund for the Expansion of Productive Capacity, Investment and Industrial and Financial Cooperation, Cooperation Plan, Protocol on Cooperation in Energy and Mining.

[4] The concepts of groundedness and density used in this study follow the definitions provided in the ATLAS.ti user manual. According to the manual, groundedness refers to the number of quotations linked to a code, while density indicates the number of connections a code has with other codes within the analytical network. See: ATLAS.ti. *ATLAS.ti 23 Windows User Manual – Code Manager*. Available at: https://manuals.atlasti.com/Win/en/manual/Managers/ManagerForCodes.html. Accessed on: 23 Feb. 2026.

The second code of greatest groundedness is “Context” which complements the analysis, insofar as it assists the identification of the specific contexts in which certain codes were used. The practical application of this complement is explained from Figure 1:

Figure 1: Example of the application of the code “Context” and other analytical codes



Source: Image derived from the database analyzed in the Atlas.ti software, in 2025

Table 1: Example of the application of the code "Context" and other analytical codes (author’s translation)

Text	Coding
Promover o desenvolvimento sustentável da indústria de petróleo e gás, por meio de apoio à qualificação profissional, ao desenvolvimento tecnológico e à agregação de conteúdo local.	Contexto: Agregação de valor; Cooperação em Energia, Mineração, Infraestrutura e Transporte, Desenvolvimento Sustentável, Petróleo, Gás
Promote the sustainable development of the oil and gas industry through support for professional qualification, technological development, and the aggregation of local content	Context: Value Aggregation, Cooperation in Energy, Mining, Infrastructure and Transport, Sustainable Development, Gas, Oil.

From this example, it is observed that the codes “oil”, “gas”, and “sustainable development” were used in a context of value aggregation, in an area of cooperation oriented toward infrastructure and transport. In this way, the construction of analytical inferences becomes efficient and intrinsically linked to the data presented in the documents.

4 EMPIRICAL ANALYSIS

When the codes of highest density are analyzed, in turn, new relationships are identified. The image below with Figure 2 of co occurrence is observed:

Figure 2: Co-ocorrence

	automotiva Gr=5	Automóvel Gr=3	cooperação Gr=71	Cooperação em Energia, Mineração, Infraestrutura e Transporte Gr=12	desenvolvimento sustentável Gr=30	energia Gr=39	energia limpa Gr=6	Energia Renovável Gr=19	infraestrutura Gr=39	mineração Gr=37	mobilidade urbana Gr=2	petróleo Gr=22	Sustentabilidade Gr=30	Veículo Elétrico Gr=2
automotiva Gr=5	0	0	2	0	0	4	0	1	0	2	0	0	0	1
Automóvel Gr=3	0	0	0	0	0	0	0	1	0	0	0	1	2	0
cooperação Gr=71	2	0	0	5	7	10	3	4	14	10	1	4	6	0
Cooperação em Energia, Mineração, Infraestrutura e Transporte Gr=12	0	0	5	0	1	1	0	1	0	2	0	5	0	0
desenvolvimento sustentável Gr=30	0	0	7	1	0	0	0	0	4	2	0	2	3	0
energia Gr=39	4	0	10	1	0	0	0	2	7	23	0	0	2	0
energia limpa Gr=6	0	0	3	0	0	0	0	1	3	0	2	0	1	0
Energia Renovável Gr=19	1	1	4	1	0	2	1	0	1	3	0	2	4	0
infraestrutura Gr=39	0	0	14	0	4	7	3	1	0	8	2	0	4	0
mineração Gr=37	2	0	10	2	2	23	0	3	8	0	0	4	1	0
mobilidade urbana Gr=2	0	0	1	0	0	0	2	0	2	0	0	0	1	0
petróleo Gr=22	0	1	4	5	2	0	0	2	0	4	0	0	1	0
Sustentabilidade Gr=30	0	2	6	0	3	2	1	4	4	1	1	1	0	0
Veículo Elétrico Gr=2	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Image derived from the database analyzed in the Atlas.ti software, in 2025
Note: The table should be read as follows, the numbering indicates how many times the two selected codes were found in the same passage or segment of the analyzed document.

In Figure 2, it is observed that the codes related to mobility, such as electric vehicle, urban mobility, and automobile, display low co-occurrence with the major institutional nodes. Due to this low co-occurrence, it is inferred that there is only a marginal presence of the operationalization of electric vehicles in the documents of economic interaction between Brazil and China. The code “electric vehicle” tends to appear in an episodic manner and often as a conclusion in the final passages of the analyzed documents, not appearing as a densely developed topic. Another inference that can be identified is that, although technically relevant terms appear, they are not articulated in a consistent way with the central institutional structures identified, which limits their incorporation into the policy fronts and governance arrangements documented.

The co-occurrence between the codes energy and mining, identified in twenty-three co-occurrences, indicates that discussions on energy are frequently related to issues of mineral

extraction and or access to inputs such as lithium and other minerals. It is inferred from this co-occurrence that, in the bilateral relationship between Brazil and China, minerals acquire a preponderant role in energy production. This alignment, in turn, is also related to the energy transition, insofar as the transition does not present itself as a purely technological or regulatory process, but as a process dependent on these materials.

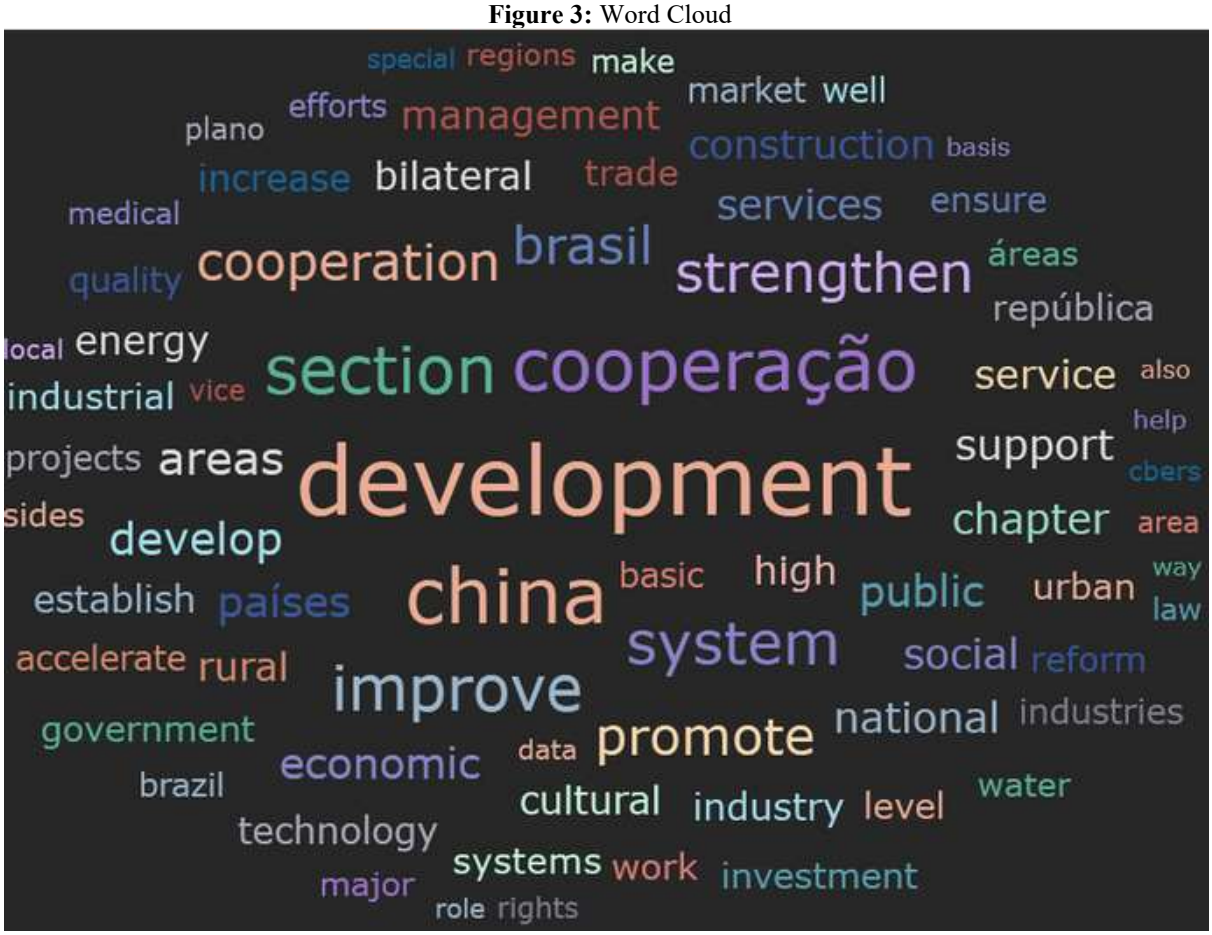
Infrastructure emerges in this context as a central link, the co-occurrence of infrastructure with mining and cooperation describes the principal pathway through which the channel of mineral exploitation is operationalized in the Sino-Brazilian bilateral relationship. This process signals that infrastructural investments and projects constitute a privileged mechanism of articulation between extraction and cooperative initiatives.

The co-occurrence of these codes points to a gap between, on the one hand, the rhetoric of innovation in mobility, which could be expressed through electric vehicles, and on the other hand, the emphasis on cooperation for the extraction and access to minerals, and infrastructure necessary for green technologies such as electric vehicles themselves. Sustainability, in turn, is concentrated predominantly on resource extraction and its derivations. It is suggested that sustainability is not treated as an autonomous field of political, technical, or technological action, but as a way of articulating supply chains, logistics, and physical works in order to make resource exploitation possible.

Specific codes such as “wind energy”, “biofuel”, and “renewable energy” normally appear associated in a way that contextual and or cooperation devices do not advance toward technical or institutional specificities. This expository form of the text indicates a possible analytical and practical gap, there are no discursive or procedural mentions of implementation priorities, no more evident mention of public policies, or of financing mechanisms.

Another way to analyze the documents is through the term cloud or word cloud, whose use is possible through Atlas.ti. When this feature is applied, the central axis of the documents is marked by the term development, cooperation, and China, which signals the explicit articulation between development agendas, mechanisms of international cooperation, and the presence of a specific state actor as a structuring element of the discourse.

Figure 3: Word Cloud



Source: Image derived from the database analyzed in the Atlas.ti software, in 2025

It is inferred that the centrality of these terms together with the coding indicates that the role of China in the Sino-Brazilian bilateral relationship is strong. There is also a recurrence of action verbs, for example improve, promote, and strengthen, which reveal a discursive register oriented toward objectives, targets, and instruments in documents that could otherwise be considered merely programmatic or of cooperative rhetoric.

In addition, the consistent presence of institutional terms such as “system”, “government”, “public”, and investment reinforces that the material operates predominantly within a state and administrative register, with emphasis on structures, capacities, and financing flows. Thus, due to the existence of this verbal morphology, it is understood that the analyzed

documents follow a teleological logic, directed toward the formulation of measures and the legitimation of interventions.

5 FINAL THOUGHTS AND DISCUSSION

The analysis of the documents of the Brazil-China relationship, at the macro regulatory level, reveals a consistent emphasis on an energy matrix increasingly articulated with mining and infrastructure. The theme of the energy transition and public policies of sustainability appear in the analysis, but they are not presented as the central axis in relation to which the activities of cooperation implementation are organized.

The analytical findings obtained in this study show a clear pragmatic confluence with the findings previously presented by Santos and Milanez (2014), who specifically analyze the Brazilian international relationship as being based upon a strong and persistent logic of neo-extractivism, a logic which is fundamentally grounded in the systematic appropriation of natural resources and which simultaneously continues a clear and structural logic of subordination to other economically stronger countries, when considered from a thoroughly international point of view. Economic growth, in this particular formulation, is accordingly prioritized to the direct detriment of a significant variation in the national productive chain and its associated network, focusing instead almost exclusively on the export of primary goods to foreign markets. This particular dynamic was not initially one of the possible hypotheses that had been considered at the very beginning of the coding project, but it nevertheless became entirely clear and evidently prominent during the subsequent process of systematic analysis. Thus, a process which, according to the textual evidence, had apparently already been an established reality since the year 2014, ultimately continued to remain the prevailing truth up to the present day, specifically during the ongoing administration of Lula III. This holds true, at least partially, according to what the available macroeconomic texts consistently indicate.

The Brazilian State continues to play a role that enhances logistical infrastructure, which ensures the outflow of production to the foreign market (Santos; Milanez, 2014). Logistics acts to eliminate possible bottlenecks in transportation, increasing Brazilian competitiveness *vis-à-vis* other markets and ensuring that its raw materials are used in the overall international development and economic power of China. In a macroeconomic context, the effect that Brazil

undergoes in the specific matter of macroeconomic legislations can be explained by the high Chinese demand, which structurally ensured a Brazilian specialization in creating products of low technological complexity. China begins to act as a catalyst for resources, reaffirming the logic of international dependency. Although some documents guarantee technological export and cooperation, both scientific and energetic, what is seen in practice in the analyzed documents, extensively presented by the codes shown throughout the entire historical period, is the primary permanence of a subordinate position of Brazil *vis-à-vis* the international Chinese economic advance.

The issue of energy sustainability arises within the Brazilian regulatory framework as a peripheral utilitarian discourse. The concept of "sustainable development" appears in legal frameworks such as the new Mining Code, but its application is limited to ensuring environmental licensing and mineral supply for the future. Within this logic, it is assumed that environmental impact is an accomplished fact in the name of economic development (Santos; Milanez, 2014). The fruit of these proceeds is what Santos and Milanez (2014) call a "Compensatory State", a concept which holds that the proceeds are used directly to guarantee political legitimacy by being reinvested in social logics and political maintenance programs rather than being implemented in programs that seek to overcome the extractivist logic.

In addition to this, Klinger (2017) observes that diplomatic declarations regarding technological cooperation do not directly translate into any effective transfer of knowledge to Brazil. What occurs instead, however, is that China finances and secures its access to natural resources (such as niobium), while Brazil simultaneously assumes the socio-environmental costs of extraction and consequently remains permanently dependent upon the export of unprocessed raw minerals or semi-processed products. Within this specific arrangement, sustainability operates symbolically by effectively cloaking the old colonial logic of raw material supply with a mere appearance of climate modernity (Klinger, 2017).

When it comes to sovereignty as well, Klinger (2017) observes a trend. Sovereignty becomes something used to defend the national interests of the elite, which would be, in essence, the defense of economic power. This means the constant outflow of resources to other countries. Within this context, the rhetoric of sustainability is also used as a "staging", employed as the minimum necessary to destroy life in exchange for economic development. By

prioritizing concessions to large transnational corporations and subjecting its internal security agenda to global geopolitical anxieties, Brazil renounces the construction of an autonomous local economy, consolidating itself as a strategic vulnerability that needs to be permanently "policed" in order to satisfy external demands (Klinger, 2017).

Complementarily, Mann's (1993) analysis of infrastructural power helps to illuminate the direction this process took in Brazil. Such power, which in theory could be mobilized to diversify the economy, was progressively captured by the elites who survived the decline of entire industrial sectors. Hiratuka (2017), for example, documents how the national automotive industry was "overtaken" by Chinese competitiveness, losing ground in global value chains. What remained of the economic elites, faced with this scenario, found in the neo-extractivist model a way to preserve their relevance and their rents, redirecting the State's infrastructural power to ensure the outflow of raw materials.

The logistical and normative apparatus that Mann (1993) describes as a potential instrument for internal development thus becomes the material support for a subaltern international insertion. One clearly observes a general trajectory in which Brazil, despite normatively inserting concern for sustainability into its very official documents, had its concrete commitments effectively organized around specific codes fundamentally linked to neo-extractivist logics. This ultimately indicates overall that the Brazilian macroeconomic movement indeed fits effectively into a distinctly particular neo-extractivist analytical key, which, in turn, closely dialogues with the critical studies of International Relations and of Law and Development.

These findings raise an analytical question, how do these bilateral initiatives related to the promotion of the energy transition and sustainability actually fulfill these purposes if, in the drafting of these commitments, there is a concentration on infrastructure related to the extraction of and access to minerals. This tension between the rhetoric of transition and the prioritization of infrastructural instruments suggests that sustainability is frequently incorporated into the discourse as a programmatic envelop.

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