

## Article

# A CLIOS Analysis for the Promotion of Sustainable Plans of Mobility: The Case of Mexico City

Ioannis Chatziioannou <sup>1,\*</sup> , Luis Alvarez-Icaza <sup>1</sup> , Efthimios Bakogiannis <sup>2</sup>,  
Charalampos Kyriakidis <sup>2</sup>  and Luis Chias-Becerril <sup>3</sup>

<sup>1</sup> Institute of Engineering, UNAM National Autonomous University of Mexico, Mexico D.F. 04510, Mexico; alvar@pumas.iingen.unam.mx

<sup>2</sup> Department of Geography and Regional Planning, School of Rural and Surveying Engineering, National Technical University of Athens, 15780 Athens, Greece; ebako@mail.ntua.gr (E.B.); kyriakidisharry@gmail.com (C.K.)

<sup>3</sup> Institute of Geography, UNAM, National Autonomous University of Mexico, Mexico D.F. 04510, Mexico; luis.chias@gmail.com

\* Correspondence: IChatziioannou@iingen.unam.mx; Tel.: +52-15-5454-37015

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**Abstract:** Transportation systems help in shaping an area's economic health and quality of life, providing the infrastructure for the mobility of people and goods. Nevertheless, the negative externalities of car-oriented urban-metropolitan planning have heightened awareness for the need of urban planning approaches that incorporate sustainable mobility. Consequently, cities worldwide have increasingly produced sustainable mobility plans. This points to the need of creating mechanisms to implement these sustainable plans, particularly in large, complex, and fast-growing cities. This paper provides guidelines to facilitate the implementation of Sustainable Mobility Plans by focusing on the case of Mexico City. This is achieved by applying the complex large-scale integrated open systems (CLIOS) systemic analysis, in two steps: first, we facilitate the identification of the complexities and relationships among the essential systems of Mexico City's urban structure, along with the recognition of their most important components and the institutions involved within the urban planning process. Second, we assess the effectiveness of the public policies—strategies that form part of Mexico City's Sustainable Mobility Plan and organize them in order of importance. The results show which principal subsystems should be considered for sustainable mobility and which public policies—strategies should be prioritized in order to implement the aforementioned plan effectively.

**Keywords:** urban planning; sustainable urban mobility plans; CLIOS analysis; public policies; sustainable mobility

## 1. Introduction

Undoubtedly, transportation is a key factor in shaping an area's economic health and quality of life [1]. Transportation systems provide the infrastructure for the mobility of people and goods. Moreover, they influence patterns of growth and socio-economic activity by providing access to several different land use types that are spatially separated; thus, allowing people to carry out a diverse range of everyday activities, such as working, studying and, shopping [1–3].

Because of its intensive use of infrastructure, the transport sector is an important component of the economy and a common tool used for economic development [4,5]. In the past two decades, the analytical literature has grown substantially with studies carried out using different approaches, such as a production function and growth regressions, as well as different variants of these techniques (using different methodologies, methods and data). Most of these studies concluded that transportation

infrastructure and the transportation sector in general contribute to productivity, output, and growth rate [6–17].

In these growth-focused studies, there is a bias towards the economic impact rather than the social goals, making it necessary to study the impact of transportation with qualitative parameters, such as development, and not only on quantifiable ones, such as growth [18].

Furthermore, it is vital to mention that there are also some negative externalities related to transportation. For example, private cars are responsible for generating the majority of greenhouse emissions and several distinct pollutants, and these emissions contribute to climate changes, which could have serious consequences in terms of health and environmental costs [19,20]. Some data for Mexico are illustrative. In 2008, the pollution generated by gasoline combustion was connected to 14,000 deaths. In addition, traffic accidents caused 24,000 deaths and left 40,000 disabled and 750,000 injured [21]. The annual cost of these accidents was around 126 billion pesos, which is equivalent to 1.3% of the National Gross Domestic Product (GDP) [22].

In terms of quality of life and social goals, the long periods of time spent in travelling reduce the involvement of individuals in their communities and limit social relations [23]. In the study by Hart [24], it can be appreciated that in regions of heavy traffic, there are 1.15 friends and 2.8 family members per person. In regions of medium traffic, he finds 2.45 friends and 3.65 family members per person, while for the case of low traffic, there are 5.35 friends and 6.1 family members per person.

In this pessimistic overview, there is the need to highlight that the degradation of public space due to the overuse of private vehicles (and its associated infrastructure) has harmful effects, not only upon the psychology of local population, but also upon the attractiveness and image of the city, which in turn lowers the value of land use [25]. Consequently, the contemporary challenge of urban traffic and urban planning systems is to promote sustainable mobility using the available network (infrastructures) and constituent entities, and with a qualitative improvement based on geospatial information, participation, accessibility, and personalized travel related services that take into account social groups with different mobility necessities.

For this reason, many countries, primarily in Europe, have attempted to implement sustainable urban mobility plans so as to shift from the traditional vehicle-oriented transport planning towards a new user-friendly way of planning urban mobility. A Sustainable Urban Mobility Plan (SUMP) can be defined as a plan aimed at establishing a better quality of life via the satisfaction of people and business mobility needs in cities and their suburbs. It is based on existing planning practices and considers the principles of integration, participation, and evaluation [26]. The focal point of a SUMP is the improvement of accessibility within urban areas to offer transportation modes and sustainable mobility of high quality through and within the urban area [27].

In pursuit of this goal, a SUMP seeks to contribute to development of an urban transport system that [27]:

- is accessible and inclusive by taking into consideration the basic mobility needs of all users;
- counterpoises and reacts to the diverse demands for mobility and transport services of citizens, businesses, and industry;
- promotes the integration of different transport modes in order to establish a balanced development;
- covers the requirements of sustainability, through the identification of sustainable development's main axes, such as environmental quality, health, social equity, and economic viability;
- enhances efficiency and cost effectiveness;
- optimizes the use of urban space, urban image, and of existing transport infrastructure and services;
- intensifies the attractiveness and amenities of the urban environment and public health that consequently raises the quality of life;
- upgrades traffic safety and security;
- improves the quality of air by reducing air and noise pollution, greenhouse gas emissions, and energy consumption.

A regeneration scheme with the above-mentioned characteristics must have multiple guiding principles due to the nature of sustainable mobility that considers accessibility, mobility, land use, air quality issues, etc. Therefore, the regeneration area where the scheme is going to be implemented should be conceptualized and understood as a whole entity (system) that includes a variety of land-uses and activities, and where each of its components are interlinked and contribute in different ways to the overall wellness of the system.

Several studies have highlighted [28,29] that the traditional paradigm of urban mobility planning based on the capacity concept in which new infrastructure (especially for auto-mobiles) is continuously built, so that to achieve a better flow of vehicles is no longer adequate because it generates a vicious cycle of development. Namely, the expansion of infrastructure (dedicated to move auto-mobiles) causes the phenomenon of urban sprawl, as access to the urban periphery is easier and can be achieved in a rapid way by the high-speed transportation networks. Nevertheless, such expansion encourages the increase in car use, which, in order to avoid congestion phenomena, further promotes the construction of new infrastructure; therefore, the vicious cycle of development is established. The result of such a development pattern forces citizens to interact less with the city, to travel longer distances, to use the car and to walk less. This pattern of urban development makes it costly and difficult to establish public transport systems, travel by bicycle, or walk. Remoteness also requires the consumption of more energy for transport and the invasion of public space by roads. Moreover, such an unsustainable development is capable of generating the fragmentation of mobility planning, which, as a consequence, causes poor adaptation to requirements regarding the sustainable urban mobility and interdisciplinary approaches, confusion over objectives, priorities, and plans, and finally, lack of communication between the different stakeholders involved (public institutions, local community, experts, users, vulnerable groups) [28,30,31].

Hence, it is essential for the successful design of urban mobility plans to consider systemic approaches [32–35]. The latter can be appreciated via the recommendations of the Committee of the Regions of the European Union [36], where it is expressed that the development of urban environments must be based upon a sustainable basis and the mobility of people should not be treated via partial counter-measures [36] that are strongly characterized by lack of continuity. Therefore, the European Committee proposes the guidelines, upon which the generation of SUMPs must be based [37]: (a) a sustainable method that seeks to balance social justice, environmental quality, and economic development; (b) a systemic approach that considers strategies with their derived policies, programs and practices of different sectors, levels of authorities, and administrative areas; (c) a strongly participative and transparent approach that takes into account public involvement and public awareness through the stages of the planning process; (d) a clear vision, persuasive goals, and incentives that are an integral part of the sustainable development plan.

Consequently, it is of paramount importance to apply systemic methods to the decision-making of SUMPs in order to achieve sustainable mobility [38], as it helps to reduce the negative externalities of urban growth and transportation activities [39,40]. With a systemic approach, a socially, environmentally, and economically sustainable urban environment is created via the promotion of principles, such as social responsibility (safety, equality, accessibility to transportation), climate change (use of non-fossil energy for vehicles, lowering the emissions of vehicles and infrastructures), and the efficient use of resources [41,42].

Developing a Sustainable Urban Mobility Plan is a complex, integrated process requiring intensive cooperation, knowledge exchange, and consultation between planners, politicians, institutions, local, as well as regional actors and citizens [43]. For this reason, in this study we decided to make use of the complex large-scale integrated open systems (CLIOS) systemic approach because it perfectly matches the requirements and challenges of the SUMP process since a complex process must be analysed by a method capable of describing such complex systems. An integrated process must be supported by a systemic approach whose components are integrated. Finally, a planning process that requires intensive cooperation needs to be handled via a method that uses open systems. Moreover, we decided

to use the CLIOS analysis because it has been applied previously in transportation studies [44–52] but not in sustainable mobility and SUMP promotion issues.

The advantages of such a systemic approach to decision-making in SUMP are, among others: focus on mobility (people), not on transportation (traffic) [53]; balanced development of all relevant transport modes, encouraging shared mobility approaches [53]; comprehensive set of actions that are not only focused on infrastructure, so that to achieve cost-effective solutions [53]; establishment of long-term vision plans that consider short- and medium-term delivery policies-strategies [53]; cooperation and communication across institutional boundaries; reduced promotion of car oriented approaches so that to regulate transportation demand [39]; secure, stable, comprehensive, multi-modal, efficient, environmentally and user friendly urban mobility system [37]; strategic and goal-oriented management; transparent and participative decision-making via the involvement of numerous stakeholders [54]; reduction of congestion; sustainable freight transport [39]; establishment of communication channels between different policy areas and removal of institutional barriers [55]; generation of interdisciplinary approaches and integration of different transport modes (public transport, walking, cycling) [56].

The SUMP approach was proposed in Mexico by the recently elected government as a possible solution to the problems faced by the majority of Mexican cities, including the capital, which, generally speaking, follow a 3D (dispersed, distant, and disconnected) model of urban growth, characterized by a disproportionate, fragmented, and unplanned urban expansion. This model of territorial occupation is highly unproductive, because it deepens the inequality and generates high levels of pollution, increasing the risk of climate change [57]. In Mexico, the losses for negative externalities generated by the excessive use of private cars alone—which is encouraged by the current urban planning practice—represent, per year, 5379 Mexican pesos per capita, or the equivalent to 4% of the total GDP of five large metropolitan areas that concentrate 40% of the national urban population [58]. This situation is predicted to worsen if the use of cars continues to grow. It is within this context that the Mexican government has proposed a SUMP. However, little has been said about how this plan is to be implemented, which mirrors a situation faced by many other large, fast-growing cities worldwide.

This study applies a CLIOS systemic analysis to Mexico City's SUMP in order to provide guidelines to improve its implementation. This is achieved in two steps: first, we facilitate the identification of the complexities and relationships among the systems of transportation, sustainable mobility, urban planning, and socio-economic activities, along with the recognition of their most important components and the institutions involved within the urban planning process. Second, we assess the effectiveness of the public policy strategies that form part of the Mexico City's SUMP and organize them in order of importance.

The main research question for this study is: “How can the implementation of a SUMP in a city that has not started SUMP procedures, such as Mexico City, be facilitated via a systemic approach?” This principal question can be divided in four sub-questions:

1. What are the most important components of urban environment for sustainable mobility?
2. What are the relations between them?
3. What is the system's structure?
4. What are the most important public policies for the promotion of a SUMP in Mexico City?

The paper is structured as follows. Section 2 provides a brief description of the CLIOS analysis and a general overview of its basic principles. Section 3 describes the application of CLIOS to Mexico City's SUMP and, more specifically, is divided into three subsections:

1. the representation phase of the CLIOS analysis where the reader can identify the actual problematic situation in Mexico City in terms of unsustainable development, and, the relations and complexities between the most important subsystems of Mexico City for integral development;
2. the evaluation phase of CLIOS analysis shows what subsystems and what components of them are the most important for integral-sustainable development, and secondly, how to assess and organize hierarchically the public policies-strategies belonging to Mexico City's SUMP;
3. the implementation phase of CLIOS presents the guidelines to implement the sustainable mobility plan and the mechanism that establishes how the plan is going to be monitored, reported, and verified.

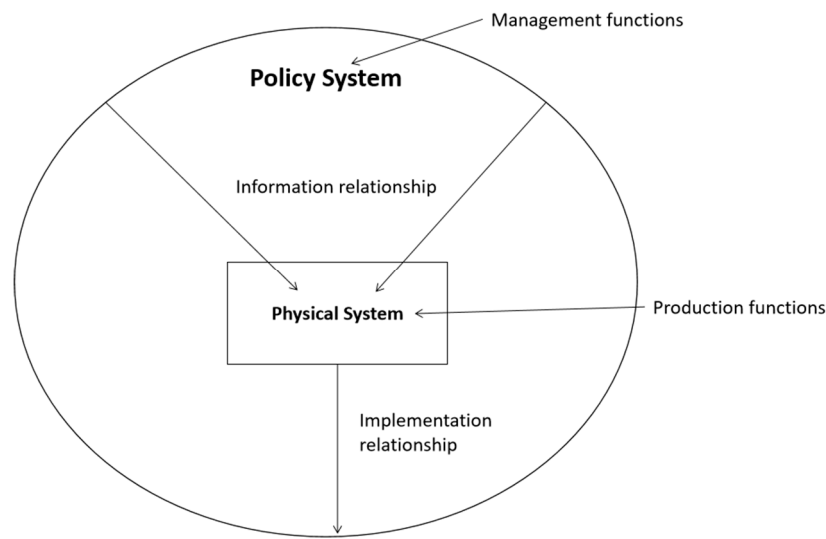
Section 4 presents the discussion part of the paper; Section 5 gives some conclusions and future avenues of research on this approach.

## 2. Materials and Methods

To provide guidelines for the implementation of sustainable mobility plans, we applied a CLIOS systemic analysis. The term CLIOS stands for complex, large-scale, integrated, open systems, and was conceived by Sussman [59] as a way to capture the characteristics of a type of system of increasing interest for researchers, decision-makers, politicians, and stakeholders. A system is complex if it is composed of interrelated elements (components and subsystems), where the degree and nature of the relationships are not well known in terms of their directionality, magnitude, and time scales. The impact of the CLIOS is of great magnitude, in terms of ample duration and geographical extension. The subsystems of a CLIOS system are integrated via feedback loops. In addition, CLIOS systems include social, political, and economic aspects, which is why they are considered open [60].

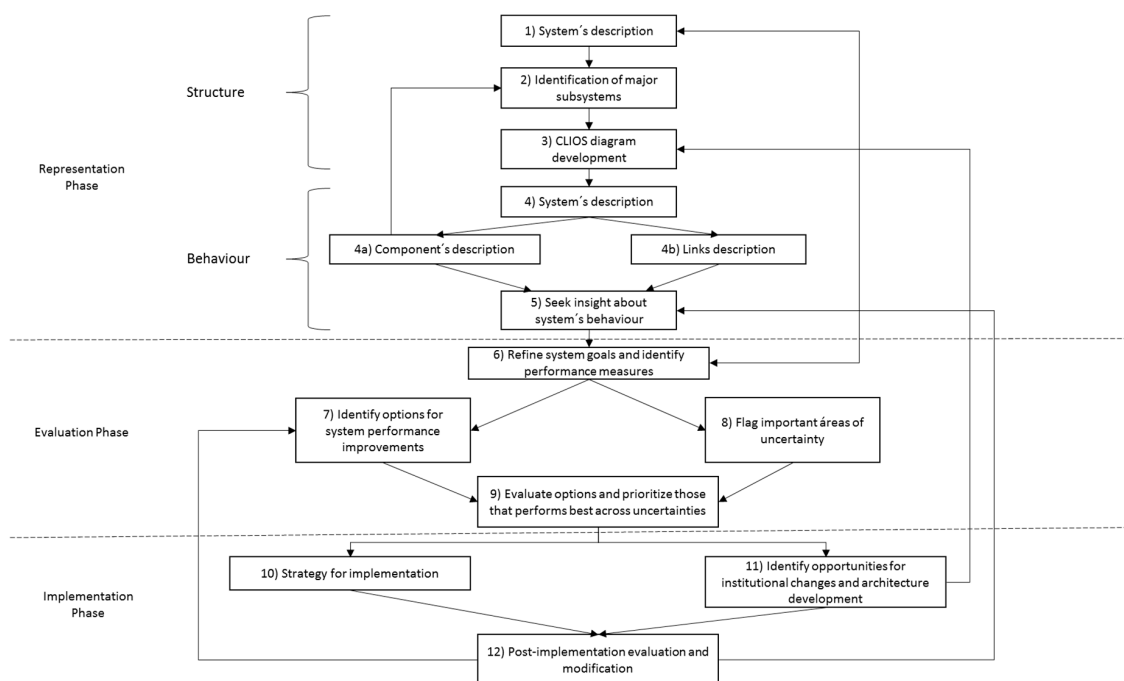
Due to the fact that the CLIOS analysis is a tool for identifying policy interventions in order to improve the systems behaviour, it is important to understand the source of the system's complexity. In this paper, we decided to think of complexity as a concept related to the four dimensions expressed by Sussman [50] and can be appreciated in the following lines:

1. internal complexity—is the type of complexity that is defined by the number of components belonging to the system and the network of interconnections between them;
2. behavioural complexity—this type of complexity is the result of the way that the sets of components interact with each other;
3. evaluative complexity—this type of complexity results from the competing perspectives of decision makers and stakeholders in the system who have different points of view in terms of “good” system performance and how to improve it;
4. nested complexity—resulting by the relationship of information implementation that exists between the policy and the physical systems (Figure 1). Policy system is the one responsible for the actions of the physical system as it informs the physical system about changes that need to happen. The physical system on the other hand, responds by implementing the commands coming from the policy system, for example, the policy system informs the physical system that a capacity paradigm of mobility is going to be followed; the physical system responds by constructing more roads for the territorial displacement of auto-mobiles.



**Figure 1.** The nested complexity within a complex large-scale integrated open systems (CLIOS) analysis. Adapted from [51].

In this section of the paper, we present the “12 Steps in a CLIOS Analysis”, showing, in a general way, what are the steps (Figure 2) that should be followed within a CLIOS analysis. However, in the results section, we explain each step in detail and provide the results of our application to the SUMP of Mexico City.



**Figure 2.** The phases of CLIOS analysis, proper elaboration based on [52].

The previous figure can be more illustrative via a brief description of the whole CLIOS process, which can be appreciated in the following lines [52]:

- the first step in the CLIOS analysis is to describe the main characteristics and challenges of the system;



- the second step of the methodology, is to determine which subsystems compose the CLIOS system and how they interact and connect with each other;
- in the third step, the determined subsystems resulting from the previous step need to be explained in detail in order to recognize the essential elements in each subsystem;
- the fourth step has as a purpose the description of the system both in terms of structure (what components form the whole system), but also in terms of interlinks (what is the nature of the relationships between the system's elements);
- the fifth step has, as a purpose, the understanding of the system's overall behaviour. This is possible through the recognition of the system's structure concerning both the physical and the policy systems;
- the sixth step aims to provide the system's identified common drivers with some necessary tools for performance evaluation;
- the seventh step permits the identification of performance improvements. The direction of these improvements can be either from the outer policy system to the physical system (outside in approach) or from the inner physical system to the exterior policy system (inside out approach);
- the eighth step considers the identification of options for the improvements of system performance via the description of the factors that cause uncertainty in the performance of the CLIOS system;
- the ninth step evaluates the system's common drivers through scenario planning in order to conclude to the most robust solutions in terms of sustainable mobility;
- the tenth step proposes a well-established process in order to elaborate the sustainable plan of mobility with its derived strategies;
- in the eleventh step of the CLIOS analysis, the structure of the policy system is analysed so that institutional changes and architecture modifications to be promoted for the elaboration of sustainable plans of mobility;
- the twelfth step establishes the necessary mechanisms, to monitor and observe whether the intended improvements in system performance actually occurred.

### 3. Results

#### 3.1. Representation Phase

##### 3.1.1. System's Explanation

In this section, we provide a list of characteristics of Mexico City, highlighting some of the most important problems that are putting the attempt to establish a sustainable mobility environment in Mexico City and its Metropolitan Area under pressure. These problems have been identified in literature review (included in the introduction and in the following lines), and are strongly related to the Mexico City's SUMP implementation attempt, as well as to the actual problematic situation in Mexico City in terms of unsustainable urban planning.

- Mexico City is a "Megacity" with more than 20 million inhabitants in its Metropolitan Zone, producing a very high demand level for mobility in order the people to cover their needs [61].
- Every day, about 17 million trips are made through Mexico City. The extensive network of public and concessional transport, as well as the road infrastructure, allows the population to access their workspaces, education, health services, as well as the transport of goods to supply the population of the city. In recent decades, this system has strengthened in terms of road safety by encouraging a gradual [35%] decline of road events [62].
- While the rate of traffic deaths has been significantly reduced, the challenges remain great in achieving an equitable and safe city. In addition to the high number of deaths (659) resulting each year from traffic events, pedestrians, cyclists, and motorcyclists remain the main victims of the car drivers driving habits. According to the Ministry of Citizen Security (SSC in Spanish), private

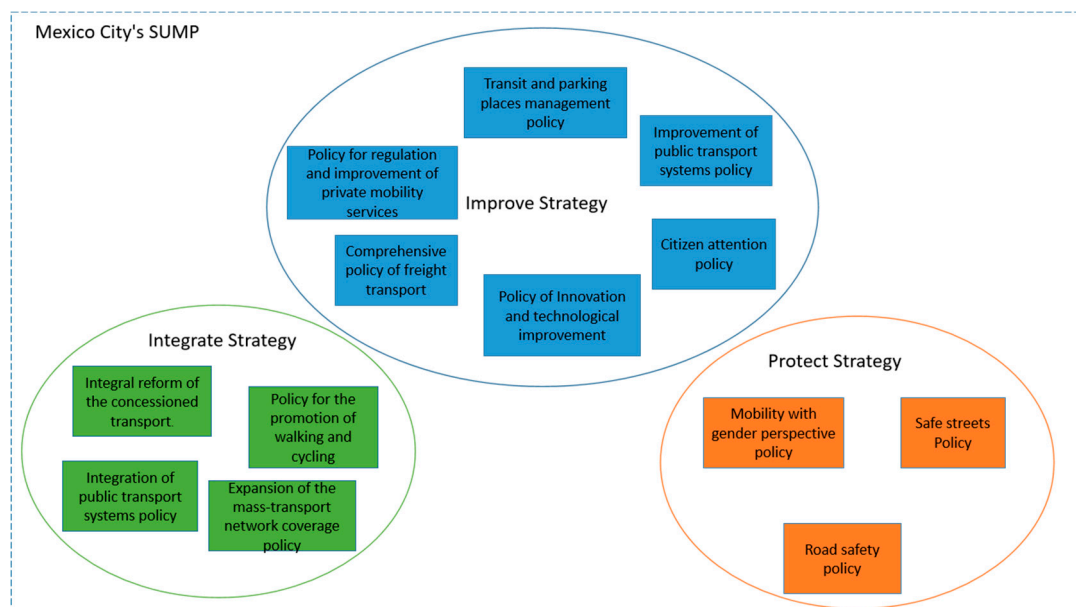
cars are involved in 50% of road events. At the same time, according to the same source, 44% of fatalities were pedestrians and only 8.5% were car drivers [62].

- These patterns of accident rates reflect that—while the mobility system as a whole is safer—the travel conditions of the most vulnerable road users have not improved: (a) the pedestrians, predominantly women of low socio-economical level, are the most exposed and vulnerable road users to traffic events. (b) Adults over the age of 61 are the most common victims of road accidents with a percentage equal to 21.7%, followed by young people aged 18 to 25. (c) Transit events are the leading cause of death in Mexico in boys and the second in girls aged 5 to 14 [62].
- The modal distribution in Mexico City can be characterized by a 57% use of public transport, followed by non-motorized usage 28% and 15% of private auto-mobiles use. While the average cost of public transport services is equal to 16 Mexican pesos considering that 50.5% of the trips total include at least two modes of transport in order for people to reach their destinations [63].
- The increased private auto usage causes several negative externalities, such as poor air quality, road accidents and congestion that not only affect the people that make use of the cars, but society as a whole [64].
- The real estate market determines the current model of urban growth in Mexico City as well as its Metropolitan Zone; until today, it has been predominantly dispersed, disordered, with low densities, without mixed uses and unsustainable. This 3D (disperse, distant, disordered) urban model demands the expenditure of a greater amount of energy for transportation and for road space allocation, a phenomenon that is reflected in the majority of Mexican cities that show a faster increase in the number of private cars in comparison to its population [65].
- The majority of investments (65%), product of public policies oriented to the mobility sector, are destined to be used in road infrastructure for private cars [66].
- The travel times in Mexico City increase steadily. In fact, the transfer times and transport modes used are very unevenly distributed in Mexico City and its suburban area. This is due to the unequal distribution of travel destination areas and to the lack of coverage and serious operational flaws of mass transit networks [67].
- There is no integrated vision of the mobility subject in Mexico City: fragmentation prevails between the different modes of transport. This is compounded by the lack of a metropolitan perspective, which fails to understand Mexico City and its suburbs municipalities as a single system of mobility. In reality, the city's mobility policies are delinked from territorial occupancy policies and programs of land use [67].
- There is no comprehensive traffic management aimed at giving fluidity and safety to the displacement of different transport modes and users. The city's cycling infrastructure is scarce, disconnected, and concentrated in the city's central areas [67].
- It is estimated that 101 trains (out of 390 trains in total) of the "Metro" mass transit system are out of operation, while their failures are continuous. Only in 2017 there were 22.195 systems failures, generating delays to millions of people a year [67]. The electrical transport system (trolleybuses and light rails) has a more acute crisis. Its 300 trolleybuses exceed 20 years of useful life, its fleet has been reduced by 12% since 2017, and only 63% of the remaining trolleybuses is in operation. In addition, a third of the light rail fleet is out of operation for a variety of reasons [67]. Furthermore, the City's Passengers Transport Network (RTP in Spanish) acquired new units in the last two years, nevertheless, 27% of its public service fleet is out of operation. Only the Metrobus (Bus Rapid Transit (BRT) system) has received investment for its expansion, but 7% of its fleet is in maintenance and has saturation problems that reduce the quality of travel [67].
- There are limited cases of established policies related to inter-modality such as park and ride, park and bike, etc., or are concentrated to the central areas of the city [67].



- It can be observed, an absence of the necessary socio-economic motives in order to establish push and pull policies and change the actual transportation paradigm from the motorized private vehicles towards public and non-motorized transportation [64].
- There are difficulties in traffic regulations concerning the territorial displacement of micromobility vehicles, such as e-scooters, hoverboards, and the connectivity of them with more “traditional” sustainable mobility modes, such as bicycles [62].
- The main driving policy (until now) is that of economic growth instead of policies oriented towards social aspects and development [52].
- Nowadays, there is a potentially extraordinary political shift for Mexico, with the election of President López Obrador in 2019, and the new government’s efforts to move from a transportation paradigm to a mobility one via the sustainable plan of mobility.

The aforementioned Federal government of Mexico, along with the government of Mexico City, proposed a SUMP with its associated strategies, policies, and lines of actions (Figure 3) in order to neutralize the actual problematic situation in terms of mobility, and to support the new mobility paradigm.



**Figure 3.** The sustainable urban mobility plan of Mexico City.

The plan is based upon three strategic axes that are called integrate, improve, and protect, respectively. The integrate strategic axis consists of the following public policies:

1. integration of public transportation systems; the focal point of this policy is based upon the unification of all the public transport services managed by the government of Mexico City into a single prepaid system. The network will count with a unified image, a single map and optimized connections between mass transit stations;
2. expansion of the mass transport network coverage; this policy is oriented toward an increase in the mass transit network managed by the government of Mexico City and the construction of the cable bus transportation system;
3. integral reform of concession transport; this policy is aimed at the improvement of concession transport (mini-buses, vans, mini-vans) and the level of service provided by this kind of transportation modes. Thus, all the circulating units are going to be equipped with Global Positioning System (GPS) platforms that will be available to the public for monitoring operation and verification of routes;

4. policy oriented towards the promotion of walking and cycling, this policy consists of the expansion of bike lanes network and the establishment of bicycle parking places next to mass transit stations (intermodalism).

The improve strategy depends on the public policies seen in the following lines:

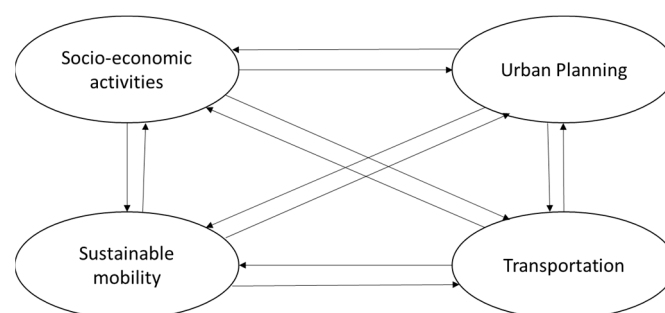
1. improvement of public transport systems; this policy is oriented towards the enhancement of public transport via the acquisition of new units (100 units for the electric transportation modes and 800 units for the public bus systems) as well as a periodical metro maintenance. Furthermore, this policy considers the remodelling of 2 modal transfer centres, the management of agglomerations in at least five Bus Rapid Transit (BRT) stations, and the implementation of exclusive lanes for public transport;
2. transit and parking places management policy, which is aimed at the integration of automated traffic light systems and the integration of parking-meter systems;
3. policy for regulation and improvement of private mobility services; this policy considers the proposal for comprehensive regulation of taxi services and the publication of guidelines for the operation of bicycle systems and micromobility vehicles;
4. policy of innovation and technological improvement, contemplating the installation of the control and innovation centre of mobility in Mexico City, as well as, the release of public transport's open data. Furthermore, this policy takes into account the establishment of comprehensive programs related to electric mobility and smart mobility in Mexico City;
5. comprehensive policy of freight transport, which is based on the publication of the strategic cargo plan for Mexico City;
6. citizen attention policy, which considers the geographic expansion of care centres.

While the protect strategy is based on the following public policies:

1. safe streets policy, which considers the establishment of safe infrastructure with elements of universal accessibility for walking and cycling;
2. road safety policy that is oriented to the behaviour change of drivers via the implementation of the good driver's decalogue and the establishment of a system of civic sanctions;
3. mobility with gender perspective policy, aimed at an improved perception of safety levels among the female public transport users, through the prevention of harassment in the transportation system of Mexico City.

### 3.1.2. Identify Major Subsystems

In our case, via the previously identified problems of Mexico City, we were able to recognize the four physical subsystems as the aforementioned problems are strongly related to transportation, urban planning, sustainable mobility, and socio-economic activities (Figure 4).



**Figure 4.** The subsystems extracted by the actual situation in Mexico City and its suburbs.

The socio-economic activities subsystem has a direct connection with the subsystem of urban planning because the population's socio-economic activities give form to the urban planning via the definition of land use. Moreover, the socio-economic activities subsystem influences both the transportation and sustainable mobility subsystems by generating aggregate transportation demand that is oriented towards vehicles and people respectively.

The urban planning subsystem provides the necessary background in order the people to realize their socio-economic activities within open (parks, sports centres) and closed (universities, schools, offices, industries) places. Furthermore, urban planning is strongly connected to transportation because according to the models of urban design, aggregate transportation demand can be generated and the usage of certain modes of transportation can be encouraged, for example, the urban sprawl with no densification patterns encourages the usage of private auto-mobiles. In addition, the urban planning subsystem influences the sustainable mobility-environment subsystem because urban planning is responsible for the establishment of accessibility via mixed land use so that the people to cover their daily activities within a compact city.

On its part, the subsystem of transportation influences the urban planning via several policies and can manipulate the city's urban development patterns, for example, transit oriented development, pacification of transit in school areas, and generation of car-free roads. Transportation through its negative externalities such as environmental pollution, road accidents, and congestion can affect the environment, making necessary the establishment of a sustainable urban mobility plan. Moreover, the transportation subsystem affects the system of socio-economic activities by offering the necessary means in order the people to travel and conclude their everyday activities.

The sustainable mobility subsystem is capable to influence transportation systems via the usage of new and more efficient modes so that the people to cover their mobility needs, such as micromobility vehicles, electric and hybrid cars. Moreover, the sustainable mobility can set the basis in order the urban planning to change accordingly, so that to encourage the pedestrian, cyclist, micromobility user, and user of public transport mobility, for example, the densification of land use close to stations of public transport and bike lanes. Finally, the sustainable mobility subsystem can influence the subsystem of socio-economic activities by providing the necessary means in order the people to cover their everyday activities without the need to use a private auto-mobile.

### 3.1.3. Develop the CLIOS Diagram via System Description

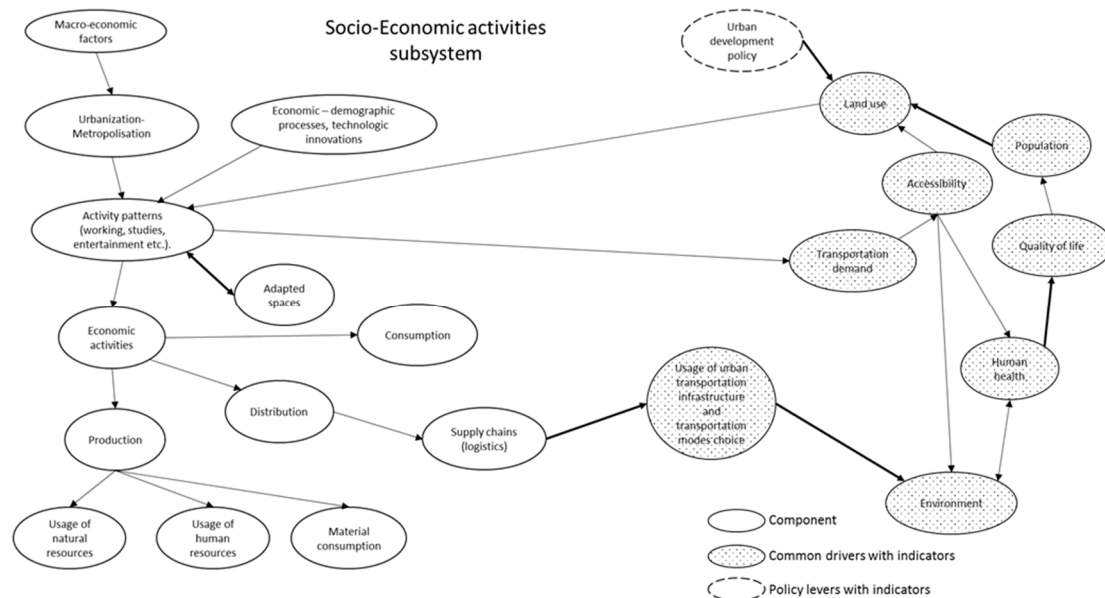
In this step, the four subsystems seen previously (socio-economic activities, sustainable mobility, transportation, and urban planning) are going to be analysed exhaustively so that to recognize the major elements in each subsystem (Figures 5–8). The nature of the system is visualized in a CLIOS analysis as a network-type diagram with nodes representing elements, and lines the relationships between them [68]. Each of these elements can be one of the three following types [51]:

- component; this is the CLIOS basic type of element and belong to the physical system;
- policy lever; the elements of this type belong to the physical system but are directly influenced by the institutions and organizations belonging to the policy system;
- common drivers; these are very important elements that belong to various physical subsystems, and, for that reason, can influence the behaviour and performance of different subsystems.

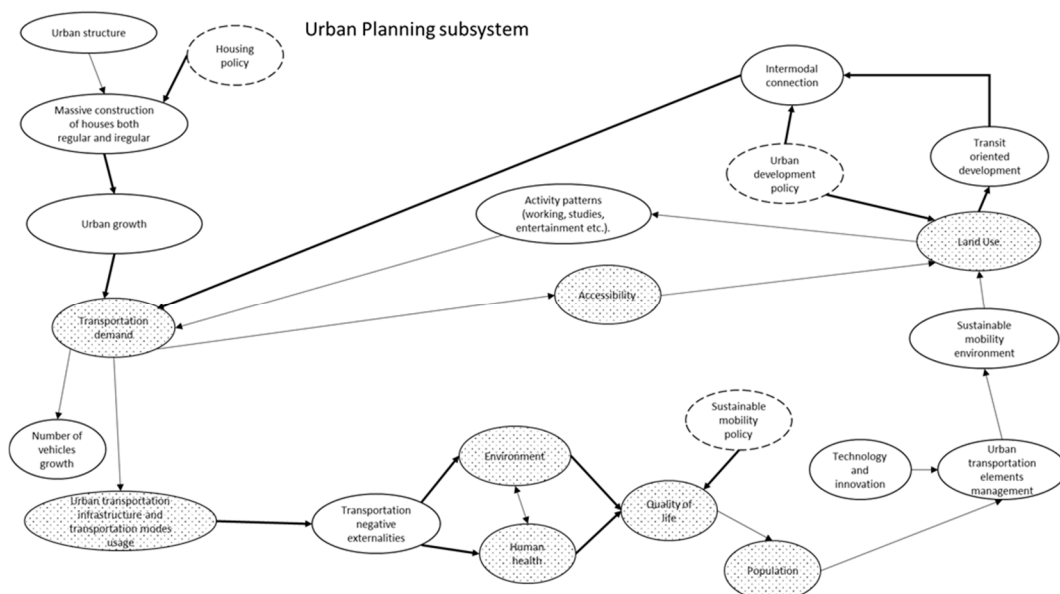
Another very important issue that needs to be taken into account within the CLIOS diagram development is the nature of the links that interconnect each element. According to Dodder and Sussman [51], the links should indicate at least:

1. the direction of influence and the existence of feedback loops;
2. the intensity of influence (important or marginal impacts on the interlinked elements).

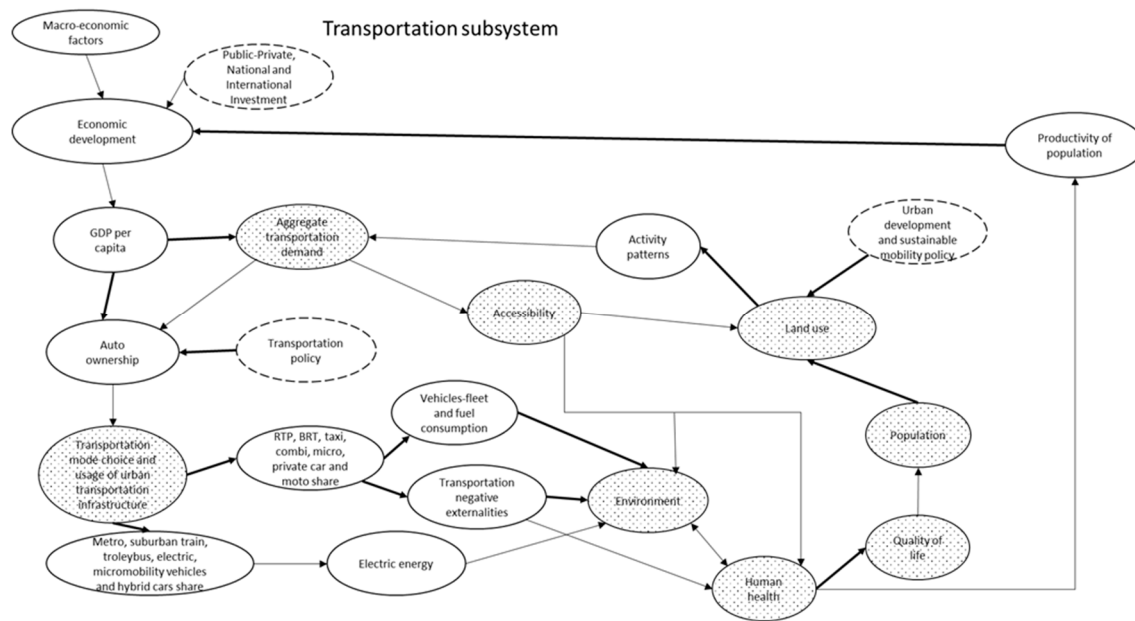
Hence, the element type as well as the characterization of the individual links for the identified four physical subsystems of our case study, can be appreciated in Figures 5–8. Nevertheless, it should be noted that the following figures are the result of an extensive literature review process where several works have been consulted [4,51,64–67], [69–79] and interlinks have been created, where at first were not obvious.



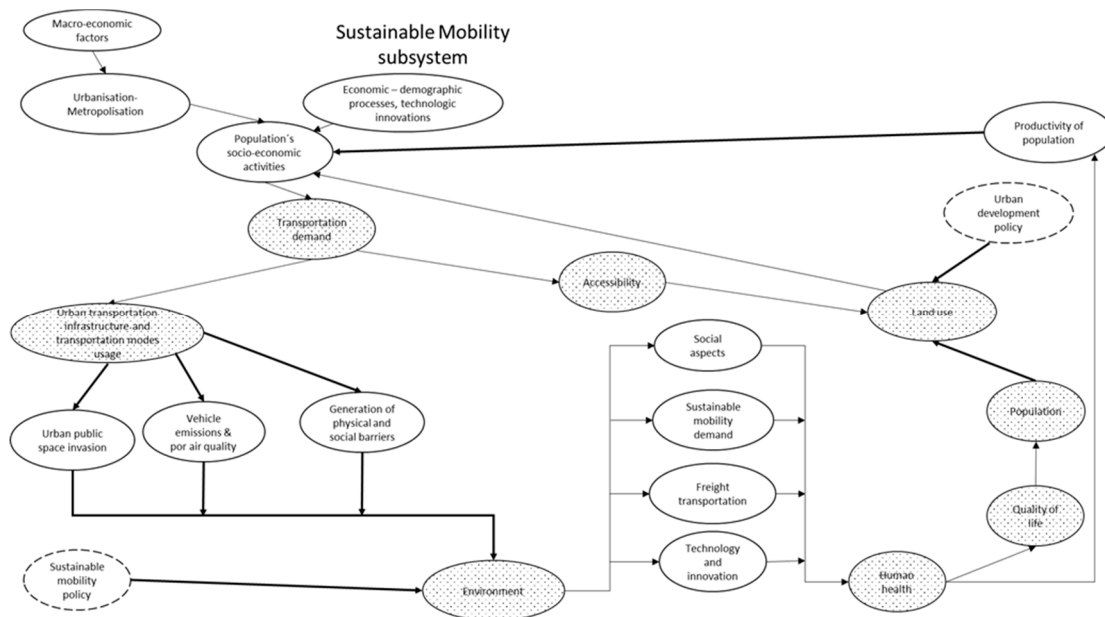
**Figure 5.** The subsystem of socio-economic activities concerning common drivers-policy levers indicators.



**Figure 6.** The subsystem of urban planning concerning common drivers-policy levers indicators.



**Figure 7.** The subsystem of transportation concerning common drivers-policy levers indicators. Adapted from [51].



**Figure 8.** The subsystem of sustainable mobility concerning common drivers-policy levers indicators.

### 3.1.4. Seek Insight about System Behaviour

In this stage, it is necessary to understand the system's overall behaviour. This is viable through the recognition of the system's structure at its different levels (both the physical and policy systems) and by asking the following types of questions concerning the relations within the policy system [52]:

- What is the hierarchical structure of the policy system, and are there strong command and control relations among the organizations (Figure 9)?
- Are the relationships between organizations characterized by conflict or cooperation (Figure 10)?
- What is the nature of interaction between organizations that both influence the same subsystems within the physical system (Figure 10)?

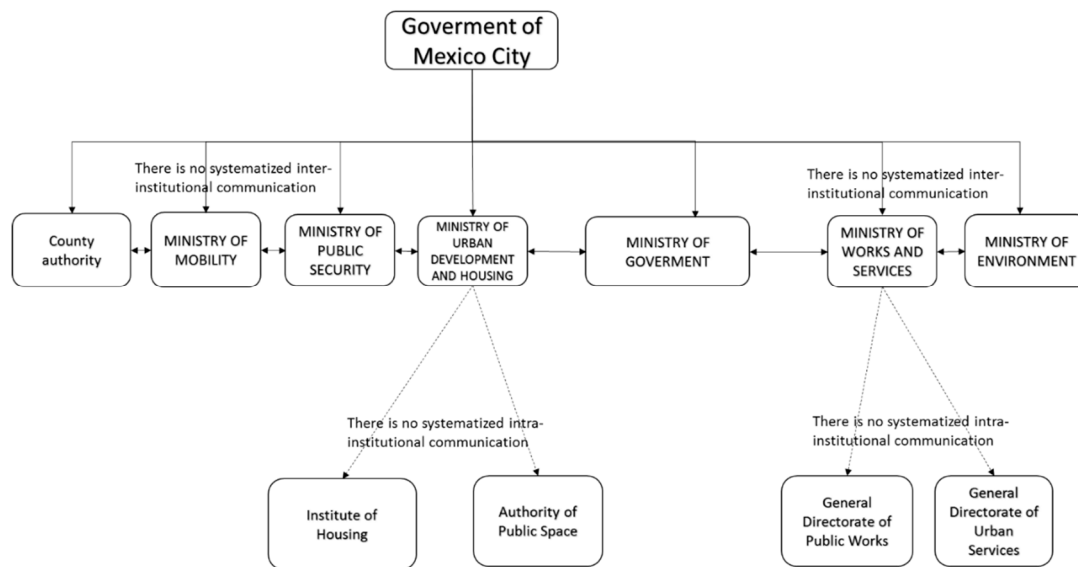


Figure 9. The hierarchical structure of the policy system.

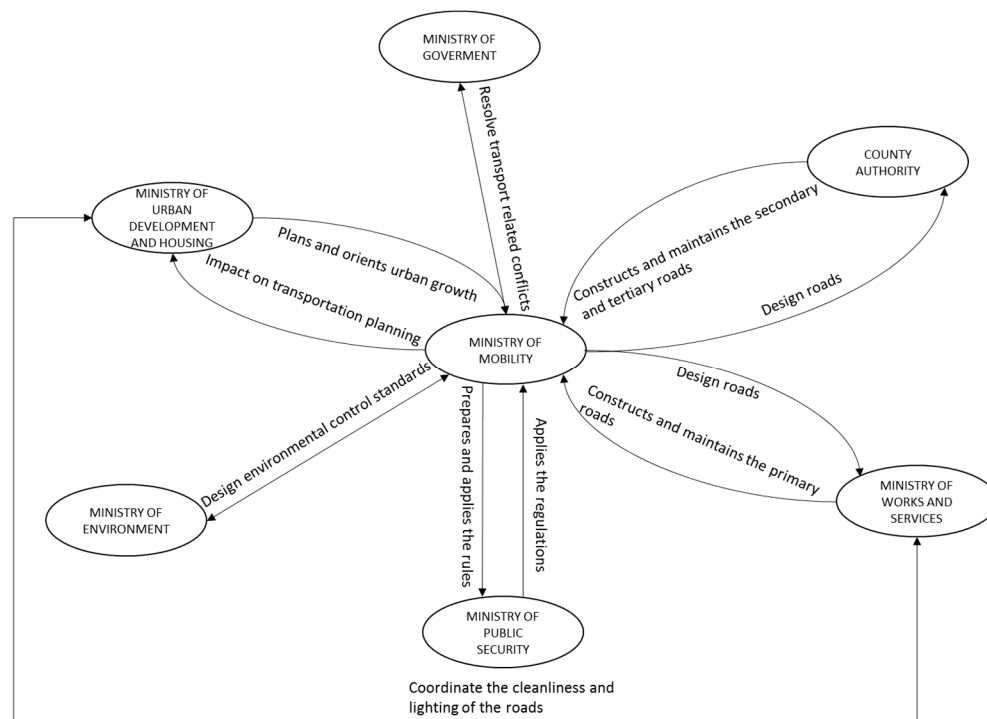


Figure 10. The relations between different organizations within the policy system. Adapted from [80].

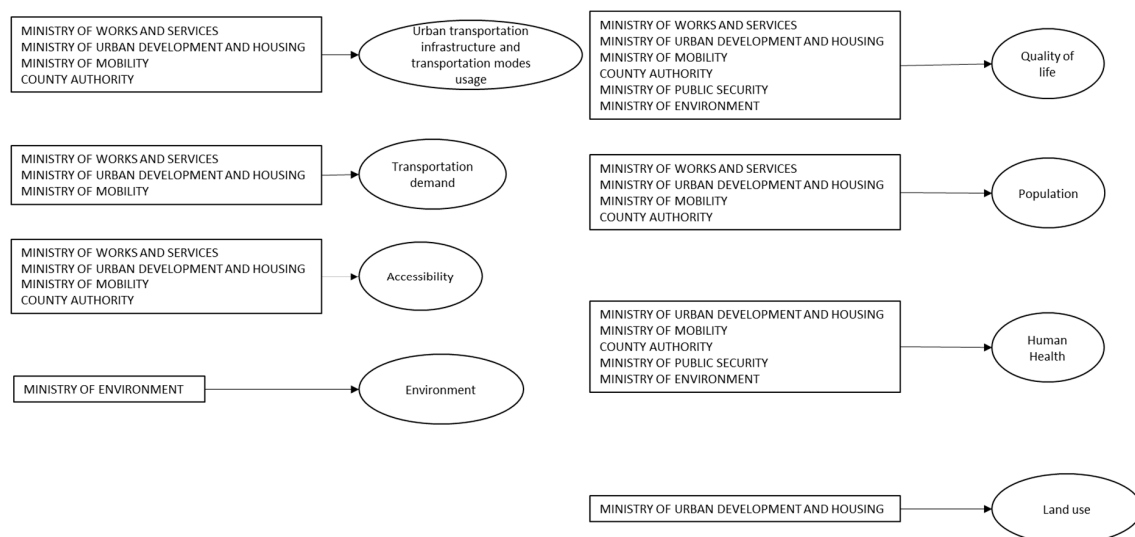
The relationships between different policy institutions are characterized, in general, by synergy due to the nature of sustainable mobility that includes issues like transportation, geography, urban planning, accessibility and environmental matters. Nevertheless, the lack of a systematized channel of communication has as a result the overlapping of activities, the incoherence of data and the difficulty to share and have access to useful data. Furthermore, the lack of a common geotechnological inventory has as a consequence the ignorance of certain infrastructure that due to the Sustainable Mobility Plan, will require a new way to see, think, build, maintain, and improve certain infrastructure of which almost nothing is known, because everything has, until now, been focused towards the auto-mobiles instead of people.



However, it is also very important for the understanding of system's behaviour to distinguish the links between the policy and the physical systems by asking the following questions [52]:

- Are there components within the physical systems that are influenced by many different organizations in the policy system (Figure 11)?
- Are there organizations on the policy system that have an influence on many components within the physical system (Figure 11)?

The components that have been characterized as common drivers as has been stated before are the most important ones due to their presence in different subsystems of the CLIOS that influences the behaviour of each subsystem and the CLIOS as a whole. For this reason, we are going to highlight the links between the organizations of the policy system and the common drivers of the physical system. More specifically, through the following figure we can appreciate the common drivers that are influenced by many different organizations belonging in the policy sphere. Moreover, we are able to identify the organizations of the policy sphere that have an influence on many different components within the physical system.



**Figure 11.** Links between the policy and the physical spheres.

### 3.2. Evaluation Phase

The evaluation phase aims to establish the required mechanisms for systems performance measures-improvements, as well as the identification of the important factors that may cause instability to the overall system's performance if not prioritized and treated accordingly within the urban planning process. The three steps contained within the evaluation phase can be seen in the following lines:

#### 3.2.1. Identify and Refine Performance Measures

The objective of this stage is to provide the previously identified common drivers with some necessary tools for performance evaluation. The performance measures that could be applied in order to evaluate performance at certain common drivers can be appreciated in the following table (Table 1).

**Table 1.** The instruments for performance measurement.

ID	Common Drivers	Unit of Measurement	Indicators
1	Policy Levers	National currency.	Level of investment for the construction of infrastructure related to private cars, bikes, and public transportation modes [66].
2	Environment	Parts per million, parts per hundred million, micrograms per cubic meter, among others.	Environmental pollutants, such as carbon monoxide, nitrogen oxides and hydrocarbons [81].
3	Human health	Road accidents deaths and injuries per municipality, road accidents deaths and injuries per census tract. Deaths and health problems caused by poor air quality per municipality, deaths and health problems caused by poor air quality per census tract.	Effects caused by poor air quality and road accidents, such as number of people who die by poor air quality or by road accidents, number of people injured by road accidents, number of people having health problems, such as asthma by the poor quality of air, etc. [21,22].
4	Population	Total population per census tract, total population per block. Number of disabled people per census tract, number of disabled people per block. Age, gender, level of studies, and salary per person.	Socio-demographic indicators. For example, total number of people living within a certain geographic area, the age, gender, income, level of studies, and the level of disability of the inhabitants of a certain geographic area [82].
5	Transportation Demand	Land use type per block, total of vehicles per intersection, total population per block.	Indicators related with the flow of vehicles and the factors that influence it, such as number of vehicles, land use type, and population concentration [71,82,83].
6	Accessibility	Number of blocks having high or very high auto-sufficiency level per census tract, number of blocks having a walk-able proximity level to various points of interest per census tract.	Indicators related with the capacity of people to cover their needs without the usage of private auto-mobiles. For instance, number of blocks that have high or very high auto-sufficiency level, proximity level of each block (number of blocks that have points of interest within 750 meters distance) [71,72].
7	Land use	Land use type per block and total population per block.	Indicators of urban planning, such as land use type per block and population concentration (number of people) [71,72].
8	Catchment area of specific means	Meters, kilometres	Indicators related to the vicinity of a stop, station, or terminal belonging to a transport line. For instance, bike sharing catchment area, public transport catchment area [84,85].
9	Urban Transportation Infrastructure and transportation modes choice	National currency, travels made by non-motorized modes of transport, private transport and public transport divided by the total number of travels realized in a city.	Level of investment for the construction of infrastructure related to private cars, bikes, public transportation modes, and indicators of modal distribution. [66,67,72,86].
10	Quality of life	Road accidents deaths and injuries per city. Deaths and health problems caused by poor air quality per city. Number of people with access to health services per city, number of homicides per city. Number of time spent in the traffic (minutes-hours) per day. Number of friends and familiars per person.	Indicators associated to the different dimensions of life's quality. For example, education level, work, social capacity, security, health, environment etc. [87].

### 3.2.2. Identify Options for System Performance Improvements

In our case of CLIOS analysis, the options that have been identified for the improvement of system's performance can be seen in the following lines.

- establish metadata norms in order to enhance the interoperability of data as well as the communication and the data searching between the organizations that belong to the policy system (inside out);
- generate an inventory related to the urban transportation infrastructure and the urban surroundings that are associated to the sustainable modes of transportation in order to be able to evaluate their levels of coverage and functionality (inside out);
- institute a systematized channel of communication between different organizations of the policy sphere in order to avoid the overlapping of activities, data incoherence, and simultaneously to enhance data sharing and the co-management of the sustainable urban mobility in Mexico City (inside out);
- integrate the city's different transport systems, promote active transportation modes and usage of public transport (outside in);
- improve the infrastructure and existing transport services with the object of increasing the accessibility of the people, decreasing transfer times, improving travel conditions, and making more efficient the transportation of goods (outside in);
- protect the users of different systems of transport through the provision of infrastructure and inclusive, worthy and safe services (outside in).

### 3.2.3. Flag Important Areas of Uncertainty

In our study, the most important elements that need to be managed primarily so that to not generate instability and uncertainty in the system's behaviour are the common drivers (seen in Table 2), that truly are essential components for the establishment of a sustainable mobility environment. The question that arises is how to prioritize these common drivers in order to evaluate public policies and promote the ones with the highest positive impact to the CLIOS system (seen in Section 3.2.4).

### 3.2.4. Evaluate Options and Select Robust Ones that Perform "Best" Across Uncertainties

In this step, the identified common drivers were evaluated through scenario planning in order to conclude to the most robust solutions in terms of sustainable mobility. One way to represent robustness is through a matrix (Tables 2–4), where the columns represent different scenarios (which may be combination of common drivers that tell a "story" about the political, urban planning, mobility, accessibility future of Mexico City). On the other hand, the rows of the matrix represent strategies belonging to Mexico City's sustainable mobility plan (seen in Figure 2) that influence the common drivers of the study. By that way, we are able to see how the strategies perform across different common drivers, as well as, the justification of the relationships between them. The logic for filling up the Tables 2–4 is to highlight the influence that each of the public policies (row) has upon the common drivers (column). For example the creation of safe infrastructure that permits unhindered walking and cycling is able to change the physical characteristics of Urban Transportation Infrastructure (UTI) and to encourage the use of such sustainable modes that will eventually affect positively the accessibility of people, human health (through active transport), quality of life (via safety and inclusiveness), land use change through urban design, permitting the densification of land use in places where bike lanes, and pedestrian zones are built so that the people to interact more with the city and its features. Finally, a policy of this nature is going to affect the city's population via civic awareness (education) so to respect the specially designed places (e.g., ramps).

**Table 2.** Hierarchical structure of public policies concerning the protect strategy via CLIOS.

Policies for Urban Mobility Resulting from Mexico City's Sustainable Mobility Plan	Transportation Demand	UTI and Transportation Modes Usage	Common Drivers					
			Environment	Accessibility	Human Health	Quality of Life	Population	Land Use
Safe infrastructure with universal accessibility in order to freely walking and cycling.		X (the transportation infrastructure needs to adjust to the mobility's necessities of people with different capacities so that to use modes of sustainable transportation).		X (physical and social accessibility).	X (active transport).	X (safety and inclusiveness).	X (education and capacitation).	X (urban design).
Road security policies oriented to behavioural change.		X (safe infrastructure).			X (road security).	X (safety).	X (education, capacitation).	
Mobility with gender perspective policy.		X (Transport services that consider the destinations and women travel hours.				X (safety).	X (education, awareness).	

**Table 3.** Hierarchical structure of public policies concerning the integrate strategy via CLIOS.

Policies for Urban Mobility Resulting from Mexico City's Sustainable Mobility Plan	Common Drivers							
	Transportation Demand	UTI and Transportation Modes Usage	Environment	Accessibility	Human Health	Quality of Life	Population	Land Use
Integration of public transport systems policy.	X (the integration of public transport systems will make easier the usage of public transport via intermodalism).	X (establishment of the necessary infrastructure that will make possible the integration of public transport systems).		X (social accessibility).			X (better quality of service, commodity).	
Expansion of the mass-transport network coverage policy.	X (an improvement in public transport system regarding coverage can increase public transport usage).	X (construction of new lines of public transport).	X (reduction of environmental pollution).	X (physical accessibility)	X (active transport due to the fact that the user of public transport when it is not on the bus it is a pedestrian or cyclist).	X (increase in social interaction among public transport users).	X (the public transport infrastructure is going to be installed where there is a great number of people).	X (urban design that benefits the city's land uses).
Integral reform of the concession transport.		X (fleet renewal).	X (fleet renewal that means a better technology of vehicles and less environmental pollutants).			X (due to the advances in urban space and the environment).	X (working opportunities).	
Integration of bicycle usage to the mobility system.	X (the establishment of a friendly environment in terms of cyclist mobility is able to generate an increase in bicycle usage).	X (construction of bike lanes, expansion of Ecobici bicycle sharing project, establishment of the cyclist infrastructure that permits intermodalism).	X (reduction of environmental pollution).	X (physical accessibility).	X (active transport).	X (due to the advances in urban space and the environment).	X (the bike infrastructure is going to be installed where there is a great number of people).	X (urban design that benefits the city's image and the city's land uses).

**Table 4.** Hierarchical structure of public policies concerning the improve strategy via CLIOS.

Policies for Urban Mobility Resulting from Mexico City's Sustainable Mobility Plan	Common Drivers							
	Transportation Demand	UTI and Transportation Modes Usage	Environment	Accessibility	Human Health	Quality of Life	Population	Land Use
Improvement of public transport systems policy.	X (a considerable improvement in public transport system in terms of coverage, travels frequency and comfort is able to generate an increase in the public transport modes usage).	X (fleet renewal, construction of new lines of public transport, construction of new accessible infrastructure).	X (fleet renewal that is friendlier with the environment).			X (due to the advances in urban space and the environment).	X (better quality of service, commodity and frequency of service).	
Transit and parking places management policy.		X (roads infrastructure and parking places management).						
Policy for regulation and improvement of private mobility services.		X (Regulation of new mobility systems: micromobility vehicles and dockless bikes. Regulation and improvement of the traditional taxi system and the application-based taxi system).						
Policy of Innovation and technological improvement.	X (alternative transportation demand, e.g. working via internet).	X (e-mobility).					X (better quality of service, commodity, information about travels).	
Comprehensive policy of freight transport.		X (e-mobility, usage of infrastructure).		X (location of distribution centres-logistics).				X (urban design for freight transport).
Citizen attention policy.						X (inclusion via participation).	X (enhanced links with the public).	

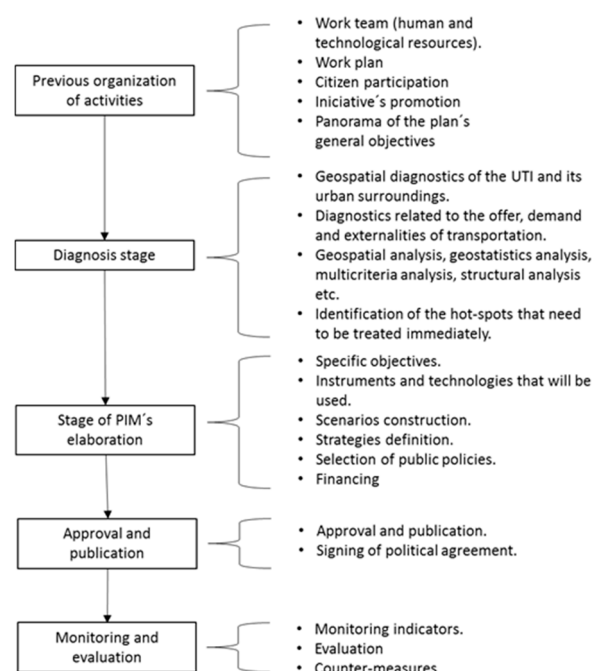


### 3.3. Implementation Phase

In this phase are proposed the necessary steps in order the Mexico City's sustainable mobility plan to pass from the conceptual world to the real one and be implemented. Hence, within the implementation phase, it is important to define the strategy for SUMP implementation, along with the understanding of opportunities concerning institutional changes and the establishment of post-implementation mechanisms for monitoring, reporting, and evaluation.

#### 3.3.1. Strategy for Implementation

Once the prioritization of different strategies has been viable through the method of scenarios, we can propose a process in order to elaborate the sustainable plan of mobility with its derived strategies. The process for the implementation of the SUMP can be appreciated in the following lines (Figure 12):



**Figure 12.** Process of Sustainable Urban Mobility Plan (SUMP) elaboration, adapted from [65].

#### 3.3.2. Identify Opportunities for Institutional Changes and Architecture

- Establish metadata norms in order to enhance the interoperability of data, as well as the communication and the data searching between the organizations that belong to the policy system and are working towards sustainable mobility.
- Generate an inventory related to the urban transportation infrastructure and the urban surroundings that are associated to the sustainable modes of transportation in order to be able to evaluate their levels of coverage and functionality. The previously mentioned inventory will be used by all the organizations that belong to the policy sphere of the CLIOS analysis and will be enriched according to the investigation made by them.
- Institute a systematized channel of communication between different organizations of the policy sphere in order to avoid the overlapping of activities, data incoherence, and simultaneously to enhance data sharing and the co-management of the sustainable urban mobility in Mexico City.

### 3.3.3. Post-Implementation Evaluation and Modification

Once the strategies-public policies have been implemented, the following step is to monitor if the expected improvements in system performance actually occurred. However, the capability to monitor the success of policy options is often absent, and therefore one may include monitoring systems as part of the strategy for implementation. For this reason, it is proposed through this paper to incorporate the SUMP's generated indicators to a Measuring Reporting and Verifying (MRV) mechanism in order to clarify the processes related to the generation of the indicators, for example via the MRV mechanism we will be able to know who measures, who reports, who verifies etc. This mechanism was chosen for the following reasons [88]:

- it facilitates decision-making and planning;
- it supports the implementation of the established action lines and generates feedback on their effectiveness;
- it promotes coordination and communication between the issuing sector;
- it generates comparable and transparent information;
- it highlights good practices.

The first letter composing the MRV mechanism is the “M” that stands for measurement and/or monitoring, in this stage it is included a set of actions whose objective is to determine the values of the parameters that were taken into account. The measurement is used to compare the actual results with the goals established for a specific indicator. However, in a broader sense, the “M” also means, “monitoring”, referring to the monitoring process of an indicator that is carried out over a determined period of time, in order to compare the results with the estimated values [89]. The letter “R”, refers to the reporting stage, which follows the previous measurement-monitoring stage. The reporting stage includes the relevant information pertaining to mitigation measures, such as, the indicators that have been used and the calculation methods for each one of them. This report can be done at a national or international level depending on the particular objectives of the project [89].

Finally, the letter “V” corresponds to the verification process of the previously measured-monitored and reported phases. This phase is related to all the activities undertaken so that to validate, compare, evaluate or provide an opinion upon the accuracy of the measurements with the objective to improve project execution and obtain better results. The verification—depending on the particular objectives of each project—can be carried out by the same institutions that implement the program or by a third party [89]. Some important questions (Table 5) need to be used as a guide within the MRV process in order to provide information about the required parameters of each phase.

**Table 5.** Structure of MRV [89].

Measurement	Report	Verification
How to measure?	What to report?	What to Verify?
What sources of information are used?	How to report?	How to Verify?
When to measure?	When to report?	When to Verify?
Who measures?	Who reports?	Who Verifies?
What actions and/or assumptions are necessary in order to carry out the measurement and monitoring phases?		

The answers to the above issues allow the MRV mechanism to be clear and accurate for the objectives required, whichever is the sector in which the mitigation strategy is developed. The MRV mechanism should consider all kinds of indicators that may be useful, with relatively simple way of measurement in order to enable the governmental agents to follow up the proposed strategies. Likewise, it is necessary to gather all the elements that may support the whole process, which means better databases need to be generated with greater reliability and accuracy.

#### 4. Discussion

Based upon the studies seen in the introduction section of the paper [37–56], we decided to apply the CLIOS systemic analysis to Mexico City's SUMP, in order to provide guidelines to improve its implementation and to serve the present study as a point of reference for other cities around the world that have not adopted SUMP procedures. The soundest part of this study is the theoretical construction of a set of subsystems related to the Mexico City's urban structure that permits the identification of the most important components and the type of connections between them. By that way, the decision makers are able to realize what the types of complexity between the different subsystems are, how the systems behave, and what has to be done in order to support the new mobility paradigm in Mexico City.

Moreover, through systems theory we were able to realize that the most important elements for sustainable urban mobility are accessibility and land use due to the fact that sustainable transportation modes (walking, cycling, and public transport usage) do not have the capacity to cover long distances. Therefore, it is necessary the existence of high density patterns close to the people's habitat in order to cover their everyday activities without the need to use a car.

In addition, human health, environment, and quality of life are also very important components that need to be taken into account within the sustainable urban mobility framework as the establishment of sustainable transportation modes has the ability to affect positively both human health through active transportation and the environment via the reduction of the pollution generated by private motorized transport, leading, as a consequence, to a better quality of life.

Furthermore, it is worth mentioning that equally important within a sustainable mobility framework are the population, transportation demand, and infrastructure and transportation modes usage. This is because population is capable to generate aggregate transportation demand and considerable urban transportation infrastructure usage. On the other hand, transportation demand and urban transportation infrastructure set the background for the territorial displacements of people and define their everyday travels.

Through the identification of the previously mentioned common drivers we were able to generate logical connections with the public policies and strategies belonging to the Mexico City's SUMP so that to organize them in order of importance. Our findings show that the most important strategy in terms of influence upon the common drivers is the "integrate" one and the most important policies are the integration of bicycle usage to the mobility system and the expansion of the mass-transport network. Once this integrate strategy is well established, then we might want to continue with the "improve" strategy. This one is related to the improvement of public transport systems and followed by the "secure" strategy, with its policy named safe infrastructure with universal accessibility, in order to allow free walking and cycling.

Finally, concerning more technical, short-term objectives, this paper proposes the following lines of action in order to help the implementation of Mexico City's SUMP:

- form mechanisms such as metadata norms that enhance interoperability of data and data searching between institutions residing within the policy system and are oriented towards sustainable mobility planning;
- develop a shared diagnostic apparatus (inventory) that considers urban transportation infrastructure and city's urban environment coverage and functionality so that to create a friendly habitat for pedestrians, cyclists and users of public transport. This apparatus will be updated periodically according to the research made by the institutions that belong to the policy sphere of CLIOS analysis and will be strongly characterized by continuity;
- establish a formal channel of communication that permits the on-time connections between different organizations of the policy sphere so that to strengthen the co-management activities of sustainable urban mobility in the city of Mexico and to avoid the phenomena of data incoherence and activities overlapping.

## 5. Conclusions

The twentieth century was decisive for the urbanization of the world as economic, social, cultural, and political processes, such as globalization in conjunction with population growth, caused the expansion of cities [90]. Hence, the cities needed to be remodelled as they faced overpopulation, peripheral formations and metropolisation. The structure of the city had transformed into a diversified, multinuclear form, with high rates of environmental pollution and internal insecurity [90]. This situation resulted in the disorder of urban space, the deterioration of public space, the weakening of links between communities and the massive exodus to the periphery of many people, generating the phenomenon of suburbanization [91]. Through the phenomenon of suburbanization, it became apparent that travels within cities and from cities to other regions were essential. Transport then emerged as a key element for urban development [92].

However, the 21st century introduced new challenges to which the concept of transport failed to respond, such as environmental problems, major congestion, the invasion of public space in order to build new roads and move vehicles, noise, barrier effects, the inclusive-equitable management, and the humanization of urban management [51,92,93]. Therefore, the literature shows a transition from one approach in terms of transport to one in terms of mobility [90,94–102]. It is worth mentioning that this shift from transport to mobility means moving from an approach oriented to the movement of vehicles and the infrastructure necessary for them, to a mobility approach interested in the movements of individuals [90].

The performance of the transportation system has the capacity to influence several other subsystems within an urban and metropolitan area due to the interlinks between them. The transportation/urban planning/and sustainable mobility subsystems are very important elements in a megacity or a fast growing urban area as the impact of transportation on the environment and land use affects the level of socio-economic activities, which will ultimately influence the people's quality of life and will make necessary the promotion and usage of more sustainable and efficient ways of transport [103–105]. Thus, transportation and urban planning via their associated strategies-public policies and decision-making indirectly determine the vision of the community's quality of life through the establishment of strategic transportation investment and system operations directions for a geographic area.

Because of the transportation's relation with other essential subsystems of a city's urban structure, a system's approach has been suggested to be part of the concept of sustainable development oriented planning [104,106–108]. The systemic approach takes into consideration whole systems, instead of assessing each of the system's components separately; this requires comprehensive and interdisciplinary research methods, which is time consuming and data intensive, but provides more useful information.

Nevertheless, big cities, such as Mexico City, are experiencing and will continue to experience significant growth, so it is very important to be able to deliver integral and holistic plans of mobility in a successful and sustainable manner. Experience with cases and projects in the past have given us insight into the failures and, according to Klynveld Peat Marwick Goerdeler (KPMG) [109], these experiences show that we need to take some points into consideration if we want to succeed:

- project environment and turbulence;
- political control and sponsorship;
- role of national government;
- effectiveness of the plan;
- effectiveness of procurement and financing;
- operations organization.

Considering these facts, this study applied a CLIOS systemic analysis to Mexico City's Sustainable Mobility Plan in order to provide guidelines to make its implementation more effective. This was achieved in two steps: first, we facilitated the identification of the complexities and relationships among the systems of transportation, sustainable mobility, urban planning, and socio-economic activities, along with the recognition of their most important components and the institutions involved within

the urban planning process. Second, we assessed the effectiveness of the public policy strategies that form part of the Mexico City's Sustainable Plan of Mobility and organized them hierarchically.

This paper can contribute in promoting and organizing, in order of importance, transportation-urban planning policies, which can mitigate the problems of urban-metropolitan regions with respect to inaccessibility and private auto-mobility overuse. It is expected that a strategy or policies of sustainable mobility can play their role in alleviating the low-income families (that do not have necessarily the opportunity to own a car) by reducing the times needed for territorial displacement via alternative transportation modes, improving by that way the competitiveness of population, urban development and quality of life.

In addition, the present work provides evidence on how certain components of urban structure within a megalopolis, such as Mexico City, are linked to various public policies—strategies, so that governmental decision-makers can assess the effectiveness of public policies—strategies according to the co-benefits that their implementation would mean to the aforementioned urban structure components.

However, there are some aspects that need to be considered in order to further enrich the sustainable development oriented planning [108]:

- the establishment of sustainable mobility within a huge metropolitan area as that of Mexico City it is not a easy task that will be solved in an instant. There is the need to change the way transportation issues are conceptualized and, therefore, to establish long-term goals that will last for different re-election cycles so that to assure continuity. Moreover, it is essential to interlink these goals to certain time plans in order to facilitate the implementation process;
- sustainable mobility takes into consideration various aspects such as transportation, land use, socio-economic activities, accessibility, the environment, and quality of life. Therefore, it is necessary to treat sustainable mobility matters via interdisciplinary and systemic approaches that permit the examination of the system's totality in order to identify the vision, system goals and objectives as well as the impacts. Furthermore, configurations related to SUMP within a megacity, such as Mexico City, need to consider multiscale analysis due to the collaboration between different states, counties, municipalities, and localities.
- the planning of sustainable urban mobility is a strongly political process, as the decisions taken into the policy sphere set the basis for the SUMP application and its outcomes are often influenced by the opinions of different political institutions and lobbies. The procedure consists of dealing and looking for consensus among stakeholders with sometimes different points of view. Hence, an effective planning process must have the ability to incorporate new information for comparative evaluation of alternatives and to provide the opportunities to all stakeholders to be involved and to be able to influence in the decision making process;
- the institutions responsible for the sustainable mobility planning need to count with the institutional structures and the skills needed to implement, operate, and maintain sustainable mobility projects within transportation systems. In addition, the ideas, cultural norms, orientations, and processes that the institution's elements adopt are suggested to be those that comply with the principles of sustainable mobility.

The next step to consider is the combination of the CLIOS analysis with quantitative, geospatial and participative methodologies in order to evaluate mobility plans with their derived strategies and public policies, and to be able create global indexes that could reveal to the public authorities the quality of urban mobility within certain geographic areas by taking into account the perception of the people.

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