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Title: ANALYSIS OF THE ORGATIZATIONAL SCHEME OF THE INTEGRATED PUBLIC TRANSIT OF BOGOTA

Reviewing team WCTR-Rio

According to the response to my submission, I am pleased to send the amended version of my paper for consideration on the publication process of the conference.

Below you can find the corresponding answer to each of the reviewers of my article.

I expect that the modifications made to the final paper are adequate and I am eager to continue the publication process of my manuscript and work in future editions of the conference.

Yours sincerely,

Yisseth Scorcia Tenjo, Msc.

Response to the comments from the editors and reviewers:

Reviewer #1:

Comment: This is an interesting topic and important one. The paper nicely sets a framework, methodology but describing several models and then examining a case study. However for the first part I was surprised by the relatively few references. The conclusion should first focus on the general broad issues that are important to conclude before moving to discuss specific conclusions for the case study. I think there is a typo in the title.

Response: According to the recommendations it was included an additional number of references in the first section, both from the local government and additional academic researches. In terms of the conclusion, it was included a section regarding the more general issues, integrating them to the more specific conclusions. The typo in the title was fixed.

Reviewer #2:

Comment: Where is decision-making in this model (P.5)? The paper should address the key issue: separation of administration (government-for policy, incl. fare integration) and service suppliers (preferably the private sector). And then whether there is a competition for the market or in the market. Now, it seems according to figure 2 that these functions are mixed and government also is a service supplier. Why would Transmilenio be involved in resource acquisition? Why cannot that be left to the private sector service suppliers? The proposed scheme ignores the effect of politics in the system planning and operation. Would not a major simplification be achieved if the government had a reduced role of policy, quality regulation, fare integration, and enforcement. The private sector would supply the services in that framework. Admittedly, these comments are theoretical and do not appreciate the difficult issue of approval and implementation. Maybe the proposed system is the one that can be approved in Bogota. The author should also address the likelihood of getting his scheme approved and implemented.

Response: Reflecting on the comments by the reviewer some changes were proposed to the paper. In terms of clarification, the model does not explicitly address decision-making although it can be inferred, as shown in the analyses, its role in the analyzed structure. The issue highlighted for the reviewer as key, public-private separation, is addressed alongside the paper and it was more directly mentioned in the problematic and the different analyses. It was also clarified that from the perspective of the model resources acquired by Transmilenio are limited only to infrastructure and material basis for the system. There were included several recommendations and conclusions regarding the redefinition and strengthening of boundaries in the discretions regarding specifically the roles of government and private agents. The described system is the one being currently implemented in the city. However, the proposed modifications to the organizational structure based on the analyses made through the VIPLAN model seek to address the weaknesses of the official model of the SITP now in operation. A brief analysis regarding the limitations of the proposal and the likelihood of its adoption was as well included.

ANALYSIS OF THE ORGANIZATIONAL SCHEME OF THE INTEGRATED PUBLIC TRANSIT OF BOGOTÁ

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ABSTRACT

The aim of this paper is to analyze the organizational scheme of the Integrated Public Transit in Bogotá –SITP-. From the study of various methodologies applicable to this case is determined that the Viable System Model is the one that meets the requirements for evaluating the structure. The analysis is done through the VIPLAN method, and based on the findings a proposal of the adjustments is developed for the organizational structure of a complex transport system that represents a novelty in developing cities.

Keywords: Transport, Bogotá, SITP, VIPLAN, Viable System Model, Unfolding of complexity.

INTRODUCTION

The public transit of Bogotá (Colombia) is a traditional organization with no clear structure of administration. This has produced a disorganized operation, sharp competence and low quality service that can be easily observed in the daily operation (Departamento Nacional de Planeación, 2010). Nowadays, the local government is working in the structure of an Integrated Public Transit for the city, SITP for its acronym in Spanish. This is a result of a series of technical studies and the analysis of local and national transport policies, as well as the objectives of the land use plans and the district's development (Departamento Nacional de Planeación, 2008; Departamento Nacional de Planeación, 2010; Transmilenio S.A. 2009). In order to improve the city's mobility, it is proposed the integration of different actors that are involved in the transport under a single figure (Alcaldía de Bogotá, 2006).

Considering that the SITP is currently in the late stage of its planning process, an academic evaluation from the organizational perspective results not only pertinent but may help to shade light over possible improvements in the design of the organizational structure and the consistency with the objectives of the system.

SITUATION OF ANALYSIS

For several years, Bogotá has suffered from many problems related with mobility which persists despite the beginning of the transformation of public transit as a result of various efforts, such as Transmilenio. Among the leading causes of the low quality in the system are: 1) An inflated fare in relation with the real cost of the service, causing oversupply even in lower demand periods; 2) A weak government agency at the institutional level, which allow that transport providers have a high power to make decisions; 3) Institutional arrangements that allow the use of perverse incentives; 4) An attractive system due to the possibilities of easy remuneration, which contributes to feed the vicious circle of oversupply and low quality service (Ardila, 2005; Gakenheimer, 1999). As a solution of this, the SITP aims to reorganize public transit under a unique figure that allows eliminating institutional and operational conditions that limits the quality of service in the city (Alcaldía de Bogota, 2009).

Organizational Diagnosis

The national government, being aware of the transport problematic in the country, created the National Urban Transport Program, PNUT onwards, as part of a set of strategies to improve the public transit systems in the main cities of Colombia. (Secretaría Distrital de Planeación, 2009). In the same vein, the District has adopted the Master Plan of Mobility, PMM, in which it is defined the creation of the Integrated Public Transit of Bogotá (SITP), the focus of this investigation (Departamento Nacional de Planeación, 2010).

On the one hand, there is a centralized administrative figure created through the agreement 257 of 2006, the Secretary of Mobility of Bogotá. This is responsible of determining the necessary guidelines to ensure the mobility of the city as well as to comply with the Master Plan. Besides that, there is the Urban Development Institute (IDU), in charge of the construction of the necessary infrastructure (Departamento Nacional de Planeación, 2010). In this sense, both institutes are in charge of the planning and execution of the works.

On the other hand, there is Transmilenio that according to the act 310 of 1996 is the managing entity of the massive transit system (Departamento Nacional de Planeación, 2010).

These official institutions interrelate with other actors in the provision of public transport, including registration companies, providers, bus owners, syndicates, control entities and users. This makes the institutional scheme a complex problem that requires better articulation and control from the institutions to ensure an adequate operation. This composite interrelation of actors, the variability of their interests and actions, the lack of control and the competition for the market between an official system and a traditional one result in the problems identified in the diagnosis by Ardila (2005).

The SITP intended to create a system that allows integrating the different modes of public transportation using the best elements of different types of fleet and services that operate today. It is expected that this system improves the quality and level of service as a way to

discourage the use of private car and enhance the life quality of the inhabitants of the city (Departamento Nacional de Planeación, 2010; Alcaldía de Bogotá, 2006).

However, it is necessary a radical transformation to reach the objectives. One of the biggest problems at the institutional level is the existence of numberless organizations in charge of specific aspects related with mobility. Their disarticulation, low technical capacity and power of decision require of pivotal changes in order to achieve the transformation ambitioned by the SITP. The important number of micro-entrepreneurs, owners of few vehicles, and registration companies (owners of the right to circulate) limit the room for manoeuvre in terms of control and planning, adding to insufficient institutional capacity to ensure the adequate provision of the service. Hence, the organizational barriers for transport provision represent not only the core motivation for proposing the new system but also its biggest challenge, as it requires a complete turnover from what has been operating in the past three decades (Ardila, 2005) (Departamento Nacional de Planeación, 2010).

Design proposed for the SITP

The SITP is one of the objectives established in the Master Plan of Mobility. It seeks the creation of a transport system that integrate physically, operationally, institutionally and with the tariff in order to offer an optimum service (Transmilenio S.A., 2012). In this sense, the SITP should ensure the unified operational scheme and modal interchange (Departamento Nacional de Planeación, 2010) and as a consequence it must include actions related with articulation, linking and integrated operation of the different modes of public transport, the institutions or entities created for the planning, organization, traffic control and the infrastructure required for the accessibility, circulation and collection system (Secretaría de Movilidad de Bogotá, 2012).

In order to achieve this objective, it was defined that it should exists an administrative entity (Transmilenio S.A.) in charge of planning and control the system, as well as an unified fare collection system (Departamento Nacional de Planeación, 2010). In order to have a centralized scheme, the SITP reorganizes the city in 13th operational zones plus the CBD. Each of these zones was assigned through procurement process that ended in the selection of 9 companies (Transmilenio S.A., 2012).

The new system uses a trunk-feeder system structure from the corridors of the BRT routes. This basic structure is complemented by auxiliary, feeder, complementary and specials routes. Transmilenio provides the core routes as the other categories are using to capture and distribute the passengers through regular buses (Transmilenio S.A., 2012).

As a way to commit these specifications, Transmilenio S.A. determined that would have two delegation schemes. The first one, structural, is delegated by fleet and is in charge of the trunk routes. The second one counts with a system of routes that is delegated by zones (Transmilenio S.A., 2012).

This new system requires an important change in the operational level taking into account the reduction in the size of the fleet and the reorganization of the routes. In addition, it implies

a change in the organizations involved in the provision of public transit and a radical transformation in the way of the transport business has been managed. In this sense, it results interesting to analyze the requirements that have been raised in the organizational scheme of the new system.

THEORICAL FRAMEWORK

Evaluation of Organizational Models

For studying the SITP, different models of organizational analysis were evaluated in order to determine the one who will help to have a broad vision of the system.

Taking into account that every model allows creating different organizational schemes, it was considered appropriated to analyze which of these models would be applicable to the chosen case study.

- The mechanistic model could be appropriate since technical, financial planning and legal structure require a high level of specialization.
- The organic model, on the other side, presents a desirable model for the problematic since it allows a high level of flexibilization in the system. However, taking into account the history of the city in topics related with transport, it is considered that if this model is applied, it would be against of the main objective that the government is searching for, centralizing the system.
- Theories of design of contingencies are the least practical in relation with the problematic since for this methodology is required analyzing every possible scenario that could happen and create contingency plans.
- The Viable System Model seems appropriate due to its high level of participation, allowing taking into account the different points of view of different actors and the way in which the system is integrated at different levels. Besides, the model allows evaluating from different perspectives such as policy, intelligence, control and coordination, which could be an added value to the problematic of the city.

Model comparison

As a way to determine the most appropriate model to study the organizational scheme for the SITP, the different models were compared based on key criteria defined to approach to the problematic.

First, the mechanistic model focuses in high labor specialization, a high level of centralization in the upper levels of the organization and a high level of formality on its departments. However, this model has limited ways of communication and it does not consider the environment or the adaptability necessary to be in it.

The organic model presents a different perspective in comparison with the aforementioned model. It is based in a low level of labor specialization which allows that every person is in charge of different functions, a low level of centralization which seeks to delegate authority and a low level of formality in the departments because the focus is in the final product.

Theories of design of contingencies combine the previous two methodologies, which provide more elements for the analysis of different situations. Another advantage of this model is that it does an environment analysis in order to comprehend the necessary solutions.

The Viable System Model is one of the most complete of them. This does not only provide different levels of centralization in order to consider some elements such as policy, but also allows analyzing functions that support the main purposes of the system of study. This model carries out deep analyses of the environment and its adaptability based on the intelligence function, and also considers the coordination between primary activities and its cohesion.

Selection of a Methodology

Based on the last two sections, it is considered that the Viable System Model is the one that meets the requirements to evaluate the SITP.

Viable System Model

Based on the election of the model to analyze the organizational scheme of the SITP, it is considered appropriate to explain it briefly. The Viable System Model, onwards VSM, is a methodology proposed by Stafford Beer, which is used to understand organizations and re-design them in a way that they can remain in a given environment (Espejo & Gill, 2012).

This model is focused on determining the necessary relationships and resources for the viability of the organization, rather than its formal structure (Espejo, Bowling, & Hoverstadt, 1999). For this purpose, it has 5 essential functions that ensure the viability of the organization in order to operate properly (Espejo & Gill, 2012):

1. Implementation: it refers to the primary activities responsible for producing the goods or services of the organization and for which it was created.
2. Co-ordination: this function allows the coordination between the different autonomous units that are necessary in the organization in order to achieve the objective.
3. Control: this function uses regular and sporadic mechanisms of controls in order to know what is happening in the organization through direct communication with the people who work in each unit.
4. Intelligence: this function is related both with primary activities and the environment in which the organization is immerse. In this sense, it is responsible of knowing about the surroundings and to be aware of the changes that would be necessary in order to address them (Espinosa, 2006).

5. Policy: its main function is to provide guidelines to the organization in order to focus on the main objectives and purposes.

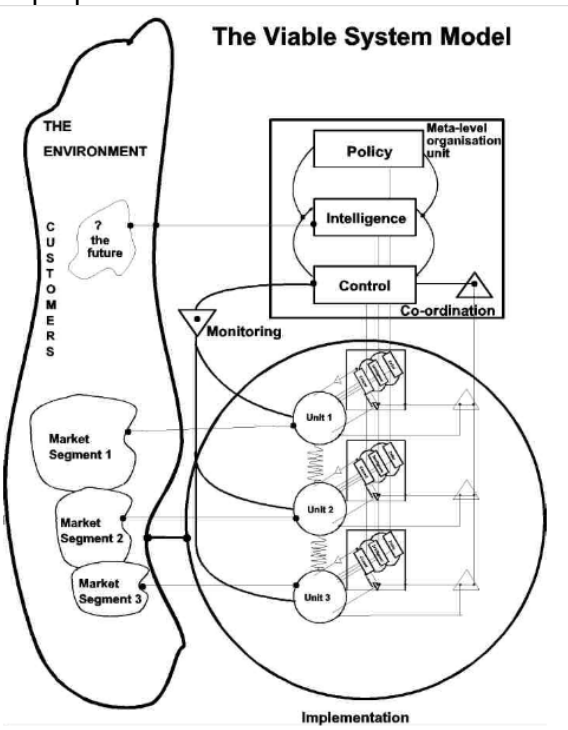

Figure 1: Viable System Model

Source: The viable system model as a framework for understanding organizations

For the organization to operate appropriately, these five functions must be integrated correctly and with a good communication among them.

ORGANIZATIONAL SCHEME OF THE SITP

The VIPLAN method is used to understand the organizational scheme adopted by the SITP in the start of its operation in august of 2012 and that could affect not only the mobility, but also the economic and social development of the city.

The information for the development of this model was obtained through a series of interviews with different actors that are directly involved with the SITP. This data was complemented with available secondary information.

Organizational Identity

From interviews with several actors and stakeholders involved in the system at different levels both in the public and private sector (High and medium level officials from Transmilenio and the local government, Administrative and operational staff from the private sector companies, users and general public, among others), it was possible to identify the current organizational identity of the system and its related items.

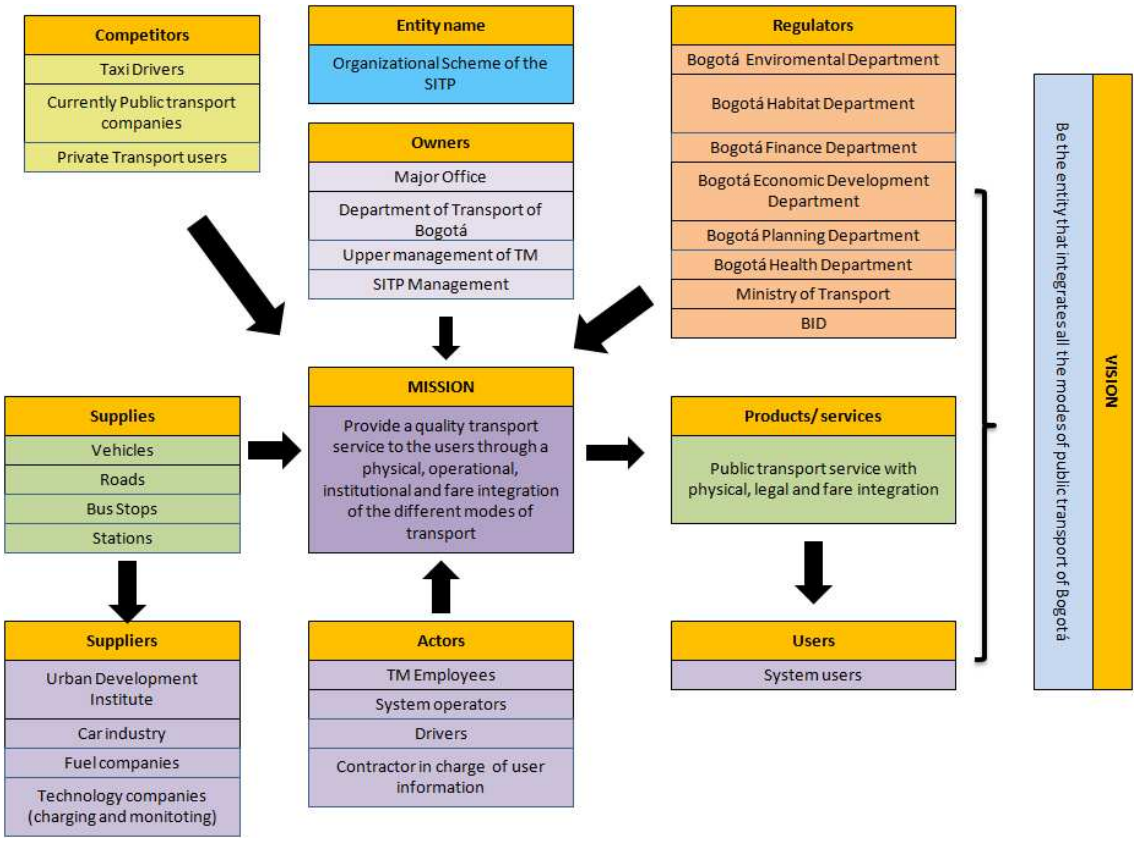

Figure 2: Mission, vision and agents of the SITP

Source: Own elaboration

Based on the above, the identity statement is:

The team of the Integrated Public Transit of Bogotá (SITP) is a group that in conjunction with the Upper Management of Transmilenio, the system operators, drivers and users seeks that the system formed by vehicles, roads, bus stops and stations transform into a public transport service through the planning and operation of routes and services across physical, operational, fare and institutional integration that provides real time information, access to all areas of the city, security and regularly on routes in order to mobilize in an efficient and economic way the inhabitants of Bogotá.

Technological Model

The structural modelling is a way to understand how the organization creates and absorbs the complexity of its environment. The complexity is an attribute given by an observer according to the number of distinctions that he or she is capable to do in the domain in which he or she interacts with a particular situation (Espejo & Reyes, 2011).

The technological model shows the activities that allow producing the transformation mentioned in the organizational identity and the way in which they interact (Espejo, Bowling, & Hoverstadt, 1999). In the structural model of the SITP, it was identified the activities

required to make the transformation and provide an integrated public transit to Bogotá. The figure below shows the 5 phases of the planning and operational model of transport.

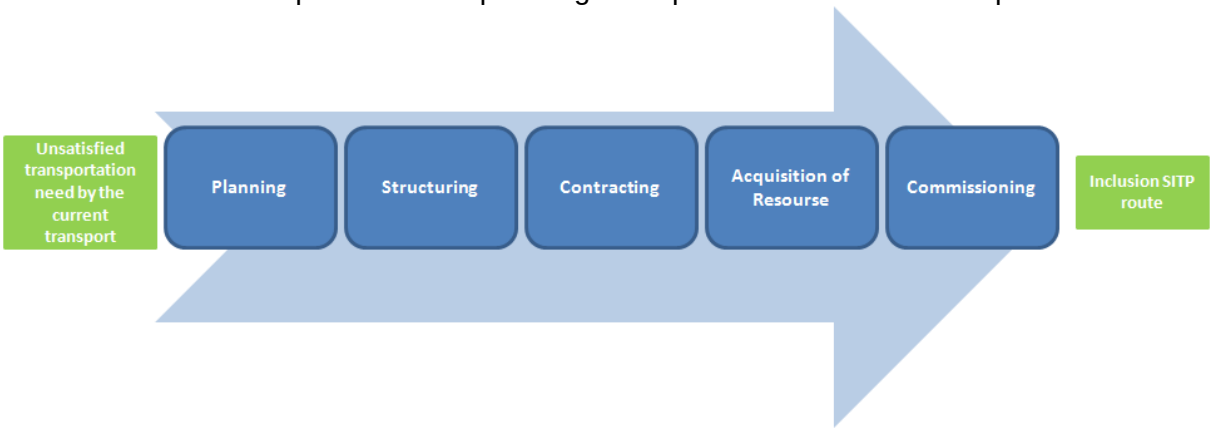

Figure 3: Technological Model

Source: Own elaboration

The starting point of the technological model is an unsatisfied transportation need by the transportation system, which is included in the structure of the SITP. The phases are:

1. **Planning:** In this phase, the management body (Transmilenio S.A.) is responsible for the system design based on an unsatisfied transportation need. The process begins with a technical definition based on the O-D matrices, in order to generate the required route scheme.
2. **Structuring:** In this phase are defined the necessary services for meeting the planned routes, the fleet size and its distribution, among other parameters.
3. **Contracting:** Based on the planning and structuring phases, the legal structuration begins and a bidding process starts in order to define the assignment of routes to the operators.
4. **Acquisition of Resources:** Once the contracting phase has finished, the fleet orders are made as well as the purchase of used vehicles in order to secure the necessary fleet to operate.
5. **Commissioning:** It is the phase in which the operation starts.

Unfolding of complexity

Due to the complexity that an organization has, it is necessary to unfold it in order to operate different levels that can absorb and handle the complexity. In this sense, if the complexity levels have a clear division inside the organization in order to have responsible and autonomous units in every process, it is possible to get an autonomous management at each level (Espejo, Bowling, & Hoverstadt, 1999).

In order to understand the level of complexity that the SITP handles, it was done an unfolding of complexity, finding 5 levels of recursion that will be explained below.

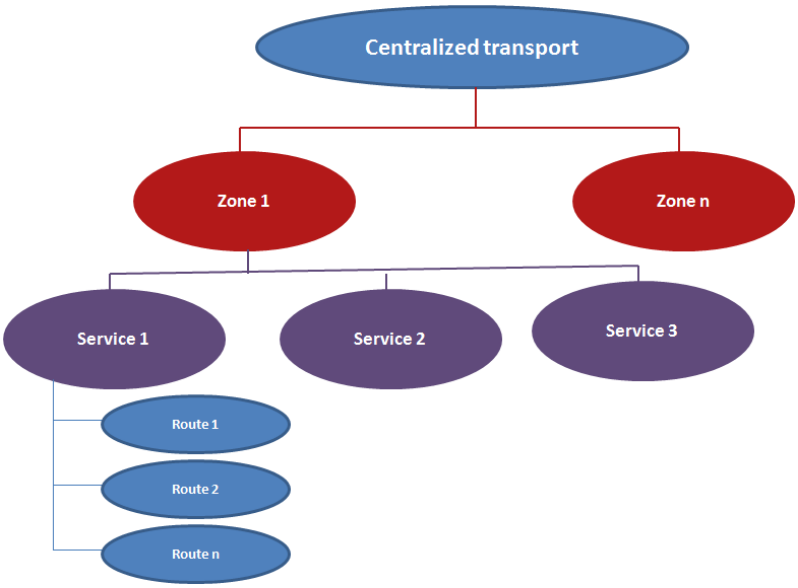

Figure 4: Unfolding of complexity

Source: Own elaboration

The first level, level 0, is composed by the Centralized Transport. Level 1 is composed by the operational schemes that the SITP handles; the level 2 is divided in the geographical areas or lots where it operates, and finally the level 3 shows the activities of the technological model.

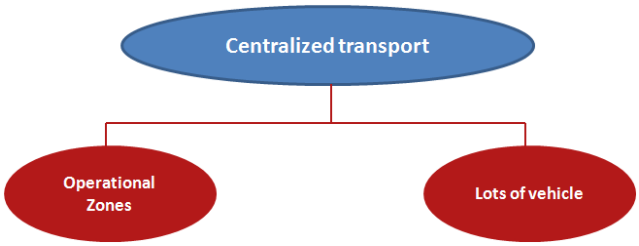

Figure 5: Unfolding of complexity, centralized transport

Source: Own elaboration

The level 0, Centralized transport, has this name since its main objective is to centralize the rest of the system under a single figure, in this case the SITP. This level of aggregation is divided in two operational schemes: Operational Zones and Lots of vehicles as a consequence of the differentiation within the system in terms of operation, which in turn are reflected in the contracting schemes.

Figure 6: Unfolding of complexity, Operational Zones

Source: Own elaboration

The operational zones are part of one of the two operational schemes that form level one. These correspond to the 13 operational zones that are not part of the mass transit services, which based on the demand has its own division in types of routes. For every of these routes the activities of the technological model are conducted. The following is an example of the unfolding of complexity by route made in two of the thirteen zones.

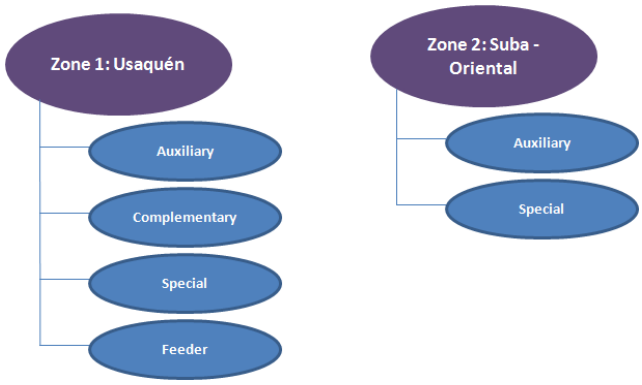

Figure 7: Unfolding of complexity, Usaquén and Suba Oriental zones

Source: Own elaboration

Similar to the case of the operational zones, in level 1 are also included the Lots of Vehicles, which are the services that operate the mass transit services. This generates a new level of complexity with 9 lots or trunks in the system.

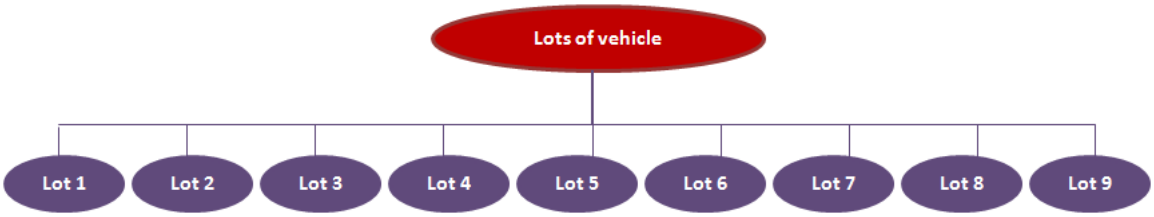

Figure 8: Unfolding of complexity, Lots of vehicle

Source: Own elaboration

The lots, in the same way as the zones, are unfolded in trunk services that are unfolded again in three types of routes that are based on frequency, speed and number of stops.

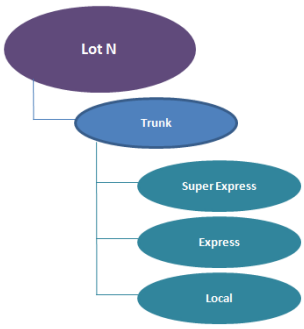

Figure 9: Unfolding of complexity, Lots

Source: Own elaboration

Distribution of discresion (Recursion-function table)

Based on the unfolding of complexity, it is necessary to do an analysis for determining the discretion in resources and functions that every of the primary activities in the different levels has. The discresion is defined as an agreement that a person or a group controls certain resources (Espejo & Reyes, 2011). This distribution of discresion between primary activities is the core to determine the level of centralization of an organization. For this purpose, it is constructed a recursion-function table, in which primary activities are related with the regulatory functions (Espejo, Bowling, & Hoverstadt, 1999).

The part on the table in which a support process is intersected by a primary activity means that the primary activity has discresion in the support process. This information is obtained through interviews to individuals responsible of both processes.

			Administrative				Economical and Financial				
		Internal Control	Human resources	Logistic	Documentation	Information and Communication Tech	Fare	Collection and distribution of resour	Control	User Communication	Maintenance
Level 0	Centralized Transport	X	X	X	X	X	X	X	X	X	X
Level 1	Operational schemes		X		X					X	
Level 2	Zones - Lots	X	X	X	X		X	X	X	X	
Level 3	Routes		X	X					X	X	X

Table 1: Recursion-function table of Centralized transport
Source: Own elaboration

In the level zero of the unfolding, centralized transport, it can be observed that there is a high level of centralization since an important part of the regulatory functions are concentrated in this level. This does not allow providing major level of discresion to lower levels. This situation is attributable to the current stage of the system, the implementation, which has not allowed the management body to delegate some functions to other actors in capacity of doing them. However, this simplifies the decision making process since the power of decision is centralized without involving many actors, even though it may slow the execution. This situation could be improved if some power is delegated to levels 1, 2 and 3 once the system is implemented. Nevertheless, this cannot be possible in the next 18 months (time of the implementation of the system).

In level one, operational schemes, few functions are concentrated as a consequence of the way in which the system has been implemented (the lots of vehicles have more than 10 years in operation and the operational zones are just being implemented). Therefore, the activities in this level have a secondary role as a result of low decision power and execution. This generates a low relation between policy and implementation functions as well as a disconnection between them. As a consequence, the agreements between the operators of

the operational scheme are minimum as well as their coordination. Besides that, their low power is minimized since the management body asks for individual results (by contractor).

In level two, an important number of regulatory activities are concentrated since in this level operators can make decisions related with their zones. Moreover, the operators are able to propose changes based on technical studies. Nevertheless, the management body is who makes the final decision as it is in charge of restructuring the system. In this sense, even though the zones and lots's operators have some decision making in their areas of operation in topics related with human resources, communication with the user and logistics, they do not have power in issues related with policy and in some cases with cohesion and coordination.

Finally, in the level three are focused a few regulatory activities. As a result of this distribution, it is highly possible that the system's vision could be lost since the actors in charge of the last part of the process do not have enough power of decision.

The results of the recursion-function table indicate that in most of the functions, except human resources, documentation and communication with the user, there could be communication problems between levels 0, 1 and 2. This, considering that many activities are scaled from level 0 to level 2, creating a loss of power in level 1 (Operational schemes). As a consequence, in this level there is no power of decision in the short-term and in the long-term less cohesion and coordination within the system.

Moreover, the results shows that it is required more cohesion and coordination in the human resources function since today most of the operators have not hired the drivers of the system. This could affect not just the system as a whole but also generate friction between the operators taking into account that two operators share the same route since the origin and the destination of the routes are in two different zones.

The model also presents a deficiency in the policy of the fare function. The time that it took to define a fare affected the system since it produces uncertainty in the operators and the loss of the system's vision. Finally, the coordination in the communication function is poor because it is distributed in all levels, but these are not in constant communication.

Diagnosis and Design of Structural mechanisms

The next step of the Viable System Model is done based on the recursion-function table by identifying which functions of the VSM are involved in the regulatory functions (Espejo, Bowling, & Hoverstadt, 1999). In this sense, it can be identified if the primary activity has the functional capacity for every function through the analysis of each regulatory activity based on the functions of the VSM (Policy, Intelligence, Cohesion, Monitoring and Coordination).

		Internal Control	Administrative			Information and Communication Tech	Economical and Financial		Control	User Communication	Maintenance
			Human resources	Logistic	Documentation		Fare	Collection and distribution of resour			
Level 0	Centralized Transport	X	X	X	X	X	X	X	X	X	X
Level 1	Operational schemes		X		X					X	
Level 2	Zones - Lots	X	X	X	X		X	X	X	X	
Level 3	Routes		X	X					X	X	X

Policy	X	X	X	X	X	X	X	X	X	X
Intelligence		X			X	X	X		X	X
Cohesion		X	X			X	X		X	X
Coordination	X		X	X	X	X	X	X		X
Monitoring	X		X	X	X	X	X	X	X	X

Table 2: Recursion-function table and identification of the VSM
Source: Own elaboration

Once the characterization of the regulatory functions is done, a mapping is made in each of the levels of discresion. Therefore, the next four figures illustrate the VSM in each level found in the unfolding of complexity:

Level 0 – Centralized Transport:

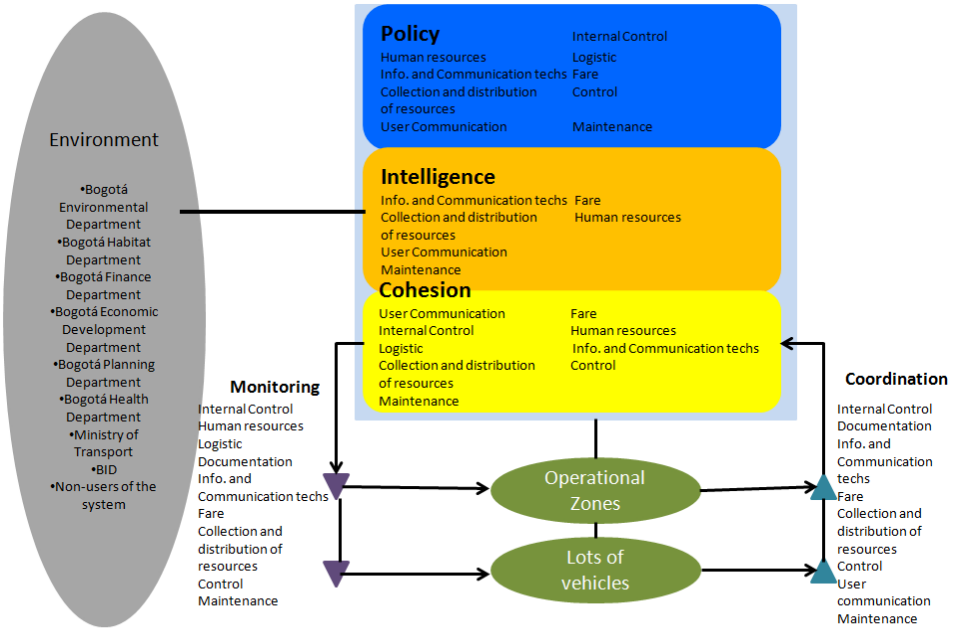

Figure 10: Viable System Model for Centralized Transport

Source: Own elaboration

Level 1 – Operational Schemes:

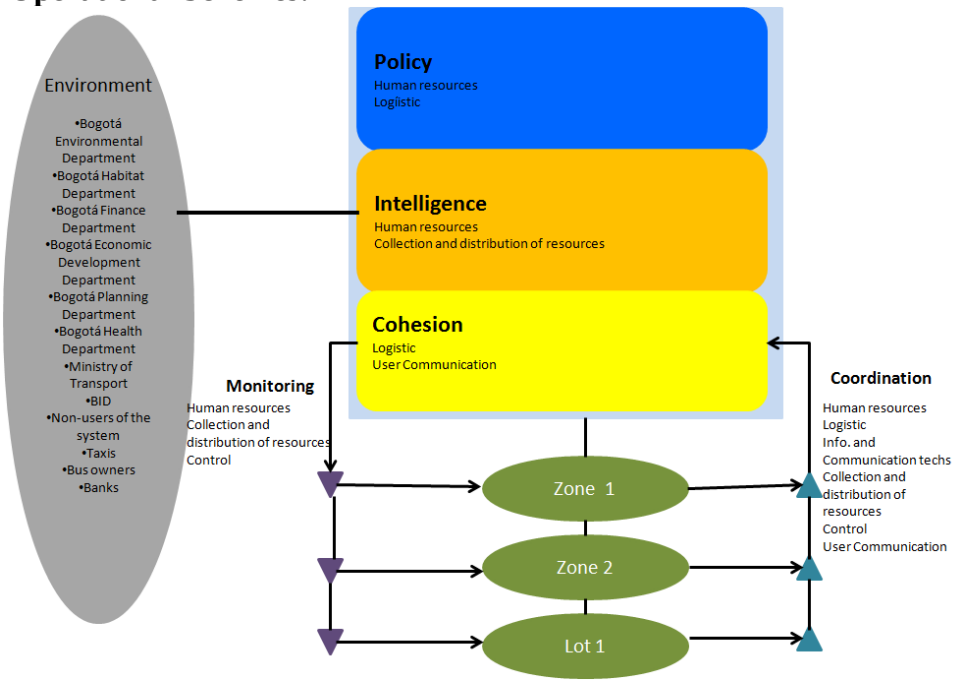

Figure 10: Viable System Model for Schemes of Operational Schemes

Source: Own elaboration

Level 2 – Zones - Lots:

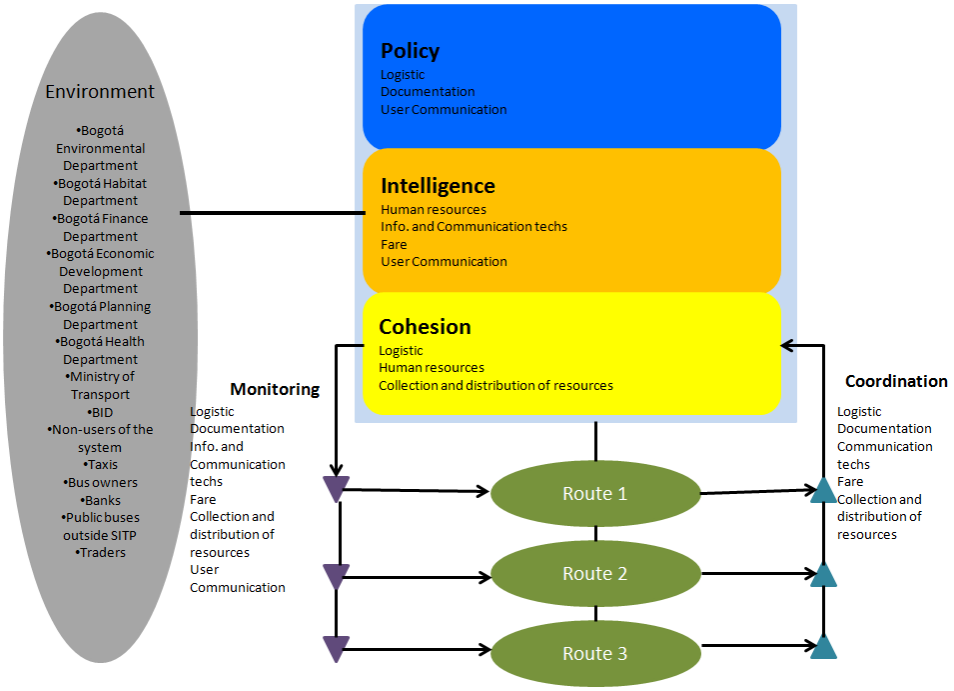

Figure 11: Viable System Model for zones and lots of vehicles

Source: Own elaboration

Level 3 – Routes:

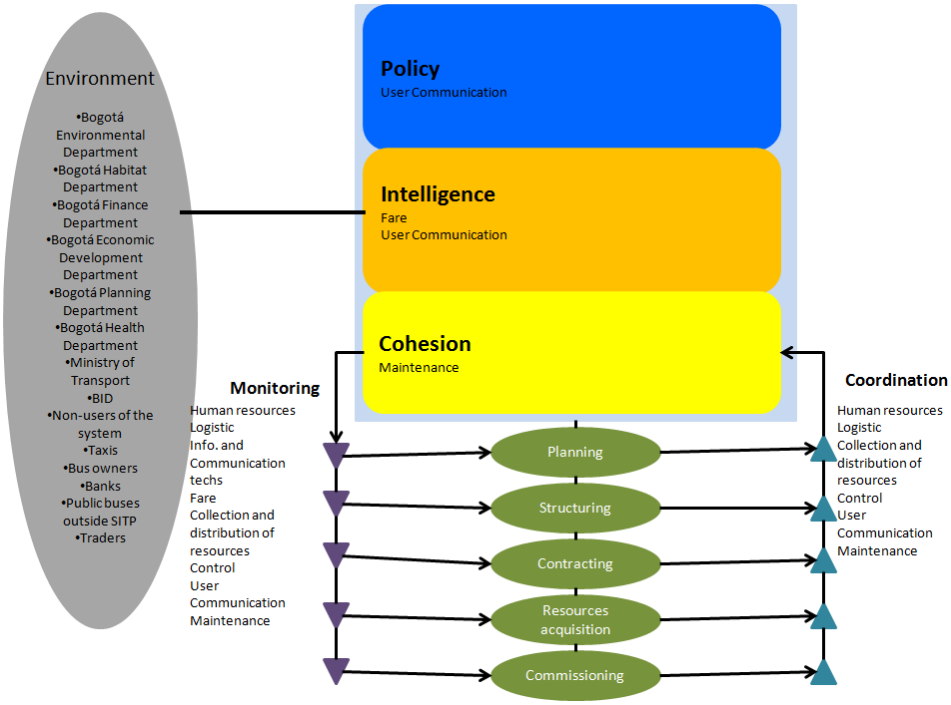

Figure 12: Viable System Model for Routes

Source: Own elaboration

VSM Centralized Transport

The viable system model for level zero, centralized transport, shows that the policy of the system is centralized in this level since in there appeared 9 of 10 identified functions. This shows that here is a high level of direct intervention over the rest of the system. However, it is recommended that this level partially delegates this function to lower levels as a way to empower them.

On the other hand, this level also shows a high relation with the environment that is evident since some functions are in charge of its analysis. This allows a better understanding of the environment and preparing the organization for possible changes that can affect its identity.

In the mechanism of cohesion is observed that as a consequence of the stage of the system (implementation), the regulatory functions are centralized at least at the level of definition and guidelines. This is no appropriate because the objective is that every level can absorb a complexity that it can manage. Thus, it is recommended to decentralize some functions.

For the coordination of the system, it is observed a similar pattern with the cohesion. It is believed that Transmilenio, the management body, will be able to coordinate different elements of the system. As a consequence, it will be able to centralize different processes in level zero. Nevertheless, it is important that these functions are redistributed in way in which there is greater balance and synergy in the participation of different actors of the system.

Monitoring and control functions are also focus in this level. In this case, based on the history of public transportation in the country and the defined solutions made by the management body, this is an expected result and is according to the plan.

VSM Operational Schemes

According to the viable system model, the level one is a highly uncompleted one since it lacks power decision. In the policy function, this level does not count with decision power to generate policies due to their limited faculties inside the structuring activities. This provides autonomy to level 2, zones and lots of vehicles.

In this level, intelligence is limited considering that although some functions for analyzing the environment like HR, collection and distribution of resources are present, other relevant functions for this objective are missing. This can be related to the fact that operators started interacting recently with each other regarding parameters for hiring and training drivers. They are also conducting labours of intelligence related to the interaction with the collection system and management of technology among other relevant elements. Conversely, it is required that this level has a communication with the user function, since this will allow a coordinated communication between different operators and with the environment, which will be reflected in a better understanding of the system by the users.

Cohesion and coordination are low in this level as a consequence of the low intervention that it has in the system. This is a consequence of the way in which the system was planned. The cohesion that exists, however, can be observed in the functions of logistics and communication of the user. In the same way, the coordination that exists is due to the effort of the operators in creating synergies in topics related with human resources, collection and distribution resources and communication to the users. Finally, monitoring is very limited although there may be certain agreements between operators.

VSM Zones and Lots

This level is one of the most complete considering that every function in it allows the viability of the system. The policy function shows that logistics, documentation and communication with the users are in charge of every operator which facilitates the decision making processes.

Cohesion, on the other side, is well organized in terms of human resources since, although Transmilenio has a major part under its control, all HR within zones and lots of vehicles are under their own decision power. In this sense, the strength of decision making allows better management of resources and interaction with level 0.

Intelligence in this level is high because decision making at this level allows a better understanding of the environment which in turn aids to a better flow of informational inside and outside the operators. This contributes to have strong phases of planning and execution.

VSM Routes

This level has almost no interference since most of the complexity has been absorbed by superior levels. Therefore, most of the functions in this level are limited to monitoring and coordinate since cohesion and intelligence were absorbed by level 1.

Regarding Monitoring and Coordination, it is necessary to highlight that in this level the operation takes place requiring high levels of coordination.

PROPOSED CHANGES TO THE ORGANIZATIONAL STRUCTURE

Based on the findings made by the VSM, some changes to the organizational structure are proposed in order to improve the system. It is clear from the analyses that there is a mixture of responsibilities in the public and private sector involved in the system that needs to be addressed and ideally redistributed.

The organizational identity of the system is clear to most actors, which evidences a common objective and understanding of the mission and vision of the system. However, since it has been evidence a low involvement of the high-level administration. In this sense, it is recommended that the Major Office and the Department of Transport of Bogotá (Owners of the system) are more involved in the process of organizational identity in order to provide greater clarity on the understanding and vision of the system.

Regarding the unfolding of complexity, the ideal structure for the system should limit the involvement of high level administration to primarily policy and control. However, this is not possible considering the current stage of the system and the necessity of stronger planning and control in order to strengthen the processes required for a completely new centralized scheme of operation. It is considered that the repetition of planning tasks by different actors could generate communication problems that would be reflected in the coordination of different routes and frequencies. This could be one of the causes for which the system does not operate properly in the trunks, which generate difficulties in the upper level. Moreover, this has led to delays in the implementation process of the routes since the operators had to do their own research to determine the route and frequency structure even though the management body had done that before. In this sense, it is required that the planning of the system is performed by one of the actors and then communicated to the others. This will allow better clarity about the system and will provide room for proposing improvements.

When analyzing the unfolding of complexity, it is observed that the level 1, operational schemes, requires to be strengthened as a way to allocate more decision power in it. For that, it is important to have more cohesion and coordination between the operational schemes. This will be possible through the transference of some functions from the levels above. Moreover, it is suggested that level 3 is removed as a way to re-distribute the complexity directly to the routes level. This enables better coordination which will be reflected in a better service.

In the recursion-function table, there are suggested some changes based on the analysis:

			Administrative				Economical and Financial				
		Internal Control	Human resources	Logistic	Documentation	Information and Communication Tech	Fare	Collection and dist of resources	Control	User Communication	Maintenance
Level 0	Centralized Transport	X	X	X	X	X	X	X	X	X	X
Level 1	Operational schemes		X	X	X	X			X	X	
Level 2	Zones - Lots	X	X	X	X		X	X	X	X	
Level 3	Routes		X	X		X			X	X	X
Policy		X	X	X	X	X	X	X	X	X	X
Intelligence			X			X	X	X		X	X
Cohesion			X	X			X	X		X	X
Coordination		X	X	X	X	X	X	X	X	X	X
Monitoring		X	X	X	X	X	X	X	X	X	X

Table 3: Analysis of the proposed discretion
Source: Own elaboration

The first proposed change is to give more decision power to level 1 (Operational scheme) as a way to give it more discretion. This will allow it to absorb some functions that currently are in charge of levels 0 and 2. These functions could be logistics in topics related with the start of operation of routes and services, as well as the management of Information and Communication Technologies and the control of some levels. In the same way, it is important that level 3 has some intervention in the control of the Information and Communication Technologies, since in this level these technologies could be more useful. In terms of logistics, resources acquisition and coordination, it is required to have a clearer boundary of the responsibilities maintaining in the centralized level responsibility over infrastructure and in the private companies the securing of operational resources under the coordinated requirements of operations by the upper levels.

It is also proposed that the coordination and monitoring functions of human resources are present in the model as a way of providing a better service and coordination between operators of different zones. This will help to understand the necessities of other operators in terms of human resources that could affect a route. In the same way, monitoring this function would help operators to avoid problems in the short and long-term.

It is considered that the policy related with fare must be modified so the actors who provide guidelines and policies, especially in the Major Office, are more involved. Finally, it is key to include the function of coordination in the Communication with the User in order to provide useful and clear information avoiding confusion.

The proposed changes are aligned with the observed objectives and perspectives of different actors within the system. It is estimated that these modifications should not pose great difficulties for their adoption since the system is still in a phase of gradual implementation

and most of the proposed changes are in terms of strengthening of boundaries, sharing and redistribution of responsibilities. The results, however, are part of an academic research and are still subject to the criteria of the main stakeholders of the system.

CONCLUSIONS

The persistent transport difficulties endured by Bogotá can be associated to a weak organizational structure and inadequate management of transport policy over the years. These conditions have led to an evidently inflated rate, a weak government agency and institutional arrangements that do not favour transport in the city. In order to respond to the root causes of this problematic, the national government has been working in the creation of different institutions, such as Urban Development Institute and the Secretary of Mobility, in order to improve the quality of transit services that are currently offered in the city. The Integrated Public Transit of Bogota is then a further step towards the transformation of the organizational and operational schemes of public transit in Bogotá, expected to be a permanent solution to most of the identified problems. In the proposed scheme, Transmilenio is in charge of planning and control of the system ensuring centralization of its planning and control.

Based on the analysis of the organizational structure, it is evident that the organizational identity of the system is clear for the actors involved in it. However, one of the core areas for improvement is a higher involvement of the Major's Office and the Department of Transport of Bogotá as a way to have more clarity about its implementation and operation. In general, it is suggested a better definition of public-private boundaries that focus the governmental activity in policy and control, therefore generating higher awareness of the implications of fare policy.

The organizational structure also evidenced high levels of centralization in two levels that have absorbed most of the functions of the system, not allowing some actors to handle their own discretion or take control over some resources that theoretically correspond to them. This situation is nonetheless explainable considering that the system is at an early stage of implementation. However, it is recommendable that both levels deliver progressively some power to the others as a way of redistributing responsibilities more efficiently.

It is also necessary to strengthen level 1, operational schemes, as it concentrates most of the agreements between operators. This would allow a better coordination and cohesion in the system. While the operators have made certain arrangements there is still a lack of mechanisms to ensure that these are fulfilled. In addition, some other functions at this level as coordination and monitoring of the human resources must be also reinforced. The policy of the fare must be clearer and coordination in Communication with the user must be included to provide clarity to the system.

Analysis of level 2, zones and lots, shown an important intervention in topics related with policy, which facilitates power decisions. Moreover, there is discretion at this level regarding

the use of resources inside their zones or lots in spite of a certain dependency on Transmilenio as manager of the system.

These results represent an important step forward in the development of organizational analyses in the realm of public transportation in the context of developing cities like Bogotá. Considering the preceding traditional structure of the system and the challenge that the implementation of the SITP poses, it can be argued that the type of analyses allowed by the application of organizational models is a necessary stage in the planning and implementation processes of complex transport systems.

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