

# Transit-oriented Development in the metropolitan governance: a comparison between the Colombian case and the South Korean experience

Desarrollo orientado al transporte en la gobernanza metropolitana: Comparación entre el contexto colombiano y la experiencia de Corea del Sur



Natália da Silveira-Arruda<sup>1\*</sup>, Claudia Marcela Aldana-Ramirez<sup>1</sup>, Carlos Alberto Palacio-Tobón<sup>2</sup>, and Diana Patricia Moreno-Palacio<sup>2</sup>

<sup>1</sup>Facultad de Ingeniería, Universidad de Antioquia. Cl. 67 53 – 108. A. A. 1226. Medellín, Colombia.

<sup>2</sup>GIGA, línea de investigación de sostenibilidad ambiental, Facultad de Ingeniería, Universidad de Antioquia. Cl. 67 53 – 108. A. A. 1226. Medellín, Colombia.

## ARTICLE INFO:

Received February 28, 2017

Accepted November 10, 2017

## KEYWORDS:

Metropolitan governance, collective public transport system, Seoul metropolitan area, Aburrá Valley metropolitan area, TOD model

Gobierno metropolitano, sistema de transporte público colectivo, área metropolitana de Seúl, área metropolitana del Valle de Aburrá, modelo DOT

**ABSTRACT:** This research studies the process and the political decisions that were carried out in the creation of Seoul Metropolitan Area (SMA) in order to respond to a territorial reorganization associated to a public transport supply that resulted in a model of transit-oriented development (TOD). Contemporaneously, the paper studies the normative framework that governs the metropolitan areas in Colombia and its metropolitan public transport, as well as, it studies the structuring of the metropolitan collective public transport system of the Aburrá Valley Metropolitan Area (AVMA). The aim of the research is to understand the process of territorial and transport policy decisions that were held in the SMA, which makes it an example and case of study to contextualize a reorganization of the collective public transportation system in the Colombian case, specifically in the AVMA. The objectives of the research are identifying the regulatory principles of territorial and transport planning, strategies, and instruments used for setting the policy decisions that have a binding character on the operating entities of the collective public transport system. In order to put the characteristics of the AVMA collective public transport bus system in evidence, a comparison between SMA and AVMA was developed. The implications emerged from this comparison are used to generate guidelines through three themes: a) governance; b) financial system and c) operational aspects. The guidelines hope point the reorganization of the public transportation bus system and a future transition to a model of Transport - and People - Oriented Development in the Colombian metropolitan level context.

**RESUMEN:** La presente investigación estudia el proceso y las decisiones políticas que se llevaron a cabo en el Área Metropolitana de Seúl (SMA) para responder a una reorganización territorial asociada a una oferta de transporte público, que resultó en un modelo de desarrollo orientado al transporte (DOT). Se estudia, en paralelo, el marco normativo que rige las áreas metropolitanas en Colombia y su transporte público metropolitano, y la estructuración del sistema de transporte público colectivo metropolitano del Área Metropolitana del Valle de Aburrá (AMVA). El objetivo general de la investigación es comprender el proceso de toma de decisiones territoriales y de políticas de transporte realizadas en el SMA, ejemplo y caso de estudio, para contextualizar una reorganización del sistema de transporte público colectivo en el caso colombiano, específicamente en el AMVA. Los objetivos específicos son identificar los principios reguladores de la planificación territorial y de transporte, las estrategias y los instrumentos utilizados para establecer las decisiones políticas que tienen un carácter vinculante en las entidades operativas del sistema de transporte público colectivo.

\* Corresponding author: Natália da Silveira Arruda

E-mail: natalia.dasilveira@udea.edu.co

ISSN 0120-6230

e-ISSN 2422-2844



Se desarrolla una comparación entre SMA y el AMVA con el fin de evidenciar las características del sistema de autobuses colectivos del AMVA. Las implicaciones derivadas de esta comparación generan pautas a través de tres temas: a) gobernanza; b) sistema financiero y c) aspectos operacionales. Con las pautas se espera orientar la reorganización del sistema de transporte público y una futura transición hacia un modelo de desarrollo orientado al transporte y las personas en el contexto metropolitano colombiano.

## 1. Introduction

This paper is a product of a research proposal selected in the KRIHS-IDB Visiting Scholar Program 2016, framed in the Metropolitan Governance themed area. It proposes to study the process of political decisions that were carried out in the creation of Seoul Metropolitan Area (SMA) in order to respond to a territorial reorganization associated to a public transport supply that resulted in a model of transit and people oriented development. The aim of the proposal is to understand the process of territorial and transport policy decisions that were held in the SMA, which makes it an example and case study, to contextualize and replicate in the Colombian case, specifically in the Aburrá Valley Metropolitan Area (AVMA).

A comparison between the characteristics of bus public transport system of SMA and AVMA cases serves to put in evidence the implications that emerged from it. These series of implications are used to generate guidelines - through three themes: a) governance; b) financial system and c) operational aspects - for the reorganization of the collective public transportation bus system and a future transition to a model of Transport - and People -Oriented Development (TOD).

The AVMA is, among the 6 existing metropolitan areas in Colombia, the first to be created, in 1980. As metropolitan area, it performs the function of planning and development of metropolitan works; with some of the other metropolitan areas legally conformed, it performs the function of authority in metropolitan and massive transport, which allows it to plan the development of the transport system in an integrated manner among the ten municipalities that constitute it. Moreover, it is the only metropolitan area to perform the function of environmental authority.

The AVMA has the unique currently existing metro system in Colombia, and will also be the first metropolitan area to present the Metropolitan Strategic Plan of Territorial Planning, in order to articulate the local plans for reaching an integrated territorial planning. It is a metropolitan area that, supporting itself in Medellín - its main city, is recognized in Colombia for the advances in planning and

development, including the transport system.

For this reason, it is considered appropriate to use it as the study case, hoping that the results generated from the comparison between the SMA and the AVMA are guidelines easily contextualized to the specific situation of each other metropolitan areas.

The article is structured in three chapters: experimentation, results and conclusion. Chapter 2. Experimentations is subdivided into three subchapters, the first is the methodology used in the development of the project; in the second subchapter, the Korean case study information is presented; and the third subchapter presents the contextualization information to the Colombian case study, and make the respective comparisons between the two cases. Chapter 3. Results is divided into implications of the current collective public transport system in the Aburrá Valley; and strategy guidelines to be implemented in short, medium, and long-term.

In Chapter 4, conclusions are presented about the current conditions of the system, consequent impacts generated in different spheres, and the necessary efforts to be undertaken a possible scenario change.

## 2. Experimentation

The research proposal is a product of the KRIHS-IDB Visiting Scholar Program 2016, and part of the scholarship consisted of sending the main investigator to Seoul, the capital of South Korea, to a fieldwork for the collection of information and data. The main investigator was received by the Korean Research Institute of Human Settlements (KRIHS), where information was given, and through the institution, interviews with different experts of the subject and governmental institutions could be made. The methodology of this research was based on a previous work stage and six stages developed after visiting the KRIHS, in the city of Anyang (SMA). The stages of the methodology of the present study are described below:

The methodology of this research was based on a previous work stage and six stages developed after visiting the Korean Research Institute for Human Settlements - KRIHS, in the Anyang City (SMA) as part of the KRIHS-BID Visiting Scholarship Program 2016. The methodology passed through a review in relation to the methodology presented in the proposal, with a restructuring of the objectives and scope of the investigation:

- Collecting information through studies, articles, and publications about the two countries and specific

metropolitan area (Colombia and AVMA, South Korea and SMA);

- Collecting information gathered in field work through information provided by members of GDPC-KRIHS;
- Identifying policies, strategies and measures that structured the framework of the metropolitan governance related to the planning of bus public transport of each study case;
- Identifying of the financial system characteristics related to the transport planning, from the level of political decision to the financial model of private operating companies of each study case;
- Identifying of the characteristics of the bus public transport operating system of each study case;
- Comparing both study cases based on the information identified at each level of analysis;
- Formulating of conclusions from the comparative analyzes.

## 2.1 Korean Case (Seoul Metropolitan Area)

Seoul is the capital and the largest city of the Republic of South Korea. It is the main city of the Seoul Metropolitan Area (SMA), which includes the Incheon city and the Gyeonggi province, conforming one of the world's largest metropolitan areas, with a population exceeding 25 million residents. The SMA is home to over half of South Korea population, 50.72% as of 2014 [1], with an area about 11,747 km<sup>2</sup>. The largest city is Seoul, with a population of approximately 10 million people, followed by Incheon, with just under 3 million, and the lacking amount of residents belonging to the Gyeonggi province. In relation to the size of the territory, Gyeonggi province has an area of 10,184 km<sup>2</sup>, the city of Incheon, 1,010 km<sup>2</sup> and Seoul city has an area of only 605.21 km<sup>2</sup>. [1] [See image 1 in the Chapter 3.1].

The increased concentration of population in the SMA – the average rate reached of 8.4% per year from the 60s - led to the rising of land price in Seoul and spillover to suburbs a middle and low-income class looking for better housing options [2]. The consequences of this continued expansion appeared as the exacerbation of job-housing mismatch, problems of congestion as also spinoff environmental problems [3].

The Central Government assumed a crucial role and function for the metropolitan management with the New Town Development Housing Shortage Mitigation ('89-'95), building five New Towns located within a radius 20 km away from Seoul, and supplying 21.4 million housing units for 1.17 million population [1, 4]. The central government

started the metro construction and for 1985 there were 4 lines, totaling 134.9 km. The construction of the metro system accelerated the building of New Towns. After a 2nd phase (2001) and a 3rd phase (2012) of constructions, the SMA metro system has now 13 lines totaling 825.2 km [1, 3, 4].

SMA Management strategies changed from a High Speed Urban Land and Housing Development (New Town 1989-95 for Housing Shortage Mitigation) to a New Town development. The New Towns built after 2000s (four other cities) had the characteristics of having less average density, being environmentally friendly and self-sufficient as strategies to decrease the commuting dependency to Seoul. Regarding transportation, these New Towns were planned according to the mass-transit oriented model, connected with vicinity areas and served by a mass transport system in order to enhance the use of public transportation and to generate a functionally connected system that, through the community, offers economic prosperity and quality of life [1, 2]. (See Table 1 in the Chapter 3.1)

Central government had always fulfilled a crucial role regarding metropolitan and local level support. The Introduction of the Autonomy to Local Governments in 85' started a period of decentralized collaboration. In 95, it started also a decentralization about how each administrative level began to participate in the budget of infrastructures and projects that share interests of all levels. Projects of national interest and impact are fully funded by the Central Government, and projects of interest and local impact must be funded by the municipal government [2]. However, when there is a transport system project, with metropolitan or regional interest and impact, the Central Government participates in the budget allocation (80%) by ensuring the coordination, management, and financing of a major item of investment. Once in the operational phase, the local government is totally responsible.

Nowadays, Growth Management Policy for the SMA has characteristics of nationwide spatial policies to remove the disparity between the SMA and other regions [3]. It also has characteristics of region-wide spatial policies for improving quality of life for residents, strengthening the competitiveness and resolving the overcrowding and overpopulation issue.

In 2004 Seoul City underwent a Public Transport Reform, introducing Transit-Oriented Policies. Measures adopted with this reform allowed the creation of an integrated transfer and transit fare system, operated in a semi-public way. In 2005, the Metropolitan Transportation Authority was set up by the local government union Seoul, Incheon,

and Gyeonggi province. The functions of this entity, among others, are to establish metropolitan public transportation comprehensive plans, consultation and adjustment in transportation policies and to build infrastructure [1, 2].

With the 2004 Seoul Public Transport Reform measure, responding to the metropolitan strategy of public transport-oriented policies, Seoul Government completely reorganized the transport model system in a semi-public operation system, with an emphasis on the public nature of the bus services for which, up to that time, private providers had operated in a private logic. After the public transport reform, the government moved into a single contract with the labor union of the private transportation companies. This entity already existed before the reform, but went on to play a key role once it started to have a contract with each of the 66 private companies authorized to operate the public bus transport service. This permitted the application of the "single-till" principle, where the government recognized the authority of each bus private company, but the revenues coming from the routes would belong to the public revenue management organization to be distributed to each bus operating company, according to the operation ratio of each route, with a bidding system introduced to control the creation of new routes [5]. (See Table 2 and Figure 4 in the Chapter 3.1)

This way, Seoul government pays to each company the amount spent in the operation of the system. The smart card system that made possible an integrated fare system and a fare reduction distance-based was installed, and the fare passed to be calculated according to the user's travelled distance, and not anymore with the number of transfer among transportation modes. This also applied to the fare of inter-city buses, which charged extra fare for traveling additional distances. With the unique fare, private companies suffered a budget shortage, imposing on the government to support them, as they offer a public service. Since then, the government subsidizes the profit deficit using capital provided by taxes. Investment costs in the transportation service offered by private companies are also provided by the government. These measures increased the profit deficit for the government, but represent the welfare policies, maintaining the fare in an affordable level and offering discounts or subsidies to socially vulnerable citizen groups such as children, elderly adults and low-income people [5].

Based on an annual evaluation of the service offered (there are requirements that the companies must meet such as: good and safely service and respect for frequencies, among others), the government defines the amount of the grant that each company will receive. With this amount, they can encourage companies to maintain a standard of quality and safety in their service. The continuing negative

reoccurrence in the evaluation system by a company generates warnings that can lead the company to have its contract cancelled by the government.

With the reform, changes occurred not only in the financial system but also in the operational aspects of the metropolitan area transport system. The already existing private transport companies had to adapt to the new system model, but now being funded by the government to offer a public service of quality and efficient. Before that time, "the quality of bus service was very poor because of old vehicles and related facilities, which caused a further decrease in the share of buses in all transport system" [5].

Private companies already had their fleet of buses and their parking lots, as well as their routes in which they were operating before 2004, and the government recognized and accepted their authority to respond to the service. Government will interfere in the operation just when a company is not able to respond to the demand in a route (for example, metropolitan government is running night buses). It is a government function to decide on the minimum frequency time and about extending some routes, or restructuring some tracts of the routs.

With the application of the single-till model, the government redistributes to each bus operating company its operating costs, such as the fuel used according to the operation ratio of each route (traveled kilometers), the drivers' wages, insurance costs, etc.

The adoption of the Intelligent Transportation System (ITS)-based Transport System Management allowed the Seoul Metropolitan Government to have all data information about the transport system, from the financial aspects to the operational ones (real-time bus information, route and transfer information, etc.). With the smart card (T-money as it is called in the SMA) the transport system does not use money anymore, and this made possible the application of the integrated fare system as well as fare reduction. With a board device installed in every bus and in metro stations (and even in taxis – but, in this case, there is a separate fare for the use of a taxi), users have to validate their smart card at the entrance and exit of each transport mode for the system to calculate the total distance made by each user to apply for the respective fare. The Integrated Traffic Management also allows a better control and planning of the system.

There were conflicts in the beginning, private companies did not accept the reform proposal initially, and the government had to organize a social movement with mayors, NGOs and important people to convince companies that they should begin to share their profits.

Despite many efforts from central government, the decentralization undertaken by the government has some limitations due to the top-down and regulation-based approach by the central government. Local governments present a semi-autonomous condition yet. The limited roles, functions and budgets of local governments, plus a lack of professionals, can generate an ineffective governance with not too much citizen participation. The issues of overpopulation and also an excessive concentration of core functions continue. Among the causes that can explain concentration in the SMA is the political factor [5].

## 2.2 Colombian Case (Aburrá Valley Metropolitan Area)

The Aburrá Valley is a subregion of Antioquia department located in the Andes Region. It is a natural basin of Medellín River that has from its north limit to its southern part 60 km long, while presents several varieties in its width, being the widest part 8 to 10 km (the one that corresponds to the municipality of Medellín) and the narrowest part with 3 km (corresponds to the municipality of Copacabana). The Aburrá Valley is a densely populated region (3,202 inhabitants per square kilometer in 2014) with predominantly urban characteristics, housing the largest population of the department (about 58.5%) [6]. The AVMA is the main pole of development, concentrating a dynamic conurbation which constitutes the second largest urban conglomeration of Colombia, with a population exceeding 3.8 million people, according to the population projection for 2016 elaborated by DANE from the Census of 2005 [7]. The AVMA is constituted by ten municipalities: Medellín, Bello, Barbosa, Copacabana, La Estrella, Girardota, Itagüi, Caldas, Sabaneta, and Envigado.

Medellín is the capital of the department of Antioquia, the largest city in the country after Bogotá and also the main city of the Metropolitan Area, as well as the largest city of the valley, with a population of approximately 2.5 million people [7], with an area of about 380.64 km<sup>2</sup>. The city represents 33% of the Aburrá Valley total area and 0.6% of the total area of Antioquia department. About 27.1% of the total area of the city is urban land, about 1.1% is urban expansion land and the other 71.8% is rural land [8] [See Figure 1 in the Chapter 3.1].

The AVMA was the first metropolitan area created in the country in 1980. The metropolitan areas in the country perform the function of planning and development of metropolitan works; some of them, including the AVMA, perform authority in Metropolitan Transport, but the AVMA is the only one that also acts as an Environmental Authority.

According to what is stipulated in the National Constitution and the laws that govern it, the AVMA has the following functions: planning the territory under its jurisdiction; be environmental authority in the urban area of the constituent municipalities; be authority in massive and metropolitan transport; and execute works of metropolitan interest. However, the AVMA currently does not exercise function of bidding control and management of land use in municipalities, as this function is performed by each municipal authority in an independently way and, in many cases, without taking into inconsideration metropolitan guidelines.

This situation arises from the Colombian Constitution of 1991 which allows the creation of metropolitan areas as administrative bodies and from the Territorial Management Law 388, 1997, in which metropolitan areas are defined as associative entities while municipalities are defined as territorial entities, with different characteristics, and therefore, also particular functions. Consequently, the AVMA can only guide the municipalities to follow guidelines of urban actions, but cannot intervene in a mandatory manner.

Within the municipalities of the AVMA, Medellín participates as the main city, not only for being the capital of the Department and the largest city, but also because it provides most of the overall budget that accounts for the entity and its projects. This makes a lot of sense considering that it is the municipality with more inhabitants, services and transport compared to other municipalities in the area. Medellín acts, in a certain way, as a subsidiary of other municipalities with lower incomes, ensuring that the metropolitan entity exercises a balancing function among participating municipalities.

Municipalities constituting the AVMA were formed in an independent way, and their growth was unplanned. Densification occurred in a vertiginous way since the early 60s, responding to particular country's social phenomena, including one very marked, the displacement of people from their home areas due to the presence of armed groups outside law and the permanent confrontations in which civilians have been involved. This situation led millions of people to take refuge in major urban centers and in Medellín, particularly, considering its topographical features, the concentration of migrant population situated mainly on the hillsides, as they constitute the periphery zone of the city, generating an occupation in high-risk areas [9].

This situation of rapid growth exceeded all possibility for local planning. The foreseen urban zone borders were overstepped, and the planning cycle "changed direction" (the government began a process to formalize

informal settlements). This growth generated a process of conurbation throughout the Aburrá Valley, and according to this lack of metropolitan planning, it is possible to notice the differences among building policies of each municipality, with very marked discordance across borders.

With the Law 388, 1997, which created guidelines for municipalities regarding the formulation of the Plans for Territorial Planning (POT in Spanish), local governments had a period to diagnose their territories and create a plan for twelve years. This resulted in the first Medellín's POT in 2000 which focused on the subjects of housing and public space, but in which transport as a structural axis in the territorial organization has not been included yet in a precise way. Despite this omission, Medellín and the Aburrá Valley, since that time, has the only metro system in the country that began operating its first line in 1995, serving today, directly or indirectly (by feeding routes), all municipalities in the Metropolitan area. In the first revision made to the Medellín's POT in 2006, the METRO System (metro system) was defined as the transport structural axis of the city. In this same review, it was recognized that Medellín had a diffuse growth and the Compact City model was proposed [10]. In 2014, with the Agreement 48, a new revision is made, formulating the current POT of Medellín, and the idea of a more inclusive city with pedestrians and cyclists is complemented to the model of Compact City by reversing the pyramid of transport, in which the pedestrian is now in the first place, and private vehicles are in the last one [11].

The Organic Law of Territorial Planning 1454, 2011 came to complement, with 20 years late (Ministerio del Interior y de Justicia, 2011), Law 388, 1997 creating the normative figure of the Metropolitan Strategic Plan of Territorial Planning (Pemot in Spanish) that articulates local Plans for Territorial Planning and defines the regional conurbation occupation model. The AVMA is the first metropolitan area among those in Colombia to present the Pemot that shall take effect from 2017 on [12].

In parallel to review processes of the POT, plans oriented to the planning of the transport system have also been made. In 1986 the first Metropolitan Road Plan of the AVMA was presented. Law 105, 1993 establishes that metropolitan areas must develop transportation master plans in the territories under their jurisdiction. In 2005 the formulation of the Mobility Master Plan for the Aburrá Valley Metropolitan Region (MMPAV) began, proposing innovative initiatives integrating the proposals that were already being discussed in the Medellín's POT with the Compact City model best defined, in the "Proyecto Metropoli 2002-2020"[13], and the Guidelines for Aburrá Valley Metropolitan Area Territorial Planning, among other

documents, to support metropolitan management area over the next 15 years in the planning of various means of transport and public space associated [14] (See in Table 1 in the Chapter 3.1).

The Colombian Government has planned the decentralized model since its Constitution of 1991, proposed through a strong autonomy of its regions, departments, districts and municipalities. This autonomy also refers to the budget formation of each of its levels, regulated by Law 1454, 2011 and Law 1625, 2013, which also regulated the participatory character of the budget when the different levels are working in a same project.

Projects of national interest are funded by the central government, as well as every level of governance finances projects that have interest and impact covering their boundaries and administrative scale. On the other hand, there are national programs where the central level invests in departments and/or municipalities, mainly supporting those that present fewer economic resources and possibilities for developing their own projects due to lack of funds. The three levels (national, departmental and local) are overlapped or complemented by each other in many cases.

The AVMA has its own budget, which comes from a series of sources that are explained in the Law 1625, 2013. This law mentions budgetary allocations from the central and the department levels, but in reality only the municipalities of the Metropolitan Area contribute to the budget formation, being the contribution proportional to the population they represented.

In 2015 Law 1753, National Development Plan 2014-2018 "All for a new Country," which is the government plan of the current president, was issued. In Art. 31 of the abovementioned law, Financing of Transport System states that transport system must be sustainable, and in order to make it possible, fares charged for a passenger public transport service provision should be sufficient to cover all costs of operation, administration, maintenance, and replacement of equipment. Territorial entities can be financing sources of fare, but in any case the National Government may not make transfers to cover these costs. The exception is in cases of co-financing of metro system or passenger intercity rail transport, in their physical infrastructure pre-operational stage and partial or total initial acquisition of rolling stock.

In Colombia, the government granted the collective public transport service to private transportation companies through tender, which selects and enables companies to the provision of public transport service. The metropolitan and local levels have an individual contractual relationship

with each of the 61 private companies that offer the service in the metropolitan area [15].

The funding model of the collective public transport service for the AVMA, and for Colombia in general, operates in a 100% private way. Municipalities belonging to the AVMA contribute to the infrastructure; however, the responsibility for investing and operating costs (the purchase of new vehicles, the maintenance of the existing fleet, operating and administrative expenses, etc.) fully correspond to service operator companies, which, in turn, pass on such costs to users through the service fare.

The AVMA, as a transport authority, defines the fare of the entire metropolitan area, both metropolitan routes as intra-urban routes. The calculation of the fare is set by a methodology of the Ministry of Transport (Resolution 4350, 1998 and its amendment 392, 1999), where all the costs assumed by a vehicle (capital costs, fixed costs, administrative costs and operating costs) per day are added and this value is divided by the average number of passengers at a vehicle in the same period. The ratio of these values defines how much each passenger has to pay to cover those costs. The average fare is fixed by municipal ordinance and annually adjusted based on the updating of the studies.

The Colombian law establishes that each municipality may determine subsidies for social groups to have access to reduced fares on public transport. The only fare reduction that works at the time, for the collective public transport in the AVMA, is the subsidy for students, which subsidizes about 50% of the ticket amount, value assumed by the Medellín City Hall.

There is no integrated fare in the AVMA collective public transport system, and users of this system must pay a new fare for each transfer, increasing the percentage of the budget allocated for transport. One of the reasons why it happens is because there is not a smart-card payment system; private transport companies manage the fare collection in cash only. The conditions change in the metro system, as in this system there is a single-collection system, which allows users to transfer into some of modes offered, such as the metro and cable lines, and with a surcharge can access modes operated by the same METRO company, as the integrated routes Metroplús (BRT) and feeding routes. The integration of these modes is called SITVA (Integrated transport system of the Valley of the Aburrá in Spanish).

Since there is no "single-till" principle, the resources go directly to each of the companies providing the service, which in its turn pays taxes to the government, both to national and local levels, but not to the AVMA. The only

tax that the metropolitan entity directly charges is the environmental fee, the other resources enter through the contributions of municipalities, as noted above.

When a company generates little profit or begins to present an economic deficit, what it does is to reduce its costs leading to a deterioration in the quality of the service, because it starts to spend less in the buses maintenance, works with older buses, and even pays less to its drivers (yet driver wages are part of the operating costs that enter in the calculation of the fare). It might happen that, although a company officially declares a payment of a minimum wage to its drivers, it actually pays a percentage of the amount collected at the end of the day. This creates an incentive for drivers to pick up more passengers, resulting in a wait longer until the bus is full before continuing its route, or creating a competition among drivers that share similar routes and with drivers of the same route. This is a traffic infraction and the driver can be fined. Operating companies do not pay fines and subpoenas, the driver must be responsible for them. Usually, a driver works from 4 am to 10 pm.

Currently, AVMA is being working on raising awareness in relation to this issue with transport companies, with still very incipient results. There are examples of the application of the single-till model for buses in the same route of a same company, and the application of the single-till model for all routes of a same company. Companies that already agreed to participate are finding advantages in the model.

The scheme under which the collective public transport in the city of Medellín was provided, for more than fifty years, and whose model has been followed in the neighboring municipalities, presented very few modifications until today in its administrative, financial, and operating structure [15].

At present, the public transport in the AVMA is composed by individual public transport (taxis), mass transport, and collective public transport (TPC in Spanish). The collective public transport service differs from the mass public transport service provided by the METRO Company, as previously mentioned, in which belong the metro service, the cable car system, the BRT bus – know in the AVMA as Metroplús, and the feeding routes, under the figure of the collective public transport, SITVA. In this sense, buses that provide the feeding routes service to the metro system make part of a fleet that in the past provided collective public service and currently are being reused as a matter of oversupply at that moment. These vehicles are not part of the fleet considered TPC because the METRO Company operates them differently.

The TPC intra-city routes are under the control of Medellín Mobility Secretariat. Additionally, there are metropolitan routes, which are routes that serve more than one municipality belonging to the metropolitan area, and which reach the Medellín downtown (See Figure 2 in Chapter 3.1). Indeed, in the other municipalities in the metropolitan area, all of the routes that serve the urban center offer a metropolitan service. This occurs because of the low demand to generate local routes in these municipalities. The AVMA and the Mobility Secretariat of each municipality are the responsible for regulating the number of routes and frequency compliance by the operator companies.

As the payment of the public transport system is made only by cash, since there is no smart card payment system, the current system does not allow a single integrated transport fare, and, as previously mentioned, this generates the charging of a new fare in each user transfer. In order to make effective the subsidy to students, nowadays the only subsidy in force in the AVMA, to subsidized students are given tickets that correspond to the value of the subsidy. The control of this distribution is a responsibility of educational institutions, when have to list the students, verify that they meet the requirements, quantify the number of trips that each student makes, and make the distribution of tickets. The ultimate responsibility for ensuring the student's subsidy is the Secretariat of Education and, ultimately, the educational institution.

In addition, provided the absence of a smart card and an integrated technology system for the TPC management, it is very difficult for the government to collect system data, relating to users such as origins, destinations, transfer, time travel, etc., or data concerning the services provided by the operating companies such as information related to operating costs, for example. It leads to a difficulty in having updated data and could use it for purposes of transport system planning.

The corporate scheme of private companies operating the TPC system functions according to the "affiliator" model: companies are usually owners of a very small number of vehicles (number that is less than 5%), and in order to comply with the vehicular offer to meet the assigned demand, companies enroll, for their operation, vehicles owned by individuals. Transport companies have parking lots for their fleet, but many individual owners leave their vehicles parked in public spaces. Each bus owner pays the affiliation of his vehicle to the company to operate the bus (in addition to paying taxes that any vehicle owner must pay to the government). This kind of connection allows companies to exempt themselves from some operational and administrative activities, transferring to the owner the responsibility of the maintenance or renewal of the vehicle

[14].

The owners, in turn, directly hire the number of drivers they need, according to the number of buses in their possession and, in some cases, less frequent, the same bus owners also drive their buses themselves. As mentioned previously, it often happens that the bus owner declares to the social insurance and the Secretariat of Transport to be paying to the drivers at least a minimum wage, but, in practice, it is known that some drivers are paid proportionally according to what they collect in tickets at the end of a working day. This situation leads to the driver looks for filling the bus with too many passengers, and disrespect the stipulated frequency, as well as creates a competition among drivers of different routes (or even of the same route) as to the number of passengers. This is what have been called the "Cent War".

The previous situation configures a business in which authorized companies do not perform the management operation, but the responsibility is transferred to the owner of the affiliated vehicles, only spending a minimum of management through the dispatchers and clock controllers at some points of the route. This implies that the incomes of the transport companies are not product, mostly, of the transport operation management, but of the vehicles affiliation and an affiliates' representation with the authorities [15]. (See Figure 4 in Chapter 3.1)

Considering that, the transport operation by each company is a sum of individual vehicles, even though there are four general categories of buses related to the number of passengers it can carry (bus standard, bus, minibus and microbus); variations of vehicles providing the service in terms of models, sizes, and colors are immense. Even the communicative elements of the bus route are presented differently in each vehicle.

The government should apply sanctions when a company providing the service violates the norms. By adding three penalties in the same year, a company can have its license suspended; two suspensions in three years can lead to cancellation. The cancellation of the license to operate may also happen when, among other cases, it is proved that the operating, technical, security or financial conditions were not restored within a period granted to the company.

According to the Medellín Mobility Secretariat, in its Executive Report Project TPMedellín 2015, the positive aspects of the current collective bus system of the city are: a great coverage; good frequencies; the possibility of direct travels without transfer; the acceptable travel times (commercial speed closed to 13 km/h in peak period); the democratization of ownership of the buses, and the



tradition of the routes in the city neighborhoods.

Also according to the Medellín Mobility Secretariat, in the same report, several aspects of the current system are identified to improve: the corporate scheme with deficiencies in the operating planning and the maintenance; the lack of signaled bus stops, appropriate spacing and sizing; the saturation in city downtown that decreases the commercial speed and pollutes; the difficulty to insert exclusive lane corridors for lack of road space in some areas; the difficulty to operate exclusive lane corridors with the quantity of current buses; the lack of a collection system that allows the finance sector to modernize, and the lack of logistics centers or parking lots without public space invasion.

### 3. Results

A series of implications emerges from the differences that exist between the two public transport systems studied. They seek to emphasize existing problems in the Colombian case caused by failures of the current system, and - through a direct comparison with the Korean study case that serves as example - become evident.

Using evidenced implications, a series of guidelines is generated in order to orient the reorganization of the collective public transport system in the AVMA towards a Transport Oriented Development model contextualized to the local conjunction.

#### 3.1 Comparison and Implications

In Colombia, the decentralized structure that empowered local government with authority to legislate presents limitations in fully implemented national laws, plans and projects. In addition, there is a lack of coordination and integration among different administrative levels in a vertical way as also in a horizontal way (among different entities in a same hierarchy), related to the normative (policies, strategies, and measures), financing and management aspects. This generates also lack of coherence among existing instruments for the governance of the territory, lacking, as well, regional and departmental level instruments.

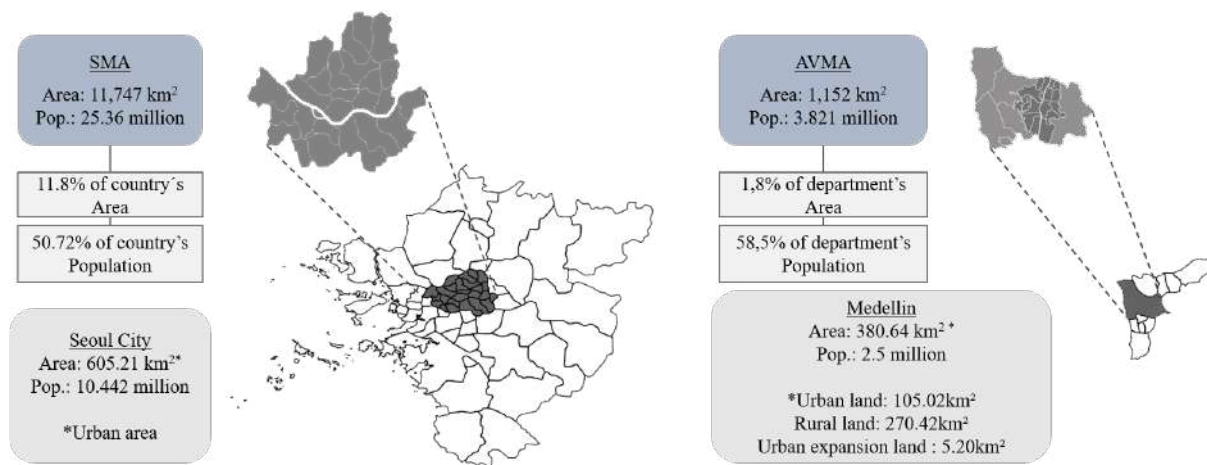
Nowadays, there are not implemented hierarchical systems of regional, metropolitan and urban mobility [14]. Furthermore, there are not yet clear policies about how to enable a polycentric network of urban nodes. According to the AVMA, the dynamic of expansion of uses and activities centered in the Aburrá Valley advances faster than the metropolitan, sub regional and municipal

planning instruments, which would allow ordering and regulating it [14]. According to the AVMA and to DANE projection data, 58.5% of the population of the department of Antioquia is located in 1.8% of the territory. In relation to the Metropolitan Area of the Valley of Aburrá, 95% of the 3,821 million inhabitants live in urban land of the 10 municipalities. The data lead us to conclude that despite the difference in size between both metropolitan areas, both SMA and AVMA present high population densities. If we consider the urban population density indicator, Medellín is even denser than Seoul, with 23,465 pop / km<sup>2</sup>, while Seoul has 17,254 pop / km<sup>2</sup>

The metropolitan area, in its associative entity condition, does not exercise authority function on land use. For this reason, it can only guide, through directives, the territorial management in its urban actions, and those limitations also cause a negatively impact on mobility and transport integration policies with public space. The Mobility Master Plan (MMPAV) seeks to respond to a comprehensive planning for mobility and transport. However, it is an "advisor" document in making decisions to institutions related with mobility and territorial space.

The budget formation of metropolitan areas in Colombia follows a bottom-up policy of fiscal decentralization, imposing on municipalities in the metropolitan area to contribute to the budget. This creates a conflict among the different municipalities, which with their budgets, many times limited, have to contribute to the metropolitan area and expect that the projects in general, and particularly in the transport system, obey to an equity and a regional balance policy. All urban routes of Medellín, besides metropolitan routes, generate an oversupply in downtown, as all routes come there, creating problems of congestion and environmental problems of pollution caused by the average age of the fleet and the fuel used.

Although the National Government, by requiring a self-sustainable collective public transport system, enables territorial entities to participate in part of this funding, it has not been established to what extent, and therefore they do not participate. It ultimately leads to transportation companies to pay for all the provision costs of a public service that is of public order but works in a 100% private way. At the same time, local governments fail in their binding character, and the legislation itself creates gaps or inconsistencies that are used by operating companies in negotiations with the government, which finds itself limited in the imposition of regulation compliance. The operating companies apply the private market rules to the provision of this public service. As there is a fixed amount for the fare, each company looks for increasing its own profit by diminishing the quality of the service.



**Figure 1** Comparison between SMA and AVMA boundaries, areas and population

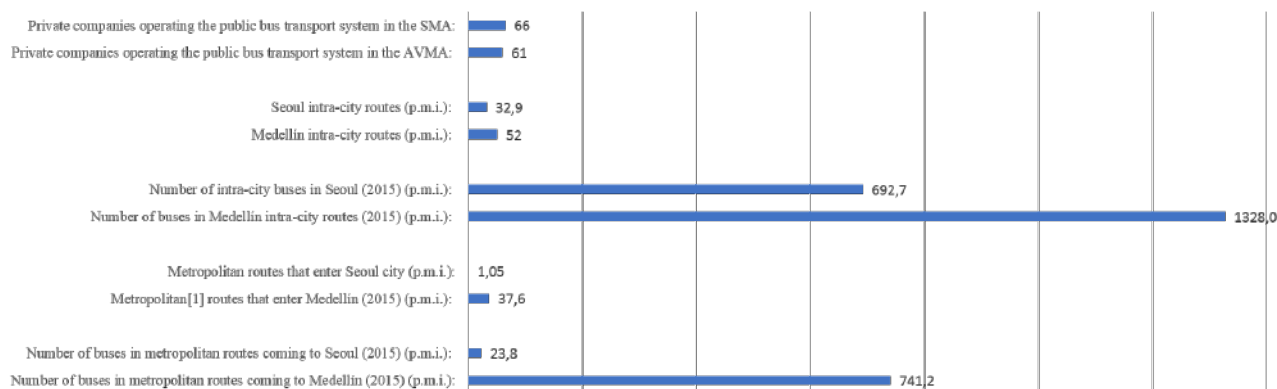
**Table 1** Comparison between management strategies and transport vision of the Korean and the Colombian case in the governance level

Korean Case	Colombian Case
<p>Management Strategies of SMA:</p> <ol style="list-style-type: none"> <li>1. Urban Growth Management: Growth Control to response to alleviate concentration.</li> <li>2. Metropolitan Development Plan: Overcome the limitation of individual urban planning system.</li> <li>3. Metropolitan Transport Network Development</li> <li>4. Legislative Measures.</li> <li>5. Public Transport-oriented Initiatives</li> <li>6. Legislative Measures for Large Scale Development</li> <li>7. Governance for inter-local collaboration in SMA</li> </ol> <p>Management Strategies of AVMA:</p>	<p>Management Strategies of AVMA:</p> <ol style="list-style-type: none"> <li>1. Regional strengthening</li> <li>2. Integrated management of metropolitan areas</li> <li>3. Equitable development and rational use of resources</li> <li>4. Inter-institutional coordination</li> </ol>
<p>Area-wide Urban Planning to overcome the limitation of individual urban planning system.</p>	<p>The Metropolitan Area, in its capacity as associative entity, does not exercise in authority in land use. Urban Planning system is exercised individually by each municipality.</p>
<p>Transport Vision: A Human-oriented transportation (safe, convenient transportation for the disabled; pedestrian-oriented transportation environment; low-cost, high-efficiency operation system.</p>	<p>Transport Vision: A Human-oriented Transportation (a metropolitan transport system which is affordable, efficient, equitable, sustainable, fast, reliable, safe and of quality that encourages the use of public transport over private motor vehicle transport). Enhance the public bus transport service and consolidate the Metro system as the structural axis of the transport system. It consolidates a single transport authority.</p>

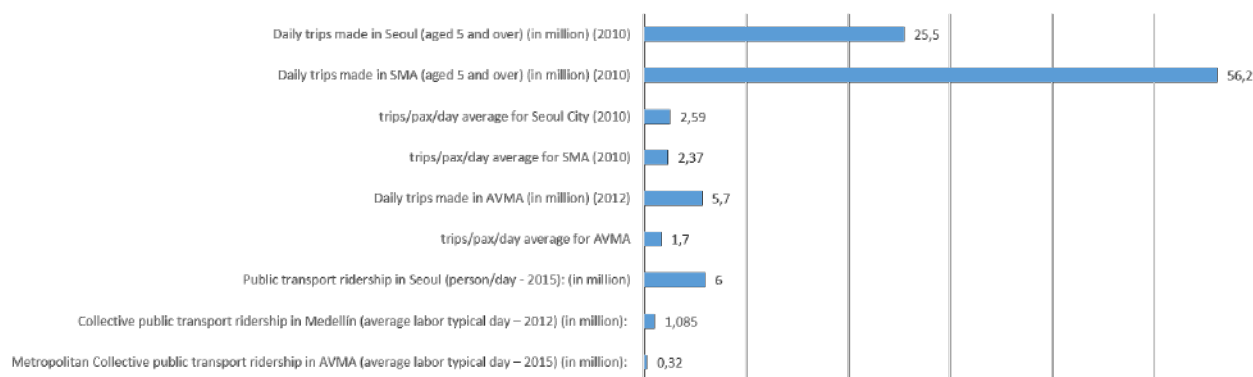
The same regulation allows a transport company to affiliate private vehicles, requiring a very small own fleet. From this, each vehicle owner represents an individual interest in the system, making it difficult to build consensus towards an organized transport system. As the government transfers the investment and operational costs to the companies, they - in their turn - do the same, transferring the costs to bus owners. It becomes difficult

to concentrate investment in collective infrastructure, as bus deposits, for example. Being these vehicles owned by third parties, in some cases, at the end of a work day, their owners park them in front of their houses, obstructing the public space.

The license cancellation of an operating company is a bureaucratic process and presents a significant problem for local governments, as this cancellation would imply



**Figure 2** Comparison between SMA and AVMA data about numbers of operating companies, routes and buses. (p.m.i.): per million inhabitants. [1]: It is not being considered in the data feeder routes, operating under the administration of the Company METRO



**Figure 3** Comparison between SMA and AVMA data about numbers of daily trips; trips/pax/day and ridership. Trips/pax/day and daily trips for Medellín was not informed

that the routes in charge would remain unserved, and the government does not have the capacity to supply them. On the other hand, there is no incentive system for companies meeting, standards of quality, efficiency, comfort and accessibility of the service.

There is a functional disarticulation of competencies and of management of the various modes of transport in the Aburrá Valley: the metro system; the standard bus, the bus, the minibus and the microbus system; and the taxi system [14]. The results of this lack of articulation are reflected in the lack of coordination among the different operators of the various modes of transport, making the implementation of a single fare and an integrated smart card system impossible.

The lack of an integrated system and the lack of a smart card do not allow, in addition to the integrated fare, a data collection that accurately represent the current state of the collective public transport system. The mobility secretariat has to collect data of the number of passengers transported based on the information contained in the

passenger counting of each bus. There is no information of an average travel time of passengers, and the possibility to verify the existing supply and demand capacity for each route is obtained only through studies carried out for this purpose.

Each trip is a fare paid by the passenger. For a person who earns a minimum monthly wage, who lives and works in Medellin, taking a bus to go/return to their job, transport costs may account for 12% of their budget; if this person had to take two buses to go/return from work, these costs would be around 23%. For a person who lives in the metropolitan area and works in Medellin or vice versa, their transportation expenses may account for 20% of their income, without the need for transfer, and 31.5% if it is necessary to take two buses to go to work and other two buses to come back home [16]. Due to lack of public funding, the only existing subsidy is the one to the student group. It is made in a crossed way, which means that the user that pays the full fare is funding the subsidized fare.

The existing low wage levels in Colombia must be

**Table 2** Comparison between operational aspects of the Korean and the Colombian case

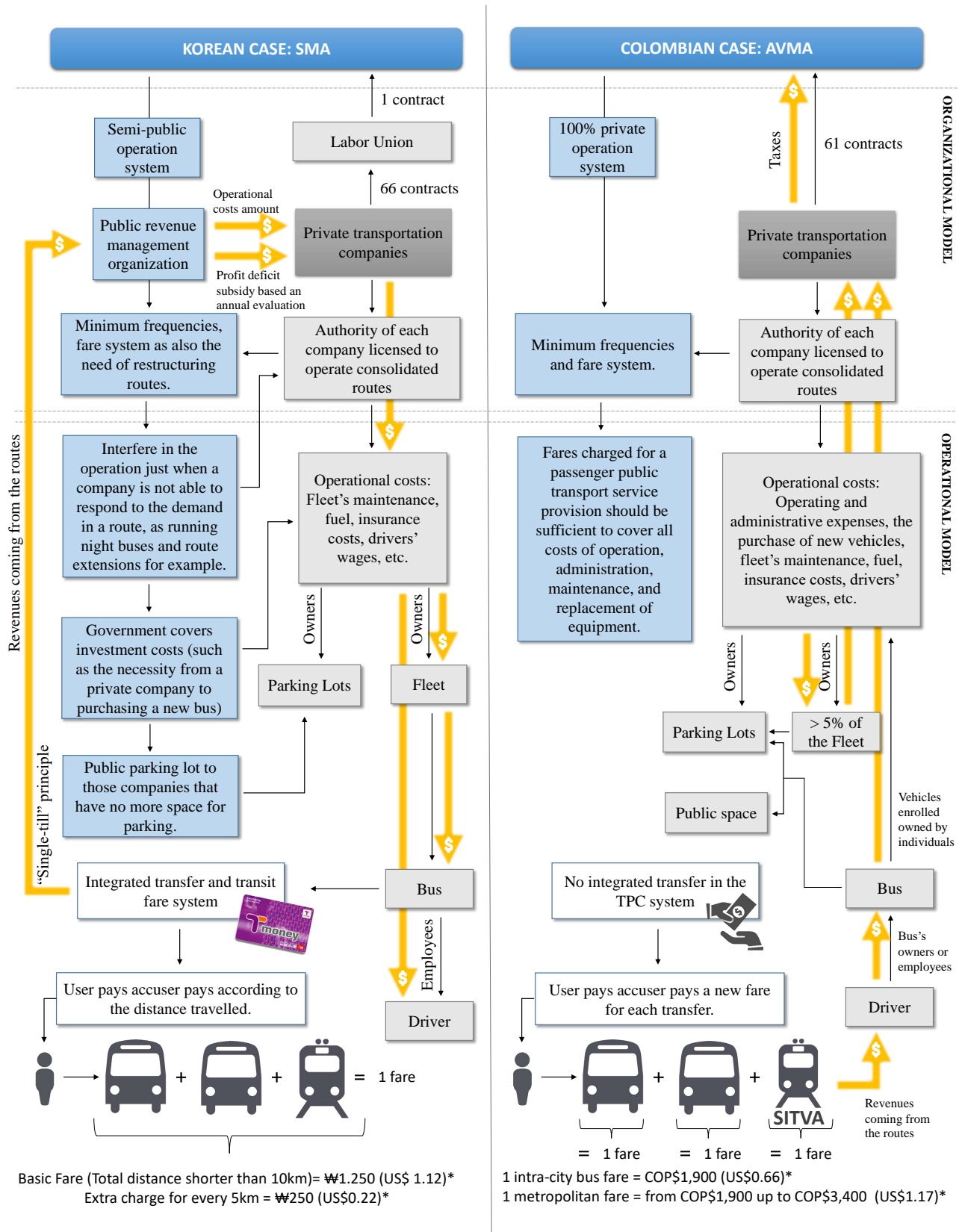
Korean Case	Colombian Case
<p>Four categories of bus routes: center-suburban (red), intra-city (blue), feeding (green) and neighboring (yellow) buses.</p> <p>There are three categories of buses: articulated buses (not in service anymore), low floor buses, and high floor buses. Most buses in South Korea are domestic models, and work with either compressed natural gas, electric batteries or a combination of both.</p> <p>Four categories of vehicles: Standard bus (capacity from 60 to 99 people), Bus (capacity from 40 to 59 people), Minibus (capacity from 20 to 39 people), and Microbus (capacity from 13 to 19 people). Wide variety of models, sizes, colors and communicative elements. Buses work with diesel.</p>	<p>Three categories of routes: radial routes (neighborhood-center), circular routes and metropolitan routes.</p>
<p>With the smart card T-money, users can pay the bus, metro and taxi fares, as they also can shop at local stores. Adoption of ITS (Integrated Technology System) to Transport Management.</p>	<p>There is not a single payment card nor the adoption of ITS (Integrated Technology System).</p>
<p>Average commuting time (2010): 62.4 minutes.</p>	<p>Nowadays, these data do not exist. According to Medellín Mobility Secretary, the travel time varies widely, and this is because the routes have different lengths, so travel time changes from 10 to 50 minutes.</p>
<p>Public transfer center creating a Hub-spoke bus network to passenger transfer.</p>	<p>In the AVMA does not exist a public transfer network for users. Metropolitan routes go to Medellín downtown and share tracks and passengers with the buses of municipal routes.</p>

considered, and specifically in the AVMA, in Medellín 12.62% of the population live in dwellings of socioeconomic stratum 1; 37.03% in the socioeconomic stratum 2; 29.64% live in the stratum 3; 9.96% in stratum 4; 6.82% in stratum 5; and 3.93% in stratum 6. Socioeconomic dwelling strata (applies to the entire country) has the following categories: 1. Under low; 2. Low; 3. Medium low; 4. Medium; 5. Medium high; 6. High. Of these, strata 1, 2 and 3 correspond to the lower strata that hold users with fewer resources, which are beneficiaries of subsidies on public services; strata 5 and 6 correspond to upper strata that hold users with greater economic resources, which must pay surcharges (contribution) on the amount of public services. The stratum 4 is not beneficiary of subsidies, neither has to pay surcharges, it pays exactly the amount that the company defines as the provided service cost. In Colombia, the methodology of stratification based on the characteristics of the dwelling and its urban or rural surrounding has been adopted because, according DANE, income per person and dwelling data are unmanageable by the volume of data that government would have to collect, because of its variability in the short term. Also it does not constitute reliable information due to the magnitude of the informality and the continuous displacement of families and, fundamentally, because the rules concerning the

stratification ordered that residential properties should be stratified, and not households [Law 142, article 101.1], among other reasons [17].

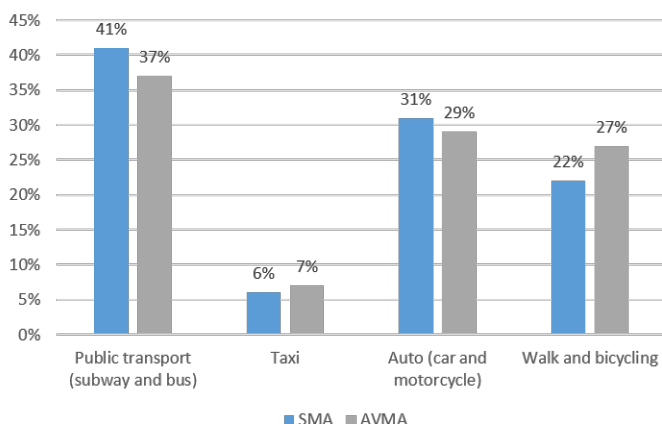
If the low wage levels data in the AVMA are crossed with the modal share (there is no published data of modal share by socioeconomic stratum), we can deduce that the percentage of trips made by public transport (37%) largely corresponds to trips made by lower strata of the population. So the costs of the reduced fare are charged to all users of the system, which, in turn, are using the collective public transport system because, generally, their economic conditions do not allow them to travel otherwise.

Under the current “affiliator model”, the payment distribution is not made from a managing body to employees, but conversely. The management of costs and profits is individual, losing the possibility to manage an economy of scale. The application of the current model, combined with the lack of institutional control, allows the generation of undignified working conditions within the system, such as payments lower than the minimum wage and extended work hours.



\*Currency conversion made through XE Currency for the date 9/21/2016

Figure 4 Comparison between SMA and AVMA organizational, financial and operational model



**Figure 5** Modal split in SMA (2010) and in AVMA (2012)

### 3.2 Guidelines

The guidelines are presented according to the possibility of their implementation in the short, middle, and long term; likewise, they will be presented following the three levels of Governance Level, Financial System, and Operational Aspects. The decision to study the different levels separately aims to facilitate the analysis and present them in a didactic way, following the hierarchical order established in planning process. That does not mean that there is no relationship among all levels, and that decisions mad at the strategic level do not impact the operational one directly. These interrelations are taken into account in the conclusions presented.

#### Governance Level – Short term

- To maintain, through metropolitan work tables, the articulation among municipal Plans for Territorial Planning (POT in Spanish), demanding an integration of environmental issues, housing, public space, and mobility, to guide the growth of municipalities towards the common model of a compact city, with technical support and representation of the Ministry of Transport so that the discussion is carried out at the light of the legislation. Thus, results of each area may be present in plenary sessions, allowing identifying strengths and weaknesses and finding common points of growth. These plenary sessions should be conducted twice a year, and the results of their discussion should be taken into account by the Ministry of Transport for policy reviews that could arise in the middle term.
- To make effective the authority in transportation of AVMA for planning the services of the metropolitan collective public transport through technical training of teams of professionals in the compliance of their

functions; and to propose a work agenda that includes the implementation of the technical aspects in which a compliance by stages and result presentations responding to the schedule set by the authority is required.

- To propose by the government a quality seal of public transport service, training companies in business topics, and quality and technical issues related to transportation. The product of such a training should be the delivery of a self-diagnosis that will be the starting point for the creation of an implementation of a corrective action document. The purpose of this document is to enable operating companies to achieve the quality parameters in a time established by the AVMA transport authority (the number of buses, bus conditions, compliance of recruitment rules and decent working conditions, and use of appropriate fuels, among others).
- To implement awareness campaigns, in which the advantages of using the public transport system are explained, and the user is invited to reduce the use of the private transport. Such campaigns should be based on the change of the people’s idea towards the public service, projecting it as a system of quality and efficiency, in which the user is also part of the change. Campaigns must start from the idea of an effective and evident change in the system, so users themselves would generate pressure to the change to be carried out.

#### Middle term

- To improve coordination and integration of different territorial and associative levels through: 1) a more simplified legislation in relation to the number of laws, decrees, ordinances, and existing alterations; 2) a more coherent legislation, which collect policies and experiences top-down and bottom-up and generate documents aligned with each other in relation to the same object, thus filling existing gaps; 3) the creation of new instruments to coordinate and integrate regulations, financing, and management together vertically and horizontally, with special emphasis on the creation of regional and departmental level instruments, as Metropolitan Strategic Plan of Territorial Planning and Departmental Strategic Plan of Territorial Planning, for example.
- To encourage the distribution of public entities and the emergence of job-creating companies in cities other than the main city, seeking to increase the self-sufficiency of municipalities in the Metropolitan Area. The aim of this strategy is to avoid the concentration of services and facilities in the main city and to achieve the goal of a polycentric network.

- To define the sustainability model of the collective public transport system and to what extent the AVMA and municipalities belonging to it will start to self-finance part of the system, covering a gap in the current legislation, which refers to a total absence of funding from the national level but allows other territorial entities to participate in it. This could support the objective of an incentive to use inter-modality and public transport, and should even be seen as a disincentive policy to the use of a private transport.
- The National Government must review the legislation of the public passenger transport. In this review, the collective public transport must be completely included within the public passenger transportation, such as it is, regulations as focused in the mass transport system and, to a lesser extent, on the integrated transport. In fact, there is an attempt to gradually change the current collective transport into the integrated transport in the AVMA.

### Long term

- To perfect the national decentralized structure scheme, empowering intermediate territorial and associative entities, between the national and local levels, such as departments and metropolitan areas that currently lack the authority in essential functions for territorial planning. The strategy would improve the current bottom-up approach, eliminating the inefficiency generated in the planning process by specialized technical teams, which currently fails in the generation of policies and coordination of projects among different municipalities and especially at larger scales.
- To make a regulation review of associative area functions expanding and authorizing them to have a binding character.
- To create a bidding regulation from the metropolitan entity to municipalities that constitute it, which gives to it the authority in the function of ordering the territory through urban actions, such as control and management of land use.

### Financial System – Short term

- To propose to transport companies, together with the government, to make a work plan for scraping vehicles that today do not meet the required characteristics. In this case, initially it will be looking for leaving from circulation buses that do not meet with requirements, but the middle-term goal would be that the entire fleet become homogenous. This should be supported by some funding or incentive of

the national, departmental or municipal government. It could be done through financial possibilities such as PPPs, so that the investment cost does not completely fall on the private company, and, consequently, on the user through the fare.

- Inserted in the proposed strategy on the issue of governance level refers to provide quality seals to the provision of transport services by private companies, it should be considered decent working conditions for employees (including drivers), such as payment of fair wages, adequate training for the transport provision, and fixed number of working hours. In addition, companies have to take charge of fines given to their drivers, worrying about, in this way, by train them.
- To implement changes to cleaner fuels, considering the global demand for emission reduction. Although in the governance, a regulation review in the middle term is proposed, this issue could start to be worked from the short term. It is proposed that within quality seal parameters of compliance, one of the points is the subject of fuel, and in the short term the company can increase its level of quality with the use of Euro 5. A proposed strategy is to have efficient categories according to the quality rating, and the higher the level reached by the company, more incentives could be got from the government. These incentives can be in the form of tax reductions and discounts on fines, among others.

### Middle term

- To expand PPP policies to the collective public transport system, to the investment phase and operational phase, which only has clear policies for mass transport.
- To adapt the collective public transport system to an integrated model through the smart card technology, already existing for the Aburrá Valley integrated transport system (SITVA in Spanish), including the modes operated by METRO Company.
- With the adoption of an integrated system through the smart card payment, the single-till collection model, where the metropolitan area is the administrative entity responsible for managing the transfer of the amount of total costs to the public transport operating companies, may be adopted.
- To adopt a single integrated fare for transshipment among different modes of collective, integrated and massive public transport. Payment to each private company would occur according the km traveled by their routes.

- To build a metropolitan control center that satisfy the needs of the collective public transport system of the municipalities that constitute it, in terms of accidents control, response time, traffic signals, frequency control, stops, speed control, and demand data, among others.

### Long term

- Through the proposed reform at the governance level, a new financial model to ensure a semi-public functioning of the passenger transport system, reformulating the government involvement at its different level in the funding of the service shall be considered.
- The public funding would be given at investment stage of the system, for example to adapt the system to an integrated model through the smart card technology, fleet acquisition, fleet maintenance, and transport infrastructure (bus deposits). Likewise, the government would start to subsidize the fares for certain social groups, without the need to charge this cost to other users of the transport system.
- To create regulatory and fiscal measures to generate a metropolitan budget fixed and independent from municipal contributions. In this way, the metropolitan area is which would contribute to municipalities through projects, different from what is done today. For this purpose, a budget allocation from the Nation should exist, and it may be thought that certain taxes that arrive at the AVMA from municipalities, could enter directly to the associative entity, such as vehicles tax collection that provide metropolitan services.

### Operational Aspects – Short term

- The metropolitan and municipal government should require from transport companies to have a bus deposit that meets the requirements regulated for it, and that 100% of the fleet remains when services are not offered. This strategy is linked to the quality seal proposal of collective public transport service provision and incentives for the bus deposit implementation, through credit facilities, agility of procedures and licenses could be proposed, among others; or to whom have already implemented it and have been properly working, that could be done incentives through tax cuts, for example.
- To make new analysis of the metropolitan and municipal route courses leading to a decongestion that currently lives Medellín downtown. This analysis could be carried out based on the next Origin-Destination survey, among other information,

in which the integration proposed here should be considered.

### Middle term

- The collective public transport operating companies must organize their “affiliator model,” in a way that all company vehicles, both owned by the company or affiliates, are entirely managed by the company. Two possible scenarios are presented. In one of them, the owner of the private vehicle would receive a fixed payment for the use of the same by the company responsible for managing the vehicle. In the second scenario, vehicle owners would become shareholders in the company and their vehicles would make part of the company fleet, considering that there shall be a set limit for the number of buses that each owner could exchange for shares, as the fleet responds to studies of supply and demand required by law.
- To disseminate the supply of existing routes, with their frequencies, bus stops, fares and hours of operation, in an integrated way, that crosses the collective public transport service with the other modes of transport and with the cadastral information of the city. This application would give options to the user, according to the proximity from different routes and the origin destination selected by the user.

## 4. Conclusions

AVMA current collective public transport system structure, in its technical, legal, and financial aspects, is on a state that requires a thorough review to make structural changes within it. It is clear that the level of service - where is evidently seen the “Cent War” in the collection-, the working conditions of drivers - in which an employment with decent conditions is not generated-, the environmental pollution factor - due to the age of the vehicle fleet and fuel used-, and road safety issues related to the increasing number of accidents are reflected on the collective public transport system supply. In this way, the “affiliator model” can be considered as the underlying problem of the collective public transport system current state, which is accepted by Colombian law.

Efforts are under the way to gradually change the collective public transport system into the integrated transport model, but, according to the analysis carried out, there are few binding measures that the government can use to impose transport companies to meet these requirements. However, there are also no financial incentives for operating companies to decide to do it.



The work of changing from one model to another is slow and, while it is not complete, there is a huge regulatory gap regarding the collective public transport, which is used by this sector to create more convenient conditions for private companies, but inconvenient for users.

In addition, to the problem of the collective public transport system structure, three important determinants that must be taken into consideration if the results are to propose effective change strategies are added, whether in a short, middle or long term. These determinants are the Aburrá Valley topography, the socioeconomic conditions of the municipalities belonging to the associative entity, and the culture of the society under coverage.

Based on the results submitted, it is necessary to recognize that the passenger public transport system must go through a national reform, following the example of the SMA Public Transport Reform carried out in 2004. In order to boost this reform, it is necessary to review the current legal provisions and establish new policies, strategies, and measures to enforce the integration of existing transport modes and the application of technology to modernize the sector. Besides new policies, it is necessary to rethink the funding and corporate model used in the collective public transport sector.

To provide an attractive, efficient, comfortable, safe, and affordable public transport system must be considered within strategies to stimulate the use of public transport and intermodal transport modes, and it should even be seen as a disincentive policy to the use of private transport.

It will not be easy to convince operating companies to change this model, as seen in the SMA study case, where transport companies were also not satisfied with the reform proposed in 2004. However, as in the Korean study case, it is seen the necessity for the public transport system to be partially subsidized, in order to offer better conditions to its users. With the currently conditions in the AVMA, to improve efficiency and quality of passenger collective public transport implies increasing the fare of the service, charging the cost to the user and increasing inequality in the access to a public service that represents a right for all citizens, the right to mobilize in the territory and to access to the various existing equipment, services, and spaces.

The strategies generated in this report - organized according to governance, financial and operational level, and structured in short, middle and long term-, intended to provide a starting point for the reorganization of the collective public transport system of Aburrá Valley Metropolitan Area into the Transport and People-oriented Development model.

## 5. References

- [1] I. Chung, "Coordinated Development & Management of Seoul Metropolitan Area: Focusing on Transportation," Unpublished manuscript, *Korea Research Institute for Human Settlements (KRIHS)*, Anyang, South Korea, 2016, pp. 1-33.
- [2] I. Chung, "Planning, Development and Management of Seoul & SMA: Land Use Transportation," in *Korea Research Institute for Human Settlements (KRIHS)*, Anyang, South Korea, 2016, pp. 1-54.
- [3] W. Lee, "Growth Management of the Capital Region," in *Korea Research Institute for Human Settlements (KRIHS)*, Anyang, South Korea, 2013, pp. 3-92.
- [4] I. Chung, "Urban Transport Policy in Korea and its Lessons," Unpublished manuscript, *Korea Research Institute for Human Settlements (KRIHS)*, Anyang, South Korea, 2016, pp. 1-32.
- [5] GDPC, "Conflict Cases of National Projects in Korea: Analysis and Implications," in *Korea Research Institute for Human Settlements (KRIHS)*, Anyang, South Korea, 2014, pp. 180-184.
- [6] AMVA, *Área Metropolitana del Valle de Aburrá*, 2016. [Online]. Available: <http://www.metropol.gov.co/institucional/Paginas/queeselarea.aspx> Accessed on: Sep. 11, 2016.
- [7] DANE, *Estimación y proyección de población nacional, departamental y municipal total por área 1985-2020*, 2005. [Online]. Available: [http://www.dane.gov.co/files/investigaciones/poblacion/proyepobla06\\_20/Municipal\\_area\\_1985-2020.xls](http://www.dane.gov.co/files/investigaciones/poblacion/proyepobla06_20/Municipal_area_1985-2020.xls) Accessed on: Jul. 20, 2016.
- [8] Alcaldía de Medellín, *Generalidades, Medellín y su Población*, 2006. [Online]. Available: <https://www.medellin.gov.co/irj/go/km/docs/wpcccontent/Sites/Subportal%20del%20> Accessed on: Sep. 11, 2016.
- [9] Alcaldía de Medellín, *Medellín Transformación de una Ciudad*, 1<sup>st</sup> ed. Medellín, Colombia: Banco Interamericano de Desarrollo (BID), 2009.
- [10] Salvador Rueda, *La ciudad compacta y diversa frente a la conurbación difusa*, 1998. [Online]. Available: <http://habitat.aq.upm.es/cs/p2/a009.html> Accessed on: Feb. 21, 2017.
- [11] Alcaldía de Medellín, *Secretaría de Movilidad*, 1998. [Online]. Available: <https://goo.gl/57yqWw> Accessed on: Sep. 09, 2016.
- [12] J. J. Ortiz, "POT metropolitano regiría desde 2017," *ADN*, no. 1938, pp. 2, 2016.
- [13] Área Metropolitana del Valle de Aburrá (AMVA), *Plan Integral de Desarrollo Metropolitano. METRÓPOLI 2008-2020*, 1<sup>st</sup> ed. Medellín, Colombia: AMVA, 2007.
- [14] Área Metropolitana del Valle de Aburrá (AMVA), *Plan Maestro de Movilidad para la Región Metropolitana del Valle de Aburrá*, 1<sup>st</sup> ed. Medellín, Colombia: AMVA, 2009.
- [15] Secretaría de Movilidad de Medellín, *Informe Ejecutivo Proyecto TPMedellín. Medellín*, Unpublished manuscript, Colombia: Secretaría de Movilidad, 2015.
- [16] Noticias Caracol, *Conozca las tarifas de transporte que regirán en el Valle de Aburrá*, 2016. [Online]. Available: <https://goo.gl/4eZLge> Accessed on: Oct. 05, 2016.
- [17] Departamento Administrativo Nacional de Estadística (DANE), *Estratificación socioeconómica para servicios públicos domiciliarios*, n.d. [Online]. Available: <http://www.dane.gov.co/index.php/servicios-al-ciudadano/servicios-de-informacion/estratificacion-socioeconomica> Accessed on: Sep. 10, 2016.