MASTER

The role of transnational processes in the worldwide diffusion of Bus Rapid Transit systems

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The role of transnational processes in the worldwide diffusion of Bus Rapid Transit systems

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Preface and Acknowledgements

During (recreational) trips I have made in my life to Thailand, India and Mexico, I became intrigued with future and sustainable mobility issues for those cities. It takes no professor to see that in large cities in those countries (Bangkok, Mumbai, New Delhi, Mexico City) mobility issues press hard on a cities livability and prosperity. Congestion during every hour of the day, people wearing facemask when they work outdoors, and the forecast of growing inhabitants and number of people on the move is not helping at all. Therefore I am very satisfied that, after a wide search, I took Bus Rapid Transit (BRT) systems as a topic for my research.

However, answering related questions and conducting an explorative research isn't something one does overnight and without help from a lot of people around him. There were times I was euphorically standing on the top of a mountain when I just had an interview with a highly placed official on the other side of the world, but there were also times when loneliness and despair took over my happy emotions. I am really proud the work that lies in front of you, but I realize that I have also many other people to thank for this.

First of all, I want to thank Frans Sengers, for his daily support, especially during processes of writing, structuring and analyzing. Thank you, Frans, for the interesting discussions on drafts and outcomes, and for the weekly meetings which motivated me to work harder. You have a large heart and knowledge about sustainable mobilization and I hope you find my outcomes useful for you PhD thesis. Then Rob Raven, you saw structure in my thesis where I lost it and your insights and efficient meetings contributed extensively to the form and content of the report as it is now.

In general I am grateful that I experienced a familial ambiance at our department and mostly at the study association Intermate. Their coffee, puzzles, desired and undesired moments of distractions, and the warm and pleasant atmosphere made my period as a student more enlightening.

Last but not least, friends and family encouraged and supported me in many ways. Fieke, I really thank you for your unconditional love and support, even during desperate times. You carried a part of my burden to write the thesis and also your ability to motivate me to work has helped a great deal to finish my work. My parents and brothers and sisters I want to thank for having a warm home to come home to in the weekends to clear my mind.
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Martijn van der Eerden, January 2013

Executive Summary

Due to increasing pollution and congestion problems, cities search for solutions in the form of mass transit systems. Bus Rapid Transit (BRT) is one of those solutions and can be seen as a hybrid form of public transportation, combining benefits of tram and metro systems with the flexibility, low investment cost and the possibility of fast implementation of bus systems. BRT projects are implemented in around 150 cities all over the world. The case of BRT is used to explore whether taking a transnational perspective in the analyses of transitions may result in new or alternate findings.

Therefore, the main research question in this thesis is:
To what extent are urban mobility regimes and the Bus Rapid Transit niche displaying transnational characteristics and what role do transnational processes play in the diffusion of Bus Rapid Transit worldwide?

Research approach and framework

The implementation of a BRT system in a city can in some cases be considered as a radical transformation of its urban mobility. The study of radical transformations is a core topic in the field of transition studies. The frameworks that are often used for analyzing the stability of an incumbent regime and its transition (potential) are the multi-level perspective (MLP) and strategic niche management (SNM). MLP defines three different levels (landscape, regime and niches) which interact with each other and may facilitate transitions to occur. Strategic niche management is looking at processes through which niches develop sufficiently to be able to compete with dominant technologies and configurations.
Recent debates in transition studies involve building bridges with / to other disciplines. One particularly interesting debate for this research is with geographers about the role of space and scale in transition studies.
In this research, an explicit transnational approach is taken. Because this has not often been the case in transition studies before, this research has a strong explorative character to explore the usefulness of analyzing transitions through a transnational lens. Furthermore, during the regime analysis, a differentiation is made between cities in Europe and cities in more developing countries. The latter is also done because interviewees and data suggested large differences between those two contexts.

Data collection and methodology

Insights and data about BRT systems are mainly found in reports on BRT; many international NGOs publish implementation guides or reports for evaluating and decision-making. This thesis makes use of efforts of organizations to try to assemble knowledge and data about best practices. Amongst others, a database constructed by a consortium of international organizations is used to visualize and describe the diffusion of BRT systems. Moreover, websites of involved actors are used to determine their role, their visions and the ways they learn and share knowledge.
In addition, several interviews were held with highly placed and internationally recognized experts in their area of expertise. Some interviewees have been involved in the field of BRT

from the start and are worldwide known for their experiences, publications and achievements. Many of them had knowledge of BRT systems all over the world and about the involved actors and knowledge transfer mechanisms.

Analyses and conclusions

Determining the extent to which incumbent regimes display transnational characteristics, and the impact of it, two interesting findings are done. First, it became clear that in both developing cities as well as in European cities the private motorized transportation regime has gained a prominent place in urban transportation and the car industry is in general extremely transnational and very strong in stabilizing the private motorized transportation regime.

Secondly, the difference between developing and European cities was found in describing the public transportation regime. Whereas developing cities might have an incumbent (informal) public transport system that is operated by various types of vehicles and operators and is not supported by governments much, in European cities the public transportation regime is much more organized and benefits from best practices in organizational set-up.

An interesting correlation is found between the lack of many transnational characteristics of a city's public transportation regime and the fact that these cities have implemented BRT systems that are larger and of greater capacity than in other (for example European) cities.

The global niche analysis displays strong transnational characteristics on all its niche internal processes. International NGOs and parties create transnational relationships and along with that many flows of researchers, knowledge, money and ideas. The creation of expectations and the lobbying occurs all around the world and is often done by the same international NGOs. In addition, steps are taken in standardizing BRT systems and developing implementation guides based on assembled, accumulated, extensive experiences around the world. Also, communication runs through very transnational mediums. However, interviewees argue that factors (i.e. the availability of funds) and local political support are crucial for successful implementation of BRT systems.

It can thus be concluded that transnational processes are an important driving factor behind the diffusion of BRT systems. It influences the pace in which knowledge is spread around the world. Furthermore, international NGOs assembled and collected experiences and best practices all around the world and disseminate it to city governments or other interested actors. However, through the findings of this research and some statements of interviewees, it is also evident that actually the entanglement with local factors facilitates the successful diffusion of BRT systems worldwide.

Recommendations

This research showed how important transnational dimensions can be in innovations like BRT. This implies that more attention should be paid on transnational dynamics in MLP and SNM research.

Though, taking a transnational perspective on the regime analysis proved to be very difficult because of the scale, subject and the amount of available and relevant data. My

recommendation for future research is that it is better to focus on specific sub-dimension, like only one regime dimension, in order to be able to study transnational influence more exhaustively.
Moreover, when analyzing the global BRT niche, the presence and importance of transnational actors and processes is illustrated. Additionally, interviewees and data on BRT suggested that actually the entanglement with local factors enables the diffusion of successfully implemented BRT systems. Therefore, besides paying attention to transnational dimensions in future SNM research, also the interaction with local conditions should not be forgotten. This might find explain for instance why some cities implemented BRT systems and some did not.

To the urban mobility practitioners, I would suggest that they continue to maturate the bus and BRT industry. Bundling voices and standardizing and identifying best practices helps to create strong narratives and positive images. Evaluation, aftercare and ongoing investments within specific projects will keep the quality, the image and the custom satisfactory of (the) BRT system(s) high as well.

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List of abbreviations

ABBG	American Bus Benchmarking Group
ALC-BRT CoE	Across Latitudes and Cultures Bus Rapid Transit Center of Excellence
APTS	Advanced Public Transport System
BHLS	Bus with High Level Service
BRT	Bus Rapid Transit
COST	Cooperation in Science and Technology
GIZ	Gesellschaft für Zusammenarbeit
IBBG	International Bus Benchmarking Group
ICLEI	International Council for Local Environmental Initiatives
IEA	International Energy Agency
ITDP	Institute for Transportation and Development Policy
ITS	Intelligent Transportation System
LRT	Light Rail Transit
MLP	Multi-level perspective
MRT	Mass Rapid Transit
NBRTI	National Bus Rapid Transit Institute
NGO	Non-governmental Organization
PPP	Public Private Partnership
PT	Public Transport
ROW	Right-of-way
RTSC	Railway and Transport Strategy Center
SIBRT	Latin American Association of Integrated Systems and Bus Rapid Transit
SNM	Strategic niche management
STS	Science and Technology Studies
SUSTRAN	Sustainable Transport Action Network for Asia and Pacific
TCRP	Transit Cooperative Research Program
VREF	Volvo Research and Educational Foundations

1. Introduction

In parts of our world major growth occurs; growth in population as well as growth in prosperity. This economic growth and demographic changes are accompanied by a growth of cities and metropolitan areas. Furthermore, especially in developing countries, there is a trend of people leaving their rural birth ground to move into big cities, for public services, education and job possibilities are generally more present and accessible in cities. Whereas one hundred years ago only 10% of the world's population lived in cities, anno 2012 this numbers has exceeded 50% and it is expected to grow in the next few decades (United Nations Population Division, 2006). The results of these trends are mega-cities with millions of inhabitants.

An increasing number of inhabitants of the existing mega-cities make their travels with private motorized vehicles, but this behavior is causing severe congestion and mobility problems. Moreover, the congestion and use of private motorized vehicles cause concentrated emissions that harm the (global) environment and cause air and noise pollution that harm the health of the inhabitants of the city. Also, individualistic mobility behavior leads to major pressure on finite commodities such as oil and gas.

The demand for (fast) mobility has increased the search for fitting public mass transit solutions to make city centers better accessible for a large number of people. These solutions, if sustainable, could also solve the environmental and health problems and at the same time improve the speed, reliability and capacity of operations (Fouracre et al., 2003). Mass rapid transit systems, as these solutions are called, come in many different forms. Bus rapid transit (BRT) is one of these alternatives, in which rubber-tired vehicles (buses) are used to move people rapidly along high performance corridors. There are many definitions for BRT, but for now it suffices to say that in BRT systems large buses drive along such corridors with a high frequency and some form of right-of-way. BRT systems can be considered as a hybrid form of transit mode that combines the benefits of rail based transit systems with the flexibility of bus modes.

Where most city planners in last decades of the 20th century prepared their cities to handle an increase of population and traffic volume, Curitiba, a middle-sized city in Brazil, planned for the opposite. The mayor at that time, Jaime Lerner, closed down Curitiba's busiest streets and created more space for people. The philosophy behind this design of the new master plan for the city of Curitiba was not to be dominated by cars. In 1974, innovative city planners and transport engineers developed a bus-based transport system that could reach the benefits of a metro system, but for only one twentieth of the cost of a metro system and with a faster implementation time. This public transportation system became the first officially recognized BRT system. It now can move 2.3 million people a day and is a source of inspiration for other cities (Lubow, 2007). The high flexibility, the low construction costs and the possibility of a gradual but fast implementation make BRT systems a very good solution for the problem that cities are facing. Moreover, by improving comfort, safety, travel time, and quality of transit

services, the system may attract private car drivers to use public transportation (Shen et al., 1998).

After the completion of the BRT system in Curitiba, the physical and operational design of the BRT system was used to implement a BRT system in 2000 in Bogotá, called TransMilenio. That system is now seen as one of largest and most iconic BRT system in the world. It inspired systems in for example cities in Mexico, India, China and other parts of Asia to duplicate and implement also such system.

According to EMBARQ, the World Resources Institute for Sustainable Transport, there are now over 120 cities with BRT systems, located in every continent. BRT globally covers 4300 kilometer of corridors, using over 30.000 buses to transport about 28 million passengers every day. It is also interesting that 100 cities implemented a BRT system since 2000. Also, 49 cities are building a BRT system, 16 cities are expanding their system and 31 cities are planning for one (Hidalgo & Gutiérrez, 2012). So, there has been a major diffusion of the concept of Bus Rapid Transit around the world. This raises the question why and how this has happened.

1.1. Research objectives

The emergence and diffusion of BRT systems are remarkable and can in some cases be considered as a radical transformation of urban mobility. In the field of transition studies, the study of radical transformations is a core topic. This thesis contributes to this field by studying BRT systems. The concept and the idea of BRT, as well as incumbent transport modes, consist of a set of rules, such as shared believes, standards and search heuristics, embodied in a specific configuration. The frameworks that are often used for analyzing the stability and transition (potential) of such configurations are the multi-level perspective (MLP) and strategic niche management (SNM). MLP defines three different levels (landscape, regime and niches) which interact with each other and may facilitate transitions to occur. Strategic niche management is looking at processes through which niches develop sufficiently to be able to compete with dominant technologies and configurations. The theoretical framework is further explained later.

Markard et al. (2012) found, after analysing the geographical delineation of 446 papers published in the field of transition studies, that the unit of analysis in transition studies is often the nation-state. They conclude that only 10% of the papers view transitions in a global perspective, with units of analysis such as ‘the world’, ‘continents’ or ‘developing countries’ (Markard et al., 2012).

However, BRT projects often involve many actors from different countries that contribute to successful implementation of a BRT system. The involvement of an actor, such as for example the World Bank, in a project generates flows of financial resources and knowledge and experiences across borders. Furthermore, as later the diffusion of BRT is defined in more detail, it will be clear that the concept of BRT is spread all over the world. This thesis

contributes to the transition literature as one of the few studies with a transnational perspective.

The concept of 'transnationality' is a complex and ambiguous term. Literature as well as institutes do not generally agree on one definition for it. This concept is explained later in more detail, but it is necessary to introduce the use of this concept a bit further at this point. First of all, this thesis differentiates between the meanings of the words 'transnational' and 'international'. In the latter concept, nationstates and borders are still intact and is refered to the linkages between two or more nation bounded parties. On the contrary, the term transnational transcends the idea of nations and operates on a more global level. It also studies the relation between and the role of international NGOs that are not controlled by policy of governments. Moreover, it can refer to flow and movement of people, ideas and objects across national borders (Van der Vleuten, 2008).

This research has an exploratory character. The goal of the research is to explore the possibilities and the contribution of taking a transnational approach in analyzing socio-technical transitions. It uses BRT as case to explore this relatively new area of research.
This thesis contains both descriptive parts in order to gain familiarity with the case of BRT and preliminary conclusions from the result of transnational analysis on the diffusion of BRT. Also promising avenues for further research for the transition studies community are identified.

1.2. Research questions and structure

This thesis uses insights and empirical material about the diffusion of BRT systems to explore whether taking a transnational perspective in transition analyses results in new findings. This leads to the main research question:

> ***To what extent are urban mobility regimes and the Bus Rapid Transit niche displaying transnational characteristics and what role do transnational processes play in the diffusion of Bus Rapid Transit worldwide?***

To answer this question, a better understanding of the concept of BRT and its diffusion in time and space is needed. Therefore, in chapter two we deal with the following sub question:

> *What do we understand by the concept BRT and in what way did BRT systems diffuse in time and space?*

As will be clear, there is not one definition for Bus Rapid Transit and great variation of types of BRT systems exists. Chapter two also deals with this.

For answering the main research question the concepts regimes and niches are used. In Chapter three, the frameworks for the analyses are introduced. Also, an overview of the ongoing debates in literature regarding space and transnational perspective within the mentioned frameworks is given.

The introduction of BRT in a city means a shift in the existing balance of the incumbent transportation modes and systems that have evolved around it. The mechanisms that stabilize and put pressure on the incumbent regimes are analyzed with an explicitly transnational approach to determine the role of transnational processes in creating barriers and opportunities for BRT systems to be successfully implemented in a city.
Because of great differences between European cities and developing cities, chapter four will describe the incumbent urban mobility regimes in both contexts. Then, the role of transnational processes on the stability of barriers and creation of opportunities for BRT to be implemented in the cities is discussed. The question which is central in chapter four is:

> *To what extent do incumbent urban mobility regimes display transnational characteristics and how do transnational processes influence the diffusion BRT?*

Besides examining the incumbent situation in cities, also extensive attention is paid to the development of the BRT as niche. According to the framework of strategic niche management, three core processes cause for the niche to evolve and become able to compete with the regime. These processes are the building of new networks, articulating expectations and learning (Kemp et al., 1998). Because BRT systems are adopted in already over 120 cities all over the world, this research follows Raven and Geels (2006) who make a distinction between a global, more aggregated, niche level and specific projects on local niche level.
Guided by the three niche internal processes, the analysis, which is conducted with an explicit transnational perspective, determines the role of transnational processes on the diffusion of BRT. This makes the question for chapter five to be:

> *If a transnational perspective on the analysis of the global BRT niche is applied, what insight do we gain and how do transnational processes influence the diffusion of BRT worldwide?*

Two BRT projects are described and used for illustrative purposes and presented in textboxes throughout the analysis. The first city that will be described is Bogotá in Colombia, with TransMilenio as their BRT system. This is one of the most famous and most successful and complete BRT systems of the world. The second city that will be discussed is Eindhoven in the Netherlands, which is much smaller and designed in a different context. The choices for the cities are based upon the differentiation between developing and European cities in the regime analysis.

In chapter six, the conclusion of this research will be presented by answering the main research question. Here, also specific hypotheses and recommendations for future research for the community of transition studies as well as the urban mobility community are articulated.

1.3. Research relevance

Societal relevance

The ability of human development through accessing public services and jobs is a very important aspect of development. The majority of the (developing) cities in the world lack efficient and cost-effective public transport and face consequences of it, f.e. severe congestion and air and noise pollution. In this research, a relatively new and innovative public transportation system is the point of focus. The BRT system seems to be a major step in the right direction towards more sustainable, accessible and livable cities at a relative low cost. This research will give more insights in mechanisms behind the successful diffusion of the concept over the world. This is complemented with recommendations for urban mobility practitioners for successfully diffusing and implementing BRT systems worldwide.

Scientific relevance

The theoretical frameworks with which this research is approached, the multi-level perspective (MLP) and strategic niche management (SNM), are well-known frameworks in the field of Innovation Sciences and transition studies (Schot & Geels, 2008). However, the analytical focus of many articles is not global or at the urban context (Markard et al., 2012). This research has both urban mobility as topic as well as a transnational focus.
Also, the transnational approach in this research will bring interesting mechanisms to light when trying to capture transnational organizations, flows and relationships. It is a valuable approach since some issues are transnational by nature, like environmental issues, economic crises and demographic changes.

However, organizations recognize that it might be impossible to implement solutions in every country (Northern Periphery Programme, 2004). Due to legal barriers, institutional bariers, cultural differences or other obstacles, adaptations to the local context are crucial.
Another contribution of this research is the assessment of the role of space and the interaction between global dynamics and local contexts. Recent debates in literature on transition suggest that more attention should be paid to spatial configurations and the places where transitions take place (Coenen et al., 2012).

This research tries to simultaneously speak to two audiences, because it is located on the border between transition studies and transport studies. On the one hand, this research aims to contribute to the field of transition studies by giving more insight in the case of BRT. It can be used to gain a better understanding of the role of transnational processes in transition studies and the result of taking a transnational perspective in analyzing transitions. On the other hand, this research aims to provide the field of transport studies (and practitioners) valuable empirical insights, because interviews are held with respected actors in the field of BRT, and provide the field of transport studies with findings when the case of BRT is analyzed with the, for them, relatively unfamiliar approaches of the field of transition studies.

1.4. Methodology

Because of the exploratory nature of this research, the empirical material on which the analysis is based consists of document analysis and in depth interviews.

Document analysis

Documentation on BRT has formed a large input in this research. For understanding the concept of BRT, mainly reports on BRT were used. International organizations have written these reports to clarify the concept of BRT for city government officials and other practitioners by presenting decision characteristics and implementation guidance. The reports are publically available and most of the time presented on websites of international NGOs and organizations.

Moreover, different international NGOs like the Institute for Transportation & Development Policy (ITDP), EMBARQ and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) have assembled their own data on BRT projects. These databases, often not completely publically available, may differ from each other, based on their definition of BRT and their involvement in projects. For educational, standardization and structuration purposes, the Across Latitudes and Cultures Bus Rapid Transit Center of Excellence (ALC-BRT CoE) and EMBARQ are collaborating with the International Energy Agency (IEA) and the Latin American Association of Integrated Systems and Bus Rapid Transit (SIBRT) to construct a database that is publically available.
For defining and describing the diffusion of BRT in section 2.7., as well as for background information on specific interesting projects, this database, that is publically available at www.brtdata.org, is used. However, since this database is still under construction, data that was available elsewhere had to be used. Effort is put in combining data and information from several databases, articles and reports.

In the analyses, when describing the incumbent urban mobility regimes and the global BRT niche, online publications are used to add and substantiate information acquired in the interviews. Furthermore, both quantitative and qualitative information is found on the websites of international NGOs.

Semi-structured, in-depth interviews

A main contribution of the empirical part of this research consists of interviews. These interviews were semi-structured. Each interviewer had their own area of expertise on which in depth questions were asked. Concepts in the MLP and SNM frameworks provided guidance for the interviews, but there was room for interviewees to elaborate on processes and concepts they were expert in or are important in their opinion. The operationalization of the concepts of MLP and SNM for this thesis is explained in section 3.5.

Most interviewees are highly placed and internationally recognized experts in their area of expertise. Some of them are involved in the concept of BRT from the start and are worldwide known for their experiences, publications and achievements. The interviewees live and regularly travel around the world. Therefore the majority of the interviews were held via Skype. The duration of the interviews was one hour on average.
Different regime and niche actors were interviewed. In this way, a complete picture can be formed, with contributions from different stakeholders. An (anonymous) list of interviewees is presented in the table in appendix 1.

2. Bus rapid transit

This chapter is concerned with explaining the notion of a bus rapid transit system and illustrates when and where the systems materialized around the world.

BRT is introduced BRT before as a hybrid form of public transportation that combines the benefits of rail-based systems, but with the flexibility of bus-systems. Other terms that are used to address this hybrid form of public transport are 'metronized bus' or 'metro on the surface' (Lerner, 2012).
This chapter first elaborates more on the definition of BRT and its key features and performance measures. Later on, it discusses the spectrum of bus based transport options and analyzes the diffusion of BRT in time and space.

2.1. Defining BRT

It is very difficult to grasp the concept of BRT (Wright & Hook, 2007; Diaz & Hinebaugh, 2009; Larwin et al., 2006; Deng & Nelson, 2011). First of all, although the name Bus Rapid Transit is frequently used in all parts of the world, the same concept sometimes is expressed through different names, such as: high-capacity bus systems, high-quality bus systems, Metro-bus, surface Metro, express bus systems, bus-way systems and high-level bus service (Wright & Hook, 2007). Furthermore, there are several definitions that can be found in reports and literature; every organization gives a different definition on their sites or in their documentation. Examples of often used definitions are given below.

The Federal Transit Administration defines Bus Rapid Transit as:
"a rapid mode of transportation that can combine the quality of rail transit and the flexibility of buses"
(Thomas, 2001)

A more elaborate definition is that of the Transportation Research Board:
"BRT is a flexible, rubber-tired form of rapid transit that combines stations, vehicles, services, running ways and Intelligent Transportation System elements into an integrated system with a strong identity that evokes a unique image. BRT applications are designed to be appropriate to the market they serve and their physical surroundings, and can be incrementally implemented in a variety of environments"
(Levinson, et al., 2003, pp. 1-1)

A slightly different definition is that of the Institute of Transportation and Development Policy (ITDP):
"It is a high quality bus-based transit system that delivers fast, comfortable, and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, and excellence in marketing and customer service"
(Wright & Hook, 2007, p. 1)

The difference in definition does not come from disagreement on the content, but merely on the difference in focus as a result of the background of the authors. BRT is an interesting

concept for a broad public, varying from traffic engineers to environmental idealists. Reports from transportation authorities, such as the report by Levinson et al. (2003), focus more on efficiently meeting the transport demands of the society. This approach gives more attention on technical and detailed decision characteristics. On the contrary, the report by Wright & Hook (2007), published with the support of international organizations that promote sustainable and equitable transportation over the world, focuses more on the implementation process, modal integration and institutional setup to make the system work for everyone.

Although different, every definition acknowledges that a BRT system should be a rapid, high-quality service provided by buses. Extensive and later definitions acknowledge that a BRT system is more than a bus service along dedicated lanes; BRT should be a complete system which integrates in other city dynamics and services, and which has an own identity and brand name. Because BRT is an ambiguous concept, many city government officials often do not know what BRT characteristics may provide this rapid, high-quality service. The result of this lack of knowledge is often the preference for railway alternatives (ITPD, 2012a).

One major reason for this lack of knowledge among decision makers and transport planning professionals is the extensive body of options of implementation elements. This causes infinite options of integrating BRT systems. In the last decade researchers and transit experts gathered a massive body of knowledge on the impacts of the various combinations of available element integration. Reports like "Characteristics of Bus Rapid Transit for decision-making" (Diaz & Hinebaugh, 2009) describe each of the BRT's elements, their varieties of implementation options and their possible effects.

Also, there are initiatives to standardize BRT and the implementation of BRT. ITDP gathered a BRT Standard Committee in 2011, consisting of experts in the field of BRT. They published a report in January 2012 which provides a framework to implement high-quality BRT systems. The BRT Standard also contains a scorecard with which existing as well as planned BRT systems can be rewarded with a gold, silver or bronze certificate (ITDP, 2012a). This classification system indicates to what extent the investigated project resembles best practices in the field. The BRT Standard should not be seen as a replacement for cost-effectiveness or cost-benefit analysis, but more as a supplement to system performance evaluations. The BRT Standard scoring system just finished its pilot year. In 2013, the final revisions to the scoring list will be made and will the BRT Standard be released worldwide.

2.2. Elements of a Bus Rapid Transit System

The way in which a BRT system is designed determines a lot of the quality and capacity of a system. Jaime Lerner, mayor of Curitiba and initiator of the first BRT system in the world, explained in an interview with the New York Times (2007) that:

"A normal bus in a normal street conducts x passengers a day. With a dedicated lane, it can transport 2x a day, if you have an articulated[1] bus in a dedicated lane, 2.7x passengers. If you add a boarding tube, you can achieve 3.4x passengers, and if you add double articulated bused, you can have four times as many passengers as a normal bus in a normal street. With an arrival frequency of 30 seconds, you can transport 36,000 passengers every hour - which is about the same load that would be achieved with a subway"

(Lubow, 2007)

Literature on BRT systems suggests that a transit system have to implement several elements to be allowed to call themselves a BRT system (Diaz & Hinebaugh, 2009). The section below is based on different reports on Bus Rapid Transit planning, decision-making and effects (Wright & Hook, 2007; Levinson, et al., 2003; Diaz & Hinebaugh, 2009; Deng & Nelson, 2011; Kittelson & Associates inc. et al, 2007; Larwin et al, 2006). The most important elements which will be discussed are:

- *Running way*
- *Stations*
- *Vehicles*
- *Fare Collection*
- *Intelligent Transportation System*
- *Service and Operating Plans*
- *Branding Elements*

Running way

The design of the running way is of great influence on the travel speed and travel speed and the reliability of the bus services. Moreover, a fully dedicated lane or other forms of markings and signage can create and stimulate the identity of the BRT system since it is highly visible for existing as well as potential customers.

Two determining factors of a running way are the right-of-way (ROW) location and the level of running way priority (Diaz & Hinebaugh, 2009). The running way type can vary from on-street variants (i.e. a reserved lane for transit vehicles or bus-only streets) till at-grade dedicated lanes (preferably on the median of the corridor) and grade-separated transit ways.
To communicate to road users as well as to customers that a BRT system is present, running way markings are necessary and very effective tools. Running way marking measure can include road signs and markings, the use of different colors and materials of the running ways and barriers between lanes that makes it hard or impossible for road users to use the dedicated lanes.
In addition to the running way type and running way markings, running way guidance can create safety and increase traveling speed as well. It can be more precise in steering a vehicle

[1] Articulated buses are typically 18 meters long and comprises two rigid sections connected by a pivoting point, and have a capacity of approximately 170 passengers.

in narrow streets and guidance technology can enable vehicles to stop at the desired distance from the docking platforms very precisely (Diaz & Hinebaugh, 2009).

A very common example of a good designed running way system is the Trinary Road System that was implemented in Curitiba, Brazil (Figure 1).This system consists of three main routes. The central component contains the at-grade segregated bus corridors on which buses in both directions can transport people in and from the city center. Right next to this dedicated lanes are lanes intended for the opening up of local traffic. On the corridors parallel to this center corridor are two one-way directed lanes located, one into and one out of the city center. These corridors, also called Rapidas (Speedy Street), facilitate an alternative route for cars traveling across the city and are essential for the system to work efficiently. The bus terminal on the center corridor is important for the integration of the BRT system with other transport modes (Karis, 2006).

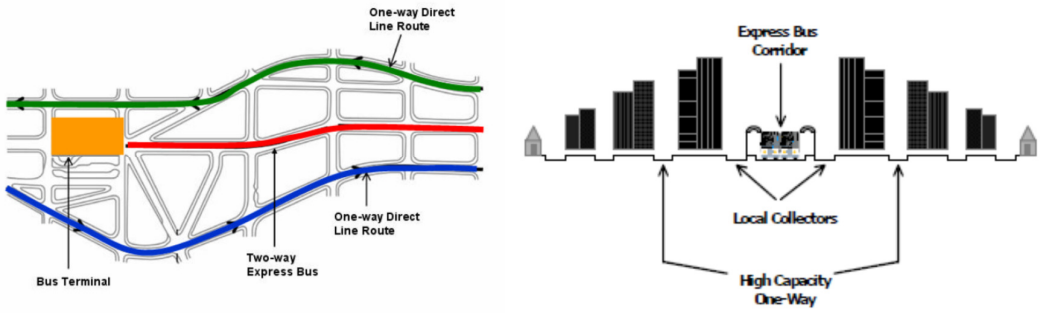

Figure 1: The Trinary Road System. Sources: Left: (Karis et al., 2006) Right: (Menckhoff, 2005)

Stations

Stations serve several purposes. Not only are they the entry points to the BRT system, and thereby a very important customer interface and system image, they also largely influence the traveling speed because of the dwelling times at the stations. So stations are of great importance to the system because they can influence travel time savings and capacity, but also the identity of the system by its cleanliness, safety, comfort, security and accessibility for i.e. women, elderly and disabled people.

The design of stations can vary from basic stop with small shelters to complex great terminals with a high capacity, a lot of information and pre-board ticketing. The compatibility of the platform with the vehicles (height of the platform and multiple boarding doors) will influence the dwelling time; the time it takes for a vehicle to board all passengers.

A great example of well-designed stations are the tube-stations in Curitiba (figure 2), which is able to embark and debark quickly and at the same level as the vehicles and with payment before getting in the bus.

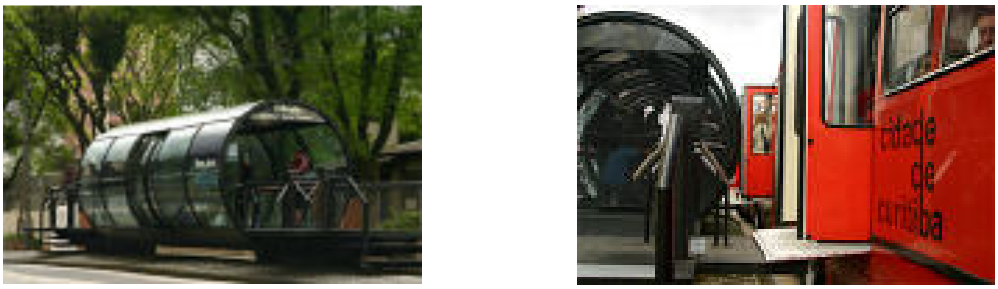

Figure 2: The tube stations of Curitiba. Source: (Maria Vaz Photography, 2012)

Vehicle

BRT systems across the world vary in the type and specifics of vehicles they use. It ranges from standard buses, to highly innovative vehicles like the ones that are manufactured by Advances Public Transport Systems BV (APTS) in the Netherlands (VDL Bus & Coach bv, 2012). Differences in size, longitudinal control for precision boarding, propulsion systems and design (amount of doors and comfort) has impact on the capacity, travel time, environmental friendliness and safety of the system. External design of vehicles can greatly contribute in creating and reinforcing the brand identity of the transportation system in a city. An example of this is the bright red buses that are part of the BRT system in Bogotá, TransMilenio (see figure 3).

Figure 3: The red buses in Bogotá. Source: (Kash, 2011)

Fare collection

Pre-boarding fare collection allows quick and multiple door boarding, which reduces the time that vehicles are dwelling at stations. Also electronic fare collection by using magnetic- or smartcards are more and more used in BRT systems. Pre-boarding fare collection in the same time can guard safety in stations. If it is required to pay before entering the station platforms, there is a smaller chance that shady figures are amongst the passengers.

Intelligent Transportation System (ITS)

One of the elements in the later definitions of BRT systems, for example by Levison et al. (2003) and Wright & Hook (2007), acknowledge that some form of ITS elements should be present in the system that enhance the reliability, safety and comfort of the system. ITS technologies come in many forms. One application is vehicle priority and traffic signal preferences at intersections to facilitate a high commercial speed of the vehicles. Other applications one can think about are automatic vehicle locationing and real-time passenger

information systems, often implemented as large digital displays with information about next bus arrival information on stations and next stop in buses.

Service and operating plans

In the design of service and operating plans needs and services are matched. In this plan the route length and structure are carefully designed, taking into account the type of running way the system is going to use, the structure of the city and the needs of the population and employment centers in the area. Also, the station spacing, the distance between two stops is contrived. Next, the service frequency is determined, depending on the demand. It is also possible that trunk and feeder services are collected in the BRT corridor. This gives options for express and local BRT services.
A well-defined service and operating plan improves the reliability of the system, accessibility of certain areas and people, and contribute to the saving of (long distance) travel time.

Branding elements

Many cities market their BRT system as distinct from other public transport services. For this, they develop brand names, logos and use distinct colors or exterior appearances for buses. In this way, all of the elements of a BRT system are packed into a cohesive system. With such distinct public transport system, it is easier to communicate values of BRT to traveling public.

2.3. The implementation process

A BRT system is more than just designing fitting key elements of the system. For example, it involves new or restructured institutions and it requires capacity at the political and technical level of the city government. So besides the technical part, other social and political parts have to work as well and everything has to be aligned for the system to work; BRT is a good example of a socio-technical system.

A simple project development process is also applicable on BRT projects; starting with system and sketch planning, via alternative analysis and preliminary engineering, and end with the final design and construction. In each phase the number of alternatives decreases and the level of detail of the plan increase (Diaz & Hinebaugh, 2009).
For further reading, the development process as proposed by Wright and Hook (2007) in their BRT implementation guide is presented in appendix 2. According to them, the steps that have to be taken to successfully implement a BRT system are project preparation, operational design, physical design, integration, business plan and evaluation and implementation.

2.4. Performance measures on Bus Rapid Transit

The next section elaborates on performance measures on Bus Rapid Transit. The focus of the section is on overall image and performance for passengers and system factors. Besides those factors, BRT systems can also be evaluated on for example cost, implementation time and space requirements. It is interesting to see that performances of BRT systems can reach those of the metro and Light Rail Transit (LRT) systems, such as trams. However, BRT systems

can be implemented for a fraction of the costs of alternative mass transit systems, and in a much shorter time span[2].

The measures that are frequently used to measure the performance of the BRT system are now discussed. These are:

- *Travel Time Savings*
- *Reliability*
- *Identity and Image*
- *Safety and Security*
- *Capacity*
- *Accessibility*

These performance measures are partly dependent on the choices made on the key elements of BRT as discussed in the previous section[3].

Travel Time Savings

Travel time can be divided into four sub categories: running time, dwell time, wait time, and transfer time (Diaz & Hinebaugh, 2009). In this part, the time needed for the passenger to get to the transit service is not discussed since it is too variable and dependent on the intensity and location of land uses.

Under running time is considered the time spent by passengers when the bus is in motion from station to station. The most determining factors are the delays that buses encounter, not the maximum speed of the buses itself. Delays can occur for example by congestion, waiting time at traffic signals and other route structure characteristics.

Dwelling time at stations mainly depends on the amount of passengers getting in or off the bus (and the crowdedness in the bus which cause congestion during boarding), the amount of doors in a vehicle and the fare collection system.

Waiting and transfer times are seen by passenger as a larger burden than running time, so it is of importance to keep the waiting and transfer times as low as possible by optimizing services and operations and provide the passengers with information about the arrival and departures of buses.

Reliability

The variation of the travel times on the same trajectories is determining the reliability of the system. Again, several aspects can cause differences in travel times. Of course the reliability is determined by the ability of a vehicle to maintain consistent travel times during the running time. Secondly, the station dwell time reliability depends on the ability for passengers to board in a set time frame, independent from the congestion situation or the time of the day.

[2] For a more elaborative comparison of BRT, LRT and metro system characteristics, see Deng & Nelson (2011)
[3] For more extensive information on the relationship between the key BRT elements and the performance measures for BRT systems see Diaz & Hinebaugh (2009).

The third aspect that is captured by reliability as performance measure is the ability of the service providers to provide the scheduled level of service, even if the system was disrupted.

Identity and image

This performance measure describes how BRT systems are perceived by both users and non-users of the system. It captures how the system is positioned in the total supply of public transport and if it fits in the image of the urban environment. Brand identity is concerned with the first issue, the positioning of the system in the total supply of public transport. It is believed that a strong cohesive marketing image, which ties all BRT elements together, will influence the public in a positive way. A strong and positive brand image will make the option to travel with the BRT system more attractive. Contextual design determines whether and how effectively the BRT system is designed to fit in the urban environment. However, the public perception of the system is affected if problems occur. Even if these problems mainly relate to financial and institutional restrictions instead of the intrinsic values of the system (Hidalgo & Gutiérrez, 2012).

Safety and security

Traveling people are subject to several hazardous and dangerous situations. Traffic accidents and robberies are part of everyday life in crowded cities. BRT contribute to actual and perceived safety in traffic because streets become less crowded and buses drive among designated lanes without lots of crossing traffic (Diaz & Hinebaugh, 2009). It also contributes in the freedom from potential threats for criminal activities, since many systems use pre-board fare collection systems in which only passengers with paid tickets are allowed to enter the boarding platform. This isolated environment is perceived as more secure than previous or other transportation modes.

Capacity

Capacity encompasses the maximum volume of people that can be transported with the BRT system per hour in one specific direction. This number is calculated on the busiest moment of the day along the most critical section in the system. A lot of elements can contribute to make this number increase. It depends on type of vehicle, the time that is necessary to board and the type of running way and priority on intersections.

Accessibility

The important factor is that it should be accessible for every group of the society. Women should be able to travel safely, elderly and otherwise disabled people should easily gain access to the boarding platform and into the vehicles. A special focus on accessibility may cause social equity. Equity is a trait character of BRT systems in which it can differ a lot from other forms of mass transit.

2.5. The spectrum of bus based transport systems

One of the issues that need further attention is the definition of BRT. In previous parts, several definitions and key features for BRT are given, but besides the fact that different cities have different structures, cities in different countries on different continents diverge in political, economic, social and cultural conditions. That is why in Europe, practitioners and

researchers want to differentiate their systems, referring to them with the term Buses of High Level Services (Finn et al., 2011). They argue that many Buses of High Level Services (BHLS) systems in Europe are not newly implemented solution, but merely an upgrade which restored the efficiency the bus systems once had in the beginning of the 20th century. This upgrade in efficiency is going together with investments for improving passenger experience and system reliability. In Europe, the demand for mass transit is often already met by rail-based system as metros and tramways, or the demand is insufficient to implement a full, high-capacity BRT system. The BHLS systems are thus BRT systems that are downscaled and adapted to the context of European cities.
There are also cities that have implemented systems that only use improved bus corridors and bus priority schemes. It can be concluded that there is a wide range of bus based solutions for (mass) public transport.

To improve the understanding and to refine the definition of the several bus based transit solutions, several scholars are trying to create categories based on objective measures. Muñoz & Hidalgo (2011) see a relationship in the (corridor) features of a bus system, the capacity and speed performance of the system and the urban environment (demand) in which the system is operating. Important performance measurements are the capacity of the system (measured in passengers per hour per day) and the commercial speed of the vehicles (Muñoz & Hildago, 2011). Based on these characteristics, they have identified four types of bus based transit systems (see table 1).

Type	**Main Features**	**Throughput and commercial speed**	**Application**
Basic Bus Corridor	Median or curbside lanes, on board payment, conventional buses	500-5,000 pphpd 12-15 km/h	Low density corridors, suburbs
Bus of High Level of Service (BHLS)	Infrastructure, technology and advanced vehicles for enhanced service provision	500-2,500+ pphpd 15-35 km/h	Small urban areas, historic downtown, suburbs
Medium BRT	Single median lanes, off board payment, information technologies	5,000-15,000 pphpd 18-23 km/h	Medium density corridors, suburb/center connections
High Capacity BRT	Dual median lanes physically separated, large stations with prepayment, large buses, information technologies, combined services	15,000-45,000 pphpd 20-40 km/h	High demand, dense, mixed use corridors, central city

Table 1: Types of bus based transit systems, described by their main features, ridership (passengers per hour per day) and commercial speed, and urban environment. Source: (Muñoz & Hildago, 2011, p. 6)

Because of the nature and the role of BHLS systems, they do not integrate many full BRT key elements in their system and the maximum capacity of the system is not higher than with basic bus corridors. However, investments that improve reliability and passenger experiences are the unique selling point of BHLS systems.

Another effort to structure the spectrum of the bus based transit systems is done by Wright and Hook (2007). They score the systems on their characteristics on physical infrastructure, operations, business and institutional structure, technology, and marketing and customer service and come up with six categories varying from informal transit services till full BRT systems. Wright & Hook (2007) do not use the term BHLS for intermediate systems with some form of bus priority and quality improvement, but refer to them as BRT-lite.

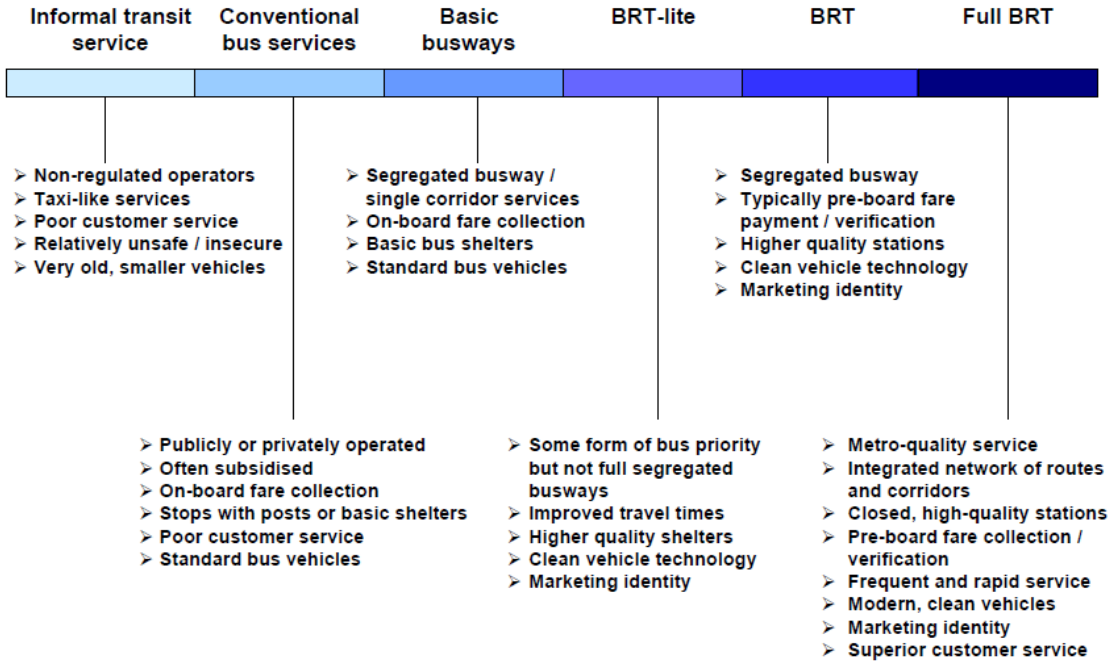

Figure 4: Spectrum of bus based transit solutions. Source: (Wright & Hook, 2007)

Since complete studies are done and reports are written on solely BHLS systems (Finn et al., 2011), and because the distinction between BRT and BHLS is acknowledged and addressed by most of the interview partners for this research, the analyses in this research are also done for both BRT systems and BHLS systems. The two main differences between BRT and BHLS are on the one hand geographical locations. BHLS systems are primarily found in Europe and full BRT systems largely in Latin America and Asia. The second difference is that BHLS systems aim at restoring the place of the bus in the transportation system by upgrading conventional bus services, whereas high capacity BRT systems aim to use the bus to provide the mass transit services in line with that of the metro- and rail based systems.

2.6. Critiques on BRT systems

The majority of the reports and articles on BRT systems only reflect the advantages of BRT systems over other mass transit solutions, such as LRT systems or metro systems: a BRT

system requires lower investment costs, has a shorter implementation time, is more flexible and provide more jobs since bus systems are more labor intensive.
However, also critiques can be found on BRT systems. Vuchic (2009) states that when decision makers face the choice between BRT systems and for example LRT systems, BRT systems has some downfalls. Compared to rail transit, the image and prestige of buses are worse than that of rail based systems. This makes that buses are also a less accepted transportation system in pedestrian streets and zones. Furthermore, compared to LRT, BRT systems still have less capacity and a lower operation speed. Moreover, the quality and comfort of the vehicles and the trip are higher with rail based vehicles. BRT systems also bring along more trouble in creating and protecting their right of way on the surface. Although BRT systems are more beneficial for livable cities than individual private vehicle use, buses still often drive (partly) on oil or gas, causing harmful emissions in city centers. And because of the nature of the system, BRT systems create a lot of noise; more than the electric propulsion of rail-based systems (Vuchic, 2009).

According to Hidalgo and Gutiérrez (2012), critics of BRT systems are often articulated towards comfort matters. They found that comfort problems are related to high occupancy levels. These are partly caused by the successfulness of the system and partly because additional subsidies, funding or investments stay out. Furthermore, experience in several developing cities show that problems can occur if the implementation of the system is rushed or accompanied by insufficient public education. Still, most of the problem of BRT systems can be translated back to financial issues (Hidalgo & Gutiérrez, 2012).

More fundamental critics on equity and power can be found in for example the case of TransMilenio, Bogotá. Although the system promotes to be very accessible for disabled persons, the feeder routes are not and this makes the system in total not a feasible traveling option for disabled people (Valderrama, 2010).
Moreover, the designing and decision making process is very undemocratic. Choices are made without much public participation. Although the city government officials are often chosen by democratic elections, all the power for decision making lies in this governmental layer, and they actually do use the power despite of possible objections (Valderrama, 2010).

Finally, the quality of a BRT system depends on the amount of investment public and private parties are willing to make. Although the average BRT system ‘only’ costs 4 million dollars per kilometer, many cities cannot afford that and choose to realize BRT systems at a lower cost and that will be at the expense of system quality.

2.7. The diffusion of BRT systems

In the previous parts the difficulty to talk about BRT systems in general is addressed. Different organizations, different definitions, different gradations of implementing the key BRT elements makes it a difficult topic to generalize. Moreover, publically available information has not been yet compiled in one place.

Despite of these issues, in April 2012, four international organizations worked together to construct a comprehensive and publically accessible database for BRT systems all over the world. The ALC-BRT CoE and EMBARQ created this database in collaboration with the IEA and the SIBRT. The database is used for producing the figures on the diffusion of BRT systems below. The data is publically available on www.brtdata.org. However, the database is still under construction.

A city is included in the database if it has implemented a BRT system, a BHLS system or even an improved bus corridor. For the sake of simplicity and clarity in this section all of these systems are referred to as the BRT systems.

Temporal diffusion

In this part the diffusion of BRT in time is reviewed. This diffusion is displayed in chart 1 below. The blue bars show the number of cities that in the associated year opened their first BRT. The red line presents the cumulative number of cities that have at least one operating BRT system. This chart only includes cities that for the first time implement a BRT project or bus corridor so it does not capture expansions of BRT systems in cities that already have implemented a BRT project.

The first BRT project was implemented in the city of Curitiba in Brazil in 1974. Two decades after the implementation of the first BRT system in Curitiba, barely 20 other cities had opened a BRT system, with many years where zero cities implemented a BRT system. In the mid and late 90's minor but constant growth of the number of cities occurred. The real explosive growth of BRT systems in the world occurred from the year 2000 and further. In 2000, Bogotá opened their BRT system, TransMilenio, which was and still is a powerful example for transportation planners and engineers around the world of successful implementation of a fully integrated BRT system. After 2000, over a 100 cities completed new systems. Interesting is that a growing number of cities annually implement new systems every year, resulting in an explosion and exponential growth of the total number of cities having BRT systems.

According to Hidalgo & Gutiérrez (2012), both involved in constructing the BRT database, in the end of 2011, almost 50 cities were in the last phase of constructing a BRT system and 31 cities more were in the planning phase.

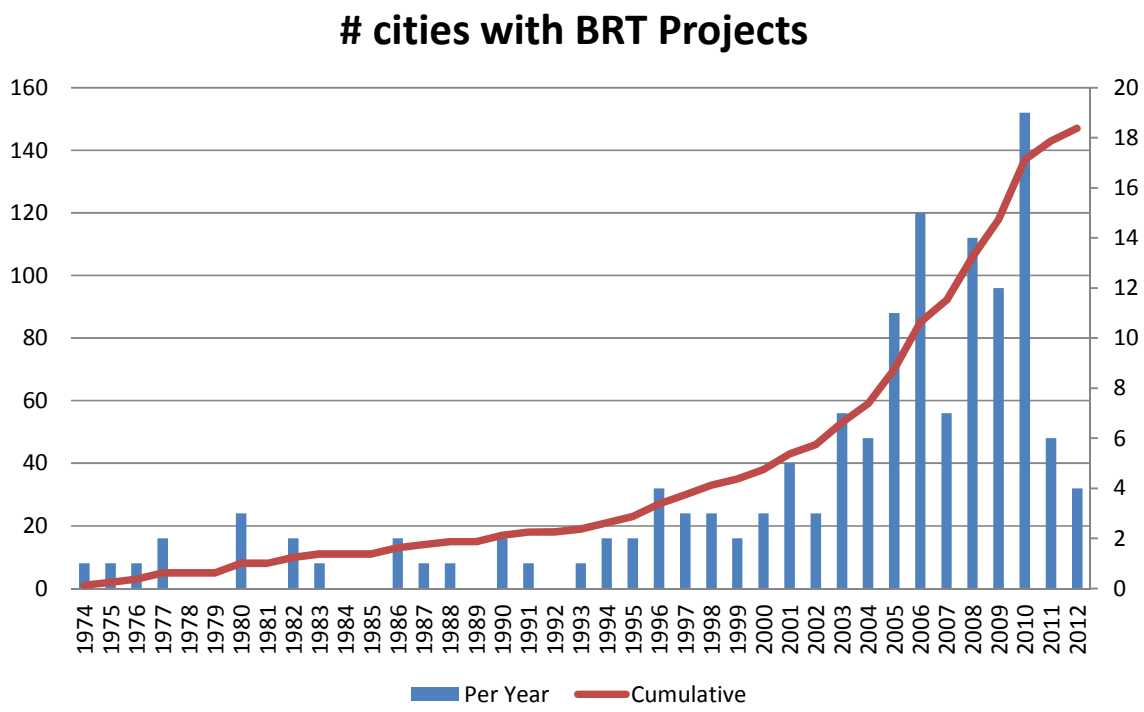

Chart 1: The temporal diffusion of BRT. Based on data available at www.brtdata.org

Spatial diffusion

This section elaborates on the spatial diffusion of BRT. Figure 5 presents a map of the world where the cities with BRT systems are highlighted. Looking at the spread of BRT systems around the world, a few clear clusters can be identified. One is located in Brazil, close to Curitiba. Another cluster can be found in the neighborhood of Bogotá in Colombia. Furthermore, with BRT systems in cities in the Netherlands, France and the United Kingdom, one cluster is located in Northwestern Europe. Many large systems can be found in China and also a few cities with BRT systems are located close to large BRT systems in Ahmedabad in India and Mexico City. Africa and Oceania as continents harbor relatively few cities with relatively small BRT systems. Although the ALC-BRT CoE and EMBARQ also include Lagos, Nigeria, and four additional cities in Australia in their database as cities with BRT systems, it can be concluded that Africa and Oceania are behind in the diffusion of BRT systems. Finally, large and famous BRT systems can be found in Santiago (Chile), Jakarta (Indonesia) and Seoul (South Korea).

The fact that clusters can be identified, suggests that besides a potentially important role for transnational processes, also local processes, actors and requirements determine whether BRT systems are successfully implementation in a city.

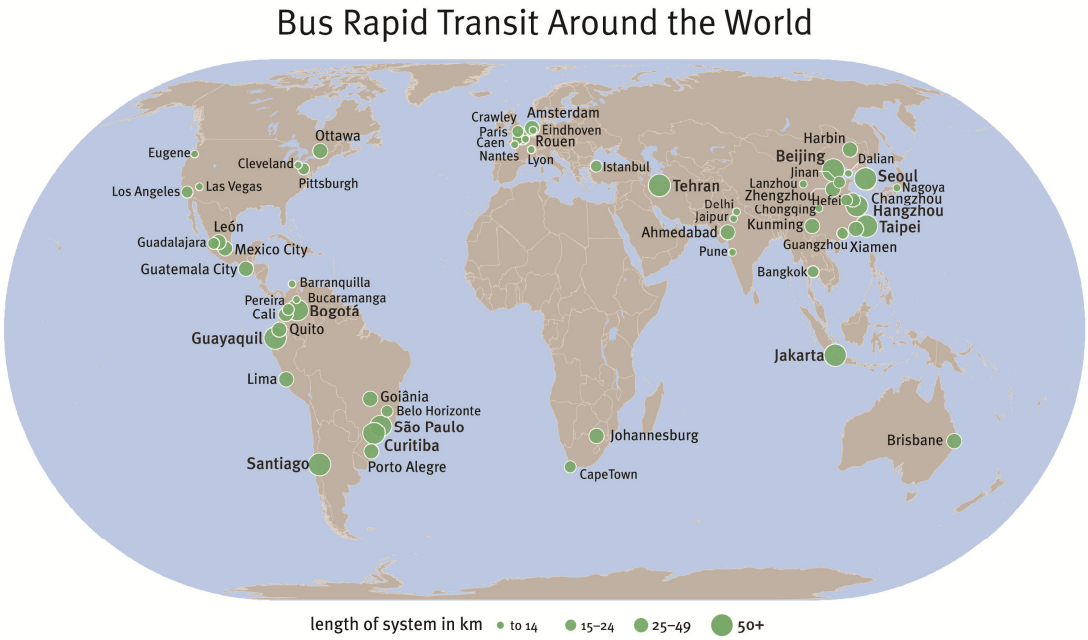

Figure 5: Cities with BRT systems around the world. Source: (Weinstock et al., 2011)

Combining the data on diffusion in time and in space, a few additional findings can be found. Chart 2 shows the number of cities having BRT systems for each continents. In the years after the first BRT system is constructed it is Latin America where the cities that implement BRT systems are located and it is Latin America that takes the lead in the decades after. Between 1974 and the 1990s, the cities that completed BRT systems are mainly located in Brazil, near Curitiba. In the mid and late 1990s the number of cities with BRT systems in other continents also increases.

In the last 10-15 years in North and Latin America, Europe and Asia, the same rapid, explosive growth of the number of cities with a BRT system can be seen. However, the starting point of this rapid explosive growth is different for the different continents. Latin America gradually grew from 1974 and then from 2004 displayed a rapid growth of the number of BRT systems. On the contrary, Europe up till 1992 only harbored one BRT system (Essen, Germany, in 1980) and then showed a constant but rapid growth of the number of cities with BRT systems. In Asia, the first BRT system was implemented only in 1998. From that point, over 20 cities in Asia developed a BRT system. Half of the systems are located in China. North America has an average score and growth of the number of BRT systems. It harbored four cities with BRT systems before 2000 and then, since 2003, shows a constant, average growth.
In Oceania, seven cities gradually implemented BRT systems and as only continent doesn't show any increase in the number of cities that complete their first BRT system since 2006. Recently also Africa has BRT systems, in Lagos (Nigeria) and Johannesburg and Cape Town (South Africa).

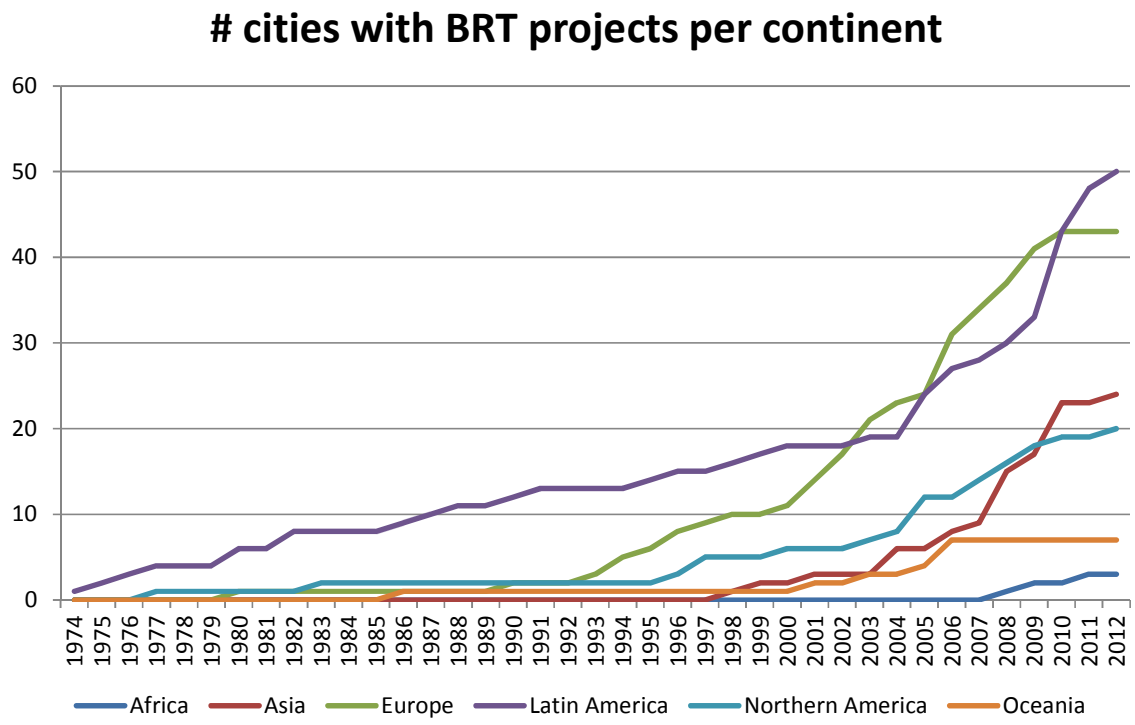

Chart 2: The diffusion of BRT in space and time. Based on data available on www.brtdata.org

From chart 2 it appears that Europe caught up Latin America and is now co-leading in implementing BRT systems. Europe, however, implemented a lot of BHLS systems or upgraded bus corridors instead of implementing a large mass transit system. Therefore, if the size of the BRT systems and the passengers that use the system every day is reviewed, other results appear. Table 2 shows the latest update (January 2013) of the number and size of BRT systems per continent.

Continents	Number of cities	Length (km)	Passengers / day
Africa	3 (2.0%)	62 (1.6%)	238,000 (1.0%)
Asia	24 (16.3%)	840 (21.9%)	5,775,622 (23.2%)
Europe	43 (29.3%)	688 (18.0%)	1,656,970 (6.7%)
Latin America	50 (34.0%)	1,328 (34.7%)	16,068,911 (64.5%)
North America	20 (13.6%)	585 (15.3%)	849,286 (3.4%)
Oceania	7 (4.8%)	326 (8.5%)	327,074 (1.3%)

Table 2: BRT characteristics per continent. Based on data available on www.brtdata.org

Based on these figures, it is clear that Latin America has implemented the most, the longest and the most used BRT systems. Together with BRT systems in Asia, Latin America accounts for the transportation of almost 90% of all BRT passengers worldwide. It is very remarkable that in the more developing countries the BRT systems that are implemented are larger and used by more passengers. Europe, harboring more than a fourth of the cities with a BRT system worldwide, only accounts for 4% of the total global BRT passengers a day.

2.8. Conclusions

This chapter was concerned with defining the concept of BRT and giving an overview of the diffusion of BRT in time and space.
BRT is an ambiguous concept. Because of the great variety of implementation options and appearances it is difficult to define BRT in one single definition. Definitions on BRT in literature or on websites of organizations partly depend on the background and mission of the authors.
Based on several reports on BRT planning and decision-making, the most important BRT key elements and performance measures of BRT are discussed. It is safe to say that BRT performances almost resemble those of LRT or metro systems, but that the investment costs and the time needed for implementation are smaller.

However, not two cities in the world are the same. Their structure is different and cities can greatly diverge in political, economic, social and cultural conditions. Therefore, there exists a wide spectrum of bus based transport options, varying from basic bus corridors to fully integrated, high capacity BRT systems. In Europe, a very distinct form of BRT systems has appeared. Researchers address these systems with the term Buses of High Level Services (BHLS). The demand for mass transit in Europe, as opposed to for example Latin America and Asia, is often already met by rail-based systems. BHLS systems merely aim at restoring the efficiency of the incumbent bus systems, with special attention to improving passenger experience and system reliability.

The first fully integrated, high capacity BRT system materialized in 1974 in Curitiba in Brazil. In the twenty years after this, most systems were implemented in Brazil as well. Since the mid 1990s, European cities are implementing systems in fast pace. Asia is materializing very large BRT systems in the last 15 years, from which many are located in China. Looking at Europe, which harbors a relatively large number of cities with a system, we can conclude that these are mostly BHLS systems or bus corridors in less dense areas with a lower demand. Asian and Latin American BRT systems together transport 90% of all passengers that use the system worldwide. Africa and Oceania have only implemented a few systems and are lagging behind in the global diffusion.

3. Concept, theory and methodology

The next section introduces the theoretical lenses through which the analyses are done. Besides introducing the multi-level perspective and the approach of strategic niche management, also the conceptualization of transitions within these frameworks is explained. Relevant extensions and known criticisms on both theories are discussed and the chapter finishes with operationalizing the theoretical concepts for the analyses.

3.1. A socio-technical approach on transitions towards sustainable development

Societies today face persistent (environmental) problems, which require transitions to occur. Sustainability experiments, defined as planned initiatives, are set up to induce a more sustainable growth models (Berkhout, et al., 2010). BRT systems, though not really an experiment anymore, are such purposely deployed experiments that try to contribute to more livable cities.

The successful implementation of for example BRT system as a solution to persistent problems requires more than solid technical systems; the structural changes in the transportation system of a city demand a co-evolution of multiple dimensions (Geels, 2012). A transition involves not only technological development, but also other resources, the creation of new markets and policies, and the creation of networks for example. Therefore these transitions are considered to be socio-technical transitions (Grin et al., 2010).

Grin et al. define socio-technical transition as a *"shift from one socio-technical system to another"* (Grin et al., 2010, p.11). Moreover, they assume that transitions require multiple changes, involving multiple actors. Transitions also are presumed to be a long-term process, a radical shift in terms of scope, and being macroscopic.

Multiple frameworks are available to analyze the transitions of one socio-technical system to another. In this research, the multi-level perspective is chosen, complemented with strategic niche management framework, for this research. The MLP is presented as a middle-range theory combining elements of different theories and finding relations between them. Because the MLP is a framework that uses heuristics to analyze complex socio-technical transitions, there are more specific theories necessary to understand mechanisms some more on a detailed level (Geels, 2002; Grin et al., 2010, p.18). Several studies have shown that SNM can be a useful tool to analyze concrete projects in retrospect. Moreover, SNM stresses the importance of actual implementation of the experiments and the interaction with user and markets for a niche development (Schot & Geels, 2008). According to Schot and Geels (2008), the SNM approach is developed to manage innovations that are: *"(1) socially desirable innovation serving long-term goals such as sustainability, (2) radical novelties that face a mismatch with regard to existing infrastructure, user practices, regulations, etc."* (Schot & Geels, 2008, p. 539).

3.2. The multi-level perspective

The multi-level perspective is a widely recognized framework. The MLP approach combines insights from evolutionary economics and science & technology studies (STS) and sociology

(Grin et al., 2010, p. 18). It assumes that transitions are driven by the interaction of processes on three different levels: the socio-technical landscape, the socio-technical regime and the niche innovations. Processes on these levels differ in structuration and are placed in a nested hierarchy. This means that the niches are embedded within the regimes, and regimes in the landscape (Geels, 2002).

MLP states that transitions occur as the outcome of the interaction between processes and activities on the three levels (Grin et al., 2010, p.4). Figure 6 gives an overview of socio-technical transitions according to the MLP.

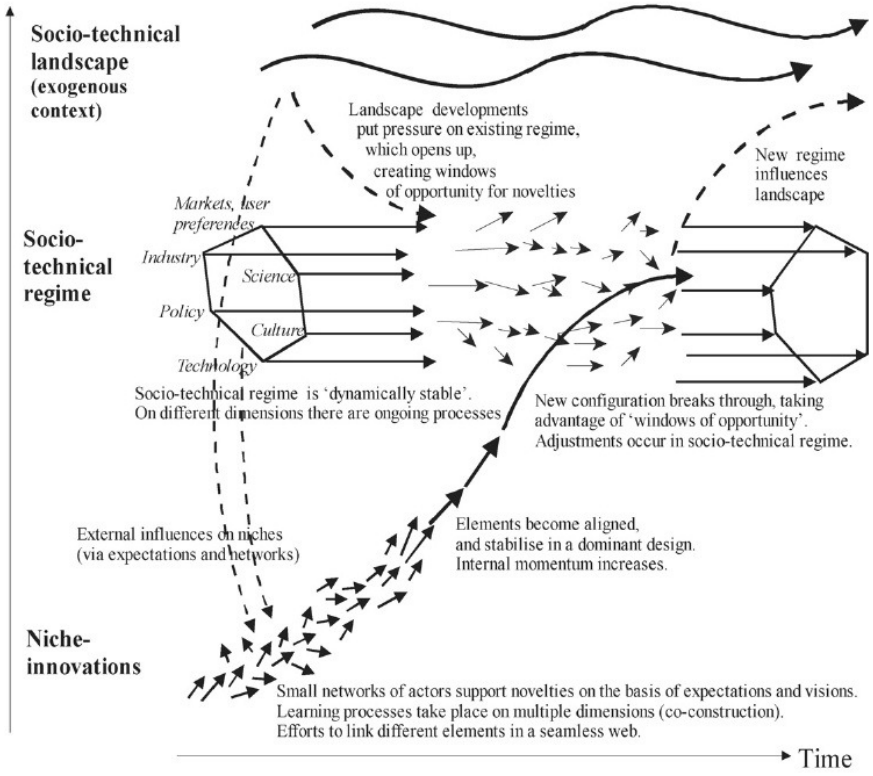

Figure 6: A multi-level perspective on socio-technical transition. Source: (Geels & Schot, 2007) adapted from (Geels, 2002)

Taking a socio-technical approach to transitions, the transport system is conceived as a configuration of several elements. These include technology and knowledge base, regulatory framework and policies, markets and industry, cultural believes and consumer practices. Multiple actors are involved and needed in maintaining and in changing the elements of such a socio-technical system.

Several elements incrementally co-evolve in time, creating a lock-in of the dominant design. This is called the socio-technical regime. When large and slow exogenous trends develop, they can put pressure on the current techniques and way of thinking that exists in the regime, creating a window of opportunity. Simultaneously, niche experiments may have been evolving in a protective environment, outside the regime. If the timing is right, these niche innovations can create changes or even shifts in the socio-technical regimes (Geels, 2002).

The type of transition depends on the timing and nature of the interaction between processes on the different levels (Geels & Schot, 2007). Section 3.2.4. elaborates on different transition pathways. The three levels will now be explained further.

Socio-technical landscape

The socio-technical landscape represents an exogenous context which cannot be influenced by actors in the short term (Grin et al., 2010, p. 24). The socio-technical landscape can come in three different forms. First, it can embody factors that change slowly or not at all. Geological conditions are examples of this type of landscape factor. Secondly, a long-term change, like industrialization, can be regarded as a socio-technical landscape. Finally, rapid external shocks, such as environmental disasters, financial crises and wars, have the characteristics of socio-technical landscape factors (Van Driel & Schot, 2005).
Socio-technical landscape factors are not within direct control of any individual actors. Developments on the landscape level put pressure on socio-technical regimes. It may turn out that incumbent technology cannot provide a satisfying solution to situations that are caused by changes on the landscape level. For example, the notion of finite natural resources or emitting harmful emissions may make society re-think their habits and use of technology.

Socio-technical regimes

However, transitions do not occur easily. The dominant design is locked-in and is being kept there by the existing socio-technical regime. This idea is based on the line of thought of Nelson and Winter (1982). They assumed a situation in which every actor of a community shared the same vision about a specific technology. This results in technological trajectories, because the incremental innovations that occurred are guided by cognitive routines. They labeled this concept technological regime. Rip and Kemp (1998, p. 340) have broadened the definition of technological regimes with more sociological routines and sets of rules.
Based on the idea of trajectories and shared routines, Geels (2004) suggested that a socio-technical regime comprised three different sets of rules that are linked together. The first type of rules is of cognitive nature. This category covers shared notion about goals and problem framing as well as search heuristics. Technical standards and rules for subsidies are examples of a second set of rules, having a regulative nature. And third are the normative rules, suggesting behavioral norms and role relationships.

Trajectories can be found for technology as well as in the areas of for example politics, economics, culture, markets and industry (Grin et al., 2010, p. 20). Because of the creation of social groups that have interests in many ways, such as professional associations, branch organizations, and the adaptation of lifestyle by people, mutual dependencies will arise (Geels, 2004). In other words, social groups in the different trajectories need each other and therefore co-evolve, trying to maintain the socio-technical regime as it is. This is depicted in figure 7.

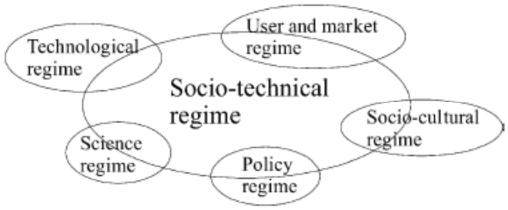

Figure 7: The socio-technical regime and the alignment of activities. Source: (Geels, 2004)

Change and innovation can still occur, but most of the time is incremental along the trajectories. This is often referred to as dynamic stability. When changes in one trajectory result in loss of synchronicities, it can generate tensions, creating windows of opportunity (Grin et al., 2010, p. 21).

Thus, socio-technical systems contain routines, which are deeply rooted in society in several areas, like technology, policy, market structures, user practices, institutional set-ups etc. Smith (2007, p. 429) uses seven dimensions to describe and analyze the stability of the socio-technical regime and the niche-regime interactions. These are:

- Guiding principles
- Technologies and infrastructure
- Industrial structure
- User relations and markets
- Policy and regulations
- Knowledge base for the regime
- Cultural, symbolic meanings underpinning practices

These regime dimensions are useful guidance for the incumbent urban mobility regime analysis.

Niches

Novelties, radical innovation and experimentation occur in niches. Unlike the socio-technical regimes, niches have relatively small, unstable social networks, mainly containing entrepreneurs and innovators. Actors in niches have to be very dedicated to uphold the niche. Routines in niches are diffuse and there is more uncertainty and less structuration of activities than in regimes.

However, niches are protective spaces outside the regime. In those protective spaces, new technologies have the opportunity to grow and develop before becoming subject of the selection environment of the regime. Regime rules often form a market entry barrier and a barrier for innovation since they benefit existing technologies. In niches, the new technologies often gain protection from dedicated actors or networks and receive (financial) resources to create stable socio-technical configurations (Geels, 2004; Grin et al., 2010, p.22). When there exists pressure on the regime, caused by internal tensions or exogenous landscape factors, and windows of opportunities emerge, it is important that the new technology is developed sufficiently in order to be able to change the socio-technical regime.

Transition typology

Geels and Schot (2007) suggest that there are four different types of transition pathways that can be taken, depending on the nature and the timing of the interaction of processes occurring at niche, regime and landscape level. Timing is important, since the transition pathways differ if the niche-technology is not yet developed or fully developed when windows of opportunity emerge. The nature of the interaction between different levels is important, because the type of transition pathways differ whether niche-technologies compete with the existing regime or can be adopted as add-ons within the existing regime. The four different types of transition pathways as proposed by Geels and Schot (2007) are:

1. **Transformation pathway**

Landscape pressure on the regime occurs at a time on which no fully developed niche-technology is available. Therefore, the regime cannot be forced to change completely in the direction of a new technology. Existing regime actors often keep their place in the regime and merely make adjustments.

2. **Reconfiguration pathway**

This type of pathway implies a more radical transition. In this pathway, when regime faces problems and opportunities for niche-technologies arise, the niche-technologies are sufficiently developed. The regime adopts niche-technologies as substitution of parts of the regime or as add-ons. Although the new regime still largely grows out of the old regime, the basic architecture of the regime will be significantly changed.

3. **Technological substitution pathway**

In this type of pathway, the problems of the regime as a result of landscape pressure and internal tensions, is more severe than in the transformation or reconfiguration pathway. The regime is falling apart and regime actors search for alternatives. Niche-technologies, if developed sufficiently, can make use of these periods of uncertainty and offering a solution. The niche actors are going to compete with existing regime actors for a dominant position in the new regime.

4. **De-alignment and re-alignment**

In this last type of pathway, the problems of the regime are more critical. Regime actors start to desert and investments in the regime technology drop. In this period of uncertainty market positions for actors can easily change. Multiple niche-technologies are brought in and will compete with each other. As dominant designs are emerging, new socio-technical configuration are built.

3.3. Strategic niche management

New technologies sometimes "*have a hard time, bridging the 'valley of death' between R&D and market introduction"* (Schot & Geels, 2008, p. 538). To deal with this problem, the strategic niche management perspective is introduced by Kemp, Schot and Hoogma (1998). This research analyses the emergence and the rise of the global niche of BRT using the SNM framework.

Some prominent SNM theories and studies have roots in the area of mobility and sustainable mobility (Kemp et al., 1998). However, BRT, as a good example of sustainable mobility, constitutes a more institutional and planning innovation than a technological innovation and experimentation where Kemp et al. (1998) and Hoogma et al. (2002) often look at.
One of the main assumptions of the SNM approach is that the transition towards sustainable innovation is made possible by the creation of technological niches (Schot & Geels, 2008). The basis for technological niches is experimentation. Gradually, the niche-innovation is exposed to market mechanisms so that user preferences and regulatory and institutional structures can be created. There are three processes that are at the core of the SNM approach. These are 1) the construction of new social actor networks for the mobilization of the resources needed, 2) the shaping and defining of expectations, and 3) learning (Kemp et al, 1998). Each of the three processes is now explained in more detail.

Building actor networks
In the development of a niche-innovation, building sufficiently good social networks is important in niche development. Social networks can facilitate interaction between involved actors and stimulate the other two niche internal processes. In this way, expectations can be aligned among actors and will all actors benefit from the experience and knowledge from all other actors in the network (Kemp et al., 1998).
The network should include heterogeneous actors which can generate multiple ideas. Hoogma et al. (2002, pp. 28-29) call this a broad network. They also argue that an actor network should be deep, meaning that the stakeholders involved show full commitment. Also depending on the position of the actors within their organizations, committed stakeholder are likely to mobilize resources.

Articulating expectations
Actors join a project with certain expectation. Well-articulated and shared expectations among actors can provide direction for learning processes (Kemp et al., 1998). If expectations are shared by more actors it is likely that these expectations can contribute more to the development of a niche (Hoogma et al., 2002). The same goes for situations when expectations are formulated very specific, so that expectations can provide better guidance for making choices in the design process. Third, if expectations are in line with other projects and reality, they are said to have higher quality (Hoogma et al., 2002).
According to Van Lente (1993, pp. 181-183) expectations can exist on different levels. On macro-level visions and general promises of the niche-innovation are articulated. These expectations can be communicated in order to magnetize resources and new actors to the network. Expectations on meso-levels involve (normative) expectations about the functionality and the role of the niche-innovation. On micro-level expectations are the most specific and detailed and concern requirements of the niche-innovation (Van Lente, 1993).

Learning processes
Learning is assumed to be crucial in an innovation process. Before a niche-innovation can develop a stable socio-technical configuration, learning processes can contribute to the development. This is the case when interaction technical and social aspects of the new

technology are explored and evaluated. Four ways of learning can be distinguished. First, learning by searching occurs in for example a R&D lab. Here, facts and new knowledge on the technology are created, the so-called know-why. Secondly, learning by doing happens in situation where the technology is actually being produced. This type of learning can create the so-called know-how. Next, when a technology is introduced in its intended context, the learning process by observing and evaluating is called learning by using. Finally, when there is extensive communication by involved actors of the new technology, learning by interacting occurs. Which type is learning is best or is used correlates with the expectations that are articulated in the actor network (Kamp, 2004).

Next to the four types of learning processes, also first-order and second-order learning can be distinguished. With first-order learning, the feedback of user experiences as well as the technical reliability is given. This can be used to make the technology better. In first-order learning actors thus ask the question: "are we doing things right?". Second-order learning is much more reflexive. It comprises the evaluation of the match between the technology and the socio-technical system that is being created. So, in second-order learning actors are more concerned with the question: "are we doing the right things?". This type of learning can help creating insights in the feasibility of the new technology (Raven, 2006).

3.3.1. Local projects in a global niche

As mentioned, niches are the interactive environments in which local experiments can evolve. Geels en Raven (2006) stress the importance to make a distinction between local projects and global niches. Local projects are experiments in specific places. These experiments interact with the local environment and have set up local networks. In time, project-based initiatives can become aligned. Actors try to construct a more stable socio-technical system and are involved in exchanging knowledge and other resources from and to the local context.

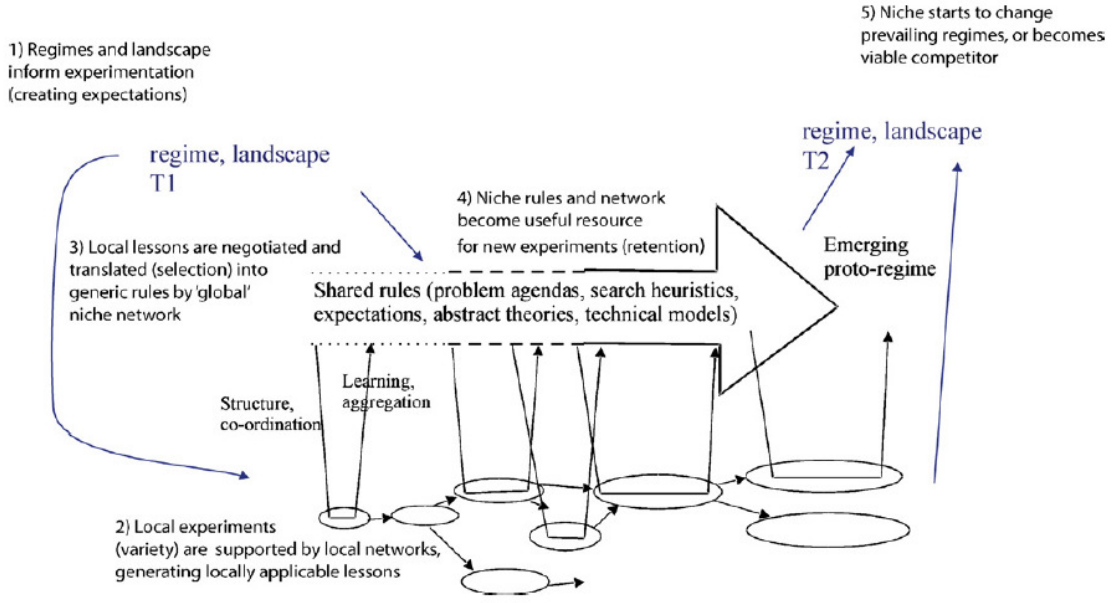

Figure 8: Local and global niche development processes. Source: (Smith & Raven, 2012), based on (Geels & Raven, 2006)

Figure 8 displays the distinction between local-level and global-level niche processes, the difference between local and global actor networks and how they interact. In time, lesson drawn from local experiments are translated to more general rules and actor networks, which provide input for new experiments. The niche can then be seen as an emerging regime, a proto-regime, and as a serious competitor with incumbent regimes (Geels & Raven, 2006).

3.3.2. Protective space

Although literature on transition stresses the importance of niches as a protected space, not until recently the concept of protection has been explored systematically (Smith & Raven, 2012). Smith and Raven (2012) identified that protection has three features: shielding, nurturing and empowerment. Shielding can be understood as processes that keep the selection environment at a safe distance from the niches. The niche internal processes, that support niche-innovation with developing, are labeled as nurturing. Two distinct empowering processes can be identified. The first type of processes makes the niche innovations ready to compete with the regime in an unchanged selection environment; this is also called fit-and-conform empowerment. The second type of processes, called stretch-and-transform empowerment, stimulates a change in the existing selection environment in a way that is convenient for niche innovations (Smith & Raven, 2012).

If these processes of protection are combined with the argument of a local-global level distinction, an additional role for global network actors comes to light. Besides the development of socio-technical configurations, global network actors are also involved in activities that promote, represent and attract investments to the niche. Niche agency occurs by advocates that try to influence actors in powerful positions; especially in stretch-and-transform empowerment where institutional reforms are essential.
Narratives, the arguments that actors use to try to reshape perspective and achieve institutional reforms, during negotiation and contending come in three categories. First, narratives can include the shaping of positive expectations for the future of the niche-innovation. Secondly, explicitly claims for a friendly institutional reformation or fit-and-conform claims can be articulated. The third category holds narratives that challenge the regime by re-frame the past, emphasize contradictions in the regime and promoting future opportunities for alternatives. Which narratives are deployed differs, depending for example on the goal, the audience, the niche experiences and context (Smith & Raven, 2012).

3.4. Recent debates and the transnational perspective in MLP and SNM

The above frameworks and theories on transition are well-established in the field of transition studies. However, as Schot and Geels (2008) also found for the SNM framework, concept and ideas over time evolve towards a more complex and nuanced framework. The recent debates that are most relevant for this research are the advocacy for a more explicit role of space in the approaches. Within these debates there are indications that point towards using transnational perspective in transition analyses. This thesis will contribute to those debates.

First, attention is paid to the debate of the role of space and scale in the multi-level perspective. Markard et al. (2012) have investigated the geographical delineation in 446 articles and papers that are produced in the field of transition studies between 1994 and 2011. From the results of their study (see figure 9 below) can be concluded that, besides theoretical and conceptual papers, transitions are mainly framed and understood in a national setting. The papers that are distributed to the category "global", focus on *"the world, continents or developing countries"* (Raven et al., 2012, p. 2). Papers with an "urban" focus have the city as its setting.

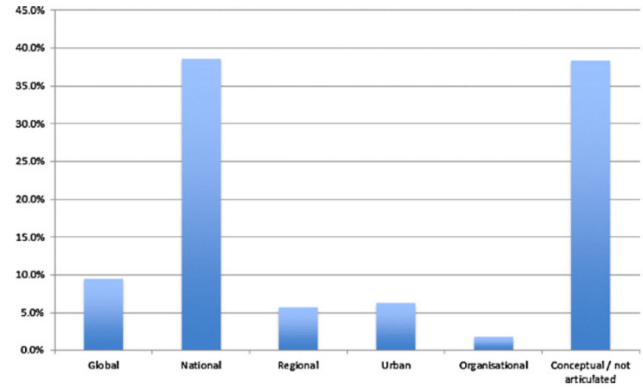

Figure 9: Geographical focus of papers in the field of transition studies (1994-2011). Source: (Markard et al., 2012)

These finding, so argue Raven et al. (2012), are conflicting with processes of both globalization and regionalization of science, technology and innovation. Indeed we see that the debates have been fueled because of the involvement of scholars in *"regional studies, economic geography, human geography, political ecology and international environmental governance"* (Raven et al., 2012, p. 3).
For example Coenen et al. (2012) argue that the MLP and SNM approaches lack 'territorial sensitivity' and that not enough attention is paid to local variations, differences in interpretation and the institutional context at sub-national levels such as cities. Moreover, they also argue for a more nuanced and detailed understanding about how local actors interact with global networks and how global and transnational flows materialize in projects (Coenen et al, 2012).

When looking to transition in an urban environment, the locus of innovation in this research, Hodson and Marvin (2009 & 2010) also have criticized the MLP for not having geographical sensitivity. Their research discusses the role of processes on city or region level in shaping socio-technical transitions. One of their statements is that innovation policies are more and more transferred from the national level to city government. That raises questions about whether the cities should be viewed as places where niches develop or whether they represent an own regime. Additionally, Armin and Thrift (1992) conceptualized regions as being nodes in global networks and argue for the possibility that a global, transnational network of cities is becoming an arena for niche development.

Another area of investigation, that on the role of sustainable experiments in shaping sustainable development in Asia, comes to the same conclusions about the limitations of the area of research.

> *"…we have only limited understanding of how global knowledge linkages influence the development and growth of sustainability experiments, but believe these linkages to be crucial in freeing us from an overly nationally-based analysis of innovation systems that appears so central to the notion of environmental convergence. We need to see experiments as located within transnational flows of knowledge, technology and other resources. And we assume that these flows influence local capability development, and the later growth of firms and new industrial sectors. But we need to know more about the mechanisms.*"
> (Berkhout et al., 2011, p.380)

All the above argue for an opportunity when including a transnational perspective in a research. However, the term 'transnational perspective' and 'transnationality' are ambiguous. Academic literature, as well as other institutes employ their own understanding of these concepts and are not in consensus about one definition.

Van der Veuten (2008) discusses three possible meanings regarding the definition of 'transnationality' that can be found in transnational history literature. One use of the term in literature refers to the study of **cross-border flows**; the movement of people, ideas and object across national borders and transcending national boundaries. Scolars in this area tend to use words like "flow", "circulation" and "relationship" (Van der Vleuten, 2008). Second, transnationality can refer to the study of transnational relations of **international NGOs**, defined as *"contacts, coalitions, and interactions across state boundaries that are not controlled by the central foreign policy organs of governments"* (Van der Vleuten, 2008, p. 980). Also, the Northern Periphery Programme, a programme to stimulate transnational cooperation between regions of Europe, give the following definition of transnationality on this: *"Transnationality deals with international co-operation on a level other than just exclusively between nation states. This can for instance be co-operation between local authorities/municipalities, non-governmental organisations, small and medium sized enterprises or educational and research institutes, located in different countries."* (Northern Periphery Programme, 2004, p. 1). Thirdly, the term transnational can be used to refer to the **debunking of the nation-state** from its posistion as central unit for analyses. This is similar to the process what is often referred to as globalization. Since the 1990s, more and more the role of nation-state as the level of analysis in literature is questioned (Van der Vleuten, 2008; Berkhout et al., 2011).

3.5. Research protocol

In order to analyze incumbent urban mobility regimes and the global BRT niche, concepts of MLP and SNM need to be operationalized. Also this section elaborates on the extent to which the additions and criticisms on these frameworks have some explanatory power.

First, the notion of differgence in transition pathways is usefull to understand the different roles BRT systems plays in different cities, for example the differences between BRT and BHLS. Secondly, the distinction between a local and global niche level is explicitly made in the niche analysis. By focussing on the global niche level, a transnational perspective is applied on the analysis. Thirdly, with the conceptualization of protection it can be understood how expectations are used in narratives as an empowerment mechanism.

The seven regime dimensions and the three niche internal processes of strategic niche management are used as guidance for both the semi structured in-depth interviews and the structuration of the empirical analyses. In tables 3 and 4 below, a more short list of questions is presented that guided this research. For the regime analysis also indicators are stipulated that can be used for describing the regime dimensions.

Strategic niche management – Niche internal processes	
Building of actor networks	- What transnational networks for creating BRT projects can be identified? - Of what partners do these networks consist and in what expertise? - How are these transnational networks influencing the diffusion of BRT systems over the world?
Articulation of expectations	- What expectations about the outcome do (network)partners have? - Are the aligned? Are they shared? Are they realistic? - Is the kind of expectations in any way similar across the world? - How are these expectations influencing the diffusion of BRT systems over the world?
Learning processes	- How does learning across borders occur? (Learning by doing? Learning by research?) - To what extent are experiences shared around the world? - What mechanisms and media is used for learning processes? - How is the (lack of) flow of knowledge across borders influencing the diffusion of BRT systems over the world?

Table 3: Research protocol - guidance for niche analysis with the strategic niche management approach

Multi-level perspective – Regime dimension		
Regime dimensions	**Main questions asked:**	**Indicators / evidence looked for:**
Guiding principles	- What kind of large underlying principles for the car / public transport system can be identified? - Are these principles the same all around the world and how is this influencing the diffusion of BRT over the world?	- Terminology used by interviewees and publishments of actors and scholars in the field - Routes operated by the different transport mode
Technologies and Infrastructure	- What kind of infrastructure is needed and what kind of technologies are the basis for the car / public transport system? - Is this the same all around the world and how is this influencing the diffusion of BRT over the world?	- Length and type of infrastructure needed - Number and type of vehicles operating
Industrial structure	- Is there an international industry for cars / buses / BRT systems and how is it structured? - How is the fact of an international industry of any kind influencing the diffusion of BRT systems over the world?	- Number of transnational companies in the industry / regime - Number of different local markets, cities and countries operate by one companies operate
User relations and markets	- How is the relation between the users/markets and the car / public transport system? What narratives are used to gain users? - Are these narratives / relations the same all around the world and how is this influencing the diffusion of BRT systems over the world?	- Amount of money spent on advertisement - Target groups of advertisements - Number of users in regime
Policy and regulations	- Can similarities in policies / policy-making / regulations all over the world regarding the private / public transportation system be identified? - How is this influencing the diffusion of BRT systems over the world?	- Amount of investments in industry - Amount of investments in needed infrastructure - Number of policies and agencies benefitting regime
Knowledge base for the regime	- What kind of knowledge is the basis for the car / public transport system / BRT system? - Is this knowledge the same all around the world and how is this influencing the diffusion of BRt systems over the world?	- Topic of the majority of the papers published in the field
Cultural and symbolic meanings	- Is the symbolism of cars / buses and the cultural value of cars / buses similar all over the World? - How are these cultural and symbolic meanings influencing the diffusion of BRT systems over the world?	- Cultural groups and classes using a transport mode - Message in advertisements

Table 4: Research protocol - guidance for regime analysis with the multi-level perspective

4. Transnational characteristics of incumbent urban mobility regimes

Because of the congestion, pollution and other problems, it is generally agreed that the ways in which urban mobility is organized should be object to change in many cities. However, in order to bring change, new ideas and systems must overcome barriers that are created by incumbent urban mobility modes. Incumbent urban mobility systems are often deeply embedded in lifestyles and hard to change. The regime analysis so to say assesses the situation in cities when the idea of BRT arrives on the scene. During the regime analysis, the associated type of BRT regime is described as well to assess the mismatch between incumbent socio-technical configurations and the required configurations in the future state.
Another goal is to determine the extent to which incumbent urban mobility regimes display transnational characteristics in order to assess the role of transnational processes on the diffusion of the concept of BRT.

In the analysis, the choice is made to differentiate in describing urban mobility regime in two aspects. First, document analyses and the interview outcomes suggest that BRT is not a homogenous category and that a distinction can be made between BHLS systems in Europe and full, high capacity BRT systems in developing cities like in Asia and Latin America.[4] This distinction is made in the analyses as well.
Secondly, in every city multiple relatively dominant mobility configurations can be identified; private transportation and public transportation. In some way, BRT systems contest with all these incumbent mobility regimes. BRT systems are often discursively positioned as an alternative for the car. Also, in decision making BRT has to compete with other forms of mass transit solutions. Moreover, the incumbent public transportation regime is interacting and integrating with the BRT system as well.
In the next sections, we are going to describe two incumbent urban mobility regimes (private motorized regime, public transportation regime) and the associated type of BRT regime in two different contexts (developing and developed cities).

4.1. Characteristics of the incumbent urban mobility regimes

It is not the goal of this thesis to discuss the incumbent urban mobility regimes exhaustively. The focus is on the contrast between the incumbent regime characteristics themselves and between those characteristics with the BRT or BHLS systems. Several authors have performed a regime analyses before, but they use different regime dimension in their analyses and/or conceptualizing the MLP framework (Smith, 2007; Geels, 2004; Geels, 2002). This research follows Smith (2007) in his analysis and choice for regime dimensions to structure and present the information and findings.

First the incumbent urban mobility regimes and the full BRT regime in developing cities are discussed. In table 5 below, the main findings of the analysis are presented.

[4] See section 2.5.

DEVELOPING CITIES			
	Private motorized transportation regime	**Public transportation regime**	**Full BRT**
Guiding principles	Individual ownership and usage Door-to-door solution	Collective usage Fixed routes or flexible paratransit	Collective usage Fixed routes
Technologies and infrastructure	Plan for (conventional) car "Predict-and-provide"	Vehicles vary from buses, minivans and rickshaws	Modern, extra-long buses Exclusive BRT facilities
Industrial structure	Transnational car manufacturing companies, operating on emerging markets	Semi-formal or informal "the war for the penny"	Local transport authorities needed Integration with feeder services needed
User relations and markets	Lots of advertisement for buying car, selling a lifestyle	Already many users Evolved from demand	Equity Low fixed prices
Policy and regulations	Governmental support for car industry	Governmental subsidies Laissez faire	Government makes capital investment
Knowledge base for the regime	Combustion engine	Organizational and contextual knowledge	Engineering and organizational (re)forms become more and more documented and standardized
Cultural, symbolic meanings	Status (freedom, autonomy and wealth)	Transport for lower class	Targets lower and middle class

Table 5: Differences and similarities between incumbent urban mobility regimes in developing cities on different regime dimensions.

The developing world context include situation that are ranging from the poorest countries to countries that do have a reasonable degree of wealth but still are developing nations. In the cities in the developing world, governance and institutions are not as structured as it is often needed [6][5]. Moreover, in the global south "*there might not be a passenger transport authority for every city and that may result in the lack of an existing well-structured transport service, let alone any other significant mass transit system, in the city*" [6].

[5] References to interviews are placed between square brackets. The interviewees related to the numbers can be found in the table with the list of interviewees in appendix 1.

In the developing world we see a *"rapidly increasing population and burgeoning demand for mobility which needs to be addressed in the short term, against limited budgets for capital expenditure"* [4]. And it is not just an increase in population and demand for mobility: "*If we take a closer look at the urbanization, we see that the number of people that has increased the most is not the rich, but the poor people"* [2].

The main difference in **guiding principles** between the private motorized transportation regime and the public transportation regime (also BRT) is the way people own and use vehicles. With private motorized transportation regime, as the name also suggest, individuals own the vehicles and use them for their own door-to-door transport demand. If necessary they can bring along a few family of friends. With public transport systems, more people travel in one vehicle and pay fees. There is a lot of variation in the appearances of public transport systems in developing cities. They can operate along fixed routes, or act as a paratransit mode and provide more flexible routes. Full BRT, as public transportation system clearly operates along fixed routes.

The incumbent urban mobility regime is among other factors depending on the level of private car ownership of a city. *"Different countries have different levels of private car ownership, but it is increasing very fast everywhere"* [8]. Not too ago, most people used public transport in cities in developing countries, but *"then car friendly policies were made and **infrastructure** became built around the car"* [2]. This way of planning and thinking is referred to as the "predict-and-provide" regime, which has had large influence on the development of the private motorized transportation regime (Geels, 2012). It is often the opinion of governmental officials that more cars in a city means more wealth and is thus desirable [4]. For instance in India, a high court ruled that it is favorable and desirable to precede mobility for vehicles instead of mobility for individuals, which means that governments should plan for more road space for general traffic instead of planning for public transport systems [8].
There is a wide range of public transport **vehicles** in developing cities, varying from buses and minivans till rickshaws, which are used for different travelling reasons and distances (Cervero & Golub, 2007). The propulsion of both private and public transport vehicles are based on the same technique. The full BRT regime contests with both incumbent regimes, since it requires exclusive BRT facilities and thus is in competition for road space with private vehicles. Besides that, the full BRT regime makes use of modern, extra-long buses with often a cleaner propulsion system.

Differences between the incumbent urban mobility regime and the full BRT regime can also be found in the **industrial structure**, the way they serve **markets and consumers** and the level of **governmental support** they receive. In the private motorized transportation regime, the car industry is a worldwide industry. They often have several factories and assembling plants in multiple continents, close to the emerging markets [8]. This instigated governmental support for the car industry, since the car plants can provide many jobs [6; 8] and good local economic conditions [4]. Also the car manufacturers influence the markets and user

experiences by the advertisements they make: *"around one out of five advertisements is about buying a car. They try to sell a lifestyle that makes you successful and happy"* [8].
This is all very different from the public transport regime in developing cities which often have a semi-structured or informal structures and rules. Sometimes only financially aided by local governments, the laissez-faire attitude of the city government in making public transport policies and legislation cause a system that is called "the war of the penny" [8]. This means that the income of public transportation operators is dependent on how many people they transport a day. Often these operators work along fixed routes but without official bus stops and are in competition with each other for ridership [8]. The upside of the (informal) public transport system in developing cities is that the system is evolved from demand for transport and therefore it already has many users a day [7; 8].
Full BRT systems on the other hand need governmental support, structured local transport authorities and feeder services to make the system work. Governmental capital investments are needed for the system to be built and also almost always, the national government is the one that has to guarantee any loans made by development banks [5]. Because BRT systems are often initiated by city governments that try to solve current or future problems, and because they put public money in the projects, equity is often a high goal that should be strived for. This results in technical adjustments for disabled people [2; 4], the creation of safer situations for elderly and for woman [3], and most important the fixed low and affordable prices [7; 8].

Important **knowledge that is shared and a basis for a well-functioning regime** is in the private motorized transportation regime mostly technical on the area of propulsion. It entails the combustion engine and recently also electrical propulsion is becoming part of the technological paradigm. For the public transportation regime, organizational and institutional set-up and a more contextual knowledge and know-how is important. The full BRT regime requires both [8]. The engineering challenge and reforms become more and more standardized and captured in protocols [6]. But also the (re)formation of institutions and organizational set-up is equally important for the success and quality of BRT systems and therefore should be present in cities who are planning for BRT systems [7; 8]. The knowledge to implement and set-up a well-working BRT systems is different than present know-how in the incumbent urban mobility regimes.

When the image of incumbent and BRT regimes are reviewed, along with the **symbolic and cultural meanings** that are attached to it, major differences can be seen. The cultural values that are attached to the car and to the private motorized transportation regime are very strong and more or less focused towards status, representing autonomy, freedom and wealth. *"For young professionals, buying a car is in Latin America the first milestone in the progress to wealth"* [8]. By the same token, public transportation is mainly used by less rich people and also the full BRT regime targets especially the lower and middle class [2]. The higher class people drive their own car and can often not be persuaded to use public transport systems. The middle class rather want to own and drive their own car unless there is a comfortable, reliable and fast alternative. The majority of rapid urbanization, however, is poor people. These people in general cannot afford to purchase a car [2].

However, we see in cities with full BRT system operating that the car is not the fastest transport mode anymore. Therefore the image and the cultural values are shifting for BRT corridors [2].

Table 6 below presents the finding of the same analysis but for European cities. The role BHLS systems play in the more developed and structured cities differs from the role full BRT systems play in developing cities. And therefore also a comparison between European and developing cities is done.

EUROPEAN CITIES			
	Private motorized transportation regime	**Public transportation regime**	**Bus with High Level Service (BHLS)**
Guiding principles	Individual ownership and usage Door-to-door solution	Collective usage Fixed routes	Collective usage Fixed routes
Technologies and infrastructure	Plan for (conventional) car "Predict-and-provide"	Public transport vehicles pretty standard	Exclusive BRT facilities Intelligent Transportation Systems
Industrial structure	Transnational car manufacturers with a strong voice	History of railway solutions for mass transit Desire and lobby for LRT	Bus industry is fractured and in competition with each other Few international NGOs
User relations and markets	Available for the majority Car use is woven into daily routines	Mostly used by students and elderly	Try to restore efficiency of the bus
Policy and regulations	Taxes as large source of income for government	Governmental subsidies	Government makes capital investment
Knowledge base for the regime	Combustion engine	Optimized organizational set-ups and capacity in place	Engineering and organizational (re)forms become more and more documented and standardized
Cultural, symbolic meanings	Status (freedom, autonomy and wealth)	Image of public transport is bad (i.e. late, slow, dirty)	Bus becomes fastest transport option and therefore gains higher status than conventional bus

Table 6: Differences and similarities between incumbent urban mobility regimes in European cities on different regime dimensions.

Compared to most of the developing cities, the European context *"in general have better structured cities, city governments, institutions, transport authorities and existing public services"* [6]. Therefore, when implementing BHLS systems *"what you effectively do is making an adjustment by putting in new infrastructure, solving new specific problems"* [6] instead of implementing the first and only significant mass transit in the city as is often the case in developing cities [6].

The car plays a large role in European and Northern American cities. The **guiding principles** that underlie the urban mobility regimes in the European cities are roughly the same as those discussed in the developing context. Individualism and flexibility are two very important philosophies behind the use of private transportation [8]. Besides that, a consumption attitude can be seen in the developed context, which attaches more value to private property than property that is for collective use [2, 6]. Public transportation in European cities is more standardized and organized and public transportation vehicles operate along fixed routes.

A few decades ago, most transport policies were characterized by the large amount of road they were planning and allowing. The 'predict-and-provide' regime brought along high investments in **infrastructure** and high sunken costs in which many (powerful) actors have vested interests. However, in the last two decades a shift in policy and regulation is noticed which does not benefit the use of cars. Traffic and demand management, parking and car restricting policies and the capitation of externalities in tariffs are examples of the abandonment of the 'predict-and-provide' way of thinking (Geels, 2012).

More and more room is available for the public transportation regime and thus for BHLS systems. Whereas incumbent public transport vehicles are quite standardized and have a normal appearance, BHLS systems require exclusive facilities and road space. Like in developing countries the BHLS regime is competing with the private cars for road space. Another point is that BHLS systems specifically focus on reliability of the system in which Intelligent Transportation Systems as a source for information play a major role ([6]; Hildago & Gutiérrez, 2012).

The car **industry** has the unconditional support of national governments. Besides the powerful voice of the car manufacturers in decision making, the car industry is viewed as such important industry, that national governments have financially aided the car industry to prevent bankruptcy, for example in the USA (Weiss & Weidman, 2012). In the public transportation regime, it is the rail solution advocates who have the most powerful lobby [3; 6; 7]. The history of railway solution for mass transit in Europe makes the experience with the systems more extensive and the benchmarking activities much better than those of the bus industry. Additionally, there are less European counterparts of international NGOs that advocate BRT systems as in Latin America and Asia. Moreover, the bus industry is fractured and in competition with each other, whereas the railway industry bundle their voice and believe that *"one tenth of a larger pie is more than that you have now"* [3].

The **markets** for the different urban mobility regimes are also very different. The car is deeply woven into daily routines (Urry, 2000). Since it is available for the large majority,

there is an implicit assumption that people have access to car as travel mode in arranging meetings and managing daily life. On the other hand, among the target groups of public transportation regime are students and elderly. The BHLS system is trying to restore the efficiency of the bus which may cause in a modal shift of many people from car use to the use of the BHLS system [4].

As mentioned, government **policies and regulation** (used to) favor the private motorized transportation regime. The other side of the coin is that governments get a lot of money from taxes, insurances and parking fees. But the government is also supporting the public transport regime. *"In Europe they have defined in the constitutional law and the EU agreements that mobility is a part of social right. Based on this political philosophy there are numerous cities that provide (sometimes indirect) subsidies for the transport sector"* [7]. Moreover, similar as in developing cities, national and city governments often make capital investments for infrastructure for public transport systems, so they are also crucial when designing and building BHLS systems [5].

The **knowledge base** for the urban mobility regimes is comparable as to that for the urban mobility regimes in developing countries. However, in Europe, often public transport authorities are already in place and have optimized there operations and organizations. BHLS systems are not more than a minor adjustment then, compared to implementing BRT systems in developing cities. The institutions in Europe are often also more receptive and have a higher capacity for organizational (re)forms. [6]

For the private motorized transportation regime, the **cultural and symbolic meanings**, which are attached to purchasing and driving a car, is in Europe the same as in developing countries. When purchasing a car, consumers in general first select on price, appearance, size and comfort (Geels, 2012). Later on, performance and brand are selection mechanisms. Emission and environmental issues (the part that is not reflected in price) in general comes last on the list of selection criteria (Geels, 2012).

The image of the bus and of the public transport system in general is often bad [6]. The bus for example is often associated with being late, travelling slow and being dirty and without privacy. When designing and planning for a BHLS system, an attempt is done to make the bus at least an equally fast transport mode again. Together with reliable services, the bus has gained a higher status than conventional buses in cities that have already implemented BHLS systems [2].

4.2. Transnational characteristics of urban mobility regimes

In the following section the extent of which the incumbent urban mobility regimes display transnational characteristics is assessed. In general, for every regime dimension is looked for evidence of spatial differentiation, the extent of diversity of routines between places. If ideas, techniques and principles are the same in multiple cities who are distanced from each other, this is regarded as the presence of transnational characteristics. Furthermore, for every regime dimensions spatial reach and connectedness of the features is assessed. If linkages across space and borders can be identified, this is viewed to be transnational.

The result of this analysis is presented in tables 7 (for developing cities) and 8 (for European cities) below. Color coding is used to differentiate between a regime dimension displaying lot of transnational characteristics (green), a regime dimension displaying no or marginal transnational characteristics (red) and regime dimensions displaying a medium amount of transnational characteristics (yellow).

The color coding is guided by the following principles. Regime dimensions can score high (+), medium (0) or low (-) on both spatial differentiation and spatial reach assessments. The color green is rewarded if a regime dimension scores two pluses, the color red is rewarded if a regime dimension score two minuses. The other cases are rewarded the color yellow.

DEVELOPING CITIES		
	Private motorized transportation regime	**Public transportation regime**
Guiding principles	Individual ownership and usage Door-to-door solution	Collective usage Fixed routes or flexible paratransit
Technologies and infrastructure	Plan for (conventional) car "Predict-and-provide"	Vehicles vary from buses, minivans and rickshaws
Industrial structure	Transnational car manufacturing companies, operating on emerging markets	Semi-formal or informal "the war for the penny"
User relations and markets	Lots of advertisement for buying car, selling a lifestyle	Already many users Evolved from demand
Policy and regulations	Governmental support for car industry	Governmental subsidies Laissez faire
Knowledge base for the regime	Combustion engine	Organizational and contextual knowledge
Cultural, symbolic meanings	Status (freedom, autonomy and wealth)	Transport for lower class

Table 7: Transnational characteristics of urban mobility regime dimensions in developing cities on different regime dimensions.

The private motorized transportation regime is displaying much transnational characteristics on each regime dimension. A lot of the private motorized transportation regime characteristics are shared in multiple cities.

What is of more importance is that the strong and transnational car industry has a high influence and spatial reach. This brings along a decrease of prices of the car [2], a creation of many jobs and beneficial economic conditions and local pressure groups that try to influence governments [8]. In this way, governments of every country are persuaded to believe that more cars mean more wealth.

So, apart from the guiding principles, for which the spatial reach is very hard to determine, every regime dimension of the private motorized regime show low spatial differentiation (+) and high spatial reach (+). The column of the private motorized regime is therefore mainly

green. Though, in different countries there are different policies regarding car use and also the spatial reach of government policy and support is not too big. The policy and regulation dimension therefore is assumed to have an (lower) average of transnational characteristics.

On the other hand, in the public transportation regime we see more variations in the systems, in the amount of governmental support and the organizational set-up of the (informal) public transport system (Cervero & Golub, 2007). The public transport is often locally evolved and operated by individuals or a few transport companies under a laissez-faire policy. The rules and hierarchy on the street are determined by the operators themselves and can differ from city to city. Because of the variation of the vehicles and (informal) rules for operating a public transport system, these dimensions are regarded as being very locally evolved and embedded.

EUROPEAN CITIES		
	Private motorized transportation regime	**Public transportation regime**
Guiding principles	Individual ownership and usage Door-to-door solution	Collective usage Fixed routes
Technologies and infrastructure	Plan for (conventional) car "Predict-and-provide"	Public transport vehicles pretty standard
Industrial structure	Transnational car manufacturers with a strong voice	History of railway solutions for mass transit Desire and lobby for LRT
User relations and markets	Available for the majority Car use is woven into daily routines	Mostly used by students and elderly
Policy and regulations	Taxes as large source of income for government	Governmental subsidies
Knowledge base for the regime	Combustion engine	Optimized organizational set-ups and capacity in place
Cultural, symbolic meanings	Status (freedom, autonomy and wealth)	Image of public transport is bad (i.e. late, slow, dirty)

Table 8: Transnational characteristics of urban mobility regime dimensions in European cities on different regime dimensions.

In European cities, the private motorized transportation regime and the transnational characteristics of it, show a lot of similarities with the private motorized transportation regime of developing cities. Also in the European context, every national government has their own tax system and car (restricting) policies.
On the European level is articulated that private transportation is a social right which national governments must provide [7]. This results in high similarities between governmental support in each country and well-structured public transport systems in every city. Although every city has its own transportation system and transport authority, on European level, research is done and experiences are shared on organizational set-up and transport engineering [6]. The similarities between cities in Europe are thus much higher than the similarities between cities in developing nations.

Because of the international research on best practices for organizational set-up, the column of the private transportation regime in Europe is colored mainly yellow and green. The contrast between developing cities and European cities in terms of transnational characteristics of their incumbent urban mobility regime is thus found in the public transportation regime.

4.3. Evaluation and discussion

Assessing the presence of transnational characteristics of the regime dimensions of the urban mobility regimes gave two main findings.
First, the transnational regime analysis shows that in both contexts the private motorized transportation regime has gained a prominent place in urban transportation. It is remarkable that it is not the European cities, which have a higher car ownership per person, but the non-European cities that have the most troubles with the car congesting and polluting in the cities. In absolute term, there are fewer cars in Europe and the level of car ownership grew less quick in Europe than in Asian and Latin American cities. The cities in Europe have had more time to adjust and co-evolve around the growth of the private motorized transportation regime. In Latin America and Asia, we see problems arise because of the rapid increase of the number of cars. In Europe, these problems are far less, but decades of planning for the conventional car have left its marks in urban design and daily routines.
The car industry is very deeply embedded in a city's urban mobility regime and extremely transnational. Multinational car manufacturers exploit the emerging markets and strengthen their roots in a city by building local factories which brings about jobs and prosperity for the region.

Secondly, on the contrary, the big difference between developing and European cities can be found between their public transportation regimes. Developing cities might not have a transport authority and the incumbent (informal) public transport system is operated by various types of vehicles and operators and do not gain much government support. In Europe, the public transportation regime is much more organized and benefits from best practices in organizational set-up.

The hypothesis that can be formulated is that when regimes display more transnational characteristics, these regimes are more stable. Indeed, a correlation can be seen between large BRT systems who find their place into a cities transport system and the extent to which incumbent urban mobility regime (especially the public transportation) are more locally embedded and evolved instead of showing transnational characteristics. By the same token, in the European context, where more standardized and internationally shared routines are found, the BHLS systems are much smaller. This argues for further research to these relationships.

4.4. Conclusion

In this chapter, an analysis is done about what BRT faces when it comes to a city. It tried to characterize the genes of the incumbent urban mobility regime and determined how their transnational (or just local) character influenced the diffusion of BRT.

In developing cities an increase of the use of private motorized vehicles is seen. In the second half of the previous century, governments have built many roads and planned for the conventional car. Their assumption and that of the inhabitants as well, is that more cars means more wealth. Also, in these cities, the incumbent private transportation system is often semi-structured or informal. Although it is used by many people each day, often there is a lack of governmental support and transport authorities. However, both governmental support and transport authorities are needed in implementing a BRT system in the city. Whereas the purchase of a car symbolizes status and wealth, public transport is seen as transport for a lower class. BRT systems specifically set equity as a goal and requirement and therefore make the system available for everyone. Especially when the bus is not the slowest transportation mode anymore, it gains status and ridership of car owners.

In European cities the car industry has a strong voice in policy and decision making. The predict-and-provide way of thinking at the government officials, and the high level of car ownership make that the use of the car is deeply woven in daily routines. However, in the last two decades, policies and governments more and more favor public transport systems. In Europe, there is a history of railway solutions for mass transit and this makes that the railway industry is better organized and has a more powerful lobby. The BHLS system is trying to restore the efficiency of the bus and hopes, since the image of the bus is connected with the quality of the BHLS system, to improve the status of the bus and to increase their number of ridership.

The car industry is a very transnational one. It is serving both European and emerging markets extensively. The car industry benefits all around the world from government support. The biggest differences in transnational characteristics between the urban mobility regimes of developing cities and European cities are mainly found in their public transportation regimes. In Europe, the public transportation regime is more structured, stronger regulated, supported more extensively and uses more standardized vehicles and best practices in organizational set-up. On the other hand, in developing world cities, a wide range of (informal) public transport can be found. Often the vehicles used are adapted to the city's environment or can

mainly be found in one city or country (think about tuk-tuks) and operate under a laissez-faire policy.

It is remarkable that in the cities that have incumbent urban mobility regimes that in general are more locally evolved and embedded, the BRT systems that are implemented are larger. Though this correlation might also be attributed to other things as well, this is an interesting topic to investigate further.

5. Transnational characteristics of the global BRT niche

This chapter continues with the analysis of the role of transnational characteristics on the diffusion of BRT systems. Now, the focus is on the niche; more specific, the development of the global BRT niche. By taking this transnational perspective, this chapter assesses whether new insights are gained about the diffusion of BRT systems when analyzing it with through a transnational lens and what the influence is of transnational processes on the worldwide diffusion of BRT systems.

Although the characteristics of niches are that they entail unstable, small networks and immature, diffuse routines, the BRT niche is growing fast and BRT systems are already implemented in about 150 cities. The term global niche thus can refer to the higher level of aggregated local BRT initiatives, a global network with shared rules and assembled knowledge and experiences. However, BRT projects have been implemented in cities around the globe, in every continent. Therefore, in this case, the term global niche can also be interpreted literally, as a worldwide happening.

The three niche internal processes of the strategic niche management approach are used to analyze the global BRT niche. It has already become clear that international NGOs are involved in the global BRT niche level. In this section, the role of these international NGOs is evaluated extensively.

5.1. Actor networks

"Transitions are the result of interactions among all actors in society: governments, business, NGOs, universities and citizens" (Grin et al., 2010, p. 155/156). But one of the interviewees acknowledged that *"the transport sector is a difficult sector to implement solutions because the multiple stakeholders and interests that are involved; the user, the public, the operators, the media, the politicians, the businesses, the lobby groups, environmental complications, poverty, social inclusion"* [7].

This section discusses different involved stakeholders operating at the global niche and assesses their roles in the diffusion of BRT. The stakeholders that will be evaluated are:

- the 'preachers'
- the international NGOs EMBARQ and ITDP,
- the city networks and initiatives ICLEI and EcoMobility,
- the BRT specific benchmark groups RTSC, IBBG and ABBG,
- the knowledge sharing and knowledge transferring organizations COST, SIBRT and ALC-BRT CoE,
- developing partners, and
- international transport planning and consulting agencies.

In creating awareness for livable cities and sustainable transport, a large role is played by what here is referred to as the BRT '**preachers'.** In specific, Jaime Lerner, former mayor of Curitiba, and Enrique Peñalosa, former mayor of Bogotá have been of big influence [5; 6; 8].

Both were mayors at the time of implementing the BRT projects in their cities. The Curitiba and Bogotá BRT systems are sources of inspiration and truly famous best practice projects in the field (Matsumoto, 2006). It should be noted that Lerner and Peñalosa are not the hero's to which the whole agency story can be attributed, but after they have implemented successful projects in their cities, they were the ones that got invited to visit a large amount of cities all over the world. During these visits, they spread their vision and tell their city's success stories. Moreover, these charismatic and influencing preachers found their ways to high positions in which they are able to advocate their opinion [7; 8].
Jaime Lerner has his own architecture and spatial planning office and developed plans for several Brazilian cities, among which Rio de Janeiro and São Paulo. He has also worked in Caracas (Venezuela), San Juan (Puerto Rico), Xangai (China), Havana (Cuba), and Seoul (South Korea); and acted as a United Nations consultant for urban issues. Besides that he lectured and guest lectured at several universities and spoke at important conferences, including TED (Lerner, 2013).
Peñalosa, as former mayor of Bogotá, was getting invitations all around the world to not only talk about TransMilenio, but also about his sustainable adjustments in his city; bike ways, pedestrian areas and the restriction on car use [8]. Bogotá was home to numerous workshops and conferences. Academically Bogotá received lots of international attention and worships. Peñalosa and the city of Bogotá has been rewarded with some international awards, such as the golden Lion of the Venice Biennale, an important price for successful innovation in cities, and in 2001 it received the Stockholm Challenge Award, an initiative of the city of Stockholm, Sweden, in association with the European Commission, which acknowledge pioneers in the application of technological development that improve quality of life and become models for other cities in the world [8]. Later on, Enrique Peñalosa became president of the board of ITDP, an influencing international organization on the topic of sustainable mobility. Peñalosa *"started using the information from Bogotá to promote sustainable transport and promoted it as a success story"* [8].

Clearly, the BRT preachers, in specific Lerner and Peñalosa, have the power to shape or reshape debates about sustainable transport and livable cities in the places they go. In their 'function' as preachers, they travel around the whole world, welcome international delegations in their cities and receive international rewards and worships.

The next category of actors is the **international non-state and non-governmental organization**. A lot of national and international institutions and network organizations have been set up in the past years. They can be divided into several categories, which all will be discussed briefly. This thesis separates international NGOs and initiatives that promote livable cities in general and bus and BRT benchmark groups and organizations with specific BRT knowledge sharing and transferring programs.

First, the focus is on EMBARQ and ITDP as international NGOs that promote livable cities. Most interviewees mentioned these as the most important and they both have an extended and important history with BRT projects as well.

EMBARQ was established in 2002 as a nonprofit program by the World Resources Institute, an environmental think tank, focusing merely on sustainable transportation. EMBARQ's mission is to *"catalyze and help implement environmentally and financially sustainable transport solution to improve the quality of life in cities"* (EMBARQ, 2012b). The initial investment for EMBARQ to be established came from Shell foundation. Their then-director was taken on a trip around the world by the first EMBARQ director-to-be, visiting highly congested and polluted cities, creating a sense of urgency for investing in quality of life and sustainable transportation.

In the 10 years of its existence, EMBARQ has established six offices in several countries and often works with key decision makers at city government level. They identify officials and politicians that have political, social and financial powers to implement a long lasting solution in major cities in the developing world. In most cases they will only invest their resources in cases in cities with such strong political will and power. Also, at a local level, EMBARQ increasingly is trying to create public private partnerships (PPPs) and private investments. On a national level, EMBARQ tries to strengthen ties with ministries of finance and ministries that are concerned with amongst others environment, infrastructure and health. Internationally, EMBARQ promotes best practices and facilitate technology, knowledge and finance transfers to amongst others multilateral development banks and global treaties like the United Nations Framework Convention on Climate Change (EMBARQ, 2012a).

A few achievements of EMBARQ are the launch of the online blog TheCityFix.com, on which sustainable solutions to urban mobility problems are being shared and explored. Also in the past five years, EMBARQ collaborated in ambitious BRT projects, providing merely technical assistance and making strategic alliances. Moreover, EMBARQ is involved in the establishment of the SIBRT, a BRT strategic alliance association for large stakeholders and partners in Latin America (discussed later), a partner in ALC-BRT CoE (also discussed later), and co-constructor of the BRT database which is used in this thesis.

Another international NGO of major importance is the Institute for Transportation and Development Policy, the ITDP. This organization also operates around the world and work with local parties to implement transport solutions that can reduce emissions, improve the quality of urban life and reduce poverty. Same as EMBARQ, ITDP works with city governments who approach ITDP for technical assistance on improving their urban transportation system.

ITDP was established in 1985 as a worldwide peace and development initiative promoting non-motorized transport under the motto: "send bikes not bombs". One year later, ITDP have set its fundamentals in an influencing paper on sustainable transport. In the years after, ITDP mostly raised awareness for sustainable transportation and shifting priorities regarding efficient and environmental transport policies. Their executive director, Walter Hook, was a pioneer in raising debates about sustainable transport at the World Bank and the Global Environmental Facility (GEF), created a restructure of their budgeting guidelines, making millions of dollars available for BRT and non-motorized transport project worldwide. With close connections to the TransMilenio and having Enrique Peñalosa as chairman of the board, ITDP organized several conferences about Bogotá which *"catalyzes ITDP's work in promoting BRT"* (ITDP, 2012b).

Besides public transport, ITDP focuses on several program areas, such as sustainable urban development and cycling and walking, but also climate and transport policy and outreach and awareness. ITDP also has been very active in Asia. It helped develop the BRT systems in Jakarta in Indonesia, Ahmedabad in India and Guangzhou in China, and ITDP assembled the Sustainable Transport Action Network for Asia and Pacific (SUSTRAN).

EMBARQ and ITDP are very influential in technical assistance and in creating awareness and changing policies. Nonetheless, BRT is only one solution they advocate in achieving their goal of creating more livable cities.

City networks are promoting sustainable urban development as well. One of the largest city network for promoting sustainability is the International Council for Local Environmental Initiatives (ICLEI) - Local Governments for sustainability. This association was founded in 1990 when the United Nations' World Congress of Local Governments for a Sustainable Future was attended by more than 200 cities from 43 different countries. At present day, the ICLEI network comprises *"12 mega-cities, 100 super-cities and urban regions, 450 large cities as well as 450 small and medium-sized cities and towns in 84 countries"* (ICLEI, 2012).

It is in the mission statement of ICLEI that the association aims at constructing a worldwide network of local governments and achieves solid progress towards global sustainability from a bottom-up perspective, beginning with local actions. For this purpose ICLEI functions as a broker between city governments themselves and between city governments and other organization on a local, national and international level. They refer to this mission as 'connecting leaders'. One of their visions articulated is: *"Look for local solutions to global challenges by connecting local leaders to global partners such as international organizations, business, entrepreneurs, academic or other non-governmental organizations and experts in the field of sustainability"* (ICLEI, 2012).

ICLEI has settled 14 offices worldwide, covering every continent. It has set up several local, regional and international programs, with EcoMobility being the most interesting initiative for this research. EcoMobility is defined as *"travel through integrated, socially inclusive, environmentally-friendly, and healthy transport options, including and combining walking, cycling, wheeling, and passenging (using public transport)*" (EcoMobility, 2012). With this new approach on mobility, EcoMobility aims to improve the quality of urban life and social cohesion.
ICLEI was involved in establishing the EcoMobility Alliance, a network of cities with strong, innovative and inspiring leaders. In this network, cities can share knowledge and involve in peer-to-peer exchanges. The EcoMobility Alliance sees itself as a global actor because of its spatial range. It also is engaged in promoting EcoMobility at a global level all around the world and tries to involve both public and private actors from different sectors all over the world (EcoMobility, 2012).

The goal of the network partners discussed above is to share knowledge and create awareness for quality of life improvements in which BRT is only one of the solutions they offer. When cities face the decision on what kind of solution or transit system they are willing to go for, city officials may come in contact with **bus benchmark groups**.
One of the most well-known international public transport benchmark organizations is the Railway and Transport Strategy Center (RTSC), located at the Imperial College in London. The RTSC started in 1992 as an organization serving merely the railway industry, but in the last 10 years it has broadened its scope. RTSC is well known for its researches within the transport industry on transport economics, policy, operation and management, but also has experience and experts working on the management of international benchmarking projects [7]. RTSC manages and facilitates several international public transport benchmark programs under which two bus benchmark organization. These are the International Bus Benchmarking Groups and the American Bus Benchmarking Group.

Benchmarking is defined by these organizations as *"a structured approach to identify actions that lead to superior performance"* (Imperial College London, 2012). Data on system performances stimulate asking questions and shaping debates at decision making layers in governmental organizations. Group members of the benchmarking groups perform case studies on regular base, identifying best practices and gaining insights for strategies in dialogues with stakeholders such as the city governments. The International Bus Benchmarking Group was founded in 2004 and has 13 large bus organizations over the world as members. The goal of the IBBG is to develop measurements that can evaluate the functioning of an organization that can help to identify best practices. It also supports decision makers and provides comparative information for relevant stakeholders.
The American Bus Benchmarking Group (ABBG) is founded in April 2011 specifically for mid-sized bus organizations in America. It roughly has the same goals as the RTSC and the IBBG. The main idea is to develop a Key Performance Indicator system to evaluate organizations and their strengths and weaknesses. And use the identification of best practices in their dialogues with stakeholders.

More BRT focused **institutions that are involved in knowledge sharing and knowledge transfer** programs can be identified.
First, the COST program in Europe is examined. COST is the abbreviation for Cooperation in Science and Technology, which is an intergovernmental organization in Europe. COST puts effort in combining national research funding in order to reduce fragmentation in research and development and creating one European Research Area. It focuses in establishing excellence in nine key fields, from which 'transport and urban development' is one. COST's mission is to connect high-quality scientific communities with each other and facilitate the mobility of researchers across Europe in order to enlarge the European innovation capacity. Moreover, it tries to enlarge the impact of scientific outcomes on decision and policy makers in both the public as the private sector.

One of the most interesting reports for this thesis and a most famous and influential report in the field of transport studies, is the COST TU0603 report on "Buses with High Level

Service", which evaluated 35 European cities with BHLS systems and provide recommendations for decision-making (Finn et al., 2011).

Second, in Latin-America, the "Asociación Latino-Americana de Sistemas Integrados y BRT", translated as the Latin American Association of Integrated Systems and BRT (SIBRT), brings together BRT agencies and other stakeholders from 19 Latin American cities, divided over 8 countries. Together, their BRT systems account for 20 million passengers a day (Gutiérrez, 2012). SIBRT was founded in 2010 and they promote the concept of an integrated transport system that provides every man with a door-to-door solution [7]. BRT is one of the fundamental parts of such systems. Inspired by the RTSC of the Imperial College in London, they aim to develop best practices for improvement in transport planning, management, standardization and operation. For this, every partner of SIBRT puts knowledge and experience on the table. SIBRT is concerned with the dissemination of this knowledge and with the improvement of the image of bus systems all over the world. Moreover, SIBRT makes strategic alliances with several stakeholders, such as governments, multilateral developing banks and industry suppliers to push for policies and financing that are favorable for the implementation of BRT [7].

The SIBRT works together with a BRT center of excellence. Since May 2010, VREF, the Volvo Research and Educational Foundations, formed a research group consisting of several parties around the world, the Across Latitudes and Cultures Bus Rapid Transit Center of Excellence (ALC-BRT CoE). This was the result of a call for a request for proposal for a BRT center of excellence [8]. The policy of VREF is to find and financially support research that aims to influence the development of transportation systems that are sustainable and accessible for all. They have constituted several other centers of excellence, BRT is one of them. Tied to the ALC-BRT CoE are a collection of research and practitioners around the world. The goal is to understand BRT better by doing research, develop new concepts and going back to practitioners to improve BRT services and systems (ALC-BRT CoE, 2013a). The ALC-BRT CoE is organizing, co-hosting and participating in global conferences [8]. Also this organization is facilitating the creation and dissemination of knowledge. The ultimate goal of the ALC-BRT CoE is to develop a guiding framework for decision makers to plan, design, finance, implement and operate a BRT. In order to make this framework applicable for different urban areas, the ALC-BRT CoE is trying to identify BRT elements from existing systems that are transferable to future systems all over the world [8].

Volvo, a car- and bus manufacturing company from Sweden, presents itself as a world leader in the delivery of buses for BRT systems, because BRT systems *"represent much of what Volvo stands for, such as improved safety, operating economy and environmental care"* (Volvo, 2012). Volvo is one of the only companies that *"have actively embraced BRT to some effect. But even that has probably had little influence on the diffusion of BRT"* [4].

When city governments have decided to go for a BRT solution, a lot of knowledge for designing the system is required. Also, money is needed. One category of stakeholders is excellent in providing both: **The developing partners**.

Multilateral development partners such as the World Bank, the Asian Development Bank, the HSBC or the Inter-American development bank, provide loans for capital investments in the infrastructure [5]. Cities in the developing world particularly are dependent on national and international financing; the cities themselves in general have very little resources. The capital investment in infrastructure is often a grant from national governments. It is also their task to gather international funding, because most of the international organizations do not enter financing agreements directly with cities. Most of the loans require national governments that guarantee such loan to be repaid [5]. International funding, from multilateral agencies give opportunities for transnational learning. When involved they often bring knowledge and contractual expertise to the cities [6].

However, funding can also be found locally. It can exist in the form of PPPs with private partners, this is often the operating and vehicle part of the system [5; 6]. Moreover, when national governments allow it, local tax fuels and/or parking fees can provide funding for the capital investment. One of the interviewees claims that *"the funding is usually local, but you still need to find it which is sometimes very difficult"* [8].

When pure technical assistance is needed, there are some very experienced **transport planning and consulting agencies** in the world, serving the whole globe. The most famous ones are located in Brazil, the UK, Ireland and Spain [5]. International tendering for BRT design and implementation often is desired and obliged. A famous and experienced English transport planning consultancy is Steer Davies Gleave. The organization has 16 offices worldwide from which 9 are located in North and South America. Steer Davies Gleave claims to continuously invest in pioneering transportation planning techniques and developing skills and has won several awards for its business (Steer Davies Gleave, 2012).

From the above can be concluded that international NGOs play an important role in advocating livable cities with BRT as a good solution and in assembling and disseminating knowledge and best practices around the world. Many international organizations have local offices over the world.

Bogotá – TransMilenio

The first and most important actor in this case is the administration of Enrique Peñalosa. The faith of the administration is the success of the system and the unconditional support lead to fast implementation of the first phase of TransMilenio [8].

The city council of Bogotá ran an international tendering for the consultancy. The consultancy that won was Steer Davies Gleave, and they worked with local offices and subcontractors from Brazil [8]. The Brazilian engineers were experienced and came with some innovative designs, for example the idea of overtaking lanes and local and express services operating on the same infrastructure (Peñalosa, 2004).

For financing the infrastructure of TransMilenio *"a combination of international, national and local sources was used (…) with the vast majority of funds coming from local sources"* (Hook, 2004, p. 118). Almost half of the many was raised by fuel taxes, which according to national Columbian law, can be charged and kept by municipalities. Besides grants from the national government and cash flows that was made by de-capitalizing the Power Company, also the World Bank provided the city of Bogotá with some credit (Hook, 2004). The financing of the operating vehicles and fare collecting systems was done by the private, local parties that were going to operate TransMilenio [8].

Also an international tendering for vehicle manufacturers occurred. Volvo (Sweden) and Mercedez-Benz (Germany) are involved in the project as well as Marcopolo-Superior, a Colombian-Brazilian conglomerate [8].

Eindhoven – Phileas

Eindhoven has made its choice for a BRT system apart from trends and international NGOs in the rest of the world. It is developed top-down in line with regulations and policies of the Dutch national government. Involved actors in the project were based in the Netherlands and sometimes even in the region. The consultancy that was hired was the Dutch firm AVG Movares and a study tour went to Amsterdam [1].

One of the minor goals was to stimulate the innovation in the region because it was important for the image and employment in the Eindhoven area since DAF (bankruptcy) and Philips research lab (withdrawal) had left [3]. The vehicle that was going to operate the BRT in Eindhoven is the Phileas bus. This vehicle has a futuristic look and entails tram characteristics for the cost of a bus [3]. For developing the vehicle, in 1998 Advanced Public Transport Systems BV (APTS) was created and served as a platform meant to brainstorm [3]. However, the biggest part of the designing of the system was already made when APTS was created ([1]; [3]).

Textbox 1: Illustration of actor networks in Bogotá and Eindhoven

5.2. Expectations

For the development of niches, articulating expectations are believed to be very important. They can attract attention and investments towards the niches and provide direction for development. These narratives may also empower the niche and form a protective space.
Because of the transnational scope applied, expectations that are articulated on the aggregate level are the focus of this section. The shared beliefs and rules on the global BRT niche level include amongst others shaping problem agendas and search heuristics to develop the niche solutions (Geels & Raven, 2006). Geels and Raven emphasize the importance of vision in this matter not only at developing local projects, but also visions that travel between projects and collective expectations that exist on the global niche level.

For each network actor that is discussed in the previous section is identified what their main vision or expectation is in relation with BRT. Then, the spatial references of those visions are determined to assess transnational characteristics of the articulated expectations. Indicators that are used for this are references in publications, quotes and mission statements of network actors. Terms like 'a city' or terms with no specific spatial reference indicate that expectations are transferable and applicable for every city in the world. References to 'partners', 'members' or the use of terms that refer to local contexts indicate that expectations are articulated for a specific context or for a specific group of actors, cities or countries. The findings are summarized in table 9 below.

The preachers Jaime Lerner and Enrique Peñalosa clearly have highly transnational expectations. The environments in which they give presentations often have a very international character. For example, Jaime Lerner held a TED talk in March 2007, reaching the whole world with his narratives (Lerner, 2007). One of his most famous quotes is: "*Every city in the world can be improved in less than three years"*. Combined with his inspiring thought that *"creativity starts when you cut a zero of your budget"* there is a large focus on sustainable mobility in the form of BRT in his vision of future cities. The fact that he won several international awards is evidence of his word and ideas spreading across the globe.
The same holds for Enrique Peñalosa. Winning international awards and being invited to present in front of international delegations makes the spatial reach of his ideas very high. Moreover, its visions (and those of Jaime Lerner as well) holds for all the cities across the globe. Although they have experience with the implementation of a BRT system, in their role as preacher they talk more on a macro level, trying to transfer their visions for cities in general.

Actor	Main vision / expectation	Main spatial reference
Preachers	- Sustainability of mobility improves the livability of the city	Global
EMBARQ	- BRT is a sustainable solution that has a high impact on the emissions, safety and livability in a city. Because it is a relatively low-cost solution it should be welcomed in developing cities. - A sound and integrated BRT system improves city live and reduces pollution. - BRT in Mexico / Bogotá a standard for developing cities worldwide. Replicate best practices in over 200 cities around the world.	One major vision and database of experiences, but local offices make local expectations for targeting city leaders
ICLEI, EcoMobility	- Mobility should be environmentally sustainable and socially inclusive. BRT can fulfill that requirements	Involvement of private and public parties in an active, global community.
RTSC, IBBG, ABBG	- The quality of bus systems improve when best practices can be identified and shared.	Only for member organizations of some cities in Europe, Australia and USA, but applicable worldwide.
COST	- Enhance sustainable mobility by developing new bus services that are able to compete with the use of cars in Europe	Focused on cities in 35 European countries.
SIBRT	- Integrated Systems are desired and BRT is the safest, most efficient and sustainable form of mass transit in it. - Improving and aligning the BRT industry improves the image of the bus in general.	Collaboration of cities in Latin American countries, but they involve and reach out to international actors.
ALC-BRT CoE	- BRT makes cities more attractive places to live, work and visit - Make information about BRT accessible for everyone	Highly transnational partners and visions.
Developing partners	- BRT is relatively cost effective and improves a city's competitiveness. - BRT systems reduces emissions.	Work with local partners and conditions under one major vision
Steer Davies Gleave	- Urban transit is a crucial element in a 21st century city.	Work with local partners and conditions

Table 9: Main findings: Actors with their main visions/expectations and the main spatial references of them

EMBARQ, has more specific expectations about the functionality of BRT systems. Not alone do they believe that BRT improve mobility on the surface of cities, they also believe that BRT *"contributes to reducing air pollution, greenhouse gas emissions, noise and traffic crashes"* for only one twentieth of the cost to implement rail transit solutions (EMBARQ, 2012b, p. 34).
In 2005, EMBARQ launched its first BRT system in Mexico City. Because one year after its opening the BRT system in Mexico City received high ratings, that case was put forward by EMBARQ as a standard for developing cities in the world (EMBARQ, 2012a).

ITDP claims that *"Sustainable urban planning and design, integrated with sound transport systems, not only improves city life, but also reduces pollution*" (ITDP, 2012c). The main transport system they advocate is the BRT system.
Moreover, ITDP uses the city of Bogotá as a success story and invite international delegation to visit the city. They also create public awareness for the important role of well designed, sustainable public transport systems in urbanization and climate change issues with the annually bestowed Sustainable Transport Award and the 'Our Cities Ourselves' initiative in which ten famous architects present their vision of how ten cities in 2030 look like (ITDP, 2012c).
EMBARQ and ITDP both see BRT as a mean to reach their ultimate goal of creating livable and sustainable cities. The local offices of EMBARQ and ITDP in different continents work under the single vision of their organization worldwide. EMBARQ and ITDP target specifically the city leaders and decision makers with their narratives [1]. They help local parties to seek for concrete solutions for a specific city. Although the expectations for a specific city are in a way very local formulated, they are articulated by actors that have worldwide experiences and data available.

ICLEI itself, as a network of cities, do not have clearly articulated expectations or visions for BRT. However, it has co-founded the EcoMobility Alliance in which visions for sustainable transport solutions are further specified. The EcoMobility Alliance includes cities that want to be frontrunners in the area of EcoMobility and advocates sustainable and socially inclusive mobility. *"They work to avoid a horrible future"* [2]. Within that vision they see BRT systems as an excellent alternative and go to city governments to advocate for BRT systems in both developed and developing cities.

The benchmark organization RTSC is now for over two decades active in benchmarking transport systems internationally. With bus benchmarking as one of its three pillars, the RTSC founded en hosts the IBBG and the ABBG. They have not articulated expectations specifically for BRT systems, but they believe that by collecting information from case studies, identifying best practices and disseminate the knowledge among its members, the transport systems of their members will be optimized (Imperial College London, 2012).
The expectations thus are very local formulated for and by member cities with almost the same urban conditions and environmental factors. However, the idea of a structured approach of benchmarking, the upgrade of the quality of the bus systems and the associated image of buses in general can be applied globally.

The BHLS Action program of COST (being TU0603) identifies successful elements and best practices of BHLS systems. It is believed by the COST researchers that the ridership of BHLS systems increased because of the improved reliability and increased frequency of services, combined with shorter travel times and car constraint policies (Finn et al., 2011). This goes hand in hand with the image of buses: *"the BRT is the revamp to the bus industry that LRT was to the tram industry in the past"* [6]. In this way, BHLS systems as a public transport system with an increased level of ridership will contribute to the reduction of greenhouse gases in the transport sector.

SIBRT proactively promotes integrated transport systems and see BRT *"as the safest, most efficient and sustainable form of mass transit"* that *"is indeed a mass transit solution that can compete with rail-based technology"* (Gutiérrez, 2012). Also the SIBRT sees a clear linkage between the quality of BRT systems and the image of bus systems in general. They believe that it is of importance to improve the overall quality of the industry [7]. Because BRT has no formalized, clear technical definitions and standards, SIBRT see the importance of *"coordinating all stakeholders to participate in the general objective to improve and provide the transit in the whole region"* [7]. Estimations of SIBRT foresee that in the next 10-15 years, *"the market for them, defined as the gap between the present and the desired situation, demands investments around 100 million dollars"* [7]. This entails public as well as private investments in both infrastructure and equipment like vehicles, fare collecting systems, etc.
Although, the SIBRT consists of cities 19 city partners of countries in only Latin America, the SIBRT organizes international conferences, and try to involve global and internationally operating stakeholders in their vision of unifying the industry.

First of all, the ALC-BRT CoE has a very pro-BRT opinion and state that: *"BRT systems are a feasible instrument to make metropolitan areas more sustainable from the economic, financial, social, political, technical and environmental perspectives, making them more attractive places to live, work and visit"* (ALC-BRT CoE, 2013a).
The ALC-BRT CoE believe that the clear guidelines and decision frameworks they are developing will be of great contribution in the transition of the way decision makers think and justify investments. Their approach is to identify best practices and key elements, and then make that information accessible for everyone. In that way, they *"envision that our CoE will be an agent for change in cities worldwide seeking to transform their public transport systems"* (ALC-BRT CoE, 2013b).
Because the ALC-BRT CoE has members and partners from every continent, and because international networks of their partners are used to reach out to the whole world, the visions and actions of ALC-BRT CoE can be considered very transnational.

An interviewee from the Asian Development Bank stated that they believe that many cities are not able to financially develop a LRT or metro system in the next decades, and that therefore BRT is an attractive option in that respect [5]. Also, he declared that he believes that cities in the same region or nation look at each other and when they see a successfully implemented BRT system, they don't want to be left behind in terms of being attractive for

businesses to settle: *A few cities were initiators and then other cities came along simply because other mayors didn't want to be left behind* [5].
The Andean Development Corporation (CAF), a developing partner in Latin America, and the transport authority of TransMilenio worked together to let the reduction of greenhouse gases emitted by TransMilenio be officially recognized. TransMilenio became the first mass transit system that integrated the Clean Development Mechanism component of the Kyoto Protocol. This widened the possibilities for BRT projects to raise funds and at the same time acknowledged that the environmental sustainable expectations of BRT can indeed be met (Andean Development Corporation (CAF), 2006).
It appears that the developing partner, often large international development banks, have general expectations about BRT systems being more environmental sustainable, beneficial for a city's competitiveness and more affordable than other mass transit solutions. However, because of the nature and the approach of these types of actors, the actual work and involvement in projects happen on a more local scale, involving contracting local actors.

According to the consulting agency Steer Davies Gleave, sustainable transport solutions "*support both economic growth and reduce our impact on the environment"* (Steer Davies Gleave, 2013a). Steer Davies Gleave claims that: *"Urban transit is a key component to many successful 21st century cities"* (Steer Davies Gleave, 2013b). They believe that urban transit and in specific BRT, offers flexibility and affordability. On the same token it is believed that BRT can address sustainability, economic and accessibility issues.
Although they have offices and work on projects around the world, their consultants work with local parties and focus mostly on the local contexts: "*Our experience allows us to recognize the uniqueness of place"* (Steer Davies Gleave, 2013b).

The overall conclusion can be that expectations of the different network actors of the global BRT niche are aligned across the world. They all in some way acknowledge the ability of BRT to contribute to the livability of cities and environmental and economical sustainability. It is also brought to light that international NGOs and other network actors of the global niche create AND spread expectations about BRT systems. Although some expectations and visions are articulated on a macro level and are applicable for every city around the world, also very local expectations are formulated. They prove to be useful in setting up specific BRT projects.

Bogotá – TransMilenio

Several projects aligned along a different vision of what a city should be, are implemented in Bogotá like a bicycle system and car restriction regulation. But one of the cornerstones was the implementation of TransMilenio. The system was planned to become *"the centerpiece of a long-term urban renewal and mobility strategy that prioritizes walking and cycling and discourages private vehicle use"* (cain et al., 2006, p.8). The ultimate goal for Bogotá was to become more livable and give more space to people and children on the streets [8].

Despite of the skepticisms, TransMilenio proved to have a positive impact on travel time reduction, traffic fatalities, reduction of GHG emissions and air quality improvement near the BRT corridors (Hidalgo, 2008) and even was integrated in the Clean Development Mechanism component of the Kyoto Protocol, which means that international emission right can be bought (Andean Development Corporation (CAF), 2006).

Eindhoven - Phileas

Due to ambitions of the national government, Eindhoven wrote a broad traffic plan, including topics as parking, car- and bicycle infrastructure, mobility management and a public transportation plan [1]. Phileas was designed with the idea to persuade car users to take the bus. One of the most important design criteria therefore was that using Phileas would reduce one's travel time [1].

The municipality and APTS had articulated some innovative goals and expectations which the system should fulfill in the end. Amongst others were there plans for an automatic guiding system and fare collection by wireless scanning of personal travelling cards on buses ([1]; [3]). From this it seems that they didn't look to other projects and the expectations turned out to be too ambitious in terms of safety regulations and expenses.

Textbox 2: Illustration of articulated expectations / visions in Bogotá and Eindhoven

5.3. Learning processes

Learning can be understood as the conflict between expectation and experience and as a result from interaction between actors. There are multiple mechanisms for learning and for transferring knowledge. Geels and Deuten (2006) stress the importance of actors who collect information from various local projects, identify best practices and key lessons and disseminate this knowledge through papers, workshops or conferences. This fits the description of some of the actions of the already mentioned actors on a global level.

Three lessons are crucial in terms of (transnational) learning and the diffusion of BRT systems [6; 7; 8]. The first key lesson is the idea that you could get results in a very short time with not a big investment, which makes this very attractive to politicians that need to show results in a very short time span. The second lesson that should be learned is on the

technical aspects of the systems; the design of systems and engineering challenges. Thirdly, lessons about the institutional and organizational aspect that a BRT systems brings along have to be learned; being able to transform the informal sector of private provision of transport into a formal organized system, including participation of some of these previous companies that operated on an informal setting. One interviewee argued that: "*If cities use these three elements, cities could create an excellent system for their city, although, there is a great deal of adaptation to the local conditions"* [8].

This section identifies for what learning mechanisms are used to transfer expectations and technical and institutional knowledge and what the main spatial reach is of the main mechanisms.

Presentation of successful cases

The former mayors of Curitiba and Bogotá as well as international NGOs that advocate livable cities and the concept of BRT usually use successfully implemented projects as an example to inspire others and to reinforce their narratives. EMBARQ (Mexico, Jakarta) and ITDP (Bogotá, Guangzhou) both have worked on such large project and proudly proclaim their achievements (Matsumoto, 2006). It is used to persuade other city's official to consider BRT as alternative for their mass transit system. *"It is like creating a best student in one class so that the others are inspired and also will work in a better way"* [2].

The success stories and their narrators travel across borders and easily reach every continents of the world via international conferences and/or local offices of organizations in multiple countries and continents. Matsumoto (2006) found in her paper that for Jakarta, Seoul and Beijing *"lessons were drawn from the Latin American good practice cases: Curitiba and Bogotá. Interestingly, however, the major origins and contents of lessons differed from city to city"* (p. 371).

Study tours

To create realistic expectations, capacity building at the city government level is done by international NGOs [2; 5; 6]. In a later stadium this is combined with study tours to cities with working BRT systems.

Taking city official to city in a developing nation creates the feeling that it can actually be realized in such context, but also taking them to smaller (European) cities that in format and design are closer to their own city can help inspiring them: *"I tell the cities to steal the best ideas from every city they see and create something new"* [5]. Important is that the visits are purposeful and that the cities that are going to be visited are carefully chosen [5; 6]. The reason is that *"mayors find it helpful to meet their exact counterparts and speak with them before they commit to large expenditures*" [6]. So, to create the most realistic expectations, "*mayors of smaller cities are often also taken to cities like Nantes (France), Eindhoven (the Netherlands) or Cambridge (UK)"* because those cities might look more like the cities where the mayors come from [5].

Study tours by mayors and city officials of Jakarta, Seoul and Beijing were the direct motivation for the cities to start designing BRT systems themselves (Matsumoto, 2006) and thereby transferring the concept of BRT systems and there technical and organizational

lessons to Asia. Catalysts for study tours to occur are international NGOs who provide (sometimes financial) assistance. Also Matsumoto (2006) claims in her paper: *"close examination of the history indicates that the visits assisted by ITDP preceded key turning points and seem to have triggered the changes"* (Matsumoto, 2006, p. 368).
The city officials almost always cross borders and even continents during their study tour. Therefore it is safe to conclude that study tours have a highly transnational character.

Standardization and protocols

Standards and protocols often are signs for the institutionalization of learning processes. Moreover, in global niches it can be seen as a step in the development of a niche because standards and protocols display the extent to which rules and routines are shared and aligned. In the global BRT niche, several successful attempts are done to standardize evaluation, decision-making, and protocols for designing and implementing a BRT system. Examples are the reports like the BRT planning guide (Wright & Hook, 2007) and characteristics of BRT for decision-making (Diaz & Hinebaugh, 2009). In the last two years, experts in the field have developed a framework, the BRT standard, which provides a scorecard with which existing as well a future systems can be certificated on different levels (ITDP, 2012a).
Also a lot of effort is made in identifying and documenting worldwide best practices. This knowledge is than often disseminated all over the world via reports, papers, international conferences and collaborations.

International conferences

International conferences are very useful and effective in the transfer of knowledge: *"In learning (…) useful information is obtained through international conferences, held by organizations such as the Transportation Research Board (TRB) and the International Association of Public Transport (UITP)"* (Matsumoto, 2006, p. 368). In 2003, EMBARQ organized and influential two-day conference on transforming transportation, at which the worldwide best practices were shared (EMBARQ, 2012b). Ever since, increasingly amount of organizations organize international conferences [7; 8]. The conferences are referred to as international conferences because the speakers as well as the attendees come from countries across the whole world.
Not only the attendees benefit from knowledge sharing, the conference proceedings and the result of the conferences are often being disseminated afterwards via the international organizations as well. For this, often the websites of the organizations are used as medium. For instance, the websites of ALC-BRT CoE, SIBRT, EMBARQ and ITDP almost always have an update on (the results of) international conferences on their homepage [2; 7; 8].

Internet

The Internet, without doubt, is very a transnational medium. Obviously, BRT organizations and other international NGOs that advocate livable cities and sustainable transportation have their own website. Often they use their site to disseminate their knowledge [7]. Each site contains a section with news and a section on which interesting publications are collected.

Furthermore different weblogs exist for discussing sustainable transport, livable cities or the impact of BRT systems for example. Good and well-known examples are the websites worldstreets.com and TheCityFix.com.

Social media also is used more frequently recently. LinkedIn is a locus for debates and crowd sourcing. Every individual can pose questions, polls and can benefit from experiences of other members worldwide. There is a publically available 'Bus Rapid Transit System' group, which has 2,028 members (LinkedIn, 2013a). The number of members has almost doubled in the last year and the group currently has around 5 active discussions. 35% of the members come from the transportation industry and another 17% work in civil engineering. 15% of the members work in an operations function and 8% work as program or project manager. The fact that no more than 3% of the members come from the same (metropolitan) area shows that this LinkedIn-group has members spread around the world (LinkedIn, 2013a).
There is also a somewhat broader LinkedIn group which also addresses the topic of mass transit under which BRT. The group is called 'Public Transit' and has over 17,000 members (LinkedIn, 2013b). The group is relatively active with around 100 comments each week divided over circa 10 discussions. Also this LinkedIn group has seen its number of members grow in the past year. The distribution of background and function of its members is almost similar than that of the BRT group, but in the Public Transit group, most members come from the USA (LinkedIn, 2013b). This shows that the USA is also very active in the search for public transit alternatives in their cities.
International organizations also use Facebook and twitter in their outreach strategy. EMBARQ, for example, has almost 6,500 followers and already has posted over 3000 tweets (Twitter, 2013).

Second-order learning

Van den Bergh et al. (2007) claim that *"Innovations may have a beneficial short run effect on environmental performance in the transport markets, but could induce unfavorable rebound effects in the longer run"* (p.249). Now several systems are used for a period of time, scholars and practitioners in the field of transport are reviewing the impact of BRT more often. Multiple essays, reviews, weblogs and online discussions can be found on the impact of BRT systems on for example the environmental performance, ridership and transport modal shift (Hidalgo and Gutiérrez, 2012; Hutchinsons, 2011). They evaluate amongst others whether the BRT systems fulfill their purpose, whether the original targets are achieved, whether the high quality of the system is safeguarded and whether introducing a BRT system to a city had the desired impact.

Moreover, some international NGOs are aware of the fact that improvements and adjustments in a city's transport system induce changes in land use [7]. This is in line with the statement that Van den Bergh et al. (2007) make in their article: *"Changes in transport costs, technologies and infrastructure appear to lead in the long run to various adjustments in the spatial organization of production and consumption"* (p.249). The areas next to BRT lines and (transfer) stations increase in value and activity and prosperity [7].

Bogotá – TransMilenio

TransMilenio (Bogotá) has clearly learned from the experiences from Curitiba. However, the capacity of the system of Curitiba was not big enough for their demands on their corridors. In Bogotá new concepts and innovations to the system were applied which resulted in even higher performances. The engineering knowledge was hired and came with the Brazilian consultants ([8]; Peñalosa, 2004).

Now, TransMilenio is thé example for BRT systems; narratives and knowledge is spread around the world. Because of the positive results, different parties were getting interested in the system. TransMilenio became subject to many papers and international conferences: *"There are more studies of TransMilenio after it was implemented than before"* [8]. Moreover, Enrique Peñalosa was invited to conferences and was rewarded international awards [8]. Furthermore, Bogotá was home to many study tours or delegations from amongst others South Africa, India, USA, Mexico, South Korea and Indonesia ([8]; Matsumoto, 2006).
TransMilenio is often the subject of lots of evaluations (Press, 2011).

Eindhoven – Phileas

Eindhoven only learned from two similar projects within the Netherlands and also the knowledge for designing the system (AVG Movares) and the vehicles (APTS) was gathered and created within the Netherlands.

However, after the first corridor in Eindhoven was finished, more and more decision makers form similar cities (for example Scandinavian and Mediterranean cities) came to visit the Phileas project in an orienting phase for them [2]. APTS, on their turn, have a clear outreach strategy and compete in international tendering in Europe and the Middle East [3]. In the latter, much knowledge transfer often don't occur, because *"usually the design is made before the tendering occurs (…) and APTS only has to be able to prove that the vehicle moves and stays within margins of the determined envelope"* [3]. However, because the Phileas buses are built from several building blocks instead of build on a chassis, the placement of doors, the length of the vehicle for example can be determined per city or corridor and sometimes the infrastructural design can be optimized when APTS has gained a seat on the table [3].

Textbox 3: Illustration of ways of learning in Bogotá and Eindhoven

5.4. Evaluation and discussion

It is evident that the findings about building the actor network, articulating expectations and learning mechanisms on the global BRT niche level are different from those on the local project level. And by looking at the global niche, automatically a more transnational perspective is applied, so the findings should logically be transnational as well. The contribution of this chapter is that it also assesses the extent of the transnational characteristics of the niche internal processes and its impact.

The findings above match to a large extent with the three possible meanings Van der Vleuten (2008) found for 'transnationality' in literature.
Both people and ideas are travelling and flowing across borders. Good examples of this are Jaime Lerner and Enrique Peñalosa, who both hold presentations in cities all around the world. Also most of the large consulting and non-governmental organizations have offices in multiple countries. Internally and by reports and the Internet, ideas and expectations are spread across border all around the world. One interviewee said: *"Cross-border learning is pretty good in BRT compared with some disciplines - but the need is greater too"* [4].

Secondly, international NGOs, are also present in the global BRT niche. In fact, international organizations are of major importance and absolutely crucial in the diffusion of BRT systems. One interviewee said: *"When you look at the genealogy of these projects, who initiated it and how it happened, probably one of the biggest instigators are NGOs like ITDP, EMBARQ, and individuals like Peñalosa and Lerner. It is often initiated because of the interventions of NGOs or influencing individuals, who are going in and stir things up by bringing BRT as option to the attention of cities. These are international NGOs and operate across all kinds of borders to cities on the options and I can guarantee you that 75% of the projects out there today probably owe their existence to one of those organizations."* [5].

Third, the interview partners and reports on BRT suggest that the role of the national government is somewhat of minor importance in the diffusion of BRT. More often international NGOs play the central role (of broker) in this process and address cities directly. However, the national government and the nation-state cannot be missed in the implementation of a BRT system. Especially for funding and developing ("BRT-friendly") sustainable transport policies, the nation-state still is fulfilling an important role [2; 5; 6; 7]. It is just not the unit of analyses in the approach of this thesis.

The importance of international NGOs and transnational mediums for spreading knowledge and diffusion BRT systems does not need much persuasive arguments anymore. It is clear by now that they play a very crucial role in the diffusion of BRT systems. However, interviewees have argued that contexts and local political support are of major importance as well. EMBARQ and ITDP target city leaders with expectations that are articulated for that specific context, and also Steer Davies Gleave, a worldwide operating consulting agency, acknowledges the uniqueness of every place. This suggests that, beside transnational global processes, also local conditions play a very important role in the way BRT systems are successfully implemented and diffused.

5.5. Conclusion

This chapter was concerned with determining the impact of transnational characteristics of niche internal processes of the global BRT niche. Moreover it explored whether new insights are gained when taking a transnational perspective on the analysis of the global BRT niche and its diffusion worldwide.

The actor network of the global BRT niche exists of many internationally operating organizations and is expanding rapidly. Most organizations are involved in benchmarking, creating awareness and promoting best practices globally. This is done for BRT or for livable cities in general to which BRT can contribute to. A lot of BRT organizations are established after 2000. Some of them, like ITDP and EMBARQ, existed earlier, but they originally had other spear points; they shifted towards promoting BRT later on.

Overall it can be said the expectation across network actors of the global BRT niche are in line with each other. Logically, they all see BRT as a solution and main contributor towards sustainable transit and livable cities. Some of the network actors articulate their expectations and visions about BRT and its impact so that they are applicable to cities around the world. However, expectations are also sometimes adapted to a more local context of a city to set up specific designs for a BRT system.

Lessons that should be learned when looking for or implementing a BRT system are 1) the benefits of BRT systems compared to other transit solutions, 2) technical knowledge about the design of the system, and 3) know-how about organizational structure and the (re)formation of institutions being. All this knowledge flows frequently across borders. It can be exchanged by scientific papers or presentations, but also by visiting already operating systems to see how things work. Also debates find place on international conferences and on the Internet.

Transnational processes thus have influenced the diffusion of BRT worldwide in a very positive way. However, through the interviews and the data that is analyzed it is also very clear that is actually the entanglement with local factors that enable the successful introduction of a BRT system in a city and thus the diffusion of BRT systems worldwide

Still, taking a transnational perspective in the global BRT niche analysis proved to be very useful since the important role of international NGOs is clearly represented in the findings. Moreover, there appears to be a correlation between the (pace of the) diffusion of BRT systems worldwide and the number of international NGOs involved in advocating BRT and in organizing international conferences and study tours. This however, should be investigated more deeply.

6. Conclusion and discussion

6.1. Conclusion

In this thesis, insight is gained about the meaning and diffusion of BRT systems. Moreover, a regime analysis and niche analysis are done through a transnational perspective. The sub-questions of this research are answered in chapters before. In this concluding section, the focus is on the main findings and will I give my answer to the main research question that was formulated as:

> ***To what extent are urban mobility regimes and the Bus Rapid Transit niche displaying transnational characteristics and what role do transnational processes play in the diffusion of Bus Rapid Transit worldwide?***

Looking at transitions with a transnational perspective, the assumption is that a new transition and innovation arena is formed in which national boundaries and governments are of less importance and the involved stakeholders are international non-state regulated actors and knowledge flows across borders.

Bus Rapid Transit systems are positioned as a hybrid form combining benefits (performance) of rail-based transit systems, like a tramway or a metro, with the flexibility of bus systems. There is a wide spectrum of bus based transport options, varying from full BRT systems, first implemented in Latin America and later in other more developing cities, to BHLS systems in European cities. Because the great differences in the two types of systems and their urban environment, and on experts' advice, this differentiation is explicitly kept in mind during the regime analysis.

The regime analysis shows that in both developing cities as well as in European cities the private motorized transportation regime has gained a prominent place in urban transportation. The car industry is very deeply embedded in a city's urban mobility regime and extremely transnational.
On the contrary, the big difference between developing and European cities can be found between their public transportation regimes. Developing cities might not have a transport authority and the incumbent (informal) public transport system is operated by various types of vehicles and operators and do not gain much government support. In Europe, the public transportation regime is much more organized and benefits from best practices in organizational set-up.
An interesting correlation I found is that in general in the cities that have a more locally evolved and adapted public transportation system, the BRT systems that are implemented are larger and of greater capacity.

The global niche analysis showed that on an aggregated level, it is clear that international NGOs are the central actor in the diffusion process of BRT and in the transition processes in the specific cities.

"NGOs like ITDP, EMBARQ, and individuals like Peñalosa and Lerner (…) operate across all kinds of borders (…) and I can guarantee you that 75% of the projects out there today probably owe their existence to one of those organizations." [5].

Moreover, international NGOs and parties create transnational relationships and along with that many flows of researchers, knowledge, money and ideas. Their communication runs through very transnational mediums and also the creation of expectations and the lobbying is mainly done by the international NGOs. Furthermore, steps are taken in standardizing BRT systems and developing implementation guides based on assembled, accumulated, extensive experiences around the world.
However, interviewees argue that contexts and local political support are of major importance. This shows that, beside transnational global processes, also local conditions play a very important role in the way BRT systems are successfully implemented and diffused.

It can thus be concluded that transnational processes are an important driving factor behind the diffusion of BRT systems but that their interaction with local factors is equally important and enables the successful diffusion of BRT systems worldwide.

6.2. Further research and recommendations

This research took BRT as case to explore the area of transnational research. Therefore, understanding performing regime analyses and niche analyses with a transnational perspective can be given, as well as insights in the forces and mechanisms behind the diffusion of BRT from a transitions studies point of view. This section identifies promising avenues for future research for both the transition studies community and the urban mobility community. A few practical recommendations for the urban mobility community are presented as well.

Suggestions for the transition studies community
Recent debates in transition studies involve building bridges with and to other disciplines. One particularly interesting debate in this research is with geographers about the role of space and scale in transition studies.

My research has shown how important transnational dimensions are in this kind of innovations. The role and importance of international NGOs is much clearer brought to light since this research had an explicitly transnational approach. Not taking a transnational approach in the analyses may lead to loss of explanatory power and negligence to crucial processes in the diffusion. In a globalizing world, it is assumable that this is probably only one of many interesting topic on which a transnational approach will contribute in understanding and explaining what has happened.
Therefore my main recommendation to the field of transition studies and to SNM scholars is to pay more attention to transnational dimensions in transition analyses.

However, I also learned that transnational regime analysis is incredibly complex because of the scale it comprises. The subject and the amount of data that has to be handles was simply too much to capture in a graduation project.
My suggestion would be to not conduct a full transnational regime analysis in future research. Instead I recommend focusing on specific parts of the regime that are interesting and relevant for the subject of the research.

Also, globalization and transnational dynamics do not explain why for example some cities do and some cities don't adopt a BRT system and in what form. During the global niche analysis it became clear to me that transnational actors, mediums and other processes help spreading (the latest and the best) information very fast, but that a great deal of the successful implementation is due to local conditions and the interaction between the global BRT niche and local actors and environment.
A familiar argument and critique on the MLP is that of geographers that argue that the negligence of the consideration of socio-spatial embeddedness and spatial sensitivity results in loss of explanatory power. I would say this research underlines this argument and I would suggest for future research to focus on dynamics on the global level as well as the entanglement of with local factors.

Recommendations for future research on urban mobility
One could argue that when urban mobility regimes display more transnational characteristics, regime stabilizing mechanisms are stronger and more and larger social groups have vested interest. In that line of thought, it can be expected that regimes that display more transnational characteristics are more difficult to change and there would be less room for a new transportation system like BRT.
In my analysis an interesting correlation is found between the absence of some transnational characteristics of regime dimensions of the public transportation regime in the developing cities and the fact that there are larger and higher capacity BRT systems in developing cities.
One topic of future research than could be to investigate:
Whether there is a relation between the size and implementation process of BRT systems and the extent to which the incumbent urban mobility regimes display national characteristics.

By the same token, one could argue that having transnational characteristics is beneficial for the development of the (global) niche. When experiences can be shared rapidly with the whole world, best practices can faster be identified and copied. Standards and narratives can then be developed and the niche can become larger and stronger.
One of the findings was that the actor network of the global BRT niche exists of many international operating organizations. However, many international organizations were established only after 2000, and the ones that did exist before didn't have BRT as a focus point as much as they do now. Around this time also a rapid diffusion of BRT systems worldwide can be seen.
Therefore it is interesting to investigate in further research:
What the relation between the existence of international NGOs advocating BRT and the rapid diffusion of BRT is, and what the influence is of international NGOs on the diffusion on BRT.

Other recommendations for the BRT and urban mobility community

First of all, without lobbying and advocating, BRT is often regarded as an alternative that is second best if compared with railway alternatives for mass transit. Dario Hidalgo said in an interview: *"Metros are really attractive and no matter if you put the numbers on the table, how much it costs, how long it takes to build, how little coverage it may have, the general public just dismisses them by saying all the big cities in the world have a metro. It's a just a question of image, not reality."* (Hutchinsons, 2011).

Partly this could be addressed to the infancy of the BRT industry and the extensive experience of the railway industry. Also BRT still is a very vague concept that should be defined further. This definition should then be operated in the whole world to encourage unity of the industry. As in the railway industry in Europe, actors of the bus industry as well as the BRT industry should bundle their voices instead of only competing with each.

Furthermore, study tours appear to have a very persuasive effect. Although they already happen on a large scale, money and resources should be invested in visits to for example Bogotá and Curitiba. And key consultants and experienced BRT practitioners should visits cities looking for mass transit option as well

Finally, since recent evaluations of (large) BRT system put forward that the systems are often overcrowded, and that the implied reason is often a lack of additional investments, I suggest that long-term policies and agreements should be made when implementing BRT system. In properly defining specific terms in PPP-contracts between city governments and private operators, future investments can be secured. The quality of the system as well as the custom satisfactory can then be maintained.

6.3. Discussion and limitations

Framework

The multi-level perspective and the strategic niche management approach have been used for the analyses of the incumbent regimes and the global BRT niche. These frameworks were chosen because of their ability to describe radical transitions on a system level. It is arguable that in some way BRT induces a radical change in cities, because it is completely at variance with the standardized routines of mobility in a city.[6]

However, the core of BRT does not entail a novel technological artifact, but it constitutes more a new way of planning and organizing. The MLP and SNM frameworks assume radical technical innovations. This brought about difficulties from time to time in conceptualizing all regime dimensions. BRT is more a configurational innovation that already exists of many technologies and associated dimensions and knowledge.

Besides that, when taking a transnational approach in analyzing, the frameworks cannot be carelessly followed exclusively. I encountered problems when the MLP framework had to be scaled up to the transnational / global level. Also, mostly because of the scale and size of the topic, a lot of information ought to be captured in the analysis. It became too complex and the

[6] See table 5 and 6 for the magnitude of the differences between BRT regimes and incumbent mobility regimes

result is a very simplistic version of reality. The flaw of the MLP that it cannot be scaled up this much is known and debated in literature amongst others by Genus and Coles (2008).
Despite the problems I encountered, the findings when performing transnational regime analysis are unique and useful.

Transnational regime analysis

The nature and purpose of my research was to explore the possibilities and feasibilities of performing transnational analyses and to what extent that would lead to new findings and insights. That is the reason why I took an explicitly transnational perspective in my niche and regime analyses.
However, I acknowledge that looking on such aggregated level comprises some limitations. Performing an exhaustive and/or detailed analysis was too complex and too demanding for a graduation project. Not all information was available that would be needed to fruitfully perform such analysis. Though, it was possible to focus on main items and differences between them.
Nevertheless, the transnational regime analysis was very lucrative. It showed some interesting and unique findings and proved that taking a transnational perspective in transition analyses should be done more often.

Urban mobility regimes

Looking at urban mobility regimes is very useful in order to assess what BRT has to face when it comes to a city. However, if one tries to identify and describe an (average) urban mobility regime in cities worldwide, he would face many differences in a few areas that make it hard to generally draw conclusions.

Not two cities in the world are the same and differ on for example lay-out, quality of the infrastructure and financial health. Furthermore, in every city multiple relatively dominant mobility configurations can be identified with which BRT has to relate to. BRT, as a public transport mode, can be said to compete with the private transport sector, characterized by privately owned cars and other motorized vehicles for individual use. Also, BRT as a 'public transport alternative' relates and interacts with other forms of public transportation, for example existing conventional bus services that are already operating in cities. Also it can be said to compete with other mass transit options for implementing (for example rail based systems).
This makes the development and implementation of each BRT project unique. Several transition pathways can be followed when implementing a BRT project. In some cities BRT is more like an upgrade of the present bus system, as in other cities it comprises more organizational restructuring and is it positioned as an alternative for mass rail transit.

In an attempt to try to address part of the flaws mentioned, I chose to perform transnational regime analyses for a European context as well as a developing context. The terminology in this thesis was occasionally oversimplified for clarity reason and I acknowledge that there still is a high variation within those categories. This underlines the importance of local factors again.

Biases

Interviewees and BRT reports and documents gave excellent insight in the ins and outs of BRT systems. However, they are all in favor of the adoption of BRT in every city in the world. Of course BRT has shown impressive and positive results and it has many benefits for being a relatively fast and cheap solution, but from time to time it was hard to stay objective or find serious criticism on BRT systems. Even the downsides of BRT systems are framed as learning points instead of severe criticism on the system itself. Perhaps this has to do with the fact that BRT is a relatively young concept. Second order learning is therefore also not being done very often.

Another bias in this research is the large amount of information that is available and used on BRT systems and organizations in Latin America and Europe. The differences between the two contexts were very interesting and illustrating when conducting the regime analysis. Both have about the same number of cities that have implemented BRT systems but the type of systems and implementation processes is very different. However, other continents are represented less in this research and this is problematic for generalizing the conclusion of this research. Also China, which probably has a very different organizational and legislative structure, is not discussed much in this research. The fact that this research was conducted from behind a desk was not helping either.

Finally, because of the transnational perspective that is explicitly taken in parts of the analyses, the results sometimes seemed very self-explanatory and self-fulfilling. For instance looking at the global niche level, it is evident that one finding would be that international organizations can be identified and that actor networks are highly transnational. But whereas in normal (national) SNM studies these would have merely acted as background variable, this research chose to view the transnational networks as a new kind of forum for niche development to be promoted, negotiated and contested, because the role of this transnational process was supposed to be assessed.

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Appendix 1

	Description (previous) functions:	Area of expertise:
1.	Senior advisor traffic and public transport at the city region Eindhoven.	Involved in local BRT project in Eindhoven
2.	EcoMobility Officer at ICLEI - Local governments for sustainability. Concerned with advocating the importance of sustainable transport and capacity building at a local government level.	Great deal of experience worldwide in decision making at city government level and in implementing BRT systems around the world
3.	Marketing and Sales Manager at Advanced Public Transport Systems B.V.	Experienced in vehicle characteristics and technology standards in BRT projects, mainly in Europe
4.	Highly experienced public transport planner and bus operations practitioner, working as an independent transport consultant.	Highly experienced in planning and/or operating bus services in the UK, the Middle East, India and China. Excellent knowledge of best practice in developing public transport in a variety of environments
5.	Senior transport specialist at the Asian Development Bank with experience as director in international NGO using sustainable transport techniques.	One of the earliest advocates of BRT systems, co-editor of one of the most famous report on BRT, previously working in Latin America and now expert in financing sustainable transport projects
6.	Independent transport consultant, specialized in institutional and regulatory frameworks. Participated in research on BHLS systems in Europe.	Worldwide recognized expert on BHLS systems and is currently taking those experiences into the developing world.
7.	Strategic director for Latin America at an international NGO and initiator for many strategic partnerships in the Latin American BRT community.	Highly experienced with BRT systems in Latin America. Held several leading positions at governments and builders of several strategic alliances and associations
8.	Director for research and practice at an international NGO and coordinator of a BRT center of excellence.	One of the earliest advocates of BRT systems and closely involved in the development of TransMilenio, the BRT system in Bogotá, Colombia.

Table 10: List of interviewees

Appendix 2

Project preparation

Every project has to be initiated by someone or an institute. Especially with a new public transport system, with encompass a new, sometimes radical view for a city, needs a powerful initiator, in practice it is often a political official or a non-governmental institution. But in the end it is the political leader that is concerned with transforming the new vision into a realizable project (Wright & Hook, 2007). Examples of great political leaders and their successful project are Jaime Lerner, former mayor of Curitiba, Brazil, and Enrique Peñalosa, former mayor of Bogotá, Venezuela.

When a vision is made and when the political leadership is present, the leader is facing the important decision of which mass transit options best can be implemented and fits local conditions the best. Alternatives of BRT are for example metro systems and light rail transit (i.e. trams). The decision is usually based on capital and operational costs, implementation considerations, performance and economic, social and environmental effects. BRT is increasing to rise as the best option because of its low capital investment and the low implementation time. In figure 4 is showed for four transit alternatives what their capacity is in terms of passengers per hour per direction and what the capital investment to implement such system per kilometer is. It is unmistakably clear that a BRT system has a low capital cost compared to the others. In the same time, it can compete with elevated railway systems and some of the metro systems in terms of capacity.

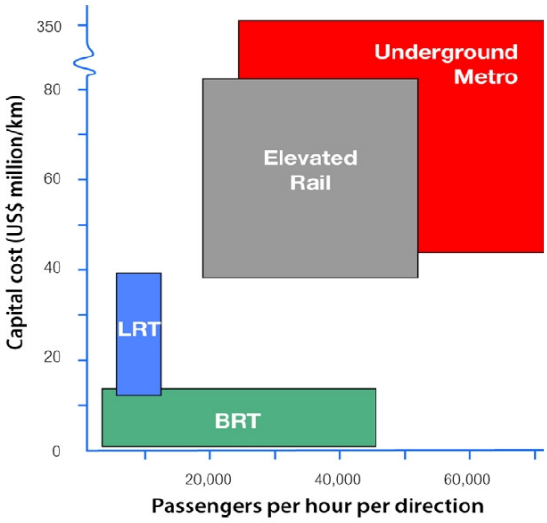

Figure 10: Cost vs. Capacity. Source: (Wright & Hook, 2007)

When the choice for BRT is made, the first thing to do is set-up a varied project team with among others engineers, financial specialists, administrators and marketing specialists. The team is likely to consist of both local officials and consultants with expert knowledge from the outside.

BRT can be implemented gradually, with the first phase generally being 15 - 60 kilometers of dedicated bus lanes. The systems design and the corridor selection should be based upon a demand assessment. The demand roughly consists of the passengers in the old situation and

some new passengers that shift from using private vehicles to public transport. The choice for corridor is generally based upon the demand analysis as well as road characteristics, costs, network advantages and social equity (Wright & Hook, 2007).
A very important factor in the process of implementing a BRT system is good communication to all stakeholders. A stakeholder analysis gives an overview of all involved persons and entities that have interest in the project. Special interest should be given to the citizens in the city. Public participation can be very effective to get a high-quality design and at the same time wide support.

Operational design

The structure of the system is greatly dependent on what the decisions are regarding the corridor access. A city can choose for an open system which permits any public transport operators to use the designated lanes. This can cause bus way congestion at intersections or service stations. Open system BRT systems are often of lower quality than closed systems, in which a restricted number of vehicles is allowed access on the dedicated lanes.
Another important choice is whether the system will use feeder services to connect lower-density areas or to the large corridors. The pitfall is that passengers often have to transfer at terminal which causes longer traveling times and require larger transfer terminals. Using the other alternative, direct services, the same vehicles drive from the city center all the way to the low-density residential areas. This is beneficial for the traveling time and the comfort for the passengers, but it is at expense of the efficiency of the operational costs.
A third choice for operational design regarding the network and services is the possibility for express services. BRT systems, unlike most rail-based systems have easily the possibility for express services next to the regular services that stop at every station. It is easily possible to takeover at stations, which can cause significant travel time savings.

In general, one of the most important things is that the BRT system is able to compete with cars. Not only is the traveling time of great importance, it is also necessary to focus on the comfort and cost of the services. Capacity and speed figures are defining the BRT system and these are also the point in which BRT systems differs with conventional bus services the most. Operational design is important to achieve high-capacity and high-speed. Design characteristics mainly focus on the dwelling time of vehicles because that is often the bottleneck of the system.
One other critical point of the system is the design at the intersections. Turning restrictions and strategies can improve the performance of the intersection. Moreover, the location of the stations in relation with the intersections and possible priority of BRT vehicles at intersections also contribute to the performance of the intersection.

Physical design

The physical design and the choices in it are mainly discussed in the previous section. Physical design involves choices regarding infrastructure and capital investment, i.e. running ways, stations, stations and terminals. Generally, this will cost between 1 and 8 million US dollars per kilometer. Physical design in the form of technology requires choices regarding

vehicle design, the fare collection system and intelligent transportation systems (i.e. real time traveling information).

Integration

Transport engineers recognize that it is absolutely necessary that a BRT system is integrated with other transport modes in the city instead of implemented in isolation. The BRT system should be the backbone of the city's public transportation system with full integration with other modes of transportation which can provide a door-to-door travel system. System designers should map the pedestrian activity and safety in the neighborhood of station to provide a safe and easy walk to the stations. If the stations are localized further away, the BRT system can be integrated with a bicycle system. Bicycle systems are also sustainable and cheap public transport options and moreover, it is also encouraging people to don't use private motorized vehicles. In Bogotá, such bicycle system (with dedicated bicycle lanes and bicycle parkings at stations) is implemented next to their BRT system, TransMilenio. Other transport modes with which the BRT system should be integrated are feeder services in the form of taxi's or informal transportation modes.

Having high-quality services in the public transportation system in place is only one requirement for making more people use the system. Active transport demand management (TDM) can discourage the use of private motorized vehicles and thus stimulates the use of the public transportation system. TDM measures are for example parking fees, vehicle ownership taxes and fares per kilometer.
Also, when the system and the bus stations of the BRT system is correctly integrated with land use policies, it can encourage people to use the system instead of their own vehicles. Examples of those policies are the stimulation of the growth of the number of shop, services and residences nearby stations.

Business plan

A business plan regarding the implementation of BRT systems typically involve several parts and topics that should be thought out. One major important thing besides the design of the system, the 'hardware" thus, is the institutional structure. It is absolutely necessary to restructure the way in which transport services are managed, operated and regulated. Having a good infrastructure in place, the local transport authority has a strong position to negotiate with private operators for a high level of services. In some BRT projects there is are excellent public-private contracts that consists of tendering for privately operated services, which boosts low cost and high level services, and a public institute that has oversight, control and the power to penalize or reward the private operator if necessary. In all cases, direct and strong involvement of a mayor or high political official is recommended; it guarantees that the project is given the priority and resources it deserves.

Financing plans are often build around a government making capital investments for the infrastructure. The financing can come from city governments or national governments. At the local level, money can be available from the transportation budget or from parking fees and patrol taxes for example. If insufficient, private parties are to be found for loans and

investments. Private-Public Partnerships (PPP) are rare but in the last years increasing in appearance. Private parties typically lend money or invest in exchange for exclusivity on the infrastructure or other long-term operational concessions. Thirdly, international investment banks are very interested in these kinds of projects. When involved they also will bring knowledge to the table.

A BRT system is able to function and provide revenues without government subsidizing when enough customers will use the system. Operational costs which will have to be made during the functioning of the system consist of three parts: loan repayment and depreciation of the capital investment, fixed costs such as salaries, and variable operating costs such as fuel and maintenance.

The marketing plan is very important for public education about the system. Although it is hard to reach and convince a lot of people, there is generally speaking a negative attitude towards the present public transport system. Creating a new brand and logo can change this attitude for the new BRT system. The marketing plan should involve a media strategy, in which is described how and what media are used to communicate. Also demonstration stations and information points are very powerful tools for public education.

Evaluation and implementation

To keep the customer satisfied, also when the system is in use, a good monitoring and evaluation plan have to be in place. Based on quantitative real-time data and qualitative surveys it is possible to identify the system's strengths and weaknesses. Corrective measures can then be taken.
Trends in terms of economic impacts (i.e. property value and job creation), social impacts (i.e. social equity, criminal rates) and environmental impacts (i.e. air quality improvements) often determine whether a system gets a further expansion.
During the implementation special focus should go out on an implementation plan that specifies the situation in which the least disturbance and disruption occur in the city. Complemented by qualitative good legal agreements with contractors about the costs, final product and duration, the implementation of a BRT system should go as smoothly as can be.