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INDUSTRY 4.0 AND SMART CITIES MOBILITY

EXPLORATORY RESEARCH ON ELECTRIC MOBILITY IN THE METROPOLITAN AREA OF BRASILIA, BRAZIL

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Abstract

The paper resumes an exploration research developed in Brazil during a four year research activity, having focus on metropolitan and smart cities mobility showing the case of Brasilia Metropolitan Area. The research uses two techniques: bibliographic and filed research for primary data. The approach was qualitative and moderate quantitative from secondary data. Quantitative figures were based on indicators from consulting firm research reports. Indicators are based on three steps: evidence of planning, evidence of system and evidence of market. The period of research was august 2018 – November 2018. Main results of the research are: in Brasilia no electric mobility planning was found form institutional evidences to develop the Smart City initiative integrated to Industry 4.0. In spite of lack of public planning, there is a great opportunity for business. The main metropolitan area is worth some 3 million inhabitants, almost 7 including surrounding metropolitan areas with millions vehicles Threats are no fiscal incentives and infrastructure of electric posts able to sustain car supply and no offer of electric/hybrid cars and conversion kits. In the other hand

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there is a great number of cars and increasing urban mobility, a great number of public and private vehicles and the urban transportation of goods uses motorcycles, van, light trucks with increasing operational cost mainly due to gasoline costs.

Keywords: Industry 4.0, Smart City Mobility, Electric car market

PAPER OBJECTIVES

Although electric car market is rising in Europe, USA and China, Brazil still stands one step beyond and still need to improve a sustainable mobility matrix in the metropolitan regions and greatest cities. Brazil don't follow the global trend about climate change governance in cities and motor vehicle changes and control. The number of electric car in Brazil is numbered in a few thousands, been several millions car driving in Brazil Cities.

Political orientations and policies supporting economy are great opportunities or could be a bottom neck for this business. Meanwhile the cost of fuels and strikes as that paralyzed all Brazilian logistic system in 2018, due to rise of gasoline and gasoil prices , should have been alerted that mobility will be always affected of such events. The risk of new strikes is a possible threat of the logistic services market.

More than this, the claimed best option, a flexible matrix gasoline-alcohol in Brazil, it's too dependent of price control of greatest company distribution. The price of alcohol in the network is rarely competitive. Also alcohol depends on logistics and distribution and could be affected too by the risk of new strikes.

Giving this context, how's working the smart cities initiative and the link with industry 4.0 for the electric vehicles market in Metropolitan Area of Brasilia?

We like to explore in this paper the problem of electric mobility of the Metropolitan Area of Brasilia. The objective of the paper is to explore strategic elements to characterize this market in the capital city of Brazil.

The paper will start with referential concepts of what we mean for industry 4.0, mobility and smart cities in Brazil and how are linked together.

INDUSTRY 4.0 AND SMART CITIES MOBILITY OVERVIEW

Metropolitan cities development in Brazil was very fast in the last decades, but the increasing challenges of fast growing urban areas has been underestimates. The poor investments budget was spent to increase an international false image of prosperity together with football and sport infrastructure during World Cup and Olympiads in 2016. In the next four years till now Brazilian economy still stand waiting new developing policies.

Doing that period, almost fifteen years, Brazil government has loosed many opportunities. One is to integrate the global smart cities initiative and movement. Especially mobility policies based on laws and plans all stands on paper without any hope that in future will be realized.

Lack of public investments doesn't means the lack of opportunity for private groups to develop ventures and offer to the executive market solutions that means only policies and regulations without public investments for smarts cities. One of these opportunities was explored by UBER transforming the Brazilian taxi system, from monopoly to concurrency market (AVENI 2018, AVENI and ALBARELLO 2020).

Industry 4.0 and Smart cities strategic mobility project must become with a strategy. In industry 4.0 environment J. Schlick et al. (2014) focused the importance of be aware of at least these scenarios: 1) Interoperability or to connect and communicate with each other via Internet of Things and Internet of Services. 2) Virtualization or monitor with sensor data physical processes. 3) Decentralization or enable factories to make decisions on their own, 4) Real-Time Capability: or react to the failure of a machine and reroute products to another machine, 5) Service Orientation or use the services of companies, CPS, and humans offered both internally and across company borders, 6) Modularity or flexible adaptation of changing requirements

In 2017 the state of the union industrial policy strategy of Europe Union key initiatives claimed for upgrading industry for the digital age, Building on Europe's leadership in a low-carbon and circular economy, Partnering with Member States, regions, cities and businesses to stimulate industrial competitiveness at all levels, Investing in the industry of the future, Reaping the benefits of open and rules-based trade and upholding fair competition for our industry and Supporting industrial innovation on the ground.

Key Enabling Technologies are among the priority action lines of European industrial policy. Currently, there is a group of six technologies: micro and nano-electronics, nanotechnology, industrial biotechnology, advanced materials, photonics, and advanced manufacturing technologies. They provide the basis for innovation in a range of products across all industrial sectors.

According to a Vasja et al. (2016) research, the fourth technological revolution is based on the concepts and technologies that include cyber-physical systems, the Internet of things (IoT), and the Internet of services (IoS), as well as Internet of Energy (IoE), the trend is leading toward the establishment of a communication channel for the continuous exchange of information about needs and individual situations in real time, provide value added for organizations and customers.

The phenomenon of Industry 4.0 was first mentioned in 2011 in Germany as a proposal for the development of a new concept of German economic policy based on high-tech strategies (Mosconi, 2015).

PWC survey (2014) outline that by 2020 European Industrial companies will invest 140 billion euros annually in industrial internet applications. At the same date almost 80% of these companies will have digitized their value chain with a 18% increase efficiency. Digitization of products and services portfolio is the key to sustainable corporate success.

In "The industry of future", the KPMG report (2106) also shows that industry 4.0 is an evolution of industrial revolution that converge to a new model based on information technology strengths. The evolution from mechanization followed by electrification and digitalization now is turning to cyber – physical system that embedded networked ICT and interacts with physical processes. For KPMG the automotive industry leads the way using all disciplines encompass all interdisciplinary fields.

McKinsey & Company Industry 4.0 model factories, stressed that the industry 4.0 key of success is based on a complex management of services and after sales, resources process, asset utilization, new form of labor, inventories, quality match supply-demand and time to market.

The autonomous car vehicle (ACV) is one of new technologies that can modify deeply mobility in cities. But in the industry 4.0 there are more

opportunities to improve mobile. The challenge is understand how to link the industry 4.0 to the smart cities concept to develop innovative mobility.

Smart cities and industry 4.0 one example is encouraging openness and co-creation to generate opportunities in the IoT. Other trends are: intelligent retail, intelligent logistic, intelligent healthcare, intelligent transportation, clean energy, reduce environment impact.

Smart cities are improving electric train to increase safety and reduce freight and transportation in urban areas. Metro are the more efficient and sustainable train to be developed today. Others intelligent systems are: traffic controls, automatic toll, traffic incident detection, vehicle plate recognition, intelligent bus systems. All these new technologies must be developed switching the cost and impact of fossil energy production to electric energy. Use of electric vehicles encompass goals of reduce cost, increase efficiency and reduce environmental impacts.

Use of intelligent systems in urban mobility allows the use of a graph and mapped database to calculate “optimal” transportation routes with respect to the contextual necessities of a urban personal trip or a transportation of a production asset. This is done by integrating contextual data by exploiting an affordance-based routing approach.

According to Deloitte (2015) projects to be developed in a Smart City are: user –centered mobility, integrated and intelligent transport, pricing and payments, automation and safety, public and private innovation.

So we can summarize that Smart City Planning involve this view of mobility in the age of industry 4.0:

- Integrated development & spatial planning
- Transportation & traffic strategy
- Environment & public safety

Arthur D. Little and the UITP study (ARTHUR D. LITTLE 2014) conducted in 84 cities around the globe stressed as strategic directions for cities and have identified four key dimensions to be considered by mobility actors in cities seeking to put in place sustainable urban mobility systems:

- Visionary Strategy and Ecosystem
- Mobility Supply (solutions and lifestyles)
- Mobility Demand Management
- Public Transport Financing

A successful urban mobility strategy needs to consider the interests of both public and private transport, passenger mobility and goods mobility, motorized and non-motorized transport and vehicles that are parked as well as those on the move. The development of a master plan with a long-term horizon, which lays out responsibilities and allocates resources, together with the introduction of clear governance mechanisms for monitoring and updating is also a must. Meanwhile, a budget plan will ensure that the investment undertaken synchronizes with existing funding streams (ARTHUR D. LITTLE 2014)

Recently the World Economic Forum (WEF 2016) recommended 10 deep drives to develop and plan future nobility of cities: improve physical integration and connectivity between transport modes, establish industry standards on data/digital infrastructure across device types, enhance day-to-day transport management through data-based approach, promote demand-responsive shared transport, streamline regulation and management of

demand-responsive solutions, introduce policies to accelerate adoption of alternative fuel vehicles, introduce policies to accelerate adoption of alternative fuel vehicles, consider possible technological and business model (r)evolutions when making, leverage corporate/institutional environments to test and showcase business, apply smart and competitive public-private financing models to fund new mobility ecosystems .

RESEARCH METHOD

The paper goal is developing Brasilia Metropolitan Area's exploratory research. The research has three step defined as: evidence of planning, evidence of the system, (both based on bibliography and assessments) and evidence of some opportunities for smart cities mobility with industry 4.0 features. In this last step was developed a field research to understand electric car market opportunity.

The first step was seeking evidence of Smart City Planning:

- Integrated development & spatial planning
- Transportation & traffic strategy
- Environment & public safety

The second step try to detect key dimensions that cam put in place sustainable urban mobility systems:

- Visionary Strategy and Ecosystem
- Mobility Supply (solutions and lifestyles)
- Mobility Demand Management
- Public Transport Financing

The third and final step is the field research of the electric car market opportunities, as one of many others for Industry 4.0 and Smart Cities in Brasilia. This was made with open interview, collect of pictures and information, open questions to users.

RESULTS. SMART CITIES PLANNNG and SUSTAINABLE URBAN MOBILITY SYSTEMS INTO METROPOLITAN REGION OF BRASILIA

Smart City Planning involve a view of mobility in the age of industry 4.0 that encompass: integrated development & spatial planning, transportation & traffic strategy, environment & public safety.

The responsibility for metropolitan management areas in its institutional dimension, it is enabled for any activity or function, but placed hierarchically in the federal government in Brazil and not the municipalities. Brazilian federalism, unlike the U.S. , was created from a unitary state , which suffered territorial division to form the member states . The last Brazilian federalist territorial organization was redefined in the last Federal Constitution in 1988 with two chambers one of Commons and one of States.

There are three administrative levels in Brazil (federal, states and municipalities) and the Federal District that is an entity with a rank of state level and with special rules for Federal District administrative divisions. However, there is a fourth form of territorial organization for which it was not yet given proper constitutional treatment: the metropolitan areas (CAFFÉ ALVES , 2001).

The first metropolitan areas in Brazil were established by the Union government in 1973 with Complementary Law No. 14 of 8 June. Complementary Law No. 14 established in Article 5 , which services would be reputed metropolitan interest , listing among them : social development ,

sanitation , use of underground soil , production and distribution of piped gas fuel , use of water resources and pollution control , and others who were to be included as competence of the Board by federal law . The constitution of 1988 put the same interests at the municipal level.

With the Constitution of 1988 the decision to establish metropolitan areas was provided to member states and by the same constitutional provision there was also the possibility of establishing urban agglomerations and micro statistical areas. All species of administrative regions constituted through laws and in accordance with the CF as the metropolitan areas, the RIDES (Regions of economic development whose territory comprises different states), urban agglomerations and micro would be formed by the grouping of neighboring municipalities to integrate the organization , planning and execution of public functions of common interest .

Thus the constituent power of the new democracy deal in 1988 opted to transfer the metropolitan problem to States, as they may, under Article 25 of the Constitution, adopt their own laws and regulations of the organization, noting only the constitutional principles. In this case , it is for each member state to create laws for the organization of metropolitan areas that may exist in their territory , facing, with this, the concept of " constitutional autonomy of municipalities " , which has been used as an obstacle to the rules of the Regions metropolitan (ARAUJO and LORENZETTI , 2008, p. 650) .

The ownership of the performance of public functions of common interest (including related services) are therefore of the public administration (municipality) organized at the regional level , the intergovernmental character. The representatives of the State and the municipalities involved must, equally, participate in relevant regulations, policies and administrative functions. The municipal autonomy is described and guaranteed by the Federal Constitution (articles 29 , 30 and 31) , attaching to the municipality the power of organizational self -regulation and self - government legislation regarding local interest , own , decreeing administration and collection of taxes within their jurisdiction and application of their incomes.

The metropolitan municipalities have an autonomy eventually constrained , but a conditional independence from the origin , the possible establishment of metropolitan areas , under the constitutional provision , when there are objective conditions that justify the measure (CAFFÉ ALVES , 2001). In addition municipality lack of funds and especially fund for developing metropolitan services, because it is the Union, and secondary the State, that provide the financial support of municipality budget. In other world there is low autonomy for the municipality to provide its own financial needs.

The metropolitan area of Brasilia fits by the supplementary law n . 94 of 19/02/1998 establishing the RIDE / DF, constituted by the Federal District and 21 municipalities of Minas Gerais and Goiás States. Another spatial area, defined only by some research institutions - Metropolitan Area of Brasilia or AMB - includes the Federal District and the municipalities in the immediate surroundings that are only 10 among the 21 municipalities. In 1999 , the AMB definition was adopted in the study by IPEA / IBGE / UNICAMP " Characterization and Trends of Urban Network in Brazil ." The study Miragaya (MIRAGAYA 2013) shows the population density in the Surrounding Underscoring the strong polarization dependence of the public sector and the acceleration of the occupation of the surroundings are phenomena that create

pressure in the institutional articulation of the four levels of government (UNION, DF , RIDE , Municipality) and conflicts of legitimacy , and the political power hinders the development of the functions of local interest .

Recently the RIDE suffers various modifications. First was expanded to 34 municipalities and a project of law in the 4th of December was signed to create Federal District Metropolitan Area which includes all municipalities on the border of Federal District. All State government of Goiás, DF and Minas Gerais must approve the creation of the area. The objectives of these changes are to grant new founds to new created spatial entities.

Between the institutional problems the greater one is mobility and public transport. For those that drive Brazilians roads, like the author , the traffic violence and the lack of police control, the number of accidents are lesser problem than to drive safety without loose own control in face of the way Brazilian people drive. Most of Brasilia drivers doesn't have regular driving license (AVENI and ALBARELLO 2020).

Brazil is still trying developing Public transport infrastructure with the main goal to reduce transport matrix dependence on cars and trucks and increase railroads. Walking and cycling too are considered form of transport to be strengthened for pro-poor planning strategy and sustainable environment safe. Railroad transport and new public transport systems as Bus rapid transit (BRT) are planned all over metropolitan areas for the next years as sustainable solution. So recently Urban policies in Brazil are moving from a focus on transportation and developed, instead, focused plans on the human right to "equitable access to opportunities".

With *Lei nº 12.587, de 3 de Janeiro de 2012*, or *Política Nacional de Mobilidade Urbana* (Urban Mobility National Policy) it is now mandatory to be developed within three years urban mobility plans for human settlement of more than 20.000 inhabitants. Brasilia metropolitan area, have already a transportation plan (*Plano Director de Transportes Urbanos - PDTU*) that decided in 2009 the future plan implied because of the new policy. The PDTU plan must be upgraded in 2014 and must be organized as well as Mobility Transportation Plan because of the law 12.587 / 2012 above mentioned. In addition an international firm based in Singapore, was appointed by the government of the Brasilia Federal District to develop part of the analysis.

The centralization and the supremacy of the Union, the central government, on the other federal entities and political patronage foster state paternalism and patronage of the Brazilian public administrative culture (ABRUCIO, 1998). Excessive regulation leads to slowness of the shares , the wear of governmental entities and overlapping of duties that hinder the processes of negotiation and coordination of local actions .

Due to political articulation financial resources will not always be reworded or redistributed in terms of their formal or textual configuration. Often carried out a territorial financial redistribution only the change in the next four years will embodying new plans. The paradox of the four years election power cycles implies that there is a fragmented or partial implementation of certain activities and services, considered solely in the interest of the municipality and metropolis, beyond the territory institutionally and administratively defined a treatment at the regional level.

Thus no relation between planning smart cities and industry 4.0 is still working for Brasilia Metropolitan area. The recent plan and infrastructure

intervention in case of World Football Cup in 2014 and Olympiads in 2016, achieved some buses new corridors, lines and a better link to international airport. No results were detected for integrated development & spatial planning, transportation & traffic strategy, environment & public safety.

About the key dimensions to put in place sustainable urban mobility systems is: visionary strategy and ecosystem, mobility supply, mobility demand management and public transport financing the only change detected is about mobility demand system. That is the case of Uber and Uber-like services introduction. The Uber works with smart phone applications from 2014 in Brazil. Lei nº 5.691/2016 allow Uber to work in Brasilia legally in spite of opposition of taxi drivers that owned monopoly of public passengers transport and lost it since 2014. The number claimed of Uber registered in Brasilia are ten times the total 7 thousand taxi registered.

ELECTRIC MOBILITY in Brasilia

Distribution of energy in Brasilia sometimes presents fall and problems but generally is not so bad and not very expensive. The actual cost of 0,60 R\$/kWh or, at the actual change, 0,15 \$/kWh that is above 0,13 \$/kWh as average residential in USA² and 0,107 \$/kWh average of all sectors. That means that at the actual cost of gasoline 4,2 R\$/L or more or less 1,03 \$/L the use of electricity inside of gasoline will be save 4/5 of total transportation cost if total transportation could have been switched into electrical.

The field research Electric car and mobility in Brasilia detected only few public electric posts. There were three in shopping centers (Iguatemi, Brasilia Shopping, Gilberto Salamon) and one in Hotel district (Brasilia 21). One in University of Brasilia (Campus Darcy Ribeiro) and one that will be installed in 2019 in University of Brasilia (Campus Gama). Few more (three) are distributed among public agencies (CAESB, CORREIOS and Ministry of "Minas e Energia") mainly with assistance of Itaipu project. Only in University of Brasilia there is a rapid charging electro charger.

There are no mechanics and information about electric cars and the great automotive brands settled doesn't marketing electric vehicles in the city.

There are no statistics about electric cars in Brasilia. It was estimated that no more that few hundred drive the city, most are private and some public most of them, like public authorities, doesn't drive at all. In the other hand, Detran, traffic department of Brasilia, points out that at the end of July 2018 there are 1,7 million vehicles only in Federal District and a raise of 3,3% in the last year for a population of more than 2,7 million people. IBGE, the central agency of Brazil statistics claims that the RIDE/DF population count more than 4,5 million people.

No statics was made for total vehicles for RIDE or new Metropolitan Area of Brasilia. It's difficult to estimate the total vehicles because de conurbation is very strong and part of mobility between Federal District and part of Goiás Estate is developed with vehicles registered both in Federal District and Goiás. Thus, considering 1,8 million people de difference between Federal district and RIDE/DF and Federal District we have some 0,5 rate of cars in the Federal District. This rate gives 0,9 million cars for people living outside Federal

² www.eia.gov

District³. So RIDE/DF total vehicles sum roughly 2,2 million cars of what 1,3 million cars in Brasilia and 0,9 million cars outside.

Obviously the complete switch of cars from gasoline to electric is a matter of time and public policies. We also have to consider that the medium trip in Brasilia is more than a trip in compact cities because Brasilia is fragmented with several urban nucleus far one to other some 20 km average. It means that a medium electric battery charge of 120 km. is a little poor. A medium trip of more than 150 km is more realistic. The solution could be hybridization of the entire fleet. A hybrid vehicle can use electric and gas power and never became out of energy.

Even thinking about hybrid solution the market sum several hundred thousand cars. Which cars? There is interest to reduce gasoline costs in all categories. We estimate that a electric car must drive more than 60.000 km to return the extra investment in one year at the actual prices in Brazil. If the choice is to convert there is some difference between electric and hybrid conversion. This is because there is a rate of efficiency between gasoline to electric, for us an average of 1/5, and between gasoline and hybridization, we calculate an average of 1/3. This average was developed research internet sites and articles that gives information and calculate how affordable and interest is to use electricity.

This cost for a worker, or who use the car less than a worker, is too high because people using urban cars drives an average of 5.000 km year in Brasilia. So for them the switch will be interesting starting from the fifth year. But there is others segments of consumers, like taxi and Uber drivers, logistic urban operators and public transportation including governmental cars, that could have a substantial gain converting to electric.

The field research included some people survey to understand how interesting is the opportunity to switch electric mobility matrix. The survey includes two dozen people: academics, students, taxi drivers and ordinary people between September 2018 and November 2018. The survey was developed without questionnaires only to discuss pros and cons.

The field survey reports poor interest on electric mobility and alternative mobility. This could be explicated by lack of information and governmental focus on gasoline, no incentives and no offers. There is more interest in reduce gasoline costs, but the cost of electric car and no electric post are the main reason to lack of interest to electric cars. Especially the Innovation ecosystem doesn't have research planned for electric mobility. In 2018 was donate a Toyota Prius to UNB but till now no results or research was informed.

New forms of mobility are the goal of young people. Sharing bicycles and electric skates are a fashion that is growing but is not enough unless incentives e low cost solutions. There's need of low cost solution injected into the market. For that, startups solutions are welcome because there is no interest for car and truck sellers to enter into a small or nice market. We can also say that the automotive lobby and the government seems to be aware that, if electric car are allowed into Brasilia market, today market share will dramatically change. Actual government is bargaining with automotive companies some solution. Meanwhile the market is close for electric solutions.

³ www.ibge.gov

Automotive firms are interested to sell actual local production and stressed incentive policies to reduce taxes when selling. The governmental executive doesn't develop policies to incentive electric too and to integrate all mobility policies with the smart cities initiative. The environmental challenge, to reduce global warming and CO² is forgot when the focus is to incentive and raise automotive sells.

Related to Industry 4.0, the field research point out that there is in Brasilia new mobility systems of sharing bicycle. Two initiatives are ongoing. First there is a dock bicycle sharing system developed by a partnership of local government and financial institutions. The other is a second sharing system from a private company call Yellow. The model of sharing of Yellow is free into a space.

These new way to move, this mobility with new models, is the great step ahead in 2018 and 2019. If these systems will develop others and other companies or partnership will follow, is possible a great development of sharing vehicles, new form of applications and software to be used with Smartphone. In addition new firms, developing electric bicycling, battery and motors, will raise in the Metropolitan region. All these elements are part of a Industry 4.0 and Smart City initiatives.

As results of the field exploration research we can summarize that there are following threats of a virtual SWOT analysis:

- No governmental and private strategy to start ongoing
- No innovation ecosystem pushing electrical mobility
- No mobility supply. Lifestyle of Brasilia is typical because depends on governmental resources and very inefficient and costly. So change in culture is very slow.
- No public transport financing. The actual public transport system is a close market between some transportation group and the Federal District government. There is no overall interest to change the contest.
- Incentive to sell gasoline and gasoil cars

Meanwhile we can underline the following opportunities in the market:

- The RIDE/DF was planned for car. Lack in public transportation, use of private vehicles in mobility. Great number of inhabitants and high rate of translate from suburbs.
- Public transport based on gasoil and gasoline matrix (no electric buses and trains). Very limited metro network.
- Great number of possible customers (uber, uber-like, taxi and logistic operators) starting from productive segment.
- No concurrency (automotive, conversion kits, mechanics) relative easy to enter and develop startups.
- High cost of fuels (increasingly every year) that imply increasing logistics costs for all.
- Is possible great reduction of environmental impacts with minor interventions.

Using these elements every investor could add their internal forces and weakness to develop a Swot matrix and strategy actions to start electric car business in Brasilia. This is the main result considering smart cities initiative and industry 4.0. Of course many others initiatives, as use others strategies as low

emission buses and metro to improve mobility and use the potential of industry 4.0. New studies could complement this one in Brasilia and other cities.

CONCLUSION

The program for Smart Cities and its link to industry 4.0 in Brasilia is still ongoing. Many plans and actions have to be implemented to develop such integration and increase new mobility with integrated development, spatial planning, transportation & traffic strategy, environment & public safety.

The exploratory research was based on three steps: evidence of planning, evidence of system and evidence of market. Smart Cities Mobility and his link with Industry 4.0 aren't present in real planning and haven't evidence to have a system in place. Many claims came from governmental executives both federal and local to have developed sustainable mobility but in fact we cannot find an integrated system working. Are many fragmented actions and lack of investments in mobility and electricity mobility projects.

About electric mobility in Brasilia the field research underline that there is a great opportunity for business, although we cannot find fiscal and public incentives. As the result of market research there are threats into the market because there is no infrastructure of electric posts able to sustain car supply, there is no offer of cars and conversion kits. In the other hand there is a great number of cars and urban mobility, there is a great number of public and private transport and finally the urban transportation of goods uses motorcycles, van, light trucks and all with an increasing cost due to increase of cost of fossil energy.

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