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"Long term effects of Major Events on Urban transport systems"

RELATORE: Prof. Giuseppe CATALANO

CORRELATORE: Prof. Karl KOTTENHOFF

Andrea FLORIS
Matricola 736578

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Abstract

Prior to a Major event the local community of the host city is euphoric about the need to invest and the opportunities that may come from the event. Large investments are realized and, with an intense work of the actors involved, the city manages its transport system in these extraordinary circumstances.
Being the preparation done with a tight due date and fixed quality of the service, the costs explode. After the event the legacy is hard to evaluate, there have been changes in the infrastructure, in demand and in supply of services; but the effects of the event are not rigorously measured. Through a common framework the study analyses three major events and shows that, even if there is a lack of competencies to manage strategically these processes, the cities manage to gain positive effects on their transport systems. The different cases show some common patterns in the measures followed and thus, to a certain extent, in the effects. The intervention on the governance, structural, operational, functional and managerial aspects makes it possible to improve the characteristics of supply in its organization, infrastructure and cost or quality. However the cases present some problems and fail in improving the composition of the demand. There are some additional aspects that need to be taken in consideration when planning the transport legacy of a Major event.

Keywords: planning, transport, public transport, metropolis, organization, market failures, regulation, governance, infrastructure, transport efficiency, Mega events, long term effects, legacy, case study, strategy.

Nel periodo che precede un Grande Evento la comunità locale della città ospitante è euforica per via della necessità di investire a per le opportunità che possono derivare dall'evento. Vengono realizzati grandi investimenti e, con un intenso impegno degli attori coinvolti, la città riesce a gestire il trasporto in queste circostanze straordinarie. Poiché la preparazione per l'evento viene effettuata con una scadenza stringente e con dei requisiti che fissano la qualità, i costi esplodono. Dopo l'evento è difficile valutare l'eredità: ci sono cambiamenti nelle infrastrutture, nella domanda e nell'offerta di servizi di trasporto; ma gli effetti non sono misurati rigorosamente. Attraverso un frame work comune questo studio analizza tre grandi eventi e mostra che, nonostante la mancanza di competenze per gestire strategicamente questi processi, le città riescono a ottenere degli effetti positivi sui loro sistemi di trasporto. I diversi casi mostrano alcuni tratti comuni nelle misure attuate e, conseguentemente, negli effetti. L'intervento sulla governance, su aspetti infrastrutturali, operativi, funzionali e gestionali rende possibile il miglioramento dell'offerta nella sua infrastruttura e organizzazione, nelle caratteristiche di qualità e costo. Tuttavia i casi presentano dei problemi e falliscono nel migliorare la composizione della domanda. È necessario prendere in considerazione degli aspetti aggiuntivi nel pianificare l'eredità di un grande evento per i sistemi di trasporto.

***Parole chiave**: pianificazione, trasporti, trasporto pubblico, metropoli, organizzazione, faalimento del mercato, regolazione, governance, infrastruttura, Grandi eventi, eredità, strategia.*

Executive Summary

The organization of a major event is accompanied with **considerable investments** in the infrastructure of the hosting city. In this **accelerated context**, with the pressure for the event organization, it is important to consider the desired legacy of the event in the long term and to use the resources in the best possible way.

There is not a continuous interest for the community and to the academia to investigate this topic with a long term perspective. However, it is also true that there is less political will to measure the longer term impacts. The only studies available are focused on one single case and thus are not comparable. It is required an analytical **FRAMEWORK** in order to adequately assess these effects.

The purpose of the research was to investigate "To what extent, and under what conditions, it is possible for a city to leverage major events to improve its transport systems". To investigate this aspects a comparison of three different past cases was done: Barcelona 1992, Athens 2004 and Turin 2006. The cases were analysed and compared in a common framework. The investigation and the interviews investigated the relations between the implemented measures and the obtained results.

Major events represent a facilitator that offer the possibility to realize important changes not only in the structure of the transport system, but also in its governance and operative management. Different indicators were considered and allowed to identify the following **EFFECTS**.

- **New infrastructures** were realized with an heavy investment activity: Many of the realized projects were developed long time before the event, then put aside and finally financed in occasion of the event. It has been observed an intense development of the areas where the event is located.
- In all of the studied cases there were **permanent changes in the governance** and in occasion of the event the **cooperation** among actors have improved.
- There were slight improvements in the quality of the services
- It was very **difficult to change the habits of passengers** in terms of mode selection: There is a positive effect in the event period but this is half reabsorbed and leaves a slight legacy.

- There is no significant loss in the utilization of resources, on the contrary it is possible to **improve cost performances** through gains in efficiency or **increases in the prices**.

To design the legacy of one event it is worth to analyze the results shown by past cases and the **MEASURES** that were implemented, these recurrent interventions can be summarized as follows:

- **Innovation of the governance** of the industry with a participative approach at the Metropolitan level.
- Realization of **important infrastructures** for long term needs, but also use of diverse measures.
- Development of **new planes** and intense adjustments of the operations. Use of some *pull measures* to improve public transport performances, even if affecting private traffic.
- Innovation of the **ticketing scheme** (e.g.: fare adjustments, integrated tickets, …) and of the **communication** of transport also through the use of Information Technology.
- Creation of **new procedures and capabilities** and reorganization of the processes. Increase of the awareness and introduction of a service oriented approach.

However, some **PROBLEMS** harm the effectiveness of Major events: Efforts and results are often concentrated in the city area, thus limited in the sub-urban areas meaning a loss of opportunity. Additionally, there is an excessive attention on hard infrastructure measures while softer interventions are undervalued. The lack of permanent effects in the characteristics of demand is related to the fact that – in these circumstances – it is difficult to plan long term and to communicate shared objectives.

On these basis is it possible to **RECOMMEND** to take a comprehensive strategic approach for the planning of the event and its legacy: It would be very fruitful to constitute an **organizational unit responsible for the legacy** of the event for the city and its metropolitan area. Furthermore, the **coherence between the measures** utilized and the ability to develop ambitious plans are key for success. This may require difficult and unpopular decisions but is critical to achieve permanent improvements. Finally, it has to be recognized that these event represent an opportunity and not the panacea, in order to improve a transport system it is **critical to commit towards a continuous and gradual evolution**.

Sommario

L'organizzazione di un grande evento è normalmente accompagnata da rilevanti investimenti necessari per la completa infrastutturazione delle aree destinate ad ospitare la manifestazione. Per tale motivo in occasione dei grandi eventi si ha la possibilità di realizzare opere importanti che andranno ad incidere sulle infrastrutture di base delle città in maniera che le sue dinamiche ne potranno risultare radicalmente modificate. Nella maggior parte dei casi recenti gli investimenti nel settore dei trasporti hanno rappresentano un'ampia fetta dell'investimento complessivo e hanno comportato spese rilevanti, variabili tra i 5 e 10 miliardi di €.

In un tale contesto, particolarmente accelerato e che risente della pressione legata alla ristrettezza dei tempi imposti dalla data fissata per il verificarsi dell'evento, è importante valutare attentamente quella che può considerarsi l'eredità che la città ospitante l'evento si ritroverà dopo il termine dello stesso e, quindi, in quest'ottica, progettare, il miglior utilizzo delle risorse impiegate.

L'obiettivo di questo lavoro è quello di investigare sino a che punto, e sotto quali condizioni, è possibile per una città fare leva sul grande evento per migliorare i propri sistemi di trasporto.

Non vi è un regolare interesse della società e della ricerca scientifica nella valutazione di questi effetti con una prospettiva di lungo periodo, è vero, piuttosto, che vi è scarsa volontà politica di misurare gli effetti di lungo periodo. Gli unici studi disponibili sulla materia si focalizzano su un singolo evento ed è quindi impossibile comparare diversi casi. È necessario lo sviluppo di un frame work analitico per valutare adeguatamente questi effetti.

Attraverso lo studio del settore specifico dei trasporti e della sua interazione con i grandi eventi, si sono analizzati alcuni importanti interventi realizzati in occasione di un grande evento, focalizzando l'attenzione specificatamente sulle misure che hanno avuto un lascito permanente sul dopo evento e tralasciando le misure temporanee, finalizzate alla contingenza straordinaria. Le azioni più pregnanti sono state distinte in cinque gruppi: governance, infrastrutture, operations, aspetti funzionali e aspetti gestionali. Ciò che risulta particolarmente critico, nell'affrontare i problemi esistenti e nel rafforzare i sistemi di trasporto, è la difficoltà di stimolare la cooperazione dei diversi attori nella

definizione di un piano efficace e robusto, che comprenda una larga parte dei diversi aspetti considerati. Per soddisfare i bisogni dell'area interessata e dei suoi cittadini è molto importante utilizzare un approccio strategico.

L'analisi è stata condotta approfondendo gli effetti riscontrati nei sistemi di trasporto urbani in occasione di tre recenti "grandi eventi": Barcellona 1992, Atene 2004 e Torino 2006. Questi casi sono stati analizzati e confrontati secondo un framework comune. Al fine di valutare i risultati, sono stati considerati diversi indicatori, raggruppati in quattro aree:

- INDICATORI GENERALI volti a valutare l'organizzazione del sistema di trasporto e gli sviluppi delle reti.
- INDICATORI DELLA QUALITÀ DEL SERVIZIO volti a valutare i cambiamenti in termini di informazioni disponibili per gli utenti e di affidabilità del sistema di trasporto.
- INDICATORI DI VOLUME volti a valutare l'utilizzo delle reti e dei servizi offerti, il riparto modale e gli effetti dei piani adottati sui problemi di congestione.
- INDICATORI DI COSTO volti a valutare la sostenibilità economica del sistema di trasporto sviluppato e l'utilizzo delle risorse.

Questi indicatori sono stati analizzati, nella loro evoluzione, per un arco di tempo di dieci anni.

Lo studio dei casi ha permesso di misurare i cambiamenti verificatisi e - anche attraverso delle interviste a personaggi con una esperienza diretta locale - di comprendere la relazione tra questi cambiamenti e l'organizzazione iniziale del grande evento. Per ciascuno dei casi considerati, sono stati intervistati più attori in modo tale che le differenti prospettive della pubblica amministrazione, dell'autorità del trasporto e degli operatori di trasporto, possano essere considerate nell'analisi complessiva.

I risultati emersi mostrano che è possibile migliorare i sistemi di trasporto su diverse dimensioni, non solo in termini infrastrutturali, ma anche nella governance e nella gestione operativa.

Nel corso dell'analisi si è potuto riscontrare quanto segue:

CARATTERISTICHE GENERALI DELL'OFFERTA – In prima battuta si è potuto osservare un importante investimento, connesso con la costruzione di infrastrutture, la cui attuazione presenta caratteristiche comuni: i progetti sono ideati alcuni decenni prima dell'evento, poi messi da parte e, successivamente, rivalutati e finanziati in occasione dell'evento. In generale si sono potute osservare forti ripercussioni nell'offerta di trasporto nelle aree prossime al sito

dell'evento. Secondariamente è emerso, in tutti i casi studiati, il verificarsi di cambiamenti permanenti nella governance determinati dall'introduzione di una autorità di trasporto metropolitana. Ancora, in occasione dell'evento la cooperazione tra i diversi attori coinvolti si è rafforzata.

QUALITA' DEL SERVIZIO – Da un punto di vista operativo si sono osservati dei leggeri miglioramenti in tutti i casi studiati. Questi comprendono estensioni del servizio di trasporto pubblico locale (aumento delle frequenze, estensione dei servizi notturni, etc.) e dei miglioramenti nelle operations (su prestazioni di affidabilità e puntualità). Questo effetto è stato particolarmente forte nel caso di Torino, anche grazie ad un intenso uso dell'Information Technology.

CARATTERISTICHE DELLA DOMANDA – È molto difficile modificare le scelte e le abitudini dei passeggeri in termini di scelta modale: si osserva un effetto positivo in prossimità dell'evento ma questo viene poi riassorbito e il lascito rimanente è limitato in questo senso. È opportuno considerare che la maggioranza degli interventi, e dunque degli effetti, si osservano nell'area urbana, determinando così la perdita di una opportunità per le aree sub-urbane. Inoltre si è verificato che, quando viene aumentata la capacità nelle strade, dopo un miglioramento iniziale, i problemi di congestione si ripresentano successivamente.

COSTI – Lo studio ha consentito di verificare che non vi sono significativi peggioramenti nell'utilizzazione delle risorse, sia per le risorse umane che per le flotte di veicoli. Al contrario, i casi analizzati mostrano che è possibile conseguire un miglioramento nelle prestazioni di costo ed in particolare nel rapporto di copertura tra i ricavi e i costi operativi. Questo fatto è stato determinato in un caso da un miglioramento dell'efficienza e in due casi da un aumento dei prezzi.

Sulla base dei risultati riscontrati si può concludere che è possibile migliorare in maniera duratura il sistema di trasporto urbano in occasione di un grande evento, sia per le rilevanti risorse impegnate sia per le possibili ricadute positive nell'organizzazione complessiva del servizio. Volendo individuare dei punti comuni – sulle misure intraprese nei diversi casi – che hanno consentito di raggiungere i desiderati effetti positivi, è possibile notare come la particolare varietà e peculiarità delle diverse misure utilizzate localmente sia importante ai fini della buona riuscita dell'intervento.

Alla luce delle analisi effettuate emerge l'importanza di considerare tre aspetti.

Risulta critico riuscire ad attuare una pianificazione nel lungo periodo. Un esempio, in questo senso, è costituito dal caso di Barcellona, dove – attraverso una serie di importanti eventi e precisi

interventi – il sistema di trasporto è stato gradualmente migliorato, affrontando diversi problemi in momenti diversi. Come è emerso in una delle interviste, gli interventi attuati negli ultimi anni sono stati molto positivi per il sistema di trasporto di Barcellona; questo è stato possibile grazie alla capacità di pianificare con ottica strategica.

Inoltre, è importante la coerenza tra le misure intraprese e la abilità di sviluppare un piano ambizioso. Questo fatto può richiedere delle decisioni impopolari – come l'utilizzo di misure che promuovano il trasporto pubblico, anche a scapito del trasporto privato, o un aumento dei prezzi – ma è fondamentale per ottenere dei miglioramenti permanenti.

Infine, per essere efficaci nel determinare l'evoluzione del sistema di trasporto, è necessario che le misure intraprese in occasione dell'evento non siano viste come degli interventi isolati, e neppure come la soluzione di tutti i problemi: è complicato migliorare un sistema complesso come quello dei trasporti. Perché questo lavoro non sia lasciato a metà è richiesta una continua attenzione, in questo senso appare raccomandabile programmare in anticipo l'eredità che si desidera dall'evento ed istituire una unità organizzativa che, durante la preparazione e nel periodo che segue l'evento, abbia la responsabilità di intervenire in questo senso.

Il lavoro svolto ha consentito di analizzare le attuali fasi di preparazione dell'EXPO 2015 che si terrà a Milano. Si sono studiate le misure programmate e, attraverso delle interviste è stato possibile condividere i risultati raggiunti con gli intervistati e investigare gli obiettivi che il capoluogo lombardo si propone di raggiungere nel prossimo decennio, anche grazie a questo grande evento.

Index

Index of Pictures

Index of Tables

Index of Graphs

1 – Introduction

In recent years, there has been increased interest in the idea of promoting urban development and change through the hosting of major events. This approach offers host cities the possibility of 'fast track' urban regeneration, a stimulus to economic growth, improved transport and cultural facilities, and enhanced global recognition and prestige. London 2012 Olympic games have relevant implications on the transport systems of the city and in 2015 Milan will host the international EXPO. These are not the principal cases of this approach to urban development planning, a long list of primary cities in the world can be done. It is possible to find western metropolis, important cities of developed countries, capitals and mega cities of developing countries, cases are spread in every continent.

The organization of a major event impacts strongly the life of the citizens before and during the event, to host this manifestation it is needed an important effort from the part of the city, the local administration, and often the national government. Large financial investments have to be decided and realized through many years of preparation. There are many aspects of the city and its life that can be impacted by major events: the economic activity, the urbanisation – or also land use planning –, its transport system, its new facilities, the labour market, the reputation or "the brand" of the city, the security for its inhabitants and so on. The success of the event depends on the resulting combination of all these elements, that are reasonably related one to the other.

For every singular element are made important investments but among the different voices transport infrastructure plays a particular role. The projects that are realised in this occasion may cost several hundreds of euro million, they require long preparation and their realisation can affect the life of the interested areas for more than ten years throughout the construction. In addiction it is possible to see how through the centuries transport infrastructure has shaped the whole society, in terms of localization of the cities, of the urbanization generated and of the Transport system are one of the main forces behind the phenomena that led from industrialization, through trade growth, to fragmentation of production. For this reason, in the context of major events organization, transport system deserve a particular attention.

This work aims to assess the real opportunities offered. The broader research question investigated in this work is: *What are the effects of major events on urban transport systems for the hosting city and its surroundings in the long-term?*

Considering the different aspects of the cities mentioned above and impacted by major events, even if it is impossible to completely isolate them, the work is expressly focused on transport system, their development and improvement in terms of planning and organization.

The perspective often considered in analysing the relationship between transport systems and major events is centred in the hard work of preparation necessary to receive the extraordinary flows of travellers that run through the city in occasion of the event. In every case it is needed to improve the capacity to serve this highly concentrated demand for transport. Only recently it has began to attract the attention of the academic and public debate what happens after the event. Referring to the Olympic games, Bovy (2002) states that "Mega event legacy is a very major issue. Lots of needed sports, cultural and transport infrastructure which are really needed for metropolitan or urban area development are generally 'produced' much faster because of the games strict deadlines. Some [...] are not really useful for a given host city and should be built as temporary structures only." This research aims to explore this area that has not been evaluated further in detail.

Major events nowadays have grown in dimension and, thanks to the new media, the competition between host cities has become harder. The high relevance that, above the others, Olympic games have acquired through television and internet allowed major events to become extremely costly, always increasing the budgets of the bids. The financing of major events nowadays comes from two different sources, public expenditure and media and marketing income generated by the events, hence these sources will – in particular after the economic crisis – in the future be more reluctant to spend these incredible amounts of recourses without understanding better the consequences.

In general the financing of transport infrastructure or the investments in public transport renewal and improvement are not the most attractive investments for private capital – at least not any more in this or not in the past century –, this can be due to the difficulty to raise consistent revenues flow in the short term. One who would accept to invest in this industry should accept to see the remuneration of his capital after years or decades. This is hard to accept also for many public administrations, and for the politicians leading them, who do not want to lose the support of the taxpayers in the short-term. So the important decisions are postponed till the planes became inadequate, not in line with the state of the art or incoherent with other decision taken in the meanwhile.

In Italy the situation is not very positive and there is a continuous debate on transport problems. The International Exposition can be for Milan and for the whole Lombardy a precious opportunity to tackle with determination these problems and to improve the different transport networks. In the next ten years the city could gain a more efficient public transport, that can attract – with a better service and organization – an higher share of passengers trips. Important infrastructure deficiencies, such as the "*Pedemontana*" and the weak airport system, that have been limiting the economical development could find a solution. The railway system could connect better the hinterland to the city and improve the quality of life of many travellers.

The organization of a major event can create, in general, a positive climate in the city and the success of its organization depends also on the little support that every citizen can provide, simply without opposing his resistance. The positive perception of the benefits originated by the event can be leveraged to implement important, and otherwise unpopular, changes for the city and for the habits of people. One could see such major events as change management tools.

Besides this possibility theoretically offered by the organization of major events there are no clear evaluations of the real results that can be obtained.

The research question

To address the research question proposed there are a few aspects that need to be taken into consideration. A sequential approach has been chosen to develop the research and, at the same time, to present the analysis and the discussion carried.

Firstly, it is important to ask the question whether the organization of major events leaves or not a long term legacy to the hosting area. In this research, it has been decided to analyse different cases in the organization of such events. The goal of these analysis is double: to assess the legacy of the major event hosted by measuring long term changes in the organization and in the functioning of transport and, at the same time, to investigate the actions and the decisions taken in the context of the planning of such events. The main question to be answered by this part is:

> *To what extent under what conditions is it possible for a city to leverage major events to improve its transport systems?*

The underlying assumption behind this research is that it is important to carefully assess the current system and to strategically decide the direction that want to be given to the change that is required. In this analysis it is interesting to observe different behaviours in the cases of different cities so that these could be classified or differentiated on the base of some parameters. These

parameters can intuitively be grouped by distinguishing the inputs and the outputs of the process of organizing and preparing a major event.

Firstly the work will concentrate on the evaluation of the effects and, secondly, on the determinants of the effects observed. From this investigation – *To what extent and under what conditions is it possible for a city to leverage major events to improve its transport systems?* – it is expected that the effects are positive in terms of capacity, quality of the service and of public transport share. Although it is reasonable that these effects have relevant variations depending on the effort spent in the planning phase, on the initial conditions of the transport system and on how different important actors cooperated in the organization of the event. Hopefully it will be possible to observe different strategic decisions based on the initial conditions of the transport system and based on the different objectives.

Finally, as specified before, the particular scope of this work is to refer to the case of Milan. In this concern it will be described more in detail the current situation of the transport system of the capital of Lombardy – "*as is" state* – and it will be presented the aimed development of the city in a 10 years time – "*to be state"* –. Hence, the second investigated aspect can be summarized as follows:

What is Milan doing well for the organization of EXPO 2015 and what can it do better?

This outlook is the basis for the analysis of the planning and organization of EXPO 2015.

In the case of Milan there is the risk that the lack of coordination between different actors – local administration, operator and authority – can obstacle the reach of an optimal result. The excessive attention devoted to road problems could create more traffic so that in a few years time the city will be facing the current congestion problem again.

Structure of the work

In the following chapter, the second one will be presented a review of the literature present on different fields covered by the work. These will be transport planning and organization, the particularities of the industry and its regulation. In this part it is also presented a definition of the major events taken into consideration and a taxonomy of the same.

The third chapter explains more in the detail the chosen methodology, by describing the data collected and the different sources of information.

After this part, in the fourth chapter, it will be addressed the question whether if the organisation of major events leaves a valuable legacy to the transport system of the city and its surroundings through the analysis of three past cases. Each case is presented with the information collected and with the results and comments from the interviews. The fifth chapter actually elaborates and discusses the cases by finding common traits and differences. At first the effects are measured, and then the measures taken in the three cases are compared in order to reach a better understanding of the improvements and their determinants.

The focus of the sixth chapter is on the case of Milan. The chapter considers the current situation and the one resulting after the plans for 2015. Taking as a starting point the results obtained in the preceding part, it will be possible to discussed the advantages and the possible problems of the current organization.

Finally the conclusions present obtained results, encountered problems and the recommendations supported by the work.

2 – Framework and Literature review

2.1 – Urban Transport Systems introduction

The first cities differed from the villages in that the residents also had other tasks than to produce goods. The tasks were initially more of the military, political and religious nature, but soon came to include trade. Essential conditions for the city's location were militarily strategic location, good communications and a hinterland with good access to goods appropriate for trade. Since the roads were very primitive places with access to navigable waterways got the best development conditions, but cities arose also in the inland at larger road junctions.

During the Middle Ages, trade was the most important city-forming factor. During the 1800s the industrialization became of special importance for urban development. The availability of raw materials was crucial for the location of major manufacturing industries. Railway routes became increasingly important for urban development. Entirely new station communities grew rapidly into cities and older communities with little connection to trunk rail lines came to lose in importance.

During the 1900s, the great concentration of industries in specific cities has sometimes led to a too rapid growth, with traffic problems as a result.

Generally speaking two different approaches to the development of transport systems could be outlined. On the one hand it is true that the development of the society influences changes in transport systems. Geographically more or less densely populated areas require different transport solutions, the development of an economy through trade and cooperation with distant regions or states require the development of specific transport modes, a congested city may require capacity improvements on its transport system.

On the other hand transport systems themselves influence the development of cities and countries. At a geopolitical level countries that have had an important position in the international

route maps have developed more than others that were more aside. Cities with large and connected airports have grown from a touristic perspective – think of the low cost phenomenon in the last decades – and peripheral areas of large cities along railways and highways have attracted the most intense urban development, attracting new inhabitants.

In brief transportation is both a driver and a tool in the development of the society: it shapes the society in which we live and it is needed to serve a certain demand for mobility, according to certain service requirements. The ability of fulfill those requirements influences both today's quality of life and tomorrow's one, allowing and facilitating further socio-economical development.

2.1.1 – Urban Transport Systems, trips and market

To proceed in the study it is needed to look closer into urban transportation. In order to do so the reasons and the nature of the trips have to be distinguished in 3 groups:

The local and regional public transport market includes, for example, trips to school, work, purchasing and health care. Long-distance or inter-regional travel by public transport is mostly recreational and business travel.

Local trips, e.g. trips within the same urban area, is almost always shorter than 10 km and takes no more than 30 minutes. The average travel length is 4 km. Almost everyone takes a local trip daily. The distribution of local trips is almost equal between car, public transport and walking and cycling. Rail is hardly used for local trips, except light rail and subway.

Regional trips are trips from one urban area to another within a region. They are usually daily, and almost always under 100 km with a maximum of 1 hour travel time. About 40% of the population makes a regional trip daily. The average travel length is 20-30 km and the car dominates as mode of transport. The bus dominates among public transport but the railway has a strong position in some areas where train services are attractive.

Inter-regional trips are trips from one urban area to another urban area in another region. They are not usually daily and are over 100 km, with an average travel length of about 300 km. Travel time is usually 3-6 hours, which means that no one makes inter-regional trips daily. A small proportion of the population makes inter-regional trips often, but most do only a few such trips per year. The car is the most used mean of transport due to the large percentage of recreational and holiday trips, but public

transport has a strong position in the longer distances, were also train, air craft and bus are competing with each other.

The classification of regional and inter-regional travels has its basis in how far you travel. A breakdown of *daily and non daily trips* may better reflect the different conditions for travel, see the table below.

Table 2.1 – Characteristics of trips (Kottenhoff, 2010)

Type of trip	**Errand**	**Restrictions for travel time**	**Geographical range**	**Distance**	**Part of population that makes the trip daily**
Daily	Work School Service Business Recreation	Max 1,5h	Within the region Local Regional	≤ 10 km ≤ 100 km	100% 40%
Non daily	Business Recreation	Over one day, Up to one day	Outside the region: Interregional	> 100 km	1%

A joint labor market is one of the important criteria for what can be considered as a region. The regional trips can be up to about 100 km long. By highways, but primarily by the new rapid regional trains, the limit for how far you can commute daily is extended. Efficient bus services can under good circumstances reach about as far as modern commuter trains. With modern high-speed trains, you can commute longer throughout the day. To commute 100-150 km a day by train is becoming increasingly common. Many professions require that you travel long distances for your job fairly often. Both air travel and high-speed trains offer such opportunities.

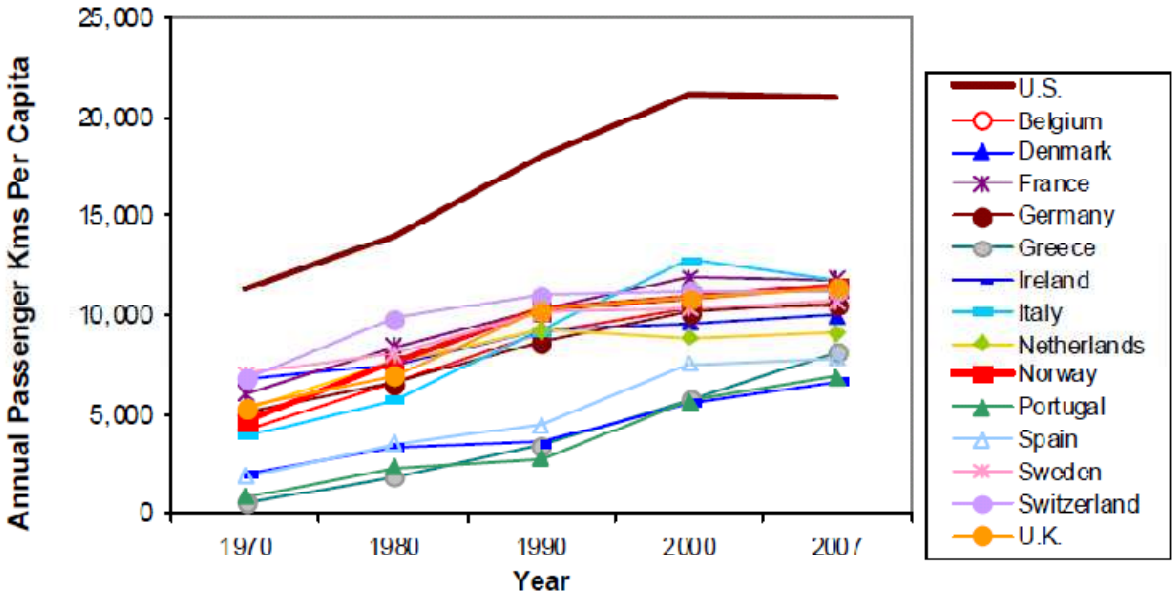
The nature of the trip and its frequency bring us to distinguish in table 2.1 two groups of trips. The most regular ones, up to a daily frequency, represent the largest part of the total number of trips and are observed in relation to one (or two) large cities as origin or destination of the trip. This characteristic of the trips help us to specify the idea of the urban transport system that is developed here. This system is meant to serve the demand for local and regional trips that occur on a daily basis. It has to be seen as broader than the only area of a large city and its suburbs, thus including smaller cities in a distance of less than about 100 km, depending on the case. In other words the

expression is referred to the "metropolitan area", a generally spread expression that indicates a region consisting of a populous urban core with a high density of employment plus surrounding territory that is socio-economically linked to the urban core by commuting, indeed the metropolitan area is also sometimes known as a commuter belt or a labor market area[1].

One specification has to be made: what is the expression "Urban transport systems" referred to? Given the explanation of the word urban by specifying the nature of the trips served, the transport system could be seen as a hierarchical entity of other systems: for instance the road network for private cars can be considered as a system, at the same time parking could be considered to be another system. There is also Public transport's system with its components that could be distinguished by mode – bus, rail, tram para-transit –. All these interrelated systems form a part of a the same main system and for this reason they will be generally referred to as the urban transport system.

Looking at the development of the urban transport system from an historic perspective the development of such system is influenced by several factors, it is interesting to highlight the most relevant ones. Those represent a useful basis to understand the industry.

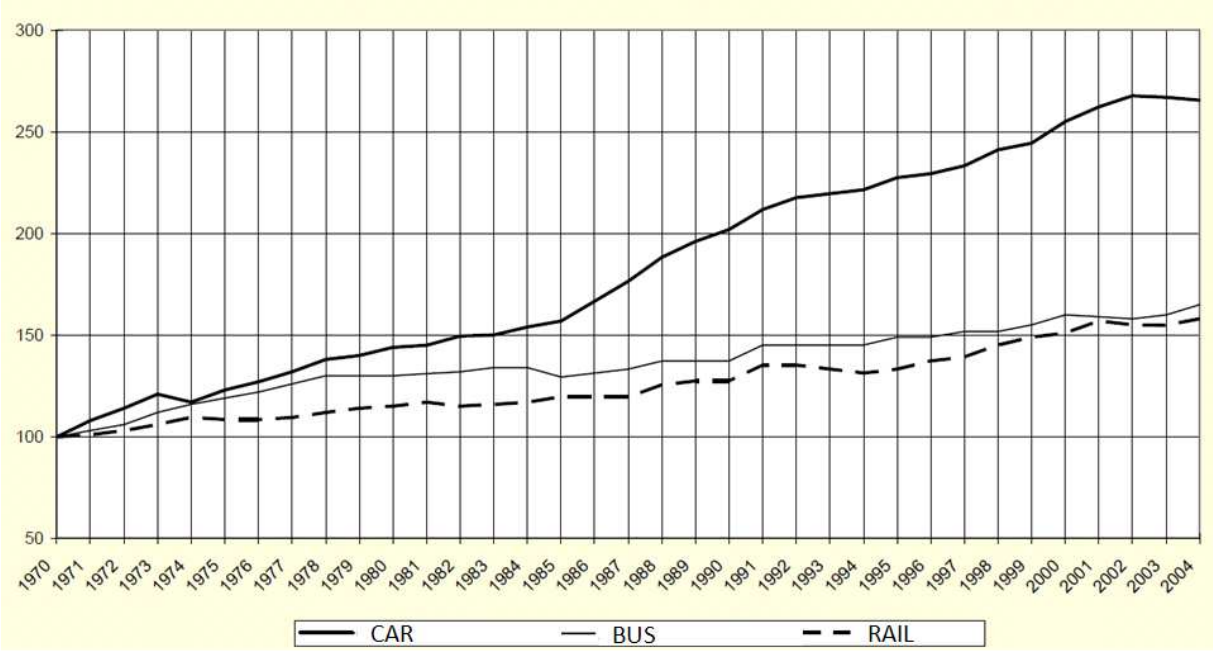
Picture 2.1 – International Vehicle Travel Trends in OECD countries (source: Litman 2010)



[1] This framework – through the expression Local Urban Zone (LUZ) – is also used by Eurostat for the *Urban Auditing* activities that it delivers to the European Commission, among others Transport Directorate General is a client of the statistical agency.

The growth in travelled kilometers has been driven by a steady growth in the number of car kilometers travelled. In the United States passenger traffic is historically dominated by cars, exception made for large cities like NYC where other transport modes play an important role; in Europe this dominance has always been lower also because of the higher density and the scarcity of natural resources. Given this initial condition private car traffic grew more rapidly than other modes like bus and rail. It is evident the we live in a car dominated world.

Picture 2.2 – Passenger traffic growth in western Europe, Pax-Km 1970=100 (source: CEMT)

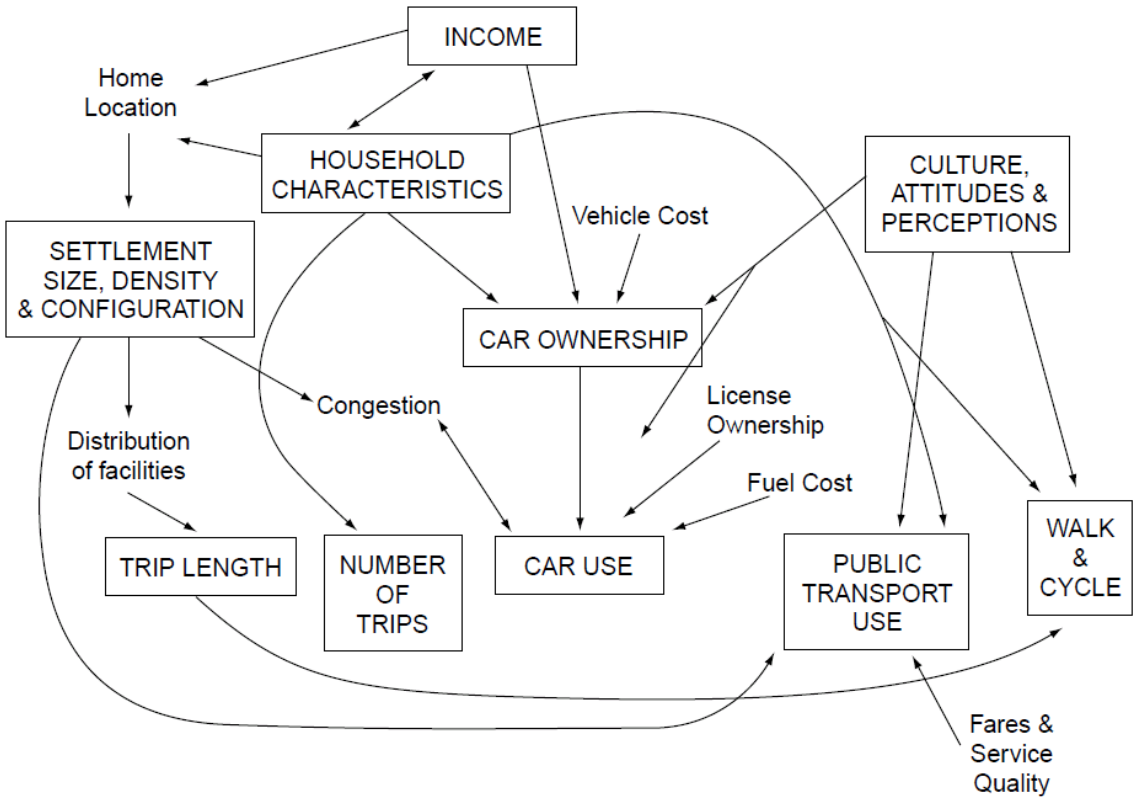


In each and every specific area the evolution of all the transport systems is, as a consequence of this situation, shaped by the interaction of the different transport systems with the land use policies and the lifestyle. The spreading of the private car was associated in the decades with other important changes: From a demographical perspective the introduction of the motor vehicle allowed the reduction of residential densities in large cities, allowing people to travel longer distances and maintaining better living conditions (O'Flaherty, 1997). From the travel patterns perspective the rise of car usage has been constantly accompanied by a fall in the use of busses and, in general, public transport. "Social developments and transport provisions are inextricably related and transport problems are in many ways simply reflections of today's social needs." (O'Flaherty, 1997). In addition to this general statement more can be detailed on the delicate relation between public transport services and private transportation.

There have been many studies to analyse what are the determinants of the characteristics of the trips in urban area, among others the Transport Research Laboratory (TRL) published a report that summarise the problem (TRL, 2004). In a causal model, shown in picture X there are five characteristics of the trips people do, namely: the number of trips, their length and weather they are made by private car, public transport or by walking/cycling. These aspects depend on five other characteristics. The first one is related to the context where the person lives, the nature of the city: its size, its density and configuration. The remaining four – the income, the household characteristics, 'culture, aptitude and perceptions' and car ownership – are related to the specific individual. Among those five determinants car ownership plays an important role, in other words, if people have a car, tend to use it.

In this framework the variables that can be controlled by the transportation authorities and transport operators (Fares & Service Quality) play a marginal role, however other studies (Taylor et al., 2009) states that "transit policy and planning do matter": the importance of a good planning and organization of transport does not have to be undervalued.

Picture 2.3 – Linkage between factors affecting trip generation and modal choice (TRL, 2004)



Public transport, through other transport modes, is mainly used is used for education related trips, and to some extend for work commuting. In order to do a good planning is important to understand the characteristics of the market. A large share of public transport users are children/students, woman and elder people. It is only in the major cities that public transport attracts a higher proportion motorists or people having a driving license. This aspects should have specific policy implications depending on the initial condition of the trips in the transport systems and depending on the objectives and goals of the planners and managers.

2.1.2 – Urban transport challenges and Evaluation criteria

What kind of system should be favoured? To evaluate the performances of urban transport system what criteria can be used? To answer to this question several aspects have to be considered. To begin with, it is important to highlight the centrality of the concept of efficiency. With a defined group of agents and limited resources, the organization of the economy allocates those resources to the agents, depending on their preferences. The resulting allocation is efficient if it is not possible to improve the satisfaction of one agent without leaving another one worse off. It is clear that the resources for transportation are limited and with the considerations introduce the framework of this study and the definition of some criteria to evaluate urban transport systems.

1 – Accessibility improvements have positive economical consequences. Accessibility is defined as the ease to reach a location or a resource and it is often measured in time. It has social, economic and environmental dimensions, access is the precondition to the satisfaction of almost any physical need. A reduction in travel time can encourage more activity in the interested area, this can lead to higher output production or higher trade. Time savings, indeed, often represent one of the main benefits of investment decisions in the construction of new transport infrastructure.

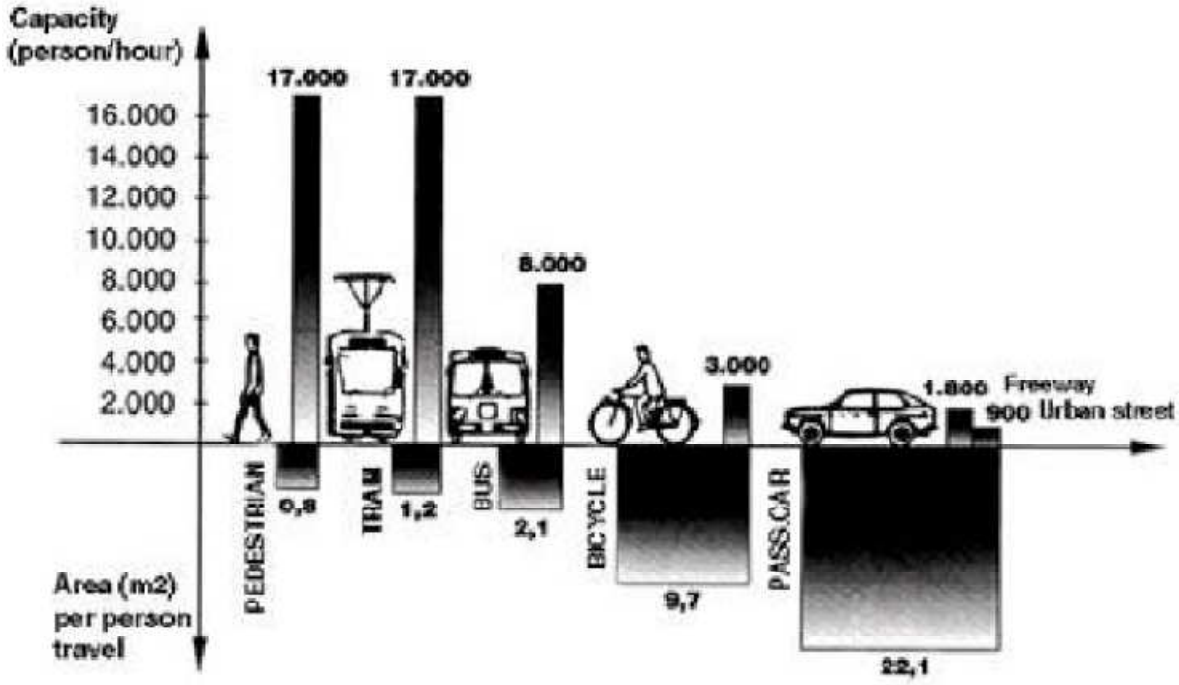
A satisfying transport supply for all citizens: regional, social balance and target groups (PT as distribution policy instrument)

2 – *In the modern and large cities different transport solutions have to be compared.* An efficient transport system has to be evaluated considering the costs, some might be direct costs – such as capital and operating expenditure – and other might be indirect such as emissions and congestion

costs[2]. Today's cities are growing bigger and bigger, especially in the developing countries the major conurbations attract different millions of inhabitants and cover a very large area. This circumstances influence the characteristics of the trips: in very densely populated area there is need to make more longer trips, this factor will have to be taken into account in the future when thinking at the desired transport system.

3 – Public transport is environment friendly. Considering the emissions of greenhouse gasses there are studies that show that with an average load factor the kg of emitted CO_2 by a bus are somewhat lower than the amount produced by a car (Chester and Horvath, 2008). It might be argued that this figure is not consistent, however there is no doubt that with a little higher load factor the comparison favours the bus[3]. Rail and especially light rails obtain even more significant emission reductions. Considering noise it can be observed the same figure: a bus produces 5 to 15 times the noise of a car – because of its lower power to weight ratio – and the general figure of the two modes is comparable, but rail-based modes achieve lower noise levels.

Picture 2.4 – Comparison of different modes per capacity and space needed.



[2] In more precise terms this aspects represent externalities, a more detailed presentation of the problem can be found in paragraph 2.3.

[3] It has to be specified that new busses fueled with ethanol have emissions level of less than two thirds of the old busses that are still in use.

4 – Different modes have different implications on congestion and land use. The picture below shows that the different modes used on the land surface have different capacities ranging from five digit measures of a pedestrian area and of the tram, to the three digit one for the car. Another difference, related to the first one, is that the space required by those modes: the capacity is defined by the density of passengers times the section times the speed, the density is the inverse measure of the area per passenger shown in the bottom of the picture. In other words the car requires about 20 times the surface needed by the tram and 10 times the bus.

5 – Traffic safety. Transit is a relatively safe travel mode (Littman, 2010): "Transit passengers have about one-tenth the fatality rate as car occupants, and even considering risks to other road users transit causes less than half the total deaths per passenger-mile as automobile travel. Since risks to other road users is hardly affected by increased occupancy, average crash costs tend to decline with increased vehicle occupancy."

6 – Conflicting aspects in transport. The choice of the transport system is driven by the personal benefits: it is not easy for the individual to see all the benefits that public transport has for society at large. Public transport has, as mentioned above, many advantages and society has long subsidized the local and regional public transport with the help of taxpayers[4]. Besides this effort the achieved results may appear not satisfactory, because the decisions by users are influenced also by the context and the culture: we live in a car-oriented society. From an individual point of view the car has great benefits: You can go when you want, with whomever you want and directly without exchanges. It is often faster and you can easily bring baggage.

To conclude, taking into account this aspects, the approach followed in this study takes particular care at evaluating the aspects related to public transport organization and diffusion. Public transport is not seen as a wealth distribution instrument but as an economically efficient solution to the problems of urban transport systems.

[4] On the other hand they have been more restrictive by financing of long distance services.

2.2 – Urban Transport Systems planning

There are different type of planning that can be made and it is important to reduce the scope of this presentation, which aims to be only a simple introduction for those who are not in acquaintance with this topic.

Transport planning can be differentiated along different dimensions:

- Specific planning vs. Integrated planning: in the first case, a 'specific plan' takes into account one or more transport modes integrated in one closed system, in the second case, an 'integrated plan' deals with modelling the relationship between the transport system and the land use scheme. Another definition of this important aspect is the definition of a comprehensive plan (Vuchic, 2004) that must consider an harmonic interaction of the network, the infrastructure and the vehicles between themselves and with the other activities in the urban area as well as with the area's character and lifestyle.
- Legal and administrative aspects, depending on the geographical scale identify:
    - Local planes: for a city usually realized at the level of the municipality.
    - Regional planes: for a specific region (e.g.: Stockholm county or Catalunya).
    - National planes: for one country.
    - Super-national planes: for an area of international integration or cooperation as European Union is.

  This distinction is based on the type of authority who realize the plan: on the one hand a municipality has the authority only of its area and inhabitants and on the other hand a region does not have the competencies and the interest to plan in detail the transportation of the city.

  In addition to those there could be intermediate situations where different levels of the administration cooperate to integrate this planning effort in order to achieve a more ambitious goal, for instance an example of these cases could be found at the level of our interest, the urban (or metropolitan) level.
- The horizon of the analysis that supports the plan allows to distinguish:
    - Short term planes: covering projects that can be implemented in 1 to 5 years, and usually do not involve major investments and infrastructure projects. In this level are included the definition of new transit service schedules, changes in the lines and purchase of new vehicles, as well as organizational and functional aspects.
    - Long term planes consist of planning of major infrastructure objects and may involve large investments and constructions, along a planning horizon of 10 – 25 years. The

investments decided in this planes have permanent implications and are not usually reversible (Vuchic, 2004) and may include new highways, railway lines or terminals; but also the realization of new control centres for traffic operations and the introduction of various ITS technologies. This type of planes has to be reviewed along the implementation at some intermediate point, for example every five years.

In some cases medium range planning refers to planes involving moderate investments and an implementation period of 5 to 10 years.

In this study it will be considered a planning approach that considers integrated and long term planning, with a specific attention on the cooperation between the different administrative levels and authorities in order to achieve a result that could satisfy the needs of the higher part of the travellers in the urban area.

The planning process presented by O'Flaherty (O'Flaherty, 1997) – a classical manual of transport planning – is a complete description of a possible approach and consists of six steps: in the land use transport planning process the planners should realize a comprehensive study and

1) "carry out inventories and surveys of goals and objectives; present travel activities, traffic facilities, transport policies and services; present future population and economic activity.
2) Determine existing interzonal travel patterns and derive and calibrate mathematical models to represent them.
3) Develop and evaluate transport options to meet future needs.
4) Use the models developed at '2' to predict future trips for the scenarios outlined at '3'.
5) Select the optimum acceptable option, and develop this in detail.
6) Continue replanning of the transport system to the extent that the available funds and techniques allow.

Another specification can be found in Vuchic (Vuchic, 2004) where the author – summarizing previous contributions in the literature – presents a eight-step iterative process, with the following phases more focused on decision making and evaluation aspects:

1) Definition of goals and objectives for the transport system in the future.
2) Collection of inventories: data about the existing city and its transport system.
3) Forecasts of changes and conditions in the selected target years for the plan.
4) Definition o a set of criteria for plan evaluation derived from the goals and objectives.

5) Development of several plans, usually referred to as alternative plans, for the projected future conditions, meeting defined goals.
6) Technical elaboration, modelling and testing of alternative plans, considering their impact on projected demand and urban development.
7) Comparative evaluation of alternative plans using the set of goal-based criteria and public hearings, resulting in the selection of the preferred plan.
8) Finalization of the selected plan and preparation for its implementation.

More sophisticated and technically detailed processes group a large number of activities in four sequential phases:

1) Inventories and data collection.
2) Model development and forecasting.
3) Alternative plans development.
4) Plan selection.

However this level of detail would be out of the scope of this work.

To conclude it has to be said that the process of intermodal urban transportation can be seen as consisting of four levels of analysis and decision making:

1) Starting with the vision of the desired urbanized area in the future the goals are defined.
2) It is defined the role that different modes should have and what should be their interrelationship.
3) Each mode is designed individually according to the goals and roles defined beforehand.
4) Finally, individual infrastructure, facilities and transit lines are designed.

2.2.1 – Urban and land use planning

Although the relationship between land use and transport is complex the control of land use is key to the control of both the demand for transport. On the one side, urban planning is more related to the demographic expectations of the city growth and to the definition of the possibilities to manage the changes (e.g.: by the utilization of abandoned areas or the requalification of existing ones); however the good urban planning is also related to transport planning, through the definition of land use schemes. On the other side, transport plans that emphasise the land use planning

approach generally seek to influence settlements and patterns so as to increase accessibility. These approach can include some measures (O'Flaherty, 1997):

- Limit the spread of cities so to keep up residential densities.
- Increase the supply of housing in existing larger urban areas.
- Locate high density points and facilities in points already served properly by public transport.
- Promote the juxtaposition of employment and residential uses.
- And others ...

There can be different solutions in defining the shape of a city and these shapes influence radically the patterns in the mobility within the area. Some examples might be:

- A city made by several connected islands. The high number of inhabitants are divided in those areas, connected with city motorways that represents isolated high rises, barriers for pedestrian and with no walking facilities. In this solution urban sprawl is incentivized, walking is comfortable only within the islands but not between them, biking is low status and cars are the most used mode.
- A city with a centre and a bone structure defined by one or more corridors of public transport, this could have the shape of a single band corridor, a star or of connected satellites; depending on the density distribution of origin/destination nodes on the branches.

The choice of the shape of the city can encourage or discourage the use of public transport but in general it is more difficult to obtain good service in low density peripheral areas, especially for trips that are tangential to the city area.

In the USA an old planning idea has come back in form of "TOD" – Transit Oriented Development. TOD is characterized by "a pattern of dense, diverse, pedestrian-friendly land uses near transit nodes that, under the right conditions, translates into higher patronage[5]" (Cervero, et al., 2004). It means that planning of (dense) settlements, working places etc is made in public transport corridors and that the environment is nice for walking and biking. This is to encourage people to use public transport and to walk to the stations.

TOD development is a complex process typically involving a myriad of stakeholders, each with a discrete interest in the ultimate development. Project partners often include transit agencies, private developers, environmental groups, alternative transportation advocates, supporters of affordable

[5] Higher shares in the private – public transport split.

housing and open space preservation, private retailers, and private transportation service providers. If successful, TOD can yield many benefits, including increasing transit ridership and profits to public and private partners (Cervero, et al., 2004).

2.2.2 – Road and traffic planning

The basic principle for road and traffic planning is congestion. In most large cities congestion is, in a sense, self-regulating, indeed people tend to avoid more congested streets and thus congestion – and average speeds – tend to be constant in time. “Traffic congestion can be described as either recurring or non-recurring. Recurring congestion is associated with expected delays, it results from large number of people travelling at the same time to the same places. Non-recurring congestion is associated with unpredictable delays that are caused by spontaneous traffic incidents.” (O’Flaherty, 1997)

In detailing the projects a very important task performed by the planners is traffic engineering, a branch of the planning activity that consists of the study of traffic flow. In the transport planes there are important components such as the definition of the capacity according to standard design approaches, the geometric design of the streets, a study of the behaviour of the vehicles and the potential accidents, the design of the intersections, of the lighting, of the regulatory measures for traffic management and of the signal controls. In addition to these “classical” aspects, nowadays driver information systems and other ITS technologies are becoming more and more important.

To organize the traffic the most effective approach consists of the construction of a road hierarchy. To better serve the traffic operations roads can be organized in three main functional groups (O’Flaherty, 1997):

1) “Arterial roads which are primarily for longer-distance high-speed through-vehicle movements and, hence, provide minimal access to frontages.
2) Local roads and streets whose main function is to provide for frontage access and, thus, whose design and traffic management is intended to discourage through traffic.
3) Collector road which are intended to provide for both shorter through-vehicle movements and frontage access.”

This could also be found as referred to as primary distributors and secondary distributors (also distinguishing among the second group district and local distributors.

2.2.3 – Public transport planning

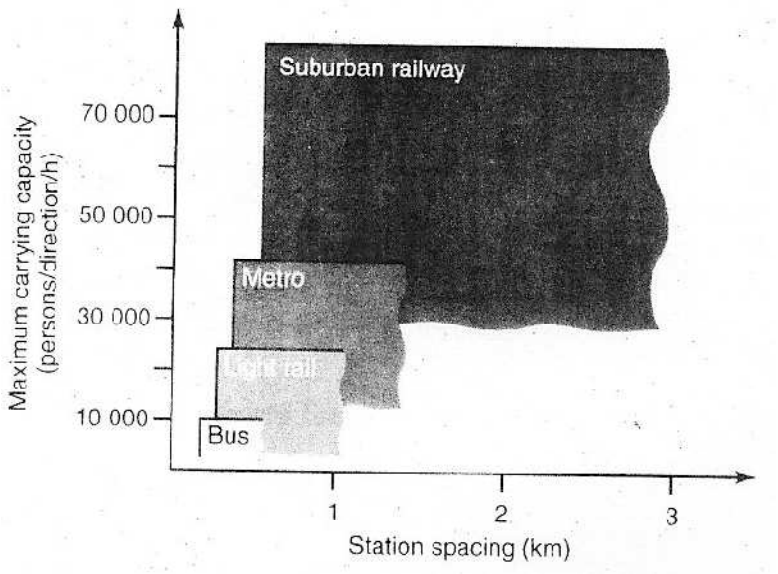
Before talking in detail of the characteristics of public transport planning it might be useful to specify what we are talking about. Public transport is a regular and advance-organized transport supply offered to the public or a specific person, under given rules (Kottenhoff, 2010). The word public indicates that is a common, public good, not necessary that more people travel together or that it is operated by a public institution related to the government. Also referred as "collective transport": Many people willing to go in the same direction at the same time.

In this definition are included: general public transport, Special public transport and Tourist and charter traffic even though the first part represent the highest share in terms of trips and costs.

Whereas in most countries provision of roads, with the exception of certain main roads, is seen largely as a responsibility of the government, the arrangements regarding public transport vary much more widely as it will be show in the paragraph 2.3.

In an urban area interact different possible systems: metros, busses, light rail lines (or trams), suburban rails and other special services. From a technical perspective different networks can exist and offer different performances so they can be integrated to provide a complete service. There is a large amount of studies and guidebooks that compare those modes (O'Flaherty, 1997)

Picture 2.5 – Example of criteria for comparison of alternative modes for public transport.



The long term planning is made by those activities and studies realized in order to shape the network of the public transport services. This planning could and should be done with an integrated perspective, trying to harmonize the different services so to allow their coordination and cooperation.

The definition of transport modes and their roles is traditionally the “hard” component of public transport planning. Traditionally the study of transport economics have been juxtaposed to the technical planning with its analysis of the characteristics of the demand through an analysis of its elasticity to price and other different factors (O’Flaherty, 1997). Since the late 70’s the deeper understanding of the economics and the reformations in several countries and in Europe allowed the “soft” aspect of planning to take more relevance in the planning activity that now includes also the definition of the organization of the industry, its regulation and subsidization schemes.

The short term planning, as specified in general terms, deals with measures that range in the horizon between 1 and 5 years. This activity includes several decisions that have to be studied in detail. In a simple manner it can be presented as the operational planning, which could be seen – again – through the classical model:

- It is studied the demand, also through the specification of user needs and the description of their behavior. This has part has both a quantitative and a qualitative effect on the decisions that have to be made.
- It is modeled the supply in the possible solutions that are being analyzed.
- It is performed a simulation to analyze the interaction between the two and to evaluate the scheduling of the vehicle and of the crew, the utilization of the offered capacity, the synchronization of different vehicles and services, the reliability of the service (Ceder, 2007) and other variables.
- Different alternatives are compared and evaluated and finally, the selected one is detailed, implemented, monitored and improved.

This planning process is continuously performed to fine tune the activities of the operators but can face major changes by setting more ambitious goals and investments for certain horizons and by incorporating the changes determined by the realization of the long term planes.

2.2.4 – Parking planning

Parking is not the key aspect in the planning of the transport system but it represents a delicate component that has to be matched with the configuration of the other components, presented above, and with the specific aspects of the city: “Parking demand is mainly influenced by the type and function of land use and the quality of the public transport system and hence the parking policy developed for any particular area depends very much on the local situation.” (O’Flaherty, 1997)

The control of the parking supply and the enforcement of parking regulations are regarded as key to the achievement of the transport objectives introduced above and that will be detailed more in depth in the following paragraph.

Some, as O’Flaherty, tend to present the problem with a spatial approach and others try to go beyond analysing the functional side of parking. In the first case it is common to focus the effort in the planning for the town centre, though a “map approach”. In addition to this some other measures can be implemented: reducing the total number of parking available (particularly on street spaces), adopting time restrictions or giving priority to selected groups. In the second case (Litman, 2006; Shaw, 1997) the analysis can be integrated with a differentiation of the needs: in peak hours there is a flow of travellers reaching the centre that could not park their private car in the city centre, compared to the flow of passengers reaching the centre in off-peak hours that could use parking facilities. The proposed solution through this approach is known as park-and-ride schemes. This solutions allow commuters to drive to common points, served by public transport, and to park there. This infrastructure require very large spaces and should be placed in strategic points where public transport and road traffic corridors have an intersection. However this approach has to complications. Firstly, the required space can be very relevant[6]: the construction can be very costly and enhance urban sprawl. Secondly, this approach could create conflicts with a Transit Oriented Approach to land use planning (see 2.2.1).

2.2.5 – Planning in practice

In today’s world large cities face several problems related to transport (presented in the paragraph 2.1.2), namely: increasing travel times – due to congestion and longer travel distances to be covered –, spending efficiency, environmental effects, implications on land use, safety. The effects

[6] Considering the capacity per hour of a metro line serving the parking structure, with a normal load factor in the car, the required surface for parking would be around 0,5 square kilometer.

of transport planning on this problems can be translated into planning objectives. Indeed this is the same set of objective for the planning activity suggested by O'Flaherty (O'Flaherty, 1997). In this context public transport represent an important element of the solution of these problems: as shown in 2.1.2, from a collective perspective, public transport systems have higher performances in all five dimensions; however, from an individual perspective, it has lower performances as compared to private cars.

Even if from a theoretical perspective it should be rational to promote public transport against the predominance of individual cars, in practice it is politically inconvenient to take serious intervention on favour of public transport because – in order to be effective – they would require and imply a penalization for private car transport. Thus the decision taking should be oriented by some clear goals and should aim at selecting a portfolio of measures assuring the coherence. The requirement of coherence has to be intended as related to both external and internal coherence, in other words, the chosen strategy has to be consistent with the external environment and – at the same time – the different measures implemented have to be consistent with each other.

O'Flaherty (O'Flaherty, 1997) groups the possible instruments used in transport planning in different portfolios of actions that identify some coherent strategies, namely:

1) Do minimum approach,
2) Use land use planning to reduce trips and trip length,
3) Develop a car-oriented transport network,
4) Develop a public transport-oriented network,
5) Manage the demand for travel.

This idea is useful to highlight the concept that with a strategic approach it is important to address a specific problem, to take a clear decision rather than trying to serve everyone. An effective strategy is a result of a precise definition of the scope of the action.

It is interesting to make a specific comparison of the third and the fourth strategies. Because of political consequences often the planes try to satisfy both public transport – because of its advantages and, more and more nowadays, because of the positive image given by environmental sensitivity – and private-car based transport – because of the most important political consensus that it is associated with –. The consequences of this compromise is a reduction in the effectiveness of the same planes.

The tendency is to cope with future or current problems with transportation system by increasing capacity to every mode: increase road capacity and increase public transport services. The consequence of this approach is that new trips will be generated: the new capacity will be filled for

private-car roads, without the possibility of resolving permanently the problem of congestion, and the new passengers attracted by public transport would be limited[7]. to understand the relationship between these two approaches these words from O'Flaherty are explanatory.

> *"Since there is a suppressed demand for car travel in most large cities (which means that empty road space is filled as soon as it is created) this explains why it is that the introduction of a new rail system often appears to have little impact on road congestion – and why there is a need for concurrent car-deterrence measures if the objective is to reduce congestion."* (O'Flaherty, 1997)

Examples of these concurrent car-deterrence measures can be Transit Signal Priority to public transport vehicles (TSP), the utilization of dedicate right of way lines for surface public transport service taken away from private circulation, charging for road use (Tolls or similar schemes), the parking policy and others. With limited resources (and especially space) these measures are fundamental for the success of the plan. Unfortunately these decision are unpopular and conflict with the common judgement that individual transport is more comfortable than collective transport.

To understand in concrete the phenomenon discussed here it is useful to have a closer look on reality. The traditional approaches study the problem from two perspective. The performance of an urban transport system, and of its ability to favor – when needed – public transport, are measured in absolute and in relative terms.

On the one hand the main absolute indicator considered in this concern is the number of trips per inhabitant. On the other hand, the modal share is the privileged system used to assess and compare the performances of transport systems. These can be measured in different ways; generally speaking there are three types of shares that are more often used, and thus are considered to be more relevant:

- National modes share,
- Local public transport share in capital cities/mega cities,
- Public transport share in rush hours to/from the inner city.

The choice of one of these depends on the objectives of the study and on the availability of the detailed information.

[7] An exception to this could be the case of developing countries where the public transport systems are not yet fully developed in terms of modes available, competencies and organization of the service.

To conclude, it has to be underlined the close relationship that these performances of a transport system are closely related to the interaction between the different modes. In this sense it is clear that the different modes happen to be conflicting. The next paragraph will, to a certain extent, analyse this interaction within the functioning of the entire industry.

2.3 – Urban Transport Systems' organization, economics and regulation

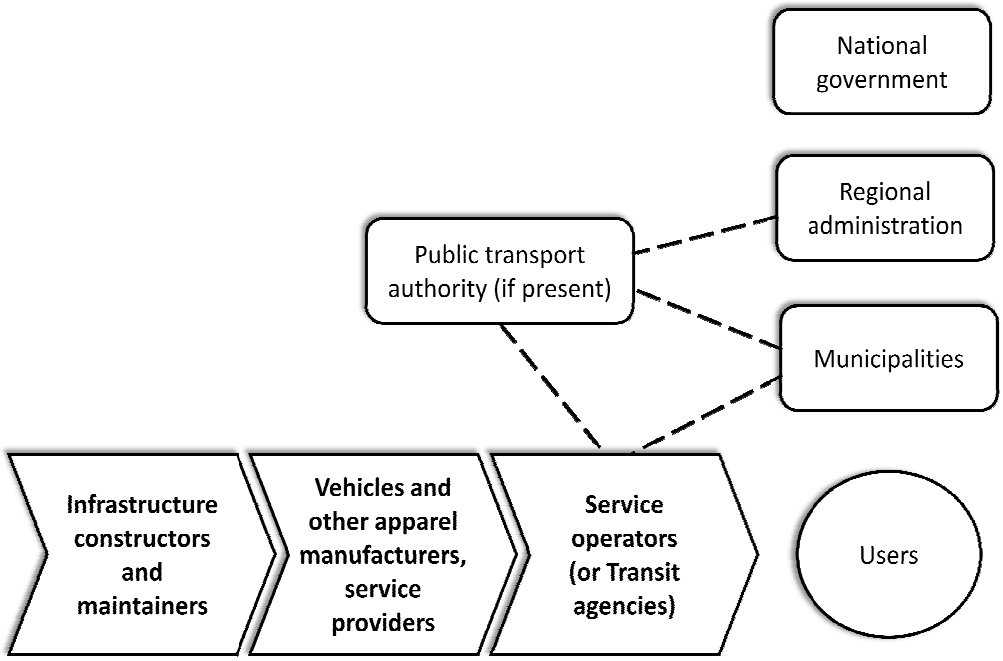
With a knowledge of the technical aspects of the industry it is now possible to analyze the more managerial aspects.

2.3.1 – Structure and organization of transport services

The primary reason for the existence of public transport in cities is to provide passenger transportation services. In the previous paragraphs it has been mentioned that public transport has a major role in the functioning of the city itself, this is true only under certain conditions of good functioning of the services. In other words, those services have to satisfy certain parameters concerning the quality and the cost: it is an issue about balancing the objectives of maximizing public transport usage and minimizing the public expenditures for public transport operations. These two aspects – the service the transport system provides and the founding it receives – have a major influence on the ownership and organization of the companies and entities that operate public transport, on government regulation and on financial aspects of the (Vuchic, 2004).

In urban transport industry there are several different actors undertaking different roles and it is important to understand the composition of the industry. These actors – shown in **picture X** – belong to two different categories, there are those operating under the civil law and those operating under the administrative law.

Picture 2.7 – The actors in the industry (source: personal elaboration)



Depending on national legislation and on the specific case the tasks of these actors and their relationships vary a lot. The rational of this very differentiated settings is that public and private ownership – as well as the degree of regulation – have been the subject of extensive discussions among transport professionals and government officials, yet many changes have been introduced.

Infrastructure constructor are private firms engaged for major construction projects. The infrastructure they realize could be committed by the regional administration or by the municipality, after construction the property of the infrastructure moves usually to a company, property of these administrations, this company in some cases may be a specific company for the management and maintenance of the infrastructure or, in some other cases, it may well be the same service operator.

Vehicles and other apparel manufacturers are, together with service providers firms competing in a liberalized market to provide vehicles, services and other components to service operators.

Service operators (also known as Transit agencies) are regulated actors and they are responsible for running the operations so they are organized to provide the required service: they take care of the operational (short term) planning and of the maintenance of the vehicles, if they are their property or if it is their obligation. In some cases they are responsible of selling and marketing activities, but in other cases this activity is under the control of the Public transport authority.[8]

[8] The most complete set of different ownership forms is given by Vuchic (Vuchic, 2004) who, however, refers especially to the North American experience.

On the administrative and public dimension of the industry interact the competencies of different levels:

The national government is responsible of the regulation of the industry, and of the distribution of responsibilities between other public entities. In states belonging to European Union its decision are guided by EU, but have to be adapted and translated in practical solutions.

The municipality, being the closest institution to the citizens, - in most of the cases – is responsible of the service and of the major planning activities. These activity can be delegated to an Authority together with the organization of the tendering process that assigns the concessions for the service to the Service operators.

The regional administration is, in most cases responsible of the budget and the financing of public transport services – in some cases this responsibility is given to municipalities or shared between them –. Because of its involvement the regional administration takes an active part in the planning of the service: in case the detailed planning is done by the municipality the Regional administration take care of harmonizing the interests of different municipalities in the territory, in case the planning and other responsibilities are delegated to the Authority the Regional administration may be involved and may hold a participation in the same Authority.

Finally, the Public transport authority – as specified above – are entities that may be constituted with the objective of enhancing the cooperation and the coordination of the other actors.

- They can – in the strongest solution – be responsible of the long term planning of the service and of the assignment of parts of the system's operations to different operators;
- they can – in the case of an intermediate solution – be responsible of running the tendering process;
- they can be the channel for financing the service – through subsidies or also through fare collection, in some cases (e.g.: Stockholm's SL) –;
- or they can exist and have very little responsibilities and means.

Originally things were different: most of the services in the nineteenth century were provided by private companies. At that time the demand for travel was significant and there were no alternatives to horse-drawn modes and, later, electric trams. The heavy interventions of mechanized transport coincided with the fast growth of industrial cities, the increase in mobility demand made transport services an attractive business venture. Public transport industry was dynamic and innovative, playing a major role in the development of cities. However there were some downsides:

- Services were often offered mostly on lines with heavy ridership, while other services – socially important but financially not remunerative – were given inadequate attention.
- Many companies crowded the busiest lines and arterial streets, this led to cutthroat competition and finally resulted in bankruptcies of weaker competitors, instability of service and, eventually, uncontrolled monopolies in some areas or entire cities.
- Uncontrolled competition resulted in duplicative and uncoordinated services that neither represented an efficient way of providing service nor offered to the passengers convenient, connected networks.

Problems and need of coordination or government control: the answer to these problems were public takeovers (cases like New York, Chicago and others) or the consolidation of smaller operators into a single large company. Where this did not happen, in Europe, there were already municipally owned transport operators since the end of the nineteenth century.

2.3.2 – Market functioning

As shown above, urban transportation appears to encounter some serious problems if regulated by the market, this paragraph analyses causes and consequences of this.

According to neoclassical economics competition is the best organization of the economy under the classical assumptions[9], even in the real world – where those assumptions are not verified – the competitive market is able to allocate in an efficient way the resources better than any other economic organization. The economists in the last century have also studied market failures, thus showing that some solutions not responding to the market-paradigm where needed. Those market failures are usually grouped in four areas (Varian, 1990): market power, externalities, public goods and asymmetries of information. Analyzing here transport industry, specifically in the organization of urban transport systems, a little explanation of those failures follows along with some examples.

MARKET POWER – In contrast to the classical model of competition, because of the presence of market power, the companies can rise prices without losing their entire share of demand. This

[9] Namely there are four hypothesis:
1) Atomistic size of the firms active in the economy,
2) Absence of barriers to the entrance or the exit of any industry,
3) Freedom of access to resources and technology,
4) Perfect information.

reduces the total quantity bought by consumers at the new level of price and thus the welfare, primary affecting the consumer surplus. More formally, there is market power when one firm is able to influence the mechanism of the formation of the price, when the company acts as a price maker instead of acting as a price taker. If this is the case, one of the assumptions of the market model of competition fells and the allocative result is inefficient and implies a sub-optimal utilization of resources.

In the case of transport supply there are several possible problems: on the one hand the operators can rise prices – as in the classical case – and, on the other hand they and also offset competition by adopting practices that aim to leverage their market power and increase it. As mentioned above, in the past it happened that stronger companies entered cutthroat competition by starting a price war with smaller operators in order to eliminate them and exploit monopoly (Vuchic, 2004). This practice is broadly known as horizontal squeeze. At first it is possible thanks to cross-subsidization and switching costs; on top of this exit barriers such as not-recoverable investments – very common and relevant in transportation – increase the intensity of price wars. After that the competitors are eliminated entry barriers guarantee monopoly for the surviving company.

Consequences of this market failure in the provision of transport services are the sub-optimal output in terms of volume – or capacity – offered –, in terms of variety of services offered and modes operated, as well as the sub-optimal investment.

EXTERNALITIES – This phenomenon is originated when the prices in the market do not reflect all the collateral effects of an activity. Externalities are external effects generated from the activity of production or consumption that influence the profit or utility function of third parties who did not generate them, but are not reflected on prices. The resulting allocation is sub-optimal meaning that the production of externalities should be better be increased, in the case of positive externalities, or reduced, in the case of negative ones.

Vuchic (Vuchic, 2004) and other authors give some examples of the externalities at a general level, in presenting some of them here they can be differentiated positive externalities by negative ones. Positive externalities of public transport systems are:

- Public transport results in avoidance of large costs which private cars would cause in terms of congestion, negative environmental impacts and occupancy of larger areas by roads and parking facilities.
- Because of network externalities the improvement of a transport service (or mode) depends on the number of users it attracts: if one service is not able to attract the required amount of

passengers it will not benefit of the positive network effects, also called bandwagon effects (Shapiro and Varian, 1998).

- Transport in general, and public transport services more than other infrastructures, enables the development of diverse urban activities, densities and functions.
- Public transport network, especially rail, can contribute significantly to desirable urban development and form, reducing potential for urban sprawl.
- Serving urban core areas of the city and suburban activity centers, public transport is oriented to people and thus enhances a city livability.

But public transport systems are also affected by negative externalities generated by individual transport. For instance:

- Private car generated congestion have negative effects also on the performances of public transport in terms of average speeds of the vehicles and reliability of the service[10].
- Transit fare levels are limited by the fact that fares must be competitive with the marginal cost of driving an automobile, rather than its total cost. In addition, fare levels that would maximize an agency's revenues would usually cause diversion of a significant proportion of trips to the automobile.

Solutions to the market failures caused by externalities are different: they could be to internalize the externalities of to create a market where externalities are traded. In the first case the economic agents at making decisions consider all the effects generated by their production (or consumption) because these effects are direct on themselves; in the second one because they are penalized or rewarded by a pricing system that signals if to increase or lower the production of externalities.

The discussion of externalities in transport problems is not very evolved because in the economic appraisal of transport plans the value is often broken-down to different components the weight of which is defined with a discretional evaluation, depending on the assumptions or the interest. This approach is described by the quotation from Litman: "in addition to their important function in providing mobility, public transport systems have various positive impacts and externalities that are largely qualitative – not conductive to measuring in monetary units. Transit is therefore operated as a combination of commercial enterprise and social service, and it is finances by user revenues as well as by government funds. The question […] whether a transit system is making or losing money, is inappropriate" (Litman, 2010). This seems not to be a rigorous basis to analyze transport problems.

[10] This problem can partially be reduced by the adoption of own right of way lanes and TSP systems, but a negative effect would always remain.

Another important element that prevent transport industry to reach en efficient equilibrium under a competitive regime are network effects. These phenomena could be seen as included in the family of positive externalities but deserve to be treated separately to be presented here. To be competitive Public transport has to be fast (to be intended in the meaning of the average speeds and frequencies) and reliable (to be intended as "on time"). The quality of the network affects both these requirements, increasing speed and reducing variability, and thus is critical. However this aspect is still very qualitative, the most valuable attempt to define network effects could be found in HiTrans guide (Nielsen, 2005).

PUBLIC GOODS – In the competitive market the equilibrium mechanism fails to reach an efficient equilibrium with goods that have two properties: indivisibility and non-excludability. An indivisible good is a good whose utilization by one individual does not reduces the amount of it available to other people. A non-excludable good is a good for which it is impossible – at a reasonable cost – to avoid consumption from someone who does not pay for the utilization of the good.[11]

The market failure here is that the companies miss the correct incentive to produce the good, thus the public good is not produced or is produced at a sub-optimal level.

Concerning the case of transport services it is useful to consider that if we assume that public transport operations are run below capacity – meaning that one individual can use and that one additional passenger does not reduces significantly the capacity available for others – and that ticket control is not very reliable, than it is possible to say that public transport is a public good. Indeed these assumptions are verified to a certain extent.

Solutions to this problem might be either acting to protect the consumption of the good – making it excludable – or incentivizing the production – through subsidies – or letting the public to supply this. For these reasons happen to encounter ticket control and fines, subsidies to operators or public ownership.

INFORMATION ASYMMETRIES – There can be different types of information asymmetries, those are usually distinguished in two cases: hidden action (or moral hazard) and hidden information (or adverse selection). Here it is useful to consider the second case as due to the quality perception of the product; in perfect competition model goods are commodities, in real world goods are differentiated and it is often too costly or impossible to evaluate their quality. The answers to this failure are signaling or an higher transparency.

[11] The typical example of a pure public good are National security and technological and innovative knowledge.

In the problem of consumption of transport services there can be found the same result as of the simple case o the “market for lemons”. Assume that transport operators are able to offer a good and a poor service, customers are willing to pay x for a good service and y for a poor one[12]. The wide known model bring to the result that if it is not possible for the customers to tell if the service is good or bad before consuming it[13], than they would be willing to pay the average between x and y. Operators are rational and know this, thus they only offer poor service. Customers, who are rational as well, know this ad accept to pay only y. the result is that no good service is offered in the market. This example seems to be realistic in a world where there is often no clear and rigorous public information of the quality of the service.

Furthermore, particular determinants that cause the failure of the market are entry barriers and particular conditions of the industry. To prevent problems in the regular and efficient functioning of the industry, there are two traditional instruments: the protection of competition done by antitrust authorities and the industry specific regulation. Economic regulation of the supply of one industry – in terms of quantities and prices – is seen as the last resource and is used in the extreme cases represented by natural monopolies. A natural monopoly is the case of one sector where because of the super-additive properties of the cost function of the industry. This property is not determined only by the cost structure – the presence of economies of scale represents a sufficient but not necessary condition – but on the scale of the minimum efficient scale and of the demand at that cost level. If in the market there is sufficient demand for one only firm producing in efficient conditions, there is a natural monopoly.

2.3.3 – Regulatory frameworks

As a public service affecting the welfare of not only public transport users, but the entire metropolitan area, various aspects of public transport operations and organization must be regulated by government agencies or other regulatory bodies. The aspects and degrees of regulation vary among countries, cities, modes, as well as other local conditions.

[12] Assume x > y.

[13] It is possible to evaluate the quality after consumption, in this case we are referring to an “experience good”.

Regulation does not has to be intended only as economical; the purpose of regulation on transport services are numerous and often mutually overlapping, but – according to Vuchic – they can be divided into four major categories:

- Safety and security: to ensure safety of the travellers and other potentially affected parties.
- Technical and social aspects: First, to achieve or test technical and operational innovations. Second, to provide certain level of mobility and special services to some population groups, geographic areas or types of trips, which are considered socially desirable.
- Economic: First, to ensure reliability and permanence of services and prevent individual and societal losses that temporary or permanent service cessation would cause. Second, to protect the public from being overcharged with excessive fares. Third, to prevent losses to the operators due to duplication of services, unfair competition practices etc.
- Impacts: to minimize negative and maximize positive impacts on surroundings, environment, urban character and quality of life (Vuchic, 2004).

To this study economic and technical regulation are more interesting meaning that the two aim directly to the economic efficiency. Rephrasing the above approach, regulation might be directed to different aspects of transport provision:

- Legal right and obligation for a company to operate services (Franchise),
- Fares charged per services,
- Quantity and quality of services.

To better understand the purpose and he instruments of the economic regulation it can be taken as reference point the work of Braeutigam, who developed a widely accepted framework for the regulation of an industry. The starting point of this *Policy roadmap for regulation* (Braeutigam, 1989) is the presence of a natural monopoly: if the minimum efficient scale is relatively large as compared to the demand it is necessary the intervention of a regulator. The specific characteristics of this intervention depend on de decision to accept or not the deadweight loss[14]. If the difference is large and there is no political will to accept it it is necessary the direct intervention of the government as a producer, this can be done through subsidies, the application of discriminatory pricing or not-linear tariffs. Otherwise, if the loss of welfare is accepted there has to be an attempt to incentive some form of competition. Some of the solutions proposed in this framework are the competition for the market (or Demsetz competition), the intermodal competition or the attempts to establish the

[14] Difference of welfare between the first best solution – of the production al the minimum marginal cost – and the second best solution – of the production at the minimum average cost – .

conditions of the contestable markets. If these measures are not sufficient to maintain the industry in a second best equilibrium public control and monitoring of the supply is unavoidable.

On this general basis – and in particular under these last conditions – are operated public transport services. The traditional measures utilized in this industry are the fostering of intermodal competition, the attempts of the establishing a form of competition for the market, together with subsidies to compensate the losses that occur among the operators[15]. In the strongest, but not rare, cases there is a direct intervention of the state as a producer.

2.3.4 – Directions for the future

Vuchic affirms that the current governance and organization of transport systems is often criticised because of the increasing inefficiencies in operations and financial difficulties of public transport operators, and because of the lack of clear transportation policies. This two issues triggered extensive discussions about organizational, regulatory and ownership aspects of public transport.

As it was shown there are still problems in the regulation and organization of transportation in metropolitan areas. The aspects that have to be considered are summarized from the contribution of different sources. Vuchic states that:

- The need for high investments in the construction of transport infrastructure requires public participation in the funding of long term projects where payoff is slow and not perfectly appropriable. This statement is supported by the fact that transport services could be seen as pubic goods, or at least goods that are dense of externalities.
- Certain modes of high quality public transport – which require large investments in infrastructure – are natural monopolies and therefore are not conductive to competition among different operators providing alternative services on the same lines.
- Because of its essential role for the welfare of the population and the economic viability of the city, transport services cannot face sudden discontinuance due to a company's bankruptcy.

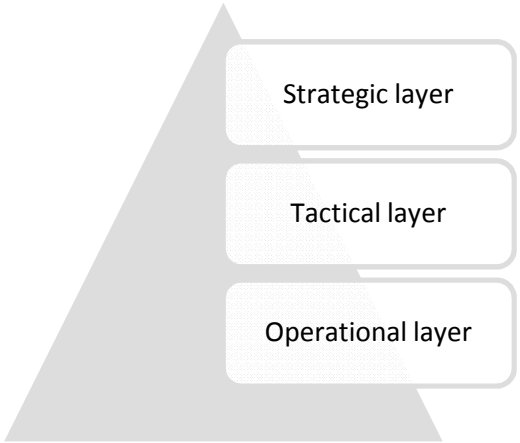
With an analysis of the theoretical conditions for a well functioning market, HiTran guide shows why one should not rely entirely on the market approach for the development of urban transport networks:

[15] Subsidies can also be justified by the definition of Universal Service Obligations for political decision due to the importance of transport services for the population.

- The concepts of economies of scale and of scope make the idea of on-the-road competition potentially difficult in practice.
- For reasons of efficiency – and especially passengers understanding – there is a need to coordinate lines and services.
- There is a clear risk that the actors in the market will make a strong effort to secure monopolies instead of concentrating on serving their customers efficiently.
- There is a need for several types of services and different modes of transport to cater for various groups of users and their different needs.
- There is a need to create incentives to the operators to make better connections to other lines, operators and modes. Without these incentives each operator will sub-optimize the system in order to keep passengers and revenues for itself[16].
- There is a need for economic incentives in certain fields of public transportation and paratransit.

To tackle these problems Vuchic suggests a 3 layers conceptual model for transit service provision. The highest, strategic level should focus on the basic goal for the authority: service to passengers or customers. Authority policy should be formulated at that level. The second, tactical level consists of designing networks, lines, and their scheduling, fare collection, etc. Actual provision of service represent the activities at the third level.

Picture 2.7 – The conceptual model for public transport provision (Vuchic, 2004)



[16] This might also include the practice of “Skimming the cream” that operators use in order to keep for themselves the better and denser areas.

In traditional agencies all three levels are performed by the same organization, however the author stated that that even if even if the levels have to be coordinated, it is desirable to define them and maintain a certain independence among responsibilities. Vuchic states that a separation of the three layers may allow an umbrella organization that performs tactical planning, to call for tenders or contracts, so that operations may be performed by public or private operators. For this approach to be effective the author highlights seven areas in which it is required a change of current habits:

1) Broaden the mission so that the authority – if it has to "manage mobility in citiy" – can have the big picture and coordinate different modes by controlling street access, parking as well as public transport services on different modes.
2) Focus on the customer that, as a passenger, is interested in the perception of the service quality of the overall system.
3) Stimulate competition, between bidding operators or between different divisions of the same agency, in case of a centralized agency.
4) Increase cooperation among operators and modes.
5) Use state-of-art technology.
6) Change the organizational structure, for many operators it would be very useful to redefine management appointing and labour relations.
7) Monitor service quality and efficiency continuously guaranteeing transparency and independency of information.

While Vuchic approach can be somewhat flexible and apply to both the cases of an integrated operator or of a transport authority, HiTrans guide is more direct and, with no doubts, concludes that the recommended governance for public transport is the authority model.

"Close cooperation between local and regional levels of government and the formation of a regional transport authority or association are important conditions for providing a product that satisfies public transport needs of inhabitants as well as economic interests. Under such an umbrella competition among transport operators can more easily be successfully initiated" (Nielsen, 2005).

An effective transport policy requires a mix of push and pull strategies: the first group of measures aim at improving directly the functioning of the transport system while the second group aim at creating favorable conditions for the development of more sustainable transport by reducing negative externalities give by car usage. This conclusion comes from the observation that in several

cases effective transport policies included both kind of objective, which are similar in most of the cities. An example from HiTrans guide is shown in table 2.2.

Table 2.2 – Push and pull strategies (Nielsen, 2005)

Push strategies	Pull strategies
Increase social inclusion (accessibility) Increase public transport use Increase cycling Increase walking Increase transport affordability Increase accessibility for the mobility impaired Increase economic development and participation in the labor market Increase air quality	Reduce car use in order to moderate congestion and environmental impact Reduce car dedicated spaces that limits more sustainable modes (e.g.: right of way lines and constraints on parkings) Reduce journey times for sustainable transport modes (thus reducing the average for all modes) Reduce accidents Reduce total persons kilometers

To implement these measures and to guarantee at least a competition for the market through the bidding process HiTrans guide states the dominance of the Authority model of transport governance. [17]

This analysis of the recent literature on urban transport will be the basis for the analysis of the relationship between mega events and transport system, which is introduced in the following paragraph.

2.4 – Transport Systems and Major Events

This third paragraph is structured as follows. The first part defines the framework and what is considered a major event. The second paragraph gives some general information about what does it mean to organize a major event and who are the actors involved in this process. Then, in the third paragraph, it is possible to understand better what is the impacts of a major even on transport systems and in the fourth one some common measures to manage these impacts are presented and

[17] The European regulation and the white paper on transport go in the same direction.

summarized in a conceptual framework. The chapter number five contains a discussion on the long term effects of major events studied up to date. Finally, to conclude, it is introduced the possibility of a strategic analysis of the problem at the centre of this study and some directions for further research are indicated.

2.4.1 – Framework and general information about Major Events

There are different types of events and before analysing them it is useful to define better the scope of this study. The events that a city hosts con be of a very wide range: there can be important concerts, festivals and cultural events, congresses, fairs, sport competitions and many others. However some events are more relevant than others. An international sport event have an higher impact on the location and the transport system than a national competition, some sports attract more spectators than others and perhaps several sports might attract more than a single one. A fair can have different size according to the number of industries that are represented and also the number of companies that participate. A in international congress that attracts thousands of visitors can have an higher effect than other events. It is important to distinguish the type of event that are interesting and what can be considered to be a major event.

Several dimensions can be used to study them: the length of the event, the number of participant visitors, the number of participant countries, the number of represented sports – the case of sportive events – the geographical extension. In order to have a general idea of what are the order of magnitude of different important events a list can be made:

Table 2.3 – Characteristics of large events (Personal elaborations)

Event	Countries represented	Visitors (approx.)	Event owner
Olympic games	200 +	2 – 8 ml	IOC
Soccer World Championships	200 +	2 ml	FIFA
International Exposition	150+	20 – 30 ml	BIE
World ski championship	Around 100	1 ml	FIS
Commonwealth games	70	1 ml	CGF
European Soccer Championship	53	1 ml	UEFA

Mazzeo (2008) and Ritchie (1984) support the theory that the scale impact of a major event is related to the geographical scale of the event – for them events go from being local, to being national, international and global. Higher the number of participating countries, higher the impact of the event.

These events have another difference that is not reflects in the table, this is to say the duration: the International Exposition is an event that lasts for a longer period of time. There are two types of Expositions, the World Exposition and the International Exposition so to use the terminology currently used by the Bureau International des Expositions. The first event is a very complex event and lasts for 6 months, the second one is reduced in terms of scope and duration, it extends for 3 months.

One comment has to be made about the Olympic games, also in this case it is possible to distinguish two different events: the Summer Olympics and the Winter Olympics. The first event is broader than the second one, it involves 26 sports against the 7 that are present in the Winter games. To this reason is due the wide range of ticketed visitors, generally the second group of events attracts a larger group of spectators.[18]

Looking at the different large events mentioned it can be noticed that the first group of three events is larger than the others in terms of visitors and nationalities represented. However in the literature some definition of major events can be found.

According to Ritchie (1984) major events – the author use the expression "hallmark events" – are "major one time or recurring events of limited duration, developed primarily to enhance the awareness, appeal and profitability of a tourism destination in the short and/or long time. Such events rely for their success on uniqueness, status, or timely significance to create interest and attract attention". According to Allen, O'Toole, McDonnell and Harris (2002) international and global events can be defined as "mega-events" if they "… are those that are so large that they effect whole economies and reverberate in the global media. They include Olympic Games and World Fairs, but it is difficult for many other events to fit into this category". Finally, according Getz (1997) "mega-events" are characterized by the fact that "their volume should exceed 1 million visits, their capital costs should be at least $500 million, and their reputation should be of a 'must see' event. […] Mega-

[18] It is important to notice that, associated with the Olympic games, both the Summer and the Winter ones, come the Para Olympic games. This different event, is seen in this context, as a part of the Olympics themselves: it is always hosted by the same city and it is regularly scheduled after the main games. For instance it is possible so understand that the organization and planning of this event are integrated in the work made for the main games.

events, by way of their size or significance, are those that yield extraordinary high levels of tourism, media coverage, prestige or economic impact for the host community or destination".

When considering a definition of what might be considered a major event, several factors induce to consider the Olympic games, the International Expositions and the Soccer World Championship. However the SWC include one only sport, it is true that this is the most followed sport at a global level.

An additional difference is that, compared to the Olympic games and to the International Expositions FIFA's SWC lacks of a "vision" that drives the decision of the hosing city and that enriches the content of the event and its legacy. On the contrary, the International Olympic committee has the purpose to serve the host cities and the society through the development of sport and culture, but also going besides this perspective; the Bureau International des Expositions – by setting a specific theme for each exposition – orientates the industry and the entire event to one specific relevant issue for the entire society.

For all the reasons above mentioned in the following part of the work the referral to "Major Events" will indicate exclusively Olympic games and International Expositions.

2.4.2 – Organization of a major event

When thinking of a major event, a city willing to organize one has to deal with a specific procedure and has to move in a defined framework. Mega events have their organization and their own history. They have been organized for a long time – the first modern Olympic was organized in Athens in 1896 and the first International Exposition was held in London in 1851 –. A city or a nation willing to organize such an event has to take into account this history and tradition, has to respect the identity of the event. In order to guarantee this coherence and the quality of the event, for the considered major events, there is an entity responsible of the same event. This actor is often referred to as the *event owner* or *franchisor*.

The International Olympic committee and the Bureau International des Expositions have their own organizations and a specific event culture. The IOC in particular has a complex organizational structure based on a matrix characterized by the national and by the sport dimension, there are more than 200 National Olympic Committee and 33 technically managed international federations with their protocols. When talking about transportation issues associated to the event is important to say that the item number 16 of IOS constituting document states that the IOC has strong

environmental and sustainable policies, that it favours environmentally friendly transport concepts, and in particular public transport oriented schemes.

The owner is responsible to monitor and guarantee the security and the outcome of the event, whereas the proper organization of the event is done by the *event organizer*[19]. This other actor is often a newly born organization representing the local authorities: the city administration, the regional and the national ones as well as other associations such as the NOC or different industrial associations. This actor work in close contact with the owner to guarantee the final result. However the organization of a major event is a long and complex project.

Before the event to be assigned to a location willing to host it there is an almost standardized selection process. The different candidates have to prepare a proposal for the event owner. Nine years before the event to take place all the candidates have to prepare an *Applicant bid* where they present a full sketch plan of their proposed event, concept and a preliminary budget. This report has a standard structure – for the Olympic covering: *Motivation, concept and legacy, Political support, Financing, Venues, Accommodations, Transport, Security, General conditions*. Only the cities demonstrating their ability to host the event are admitted to the following step, this successfully short listed cities become *candidate cities*. At this stage a comprehensive proposal as to be presented in a more complete document. This bidding procedure ensures that only robust and reliable proposal could be successful to attract the event. There is, it is impossible to deny it, a political decision of the event owner when assigning the event, but the chosen bid is technically and financially complete.

After the decision of the IOC, around 7 years prior to the event, the organization of the event can be seen as a triangular contract between the organizer, the owner and the local authority (Bovy, 2008). In this context we comment the issues related to transport. Guarantees for transport cover the essential infrastructures the event needs. Again, in the case of Olympic games, these guarantees are five, representing 10% of the total number of guarantees:

- Projected capacity improvements in the airport(s),
- Planned and additional transport infrastructure projects,
- Projected fleet and rolling stocks capacity improvements,
- Delivery of *Olympic lanes*,
- Transport and traffic management command and control centre.

[19] The organizer can also be seen as the *franchisee* and in the case of Olympic games is often renamed as [Name of the host city, e.g.: London] Organizing Committee for Olympic Games (in the example, LOCOG).

Transportation issues are in this phase considered as a qualifier, it is to say that these issues carry an important role in the bid evaluation: a bid with a weak transport plan has no chance to succeed, however the uniqueness of a candidate's proposal is not obtained by its transportation planning.

The organizer is a large temporary multi functional organization that during the event can employ between three and four thousands persons. In this organization there is a department specialized on transport, it is in charge of the strategic and operational planning. The specific staff in this department exceeds one hundred persons before the event to start while during the event – in the case of the Olympic games – it might reach five or seven thousands, including volunteer staff.

To analyze the transportation requirements for the event one practical aspect is related to the distinction between the system that allows the visitors to reach the city of the event – it is to say the airports and, in some cases, the long distance railway – and to the urban transport systems that are used by the visitors to move within the city and to the precise event location.

To cope with this problems and to document the organization of the event of the owner, the organizer has to study and plan in details the following aspect related to transport:

- Definition of transport strategy and organization, as well as definition of the competent authorities.
- Analysis of the Infrastructure and the supply, covering provision and capacity.
- Analysis of the demand.
- Definition of the intended operations, covering layout and scheduling.
- Traffic management and communication
- Analysis of the airport network.

Mega events might attract several hundred thousands of visitors in one area with a limited capacity where accommodation, catering, transportation and an entire logistical organization have to be set up, these are often temporary. From transport perspective this can be done only by a strong reinforcement of public transport system. In the case of major events there is no alternative choice but public transport because for space limitations in the area there might be no space to create parking spaces and because of capacity limits of the road system. Public transport is known to be characterized by a more efficient use of space.

Bovy (2002) states that it is "often underestimated the importance of logistical and support activities of large events, it generates traffic demand which amounts to a third of spectator flows".

The author also reminds that logistical transportation requirements are also generally more demanding in terms of scheduling and reliability than spectators' transport.

2.4.3 – The impacts of a Major event on Transport systems

To understand what is the dimension of the impact of a major event on the transport systems of a city it is useful to consider a simple example. Let us say that a pavilion or an Olympic park has a capacity of 500'000 visitors on one day. One scenario could consider the participants to reach the even by car, let us say, with a generous estimation, that there are on average four persons per car, there would be 125'000 cars reaching the area. To park this amount of cars it would be needed a parking area of more than 2,5 square kilometres[20]. The feasibility of this approach can easily be understood considering that the entire Olympic park under construction in London – with very limited parking places – occupies the same area. Another aspect that can be relevant is that an average metro system in a large modern city, also called Mass Rapid Transit, has a capacity around 50'000 passengers per hour, per direction. This says that to allow visitors to reach the event area one would need 10 hours of full metro peak from one direction[21]. It goes without saying that transport systems, in the occasion of major events, are stretched to their very limit.

The amount of the generated traffic and the great effort done to cope with this extraordinary demand is reflected in the size of transport budgets for major events. Bovy (2002) affirms that the operating costs, as well as the infrastructure costs, are a major issue, in the case of Sydney it is indicative the fact that the "15 ml$ estimated transport operating cost, ended up at about twelve times higher, or about 180 ml$". And this is not an isolated case.

All these aspects suggest the need for a very complete and detailed plan, at least as a careful execution of that plan and a close monitoring. Dealing with the organization of transport for a major event two layers of the problem can be distinguished: the level of the strategic planning and the level of operational planning.

In the first level several decision are taken. Firstly, the organizer has to define the network model to be developed, even if this decision have to respect several rigidities imposed by the choice of the

[20] The result is obtained considering a space of 20 square meters per parked car, with included the lanes for the accessibility of cars.

[21] From two direction sit would be 5 hours, from three it would be less than 4 hours. In any case it is clear that size of the impact.

location of the event. Another strategic aspect to be considered is the definition of client groups so to distinguish general public, ticketed spectators, sponsors and media, logistics and workforce, accredited spectators and – especially for Olympic games – athletes and their families. These groups have different needs and requirements, therefore the transport provision directed to them shall be differentiated. Other relevant strategic aspects are the targeted public transport share among the trips directed to the events and the intended modal split.

In the second level besides the classical transport operational planning process there has to be done a distinction between the different transport services to be operated. For this purpose Bovy (2007, 2008) distinguish between three superimposed layers:

1. The permanent host city transport systems,
2. The temporary, strongly reinforced, public transport system, and
3. The temporary transport system dedicated to the event.

This distinction can be useful to analyze the organization of transport from the points of view discussed in the following paragraphs.

2.4.4 – The analysis of impacts and Transport measures

Often transport specific issues are mentioned as a marginal part of urban or economic implications of major events (Chalkley and Essex, 1999; Brunet, 2002), or as peripheral to the tourism destination management literature (Dickinson, 2004; *et al.*). The most of papers, informative studies and documents on the relationship between transport and major events provide examples and more or less detailed descriptions of one or few cases (Bovy, 2002; Controubas et al., 2004; Baohua, 2008; Zoghi et al., 2009).

A last group of sources of information about the organization of transport for events is represented by guides, sector studies or information kit. These are realized for the public administration of cities or states, mostly in the United States or in Australia.

When presenting in their paper a conceptual framework, Robbins, Dickinson and Calver (2007) affirm that “to date, the existing body of event-related research is somewhat piecemeal and a knowledge base has yet not systematically developed. Most studies conducted are descriptive, atheoretical and event-specific – doing little to advance conceptual knowledge – and have limited application beyond the event studied. Many studies are driven by the agendas of event organizers keen to justify commercial sponsorship or public founding”.

However there are a few cases that need to be expressly mentioned. The work of Bovy, a retired transport professor from Swiss Federal Institute of Technology, now still active in the analysis of Olympic transport cases and as a consultant for Major events planning for transport, has developed a complete and coherent framework of analysis used for different cases. However it can be noted that it is missing a work that summarize all this knowledge and gives a critical analysis.

Another notable exception is represented by Robbins et al. (2007). In their conceptual framework the authors group the considered aspects in three different time periods:

- "Pre-event planning" is the basis for the entire event transportation management,
- "During" the event impacts and performance are monitored and measured,
- In "Post-event" stage results and legacies might be analysed.

Robbins and his colleagues have a broad view an event of all sizes. For this reason, and for the differences in the chosen perspectives, the proposed conceptual framework – including event typology, event destination geography and the transport impact of events – is not applicable to this report.

Finally, in a recent position paper the International Association of Public Transport (UITP, 2009) gives some guidelines to transport planner for dealing with major events. In this document the authors indicate the opportunities for a winning cooperation between the event organizer and public transport operators. To manage major event, in UTIP recommendations they are particularly highlighted the advantages of a collaborative approach in order to obtain shared benefits.

The different frameworks proposed in the literature frequently include several common matters presented in the following resume.

GOVERNANCE – An important component of the organization of the transport for a major event is the constitution of a responsible authority, and at the same time the event organizer must deal directly with local public authorities (Bovy, 2002). Transport governance in "each mega event and each host city is a specific case [...] it varies tremendously from an almost public sector ad hoc authority, to tailor-made private-public partnership arrangements where the mega event organizer has an heavier role and subcontracts operations to a variety of private and public entity." In this framework, defined by the governance, the contribution on the costs and the division of the income should be clarified at a very early stage of the process (UITP, 209).

STRUCTURAL ASPECTS – The provision of sufficient capacity on specific routes is fundamental to the smooth running of major events: the infrastructure has to be developed together with a strategic plan and public transport has to be suitably designed (UITP, 2009). In this concern also the choice of the location is strategic (Robbins et al., 2007).

OPERATIONAL ASPECTS – The transport unit should develop a detailed plan and procedures to deal with transportation's challenge. Olympic lanes, practices to reduce or to allocate demand by the different groups of users and a coordinated scheduling for events and transport services are shown to be very positive for the success of the event (Bovy, 2008; Bovy, 2002).

FUNCTIONAL ASPECTS – Sydney's Olympics' case study has shown the advantages of an integrated ticketing for the event and for public transport in order to attract users to the more efficient modes (UITP, 2009). This measure – also called "free transport" – is being strengthened by a rigid parking policy that offers very few parking facilities in proximity to the central area of interest of the event and defined procedures to guarantee the access to these areas. Marketing and sales team of the event and of transport authority should closely work together (Bovy, 2002). Public communication is an important component as well and has to be used early in organizing the event.

MANAGERIAL ASPECTS – Pre-event testing is said to be vital to the training of transport staff and to the organization of the project: an important milestone and an element able to give confidence. Real time control and monitoring should analyse the performance and guarantee the satisfactory result towards all the target groups of users (Bovy, 2002).

With an integrated analysis of these five aspects of the provision of transport for major events the different approaches could be compared and evaluated.

2.4.5 – The legacy of the event

In the last one or two decades it became common to consider in the planning phase the sustainability and the long term effects of major events. The heavy use of financial, natural and human resources have imposed this urgency. The changed sensibility to these topics is reflected by the high relevance that they have in the public communication and in both the statements from event organizers and event owners. It is now common to hear about major events legacy.

Even if the concept have become common and familiar to the persons in some manner related to event organization, it remains barely applicable because of the lack of a conceptual scientific knowledge of it. This lack is explained by the fact that the organization of an event is an isolated project for an administration and, as a consequence, there is not a continuous interest for the community and to the academia to investigate this topic with a long term perspective. However it is also true that "there is less political will to measure the longer term impacts" (Robbins et al., 2007).

Both negative and positive interrelations between the event and the host transport system are not rigorously being studied. Thus impact studies tend to focus on pre-event analysis and "on the prediction of the likely positive economic and image-enhancing benefits" – that are often vague – "while there is little post-event clarification of the actual impacts that resulted" (Robbins et al., 2007). The authors especially affirm that the negative effects and the unequal distribution of benefits are less explored. With their proposal for a research agenda they support the call for an evaluation framework that can be found also in others sources.

The raise of this new issue of sustainability and the attention paid to avoid explicit waste of resources have determined a move form "excess" to a sort of "minimalism". At least it is possible to notice a strengthened emphasis on either the construction of temporary venues or the reuse of the infrastructure. In the direction of the former, for Olympic games and for International expositions can be observed this tendency to use temporary stadiums or other infrastructure, the most intuitive consequence of this for the transport of the event is the intense use of bus-based services that can later be replaced in other areas of the city. The latter is a delicate issue and it has to be understood to what extent the local communities really need the infrastructure they receive thanks to major events and if it is possible to make a good use of them. Analysing this issue Mazzeo (2008) indicates the utility of hosting several events and to coordinate – in one city or in one region – the efforts made for different events in a sequential order in time. The author refers to a "Pulsar effect" that should be able to act as a multiplier of the effects of one single event. The intent is to allow an accumulation of the benefits derived by each single event and to cast them towards the following event, hence increasing them and making a better use of them.

As it has been done with the impacts on the previous paragraph, it is possible to analyse the different legacies presented in the literature in a parallel framework.

The legacy that major event leave to the host location in terms of infrastructure and structure of the city is "to provide the city with efficient and attractive connections that could reduce congestion in central area and public spaces and a network characterized as quality urban elements" (Ceudech,

2008). This is obtained also by the construction of new urban centrality (Mazzeo, 2008). Major events are facilitators of transport system renewal: at the same time, they "create a new necessity for intervention on transport infrastructure and a momentum that makes the investments easier to be decided." (UITP, 2009)

Furthermore major events facilitate changes in the different modal shares of daily trips. Bovy (2003) states that the measures taken on the infrastructure and on the organization of the flows in occasion of major events originate innovating schemes that often last till after the event remodelling the habits of citizens. This is possible thanks to the fact that major events create a focus on the quality of the communication and information, needed in order to attract to public transport passengers that may not be familiar with it (UITP, 2009). This effort, spent in preparation of the event can leave permanent positive effects in the long term.

In addition, with a coordinated action, operational aspects are impacted by the hosting of the event. The authority and the operators experiment a special need of coordination. The quality of the operations might be improved, it has to be studied to what extent. The planning effort gives the opportunity to address operational problems and the event represents a deadline to keep in mind in order to apply new solutions and obtain the desired results. UITP (2009) affirms that "the organization of a major event constitutes an opportunity to renew the transport plan of one city and to validate it".

An important legacy related to transport management is on knowledge. The formalization of existing knowledge during the bidding and the preparation for the event and the compilation of manuals can ease a consolidation of knowledge in the industry. The collaborative environment and the possibility to have not-ordinary evaluations and observations contributes to the creation of new knowledge (Bovy, 2002). This process has two dimensions, on the one hand it is beneficial only because the internal effort that has to be spent because of the event, on the other hand it is due to an opening to the international scenario: different cases of events or the solutions adopted in other cities are studied with renewed attention, and more experts study the interested transport system and bring their contribution. Furthermore the way the different actors in transport value chain manage information might change thanks to a major event. The special effort spent is likely to have long term effects on the information directed to users, on the sharing of information within the same company or between cooperation operators. Last but not least, Caudech (2008) states that the possibility that major events and the associated opportunities are exploited relies on the respect of the distinct roles of public and private stakeholders, in this occasion is especially trained in the "ability to create a public leadership", an important element for the organization of a competitive transport system.

The long term effect on the governance and on the organization of the industry do not occupy a relevant role in existing literature, however they will be explored further.

2.4.6 – Developing a strategic perspective

A newly developed role in the literature about major events is represented by the strategic definition and evaluation of long term effects. In a recent report A. T. Kearney (2005) states that "hosts tend to treat mega-events as prestige projects that are justified (accurately or not) through a measurement of tangible benefits minus tangible costs. Countries tag on some social programs to help make their case and obtain local support, but both the benefits and the add-ons are rarely integrated into a broader national or regional strategy". This report propose a broad strategic framework for a social, environmental and sportive legacy and tries to incorporate in the analysis also intangible factors. It is stated that "hosting a mega-event is a risky proposition: financial benefits that once seemed solid can crumble if organizers don't keep a constant eye on both near- and long-term planning. But with the right strategies in place, the tangible benefits can be both significant and long-lasting." In this strategic framework transportation, as well as infrastructure and urban development, play a very important role: they are also mentioned as "*quick wins*"!

The table below (adaptation from A.T. Kearney, 2005) shows how a host city can prioritize the interventions on transportation issues considering the nature of the interested area and country.

Table 2.4 – Segmenting the goals of the event (A .T. Kearney, 2005)

Country	Transport weaknesses, growth and infrastructure
Emerging	- Poor physical infrastructure to be regenerated. - Unstable administration and legal system. - Very weak regulation scheme and blocked competition
Evolving	- Basic regulatory scheme. - Strained infrastructure by economic and demographic pressure.
Excellent	- Continuously adapting infrastructure. - Business-driven and creative competitiveness.

Moreover A.T. Kearney proposes a strategic framework that, thanks to five components, would allow the host to pursue the right initiatives and to secure the necessary founding and support, so to achieve the best possible legacy for them:

1. Social and economic development: fit the legacy program in a wider agenda.
2. Community mobilization: the quality of the planes and leadership are key to achieve the desired changes.
3. Stakeholders management: a legacy program begins with getting buy-in from all interested parties.
4. Leveraging event resources: promote problem solving and knowledge transfer.
5. Branding and sponsoring: it can also be seen as a fundraising instrument.

In addition this last contribution includes the recommendation to develop "detailed measurement systems, [so that] host cities and nations can determine whether or not they are realizing the desired benefits".

So far these are the most relevant contribution present in the literature concerning this topic. To conclude it is it can be said that there are several points still to be developed. Some of these problematic issues to be evaluated in the study of long term effects are the following:

- It is needed a rigorous evaluation framework in order to assess the real long term benefits on transport systems of hosting major events.
- The literature is focused in listing the possible benefits but there is no clear definition of what risks and drawbacks hosting a major event can generate for the urban transport systems.
- The relationship between the general framework of regulations and urban development plans and the development of transportation network still has to be explored. It appears to be rare that the decisions taken for the event are integrated in the operating framework of mobility and in its development.

It is interesting to observe that the acceleration of ongoing processes might cause speeded investment decision by local authorities that are not accompanied by the needed investigation and analysis.

3 – Methodology

In this chapter it is described the methodology adopted in the study. A major relevance in this chapter is dedicated to the first research question investigated by this work, that is to say:

To what extent and under what conditions is it possible for a city to leverage major events to improve its transport systems?

On the other hand the organization of the interviews and the methodology for the case of Milan will be presented in the specific chapter dedicated to Milan's case (see chapter 5).

To present the most relevant empirical work present so far in the research on major events and transport systems, the first paragraph compares two different approaches possible. In the second paragraph a brief example of the available information is presented. The third paragraph introduces the strategy adopted for this study and the scope chosen for the investigation. The fourth paragraph presents the adopted evaluation framework used in the assessment of the formulated hypothesis.

3.1 – Problem definition and related empirical studies

When considering the proposed research question there are several aspects that have to be considered. It is meant to investigate if the past major events, or at least some of them, have had long term effects on the transport system of the host city. In considering the results of such investigation, before responding to the posed question there are three conceptual problems to be considered:

1. How is it defined an improvement of the transport system?
2. In what time horizon shall the effects of major events be expected?
3. Given that the transport system of a host city have been improved in the considered timeframe, how is it possible to define a relation of causality between the organization of the major event and the observed change?

Considering the first problem, the improvement of a transport system has to be considered as an improvement of the performances of the same system. In the second chapter we have analysed the structure of transport industry and how can transport system be studied. With a general approach

productive and allocative efficiency can be considered as two driving principles in the evaluation of the performance of transport systems, but there are some practical complications. There is not a single indicator of the performance of a transport system – or of a group of transport systems – and different indicators might bring to different conclusions. In defining the approach, measure problems and lack of information have to be considered.

Secondly, considering the selection of the timeframe of the observation, it has to be kept in mind that – as shown in the previous chapter – the organization of a major event is a long process. From the decision of participating in the selection of the host city of the event to the same event ten years might pass. Between the event and the stabilization of the transport system in a new equilibrium – if it would be ever reached in reality – some time shall be accounted after the event transitory. In defining the timeframe to be used expectations play a key role and have to be considered: the city whom is considering the possibility of hosting an event ten years might start a process of deep renewal even before bidding for the event.

Finally, having hypothetically defined the best indicator(s) and a suitable time-horizon, having observed some effects on the transport system of the host city, to draw a conclusion it has to be identified the nature of this relationship. One should consider several scenarios, namely: Is the change in the performance due to the major event? Would the observed change have happened also despite the hosting of the event? Is it inserted in a more general trend? Meaning, are other cities living comparable changes in their transport systems? At what causes shall the eventual difference be associated?

These three aspects are only introduced here but they will be addressed in the following parts of the chapter.

Abstracting the problem, two possible approaches can be considered to investigate the proposed question: With a model-based approach one could hope to design an econometric model to study different individual cities. Alternatively, with a more specifically designed framework, one could investigate the studied problem and the hypothesis elaborated. The two approaches could be found in very close researches and are presented in the following paragraphs.

3.1.1 – Econometric approach

In a recent paper Andrew Rose from Haas School of Business at Berkeley University and Mark Spiegel from the Federal Reserve Bank of San Francisco study “The Olympic Effect” on the host

nation (Rose and Spiegel; 2009). The authors "examine the possibility that both sides of the argument [the great enthusiasm associated with the Games and the skepticism] may be right. In particular, we show that there is a large economic benefit associated with mega-events (justifying the public's enthusiasm), despite the fact that much of the requisite new infrastructure is a net cost (explaining the skepticism of economists)". The authors decide to focus their study on the effects on trade, especially on national exports. They show that "countries which have hosted the games seem to have exports some 30% higher, ceteris paribus. Other mega-events such as the World Cup also have large positive effects".

The work by Rose and Spiegel (2009) design a panel to study 96 countries with a total of 449,220 bilateral annual observations. The identified independent variable is the level of exports from one country to the other, on the specific year. Having included traditional variables to describe trade – through a rich-gravitational model –, a series of dummy is included to indicate if the observed countries have hosted or not a major event, and what type of event it was[22].

Concerning the considered timeframe this study covers a period of an average of eleven years per studied country, ranging from before the event to after it.

With the utilized specification of the model the third conceptual problem that was identified can easily be addressed. The estimation of the parameters associated to the event dummies gives the sign and the magnitude of the effect generated by the event. The default test of the significance of the same parameter gives a measure of the reliability of the result. Without ambiguity Rose and Spiegel show that major events have a positive impact on the economic activity and it cannot be rejected the assumption that there is a causal relationship between the events and the observed benefits.

The obtained results are accompanied by the following interesting considerations: "In July 2001, Beijing was awarded the right to host the Games of the XXIX Olympiad. Just two months later, China successfully concluded negotiations with the World Trade Organization, thus formalizing its commitment to trade liberalization. Nor is this a once-off coincidence. Rome was awarded the 1960 games in 1955, the same year Italy started to move towards currency convertibility, joined the UN, and, most importantly, began the Messina negotiations that lead two years later to the Treaty of Rome and the creation of the European Economic Community. The Tokyo games of 1964 coincided with Japanese entry into the IMF and the OECD. Barcelona was awarded the 1992 games in 1986, the

[22] Meaning: Olympic games (summer or winter ones), International expositions or Soccer World Championships.

same year Spain joined the EEC; the decision to award Korea the 1988 games coincided with Korea's political liberalization. The correlation extends beyond the Olympics; the 1986 World Cup was held in Mexico coincident with its trade liberalization and entry into the GATT."

3.1.2 – Case studies approach

In 2001 the International Olympic Committee (IOC) as initiated a completely new – and very ambitious – project. The Olympic Global Impacts project (OGI) aims at assessing the long term effects of the Olympic games in the hosting location[23].

The principal objectives of OGGI are:

- "to measure the overall impact of the Olympic Games;
- to assist bidding cities and future Olympic Games Organisers, through the transfer of strategic direction obtained from past and present Olympic Games,
- to identify potential legacies and thereby maximise the benefits of their Olympic Games; and
- to create a comparable benchmark across all future Olympic games". (IOC, 2006)

Presenting the project the IOC added: "OGGI is above all a dynamic management tool which allows the organizers to have an overall vision of the impact of their activities and investments made in the framework of staging the Games. Used actively, the OGGI study offers the organisers a means of understanding the effects of certain actions undertaken and to make adjustments if necessary. It is also a formidable tool to demonstrate the positive contribution of holding the Games in terms of local and regional development."

The IOC started working with a network of local universities and advisors to develop a methodological framework and select a set of measurable research indicators for the collection and analysis of data from future Olympic Games in the

- Economic,
- Social and
- Environmental spheres.

The OGGI methodology and indicators that were compiled by the IOC, and are being implemented by every future Olympic Games Organising Committee.

For every OCOG the OGI study covers a period of 11 years. The study commences when a city's official Olympic candidacy is announced by the National Olympic Committee, two years prior to when

[23] The project was initially named Olympic Games Global Impacts (OGGI) but was lately renamed OGI, thus it can be found in different sources indicated with the two names however it has remained the same in its nature ambition, and methodology.

an Olympiad is awarded to a Candidate City, and concludes two years after the staging of the Olympic Games. Throughout the 9-year time-frame, the OGGI study requires an OCOG to collect data at specified intervals and to produce four OGGI reports. That is to say:

- An Initial OGI report – where it is presented the structure of the study (prepared 6 years before the event)
- An "OGI preliminary report" (4 years before the event)
- The "OGI event report" (1 year after the event)
- To conclude it is redacted the "OGI final report" (3 years after the event).

The set of indicators used is composed by a large panel of observed measures. The structure of the work is flexible, this is due to the fact that the project is in a very initial stage and to the strong effort required in gathering and elaborating the information. They are considered general and event-specific indicators, the first group is the one that aims at observing the long term effects of the event and thus is the most relevant in the context of this study. Furthermore there is a distinction between mandatory and optional indicators. Roughly the number of indicators used by one OGI study is around one hundred of different measures.

Among these indicators only a few indicators are expressly referred to transport systems. There are two mandatory ones:

- Transport networks: it represent a breakdown of the different networks included in the transport systems of the host city and measures their size (in kilometers) along the considered timeframe. (e.g.: the length of urban roads, highways, railways, cycling and pedestrian ways).
- Public transport: represent a specific breakdown of the public transport system that measures the length of the different services offered to the passengers.

Even though this very limited number of mandatory indicators[24], some other optional ones can be focused on urban transport systems. Two examples are:

- Daily traveling distance: kilometers traveled by commuters.
- Road congestion: indicator of the flow of vehicles in the major traffic arteries of the city.

These indicators have been obtained by the preliminary OGI report prepared for Vancouver's winter Olympics (OGI-UBC, 2009).

[24] Another mandatory indicator is the Airport traffic (intended as number of arrivals), however this indicator is not included in the scope of this work because is not a part of the urban transport system. The indicator "Olympic transport impacts" is also not considered because it represents a short-term indicator.

Concerning the second problem of the timeframe of the study, it has already been said that the OGI studies aim at monitoring the selected indicators for a period of 9 years. After the study has began, however, the indicators are observed with different frequencies because of their different velocity in changes and accordingly to the availability of information.

The issue weather if the observed changes in the indicators are due to the organization of the major event in this case is considered by making a comparison with other comparable cities that were not affected by the event or other extraordinary circumstances. For example, in the study of Vancouver's winter Olympics the host is compared to other cities and provinces of Canada: "The "*before and after control impact*" (BACI) technique was used to address an important question when assessing impact: how certain can one be that any observed changes are a result of the Games, instead of a "normal" trend that would have happened anyway in the absence of the Games? The BACI method tests for differences between an impact site (e.g., Vancouver) and "control" sites before and after the event. Given the limitations of finding a "perfect" control site(s), the following sites were selected. Vancouver was compared to the Canadian cities of Calgary, Edmonton and Victoria (all are in Western Canada). For regional comparisons, we chose the Greater Toronto Area (GTA). Provincially, B.C. was compared with Alberta (and occasionally to Ontario). Canada was usually compared to the United States." (OGI-UBC, 2009).

A specific comment is needed to clarify that the project is not an open research project but an internal process and it still is not clear whether the elaborated documents – or at least the final OGI reports – will be public documents or I thy will remain for the use of the IOC. Currently no study have been completed to the end. The first report available is expected to be the study of Beijing 2008. In total, in 2007, three existing OCOGs were conducting the study: the Beijing Olympic Organising Committee (BOCOG), the Vancouver Olympic Organising Committee (VANOC) and the London Olympic Organising Committee (LOCOG). In the last three years two more studies should have been initiated for the winter games of Sochi (Russia) in 2014 and for San Paulo summer games in 2016.

The Olympic Global Impacts project is an important and ambitious project. However the fact that it is in an early stage of its development, together with its very broad and general perspective, make it impossible to answer the proposed question straightly. In the scientific debate it is relevant to consider closely the effects of major events on transport systems.

The methodology used in the OGI project represent a great improvement and an important step towards a more sustainable, effective and efficient organization of the Olympic games. However

some improvements can be integrated in its application. These are be detailed further in the final part of the chapter.

3.2 – Case studies and Evaluation framework

Given the decided approach, the study analyses three past cases, namely:

- Barcelona and the Olympic games of 1992,
- Athens and the Olympic games of 2004,
- Turin and the Winter Olympic games of 2006.

All of the three cases represent Olympic games and are located in the south of Europe. The results of the study are thus particularly related to this conditions but some more general conclusion could be drawn.

In order to make the information comparable the results from the different cases presented are ranked in a panel of indicators, thus summarized and compared in the Box Score.

3.4.1 - Indicators

The indicators considered, for a total of thirteen, are introduced here.

GENERAL GROUP

1. Governance

Starting from the discussion and the framework presented in the literature review, this indicator monitors the obtained improvements in the governance, regulation and organization of the urban transport system. The creation of a responsible authority for transport is considered as a key component of a positive change of this indicator. At the same time an increase in the number of the contracted operators, the number of operators bidding to provide transport services, the openness of the market (meaning if it includes operators originally from other regions) and the cooperation between these actors are all positive signals. On the contrary a negative level of this indicator might, for example, indicate an increase in the role of the politicians in the planning and organization of the transport system.

2. New infrastructures

The construction of a new infrastructure is regularly observed in the preparation of a major event, thus is necessary to define a qualitative metric to evaluate this dimension. Here it is considered the harmonic development of transport infrastructure with the city. That is to say the ability to realize the infrastructures needed by the city prior the event and especially to expand the city in new urban areas, to connect them with a good quality transport network. This quality is defined as corresponding to the framework presented in the part of the literature review on transport planning.

3. Capacity on existing network

This indicator measures whether if the growth of transport network is accompanied by a growth of public transport capacity. An improvement of the fleets, in terms of number of seats, and an improvement of service frequencies are summarized considering the passenger capacity per hour and per direction in the most dense transport corridors, and on average on the rest of the network.

QUALITY OF SERVICE

4. Information

The indicator monitors the effect of the introduction of new technologies to develop *Intelligent Transport Systems* and info-mobility. The investment in new or renewed control rooms, the realization of new maps and services to provide the users with better information and the use of ICT to coordinate the different operators and the eventual authority are considered to have a positive impact.

5. Frequency and flexibility

The indicator monitors the improvements of the network assessing headway reduction and especially evaluating eventual improvements on supply flexibility. That is to say the ability to steadily increase and reduce planned capacity in different phases of the day, by adapting the frequency.

6. Reliability

This indicator monitors the improvements in reliability, where reliability is mainly meant as punctuality and regularity of the service

VOLUME

7. Number of trips per year per person

A common indicator of the performances of a transport system in large cities is the number of trips per year, per person. This indicator can be considered as a 'relative' proxy of the allocative efficiency of the system, this indicates the ability of the industry/system to offer to the customers the largest possible supply.

8. Congestion

The reduction of congestion in rush hours, especially to and from the city. This indicator is measured as changes in the time to access the city or to travel from one side of it to another one.

9. Modal split

This indicator measures the changes in the modal shares, it is positive to observe a reduction of private cars' share and an increase of public transport one.

COST

10. Cost recovery

This indicator measures the change of the fare-box ratio, it has already been defined as the ratio between the revenues from tickets and the operating costs. This measure represents the ability to cover the costs and to finance operations.

11. Labor productivity

The effects on the cost of the workforce is measured by change in the ratio between the number of trips and the total workforce employed.

12. Vehicle utilization

This indicator monitors the changes in the utilization and in the occupancy of the vehicles. It is particularly critical to consider this indicator to identify resources waste especially in the urban areas developed thanks to the organization of the event.

13. Pricing schemes

The changes in the ticketing system are indicated by this measure. The unification or harmonization of the tickets for different networks is considered as a very positive change. As well as a reorganization of the prices.

3.4.2 – Evaluation scores

In the this framework, for each indicator, four different aspects are being considered; these are reflected by three different scores. First is an *effect score*, reflecting the direction of effect (a positive or negative effect) and the strength of the effect as assessed by the analysis. The second is *reliability weight*, which is a measure of reliability of the presented data. The third is *conclusivity*, which is an estimation of the level of confidence in the reported outcomes. It should be noted that the effect scores, reliability weights and the levels of conclusivity are given by indicator only and then mathematically aggregated.

The effect score scale ranges from -2 to 2, where: 2 Represents a positive effect; i.e., there is a definite change in the indicator that is most likely due to the Games. In the elaboration of the effect score two factors are considered: the impact score – measuring the direction of impact (a positive or negative impact) assessed and its strength – and the causality score. The definition of the two scores and the levels that they can assume are clarified in the following tables. To operatively calculate the effect score the impact score and the causality score are multiplied.

Table 3.1 – Methodology and scores, Impact score

Impact score	Description
3	Represents a very positive impact.
2	Represents a positive impact; i.e., ten-twenty percent points change.
1	Represents a slight positive impact; i.e., few percent points change.
0	Represents no impact.
-1	Represents a slight negative impact; i.e., few negative percent points change.
-2	Represents a negative impact; i.e., ten-twenty percent points change.
-3	Represents a very negative impact

Table 3.2 – Methodology and scores, Causality score

Causality score	Description
100%	The impact on the indicator is associated to an intervention due to the major event, meaning a decision that would not have been taken without hosting the event.
75%	The event have required an action that caused the associated impact to be made. It have facilitated the change and have generated an otherwise unlikely change or have considerably amplified the size of a needed change.
50%	The event have facilitated one change associated with the impact.
25%	There is a weak relationship between the interventions realized because of the event. and the observed impact.
0%	The impact is due to other factors external to the event and would have been observed also in absence of the event.

The reliability weights range from 20 percent to 100 percent. They reflect our assessment of the data in both quality and availability and are used in the evaluation of group of indicators and overall effect. Using reliability weights allows us to correct for overestimating impact due to imperfect data. The reliability threshold ratings are as follows:

Table 3.3 – Methodology and scores, Reliability score

Reliability score	Description
100%	Very reliable data: comes from an official source (e.g., a Statistics report) and has sufficient longitudinal data.
80%	Reliable data: official data with some issues (e.g., data from multiple sources, data for only two points in time, differing time points for indicator dimensions, etc).
60%	Somewhat reliable data: data with potential problems (some concerns with data source, or representativeness of the data in terms of indicator specification).
40%	Questionable data: inconsistencies are present in the data, and/or further investigation is pending.
20%	Unreliable data: circumstantial/descriptive data that cannot be analyzed.

One factor affecting the reliability score of the information on one indicator is also the role of the interviewed expert. The assigned value accounts for the directness of the information transmitted and for the possibility of a conflict of interest. The last element is meant to take into account that involved public officials, politicians and directors of some companies might have an interest to give a particularly positive evaluation to their results, while they might diminish the results obtained by their predecessors, their counterparties or competitors.

Conclusivity uses a binary rating and reflects whether or not we feel that the outcome/conclusion of impact can be trusted. As with the reliability weights, conclusivity addresses data issues or indicator specifications which prevent us from reaching a final conclusion about impact. A conclusivity rating of 0 (zero) means that no conclusion was reached after analyzing a particular indicator. Mathematically, a conclusivity score of 0 removes the impact score of that indicator from further aggregation. This is a conservative solution that precludes biasing the overall impact. A conclusivity rating of 1 (one) means that some conclusion is offered (i.e., we feel confident enough to offer a conclusion). It should not be interpreted as a "100 percent certainty" in that conclusion – which is impossible to reach given the methodological nature of the analysis –.

3.4.3 – Box score and conclusion

Finally, the information elaborated in the study is presented in a table like the one presented here. This table will be referred to as the Box score.

Table 3.4 – Box score example

Indicator	Impact score	Causality score	Effect Score	Reliability weight	Conclusivity	Resulting Effect
Indicator 1	i_1	c_1	$E_1 = i_1 * c_1$	R_1	C_1	$RE_1 = E_1 * R_1 * C_1$
Indicator 2	i_2	c_2	$E_2 = i_2 * c_2$	R_2	C_2	$RE_2 = E_2 * R_2 * C_2$
Indicator ...	i_k	c_k	$E_k = i_k * c_k$	R_k	C_k	$RE_k = E_k * R_k * C_k$
					Overall Result	Avg(RE)

As explained above the single score is aggregated in the calculation of a synthetic score that assesses the resulting long term effect of the major event on the urban transport system of the

specific indicator in the examined case. Different indicators of the panel are compared and aggregated to discuss the results of the study and to draw some conclusions.

As expected, to conclude, thanks to this framework it is also possible to compare different cases and to aggregate them in order to provide a deeper understanding of the investigated phenomenon and an answer to the research question investigated here.

4 – Case studies

4.1 – Barcelona

4.1.1 – The city and the event

Barcelona represents today the nucleus of a metropolitan area of almost million inhabitants. In the same city lives about a third of the population while the rest is living in the surrounding cities that are closely connected with Barcelona.

In the years between 1986 and 1991 Barcelona went through a rapid growing process – from both a an urban and economic perspective – that coincided with the election of the city to host the Summer Olympics in 1992 and the entry of Spain in the European Community. The city changed its face taking an important leap towards the new century: there was an important process of de-industrialization that brought the city to have 80% of its workers involved in tertiary activities – including services to companies, financial and insurance services, service retailers and public administration. Because of the economic growth an always more relevant part of workplaces attracted workers in the city, in the meanwhile the city has grown and more and more people decided to live in the surrounding and to travel for work.

On the effect of the games on Barcelona it has been said (Brunet, 2005) that “The impact of the city’s nomination as Olympic host city was immediate: unemployment underwent a dramatic fall, the housing market came back to life and, of course, the construction industry underwent a boom. However, one decade later, it is surprising to find that this expansive trend continues : 1993 was worse than 1992 – as it was in the entire region, and indeed in all of western Europe; however, every year since has seen new growth records on all indicators: employment, investment, income, attractiveness, etc. Not only did Barcelona react well to the Games, it succeeded in maintaining the

growth generated, on a scale never seen before." The prolonged growth, looking back from now could be also due to the financial boom in Spain, however Brunet also comments that "the average annual effect over the 1987-1993 period of Barcelona'92 was employment for some 59,328 persons. From this we can conclude that at least 88.7% of the reduction in unemployment registered in Barcelona between November 1986 and July 1992 (66,889 fewer unemployed) was due to the Games." This data support the hypothesis of a certain causal relation between the games and the positive finding.

4.1.2 – Measures and planes

Barcelona Games were outstanding for the increased Organising Committee income, investment in facilities and infrastructure, and impact. The Games continue to have an impact.

"In general terms, as an organisational model – the memory of the excellent organisational and sporting results lives on; and as a model of urban transformation;

Locally, in the present effects of the Olympic investments, in the scale of the Olympic Legacy and the far-reaching impacts of the city's improved strategic positioning.

Herein lies our interest in studying the investment in infrastructure and facilities generated by the Barcelona Games, the city's harnessing of the Olympic legacy, and the ongoing investment and urban renewal process." (Brunet, 2005)

It is useful to consider some general figures concerning the costs of the event. On the side of the organization of the event the direct cost were sustained by the Organizing Committee that in the Barcelona games took the name of COOB '92 (or, more simply, COOB). These organizational costs were equal to 1,364 billion dollars of the time – 195,6 billion pesetas – (Brunet, 2005).

The national Spanish government and city administration of Barcelona set up a joint venture, Barcelona Holding Olímpic, S.A. (HOLSA), to facilitate and coordinate the investment process. HOLSA built the main Olympic facilities , the of new road infrastructure and the Olympic Village. Given the Barcelona'92 objectives, a vast amount of construction work was required, and much more was also indirectly generated, most of the latter not being directly necessary for the holding of the Games. This is one of the aims of candidate host cities : to generate construction of as much infrastructure and facilities as possible which will serve the city in the aftermath of the event itself. Total such spending linked to the Games over the period between 1986 and 1993 amounted to 8,012 bl dollars. The details on these investments could be found in the table presented in Brunet's paper:

transportation related investments represent a share of more than 42% of the total (and more in detail 26,6% of the total refers to the Urban Transport System, according to the definition used in this study). This category represent the most relevant one, followed by 'Houses, offices and hotels', and by 'Telecommunications' while sporting facilities represent only al small part (9%).

Picture 4.1 – Investments in the interested period and the following decade (Brunet, 2005)

Accumulated values in millions of euros at 2000 rate#	1986-1992 Public and private investment related to the Olympic Games = Olympic Legacy		1992-2004 Investments in metropolitan economic infrastructure	
Coasts, recovery work and parks		673	Environmental infrastructure	930
Telecommunications and services		1375	Telecommunications (telephones and cables)	2036
Housing, offices and premises		1556	AVE and non-regional trains	1658
Hotels		1336	Extension of airport	925
Sports equipment and facilities		976	Extension of port	841
Cultural, health facilities and others		237	Electric network	589
			Road network	1502
Roads and transport		4507	Metro, urban trains, trams and buses	1394
	Total	10660	***Total***	9875

These investments were realized through a mixture of public and private funding. A share of 36.8% was promoted by the private sector, and one-third of this was funded with foreign capital. Private investment focused on Housing, Hotels and Business Centres. The high level of private investment was fostered by the expectations for the growth and improvement of the city.

Another outstanding feature of the Games was regional decentralisation: Olympic investment also went to numerous sub-host cities . Of the total investment, only 38.5% was located in Barcelona city. The immediate impact was, therefore, felt throughout the region.

The city and the metropolitan area went through a long change process. In the early 80's they took place a series of small intervention with an high impact on life quality in different areas of the city, the measures taken in that period had the goal to revaluate public spaces and the peripheral areas. (Trullén, 1998) identifies a second phase in the urban renewal, associated with the Olympic

project, between 1986 and 1992. This phase had a more relevant impact, even if it continued with the same principles setted in the *General Metropolitan Plan* (in 1979) and used previous phase, the measures that had been realized include several critical projects that were opposed by institutional obstacles such as:

- The construction of the *Rondes*,
- The opening of the city towards the sea and the requalification of the area of Poble Nou,
- The construction of an important network of collectors,
- The expansion of the airport. (Trullén, 1998)

The goals and the plans were clear, said Pasqual Maragall, "everything was written but it was not defined and it could not count on the institutional approval and financing, [the project] could continuously be aborted". In this sense Trullén identifies the causes of the success of the renewal of the city in the consensus that could be reached in the phase preceding the Olympic Games.

To support this thesis – that the organization of the Olympic Games it is useful to quote the testimonial of the director of the infrastructure division of the Organizing Committee: "As the mayors Narcís Serra and Pasqual Maragall repeatedly stated in the initial years of the candidature process, Barcelona needed a global project that would bring together a great variety of citizens' energies in a similar way, as had happened before in 1888 and 1929 for the Universal Expositions. «Any city grows out of specific platforms, in projects or «pretexts» —if we might use a supposedly negative expression— in the context of which great proposals of change are articulated», affirmed Pasqual Maragall in an interview published in the architecture and design magazine CAU shortly before the nomination of Barcelona in 1986. The first years of «balsamic» urban planning, begun in 1980, had been successful, giving priority to small scale actions, focused in public spaces —squares, gardens, streets— with the objective of strengthening the local systems of the city that had suffered from the lack of any urban initiative for many years. Narcis Serra referred to this patient and systematic labor as a «patch-up job», pointing to the need to have a global project for the city to allow it to establish more ambitious goals that could be carried out in the medium term." (Millet, 1995)

From this statements it emerges that hosting the Olympic Games was an important component of the urban renewal plan. However, as it often happens, it is difficult to distinguish a strategy that was carefully planned from a strategy developed thanks to the opportunities that materialize: "It is difficult to precise the moment of getting the idea (of hosting the games and the precise urban project) and the one of expressing it formally" (Domenech, 2006). They took place in parallel the discussion about the roads of Barcelona, the creation of the Areas of New Centrality and the location of the four Olympic areas strictly speaking, integrated in the last group. According to the architect

the decisions were driven by the areas to be developed as the centralities of the new city, then those centralities were connected between each other.

One of the most interesting aspects of the requalification of the city have been the intense renewal observed in the costal zones – in the strip between Besòs and Llobregat that could never develop – and the Diagonal area in the western part of the city. In particular in the area of Poble nou was located the Olympic village, Reorganizing the port Barceloneta became the beach of the city, the Cuitat vella was restructured and become the centre and touristic attraction, and further west – in the area of Montjuïc – it was located the Olympic stadium. Because of this accelerated growth, these areas have had a very intense development also in terms of transport infrastructure and services.

GOVERNANCE ASPECTS

In the event of the games there were involved two main actors:

- COOB '92 – Comitado Organizador de las Olympiadas de Barcelona '92 –, in the role of the Organizing Committee for the Olympic Games, and
- HOLSA, in the role of the delivery authority for constructions and investment projects. The two entities cooperated with the IOC and saw the active participation of local administration and personalities.

Concerning transportation governance, in particular, it has to be noticed that also in this case there were important changes in the years before the event. Along the 80's the organization and planning o transport services were realized by the main operators and the local administration holding the control of those operators. In 1987 the law 7/1987 of the Parliament of Catalunya created a new authority under the name EMT – *Entitat Metropolitana del Transport* – in order to provide more integrated services in the metropolitan area. This public entity was given the responsibility to organize the services and monitor the behavior of the operators in 18 municipalities that form the metropolitan area.

- Regulate and coordinate the operators,
- Approving transport infrastructure investments,
- Carry administrative service for taxis and other special services,
- Study and monitor the traffic on the streets of the urban network.

The EMT is integrated in the *Consorcio Área Metropolitana de Barcelona with two other components:* Entitad del Medio Ambiente (*EMA-EMSHTR)*and Mancomunidad de Municipios del Área Metropolitana de Barcelona (*MMAMB)*.

There are several operators that provided different services:

- Transport Metropolità de Barcelona (TMB) is the main operator, organized in two different companies that came under this common control in 1979, namely
    - *Ferrocarril Metropolità de Barcelona SA*, which controls the metro operations and
    - *Transport de Barcelona SA*, which controls the ground services (bus and tram).

  TMB is owned by the same EMT.
- Ferrocarril de la Generalitat de Catalunya (FGC) is responsible for the urban railways and is owned by the Generalitat.
- *Rodalies Renfe* (Renfe Cercanias-Barcellona) is the division of the national train operator which takes care of the suburban rail service.
- In addition to those there are around 40 other small companies that run point-to-point bus services, in particular connecting smaller cities.

This structure remained and consolidated during the years around the Olympic games. However, after some years that the governance of the industry had reached a stability – on top of EMT – in 1997 – it was created also an additional authority that can be defined as a "intra-authority consortium". In this consortium, named *Autoritat Metropolità de Transport* (ATM), participate the same EMT together with the Generalitat and the Municipality of Barcelona with respective shares of 24%, 51% and 25%.

The competencies of the ATM are:

- The planning of both the infrastructure and the services,
- The financing of public transport, it functions as a vehicle through the one local administrations provide subsidies,
- The regulation and definition of the prices on different services,
- Operative construction of mayor infrastructures and
- Communication and promotion of the entire public transport system.

In this framework the relationship between the authority and the operators is the classic one[25]: the authority defines the requirements for the commissioned services, the needed investments and the financial contribution (subsidy); the operators that obtain the concession need to fulfill those requirements.

STRUCTURAL ASPECTS

From the infrastructural perspective, as said before there were very important investments in that period. To cope with the demand for transport and the high car ownership (410 cars per 1000 inhabitants) the Ring Road and a number of substantial high-capacity radial routes were completed

[25] The only exception is Rondalies Renfe that has its agreement at a national level.

with very heavy investments within the context of the 1992 Olympics. So after that period the provision of strategic and main roads in Barcelona has been of a very high quality compared to other cities' standards.

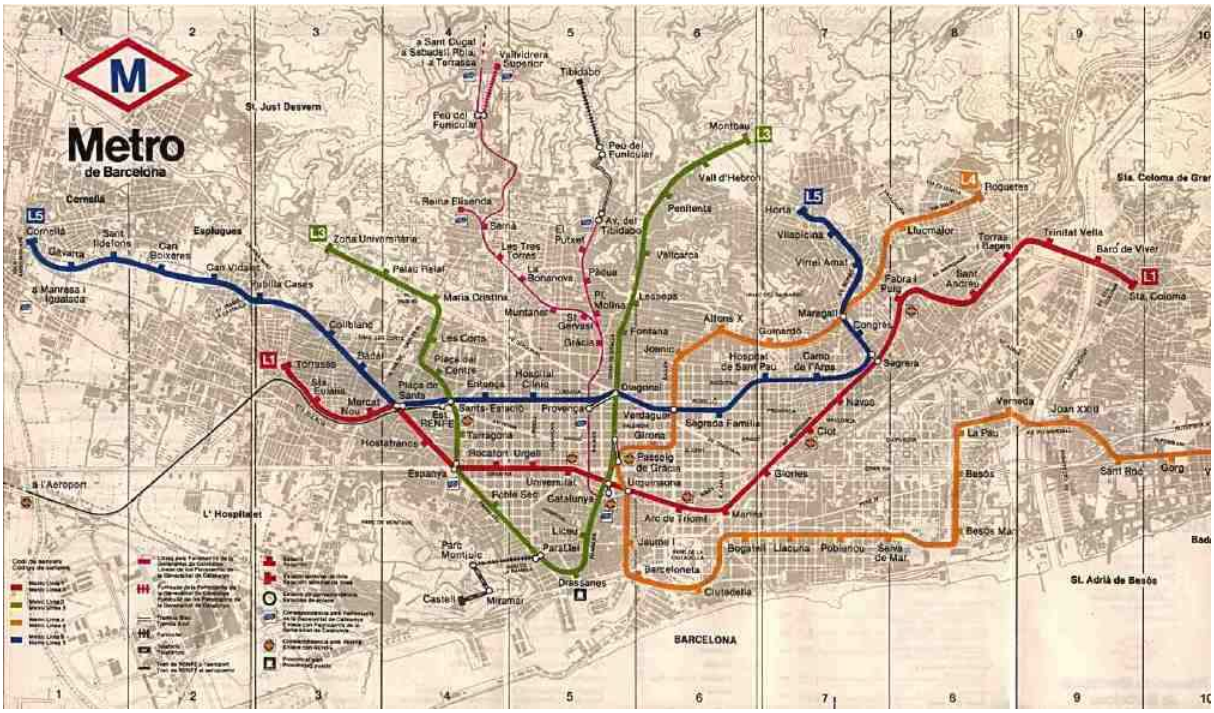
The Rondes – Ronda de Dalt, in the inner side, and Ronda de Dalt, in the costal side – in the period before the games were constructed at a very high pace as compared to the previous one, they were realized 40 kilometres of roads on the ground surface and underground. The project is vilualized in the picture below.

Picture 4.2 – Map of the Rondes and other road connections realized in pre-Olympic years.

This ring roads represented the most important single investment on which the city have concentrated its attention. "The political direction of the project that the city hoped to get off the ground was expressed with great clarity and technical precision. First of all, it was necessary to vertebrate the city, giving it a road system that would add to Barcelona's relation with other cities of the metropolitan area, and would solve the difficult east-west transit of the city, connecting it to the total urban territory with systems of regional transportation. In the same sense it was necessary to define a new rail transportation system, like the metro, which would tie together the main cities of metropolitan Barcelona." (Millet, 1995)

The changes in the metro system were slow. Up until 1986 there were four metro lines in the city and those lines were managed by Ferrocarril Metropolitano Barcelona SA, after that year it begun the expansion project under the name of TMB (TMB, web). The situation of the metro at that time is represented in Picture 4.3 showing an old map of the city metro.

Picture 4.3 – The old map of the city (1986)



The most recent changes – dated 1983 – were in the east end of the red line (L1) and in the west end of the blue line (L5), as well as the east end of the yellow line (L4) dated 1985. The expansion of the metro network continued with the completion of the red line (L1) with three different inaugurations: in 1987, 1989 and 1992, a few months before the start of the games.

In the meanwhile it was started another important project: the construction of the purple line (L2) that could see the light only in 1995 – connecting Parallel and Sagrada Familia, and then reaching La Pau two years later. The project of this construction was originally conceived decades before – in the 50's – but the idea of realizing it disappeared completely since 1970 and was put aside since Barcelona was assigned the Olympic Games. Only at that time it was possible to find the financial resources and an agreement on the executive project, thus the work restarted. Even if the project was expected to be finalized by the start of the games it had to be delayed (Sanz, 2010).

These important infrastructures were necessary for the city but it is important to quote the position of the Director of Infrastructure division in the COOB: "It would not be an overstatement to say that without the Olympic Games, the maritime coastline of Poble Nou would have evolved very little and the quantity of public funds necessary to initiate the operation would still be under negotiation. The Diagonal Area, in my opinion, would not have evolved at all, since it was not a priority urban problem, and Vall d'Hebron, where all the land was already municipal, certain projects

for local improvement could have been developed. Most seriously, however, would have been that the ring roads would still be left to do: in the previous twenty years only four kilometres of ring roads had been built, while in the four years before the Olympics 40 kilometres were built. If we were to look at a complete list of projects in the Olympic catalogue and their budgets beside them, one might make a real hypothesis of what it would have meant to not have made such investments." (Millet, 1995)

Picture 4.4 – Map of the metro ten years later (1997).

OPERATIONAL ASPECTS

With the preparation of the Olympic games there had to be developed different new planes.

On the one hand, the definition of the Olympic transport plan was an intense activity. This planning activity and organization was jointly coordinated among TMB and the COOB '92. They were involved hundreds of busses that were rented with a full contract – including the driver – from other cities of Spain (Madrid, Saragoza, Valencia …) for the duration of the event. The organization of these resources with its complexity left a know-how that remained as a legacy for the city within the several local transport professionals involved.

On the other hand a valuable effort was spent in that period to reshape the transport plan for bus operations within the city centre. With the opening of Rondes a large share of traffic was shifted towards the ring road enabling better operations within the city.

In the interview with Jordi Singla it emerged that along time the peripheral network did not evolve in an organic way, on the contrary when a new quarter of the city was developed one or few lines were added to the bus metro to manage directly local demand. The resulting system is a complex network that is not very simple to understand for occasional users – that are not familiar with the services in one area – which have to spend a big effort to understand the connections.

FUNCTIONAL ASPECTS

Given that the event dates back to the beginning of the nineties, and given the technological development in that period there were innovations in the ticketing system from a technological and from an organizational perspective. Even in presence of the newly created competent authority there were no relevant improvement in the integration of the ticketing among the different operators. The only measure important to be mentioned is that Barcelona games were one of the first one events that included free public transport passes within the Olympic ticket (Bovy, 2001).

Concerning the use of information technology they have been realized very important investments in the pre Olympic years. Both the municipality and TMB were active in this sense to develop the control centres which are still operating nowadays. On 14 May 1984, five months after the Preliminary Project for the Candidature was approved, the Barcelona City Council announced a competition for the design and preparation of the project for information technology and telecommunications requirements for the 1992 Olympic Games. This study, which was finally entitled BIT'92 (Barcelona Informàtica i Telecomunicacions 1992), pursued two objectives: first, to meet the requirements of the IOC, that is, to show that Barcelona was technically capable of organising the Olympic Games and, at the same time, to draft plans suited to the future needs of the city and the surrounding area. BIT'92 set out to plan the technological needs of the Barcelona Games in the fields of information technology, telecommunications and broadcasting. It analysed information requirements, which it divided into six groups: business management, event organisation, communication and information, services, support and security. The functions, main specifications and most important inputs and outputs for each system were described. Most of the proposals contained in BIT'92 went beyond the basic requirements imposed by the Games; for this reason the

drafting of the study had to provide the necessary impulse to enable public bodies and companies to modernise information technology in a short period of time. (COOB ’92, 1992)

Picture 4.5 – Barcelona City Council's traffic control room realized for the Games.

MANAGERIAL ASPECTS

Also in the case of Barcelona the Olympic Games have shown to be an occasion to improve managerial capabilities and to increase local and international trust. Barcelona’s case was the first of an Olympic see required to perform a trial simulation prior to the event, (Bovy, 2000), however the city and the local administration have shown their ability to cope with large scale challenges. This component is a valuable part of the Olympic legacy, to say this with more prestigious words: “we are not speaking of a stadium more or a stadium less, but the overall activity of the city, the expectation generated by the Olympic project, and the renewed trust in the city’s own capacity for administration and transformation. Without the Olympic Project, Barcelona would not have changed in this respect. (Millet, 1995)

“The confidence of Barcelonans in the 1992 Games was almost unanimous, and many visitors were surprised by the unanimity and passion the city showed for the Olympic Games. The projects in the streets were so numerous that it was thought that the situation had to lead to improvements. Surveys showed this tendency both before the Olympic Games and afterwards. In 1987, 61.4% put the urban changes in first place among the perceived benefits the Games would bring the city. 81.7% believed that there was enough time to develop the Olympic project, while 38.0% expected that it would result in benefits. A half a year before the Olympic Games, this optimism not only remained

intact but had even increased. 87% of all Catalans believed that Barcelona would come across well during the Olympic Games. 55% felt that the construction projects would be finished on time, although 48% were afraid that the city would become apathetic in 1993. Immediately after the Olympic Games the average mark given of those questioned was 8.78 out of 10. 23% had attended some Olympic event. The King of Spain, the Mayor of Barcelona, and the President of the International Olympic Committee received the highest evaluations of all leaders." (Ferran, 1995)

Just as occurred with the Games, there have been very important projects going on around the city and coordinated with other events. One first example of this is the Forum organized in 2004 which will serve as a framework for large-scale urban planning projects, several of which would be difficult to undertake and complete under normal conditions. Also in this case funding was largely public but with an important private component associated.

These approach mobilized important investments set out in three phases:

- 1986-1992, as the initial effort associated with the Olympic games.
- 1992-2004, in which other large-scale projects such as the AVE (high-speed train), work on the Besòs and Llobregat rivers, and the extensions to the port and airport were added to the direct investment in the Forum 2004.
- 2004-2010, in which investment still pending from earlier projects, and a major public transport initiative covering Barcelona and its hinterland, will be added to direct investment in the Poblenou area.

In this approach it can be identified the multi-event strategy that has been identified as the approach oriented to leverage a "pulsar effect", indeed Barcelona went further than organizing smaller event for reuse scopes, but organized other events and – in this way – kept a constant attention on the urban infrastructure investments, especially in the developing areas.

4.1.3 – Impact study

In this section it is presented the result of the analysis using available data and the information obtained through the three interviews.

GENERAL ASPECTS

1. GOVERNANCE

The creation of the new authority, competent on the organization of the transport system had two positive consequences: it increased the consciousness of the importance to tackle transport problems at a metropolitan level and represented a first step towards the idea of organizing a networked system of transport services.

Besides these positive evaluations the modifications of the governance and the introduction of the metropolitan entities failed to increase the cooperation among the different levels of the local administration: the new entities were seen as an almost unilateral emanation of the municipality of Barcelona and thus were evaluated negatively by the regional administrative centre (*La Generalitat*). Also because of the political rivalry between the two administration – due to the long predominance of the left wing party in the municipality and of the right wing one in the Generalitat – the change introduced in 1986 did not last for a long time. Soon after that year the Generalitat realized that the Entitat Metropolità del Transport had some weaknesses that were an obstacle the full benefits that such an authority could bring. Indeed, as confirmed by the interviews, the EMT could be seen as a political harm throw which the municipality could control the transport system in the city and its surroundings.

In the beginning of the nineties there were some papers (Matas, 1991) that highlighted the need to develop a regional perspective, missing with the EMT. This new regional phase was pursued by the Generalitat through the preparation of the *Pla Intermodal de Transport* (PIT), completed in 1995. One of the decision following this plan was to create the Consortium-Authority ATM in 1997.

Table 4.6 – Roles in the governance of transport
(Source: Direcio General de Transport, Generalitat).

	Competence of the Service	Hierarchical dependency	Financing
FMB (Metro)	Generalitat	EMT	Generalitat
Transport de Barcelona (BUS)	EMT*	EMT	EMT
FGC	Generalitat	Generalitat	Generalitat
Renfe Cercanias	MOPT	MOPT	MOPT
Other minor operators	Generalitat / EMT	Generalitat / EMT	Generalitat / EMT

* The competence of the bus service is delegated to EMT from the participant municipalities.

Note: MOPT, *Ministerio de Obras Publicas y Transporte*.

It can be concluded, thanks to the opinion of the interviewees and to the critics to the initial solution, that the system created in 1986 was not able to solve the problem of the cooperation of the local administration: the Generalitat – the decision maker for the financial issues – was not involved in the EMT, thus the same EMT resulted unable to plan the transport services. This problem was solved only later, thanks to the creation of the ATM. It have to be noticed however that the loss of that opportunity of cooperation in 1986 is the cause of the complicated governance that remained to the city.

In terms of the evaluation that is being done in this work it is clear that, even if the creation of the EMT was a positive change – somewhat related to the event as it can be deduced by the timing – it obtained a slightly positive result.

2. NEW INFRASTRUCTURE

"The key «piece» of the Olympic project was, however, the road infrastructure operation and, more concretely the construction of the Ring Roads (Ronda de Dalt, and Ronda Litoral), which ring the entire city. The Olympic Games were the excuse to guarantee that the circuit was completed before 1992, as they were necessary for the effective connection of the four Olympic areas. The importance of the Ring Roads as a vertebrating element in the expanding urban nature of Barcelona was unarguable from the opening day of the Games onward." (Millet, 1995)

Other important infrastructure changes were observed in the metro system, these improvements are considerably related to the event: to support this thesis it is noticed that the impact of the development of the metro was really concentrated in the Olympic areas. In the 10 years prior to the games 24 new metro station were realized: 10 in the area Besos-Poblenou, 10 in the area of Llobregat and 4 in the area of the north/north-west of the mountains around the city. In the 5 years after the games 13 stations of the Purple line (L2) were finalized: 4 stations in the event area and 9 in the centre.

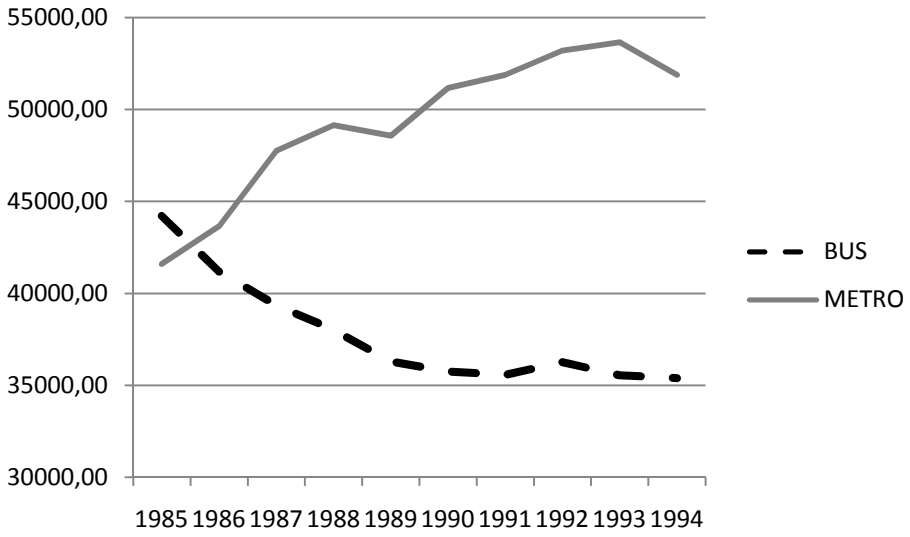
One weakness pointed out was a lack of inter-connections between the different modes of public transport with some Metro and railway lines passing near to each other, but failing to connect, or requiring long walks between platforms (e.g. Placa de Catalunya).

3. CAPACITY ON EXISTING NETWORK

It is curious to observe that, as they were opening new stations and as the operations of the metro system grew, the vehicle km performed by the surface transport system – represented by the

trams of transport de Barcelona SA – reduced in the same proportion (or little less, to be more precise). So that the total vehicle km performed grew very little. Besides this information, represented in Graph 6.1, it is hidden a growth in capacity due to the different capacities of the two vehicles.

Graph 6.1 – Vehicle km offered on the systems operated by TMB
(Source: data from the operator).



In particular it can be noticed that, in the meanwhile, in the northern area of Barcelona there has been a strong increase of a new operator that in 1989 increased the number of bus lines operated by 50%, increasing the vehicle kilometers by approximately 30%.

To conclude, the strength of the substitution effect described above caused a reduction in the vehicle-km supply, this decrease in supply by 20% was more than compensated by the increase in supply of the metro system – estimated as equal to 24% -, on top of this it can be considered as a positive impact also the growth of suburban supply provided by other operators. Since the adjustment of the existing bus network followed the changes of the metro network this impact can be considered to have the same causal ratio as the impact on the metro system.

QUALITY RELATED PERFORMANCES

4. INFORMATION

Given the period of the game it can be understood that the possibility to introduce pervasive Intelligent Transport Systems solutions was limited. From an external perspective, the cooperation

among operators through the Entitat Metropolita del Transport enabled a more clear map and communication.

From a perspective internal to the transport operators, the development of the Centre for Traffic Control represented an important improvement, even if limited as compared to the other cases considered in the following paragraphs.

5. FREQUENCY AND FLEXIBILITY

The gradual mode evolution from busses to metro determined an improvement in the frequencies of the services, this was particularly true if considering the local effects. Mr. Pelaez, from TMB, in the interview did not provide any quantitative estimation of this phenomenon, which he associates to the games.

6. RELIABILITY

From the official data and from the interviews it was found no improvement in this indicator thus its impact was set to zero.

VOLUME RELATED PERFORMANCES

7. NUMBER OF TRIPS PER YEAR PER PERSON

This main indicator highlights a slight improvement for the transport system since the number of trips per year per person in the metropolitan area have increased 5% from 184,3 to 193,5 between 1985 and 1994. As shown in the table below the total number of trips increased and this is a positive result, however to understand better the evolution it is important to consider the evolution of the habits of the citizens, which will be analyzed more in detail in the indicator number 6.

Even if the general results for the metropolitan area on the volume and on the nature of trips were modest, the results obtained thanks to the investments that aimed to improve collective transport modes were very positive for the first ring, *primera corona*, surrounding the city of Barcelona (Villalante, 1995).

Table 4.7 – Calculation of the number of trips per year per inhabitants

(Sources: data from operator and from INE – Insituto Nacional de Estadistica.)

Passengers Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
BUS	243,40	221,10	217,80	214,80	202,10	202,90	199,90	204,70	197,70	201,70
METRO	253,70	258,30	261,70	264,80	264,40	280,10	280,90	277,18	265,10	253,90
FGC	17,3	17,7	18	18,2	19,1	19,8	20,6	22,2	22,8	23,4
RENFE	0	0	40,2	41,3	42,6	53,4	54,16	55,8	56,9	58,2
TOTAL	**514,40**	**497,10**	**537,70**	**539,10**	**528,20**	**556,20**	**555,56**	**559,88**	**542,50**	**537,20**
Inhabitants ('000)	2791,20	2791,20	2797,21	2822,45	2831,73	2834,29	2755,41	2749,85	2768,89	2775,78
Tips per year per inhabitant	**184,29**	**178,10**	**192,23**	**191,00**	**186,53**	**196,24**	**201,63**	**203,61**	**195,93**	**193,53**

One comment that can be done on this data is that only between ’89 and ’94 the number of passengers using the suburban railways operated by FCG and Renfe have grown considerably.

The general increase in the number of trips per year per inhabitant however is considered to be due to the Olympic games. To support this thesis we can see that the increase was particularly concentrated in the years of the event when the positive change as compared to the initial value was of the 10%, after the event this was partially reabsorbed so that the final change has been approximately of the 5% of the initial value. The fact that there is a somewhat causal relationship between the improvement is indeed supported by the presence of this transitory phenomenon and by the statements of the interviewees. However this impact failed to leave a lasting change but was partially lost.

8. CONGESTION

On the one hand, thanks to the infrastructural intervention, traffic in central streets decreased by around 7.5% – remaining static after 1995 (CFIT, 2001).

On the other hand, A few years after the opening of the ring roads car traffic grew and there were new congestion problems: traffic faced a growth of 2-4% per annum on the key bypass and approach routes to the city. (CFIT, 2001) Traffic growth and the social and environmental impacts of congestion become high-profile topics for political debate in Barcelona around the year 2000; thus investment has moved away from extensive provision of additional highway capacity and now is concentrated in tackling congestion, air quality and noise. Data from municipal surveys show that congestion and pollution are top of citizens' concerns and public policy is moving towards maximising the efficiency of the existing network through traffic management, transport telematics and encouraging car drivers to shift mode. Only after this stage there was an important investment on technologies to provide information to drivers on the roads. This later investments include the Rondes traffic control system, linking cameras, data collection stations and VMS of differing types to inform drivers, display the enforced speed limit and re-route drivers where necessary.

To conclude, the opening of the Rondes has had a positive effect on the traffic circulation within the city by reducing congestion in the inner city and by increase public transport share within the city (Interview with Mr. Pelaez). Generally speaking, however, it is worth to notice that, across the whole metropolitan area, distance travelled by car increased by 25% between 1990 and 2000 (CFIT, 2001). As a consequences of this Villalante (Villalante, 1995) states that it has increased the number of people that need to take a faster transport mode and cannot reach work walking any more.

9. MODAL SPLIT

One study from Manel Villalante – Director of transport services at the Municipality of Barcelona – analyses the changes in the habits of the inhabitants (Villalante, 1995):

- The share of the trips made by private car[26] that have as origin or destination the inner city have grown from 25% to more than 40%.
- The share of the trips made by public transport that have as origin or destination the inner city have grown less, only by 11%.

Table 4.8 – Modal split statistics (Source: Clusa, 1995)

Àmbit	Transport col·lectiu			Transport individual			Altres		
	1986	1991	Variació 1986-1991	1986	1991	Variació 1986-1991	1986	1991	Variació 1986-1991
Barcelona	39,5	41,1	11,6	22,7	26,6	25,6	37,8	32,3	–8,7
Resta àrea metropolitana	23,8	27,7	34,1	22,4	30,6	57,6	53,7	41,7	–10,4
Total àrea metropolitana	32,5	34,9	18,9	22,6	28,5	39,8	44,9	36,6	–9,6
Resta Regió Metropolitana	12,2	15,2	48,7	31,4	43,0	64,0	56,4	41,8	–11,2
Total Regió Metropolitana	26,9	29,2	22,6	25,0	32,7	48,2	48,1	38,2	–10,1
Resta Catalunya	11,7	12,5	17,5	32,9	42,9	43,6	55,4	44,6	–11,3
TOTAL Catalunya	22,3	24,2	21,8	27,4	35,7	46,5	50,3	40,1	–10,5

This overall change is due to the fact that as the city and the metropolitan area grew it increased the need for faster modes and walking and cycling suffered. This problematic aspect is also shown in the last column of the table above shown. The consequence of this changes was that among the motorized trips the share of private car has grown from 47% to 53,6% in the five years preceding the games (Villalante, 1995).

It appears that this changes were to happen in any case: the city was going to face a growth that would include an increase in car ownership and utilization. With the growth of the city probably this

[26] Indicated in the table on the group of clolumns *Transport individual*, in the row indicating the urban area of the city of Barcelona (also referred to as *Primera Corona*)

was going to happen in any case but in a longer time frame, thus the hypothesis of a weak causal relation holds.

COST RELATED PERFORMANCES

10. COST RECOVERY RATIO

Given the important changes in the structure of the transport system we could expect changes in the efficiency of the system. Before the event in the early 80's the operators were facing serious financial problems and their level of debt was increasing considerably (interview to Jordi Singla). In this circumstances it was spent an additional effort to improve the system and one could worry about the economical performance of the service, however in the ten years studied the cost recovery ratio increased of more than five percent points. The table below shows the final results of the elaboration of the data provided by Transport Metropolita de Barcelona, the first operator in the metropolitan Barcelona, which alone carries 85% of the passengers.

Table 4.9 – Cost recovery ratio for TMB services (Source: elaboration from TMB data)

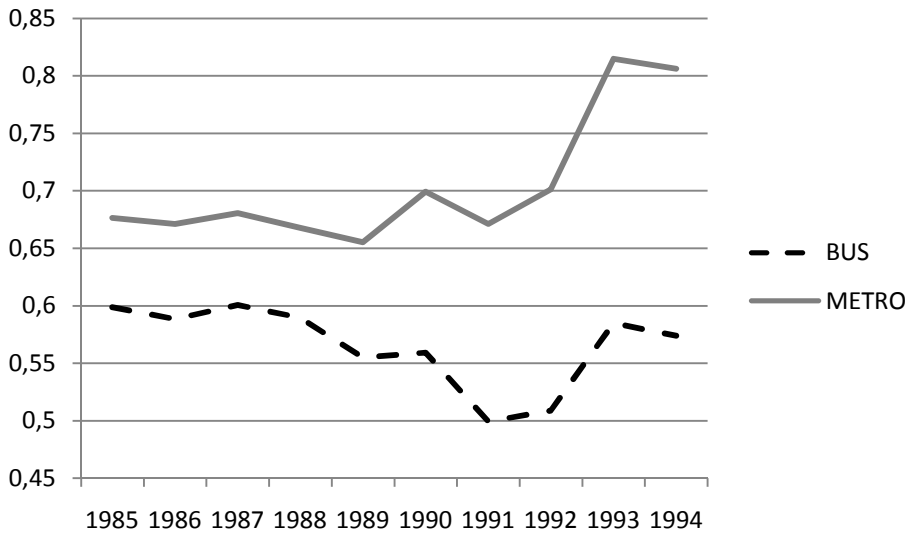
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
BUS	59,9%	58,8%	60,1%	59,0%	55,5%	55,9%	49,9%	50,9%	58,5%	57,4%
METRO	67,6%	67,1%	68,1%	66,8%	65,5%	69,9%	67,1%	70,1%	81,5%	80,6%
TOTAL	**63,3%**	**62,7%**	**63,9%**	**62,8%**	**60,6%**	**63,1%**	**58,4%**	**60,2%**	**69,8%**	**68,6%**

The elaboration of this indicator in this case of Barcelona has gone one detail further: the operator provided the detailed information for the two networks: surface services, mainly busses, and metro services. These analysis shows an important difference between the two groups. The efficiency of the bus operations have remained more or less unchanged, after one reduction of a maximum of 10% in the four years between 1989 and 1992 it rose again to the original level. The cost recovery ratio of the metro system on the other hand has oscillated in proximity of the event, without decreasing of more than 2%, and but later have increased up to 80% - meaning a 13% increase in the considered period.

This trend is very positive and supports the idea of the phenomenon to be depending from the Olympics. For the case of the metro operations the revenues have grown more than the costs for

additional services did. This was accompanied by a more or less stable situation for the bus operations.

Graph 4.2 – Cost recovery ratio for the two networks. (Source: elaboration from TMB data)



11. LABOR PRODUCTIVITY

Labor productivity have changed in a coherent way for the two networks[27]. For the surface operations the number of employers was reduced with the reduction of the vehicle kilometers and the productivity indicator has increased but not significantly. For the metro operations the productivity indicator has increased approximately of 43%. This remarkable result allows that the productivity of the entire TMB workforce grew by 26%.

Table 4.10 – Elaboration of labor productivity (Source: elaboration from TMB data)

Year		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Vehicle km ('000)	BUS	44216	41185	39354	38023	36302	35752	35560	36254	35551	35392
	METRO	41595	43648	47749	49154	48571	51172	51882	53210	53654	51880
	TOTAL	**85811**	**84833**	**87103**	**87178**	**84873**	**86925**	**87442**	**89465**	**89205**	**87271**
Employers	BUS	3560	3308	3512	3388	3234	3054	2910	2710	2610	2694
	METRO	2769	2688	2626	2593	2571	2634	2510	2506	2440	2418
	TOTAL	**6329**	**5996**	**6138**	**5981**	**5805**	**5688**	**5420**	**5216**	**5050**	**5112**
Labor producti-vity	BUS	12,4	12,5	11,2	11,2	11,2	11,7	12,2	13,4	13,6	13,1
	METRO	15,0	16,2	18,2	19,0	18,9	19,4	20,7	21,2	22,0	21,5
	TOTAL	**13,6**	**14,1**	**14,2**	**14,6**	**14,6**	**15,3**	**16,1**	**17,2**	**17,7**	**17,1**
Cost of HR (% of total)	BUS	0,7324	0,7671	0,7779	0,7713	0,7876	0,765	0,66	0,6347	0,6657	0,6462
	METRO	0,6088	0,6061	0,5905	0,5702	0,5804	0,5795	0,4706	0,4729	0,5353	0,5426
	TOTAL	**0,6734**	**0,6866**	**0,6812**	**0,6643**	**0,6758**	**0,6651**	**0,5619**	**0,5524**	**0,5979**	**0,5934**

[27] Given the fact that old data was required for this analysis it was not possible to find the number of drivers employed but it was used the total number of employers for the analysis.

One comment would be that in the considered period the share of the cost of labor among total costs have decreased in both the service operated by TMB.

The causes of this improvement could be found in the improvement of the circulation of vehicles and in the development of more knowledge thanks to the competencies that were acquired in that period, thus we find a consistent causal relationship between the event t and this effect.

12. VEHICLE UTILIZATION

The other important component of the cost is the rolling stock: the utilization of this resources have increased only for the metro service, while the bus service did not evidence any relevant change in this concern. To cope with the changes in the general supply – on the one hand – the number of metro vehicles have increased progressively, and with it their utilization. On the other hand the number of busses have decreased and the number of kilometers run by those busses have remained substantially unchanged.

Table 4.11 – Elaboration of vehicle productivity (Source: elaboration from TMB data)

Year		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Vehicle km ('000)	BUS	44216	41185	39354	38023	36302	35752	35560	36254	35551	35392
	METRO	41595	43648	47749	49154	48571	51172	51882	53210	53654	51880
	TOTAL	**85811**	**84833**	**87103**	**87178**	**84873**	**86925**	**87442**	**89465**	**89205**	**87271**
Vehicles	BUS	926	875	832	801	801	805	835	792	780	780
	METRO	416	440	474	484	478	483	483	488	488	488
	TOTAL	**1342**	**1315**	**1306**	**1285**	**1279**	**1288**	**1318**	**1280**	**1268**	**1268**
Vehicles Utilization	BUS	47,75	47,07	47,30	47,47	45,32	44,41	42,59	45,78	45,58	45,37
	METRO	99,99	99,20	100,74	101,56	101,61	105,95	107,42	109,04	109,95	106,31
	TOTAL	**63,94**	**64,51**	**66,69**	**67,84**	**66,36**	**67,49**	**66,34**	**69,89**	**70,35**	**68,83**

The overall picture of the costs is coherent and significantly positive. Even if it is small in size as compared to the above measure it is possible to relate this to the newly acquired competencies in the period of the games.

13. PRICE SCHEME

In the period of the games there were no relevant changes in this sense: there was not any integration of the fares under the EMT. The ticketing system remained unchanged but the – initially low – fares were increased in that period. Furthermore, it is possible to observe one curious fat for the main operator, which allowed the unexpected improvement in the cost recovery ratio: the

revenue per carried passenger had doubled for both the services going from approximately 16 to 32 euro cents in both cases.

Ultimately, the consequence of the increase in the revenue per passenger, on one side, was that – associated with an increase of the passengers – this translated in a strong improvement of the cost recovery ratio of the metro operations. On the contrary, for the bus operations – where there was a reduction of the number of passengers – the increase of the revenue per passenger compensated the changes in demand resulting in a constant cost recovery ratio.

To conclude it has to be said that the integration of the ticketing of the different services was implemented only in 2001 after the constitution of ATM.

4.1.4. – Box score and evaluation

To summarize what has been found, the box score below shows that the legacy of the Olympic games was relevant for the transport system of Barcelona.

Table 4.12 – Barcelona's case box score

Indicator	Impact score	Causality score	Effect score	Reliability weight	Conclusivity	Resulting Effect
GENERAL						**1,44**
Governance	2	0,75	1,5	100%	1	1,50
New infrastructures	3	0,75	2,25	100%	1	2,25
Capacity on existing network	1	0,75	0,75	75%	1	0,56
QUALITY OF SERVICE						**0,45**
Information	1	0,75	0,75	80%	1	0,60
Frequency and flexibility	2	0,75	1,5	20%	1	0,30
Reliability	1	N/A	0	N/A	0	0,00
VOLUME						**0,13**
Number of trips per year per person	1	0,5	0,5	100%	1	0,50
Congestion	1	0,5	0,5	40%	1	0,20
Modal split	-1	0,5	-0,5	60%	1	-0,30
COST						**1,50**
Cost recovery	1	0,75	0,75	100%	1	0,75
Labor productivity	3	0,75	2,25	100%	1	2,25
Vehicle utilization	2	0,75	1,5	100%	1	1,50
Pricing schemes	2	0,75	1,5	100%	1	1,50
Overall Result						**0,88**

In those years there were many important changes, not only in the transport system but in the life of the city, which is often taken as the strongest urban revolution due to the Olympic games.

It is only after the stabilization of the transport system after the games that the weaknesses of the public transport system were clearly addressed and tackled:

- It was decided to realize an Intermodal Plan for Transport (*Pla intermodal de Transport*) that was developed between 1994 and 1995 with the goal to pursue a stronger integration of the different modal networks and an integration in the ticketing system.
- It was decided to proceed with the metropolitan approach and to create the Consortium authority for public transport (ATM) a few years later in 1997.

This measures were soon followed by the introduction of the integrated fare and the introduction of ITS solutions.

4.2 – Athens

4.2.1 – The city and the event

Greece has a concentrated urban structure, with Athens – its capital- encompassing some 50% of the country's urban population, exhibiting a concentration of private and public social and economic activities. Greek land policy characterized by a weak urban planning and control mechanism, allowed intensive use of land and construction both inside and outside town boundaries, enhancing the role of illegal construction as the basic mechanism of urban development. This situation is deteriorated by the negligible public expenditure on urban infrastructure and the subordination of urban policy to the priorities of social policies. Athens 2004 Olympic projects also comprised the regeneration of waterfront areas such as the Faliron Marina, Piraeus city and Hraklion seaside, in order to host competition venues and improve the city's image. (Dimopoulou, 2009)

It is widely accepted in Greece that EU funds and the mechanisms that were established to support their use, have contributed to a great extent to the transformation of Greece into a modern European state and to the entry of the country into the Euro-zone. Moreover, EU funds have contributed decisively to build the appropriate level of infrastructure to support the successful organization of the 2004 Olympic Games in Athens. The Olympic Games was a unique opportunity for Greece to upgrade the quality of life and a strong motive for the restructuring of the Athens region.

While employment grew most considerably in construction and touristic industry (Tziralis et al., 2006) the whole metropolitan area took advantage of the opportunity for "fast" urban changes, based on specific legislative measures and rapid decision making processes. Thus one of the studies of the organization of this event stated:

> *"The size of the Olympic event and the activities needed for the preparation and hosting of the Games are of a scale able to act as a catalyst for urban redevelopment, enabling changes which might normally take several decades to complete."* (Tziralis et al., 2006)

4.2.2 – Measures and planes

The source for the raw data used for extracting the results referred to this subsection is a paper from Tziralis and others (Tziralis et al., 2006) that elaborated information from the General Accounting Office of Greece. The total expenditure of the Olympic Games of Athens 2004, both

operating and capital, regarding the Olympic, as long as the context, activities was finally equal to 11,27 billion €.

- Only the 20.1% of this cost was covered by private funding,
- all the rest being public subsidy (79,9%).

According to the OGI classification, the total amount of expenditure could be decomposed as follows.

- Capital expenditure on context activities was equal to 6.025 billion €, namely 53.4% of the total amount,
- Operating expenditure on context activities was 0,62 billion €.

Regarding the Olympic activities,

- Capital expenditure finally total to 2,248 billion € and
- Operating expenditure to 2,382 billion €.

In addition, their catalyst effect, expressed as the ratio of expenditure on context activities divided by expenditure on Olympic activities, came finally up to 1,44. The role of the public sector was of crucial importance, as public share covered 95.6% of the expenditures on context activities.

Greece was nominated to organise the 2004 Olympic Games in 1997. A seven-year period was considered to be long enough for the execution of the ambitious preparation programme. Several delays during the first period of the preparation programme resulted in continuous interventions by the International Olympic Committee. It is certain that several consequences were result of all those delays:

- firstly, there was the escalation in costs due to the direct commission of the various projects to construction companies. The whole procedure led to the provision of no discount by the contractors,
- secondly, the delay caused negative publicity for the upcoming Olympics. (Deffner and Zografos, 2007)

However the final result was satisfactory.

Back then, there was a general priority in Greek policies towards the radical upgrade of the Athens' transportation system. This policies was situated at the core of the national *Operational Programme 'Railways, Airports, Public Transport'* (3rd Community Support Framework for Greece 2000-2006) which comprises four main categories of interventions, which correspond to railways, public transport, airports and road safety. Among the goals of this program we can read:

- Improvement of the railway network's interconnection with other modes of transport by promoting combined transport, in particular at ports, airports and other transit centres for goods and passengers in the urban centres of Athens and Thessaloniki.
- Improvement of the services provided by the entire transport system of Athens by developing a modern tramway and modernizing the existing public transport system (buses, trolley buses and electric railway)
- Placing the citizen/commuter (rather than the vehicle) at the epicentre of policy and the organization of public transport.
- Decongestion of the road network and improvement of the quality of the urban environment, because of the shift away from private to public means of transport.
- Decongestion of the road network and protection of the environment by increasing the relative share of railways in the carriage of goods and passengers. Ensuring the interoperability of transport means within the framework of the policy announced for the development of combined transport in urban areas.
- Improvement of the safety and upgrading of the operating systems, with systems for remote management, signaling coordination and the monitoring of trains, platforms and stations with the modernization of the Operation Control Centre.

In addition to those it is defined the modernization of the OASA Group of Companies by renewing the fleet of vehicles, building new depots, upgrading the stations on the Athens-Piraeus Electric Railways (ISAP) line and modernizing the Train Control Centre. The aim of the project is the overall improvement of urban public transport services and the interconnectivity of fixed route and bus networks.

Before going in depth in the analysis of Athens' case it is worth to quote Dimopoulou's comment on the legacy of these games: "The activities needed for the preparation and hosting of the Olympic Games are in a scale able to act as a catalyst for urban redevelopment, enabling changes which might normally take several decades to complete. The Athens 2004 Olympic Games have been considered for Greece, as an opportunity to overcome urban and environmental problems for the greater metropolitan area and for the other host cities: Thessaloniki, Patras, Volos and Heraklion. The Olympics served as the major or minor cause for improvements in urban planning and development. In the totality of the Olympic cities and particularly in Athens, a wide revitalization program has been carried out." (Dimopoulou, 2009)

GOVERNANCE ASPECTS

Athens Urban Transport Organization (OASA) is the consortium of public transport operators since 1993. At that time it was constituted putting under the public control all transit services in the urban area. In 1998 the Public Transport Act set the legal framework for public transport operation. OASA S.A. became the responsible authority for the planning, co-ordination and control of all public transport modes in the greater Athens area (thermal buses, trolley buses, metro).
The operators that it coordinates are:

ETHEL S.A.: "The company of thermal buses", founded in 1994 by Athens Urban Transport Organisation (OASA S.A.). The company is a Legal Entity of Private Law and belongs to the public sector. The mission of ETHEL is the implementation of urban transport services with thermal buses in the Metropolitan area of Athens. It operates 310 bus lines that cover the capital in its entirety representing the main operator.

The renovation plan of the ETHEL fleet was funded primarily by the 1998 - 2005 investment programs. The renovation had an 8 year timescale and included the purchase of 1,443 new buses, of which 744 are diesel -powered Euro II, 283 Euro III and 416 were natural gas powered. This purchase was co-funded by the 2nd and 3rd Community Support Framework and the Program of public Investment.

ETHEL owns and operates a fleet of 2'099 buses on a network of 16.000 routes, which represents 98.6 of all scheduled routes. This percentage is considered very high, given the constant deterioration of traffic conditions, as well as the continued decrease of the buses' average speed.

ILPAP S.A.: ATHENS-PIRAEUS TROLLEY BUSES was founded by the Law 768/1970. The company belongs to the public sector and OASA is the only shareholder of it. It operates 22 lines that serve primarily the Athens and Piraeus city centers.

ISAP S.A. (ATHENS-PIRAEUS ELECTRIC RAILWAYS or EFSE): Is the company that operates the metro line 1 and suburban trains, a 133 years old operator with a total length of the network is 25.6 km.

ATTIKO METPO OPERATION COMPANY S.A. (AMEL): Is a listed company and partly owned by Athens Municipality that since 2001 operates on a central network of 27,3 km and additionally extend the service on the suburban railway for other 21,2 km.

TRAM S.A.: Is the operator that since 2004 operates the two tram lines in the city of Athens.

TRAINOSE S.A.: Is an additional Suburban Railway Company established in 2005, as a subsidiary of OSE S.A. (Organization of Greek Railways) but became independent of the OSE Group in 2009. It is a state owned company operates the national rail network as well as a Cargo service.

The Public Transport Act disposed that OASA can enter into business contracts agreements with the operators which will include mainly the terms and rules for accomplishing the business plan targets of the EFSE and the indices for critical economic ratios, such as the cost for the provision of the services, productivity, personnel utilization, quality of the service provided etc. According to the recent Law 3297/2004 the above companies have been placed in the financial and coordinative supervision of OASA.

STRUCTURAL ASPECTS

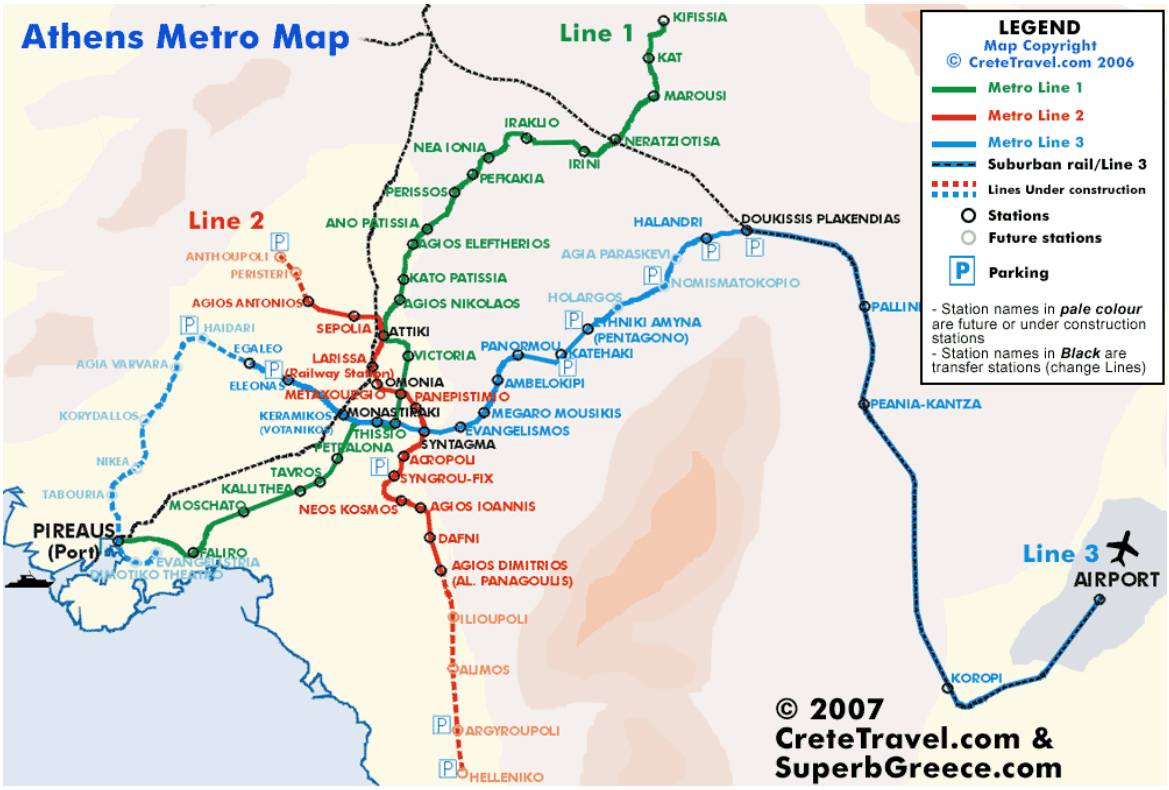
"During the organization phase of the Games, a substantial recreation of the public transport networks was carried out in the city of Athens. At the beginning of this ambitious program in 1996, an obsolete metro was the only railway system in the Attica region, while the use of buses or private cars was almost unaffordable, as the average duration of stationary traffic was 6 hours per day. After all the often belated and repeatedly over budgeted works, a rather new Athens public transport system, described right below, was ready for serving both the Games and the citizens of Athens." (Tziralis et al., 2006)

The general infrastructure improvement activity consists of the re-engineering of the transportation system . The improved infrastructures are a legacy of the event and show at the same time an underlying perspective, to put Athens on the map as a major metropolitan area. These projects are briefly presented here.

SUB-URBAN TRAINS: A major transportation system was partly developed in the pre-Olympic period. Athens' expansion in the surrounding rural areas is expected to be explosive when the whole system is completed. In terms of spatial transformation and the expansion of the metropolitan boundaries, the suburban railways system is going to play the key role. The part of the suburban railway which was completed due to the organisation of the Olympics connects the central Athens station to the *"Eleftherios Venizelos"* airport. Its route is almost parallel to the extension of one of the routes of the Athens metro system.

METRO: the Athens metro system has greatly expanded in the 4 years before the event with the operation of two additional metro lines – line 2 and 3 – that complement the operation of line 1. As shown in the map, these lines were eater extended so to reach a broader base of inhabitants and to create interchange opportunity with the suburban railway.

Picture 4.6 – Athens' metro and Suburban rail map in 2006.



TRAM: The light railway of Athens, was actually the only project which was clearly defined as Olympic. Its completion was finalised only a few days before the opening ceremony of the Games. The project's development was very fast, as it was the only project that was so delayed. Its route changed several times for various reasons, mainly technical ones. In the meanwhile, the objection and the protests of residents from areas along the route of the light railway were causing further delays to the completion of the project. The routes of the tram served all those Olympic visitors who wanted to visit the coastal Olympic facilities.

ATTIKI ODOS RING ROAD: The construction of the ring road was almost completed a few months before the Olympics. Its completion, reassured the efficient transportation of the athletes and the rest of the Olympic family, from the Olympic village to a significant number of Olympic facilities, such

as the pole of the Olympic Centre in Maroussi. “Attiki Odos” can be characterised as a major project which actualizes the spreading of urban development in the area of Mesogeia and the rest of the west Attica. “Attiki Odos” is a major means of the transformation between the plethora of second home coastal settlements on the western side of Attica into new Athenian suburbs. It seems that “Attiki Odos” is the key factor for the spatial organisation of the extended metropolitan area.

AIRPORT: Furthermore, the creation of the new international airport helped the whole country to reposition itself in the context of tourist destinations. Eleftherios Venizelos Airport plays a significant role in the reformation of the urban development in the Athens greater area.

Picture 4.7 – Road construction and intervention on Athens’ map (Source: Coutrouba, 2009)

It is certain that Olympic Games have changed the function of Athens as a metropolitan system. The addition of a transportation system such as the "tram", a project which was characterised as Olympic, reshaped the urban morphology of the Athens metropolitan area. Various other projects were accelerated due to the impending organisation of the Olympics. There was a general priority in Greek policies towards the radical upgrade of the Athens’ transportation system (Deffner and Zografos, 2007).

OPERATIONAL ASPECTS

In occasion of the games they were taken different operational measures which could be grouped in two families, namely: bus-related and rail-related measures.

The bus network had to face extraordinary operating conditions and thus it was necessary large effort in the *ad hoc* planning activity. In order to achieve the most efficient public transport management, it was carried out a detailed re-planning of the bus lines, based on data and proposals provided by the Urban transport authority (OASA). Such re-planning included Olympic express lines, enhancement of frequencies serving Olympic venues, extension of the operations up to 24h of service. In the developed network there were 26 lines connecting Olympic locations with the city centre, with park and ride facilities and with the railway or the metro network via the expressly created Olympic lanes. After the event 4 of these lanes were kept as dedicated right of way to public transport operations, for a total of approximately 40 km (Bovy, 2004).

The rail network had to face some specific improvements due to the games. The capacity of metro line 1 had to be increased from 17'000 passengers per hour and direction to 26'000, meaning almost a 50% increase that was realized by improving the signaling system, substituting the rolling stock and extending the length of the platforms in several stations. The other networks were used to connect Olympic venues with the city centre and the sea front as well as with the airport, increasing reach and capacity (Coutrouba et al., 2003).

The organization of extraordinary transport provision for the Olympic family was performed by ATHOC – the Organizing Committee – that managed approximately 1'500 busses, 3'000 cars and 5 depots.

FUNCTIONAL ASPECTS

An high level of cooperation and sharing of systems had been required to the involved agencies. Before the event communication was seen as a critical lever to achieve the required level of Olympic transport arrangements, this could also "encourage the community to be actively involved in the delivery of successful transport" (Coutrouba et al., 2003). This communication measures included a heavy use of Travel Demand Management – a traditional method used to reduce the overall traffic demand, particularly at peak times – in order to encourage target groups to modify their transport behavior or to leave the city for the event period. This was divided in the *pre game time*, that aimed to inform inhabitants of the changes and measures that were to occur, and in the *game time*, that aimed to encourage a certain behavior by inhabitants –. Moreover Coutrouba – Transport manager within ATHOC – stated that the games aimed "to raise public awareness around transport issues, and provide a base for future improvements towards sustainable transport".

As mentioned above, in the circumstances of the games, the Athenians moved away from their city (partly as a result of governmental initiation), while only a few visitors came during the first days of the Games. That is why the city appeared to be abandoned. Due to major security issues, cutting edge technology equipment was bought from abroad, ensnaring the country's political system in various post-Olympic discussions. It seemed that the organisation of the 2004 Olympic Games was not as easy as the "Barcelona model" had made it appear. (Deffner and Zografos, 2007)

As in the case of Barcelona, one of the important permanent measures have been the constitution of the Traffic Monitoring Command and Control (TMCC) which would allow the control of 1100 signalised intersections, 204 cameras and 24 variable message signs – to provide the travelers with necessary information – (Bovy, 2004).

A final measure to be mentioned in this group was the re-qualification of the historic centre of the city. The programme for the unification of the city's archaeological sites was another project accelerated due to the Olympics, and it was the one which created the biggest pedestrian zone in Europe. The majority of the area at the foot of the Acropolis rock is now totally pedestrianised, assuring a decent setting for the city's heritage. The whole project was completed in time for the Olympics in an effort to revitalise the city's centre, which was largely abandoned by its residents, who had moved to the suburbs. (Deffner and Zografos, 2007)

MANAGERIAL ASPECTS

In order to manage the complexities of the event the team that organized the transport realized a considerable effort in the preparation of the event period by developing a specific procedure that included:

- A Transport Demand Analysis program based on the data of the events and on the adjusted matrix of Origin-Destination of the trips.
- A set of traffic management measures that allowed a shift from passive traffic management to an active one; this was possible thanks to Traffic Management Centre realized for the occasion with the joint control of the traffic light system, the traffic surveillance system, the variable message management system and the traffic sensor system (Coutrouba et al., 2003).
- Related traffic management measures that were implemented were the Traffic Control Zones, the Parking Control Zones and the Olympic Lanes with exclusive right of way for Olympic vehicles.

To coordinate all of this it was created an Emergency Traffic Unity in order to cope with special situations.

Among the operators there was the need during the games to keep very high standards and this pressure – as it was stated by MST, in one of the interviews – caused some changes in the activities of the same operators. The interviewee said that it was the first time the transport system and its professionals faced such a challenge and this left a legacy in the management of current and extraordinary issues.

It has to be noticed that Athens games were the first games to benefit of the Transfer of Knowledge[28] that was experimented here after Sidney's 2000 Games: Athens transportation organizers could observe closely the previous games and were facilitated by the Olympic Committee that expressly developed a program that aimed at transferring the knowledge in the management of transport and the event. Also the two interviewees the transfer in terms of Know-how of demand management and transport communications was a precious contribution, which could, however, develop further.

4.2.3 – Impact study

GENERAL ASPECTS

1. GOVERNANCE

In the years prior to the event there have been very important changes in the governance of Athens' transport system. To summarize the effects of the Law 3297/2004 and the other measures taken it can be said that:

- OASA became responsible of the planning of the service and thus represents the focal point for the coordination among the operators,
- OASA was assigned the additional task to monitor and report transport services in the city of Athens, taking the role of "Transport observatory",
- Three new operators were created to manage different services, creating a potential competition for the market.

Beside these aspects what was missing – and is still missing – in the new governance is the comprehensive approach for the entire metropolitan area: "A Metropolitan Transport Authority is not yet in place, in order to manage and coordinate public transport, road infrastructure and

[28] Often referred to as TOK within the IOC context.

parking" (Coutrouba, 2009). The same Ms Coutrouba identifies a persisting problem in the fact that public transport companies are still state-owned.

The overall evaluation of these measures is positive given that their direct consequences were an increase in transparency in and in the coordination of the operators. While the first one couldn't be argued, the second aspect is more controversial. On the one hand, MRH states that with the current number of operators it is difficult to coordinate their services in terms of scheduling and quality of service. On the other hand MST states that from her point of view the new governance and cooperation among the operators was the most important "soft" legacy from the event. It is possible to find in these contrasting perspectives a different approach to the governance which can be conducted to the two alternative models presented in chapter 2: the model of an integrated transit agency and the one of a transport authority. To conclude it is possible to say that besides unarguable improvements the tendency to implement EU directives can be considered as a positive impact.

This impact is easily related to the event considering that the law was approved right in the months prior to it and considering the opinion of one of the interviewees. According to MST the direct consequences of this was the fact that in the Olympic games this new governance found a positive equilibrium fostering the spirit to work together and more in order to deliver better transport.

2. NEW INFRASTRUCTURE

The projects realize d in terms of infrastructure were very important. The new highways, the new metro line, the suburban railway and the tram represented a real upgrade in Athens transport infrastructure. These were the key legacy from the event as confirmed by the interview to MRH. These infrastructural investments were developed long time before the event but never realized; when Athens was assigned the Olympic games they gained the final approval and financing thanks to the European funds for developing areas within the Union.

It can be thus said that the legacy in infrastructural terms have been considerable in Athens' case, so that one comment during the interview was that the reasons of the current financial situation could be also found in the massive capital expenditures done for these infrastructures.

3. CAPACITY ON EXISTING NETWORK

The capacity of the existing network was increased because the substitution effect between metro and busses was accompanied by a reorganization of the bus network. The characteristics of this reorganization were:

- An expansion of the bus by 2,5% up to 180 km and increase supply by 5% of vehicle-kilometers (Coutrouba,2009),
- The creation of bus corridors using the Olympic lanes that were dedicated to public transport with a permanent effect (Interview to MST),
- The organization of a network of feeder lines for bus corridors or for other fast modes (Interview to MST),
- Thanks to this reorganization new suburban areas were served.

This enhancement – as the interviewee defines it – was a permanent change that was done in the event period and was associated with the new infrastructures realized closely to the event.

QUALITY RELATED PERFORMANCES

4. INFORMATION

The performances related to the use and provision of information to users presented a slight positive change. The major legacy in this concern was the Centre for Traffic Monitoring Command and Control (TMCC) which would allow the real time control – TETRA – and communication with all transport operators (Coutrouba, 2009). In this TMCC Centre cooperate OASA with Athens' police. Furthermore, it was already mentioned above the importance of "Transport Observatory" function that was assigned to OASA. Besides these measures it was done a limited use of ITS solutions for passenger information.

The interviews support the thesis that the these changes were made possible thanks to the Olympic games. MRH stats that, thanks to the investments and to the extraordinary level of complexity faced in those circumstances, it was possible to evolve from a "passive traffic management" to an "active" one, realized thanks to new policies and procedures. To conclude, according to both the interviewees the TMCC Centre represented an important legacy of the event.

5. FREQUENCY AND FLEXIBILITY

The interview to MST has helped to examine the improvements that concerned the frequency and the flexibility of the services:

- There was an expansion of express lines that, thanks to the isolation from congestions and the support of the TMCC Centrs, reached a 21-23 km average speed
- It was increased the frequency of the bus lines serving the city centre,
- It was started a 24 hour service in three bus / trolleybus lines representing a first part of the network during night service.

6. RELIABILITY

The increase in reliability was limited, according to the interviewees, but supported by the enhancement of the bus lanes and by an improve in the operational competences. The precise plan that was executed without major problems during the games, after this extraordinary period, implied only slight improvements.

However bus lanes are still limited in length and enforcement is difficult: cameras and crane-trucks to remove parked cars and obstacles helped in this sense to protect public transport operations by external noise derived from car traffic. Besides all the efforts, the habits of the citizens didn't change permanently (interview with MRH) and violations spurred once again after the games.

VOLUME RELATED PERFORMANCES

7. NUMBER OF TRIPS PER YEAR PER PERSON

In the years between 2001 and 2006 the number of trips done by public transport increased by almost 9%, from 697 to 758 millions. Data from the previous five years was not made available by OASA and, however, it is not clear the evolution of the number of inhabitants, thus the evaluation if this indicator couldn't be completely reliable since it is based only on qualitative statements from the interviewees.

Indeed MST confirms that the growth of the number of trips is due to an increase in the number of trips per inhabitants. Possible causes of this positive change were the investments in infrastructure and traffic management measures, as well as the enhancement of the network described above.

8. CONGESTION

Also in Athens' case it was confirmed the fact that in the long term there is little or none impact on the congestion through infrastructural investments. The road network, even after the Olympic Transport Projects was still challenged with congestion and low speeds (Coutrouba, 2009).

9. MODAL SPLIT

To support the result in the indicator that measures the number of trips per year per person it can be observed that there was an improvement in the modal split. The new infrastructure made PT more appealing to both short trip passengers and commuters. Metro ridership increased by 16% and the share of public transport grew by 6% between 1996 and 2006, reaching – on a general average –

43% of the total trips (Coutrouba, 2009). This impact was confirmed and explained by MST with the arguments already presented in the analysis of the indicator number 7.

COST RELATED PERFORMANCES

10. COST RECOVERY RATIO

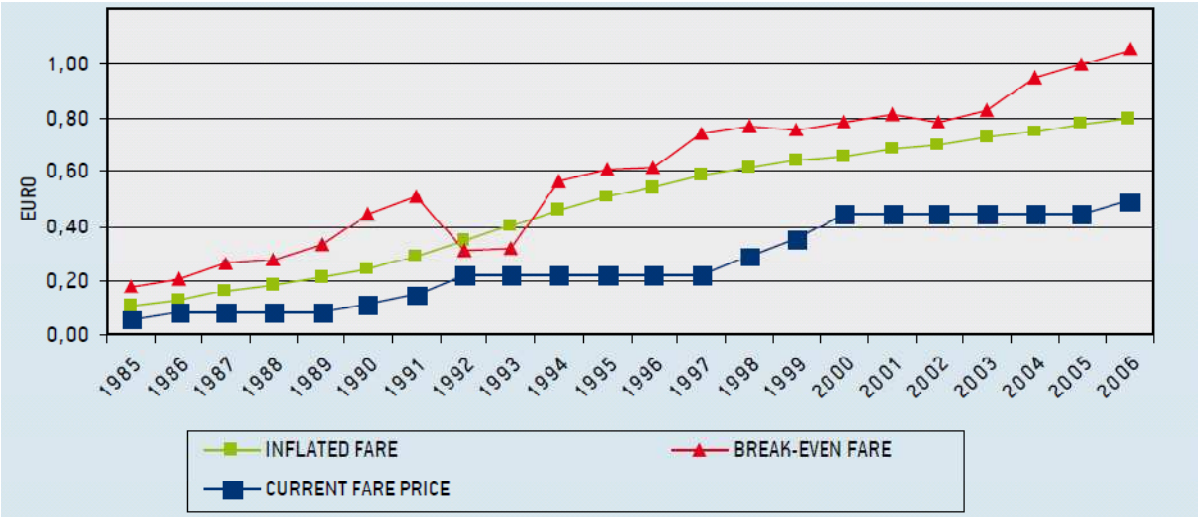
The primary performance of cost shows a very positive improvement with an increase of more than 8 percent points, the cost recovery ratio elaborated from the data published by the transport authority and presented in table 4.13 has gone from 33,6% of 1996 to 41,8% of 2006.

Table 4.13 – Athens cost recovery ratio (Source: Personal elaborations from OASA's reports)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Revenues from fares	88	99	119	131	151	208	212	224	240	239	264
Operating expenses	262	292	291	306	341	396	408	459	566	584	632
Cost recovery ratio	33,6%	34,0%	40,9%	42,8%	44,3%	52,5%	51,9%	48,8%	42,4%	40,9%	41,8%

The causes of this can be found in a steady increase in the revenues as of 2001, followed by a steady increase in the costs in 2004. The first change can be explained by an increase it he prices which is shown in the graph 4.3. In this chart OASA showed the evolution of the nominal fare (Inflated fare), the real fare (current fare) and the break-even fare – defined as the ratio between total operating expenses and the number of trips – from 1985 to 2006. It is possible to see clearly that between 2000 and 2001 the real price has doubled thanks to corrections to the fare significantly larger than the inflation.

Graph 4.3 – OASA's Fare chart (Source: OASA, 2006)



11. LABOR PRODUCTIVITY

Without the provision of the vehicle kilometers production from the operators it was not possible to calculate the value of this indicator.

12. VEHICLE UTILIZATION

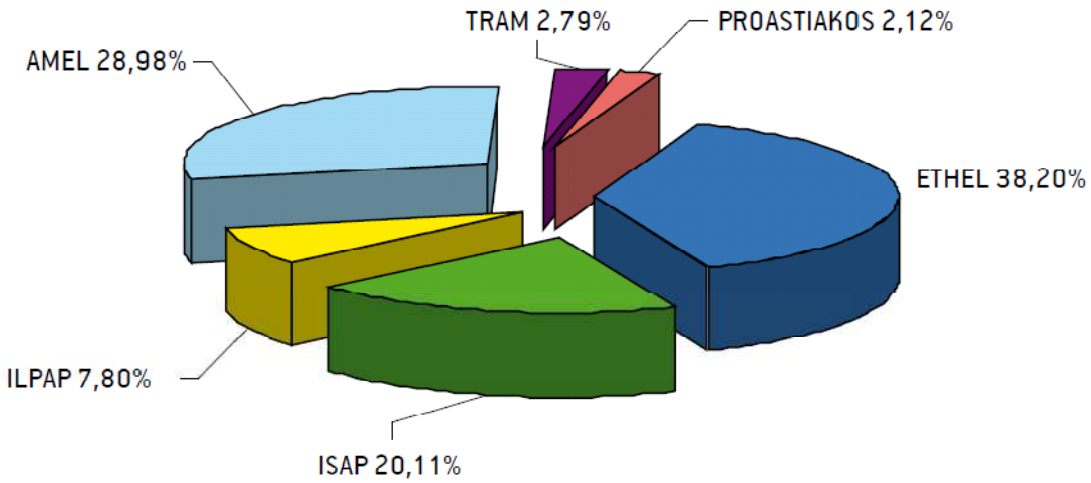
Without the provision of the vehicle kilometers production from the operators it was not possible to calculate the value of this indicator. However it can be said that there were no inefficiencies in the utilization of new fleet (Coutrouba, 2009).

13. PRICE SCHEME

The major changes concerning pricing scheme were two: The introduction of an integrated free-transfer ticket for 90 minutes for all urban transport modes and the increase in the level of fares (Coutrouba, 2009).

To conclude the group regarding the costs, considering that there are not other reliable explanations of the increase of the cost recovery ratio, the decision to adjust a particularly low fare can be considered to be a key determinant of the improvement. In this concern MST states that, while the integrated tariff was an older project, the fare adjustment had been possible thanks to the important investments and interventions associated with the games: this expectations and circumstances made the increase acceptable for citizens.

Picture 4.8 – Contribution of operators to the revenues of OASA as of 2006 (OASA, 2006)



One last comment could be done considering the origination of revenues from the different operators coordinated by OASA. Picture 4.8 shows that the shares are comparable and, especially when compared to the previous years, show that the new fare scheme – together with the new governance – are contributing to the creation of a pool of potentially competitive operators.

4.2.4. – Box score and evaluation

One final comment on this case could be that this chosen approach in order to foster the development – being based mainly on the issue of public debt – was very expensive and symptomatic of the growth of Greece in the last decade, which helped the preparation of the dramatic crisis of this current year. Beside this, it is not the purpose of this study to evaluate the financial decisions of the Greek government.

Table 4.14 – Ahens's case box score

Indicator	Impact score	Causality score	Effect Score	Reliability weight	Conclusivity	Resulting Effect
GENERAL						**1,38**
Governance	2	1	2	80%	1	1,60
New infrastructures	3	0,75	2,25	100%	1	2,25
Capacity on existing network	2	0,75	1,5	20%	1	0,30
QUALITY OF SERVICE						**0,60**
Information	1	0,75	0,75	80%	1	0,60
Frequency and flexibility	2	0,75	1,5	80%	1	1,20
Reliability	0	N/A	0	N/A	0	0,00
VOLUME						**0,35**
Number of trips per year per person	2	0,75	1,5	40%	1	0,60
Congestion	0	N/A	0	60%	1	0,00
Modal split	1	0,75	0,75	60%	1	0,45
COST						**1,50**
Cost recovery	2	0,75	1,5	80%	1	1,20
Labor productivity	N/A	N/A	0	N/A	0	0,00
Vehicle utilization	N/A	N/A	0	N/A	0	0,00
Pricing schemes	3	0,75	2,25	80%	1	1,80
					Overall Result	**0,96**

4.3 – Turin

4.3.1 – The city and the event

the city of Turin is the capital city of the Piedemont Region (Piemonte) in northern Italy. The city dates its origin in the roman times around two thousand years ago and grew along the centuries. Since the 1703 was the capital of the Savoia's Kingdom and after the unification of Italy it has been the capital of the new nation for four years.

Turin is known worldwide as Italy's car manufacturing capital, indissolubly connected with FIAT, which has given Turin its well known image of a "one company town" but the city has been changing a lot in the last decade.

The idea of hosting the Olympic Games came in the context of the development of the first Strategic plan for the city and the metropolitan area. These work started in 1998 and in the same year the city prepared and presented its dossier in order to bid for hosting the event (Guala, 2008). The goal was to "accelerate a process of transformation of the city which had already started, and to promote tourism, both in Turin and in the Olympic valleys." (Bondonio and Campaniello, 2006)

4.3.2 – Measures and planes

In general terms it can be said that Torino's Olympic games can be qualified as expensive games (Bondonio and Campaniello, 2006): the total cost of TOROC – the Organizing committee – were USD 1,33 billion and the total investment of Agenzia Struttura Torino 2006 were USD 2,19 billion, among them the total of transport investment was USD 1,008 billion – equal to the 46% of the entire investments. In addition they should be considered other investments realized in the period before and after the games. These very high investments were also accompanied by two recurring problems: delays in construction works and variance of the forecasted costs. Bondonio and Campaniello describe the second problem with these words: "The cost variance is rather high, evidenced by the fact that actual costs increased by 53% with respect to the budget. The discrepancy was obvious even during the transition from the feasibility stage to the preliminary study, which revealed the initial problems with planning".

It is absolutely evident that participation by private investors was not so significant in paying for the infrastructures, the share of private source funds among the entire investments was approximately 6% (Bondonio and Campaniello, 2006). The attempt to attract more private investors did not have the result that was hoped for at the beginning of the process. The important opportunity to spread a new mentality, more open to change and optimistic about the future amongst private operators, seems to have been lost.

The preparation of the event has been developed closely by some planes closely interconnected, in chronological order:

- The General Plan for Urban Traffic (PGTU) of 2000.
- The Plan for Urban Transport (PUT) of 2001.
- The Regional Plan of Transport (PRT) of 2004.

The first two planes have been developed in parallel during more than 2 years and represent the main source of information of the intentions of the public administration regarding transportation issues.

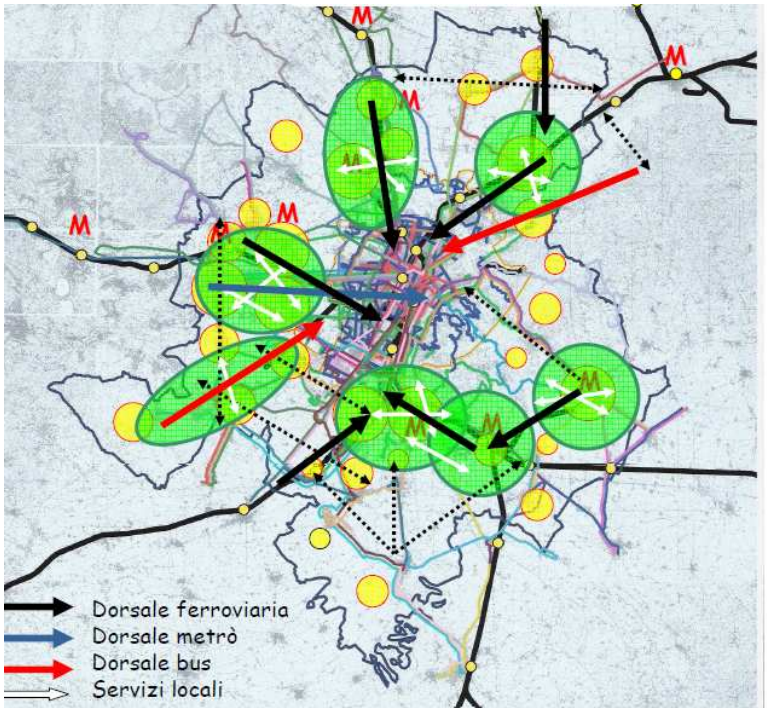
The PUT 2001 defines a hierarchy for the components of the transport system of three levels:

1) Urban railway system and metro
2) Strength corridors (served by bus, trams and other systems in support)
3) Road connections that complete the network in the city.

From the picture 4.9 it is possible to see also that the planning activity tried to identify a clear network structure by defining the important nodes of the city and differentiating the services that connect the nodes between themselves and with the city centre.

One aspect that has to be identified is that the urban development of the city has been successfully directed towards the new expansion area. Thanks to the concentration in the area of Lingotto of many of the new venues and facilities – among which the Olympic village – and thanks to the realization of good transport services that connect the new area with the city the requalification of this area can be considered to be successful. From a transport perspective, in this area the capacity have increased considerably and this better service is being used by the citizens who usually go to or live in the area.

Picture 4.9 –Urban network architecture (Source: ATM, 2005)



GOVERNANCE ASPECTS

For the organization of the Olympic Games the Organizing Committee of the Olympic Games (OCOG) was given the name TOROC (Torino Olympic Committee), it was participated by the municipality of Turin, the Region, the Italian Government and the IOC. To support the preparation of the event and to realize the numerous infrastructure investment it was created the company named Agenzia Torino 2006: a public body with the dual function of acting as general contractor, and responsibility for the timely completion of the planned works.

Taking a specific look at public transport, unitil 2002 the services were operated by three main operators worth to be mentioned:

- ATM (Azienda Torinese per la Mobilità S.p.a): the main operator, covering about 90% of the revenues, owned and controlled by Turin municipality.
- SATTI (Società Auto Trasporti Torinese Intercomunali S.p.a): the operator covering the remaining share of the market with its bus services that connected Turin City with the municipalities in the surroundings. This operator was owned by the regional administration of Piemonte and the province of Turin.

- Trenitalia: the national rail operator that provided the only rail connection to the municipalities around Turin.

In 1998 the Municipality decided to change the shape of the industry introducing some important changes: the two urban operators were merged and a transport agency was created.

The new company, originated by the merger of ATM and SATTI was given the name GTT (Gruppo Torinese Trasporti S.p.a)

In the following year it was decided the creation of a new authority with the participation of the municipality and of the regional administration (each with a share of the 37,5%) as well as the participation of the province of Turin and other 30 smaller municipalities around Turin. The new authority – AMM (Agenzia per la Mobilità Metropolitana di Torino) – was created in the first of January of 2003 even though the official commitment to realize the new Metropolitan Transport Authority can be found in the article number 8 of the Regional Law 1/2000. It represented one of the first cases in Italy of the constitution of a competent authority on urban transport. This decision was in line with the Law Burlando (D.lgs. 422/97). The new authority was assigned the task to promote sustainable mobility in the metropolitan area of Turin by optimizing the public transport services through the following tasks and responsibilities:

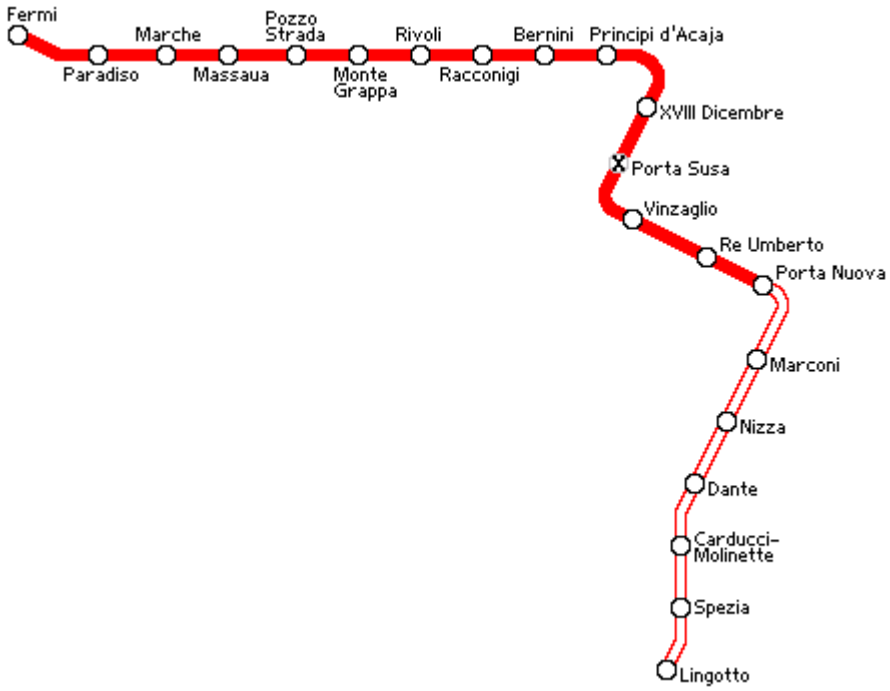
- Planning the strategies of the development of the transport system in coherence with the urban plans for urban development and mobility.
- Programming the development of transport infrastructure, rolling stock, technology and quality of service on a regular basis, by developing three years horizon planes for the entre metropolitan area.
- Managing the fares and the contracts with the operators, convey subsidies from the participant entities to the operators. This also include the organization of the tendering process to give the concession to the operators and the monitoring of these contracts. (AMM, 2003)

STRUCTURAL ASPECTS

Concerning the first level of the transport hierarchy defined by the PUT 2001 mentioned above, on the one hand, the metro was the most important project and it has been given a lot of relevance on the media as well. However its construction has been planned for long time and approved in 1996, only in 1999 the local administration achieved the financial support from the Italian government that provided 60% of the funds necessary for the investment. Even if the project was supposed to be delivered for the Olympic games only a first part of the metro was inaugurated on

February 2006, the second part of the track, reaching Porta Nuova has been inaugurated in 2007 and the final part is expected to open the service in 2011.

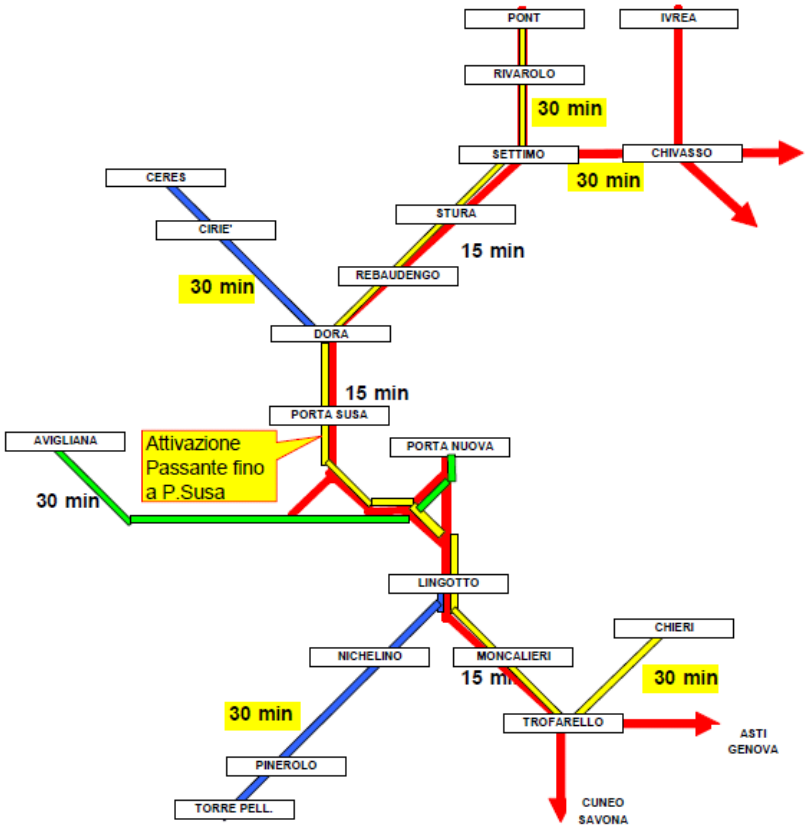
Picture 4.10 – Metro Map



On the other hand, the urban railway has been reorganized and improved though the previous construction of the tunnel that connected Porta Nuova's Station with Porta Susa's one. The services are organized in 4 lines as shown in the picture below, the plan set the target to reach by 2006 a headway of 20 minutes in the branches of the line and a 7 minutes headway in the trunk between the stations of Lingotto and Dora.

Picture 4.11 – Plan of the actual reorganization of the urban railway, *Passante*

(Source: ATM, 2005)



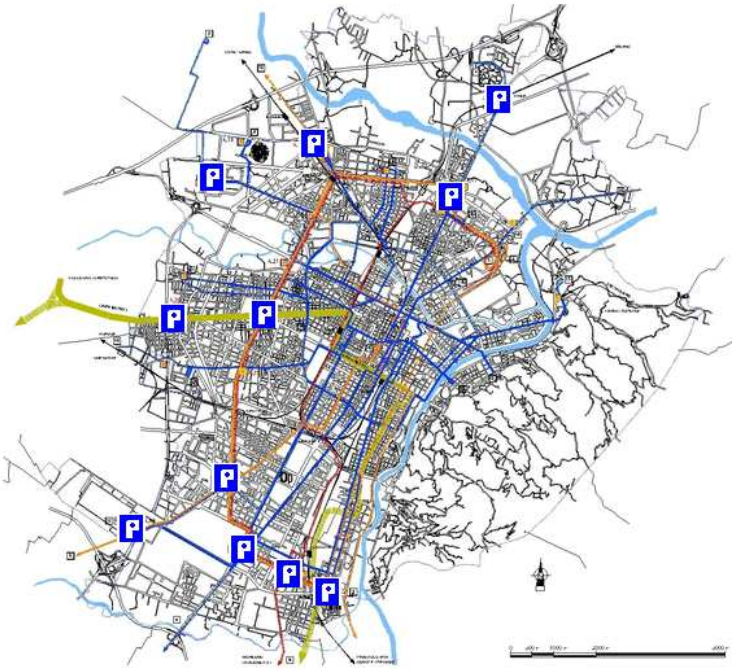
In 2005 it was realized a temporary connection in the Dora station of the two railways, the one operated by the blue line (Station Dora GTT) and the one operated by the red and yellow ones (Station Dora FS). Thanks to that temporary solution during the Games there was a direct rail connection from the airport Caselle (on the blue line) and the media and communication centre at the Lingotto. This temporary solution was going to encounter capacity problems in any case so, after the Games, new construction works begun to move 10 meters underground the station Dora FS. This project have been concluded in 2009 and only afterwards it has been possible to increase the frequencies in the section above Dora FS station.

Because of this changes nowadays the blue line has not yet been completely connected[29], thus it has been possible so far to reach only headways of 30 and 15 minutes respectively, meaning that the target has been only partially satisfied.

[29] Indeed, today the service in the south side is operated by Trenitalia and the north one is operated by GTT.

To complete the listing of the structural intervention they have been constructed road extensions and the improvement of congested junctions. Finally 11 main parking facilities have been constructed and indicated for park and ride destination along the metro and 4 of the high frequency "strength lines" of the tram.

Picture 4.12 – Main Park and ride facilities realized (Source: PUT 2001)



OPERATIONAL ASPECTS

The new planes developed in this occasion have been an opportunity to test the planning capabilities of the city, as well as the cooperation between the different actors. The new planes developed included a mix of reorganization of the service through the strength lines (and thus increased frequencies), the constitution of new lines. The provision of transport for the Games put a very intense pressure on the operator: GTT took two measures to deal with the event.

1) It had to operate for two weeks a fleet of a thousand additional busses and 1900 drivers – almost doubling to its ordinary size –. All these resources were temporarily sourced ad accredited with its costs to TOROC.
2) It had to intensify its ordinary operations for visitors and spectators by adding 200 busses and 400 drivers.

This great effort and the requested coordination of the activities, as showed in the following analysis have brought several results.

Concerning the second level of the hierarchy of the network defined by the PUT 2001 the system has been improved by introducing a new measure that can be considered as an intervention that stands in the middle between the operational and the functional aspects. In the network of surface services – of busses and trams – the lines have been distinguished in two groups, the ordinary lines and the "strength lines" with an higher frequency. This solution is also implemented in other cities such as Stockholm. The goal on these 13 "strength lines" – expressly for the tram based ones – was to increase the average speed by 20%.

Finally, on the third hierarchical level was performed a very intense construction work of streets and highways, especially in the province of Turin, outside the city.

FUNCTIONAL ASPECTS

One very important component of the functional changes implemented in the period of the preparation of the games of 2006 was the project 5T. the project was initiated in 1992 as a joint venture of the main operator of the time, ATM, and other industrial partners; later in 2000 it moved under the control of GTT. This project had the goal of

- Increasing the speed of traffic,
- Incentivizing the use of public transport,
- Reducing environmental effects[30].

The solutions implemented in this concern include the following measures:

- The control system that supervises the traffic of the road network as well as the access to the city and to the Limited Access Areas (ZTL – Zone a Traffico Limitato). This control room also monitors the congestion level and can act to spread it and solve punctual problems through the control of about 230 cross roads[31].
- The information system redirects the traffic also through information panels on the streets and indicates the availability of parking in the city.
- The system allows – in a separated and independent control room – the monitoring of the regularity of public transport operations and

[30] From the website of the project: http://www.5t.torino.it/5t/it/docs/sistema5t.jspf

[31] This number is lower than expected by the planes (see PUT 2001) that aimed at reaching 300 crossroads by 2006, starting from the 137 already available at that time: the goal have been only partially achieved.

- Manages to communicate to users the information of the service with 600 panels at the stops.
- Finally, it is integrated with the measures of environmental pollution.

Concerning the introduction of the "strength lines" there are two functional aspects to be considered: the provision of transit signal priority for these lines and the effect on users related to the perception of an higher reliability of these lines.

Other measures important to be mentioned are:

- The extension of the integrated ticketing system through the inclusion of 25 secondary private operators in the system that already included the publicly owned operators and through the formulation of new integrated ticketing schemes for park-and-ride facilities and public transport; in 2002.
- The creation of the user information service on the platform offered by Google Transit, being the first important Italian city to have this service available.

MANAGERIAL ASPECTS

The Olympic games have apparently been anticipated by strong changes in the organization of the transport system. This aspect – that accompanied the changes in the governance, in the use of ITS and in the operations of the new planes – are, according to management literature, very important for the success of the changes. This created a positive mood were it was possible to let the managerial competencies grow. One example can be the same 5T project. Conceived as an internal project to exploit new opportunities from ICT, grown in cooperation with a network of external partners, 5T took the shape of a consortium. It was given some organizational independence from GTT ordinary activities even if the operator remained as principal shareholder. 5T had the opportunity to grow and develop new competences especially thanks to the Olympics: even if it was not conceived for this purpose 5T provided TOROC the traffic control centre needed for the event. In this occasion 5T developed its knowledge and reliability so that afterwards it become able to sell services and to advise other operators around Italy (Interview with Ing. Nicolello, GTT).

One positive aspect that has to be noticed is that – through the "pulsar effect"[32] – Turin was able to create a positive climate around the improvements to the transport system: after the games the city has been hosting five minor events that allowed the utilization of the new infrastructures and the

[32] See paragraph 2.4.

continuous improvement of the transportation, last among the have been the exposition of the Holy Shroud.

4.3.3 – Impact study

In this section it is presented the result of the analysis using available data and the information obtained through the three interviews.

GENERAL ASPECTS

1. GOVERNANCE

The organization of the industry and its governance had a radical change that happened in the same circumstances of the Olympic Games. From a theoretical point of view there are two contrasting aspects that have to be highlighted:

- The creation of the authority (AMM) represented an important anticipation in the Italian landscape of urban transport. The change introduced, in accordance with the European legislation and guidelines (provided in the White paper on transport).
- The merger between the previous existing operators allowed some efficiency – as it will be shown in the analysis of cost related performances – but determined shift toward a stronger concentration of the industry, that today appears to be irreversible. This aspect weakens the opportunities for the market to benefit in the future from the positive consequences of the competition for the market (also referred to as Demsetz competition).

From the interview with the Assessore Sestero it emerged that the creation of the authority was a positive result because it allowed a stronger integration of the different types of service offered. The three interviewees agreed that, even if there was not a strict causal relation between the Olympic games and this intervention, the event represented an important element that made possible for the different parts actively participating in the authority to work together. Nicolello, from GTT, said that in this occasion the cooperation was positive at it was possible to avoid conflicts and political battles between the operator and the authority, this could have ruined all the results of the effort spent to improve the transport system.

2. NEW INFRASTRUCTURE

The new infrastructures realized for the urban transport system in the considered period were:

- Construction of the first metro.

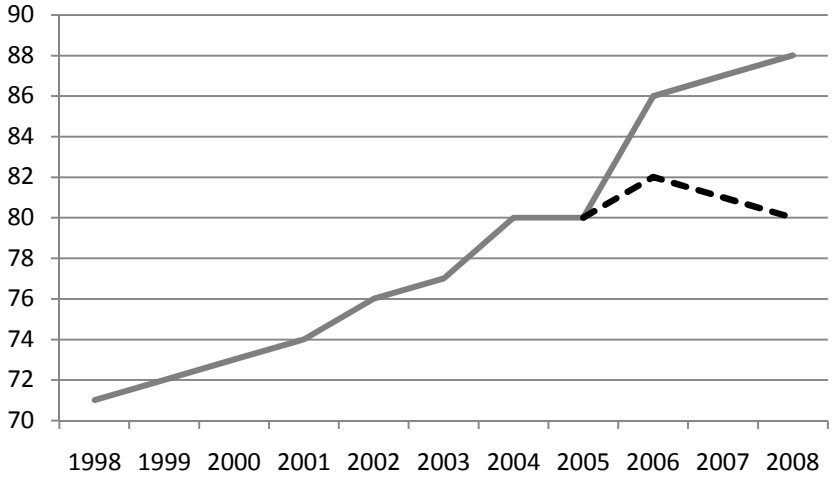
- Reorganization of the sub-urban rail system.
- Restructuring and construction of roads and connections with the valleys.

Although in 2006 during the Games the metro was not serving the area interested by the event and although the project of its realization was older Ing. Paonessa and Ing. Nicolello Agree that the selection of Turin in the short list for the 2006 Winter Games made it possible to finally realize a project that has been waiting for several years to receive its final approval. In particular Ing. Nicolello, show some skepticism on whether the project could have been concluded without the organization of the event, and thus he defines the metro as one of the major legacies from the event.

3. CAPACITY ON EXISTING NETWORK

Considering the vehicle kilometers tracked on a yearly basis by the transport operators in the balance sheet shows that the growth of the capacity of the system. In 1998 the two operators offered a total of 71 million vehicle km (ATM, 1999 and SATTI, 1999) and in 2008 GTT offered 88 million vehicle km (GTT, 2009). This means almost a 24% positive variation in a 10 year time. The changes have always been positive during this interval, and in particular the major growth can be observed between 2005 and 2006, with a 7,5% growth, the reason of this sudden change is given by the beginning of operations of the metro. In this same period have been concentrated intense investments by the GTT company.

Graph 4.4 – Equivalent vehicle kilometers, in million (Source: GTT 2003 – 2009)



Footnote: the continuous line indicate the total km
the dotted one the ones excluding the metro.

In the graph they are presented two lines: the continuous one that indicates the total vehicle kilometers and the dotted one that indicates the vehicle kilometers on surface traffic. Busses and trams have had an increase even if after the peak of 2006 their value have decreased a little.

In these ten years the growth of the number of vehicle km is explained by a growth in the number of lines as well as in the frequencies.

One comment that needs to be made is that – from the data of the survey of mobility (IMQ, 2008) – the introduction of the metro has partially substituted other public transport modes (78%) and partially used private cars (11%).

QUALITY RELATED PERFORMANCES

4. INFORMATION

The numerous measures taken in relation to information brought several results. Even if the general evaluation from public transport users only increased from 6,48 to 6,65 points, it is clear that in this period there were very important improvements in this sense: info-mobility was improved as well as information to drivers, they were developed a new centre for traffic control and one for busses operations control, the information on public transport were coordinated with Google transit.

These measures were defined by the transport plan PUT 2001, promoted by the municipal authority or by 5T, or also required by the IOC in order to manage the games; thus it is clear that there have been a strong relationship between these improvements and the games of 2006. This is true also considering the opportunity that the event represented for 5T, the provider of these services to the city[33].

5. FREQUENCY AND FLEXIBILITY

An important part of the new surface transit was introduced through increases of frequency.

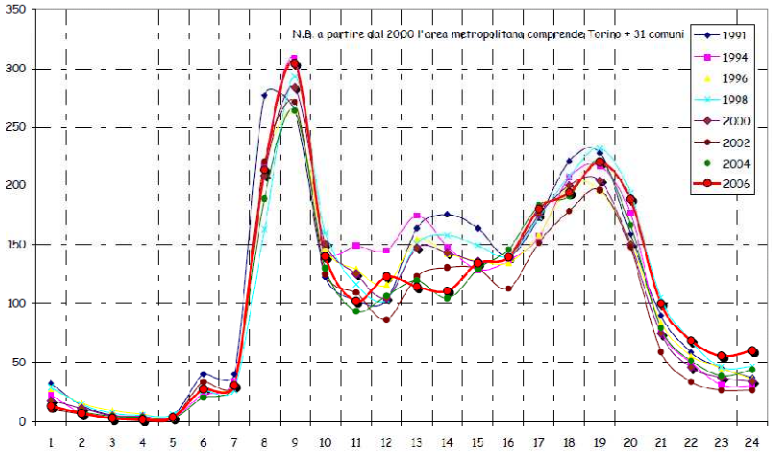
- The introduction of the “strength lines” implied an increase in the frequency, together with the changing of the operated vehicle in some cases to obtain higher capacities.
- The major effort was concentrated in the afternoon peak from 5 to 8 pm when the initial frequencies were lower.

Ing. Nicolello stated that this measures were oriented to increase the competitiveness of public transport for work related trips. The intervention was concentrated and thus represented an increase in the flexibility of the service. The interviewee confirms that the presence of the Olympic games caused a considerable pressure on the whole organization, thanks to this experience he

[33] Ref: Interview with Ing. Nicolello.

believes that the capacity of GTT to manage a more flexible network and react to problems have increased considerably.

Picture 4.13 – Number of trips in thousands by time categorized by time distribution
(Source: AMM, 2006)



In terms of knowhow and organizational capacity Ing. Nicolello states that the tangible legacy of the Olympic games were new processes and procedures to manage ordinary services and extraordinary occurrences. This aspect, without going into closer details, can be considered as a very positive outcome and was indeed indicated in the general framework as a potential take away from the organization of a mega event.

6. RELIABILITY

Punctuality and regularity of the service, measured by the satisfaction of passengers through the survey on the quality of mobility (AMM, IMQ) have increased from 2000 to 2008 with approximately linear growth from 5,74 to 6,35 – meaning a 10% increase. This change might be due to the fact that the measures implemented to increase the speed of the service – also isolating the services form the variability induced by congestion – and to provide information to the users on the regularity of the service. This result is important because it is possible to see that the actual improved was in fact perceived by the users.

Moreover Ing. Nicolello in the interview highlighted the critical importance of the role of the driver in this concern. On the one hand the selection process of the drivers in the last decades have changed considerably: once they were asked to drive perfectly, nowadays they are considered also

relational skills and the attitude towards the clients. On the other hand the responsible of Public transport planning at GTT indicates that the motivation of the drivers to provide a regular and reliable service can have a very strong impact: the new technologies allow the continuous monitoring of the position of the bus (or tram) compared to its schedule and they allow the communication between the control centre and the driver; thus a committed driver can influence in a very effective manner this performance of the service.

VOLUME RELATED PERFORMANCES

7. NUMBER OF TRIPS PER YEAR PER PERSON

The total number of trips have been increasing in the considered horizon from about 170 million of trips in total (ATM and SATTI) in 2000 to 186,9 million trips in 2008 (GTT, 2009). The number of inhabitants in Turin have decreased in the middle of the considered period but in both 1998 and 2008 was very close to 900'000 people. A different situation can be observed in the data provided by GTT's balance sheet where the covered market – defined including the citizens of 25 of the 31 municipalities participating in ATM authority transport services – grew from 1,4 million to 1,5 million.

The aggregate figure for the metropolitan area didn't change considerably: the number of trips per year per person moved from 121 to 124. Although the goal of the metropolitan authority is to promote public transport in the entire metropolitan area GTT improved the transport system concentrating its effort in the city of Turin. Indeed the result in the urban area has been consistent and – even in a shorter time frame, from 2003 to 2008 – the number of trips grew of 5%, the from 178,8 to 186,5.

Table 4.15 – Calculation of the indicator: personal elaboration from GTT annual report (GTT, 2009)

Year	**2004**	**2005**	**2006**	**2007**	**2008**
Trips	161,3	166	165,9	168,5	169,3
Inhabitants	902	902	901	907	908
Trips per person	178,8	184,0	184,1	185,8	186,5

8. CONGESTION

The most reliable measure concerning the congestion in the metropolitan area is derived by the IMQ – survey on the quality of mobility –, the perception from the passengers from the year 2000 to

the year 2008 have had very little changes which appear not to be significant. The indicators measuring the rapidity of the trips made by private car and the ability to predict trip length went respectively from 6,63 and 6,51 to 6,85 and 6,75. The indicator measuring the regularity of the traffic flow went from 5,46 to 5,65.

9. MODAL SPLIT

The changes in the modal share are always difficult to evaluate and are something that can easily be manipulated. However there are two negative performance on this concern that can be found in the surveys on daily mobility realized by the Metropolitan Transport Authority. From the survey of 2008 it results (AMM, 2008) that the modal share of public transport and private transport among all the trips performed[34] have not changed in the 10 considered years.

From the survey of 2006 it results (AMM, 2006) that the share of public transport in morning peak hours for the dips directed to the inner city have decreased to 30%, indicating a negative change if compared to the 36% of ten years before.

However the positive result is that according from the same surveys the share of motorized mobility have decreased in favor of walking and cycling. This result is confirmed by the Ms Sestero who, in the interview, said that "A positive effect that was obtained thanks to the organization of the Games is that many more people chose to walk within the city. Because of the support to the realization of the Limited Access Area (ZTL) and the good image that the event brought, the city has become more lively and people is more keen to walking."

As explained later, in the last years, GTT decided to concentrate its effort on the afternoon peak hours rather than on the morning peak, in this concern it can be partially understood the poor result on the share of public transport on trips towards the city in the morning peak.

COST RELATED PERFORMANCES

10. COST RECOVERY RATIO

The main measure considered in this dimension is the ability to cover the operational costs with the revenues from the current operations, excluding subsidies. This cost recovery indicator is indicated in the table below.

[34] Reference, the general modal share mentioned in the paragraph 2.2.5.

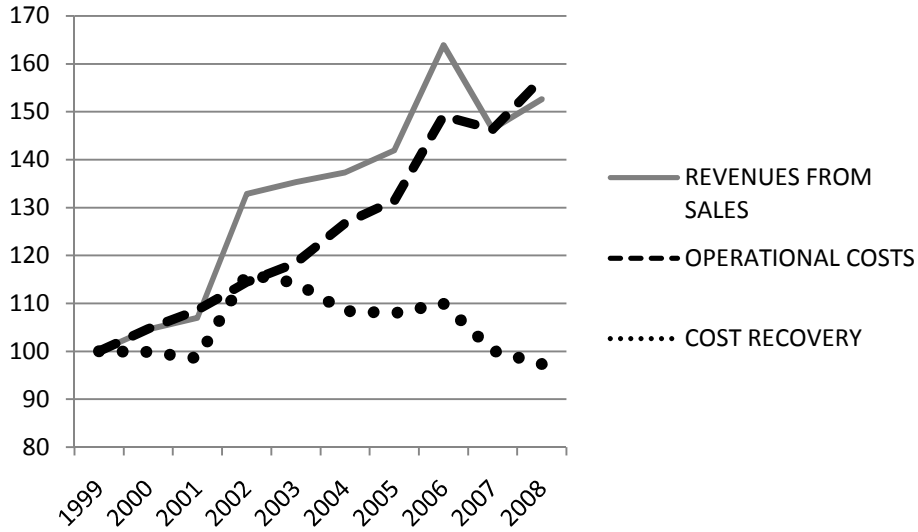
Table 4.16 – Cost recovery indicator calculation and subsidies

(Personal elaboration from the balance sheets of GTT and the two previous operators.[35])

	1999			2000			2001			2002	2003	2004	2005	2006	2007	2008
	ATM	Satti		ATM	Satti		ATM	Satti								
REVENUES FROM SALES	129,2	27,5	81,30	135,20	28,60	84,99	69,60	17,35	86,95	108	110	111,65	115,37	133,26	119	124,1
SUBSIDIES	344,98	75	210,55	320,10	74,40	195,03			228,75	196,6	211,7	215,85	219,97	241,8	242,55	278,2
Raw materials	54,85	11,7	34,53	70,90	12,50	43,27	32,40	7,40	39,80	40,74	38,6	39,14	44,3	51,4	51,56	55,52
Services	77	13,9	47,16	74,66	22,50	50,41	45,00	11,50	56,50	66,7	71,8	78,6	81,96	107,7	96,7	106,53
Third party goods	27,5	1,2	14,89	28,00	1,20	15,15	14,50	0,60	15,10	15	15,9	15,5	14,4	14,5	14,86	19,3
Human Resources	271,32	60,8	172,32	272,67	60,20	172,71	147,60	33,00	180,60	185,2	192,2	207,45	212,77	227,2	230,15	240,5
OPERATIONAL COSTS	430,67	87,6	268,90	446,23	96,40	281,54	239,50	52,50	292,00	307,64	318,5	340,69	353,43	400,8	393,27	421,85
COST RECOVERY	**0,3000**	**0,3139**	**0,3024**	**0,3030**	**0,2967**	**0,3019**	**0,2906**	**0,3305**	**0,2978**	**0,3511**	**0,3454**	**0,3277**	**0,3264**	**0,3325**	**0,3026**	**0,2942**

Looking at the values in the table it is possible to say firstly that the value of the Cost Recovery Ratio is pretty low. In 1999 the weighted average for the two companies was a little above 30% and in 2008, the ratio of the new company – stabilized after the merger and after the Olympic games – was one percentage point lower. It is curious to observe that this value has been considerably higher for 5 years in the middle of this time-window. The causes of this temporary change are not clear. Graph 4.5 shows that the value increase is due to an increase in the revenues from sales – in 2002 –, followed by the growth of the operating costs – 5 years later –. The cause of this could be either the merger, the annunciation of the hosting city of the event in 2001 or the changes in the ticketing scheme.

Graph 4.5 – Trend of the values, set at 100 with the value of 1999.



[35] The vales in the grey cells are expressed in Italian Lira (Lira billion), then aggregated and converted in € million.

The graph confirms that the temporary improvement of this indicator was due to the sudden increase of revenues in 2003, later the value of the costs increased more rapidly so to "catch up" the revenues. From the graph it is clear that the Olympic games in 2006 caused an isolated peak that did not cause any permanent change, indeed the preexisting trend restarted without major modifications. It can be said that there was no impact on this indicator along the considered timeframe.

11. LABOR PRODUCTIVITY

Generally speaking the labor cost – which has been moved from 54% to 49% of the total costs – is the most relevant cost category. Given the dataset available from the balance sheet of the operators it is possible to calculate the measure of labor productivity as the amount of kilometers per driver employed per year. This result is dependent on two variables: the amount of driving-working hours and the average commercial speed of the vehicle. The first variable depends partially on the contractual relationship between the operator and the unions, the second one depends on the time and spatial distribution of the services (either in peak or off peak, in the centre or out of the city centre …) as well as on the measures to increase commercial speed of the service that have been undertaken. The interview with Ing. Nicolello helped to understand this distinctions and the one with Ing. Paonessa confirmed that the goal presented in the PUT 2001 to increase by 20% the average speed in the "strength lines" have been achieved through the implemented measures.

The change of this indicator appears to be positive because it moved from little below 27'000 km per year per driver to 28,400. This indicated a positive change little bigger than 5%[36].

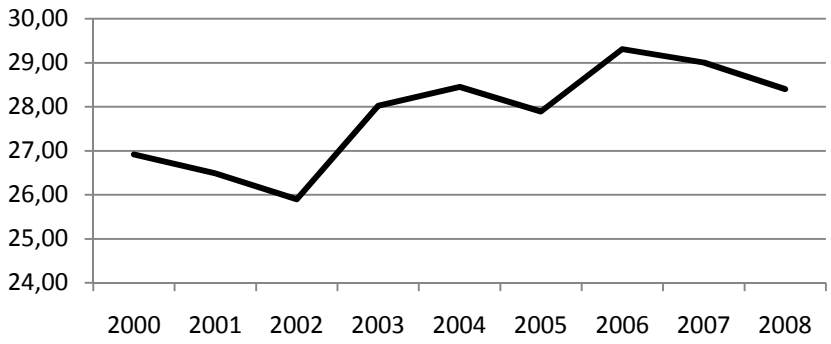
Table 4.17 – Labor Productivity (personal elaboration from operators balance sheets).

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of drivers	*2712*	*2794*	*2934*	2748	2812	2868	2798	2793	2817
Labor Productivity	26,92	26,49	25,90	28,02	28,45	27,89	29,31	29,00	28,40

Looking at the time evolution of this performance it is curious to notice a series of cycles of three years. This phenomenon might be associated with some motivational consequences of the three years planning horizon.

[36] The indirect effect on the productivity of labor is less than proportional but this can be understood considering the changes in the time and spatial distribution of the services, that also affected the general average speed.

Graph 4.6 – Tendency of labor productivity (Personal elaboration from Table 4.17)



12. VEHICLE UTILIZATION

Considering the utilization of the fixed tangible assets, the average kilometers per vehicle per year have increased considerably. This value have grown of more than 5% in the year of the Olympic games but the most of the obtained improvement have been eroded in the two years after the games (GTT, 2003-2009).

Table 4.18 – Thousands Kilometers per vehicle per year (Personal elaboration GTT reports)

Year	2003	2004	2005	2006	2007	2008
Busses	1137	1153	1212	1122	1124	1138
Trams	199	231	231	231	231	231
Productivity	57,63	57,80	55,44	60,61	59,78	58,44

The negative effect on the utilization of certain assets that could be expected in correspondence of the games was not observed in the case public transport.

13. PRICE SCHEME

The price scheme, as commented above, was subjected to important changes in this period:

- The ticketing systems of the two operators – ATM and Satti – were unified with the merger of the two operators,
- The new operator GTT, Trenitalia and other minor operators started in 2003 to sell integrated travel cards for regular users,

- Later, in proximity of the games, it was created an integrated ticketing package for tourists, that included access to museum, cultural exhibitions and public transport.

Besides these important improvements, it understood that this changes have had little interactions with the games. Indeed, in the interview, Ing. Paonessa confirmed this conclusion.

However it has to be noticed that there were no changes in the prices. This fact, in general considered as a positive thing, has a negative evaluation in this context because of the low prices associated in Italy to public transport services. With the Olympic games it was lost an occasion to increase fares to try to begin compensating this big difference in comparison to other western European countries.

4.3.4. – Box score and evaluation

To conclude the analysis of Turin's case, in the following page, it is presented the table box score obtained by the elaboration and the interviews.

Table 4.19 – Turin's case box score

Indicator	Impact score	Causality score	Effect score	Reliability weight	Conclusivity	Resulting Effect
GENERAL						**1,50**
Governance	2	0,75	1,5	100%	1	1,50
New infrastructures	2	0,75	1,5	100%	1	1,50
Capacity on existing network	3	0,5	1,5	100%	1	1,50
QUALITY OF SERVICE						**1,55**
Information	3	0,75	2,25	100%	1	2,25
Frequency and flexibility	2	0,75	1,5	80%	1	1,20
Reliability	2	1	2	60%	1	1,20
VOLUME						**0,32**
Number of trips per year per person	1	0,8	0,8	80%	1	0,64
Congestion	0	N/A	0	60%	1	0,00
Modal split	0	N/A	0	40%	0	0,00
COST						**0,00**
Cost recovery	0	N/A	0	100%	1	0,00
Labor productivity	0	N/A	0	60%	1	0,00
Vehicle utilization	0	N/A	0	80%	1	0,00
Pricing schemes	2	0	0	100%	1	0,00
					Overall Result	**0,84**

5 – Results and discussion

This paragraph has the purpose to analyse the results of the case studies in order to find common trends and differences. Additional comments and referral to specific data or information from the interviews have aim at discussing the causes of the facts that can be observed. The structure of the paragraph is conceived in order to follow with continuity and simplicity the developed framework and distinguishing the two research questions. These questions are answered in the logical order investigating, firstly, whether if it is possible to improve transport systems through the organization of a major event, and, secondly, under what conditions is this possible. In the first paragraph there is a focus on the effects and in the second one on the measures implemented.

5.1 – Results from the case studies

The better way to convey the information collected through the three cases analysed towards an organized discussion on the possibility of gaining long term improvements in the performances of the transport system is to follow the structure used to present and assess these effects. The paragraph is then divided in four paragraph that refer to the general information about the supply, the performances of the quality of the service, the volume of trips and the characteristics of the demand, and the costs of operating this services; finally some conclusions are drawn. It is interesting to anticipate that not only infrastructural improvements can be achieved if a proper planning is realised.

5.1.1 – General supply

The first dimension considered is the governance of the transport system and its actors. It is possible to notice that in all of the three cases there were permanent changes in this issue. The main change in this concern was the creation of the authority responsible for public transport services in the metropolitan or, at least, urban area. The Entitat Metropolita de Trasport, the Athens Urban

Transport Organisation and the Agenzia per la Mobilità Metropolitana are *de facto* three authorities, even if they differ in the name and in the powers that they are given. In this concern it can be done a simple comparison among the cases by considering the changes implemented.

Table 5.1 – Characteristics of governance interventions (Personal elaboration)

City	Barcelona	Athens	Turin
Constituted Authority	EMT	OASA[37]	AMM
Years prior to the event	5	0	6
Responsibility on	Metropolitan area	Urban area	Metropolitan area
Planning	Yes	Yes	Yes
Financing of PT	Yes	Yes	Yes
Construction of new infrastructure[38]	No	No	No
Bid for PT operations	Yes	"Yes"	Yes
Number of bids	None	None	None
Transport observatory	Yes	Yes	Yes

In all the cases the authority was made responsible of the planning of the service, the financing through subsidies, the public bid for the programmed services and the function of transport observatory. It is worth to comment, however, that there have been some controversies in all of the three cases thus none of the three authorities have never published a bid and this is considered unlikely to happen given the most actual information available.

The process of the creation of an authority to organize transport services is very complicated and requires, as most organizational and political changes, a very long time to be understood and absorbed. One positive effect of the organization of the event that was verified through the case studies was that in all three cases the occasion of the event has shown to be critical to improve the coordination among different actors.

The construction of new infrastructures and the provision of new services are one key element of the legacy of mega events, often they attract a lot of attention on themselves. The three cases

[37] OASA was only renewed and reshaped as an authority from the legal perspective even though, because of the incomplete transformation, it is closer to the model of the transit agency.

[38] To be intended not as the physical constructor but as the owner of the new infrastructure in the period of its realization.

considered show that these can range from highways, metro, sub-urban railways, trams, to parking infrastructures. Findings can be summarized in four points:

- These construction works represent very important projects and a consistent share of the capital expenditures associated to the event. Approximately 45% of infrastructural investments is represented by transport infrastructures and more than 25% is expressly dedicated to urban (or metropolitan) transport systems.
- The major projects that were realized had been designed long time before the event, but then put aside. There is, however, a causal relation with the event: they obtained final approval and financing from the central governments only alter the nomination of the city as host of the major event.
- It is also possible to find a close relationship between a part of the investments and the event when considering the location, it was found an intense development of transport of the areas where the event is located.
- There is a substitution effect between different modes: when constructing a faster mode (e.g.: metro) the supply of slower pre-existing mode (read, bus) is reduced locally. Against this, the overall urban or metropolitan effect is undetermined: depending on the initial conditions and on the decisions taken, the overall bus supply can increase (cases of Athens and Turin) or be reduced (Barcelona's case).

All of the three case studies have shown these results that, beside the limited statistical relevance of the champion can be considered to be somewhat reliable.

5.1.2 – Quality performances

The cases have shown slight improvements in the quality of the services in all the three cases. Quality effects can be divided in four major groups:

- Extension of operations: the cases of Athens and Turin have shown improvements in this area, including an increase of the frequencies and an extension of night services (only in Athens' case).
- Operational improvements: they have been shown in the three cases improvements in the reliability and in the punctuality of the services.
- Internal functional improvements: all the three cases present the realization or the upgrade of a Traffic Control Centre. This intervention has a strong effect on the capability of its owner – either the authority, the municipality or one of the operators – to monitor the behavior of

the system, to react to problems or even to prevent them. The positive consequences of this "active traffic management" range from safety, to congestion reductions, and then to an higher regularity of public transport operations.

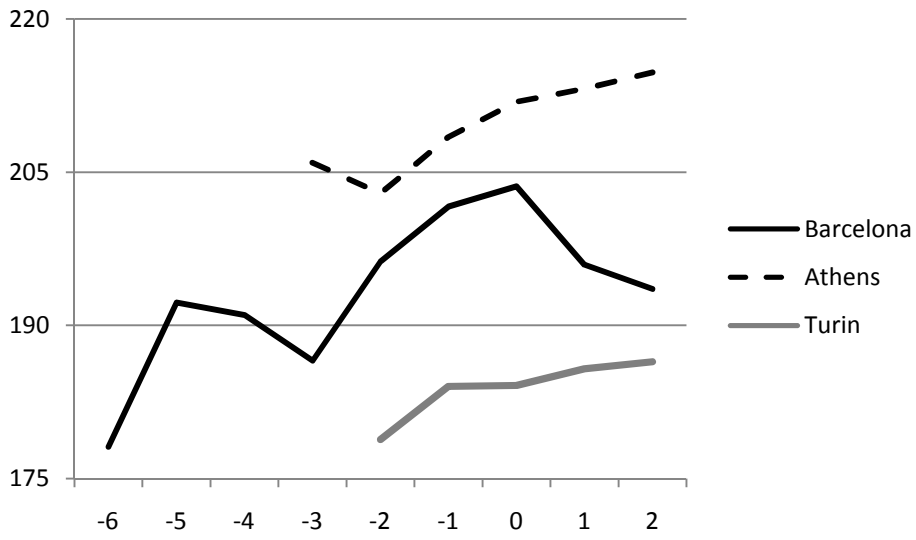
- External functional improvements in the provision of information to the users through the use of Intelligent Transport Systems. This effects are considered very valuable for the users because they increase their satisfaction and perception of the quality. Also thanks of the more advanced date of the event, this effect has shown to be particularly positive the case of Turin.

5.1.3 – Demand and volume

Compared to other dimensions the limited results in this area show that it is very complicated to change the habits of passengers in terms of trip generation and mode selection:

- There is a positive effect in the event year and in the year before but this is half reabsorbed and leaves a slight permanent legacy in this sense.
- Efforts and thus results were concentrated in the city area, while were limited in the sub-urban areas.
- Concerning the effect of road provision, congestion problems always came back even if this does not mean that road interventions are ineffective or unnecessary. It can be positive, if not needed, to change in the shape of the city and to redirect the flows: in the case of Barcelona, for instance, Rondes system was able to divert a large share of traffic out of the city centre and to improve the quality of traffic for both car drivers and others, like public transport riders and pedestrians.

Graph 5.1 – Trips per year per inhabitant comparison[39]



5.1.4 – Cost performances

The results from the case studies shows that it is possible to achieve improvement in cost related performances.

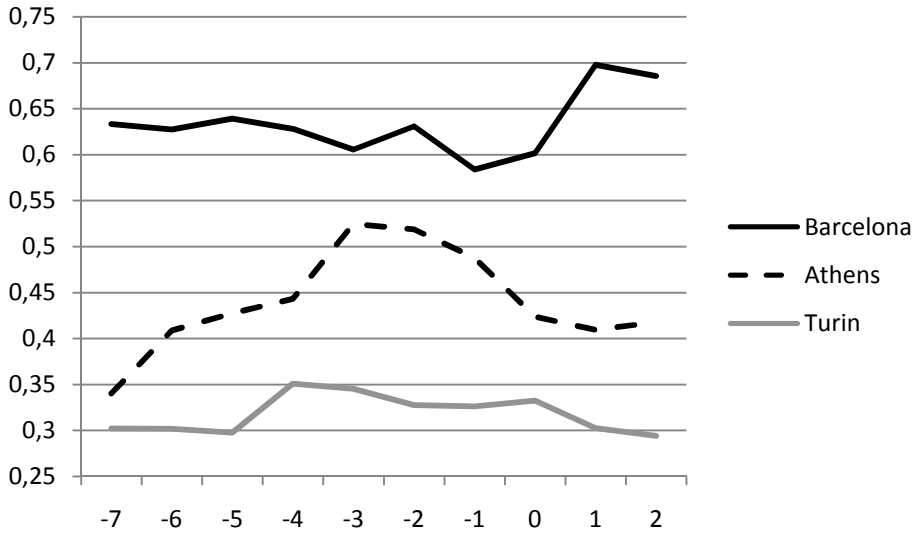
- In one case out of three this was due to the due to gains in efficiency. This occurred for Barcelona's main operator, in particular for the metro operations that gained up to 43% in productivity of labor and approximately 6,5% in the utilization of vehicles. In the other two case these measures did not vary significantly.
- In two cases out of three the improvement of the cost recovery ratio – measure chosen as the principal indicator I this area – was determined by prices adjustments. In both the cases of Barcelona and Athens prices were increased while in Turin they were only partially adjusted for the inflation.

The graph below shows the comparison of the evolution of the cost recovery in the three cities in the considered period and confirms what has been said above. They can be seen also the differences among specific cases. Barcelona's system prepared itself for the event and – as change management theory predicts – occurred in a worst cost performance before facing the event, and then, – thanks to the additional revenues – had a steady improvement in the cost indicator equal to 10 per cent points. Athens' transport system, when was about to face the larger investments, three years before

[39] The event year is referred as t = 0.

the event decided to double the real price of the ticket and then sow the cost recovery ratio soaring by almost 10 per cent points. Turin, on the other hand, faced a major change four years before the event when the two main operators were merged, the increased revenues determined a sudden increase of 5 per cent points in the cost recovery ratio. From two years after the merger to the event the rise in the costs – due to the increase in the quality of service – gradually eroded the improvement of the cost performance until the time when, vanished the revenues from the extraordinary demand due to the event, the ratio returned to its original level.

Graph 5.2 – Cost recovery ratio comparison[40]



Besides the improvements and the analysis of the positive effects, to counter-argue the thesis that mega events represent or encourage a waste of resources, this case study finds a positive evidence that there is no significant loss in the productivity of the fleets or of the drivers.

5.1.5 – Conclusions

The results of the study show that there can be an interesting variability in the effects from case to case and thus it is positively underlined the need to evaluate and monitor the changes with a broad perspective as the one used here, through the development of a specific framework, or the more general one used by the OGI study.

[40] The event year is referred as t = 0.

After analyzing the different dimensions considered for the possible and desirable effects of major events, it is possible to answer to the research question by saying that – in the occasion of a major event – it is indeed possible to improve the transport system in the long term. The study confirms that there can be also organizational and social improvements through the redefinition of the governance of the industry. Other possible effects occur either in the cost related performances or in the quality related ones. Based on the considered cases it was not possible that the aggregated effect of the two dimensions of cost and quality were improved at the same time. For this reason it might be reasonable to focus on a specific goal: either the improvement of cost performances or of the quality ones, it is difficult to improve everything contemporary.

5.2 – Analysis of the causes

To investigate under what condition it is possible to improve the urban transport system in the occasion of major events the study needs to go further in detail. This paragraph has the purpose to analyse the measures that were taken in the three case studies in order to investigate the determinants of the effects that have been observed. Additional comments and referral to specific data or information from the interviews have aim at discussing the causes of the facts that can be observed. The structure of the paragraph is conceived in order to follow with continuity and simplicity the developed framework that groups the legacy oriented interventions in five families: governance measures, structural measures, operational measures, functional measures and managerial measures. Within those areas, it is clear that different measures have different effects. This paragraph tries to evaluate what was done well and what could have been done better.

5.2.1 – Governance measures

As reflected by the performance indicator that concerns the governance, there have been very important changes in this area. It can be said that major events represent an opportunity to innovate the governance of the industry, a critical issue in order to improve its results.

It has been said that this changes in the governance innovation represent a very delicate change and need to be managed accurately because problems can always occur and limit the benefits of the

innovation by disarming the new governance or even forcing to get back to the initial situation. For this changes in the governance to be effective it is critical to adopt a participative approach but, it is also true that there is often an issue of politics and that everyone can't always be fully satisfied with the decisions taken.

What was done well was that:

- It was decided to intervene on this delicate issue and to tackle existing problems, without ignoring them. The circumstances created by mega events have shown to be very positive in the organization of such a change because of their positive effects on the cooperation among the actors involved.
- It was adopted in two cases out of three a metropolitan approach, even though the results in the general metropolitan areas were limited[41].

The overall effect on the governance were positive or very positive but it has to be remembered that few years after the event there were other changes in the governance that partially disarmed or reverted the measures taken prior to the event. To analyse the causes of this problems it is useful to extend the information summarized in the table presented in the first paragraph.

In the case of Barcelona 5 years after the Olympic games it was created a new authority (ATM[42]) without eliminating EMT: already in the beginning of the nineties it was highlighted the need to develop a regional perspective, missing with the EMT. This new regional phase was pursued by the Generalitat[43], one of the decision following this intervention was the creation of ATM, a new Consortium-Authority in 1997. It can be concluded, thanks to the opinion of the interviewees and to the critics to the initial solution, that the system created in 1986 was not able to solve the problem of the cooperation of the local administration: the Generalitat – the decision maker for the financial issues – was not involved in the EMT, thus the same EMT resulted unable to plan the transport services. This problem was solved only later, thanks to the creation of the ATM. It have to be noticed however that the loss of that opportunity of cooperation in 1986 is the cause of the complicated governance that remained to the city.

[41] However this problem, as shown by the cases of Barcelona and Turin was due to the fact that a very strong effort t was spent in the inner parts of the city.
[42] See the paragraph 4.1 for a more detailed explanation.
[43] Regional administration of Catalonia.

Table 5.2 – Problems in the governance interventions (Personal elaboration)

City	Barcelona	Athens	Turin
Constituted Authority	EMT	OASA[44]	AMM
Years prior to the event	5	0	6
Responsibility on	Metropolitan area	Urban area	Metropolitan area
Planning	Yes	Yes	Yes
Financing of PT (origin of the subsidies)	EMT or Generalitat	Ministery of transport	Local administrations shareholders of AMM
Construction of new infrastructure[45]	No	No	No
Bid for PT operations	Yes	"Yes"	Yes
Number of bids	None	None	None
Transport observatory	Yes	Yes	Yes
Ownership of the Authority	Municipality	Ministery of transport	Participated by 3 local administration tiers
Ownership of the main operator(s)	Municipality or Generalitat	Authority, municipality or others	Municipality

In the case of Athens the problem that makes impossible to exploit the full benefits of the new governance is that the ownership of the operators still remains within OASA even though it is supposed to have the role of an authority and not the one of a government-owned company that collects the participations of the administration in the operators. In this situation it would be impossible to benefit from the new governance because auctions could not be competitive under this conditions. So far there have not been new regulations but there is a debate about the political will to merge the operators in the authority that, then, would actually become a transit agency operator with the monopoly in the urban area.

Finally, in the case of Turin four years after the event, in the spring of 2010 – before the Agenzia per la Mobilità Metropolitana to organize the first auction – the municipality unilaterally decided to rethink the decision to delegate the competence to organize the auction to the authority. The press

[44] OASA was only renewed and reshaped as an authority from the legal perspective even though, because of the incomplete transformation, it is closer to the model of the transit agency.

[45] To be intended not as the physical constructor but as the owner of the new infrastructure in the period of its realization.

said that this decision was due to the potential risks of the main operator – owned by the municipality – to lose some services in favor of other minor operators or of the operator of Milan, Azienda dei Trasporti Milanesi (La Stampa, may the 11th 2010).

To conclude this discussion, even if it is still central the positive effect that major event can have on these changes of the transport industry of the area, it is clear that – behind the need of time to absorbe these changes – that it is critical for the parties involved to know the reasons behind governance innovation. The fact of communicating properly the reason why some decisions are taken requires a culture of transparency which probably is still missing in our continent.

Considering the recommendation to institute an organism responsible for the legacy of the event found in the mentioned A. T. Kearney's report[46] on mega events, it is worth to comment that this was done in none of the studied cases. This measure could increase the effectiveness of the investments made in occasion of major events and could allow better, or more efficient, management of these issues.

In the study of the cases it is possible to identify this need for a better planning of the legacy, the transport responsible of Athens 2004 recommended after the games to "Plan and implement directly for the Legacy" (Coutrouba, 2009), the institution of a "Legacy committee" could drive the changes with strategic approach instead of the "contingency approach" that is prevailing.

5.2.2 – Structural measures

For what has been said above, it is critical to develop transport plans with long term perspective. Also concerning the structural measures. Considering that the realized projects are often dated some time before the actual decision to realize them it is even more critical to plan for the long term and use a complete evaluation framework when considering the infrastructural interventions that could be done in occasion of the event. Mega events are often seen as the excuse to realize enormous construction works but, as shown from the case studies, these projects are not able to solve all the problems related transport in one city or metropolitan area. Mega events should instead be seen as leverages to obtain difficult and needed changes.

[46] See paragraph 2.3

The findings from the study can be summarized as follows:

- In the three cases considered there was not a clear distinction between current needs and investments for the future, or at least it was not intelligible through the publications and the interviews to the experts. This is something that should be done.
- The decision of the location of the event is a key decision for shaping the legacy of the event. It should be a strategic one line it was in the three cases considered: the population, the number of people that visit the area for professional or leisure reasons, and the attractiveness of these interested area increased considerably. In the three cities the Olympic areas were sub-urban or low-density areas characterized by a good position in the city.

Too often there is an excessive focus on infrastructure evaluation from technical perspective. Transportation engineers in the industry do not regularly deal with other issues like urban development, economical aspects and costs of ownership of the system.

It is possible to say so because the cases showed an excessive focus of the people involved in this topics on the hard aspects of the provision of the new infrastructure. However, the specific literature on transport highlights the centrality of mixing Push and pull strategies – according to the definition of HiTrans guide – in order to change the behavior of the citizens and thus improve the performance of the transport system. In this concern two comments could be done o the considered cases:

- Besides all the effort that had been done to improve the conditions of public transport directly by increasing capacity or quality – push strategies –, there has been some intervention that aimed at reducing the factors that decrease the efficiency and the quality of public transport service, making it a secondary and less desirable option for the commuters. In the considered cases it has been shown some usage of pull strategies as the implementation of an elementary Transit Signaling Priority of public transport or as the creation of dedicated right of way lanes previously used for or traffic or parking. These measures were only a few and moderately impacted car traffic.
- In all of the three cases it has been used the strategy of providing park and ride facilities justifying this decision by stating that this approach would attract commuters to public transport in dense areas. However, as mentioned in chapter 2, it is not clear whether this approach is effective or not. Park and ride might work out only if accompanied by a restriction of parking capacity or an increase in the cost of parking in the very city, otherwise it is a measure that could gain very few effects in favor of public transport.

It is true that pull strategies are not very fashionable in political terms and that park and ride solutions are very simple to realize because they can be realized without the need of a long period of

planning and can be also easily presented as sustainable, permanent infrastructure measures directly associated with the event, but these problems might be a cause to the very poor effects observed on the demand.

5.2.3 – Operational measures

The three cases considered have shown some improvement of the quality of the service, this quality can be obtained through operational improvements. Some lessons can be learned in this concern. All of the three cases improved the frequency or the flexibility or the extension of the operations. Furthermore, especially in the case of Turin, there was an important improvement in the use of information technology and, consequently internal improvements and a better perception from the travelers.

The interviewees closer to the perspective of the operators stated the participation in the organization of transport for the event increased considerably the ability to manage more operational complexity. However it was not very clear how this was possible. Here we can summarize the operational measures that were taken:

- Reorganization of the network through the definition of principal axes and through an increase in the frequency on these corridors.
- Extension of the service in the city area with 24 hours operations on strategic lines.
- Extension of dedicated right of way lines for bus operations.
- Strengthening or introduction of Transit signal priority .
- Evolution of traffic control systems and thus an upgrade from “passive traffic control” to an “active traffic control”.

It can be commented that, even if limited, there was a certain use of “pull policies”, however the few permanent measures taken in this direction were not sufficient to improve significantly in all the cases the reliability of bus operations.

It is true that in occasion of the games there is a very intense development of transport plans and that this additional activity might create a deeper knowledge and a potential for operational and practical improvements, however the cases have shown that it is necessary to be ambitious and clear on the nature of the changes that are to be implemented. Only then, clarifying from the beginning what is temporary and what is not, it would be possible to improve permanently the operational performances of the system.

5.2.4 – Functional measures

The measures in this area covered different aspects and ranged from the ticketing to the communication to the public. It is worth to comment them more in detail.

First, the ticketing. It has been commented above that in the cases of Barcelona and Athens the price adjustments were key determinant in the improvement of the autonomy of the system and of the quality of overall public transport supply:

- An increase in the prices of public transport tickets, even if it is often necessary – especially in southern Europe –, is a very delicate subject of political discussion. The definition of prices is not free for the operators – exception made for some heavily liberalized services – but it is either directly in the hand of the politicians or it is delegated to the transport authority that, on a so delicate issue, can't do anything but executing the politicians instructions. It is difficult then, for the politicians to take a decision that has an immediate negative effect on the electorate and can allow the system to offer a better and more economically sustainable public transport. The lesson that can be learned from two of the considered cases is that this is and could be done with good results if accompanied by service and mode improvements.
- In addition to fare adjustments one important measure observed in the same cases of Athens and Turin was the introduction of an integrated ticketing for public transport services operated on different modes and by different operators. This improvement is very valuable for the users and in the case of Athens was said to have some relationship with the event, while in the case of Turin this was decided before the nomination for the games and was more related to the merger between the two main operators of the city.

In this concern mega events could be seen as change facilitators: with the high expectations that they generate on the economy and the society in general, they can justify important investments for the upgrade of the transport systems and thus adjustments in the pricing scheme.

Secondly, the communication. In all of the three cities there have been improvements in the communication to the citizens and the users. The interventions that were realized range in different areas:

- The interventions to improve the service organization and shape network require, at first, an effort to model and evaluate the different alternatives, and then an effort to communicate the decisions taken. This means new and better maps, better organization of the information on the internet and other improvements.
- It was observed also that – accompanied with the constitution of the authority and the reshaping of the governance – investments in the transparency of the entire system can create positive effects on the perception of transport and of the local administration. The organization of regular and complete reports from the authorities is at the very centre of this improvement in transparency.
- Finally there are measures that can be taken to improve the information provided to the users and info-mobility: displays at the stops or stations, better or personalized timetables, or information on the internet – either on operators' websites, on the website of the authority or on tools like Google transit.

In this concern the efforts spent to organize and communicate well the aspects related to the organization of the event can leave a legacy in term of a better capability to summarize or present the information.

In the pre event phase there is a very important intervention in order to manage and direct the demand to the locations and modes more convenient, these measures however are only oriented to manage mobility during the event. Considering that – at least in the three cases analyzed here – there have been no permanent changes in habits and behaviors of the travelers, it might be desirable to experiment something in this sense. As it has been shown for the issues related to the governance and to the pricing, major event could be leveraged as facilitators of change by gradually modifying the habits and attitudes in relation to different modes.

5.2.5 – Managerial measures

All the changes on the system in terms of governance, infrastructure, operations and functional aspects also require an adaptation of management practice within the industry.

Firstly the new governance might require the change of the activities of the actors involved: the new authority might need to take the control of some processes that previously were executed by the public administration or by the operators. Generally speaking, this evolution means that there can be duplicated activities. From the organizational point of view the reshaping of the industry may require the need, for one organization involved, to acquire new competences. Furthermore, one problem that needs to be managed in this cases – and was not mentioned before –, when an integrated ticketing system is developed, is the procedure to be adopted to split the revenues among the operators and to cover the central costs of the authority.

Secondly, there is the need to issue new procedures or to adapt the old ones in consideration of the new aspects, this means that the changes in the infrastructure, in the organization of the service, or simply the introduction of a new schedule might require new procedures. In this context there is pace for small improvements in the efficiency and for the development of better operational practices.

Furthermore, the extension in the use of Information Technology can improve internal performances: the development of a traffic control centre that monitors the situation of a bus or metro network by using a vehicle positioning system allows to keep track of the state of the network and to intervene in case of problems. This innovation was very important in the cases of Turin and to a less extent in the other ones. Through these measures there is a strong potential for the improvement of the services but it has to be recognized that the sector of public transportation in general is not at the frontline in the use of processes control techniques to monitor and improve the performances of the service

Finally, the cases have shown that – not only in the period of the event, but generally in last decades – the operators spent a considerable effort in order to increase awareness of the nature and the importance of collective transport services. Target of the measures introduced with this purpose were the passengers and especially the employees. It is a long and complicated process to develop a service oriented mentality where it is missing.

5.2.6 – Conclusions

It can be noticed that the effects above presented are not given, it is required an effort in planning the interventions and a strategic perspective. The discussion of the cases has shown that there in a certain experience on how to manage the preparation of transport for these major events

in order to prepare the future of the city and the metropolitan area, however something could be improved.

It is confirmed that major events represent a mobility laboratory where different solutions can be experimented – as it was said by Louis Pelaez in one of the interviews –, however the cases analyzed show that it is critical to adopt a strategic approach in selecting the objectives for the legacy to leave to the host city after all the investments. This strategic approach has to be intended as referring to both the choice of the location and the problems to tackle, in terms of the performances defined as the general conditions and the quality of the supply, the behavior of the passengers and the costs of the system.

6 – Milan's preparation towards EXPO 2015

Considering the early stage in the preparation of the event it is not possible to analyze the development of the city in relation to the event, but it is, however possible to analyze the initial situations and the measures planned to prepare the event and its legacy for the city. This is the purpose of this chapter, that tries to apply the findings of the realized study in the current case of Milan.

After that the situation of the city and the plans for the coming event have been studied on the official documents or on various publications and presentations, they have been discussed in some interviews to persons that are directly involved in the organization of the transport system of Milan, as for the cases previously analyzed the references of the interviewees can be found in the appendix.

6.1 – The city and the event

With GDP of over 137 billion € – around 10% of national GDP –, per capita GDP of 35,776 € and household purchasing power 23% above the national average, the Province of Milan is the wealthiest and most economically developed region in Italy. However, recently the Financial Times defined it "Europe's Cindarella": "Despite its industriousness, many attractive assets and heavy lifting on behalf of the Italian economy, it remains saddled with a surfeit of obsolete and ugly architecture, scarce greenery, old infrastructure barriers, intractably tangled traffic and some of the continent's most polluted air." (Financial Times, 2009). The city decided to bid for hosting the World Exposition of 2015. In the document that presented Milan's application for hosting the event to the Bureau of International Expositions the reasons for the application were explained by saying:

"Milan views Expo 2015 as an engine for radical strategic development which will project the city into a new international dimension, placing Milan at the centre of the decision-making process on world governance and making it a leading protagonist in applying measures and best practices for the good of mankind. Expo 2015 will also help raise the quality of life of Milan's citizens bringing sustainable mobility, economic and employment benefits, a cleaner environment, greater technological assets, a stronger security apparatus and the valorisation of human capital." (Dossier EXPO 2015).

The theme for Expo Milano 2015, "Feeding the Planet, Energy for Life" – chosen to focus attention on developing effective sustainable solutions to the complex and pressing issues that surround human nutrition, both in terms of food safety and security – is closely related to the tradition of Italy and to the leading international role of Milan.

The event is expected to attract 29 million of visitors – 25% of them coming from abroad – and will be located in the north-western area of the city in proximity with the new fair of Rho – Pero. The area is 200 acres and will host 180 expositors from 120 countries.

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Given the large number of visitors expected to visit the exposition the additional traffic would be considerable. A total of 250 thousands visitors is forecasted on weekend days and a total of 160 thousands on an average on working days. Considering the large number of trips done in the second case for work or study reasons the most challenging days for the metropolitan transport system would be working days.

The city of Milan is a dense populated area and is surrounded by a very large residential and work basin, thus in there are very large flows. Within the metropolitan area there are more than 5 million trips each day. Among those the share of trips done inside the city of Milan represent only the 48,7% of the total, the remaining 50,3% has as origin or destination the areas of the metropolitan area external to Milan's city (Croci, 2009). Today the vast majority of these trips is done by private car and there are serious congestion issues in specific critical nodes.

6.2 – Measures and planes

The organization of the event will be responsibility of the organizing committee EXPO 2015 that is participated by different administration tiers as summarized in the table below. In the organization

of the committee There will also be four central offices that will supervise the following activities for both business units of the Organising Committee:

- Strategic planning and control,
- Corporate finance and legal affairs,
- Human resources and organization,
- Promotion, communication and media relation.

The only one that appears to be related to the post event legacy is the first one that will take care of the budgeting for the event and develop financial planning for infrastructure projects in collaboration with the other entities involved.

Table 6.1 – Participation in EXPO 2015

Entity	Share
Central government	40%
Regione Lombardia	20%
Provincia di Milano	10%
Comune di Milano	20%
Camera di commercio di Milano	10%

EXPO 2015 will be responsible of the organization of the event within the exposition area while the interventions, related to the event and external to the exposition site have been demanded to the vehicle created by Lombardy Region: *Tavolo Lombardia* it was instituted with the law 133/2008[47] and made responsible of the coordination and delivery of infrastructures related to the event. These infrastructures amount at approximately 13,5 billion euro that will be financed with central government funds as well as regional resources.

One of the pillars of the bid for the event was the expected set of "valuable legacies for the future", described as follows. "The event was conceived and designed with particular attention to the cultural, infrastructural, economic and human legacies that it will leave to future generations." These cover different areas, from the economics, to cultural activity to transport, since "the connecting infrastructure between the site and the city will improve mobility in the area and the quality of life for the inhabitants" (Dossier EXPO 2015).

[47] Finanziaria regionale 2009.

This event is located within the context of the program – *Accordo di programma* – proposed by the Major of Milan Letizia Moratti on October the 17th 2008. This program, that was afterward agreed also by the regional administration and by the province, integrated and summarized the *Masterplan* presented in the dossier prepared for the application. However in this plan there were some unclear aspects. One of them, the most urgent, related to the property and the fees for the utilization for the exposition site, and the other, related to the future utilization of the same site, is not clear from either the Masterplan or the *Accordo di Programma*.

GOVERNANCE ASPECTS

After the national law of 1997[48] it was decided that the different regions, in conformity with the specific decision can demand the functions of the administration of public transport to the local administrations, namely provinces and municipalities.

The governance of the transport system in Milan is characterized by the latest interventions on the subject that date back to twelve years ago; at the time of the regional law 22/1998 that dealt with the reorganization and development of the regional public transport system. Later, the regional law 1/2002 has imposed the separation between the function of the regulation – solely assigned to public entities – and the other one of the operation of the services. The purposes of this regulation were the encompass of monopolistic situations in the industry and to introduce competition in the assignment of the services. The purpose of the regulation was to increase the quality of the service, its effectiveness and efficiency, thus its affordability.

These law represented a first step in the direction of the national law …

The different organizations involved are described in the following list:

- Agenzia Mobilità Ambiente e Territorio (AMAT) constitutes the technical structure of the municipality of Milan and has the purpose to support the planning and the regulation of the services. However, it is not an authority but a vehicle of the city administration.
- Azienda Trasporti Milanesi (ATM), the main operator of public transport of the city. Completely owned by the municipality of Milan, ATM controls the network of Metro, busses and trams, together with other services like parking, bike and car sharing.
- Le Ferrovie Nord Milanesi: (FNM) is the local operator of the suburban rail which is under the control of the Region.

[48] Decreto Legislativo 19 novembre 1997, n. 422: "Conferimento alle Regioni di funzioni e compiti in materia di trasporto pubblico locale, a norma dell'articolo 4, comma IV, della Legge 15 marzo 1997, n. 59".

- Trenitalia Lombardia, the regional division of the national railway operator.
- Metropolitana Milanese (MM) is the company that is used by the municipality for important infrastructure construction works. After that the system is ready to go live it is delivered to the operators.[49]
- In addition to those actors a series of other companies specifically related to the road system: ANAS, Bre.Be.Mi, Autostrade and others.

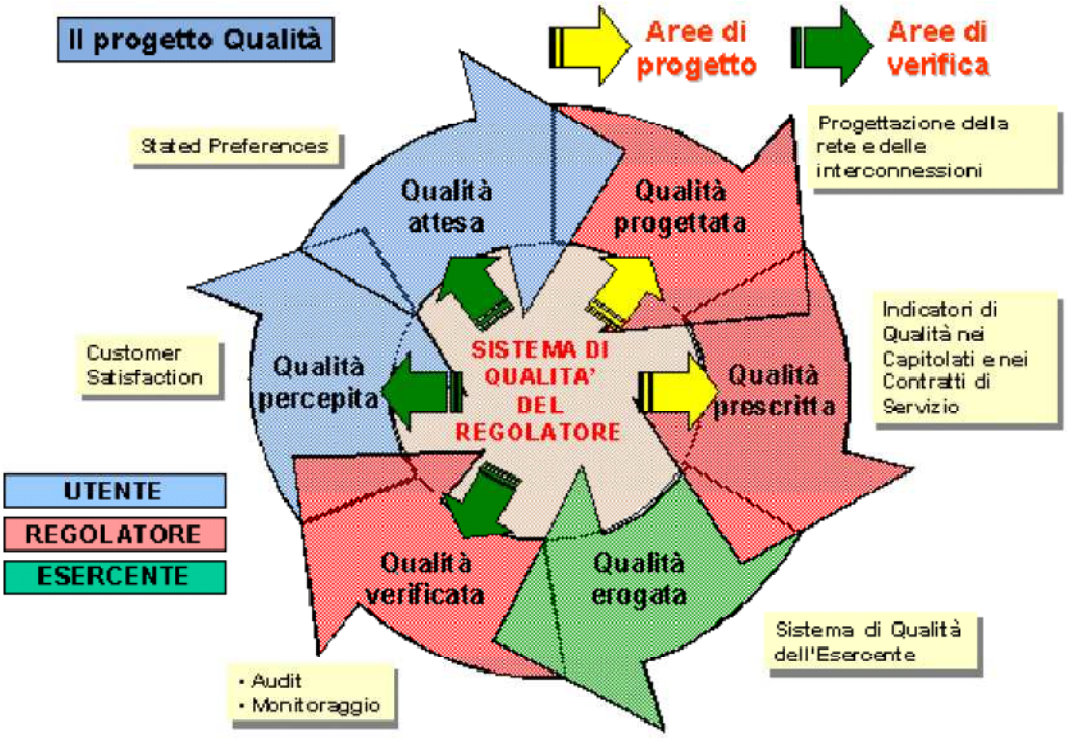
The presentation of the governance of the system – in particular focusing on public transport –, as it was shaped in 2002, on the website of AMAT shows what would be necessary but the regional law was incomplete and did not succeeded to implement the solutions indicated by the national and European laws and indications. Three main problems weaken the current governance:

- The regulation, as it is presented is valid only within the city of Milan. The sub-urban and extra-urban services are under the competence of the provinces. This is a particular problem for the integration of the different transport systems, in particular since the time when Monza – a city at less than 15 kilometers away from the very centre of Milan – became a new province. In this administrative environment it is impossible to cooperate and harmonize the services.
- There is a strong and central role of the municipality that, holding – with one hand – 100% of the operator ATM, should – with the other hand – organize the auctions for the assignment of the services to create a competition for the market among the operators. This specific point is the same problem that occurs in the governance of Athens.
- The lack of an observatory of transport to monitor the system, the demand and the performances of the operators complicates the evaluations (ISFORT, 2007).

In this situation it can be observed that there are two important operators, the only ones that can offer the more attractive services in the city, and hundreds of atomic operators that cannot provide a competitive service in a liberalized market (Catania, 2005). For these reasons, the current system has failed to integrate the long distance network and the core urban network (Senn, 2009) thus something could be done in this sense to improve the results.

[49] The company was recently divided in three departments, one of them taking specifically care of transport infrastructure.

Picture 6.1 – Model of the regulation of Milan Transport system (Source: www.amat-mi.it)



Back to the event. Until today, the involvement of the operators in the preparation of the event has been very little, ATM was only asked by the organizing committee to estimate the mode selection of the flows and to propose some technical solution on specific issues. It could be wished that IT can be reached a more participative approach and it would be decided this favorable occasion to tackle the existing problems and to improve the governance through the creation of a Metropolitan Transport Authority.

STRUCTURAL ASPECTS

Because of its attractiveness within the Italian – and to some extent European – scene the city is still growing and attracting new inhabitants. The areas chosen by the municipality for the urban development and expansion are located on three radial axes departing from the city centre, the shape obtained by linking these areas is an "upside-down T". The shape and the ares – highlighted in red – can be visualized in the picture 6.1. Namely, the targeted areas are, from the north-west to the south-east, Rho-Pero, Garibaldi, Republica, Porta Vittoria and Santa Giulia; and from the centre to the north-east, Bicocca and Marelli's areas.

Picture 6.2 – The “upside down T” (Simonetti, 2009)

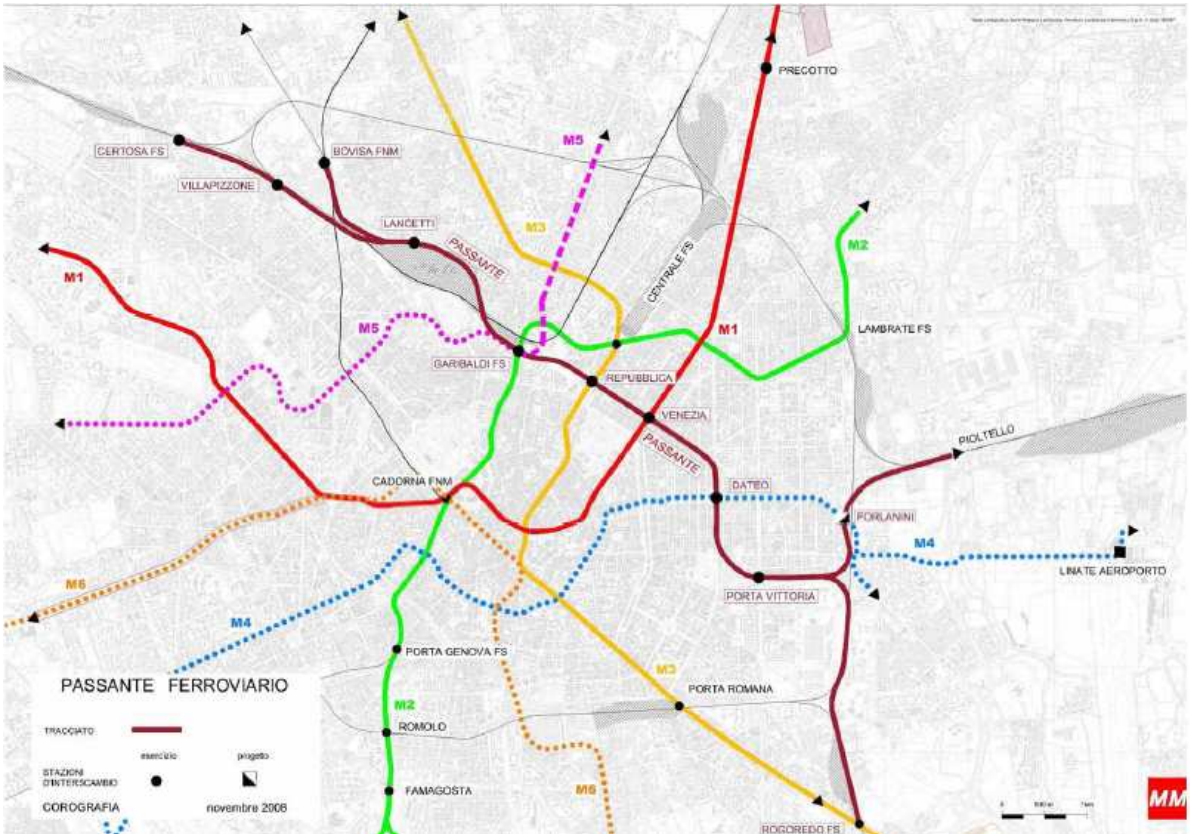
The new areas will need to be harmonically connected and integrated within the rest of the city. For this reason and for improving the current transport system there are important infrastructure construction that need to be done. Some of these project have been developed long time ago and others have been planned more recently. The city in 2015, according to the original planes by the municipality should look like it is shown in the map in picture 6.2. By the time of the event there should be:

- The three new metro lines M4 (Linate – Policlinico – Lorenteggio), M5 (Bignami – Garibaldi – San Siro), M6 (and the extension of M1 to Monza Bettola).

  Among those lines the only one expected to be completed before the event is the line M5 that should open the first track in 2012 and the second one the following year, the other two lines are still in the process of the executive design and final approval.

- The three highways that aim at diverting the flows not directed to Milan's away from the city: Pedemontana (to be delivered by 2015), Bre.Be.Mi (to be delivered on December 2012) and the New External Tangenziale Est (Still to be financed and approved).
- An extended suburban railway network tank to precise interventions at Malpensa airport, at the Rho-Pero area, on the line Rho-Gallarate and up to Parabiago.
- Plus other road constructions to link the event site with the closest highways.
- Finally, it is expected an additional provision of parking for 25'000 cars and 1'500 busses in the proximity of the event site (OTI, 2009).

Picure 6.3 – The map of Milan's public tran sport in 2015 (Senn, 2009)



OPERATIONAL ASPECTS

The most important problem to be tackled is the limited capacity in the segment of the metro M1 between Pagano and Cadorna. This section already encounters problems of capacity and a solution is absolutely required by the time of the event. Different technical options are being evaluated to synchronize the trains that merge their track before Pagano's station. The most realistic

one would be to try to reduce the headway between two trains below the 2 minutes; by improving the signaling system, a reduction up to 90 seconds could solve the problem.

One secondary intervention will be the extension of bike sharing. This service is reaching a broader user base and ATM plans to expand its coverage of the city. This decision can be considered as independent from the event even if it is being discussed the possibility to use this same service in the site of the event to move the visitors within the area.

One intervention that was not already planned but can be reasonably expected is the reorganization of the bus network after the start of the new services in the new infrastructure. The study has shown that there can be a general substitution effect between metro and bus services, however it is premature to evaluate what will happen in Milan in this sense. In any case it wll be needed e reorganization of the entire network.

FUNCTIONAL ASPECTS

The ticketing scheme seems to be robust. The city has an integrated ticketing and this system was extended at regional level with the entry of Trenitalia in 2008. However some problems might be found because the price of the single trip ticket in Milan did not grow in the last decade and has always been at the level of 1 euro. The municipality that has the competence on this decision choose not to adjust the fare while, on the contrary, in the last auction of four of the six tranches of sub-urban services, the Province of Milan decided to raise the price considering the inflation, measured by a consumer prices index (Interview with Mr. Vazzana). Besides the political choice to keep a fixed low fare, this difference might considered not to be even. Considering the findings of this study and of the economic literature on public transport service, the cause of this discrepancy is the lack of coordination due to a poor governance of the system. One single authority could plan the service, better consider the different needs of the users and better manage the auctions for the provision of the services that have been decided.

The operator decided to merge the three separated control rooms of the metro lines. This decision will be accompanied by the investment in a new and more sophisticated control room that will also take the control of the new future metro lines. The additional advantage of this intervention that ATM expects is a better coordination among the three operators in the control and monitoring of the services, to provide the passengers with better regularity, better modal integration and better information.

Indeed, in this sense the organizing committee commissioned to ATM a study on the possible improvements of info-mobility from both a technical and economical perspective.

MANAGERIAL ASPECTS

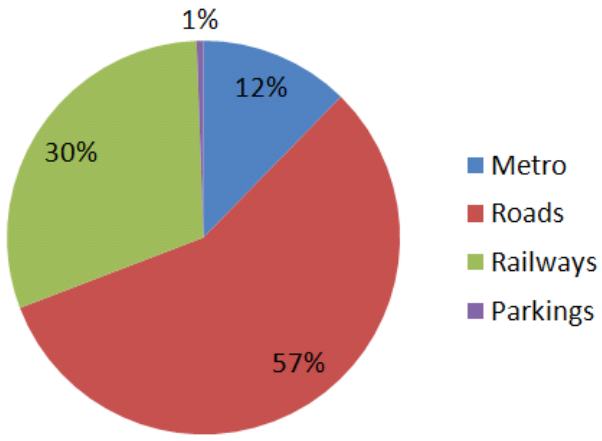
Given the early stage of the preparation of the event and the marginal involvement of the operators, at the moment it was not possible to identify any intervention aiming at the improvement of managerial aspects.

6.3 – Impact prediction and recommendations

It can be seen that the effort that is planned to be spent on construction works is very important. The planned measures are coherent with the results found in the past cases: among the projects to be realized there are some that have been conceived several decades ago and only now, in the occasion of the event, have been approved and financed. From table 6.2 it can be seen that, given the fact that the two metro lines will be completed only after 2015, and the projects are still pending for final approval, the 57% of the investments in the urban transport systems will be represented by roads: highways and ring roads. This mix of investments is not encouraging in a city that want to improve the attractiveness of its public transport services for the citizens.

Table 6.2 – Infrastructure investments summary (Personal elaboration)

Infrastructure	**Cost**
M1 Extension	206 ml€
M4*	2 179 ml€
M5	1 214 ml€
M6*	900 ml€
Pedemontana	4 006 ml€
Bre.Be.Mi	1 400 ml€
Other highways	552 ml€
Malpensa railway	1 200 ml€
Suburban rail (lines and stations)	2 286 ml€
Local connections EXPO site	593 ml€
Parkings	64 ml€
TOTAL (Projects in the Bid)	**14 600 ml€**
TOTAL (Expected)	**11 521 ml€**



Comment * Expected not to be completed before the event.

One comment could be done on side measures like the provision of parking and pollution charges (called Ecopass). Besides the lack of parking facilities in the city, centre a large number of parking will be made available in the city: one might ask till what point this is needed and till what point it will encourage private car usage. This issue is even more delicate if it is considered the habit for savage parking on streets and pathways, and the light control policy applied on this violations that create a damage for urban quality and for public and private traffic circulation. Furthermore, two years after the launch of the Ecopass there has been no clear statement of the results of this intervention and of the direction that this system will evolve.

Apart from hard construction works there is no very clear commitment on more light or soft measures aiming at improving the overall performances of the system. So far there has been a limited discussion on the legacy that the event can leave beside infrastructures. One example of this could be the promotion of cycling within the city: the operator and the city are promoting the new BikeMI system and plan to expand its service, however one might raise the issue that for safety reasons and for the same effectiveness of the measure it is urgently required the creation of cycle paths. This need could hopefully determine an occasion to take away from private car traffic a good quality urban space and dedicate it to a more efficient mode.

Even if, as shown above, there is a poor detail level of planning of the measures to be taken in order to exploit the opportunity of the EXPO and improve the transport system, the figures shown about the conditions of transport tin 2015 are ambitious. To quote a few:

- After the nomination the head of development of the city of Milan, Carlo Masseroli, said “Milan is experiencing a magical moment,” he said. “It is re-conceiving itself, rethinking the development of the city, which is something that hasn’t happened since 1954” (Financial Times, 2009).
- The number of trips on public transport system within the city of Milan is expected to grow up to 1,7 million (Croci, 2009). This would mean an increase of more than 50% from current figure. Such a large increase could be reached only through a better connection between the different networks that serve trips with various ranges.

7 – Conclusions

7.1 – Concluding comments and future research

To summarize the results of the study it is possible to conclude that major events represent a facilitator that offer the possibility to realize important changes not only in the structure of the transport system, but also in its governance and operative management. The different indicators evaluated show the following results:

Firstly, they were realized new infrastructures and services with an heavy investment activity. Many of the realized projects were developed long time before the event, then put aside and finally financed in occasion of the event. It has been observed an intense development of the areas where the event is located.

Secondly, in all of the studied cases there were permanent changes in the governance through the constitution of one Metropolitan Transport Authority. In occasion of the event the cooperation among actors have improved.

From an operational perspective there were slight improvements in the quality of the services in all cases, including an extension of service (frequencies, night services) and operational improvements (reliability and punctuality). In all three cases it was realized a new Traffic Control Centre and it was intensified the use of IT, especially in Turin.

The findings concerning the characteristics of demand have shown not so positive as the others. It is very complicated to change the habits of passengers in terms of mode selection: There is a positive effect in the event year and in the year before but this is half reabsorbed and leaves a slight legacy in this sense. Efforts and results were concentrated in the city area, thus limited in the sub-urban areas meaning a loss of opportunity. Congestion problems always came back when street capacity is increased.

Finally, also as a consequence of the matching of the new supply and the new demand it was found that there are changes in the costs of the transport system. It was found a positive evidence that there is no significant loss in the productivity of the fleets and of human resources. On the contrary, it is possible to achieve an improvement in cost related performances: in one case due to gains in efficiency and in two cases related to increases in the prices.

The case studies have shown that there are common measures that have shown to be robustly effective.

To begin with, the major events represent an occasion to improve the governance of the transport system, this context might enhance the cooperation among the parts involved but it is critical to consider the coherence of the new governance with the division of power and the details of the proposed solution. These changes in the governance require a long time to be absorbed and fruitful, it is thus necessary a continuous attention and an accurate communication of the reforms.

In the occasion of the large investments it is useful to consider a comprehensive planning of the network with a long term perspective, even though this is not always possible. It has been found that there is a strong focus on the most capital intensive infrastructural measures, while – other less expensive, but not less important aspects – might be put at the second place, reducing the benefits of all the actions.

In the occasion of major events there is the opportunity to plan and experiment new plans that could improve the operational aspects of the transport system, ranging from the provision of public transport services to the active control of traffic in the network.

From a functional perspective it was found that successful measures are the introduction of new applications of Information Technology – for both internal and external purposes – and the introduction of an integrated ticketing. In this context, major events may also represent a facilitator for the adjustment of fares.

Finally, the diverse changes that impact the industry and the high demand on its performances represent an opportunity to improve the management of the whole system through changes in the processes, introduction or new procedures and the creation of new competencies.

Connecting the dots between these observed measures it must be said that it is critical to plan in the long term. It is possible to take the example of the case of Barcelona, where – through a series of important events and precise interventions – the transport system was gradually developed by tackling different problems at different times. As it emerged in the interview to Jordi Singla, the last 25 years have been very positive for the overall development of Barcelona's transport; this was possible thanks to the ability to plan the decisions to be taken in advance.

Furthermore it is critical the coherence between the measures utilized and the ability to develop ambitious plans. This may require difficult and unpopular decisions – like the use of pull measures to

promote public transport or adjustments in the fares – but is critical to achieve permanent improvements.

Finally, in order to be effective in determining the evolution of the transport system it is necessary not to see the measures taken in occasion of the event as isolated interventions or even as the solution to all problems; it is complicated to improve a complex system as transport and the work should not be left "half way done" because a continuous attention is required. In order to be effective it is important, on the contrary, to commit towards a continuous and gradual evolution.

In the future the understanding of these phenomenon will improve also thanks to more complete evaluation that is being introduced by the International Olympic Committee – through the Olympic Impact Report – and to the attempts to compare different cases.

One specific discussion could be opened to discuss the effectiveness of the large investments associated to major events. Federic Sambrià, Professor of Operations management and expert on transport industry from IESE business school, when interviewed on the case of Barcelona, said that in the occasion of the event the intervention on transport can be valued as it is typically done for a general project. If time is fixed because the event represents a deadline and if quality is fixed because of the requirements of the International Olympic Committee, then costs can hardly be prevented to rise out of the control of the responsible entities.

In this direction were also directed the comments made by Bill Halkias, interviewed about the case of Athens. The experienced executive said that the legacy of the games was extremely important as well as it was extremely costly. It was impossible to properly plan in advance the intervention and there was little that could be done to prevent the risk of wasting large resources. The interviewee said: "we were reacting to a situation we had never seen before, planning was just prediction and it was not possible to make any strategic reasoning".

The comments of these two experts, considered particularly valuable in the international scenario because of their prestige and because of the fact that they represent a mix of technical knowledge of transport engineering and of management – theory and practice –, could induce to doubt on the limits of current appraisal techniques used in transportation industry. Considering these two comments, it clearly emerges that the study did not cover the issue of the economic assessment. This would require a work that could analyze the effectiveness of investments and the evaluation techniques used for decision making.

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Appendix – The interviews

Barcelona's case study

Jordi Singla

Transportation engineer, Partner and founder of

ALG (Advanced Logistics Group) – Transport consultancy

Holds a long experience in the organization of multimodal transport in Barcelona

Interviewed on October the 20th 2010.

Luis Peláez de Loño

Director of Transport and Service Planning

Transport Metropolita de Barcelona (TMB)

Interviewed on October the 27th 2010.

Athens' case study

Bill Halkias

President of the association of Greek Transport Engineers and

CEO of Atiki Odos

Holds large experience in transportation and in government management

Interviewed on November the 3rd 2010.

Nellie Tzivelou

Transportation engineer, planning division

Athens Urban Transport Organisation – OASA

Long experience in the company

Interviewed on November the 8th 2010.

Turin's case study

Maria Grazia Sestero

Assessore alla Viabilità e ai Trasporti

Comune di Torino (Turin Municipality)

In charge since 2000.

Interviewed on May the 19th 2010.

Ing. Cesare Paonessa

Director

Agenzia Torinese per la Mobilità Metropolitana (Authority for Metropolitan Mobility)

Holds a long experience in the organization of transport in the provinces of Turin and Alessandria.

Interviewed on September the 15th 2010.

Ing. Guido Nicolello

Manager responsible for the planning and programming of public transport service

Gruppo Torinese Trasporti S.p.A. (GTT)

Holds a 20 years experience in the job.

Interviewed on September the 16th 2010.

Milan's preparation for EXPO 2015

Ing. Maurizio Vazzana

Head of Mobility analysis and Modeling unit

Azienda Trasporti Milanesi, ATM

[Delegated for the interview by the Director of Corporate planning, Ing. Giampaolo Codeluppi]

Interviewd on November the 11th 2010