Governance in Structuring the Electric Taxi Pilot in Bogota

Gobernanza en la estructuración del proyecto piloto de taxis eléctricos en Bogotá

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Abstract

The global discourse on environmental preservation and the urgent need to develop fair, equitable, and sustainable development models has gained significant momentum. Within this context, the transportation sector is increasingly recognized as a focus for initiatives aimed at mitigating the adverse impacts associated with fossil fuel use, including the adoption of electromobility. Colombia has demonstrated a political commitment to the electrification of public transportation, which has facilitated the development of pilot projects involving electric buses, taxis, and trucks. These initiatives have unveiled various challenges in financial, regulatory, and

technical spheres, all of which have been effectively addressed through governance during the structuring and implementation phases. This governance has proven crucial in yielding positive public policy outcomes, bringing together diverse stakeholders, and advancing electromobility across different segments of urban transportation in the nation. A review of relevant literature supports this argument and underscores the importance of tailoring approaches to specific territorial contexts. A notable example is Bogota, which successfully implemented an innovative pilot project for electric taxis, where governance was applied informally yet effectively to ensure the successful structuring and execution of the initiative. This experience underscores the pivotal role of governance in the widespread adoption of electromobility across the country.

Keywords
governance, transition, pilot, electric taxi, experience, Bogota

Resumen

El debate mundial sobre la preservación del medio ambiente y la necesidad urgente de diseñar modelos de desarrollo justos, equitativos y sostenibles ha cobrado un impulso significativo. En este contexto, el sector transporte es cada vez más reconocido como un ámbito clave para las iniciativas destinadas a mitigar los efectos negativos asociados al uso de combustibles fósiles, incluida la promoción de la electromovilidad. Colombia ha demostrado un compromiso político con la electrificación del transporte público, lo que ha facilitado el desarrollo de proyectos piloto con buses, taxis y camiones eléctricos. Estas iniciativas han puesto de manifiesto múltiples desafíos en los ámbitos financiero, regulatorio y técnico, todos los cuales han sido abordados de manera efectiva mediante la gobernanza durante las fases de estructuración e implementación. Esta gobernanza ha resultado decisiva para obtener resultados positivos en materia de política pública, articular a las diversas partes interesadas y promover la electromovilidad en diferentes segmentos del transporte urbano del país. Una revisión de la bibliografía relevante respalda este argumento y subraya la importancia de adaptar los enfoques a los contextos territoriales específicos. Un ejemplo notable es el de Bogotá, que implementó con éxito un proyecto piloto innovador de taxis eléctricos, en el cual la gobernanza —aunque aplicada de manera informal— resultó fundamental para la adecuada estructuración e implementación de la iniciativa. Esta experiencia resalta el papel crucial de la gobernanza en la adopción generalizada de la electromovilidad en todo el país.

Palabras clave:
gobernanza, transición, piloto, taxi eléctrico, experiencia, Bogotá.

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Introduction

Climate change, poor air quality, environmental damage to urban ecosystems, and the growing socioeconomic costs that these imbalances cause in the territories are just some of the facts that point to the urgent need for a sustainable transportation supply. In this line, electromobility re-emerges at the end of the twentieth century as a technological alternative that can be implemented on a global scale to replace internal combustion vehicle technologies, recognizing its benefits, not only in terms of energy, reliability, and reduction of polluting emissions, but also for its impact on equity, health, and user comfort. Electrifying public transportation is technologically feasible, but it requires a political framework, financial resources, and incentives that enhance its competitiveness in each specific context [1].

In the Colombian context, the unsustainability of the transportation sector is evident from energy, environmental, social, and economic perspectives. By 2024, the transportation sector was the segment with the highest energy consumption in the country, accounting for 42% of the demand [2]. This energy consumption serves about 19.86 million vehicle units, of which about 12.33 million are motorcycles [3]. In this scenario, the need to transition towards electromobility in public transportation becomes imperative, given the benefits of electric technologies during their service life.

A study conducted by DNP [4] estimated the health costs associated with environmental degradation in Colombia at approximately COP 20.7 billion (2.6% of the 2015 GDP). The study highlighted that urban air pollution was responsible for the most significant portion, at 75%. Along these lines, air pollution is the primary environmental risk to which Bogota's inhabitants are exposed and is responsible for several cases of hospitalization and premature deaths [5], [6].

Thus, migration towards cleaner technologies such as electromobility represents a "transition" that requires time and consistency of actions undertaken by different public administrations. The initiative must break the rules in a market consolidated around fossil fuels and internal combustion technologies, break paradigms, and grow in an environment of opposition, uncertainty, and distrust among the stakeholders involved.

By 2025, electromobility can be considered a rapidly maturing technology. Although an initiative is framed in Colombian Law for promoting urban and regional public transportation, evidence indicates that the technology has not achieved massification, is concentrated in Bogota, and its introduction in other cities is limited or nonexistent. Multiple challenges emerge, but in the territories, they may be differentiated in terms of geographic, institutional, operational, and capacity factors, as well as the relationships among stakeholders, infrastructure conditions, and other particular connotations.

As indicated, a "sociotechnical transition" is a change that involves a long-term process and involves multiple stakeholders. As recognized by Marsden et al. [7], while it has been recognized that institutions are important in transportation policy, so are the dynamics of formal and informal influence governance, the coordination capacity between public and private,

and the reasons why certain stakeholders dominate a system, including monetary arguments, experience, information, and legal authority.

In this context, the formalization of governance could facilitate the consolidation and massification of electric technology in urban/regional public passenger transportation in Colombia, making it possible to meet the goals previously established in national policies on the subject. Jaimurzina [8] has evidenced that in recent years, more attention has been devoted to governance in various transportation issues and projects.

In Bogota, the electric taxi pilot, the first of its kind in Latin America, and the electric bus pilots were projects where multiple stakeholders at different levels participated and aligned their interests to mitigate risks and facilitate implementation. The district government led the process, with the strong support of the local energy company, Codensa (currently ENEL), and international cooperation institutions. In these processes, a successful informal governance was demonstrated, which today positions Bogota as a regional leader in transportation electrification, offering a promising model for the future of electromobility in Colombia.

Methodology

This work developed a literature review that evidenced the use of governance as a facilitating instrument in the process of transitioning transportation towards electromobility. For this purpose, the SCOPUS database of the Universidad de La Salle and the Vosviewer tool, an open-source software that allows the construction and visualization of bibliometric information, were used to visualize the bibliometric network [9]. Subsequently, a conceptualization of the term governance was developed using theoretical references that enable linking this concept to the energy transition of urban transportation. Finally, the case of the structuring of the electric taxi pilot in Bogota was presented, highlighting the technological challenges and the role of governance in the process of materializing the project.

Results

Electromobility as a technology is not new, highlighting the presence and evolution of the technology in public transportation. However, the rise of electric mobility, with batteries as an alternative to fossil fuels, and the improvement of environmental conditions in urban and regional contexts took a significant boost by the end of the twentieth century. The technological growth is evidenced by the reported sales of nearly 14 million vehicles with electric or rechargeable hybrid technology, which accounts for 18 % of total vehicle sales worldwide by 2023. This report evidenced a 35% growth in global sales and a world fleet of close to 40 million units [10], indicating a significant global shift towards electromobility.

A boom in publications has accompanied the growth of the electromobility market. In the present research, we utilize the SCOPUS database, accessible on the library platform of the Universidad de La Salle, for the review period of 2020–2024. The purpose of limiting the search to a specific time frame was to identify updated studies in line with technological development, recognizing that battery electric buses in public transportation began to be incorporated into the market at the end of the twentieth century.

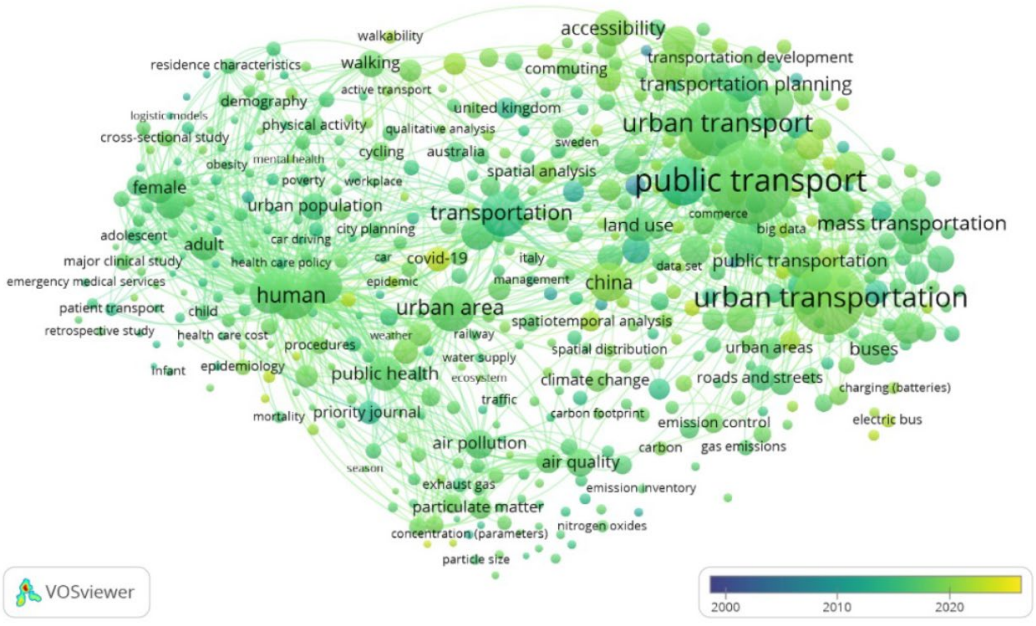
English keywords associated with the study topics were used as search terms in the databases, which yielded the results shown in Table 1. The results were organized into seven reviews, starting from the general (electric vehicles) to the more specific (governance around electric public transportation).

Table 1. Search Results on the SCOPUS Platform

	Keywords	Results
Review 1	Electric vehicle	197,392
Review 2	Battery electric vehicle	74,133
Review 3	Urban public transportation	19,167
Review 4	Electric urban public transportation	1,313
Review 5	Governance public transportation	1,203

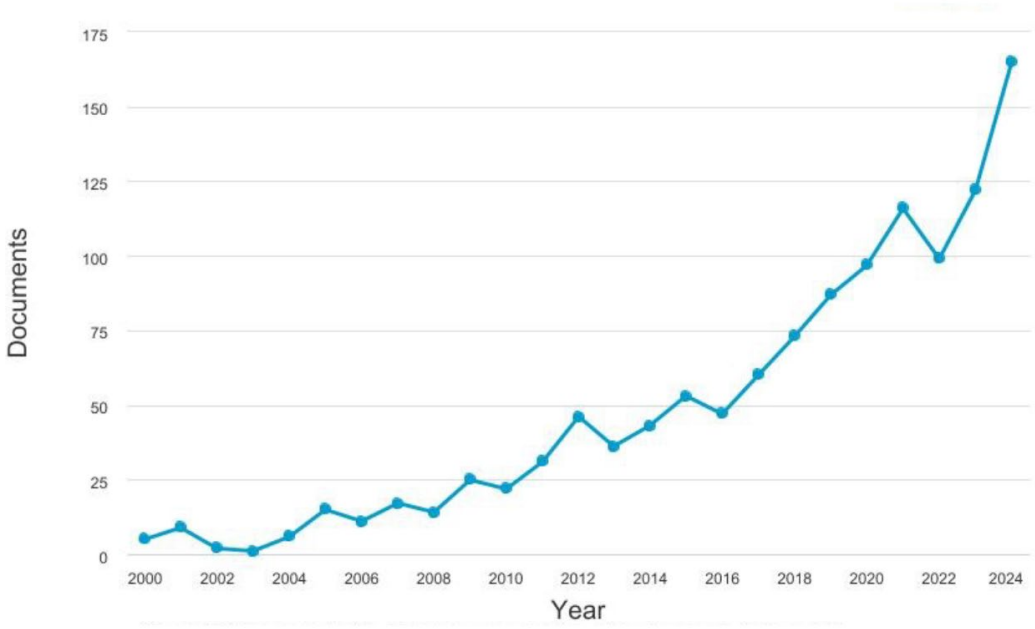
Regarding the combination "urban public transportation," 19,167 documents were found in the SCOPUS database. The evolution in the number of documents identified on the topic of urban public transportation is remarkable between 2012 and 2024. This search enabled the identification of a diverse range of publications, covering aspects related to users, structuring and operation, policies, technologies, accessibility, and relationships with other sectors, including urban development, environment, and energy. Figure 1 shows the map of concurrences generated by the VOSviewer tool, derived from Review 3, with a minimum of five keywords per article and up to 500 recurrent words. The clusters with the highest relevance are shown on the right of the figure, concentrating on topics that could be called "hard." On the other hand, clusters involving social, urban, and environmental issues are relevant in the mapping, showing a greater dispersion and interconnection among them.

Figure 1. Map of Concurrences in VOSviewer for "Urban Public Transportation."



The combination of the words "governance public transportation" reported 1,234 documents in the SCOPUS database. The evolution in the number of documents regarding the subject is remarkable from 2016 onwards, as shown in Figure 2. The bibliometric analysis of Review 5 enabled the recognition of the relationship between the concept of governance and environmental and social aspects related to public transportation. Figure 3 identifies other relevant clusters from this review, including smart cities, mobility, urban development, and aspects related to citizens.

Figure 2. Cumulative Publications 2000-2024, Review 5 [11]

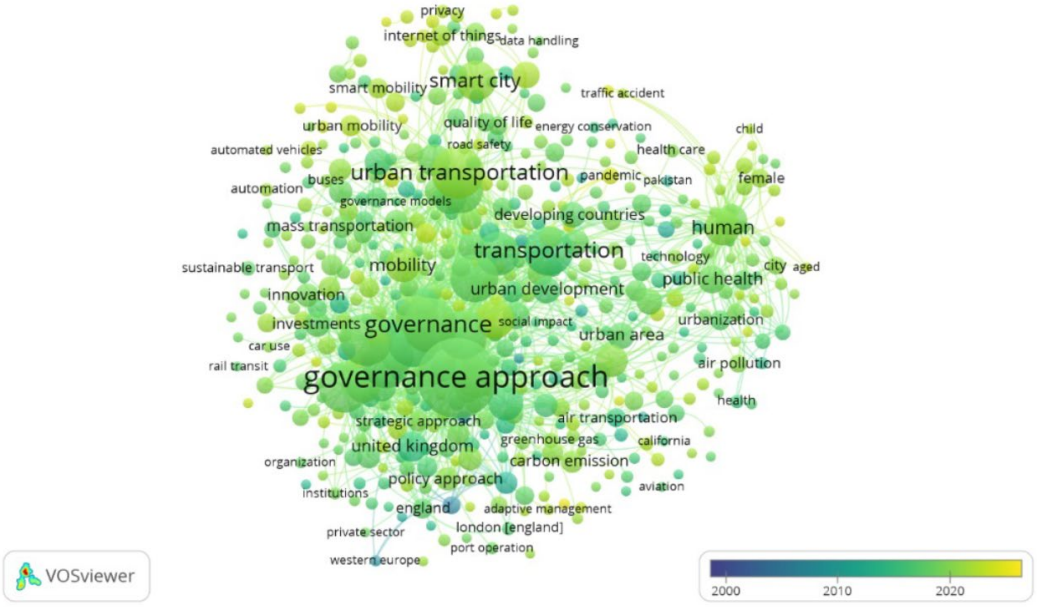


As evidenced in the review, governance as a concept in transportation or energy transition projects is not new and has been enriched in recent years. As a concept, governance seeks to strengthen and consolidate the relationships among various stakeholders within an organization or system, particularly among those whose capabilities and resources are necessary to address social problems and induce the desired transformations. Parejo [12] considers that governance is used to indicate a new way of governing, distant from the model of hierarchical control, under a model where relationships are developed horizontally and cooperation among stakeholders in mixed networks is favored.

Fernández et al. [13] suggested that governance is an alternative to the top-down government proposal, which may not be effective in the technological transition. It is considered a form of horizontal participation in which multiple local social actors are involved in generating consensus and input on any issue, thereby legitimizing public policies. For his part, Soto [14] stated that through governance, the combination of intermediation and negotiation between civil society and the State is created, in which different stakeholders interact, deciding on objectives and ways of coordination according to their interests.

Veeneman et al. [15] explained that the national government is not the dominant actor in the formulation and implementation of these policies, requiring ongoing negotiation among hierarchical governments at different territorial levels. As has been demonstrated, neither the government has the full capacity to manage processes and/or mobilize all the stakeholders in a context for the energy transition from public transportation to electromobility, nor do the stakeholders have sufficient independence and autonomy to the point of resisting the lines defined by a contrary government or those that are not beneficial to their interests [16].

Figure 3. VOSviewer Concurrency Map for "Governance Public Transportation"



Docherty et al. [17] examined the role of governance in managing the transition from a socio-technological regime to smart mobility. They demonstrated attention to the why (the role of public policy), the what (the rules of the game), the who (networks of stakeholders, including position, power, and objectives), and the how (how the public is involved). European countries with greater leadership and experience in technological advancements emphasize the importance of governance in the construction and development of transportation projects, as well as in plans for building sustainable cities. This argument suggests that governance can be applied to address social problems and, in turn, facilitate cooperation toward the collective development of the energy transition from transportation to electromobility in Colombia.

Case. Electric Taxis in Bogota

The individual public transportation service (taxis or cabs) in Bogota is served by a fleet of 56,437 units, with 25.3 % using gasoline, 74.6 % using natural gas conversions, and 0.1 % being electric [18]. This fleet operates under two schemes: long shift and double shift. It is estimated

that they travel an average of 300 kilometers per day, a figure equivalent to the mileage of approximately 20 private vehicles. As a result, the taxi segment represents a high consumption of fuel and, consequently, significant polluting emissions.

To improve the service, the city issued Decree 677/2011, which enabled the pilot of electric taxis. The decree adopted measures to encourage the use of electric vehicles and a "temporary quota" of 50 units, which would be extended for 10 years [19]. The pilot sought to evaluate the behavior of the technology and assess vehicle charging schemes.

As a promise of value, electric taxis offer greater energy efficiency and the possibility of significantly reducing operating costs compared to gasoline-powered technologies. In this regard, considering an operation with a single daily recharge and a similar regulated route of 170 kilometers, an e-taxi with reference energy efficiency could represent fuel savings of 30 % compared to a gasoline vehicle, as shown in Table 2 (MTR of COP 4,000 per dollar, July 2025). The costs of recharging correspond to a reference tariff for public infrastructure, but an alternative may be available through home recharging under a long-shift operation. Moreover, electric vehicles are estimated to induce additional savings in lubricants, gaskets, exhaust systems, air injection, filters, brakes, transmissions, and engine maintenance [19].

Indeed, if the vehicle used travels more kilometers per day, the savings for the vehicle operator will be greater. In this regard, an electric vehicle can circulate without limitations, whereas a combustion car is restricted to circulating on only 12 % of the days per year. This aspect shows that an electric vehicle, with lower maintenance requirements, allows for higher activity, consequently resulting in a higher annual income.

In terms of emissions, an electric vehicle is a zero-emission urban option. The estimated CO_2 savings from using an electric taxi compared to a gasoline vehicle for one shift is 10.5 tons/year. Considering the average emission of the Colombian electric generation sector, estimated at 0.16 Kg/kWh [20], and the emissions factor resulting from the participation of conventional and non-conventional renewable sources in the national generation matrix, it is estimated that savings in annual CO2 emissions can be as high as 80 %. Furthermore, Table 2 illustrates the potential emissions savings resulting from the introduction of electric vehicles for intensive use in Colombia.

Table 2. Comparative Annual Energy Costs by Technology (July 2025)

Indicator	Gasoline	Electric
Energy efficiency	45 km/gl	0.25 kWh/km
Annual mileage	59,500 km/year	59,500 km/year
Fuel consumption per vehicle	1,323 gallons	14,875 kWh/km
Unit cost per energy	4.05 USD/gl	0.25 USD/kWh
Annual cost per unit of energy	5,358 USD	3,718 USD
CO_2 emissions factor (urban)	2.1 kg/lt	
Reductions generated per fleet	10.5 T	

On the other hand, the most significant difficulties associated with electric taxis have been linked to the magnitude of the initial investment, access and financing costs, charges associated with comprehensive insurance, the lack of a public policy for their promotion, resistance to change associated with technological ignorance, and optional investments associated with the installation of domestic chargers. Considering this, the structuring of the electric taxi pilot was developed at a time of high resistance.

In that scenario, the local energy company Codensa and the Clinton Foundation joined forces to convene the Mayor's Office of Bogota, marking the first electric taxi pilot in the region [21]. By 2011, the political framework surrounding electromobility was limited, despite some political will from the national government to introduce new technologies. However, the district administration quickly grasped the motivation of the private sector and, in line with its policy, a working group was formed under the leadership of the District Secretariat of the Environment (SDA, by its Spanish acronym). The objectives of the pilot were to evaluate the behavior of the technology in an operational scheme of taxis in Bogota; to assess recharging schemes integrated to the operation and future intelligent networks; to build the supply and maintenance chain for BEV; to identify the competitiveness of the technology; to monitor the behavior of the batteries in a service of high operational demand.

A review of the electric vehicle market at the time identified that BYD, with its E6 reference, could meet the expectations of taxi drivers in terms of autonomy, vehicle size, and status. At that time, the brand's representative in the country (PRACO Didacol) would assume the commercial challenges, and BYD would take responsibility for the production and quality assurance of the batteries. With this reference, the energy company initiated tasks such as defining the equipment for vehicle recharging, locating the first electric lane stations, designing the required technical specifications, estimating the budget, and securing the bid for their construction.

Three taxi companies would join the initiative. Their role would be to offer affiliation to the new vehicles, provide knowledge about the service, and the taxi market in the country. In addition, the presence of the companies, along with the participation of academics from local universities, generated confidence among potential new investors interested in entering this business with new technologies.

The policy required a legal basis to permit the introduction of new vehicles into the city's taxi service. The first evaluations in 2012 pointed out the impossibility of replacement, considering the high value of the vehicles (USD 48,000) and the associated risks. As a result, it was concluded that the need to increase transportation capacity under the current regulations (Decree 172/2001, Decree 1079/2015) is a necessary incentive for an investor to take on the cost of the electric vehicle without incurring the amount of the "quota." The market defines this informal cost associated with a taxi. It is paid by anyone who wants to enter the business, which would be equivalent to 50 % of the electric vehicle.

In 2012, the Ministry of Transportation endorsed the District Mobility Secretariat's (SDM, by its Spanish acronym) request for the exceptional circulation of units with blue and white colors, which are atypical according to regulations. Likewise, governmental institutions such as UPME and ANLA followed the project. They used it as a reference for their policies and the definition of procedures to be carried out by stakeholders to access tax benefits for energy efficiency projects and environmental contributions.

With the approval of the 50 quotas for electric vehicles, BYD began importing the vehicles, taking advantage of the national incentive in force that reduced tariffs for this type of technology (Decree 4931/2011). Likewise, the national government made resources available to finance the vehicles through the Bancoldex route (a second-tier bank) and Helm Bank (also a second-tier bank), the latter being responsible for negotiating with the taxi drivers.

Regarding this issue, the selection of the beneficiary taxi drivers evidenced multiple difficulties. The district administration insisted on "democratization" in the process by placing different requirements that the interested parties did not easily meet. Subsequently, some of the beneficiary taxi drivers were excluded from the financial risk analysis carried out by the bank responsible for the loans. These events generated administrative rework that disrupted the allocation of the "quotas" and delayed the project's start.

For the installation of the first electric charge stations, there were challenges related to regulations regarding the use of public space and the installation of equipment with electrical risks. The concessionaire BYD would allow the installation of chargers at a strategic point near the El Dorado International Airport, and the city would allow the installation of chargers in the Tercer Milenio parking lot. The first point would be fundamental in the pilot's early years, as it recognized the failure of the second site due to its location, accessibility, and the limited services it offered to taxi drivers.

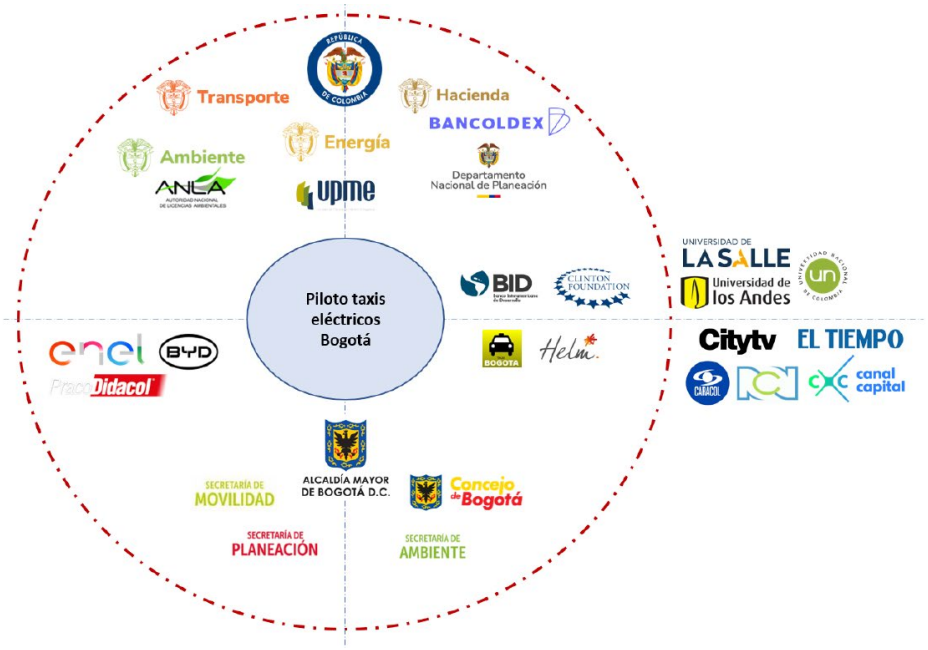
Also, the media played a crucial role in promoting the initiative and showcasing the progress of electromobility projects in the country. Their influence has been considered relevant as a mechanism to pressure governmental actions to promote the electrification of transportation in the country.

On the other hand, to address the financial challenges faced by taxi drivers, the city proposed economic incentives as a means to promote environmental sustainability. These resources would provide additional income, contingent upon the vehicles' participation in exhibitions, trade shows, and events where the district is present. The incentive was offered during the district administration, with the possibility of extension.

In this scenario, Figure 4 illustrates the mapping of stakeholders who participated in the structuring and launch of the electric taxi pilot in Bogota. National public institutions are located in the upper segment, while district institutions are situated in the lower segment. On the other hand, non-governmental actors are located on the axis of the diagram. On the outside, some stakeholders participated in or accompanied the process without being considered indispensable in the implementation phase.

Following this articulation, the pilot commenced operations in 2012 with a portion of the vehicle units, gradually expanding to a total of 43 vehicles. At the same time, an external action was led by private actors who were not part of the project and sought to superimpose their particular interests by capturing some "quotas." The electric vehicles incorporated by these stakeholders were inadequate and failed to provide reports to the original project.

Figure 4. Mapping of Stakeholders around the Electric Taxi Pilot in Bogota



With the implementation of the electric taxi pilot, other challenges and conflicts would emerge, which were part of the learning curve around electromobility in public transportation operations. The determined participation of the energy company and the brand's concessionaire would be crucial for the project to be successful and potentially exceed the initially agreed-upon trial period of 10 years. This data would be key in conducting studies on the electrification of taxis and projecting new incentives for electromobility.

Conclusions

Concerning governance, its existence can be appreciated in the structuring of the electric taxi pilot, which allows for the balancing of the interests of various stakeholders and facilitates private investments with a certain level of risk. However, governance during the structuring and initiation of the project was not maintained due to changes in district administrations. This fact indicates that governance is not yet mature, mainly due to the District's political instability and its strained relations with the national government. This fact generated crises in the pilot, affecting trust and sparking conflicts and debates about the convenience of electromobility.

The reduction of initial costs associated with vehicles, the deployment of public vehicle charging infrastructure, the entry of new brands into the domestic market, and the establishment of new incentives under Laws 1964/2019 and 2099/2021, combined with the increase in domestic gasoline prices, favor the analysis of electromobility. However, the technology remains expensive; there are no tariff incentives for the use of electric vehicles, financing challenges persist, resistance to change is prevalent, and a lack of local policies hinders the initiative. Additionally, the competitiveness of natural gas limits its mass adoption.

Leaving the responsibility for the energy transition of taxis to the market and the private sector is not convenient, so the implementation of pollution charges in urban areas, the implementation of zero emission zones that define exclusion zones to polluting vehicles, preferential parking areas, and new incentives for the deployment of public chargers in the territories are needed. This study emphasizes the importance of aligning stakeholders with a common goal of shared gain, where governance serves as a mechanism for coordination and consensus.

The district government assumed a leadership role in the project's governance; however, its participation with financial contributions was marginal, and commitments to taxi drivers were not guaranteed over time. The private sector made risky investments, placing the greatest burden on taxi drivers. This situation is not positive in a project where governance was evident and facilitated project implementation in a resilient context.

Finally, governance becomes a mechanism that fosters innovation and breaks down existing paradigms, which, in the case of transportation, have been entrenched for a century around fossil fuels and combustion technologies. It is evident that governmental actors play a fundamental role in the energy transition of transportation and its associated components; however, the significant contributions of the private sector and the community are also recognized. Indeed, citizens are not only recipients of the decisions made by the authorities or the market, but they are also stakeholders with the capacity to invest, adopt, and demand new technologies.

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