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Global Markets and Supply Customization in Urban Transportation Systems

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Abstract

The increasing world's population, mainly concentrated in urban areas, is leading to an increasing demand for transport services, which is an inescapable consequence of global trends. Indeed, evolving demographic, social and economic trends create dynamic demand for mobility by individuals, companies and governments.

Developing and emerging countries manifest several needs mainly related to commuting mobility from home to work, infrastructures, production plants and machinery, housing, economies of scale and modern technologies. In these countries, passenger demand is growing due to increased separation between accommodation and work and, as a consequence, traffic in urban and metropolitan areas, as in surrounding regions, is progressively congested.

On the contrary, networks and interactions between people for the creation of new knowledge characterize developed countries and the needs are referable to mobility during the working time, for shopping and for social purposes.

More in general, cities, big and small, are faced by several challenges in health, mobility, social development, security, water and energy resource management, but nowadays their survival and sustainability depend more and more on a reliable and worthwhile transportation system. Indeed, especially in fast growing context, the issue of mobility and transport is the key challenge facing cities now and in future.

In this context, cities represent the engine of the urban transportation systems industry and the present dissertation focuses on the response of global suppliers of rail-based solutions to increasing need of mobility.

In global markets, where the time is considered a decisive factor (*time-based competition*) and the competitive space become broaden and dynamic (*market-space management*), the urban transportation systems suppliers could compete and survive only adopting a Market-Driven approach.

The customization and the adaptation of the transportation systems to the

requirements of several clients represent a primary challenge for global market's suppliers, which need to organize their operations on flexibility and on non-competitive structures, such as networks, taking into account sub-suppliers, clients and even competitors.

In borderless competitive arena besides Europe and United States, new markets are increasingly drawing the attention of global suppliers and in this dissertation through a field research has been examined the situation of the Saudi Arabia.

Declaration of originality

The work referred to in the thesis has not been submitted in support of an application for another degree or qualification of this or any other University or other institute of learning. I declare that this thesis embodies the results of my own work. Following normal academic conventions, I have made due acknowledgement of the work of others.

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Acronyms and Abbreviations

ASTS	Ansaldo STS
AB	Ansaldo Breda
B2B	Business-to-Business Market
B2C	Business-to-Consumer Market
CER	Community of European Railway and Infrastructure Companies
DC	Developing countries
EC	European Commission
EME	Emerging Market Economies
EU	European Union
FgC	Fast Growing Cities
GCC	Gulf Cooperation Council
GHG	Greenhouse Gases
GDP	Gross Domestic Product
ICT	Information And Communication Technology
ITF	International Transport Forum
MDC	More developed countries
MdM	Market-Driven Management
MdO	Market-Driven Organization
MENA	Middle-East and North Africa
OECD	Organization for Economic Co-Operation and Development
O&M	Operation and Maintenance
PNU	Princess Noura Abdulrahman University for Women
RDC	Recent developed countries
SME	Small-Medium Enterprises
UIC	International Union of Railways
UN	United Nations
UNEP	United Nations Environment Program
UNFPA	United Nations Population Fund
UNDESA	United Nations Department of Economic and Social Affairs
WB	World Bank
WHO	World Health Organization

Chapter 1

1. Introduction

The globalization is the phenomenon that has symbolised the last three decades and has completely reshaped the markets' conditions that are rapidly and continuously changing, driven by deregulation and technology.

The liberalization of international trade led to the creation of global markets, characterized by the opening up and development of demand in new geographical areas, consequently shifting the core of the world economy from saturated markets, such as Western Europe and United States of America, to recent developed and fast growing markets (emerging market economies¹).

Globalization is behind this change of scene; it allows free trades of flows of capital, goods and information, on a global scale.

This phenomenon has grown increasingly in the past thirty years and has deeply changed the structure of the world's markets. On the one hand, it has enhanced the interdependence between countries and, on the other hand, it has given the possibility to adopt vital economies of costs, involving clients, suppliers and governments, in several markets.

The globalization has passed through the obstacle of the 'dot.com bubble', but has faced serious difficulties with the financial crisis of 2008 and the on going Eurozone crisis of 2011, during which consumption has lessened in the developed countries, reducing consequently production rhythms. Particularly in Europe and North America, the economic slump that has started in the past year is expected to continue, making its effects felt for some time.

Differently than other crisis, the impact of the financial sector failure on the real economy has created a 'Domino Effect', that has shifted rapidly both nationwide and towards different countries and the consequences have spread to Sovereign

¹ In 1981 A.W. Van Agtmael (World Bank) defined as 'emerging market economy' an economy with low to middle per capita income. Today, such countries account for approximately 80% of the global population. Van Agtmael A.W., *The Emerging Markets Century: How a New Breed of World-Class Companies Is Overtaking the World*, Simon and Schuster, NY, 2007.

State level, endangering the countries' solvency.

Companies, in such global context, in order to face the crisis, cannot solely rely on their products and/or services, but they need to focus on secondary factors as technology, communication and corporate intangible assets. In other words, in today's global markets, eased by the enhancement of telecommunication and transportation technologies, companies deal with a borderless competition, where space is not anymore a known variable, but a competitive factor that needs to be managed with several actions and reactions to the different behaviours of other companies operating in the market.

In this conditions, the closed relation between market demand and supply within a physical border (e.g. country, region, area) is broken by new competition's conditions; with regard to the latter, Brondoni stated: 'globalization determines a profound evolution of economic and social bonds, which are slowly transformed from territorial to functional. In the most advanced corporations, social and economic relations embrace a number of interrelated functions that go beyond a specific context to a physical space, organised around the protection of precise and exclusive local rights and duties'².

In global market, mostly characterized by condition of over-supply, it emerges the supremacy of a Market-Driven approach, as a long-term policy, aimed at the satisfaction of the market demand. Moreover, in a market-oriented view what clients seek, both at consumer level and in business-to-business market, are not anymore products but solutions to specific problems and this emphasizes the importance of intangible factors of market supply.

Markets are rapidly changing due to continuous technology's evolution, globalization and deregulation, thus, in order to face over-supply market's conditions, seems to be vital for companies to adopt differentiation strategies in partnership with client, suppliers and other companies, even though these are competitors, in order to produce a functional supply system that reflects what

² See Brondoni S.M., *Ouverture de 'Market-Space Management'*, Symphonya. Emerging Issues in Management, n.1, 2003.

consumers and clients are looking for. The period of *one size fits all*³, that means a product that can satisfy the needs of mass consumers, is over and in order to satisfy the demand's needs is essential for Market-Driven companies to develop technical knowledge and technologies on the state of the art that will change the way how demand is served.

These conditions impose new interconnected organizational structure between different actors, such as networks, based on knowledge sharing, competitive alliances and outsourcing agreements⁴. Such structures focus on efficiency of the whole supply chain, enhance internal efficiency allowing costs reduction, while improve quality of goods and services, necessary conditions to survive and compete in global markets.

As a result of this premise, the present research is based on the theme of supply customization and is aimed at explaining the dynamics of development and management of mass-transport infrastructures, as light rail and metro systems, in fast growing cities.

Functioning transportation networks are key elements for cities and towns across the globe and are preconditions for economic activities and social participation. In addition to its importance as an urban service aimed at moving people and goods, the transport infrastructures are significant generators of wealth and employment⁵.

In this dissertation special attention has been paid on the role of cities in recent developing countries and emerging economies, where high urbanization rates and availability of natural resources, create market's conditions of supply scarcity of infrastructure, which give to investors (local or foreigners) the adequate confidence on the repayment and compensation of capital invested.

According to the data provided by the United Nations⁶, today more than fifty per

³ See Kotler P., *Marketing Management*, Millennium edition, Prentice-Hall, New Jersey, 2000.

⁴ See Brondoni S.M., *Ouverture de Intangible Assets & Global Competition*, in *Symphonya*. Emerging Issues in Management, n. 2, 2010.

⁵ Cf. UN, *People and Mobility Promoting non-motorised transport options and compact cities as complements to public transport*, United Nations Human Settlements Programme (UN-HABITAT), Nairobi, 2011.

⁶ The data related to the world's population, and collected in the present dissertation, are provided by the Department of Economic and Social Affairs of the United Nations.

cent of the world's population live in urban areas, but this level of urbanization has not been reached in all regions of the world. In fact, while in more developed countries the cities account for the majority of the population, there are areas, as Asia and Africa, where urbanization is growing with high percentages.

In a long-term perspective, cities could function as the engine of social development and economic growth, but according to 'Lisbon Strategy'⁷ they should preserve social equity and warrant high quality in the fields of urban planning and infrastructures.

As a matter of fact, the rapid urbanization path taken up in developing countries along with demographic, economic and social trends are the drivers of increasing demand for mobility and big cities are indissolubly tied to efficient transportation systems.

More than other infrastructures, transportation seems to be the one on which mostly rely governments and on which are concentrated high perspectives of investments. Sustainable urban transportation system if accessible and affordable, with coordinated connections with the transportation network of the surrounding area, could contribute as well in terms of higher quality of life, places and environment.

⁷ The Lisbon Strategy, adopted by the Heads of State or Government of the European Union in march 2000, represents the most concrete policy manifestation in terms of essential structural reforms, that countries within the EU shall adopt in order to face the challenges issued by globalisation, technological change and ageing population. The strategy aims at turning the European Union into “the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion” (Lisbon European Council conclusions, March 2000). The focus of the strategy is based on three pillars: economic (promotion of productivity, innovation, competitiveness), social (encourage employment) and sustainable development. See also: Demosthenes I., Ferdinandusse M, Lo Duca M., Coussens W., *Benchmarking the Lisbon Strategy*, Occasional Paper Series, European Central Bank, no.85, Frankfurt, June 2008.

1.1. The structure of the paper

This section has the scope of explain the core issues examined in the present PhD thesis, which explores the growing need of urban mobility systems and the response of the major players of the urban transportation systems market.

In this context, two research questions drive this dissertation:

- How should urban mobility growth be managed?
- Are global market suppliers able to answer to increasing need of sustainable mass transportation systems?

Chapter 1 introduces the context of global markets in which nowadays companies operates; these markets are characterized by socio-economical systems with high instability and over-supply competitive conditions. Furthermore, it presents the background of global markets and the Market-Driven management policies with several literature reviews.

In volatile market's conditions space and time represent key variables for the adaptation of companies to the environment in which they compete; on the one hand these elements increase the complexity of the market⁸; on the other hand, if managed efficiently, space and time are the exclusive elements that allow the development and the preservation of competitive advantage⁹ and specific market position.

Sub-section 1.3 outlines a field research in Saudi Arabia, where emerge the critical role of intangible assets and network of companies in managing international projects. This subject will be further examined in chapter 5.

In Chapter 2 is delineated the core subject of the present PhD thesis, the *fast growing cities*, and it aims at analyse and explain the underway demographic

⁸ See note 4.

⁹ Porter encouraged companies to build as earliest as possible a sustainable *competitive advantage*, defining it as a company's ability to perform in one or more ways that competitors cannot or will not match. Porter M.E., *Competitive Strategy: Techniques for Analysing Companies and Competitors*, Free Press, New York, 1980. Kotler reinforced the concept and stated that customers must see any competitive advantage as a *customer advantage*. Kotler P., *Marketing Management*, 11th edition, Prentice Hall, New Jersey, 2007.

phenomenon that sees, especially in developing countries, a considerable number of people moving from rural to urban areas, with all the relevant issues in terms of need of urban infrastructures.

As a matter of fact, in both the developed and developing world, infrastructures play a critical role especially in urban areas, where driven by unprecedented growth is emerging an extensive need of secure water network, low-emission energy, sustainable health care system, affordable education and effective transportation systems.

The data utilized in the present dissertation and analysed for the development of fast growing cities concept have been retrieved at the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, that provides up-to-date and scientifically objective information on population and development¹⁰.

In the midst of several data, major attention has been paid on the estimations and projections of the distribution of the population between urban and rural areas and in cities along with the relationship between socio-economic development and population change. These are the bases on which has been analysed the soaring percentage of population that migrate from rural to urban areas, transforming in few years small and medium size cities in megalopolis with millions of inhabitants, hereinafter also referred to as fast growing cities.

In the present paper has been made a customized segregation between several countries based on the need of infrastructures¹¹, both in major cities and nationwide, consequently the outline given is *more developed*, *recent developed* and *developing* countries (see figure 1).

Starting from the first definition, the *more developed countries* include a number of areas where infrastructure development started at the beginning of the twentieth century and in some cases before (e.g. London's first underground opened in 1863). In these countries the demand of mass transport is mainly related to the

¹⁰ See also UNDESA, *World Urbanization Prospects. The 2011 Revision*, United Nations, New York, 2012.

¹¹ Generally the segregation between developed, emerging and developing countries is based on their development status or average income.

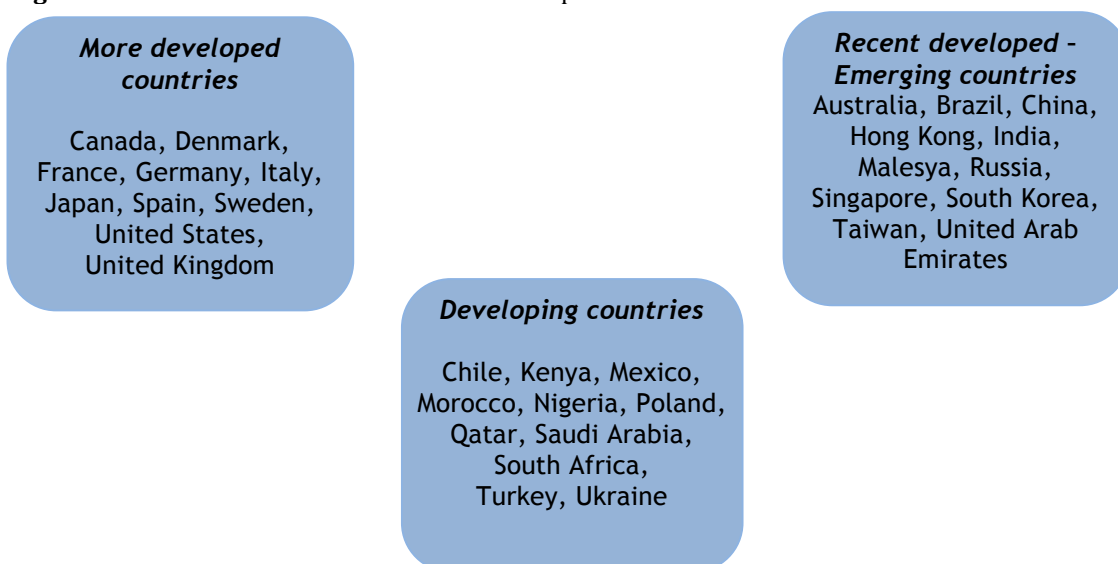
modernization and the upgrade of existing infrastructures, especially in concomitance of events as Olympic Games or Universal Expositions, and it is rarely oriented to the construction of new facilities.

The *recent developed countries* are represented by nations that starting from the nineties have seen their GDP growing increasingly, but still individuals residing in this areas have middle or low-income¹². This sample encompasses states where infrastructures have seen an impressive rate of development and expansion in the last ten years; moreover, most of the above mentioned *fast growing cities* are concentrated in these areas.

The last group, but not least important, is the one of the *developing countries*, that has already mentioned do not necessarily express the development level reached but refers to the demand of urban facilities due to growing migration and/or trade's needs.

As a result, the present dissertation focuses its investigation mainly on the last two groups, since it is vital for these countries to develop sustainable infrastructures with the aim of cope with soaring population.

Figure 1 - Countries and Infrastructures' Development



Source: Author

¹² The data related to the population income have been collected from the World Bank. See also: <http://data.worldbank.org/about/country-classifications/country-and-lending-groups>

Chapter 3 is a presentation of the urban rail market, in which the emphasis has been posed on the role of technologies in developing efficient, sustainable and affordable mass transport systems. In this chapter are examined the dynamics of the market and the key factors that drive the demand of urban transportation systems. Furthermore, the subject proposed aims at analysing the competitive conditions of the market of the international metro systems demand, that depending on the area is experiencing the following situations:

- Over supplied condition, in countries where infrastructure have been developed since the beginning of the twentieth century and where nowadays major investments are focused on renovation and modernization (saturated markets);
- Supply scarcity condition, in developing areas that are experiencing economic, social and demographic growth.

Chapter 3, starting from sub section 3.1, deepen the analysis into the variables that influence the adoption of urban transportation systems, giving an external perspective. As a result, beside technology the dissertation focuses on environmental and sustainable development concerns and climate changes. Indeed, a recent report of the United Nations demonstrated that cities account for producing 70% of greenhouse gases and share the burden of responsibility for global climate changes¹³.

Moreover, transportation increases as economies grow, especially in developing countries. Emissions by the sector are expected to continue increasing in the coming decades. As a consequence, decision-makers at several levels are called in order to implement policies aimed at reducing emissions by the sector¹⁴. In this perspective emerge the need of energy-efficient infrastructure planning in developing urban areas.

Corporates' response, in unstable market conditions, such as the global markets ones, are investigated in Chapter 4. Major attention has been paid on the approach

¹³ UNFPA, *State of World Population*, 2007.

¹⁴ See also UNHABITAT, *Global report on human settlements 2011. Cities and Climate Change*, Earthscan, London, 2011.

of global corporations in balancing the quantitative growth (supply-driven management) with the differentiation and customization of the supply (Market-Driven management), which enable a prompt response to volatile market conditions. As a consequence, nowadays, companies organize their operations through a dynamic supply chain, based on many favourite sub suppliers, following the concepts of lean manufacturing and just-in time, adopted for the first time by Toyota Motor Company.

Chapter 5 introduces new paradigm in transportation industry and presents the globalization pattern that major industry's player are following, in order to survive to unstable conditions. In a global context, where relationship are functional rather than geographical, space and time have substituted products and demand and these factors became the main variables to be managed.

In recent years, rail industry has undergone a major disruption that has seen many companies leaving the market, in Italy and elsewhere. In the meanwhile, new markets around the world have opened up, driven by technology and price.

The data provided by several organizations involved in the railways industry, clearly show a shift of the global demand of urban transportation systems from Europe and United States to the Arabian Peninsula¹⁵. Nowadays, as a matter of fact, the Gulf countries and Saudi Arabia, along with China, represent the engine of the entire global industry of urban transportation systems, driven by huge amount of natural resources, such as oil and gas, and consequently the adequate economic and financial solvency.

Within the Gulf Countries has been taken into primary consideration the Saudi Arabia, where is taking place a significant demographic migration from rural areas to cities and where is emerging an over demanded market situation in terms of infrastructures. The population in urban areas is rising at an exponential rate, consequently the need of urban and suburban transportation system is continuously soaring.

In order to accomplish the research objectives, the present dissertation has been

¹⁵With regard to the Arabian Peninsula have been taken into account the following countries: Bahrain, Kuwait, Qatar and United Arab Emirates.

gathered with a personal field experience in Saudi Arabia, which has been reported in sub-section 5.2.

In chapter 6 are outlined the findings and conclusions of the dissertation.

1.2. Competing in global market

The typical closed markets of the twentieth century have been succeeded by open markets, in which dynamism prevails over immobility and companies develop complex models of competitive interactions. The economy has become supranational and is not anymore related to the physical borders of a certain geographical area; as a result, the socio-economic relationships shift from being territorial to being functional¹⁶.

In these conditions, goods, capital, people, knowledge, technologies and ideas circulate freely and companies cannot solely rely on their internal resources, but market conditions impose to enter into competitive alliances with other organizations, operating in the market¹⁷.

Corporate's management in global markets is closely bind to the different conditions of market's competition, that can be charted as follow¹⁸: scarcity economies ($D>S$), dynamic equilibrium between supply and demand ($D\approx S$), and over-supplied economies ($S>D$).

Table 1 - Competitive Conditions and Corporates' Management

Competitive Conditions	Company's Orientation	Strategy	Company's Efforts
Supply Scarcity	Price and Production	Passive Marketing	Concentrated on produce and supply the quantities required by the market demand
Dynamic Equilibrium	Sales (Demand/Customers)	Marketing Management	Mass Production and Marketing Mix
Over Supply	Markets and Competition	Market-Driven Management	Corporates Intangible Assets and Supply Differentiation

The economies in scarcity experience a situation in which the quantities demanded

¹⁶ See Brondoni S.M., *Market-Driven Management and Global Markets*, in VVAA, *Market-Driven Management and Global Markets*, Giappichelli, Turin, 2007.

¹⁷ See note 4.

¹⁸ See also, Brondoni S.M., *Mercato globale, risorse immateriali e spazio competitivo d'impresa*, Symphonya. Emerging Issues in Management, Issue 1, 2002.

by the market exceed the goods manufactured and/or the services provided by companies. Since the beginning of the twentieth century the demand of goods was, in most of the markets, greater than the outputs manufactured by the companies. Therefore, in such circumstances, the marketing departments were not even developed since the production was easily sold without significant efforts. As a result, there were great opportunities for the entire supply system related to an unsatisfied demand that was mostly focalised on primary and well-known needs, mainly related to basic human requirements.

In this period, which lasts up to the 1940 in the USA and the 1950 in Europe, emerged the model of '*rational management*' of the companies, whose sales departments were shaped to drive a demand of goods larger than the capacity of the supply¹⁹.

The Ford T model is a stereotype of corporate's management in market conditions of demand exceeding the supply; as a matter of fact, Henry Ford has been the first manufacturer of automobiles, who optimize a steady sequence of manufacturing, technological and commercial innovations, in order to produce and sell its car in massive quantities.

Ford, declaring that '*The Customer Can Have Any Colour He Wants So Long As It's Black*'²⁰, chose to concentrate the whole production exclusively on the black colour of the Ford T model. By means of forcing the market with a unique version, available in a single colour, Ford demonstrated a comprehensible marketing approach oriented to the product. Indeed, Ford achieved high levels of economies of scale and economies of experience, through the deployment of the efforts of the entire company on innovation, applied to work and resources, as suggested by Taylor's theories²¹. This strategy enabled the company to reach a competitive advantage and market leader position up to 1930.

As a matter of fact, in the decade between 1920 and 1930 the daily production was over ten thousand vehicles and the unit price dropped from the original 850 to 260

¹⁹ See Lambin J.J., Brondoni S.M., *Ouverture de 'Market-Driven Management'*, *Symphonya. Emerging Issues in Management*, n. 2, 2000/2001.

²⁰ See Ford H., Crowther S., *Today and Tomorrow*, Doubleday, 1926.

²¹ See Taylor F.W., *Principles of scientific management*, Harper & Row, New York, 1911.

dollars²².

Nowadays, the number of markets characterized by this competitive condition is declining continuously and the existing ones are normally dominated by condition of monopoly²³, where price is the major aspect that influences the competition. As expected, in what could be delineated as supply scarcity, companies face major problems in manufacture the quantity required by market demand and the orientation to the market can be defined passive²⁴.

The global markets of oil and natural gases suppliers represent a typical example of economy in scarcity. The competition is very low and the players are few; in these conditions, global corporations take advantage from the lack of alternative resources. Furthermore, these markets are characterized by a low level of interdependence and are generally managed within the physical borders of a single state.

The markets that experience condition of supply scarcity have a stable context in terms of demand and competition, at least in short term. For corporates, in an internal point of view, the quantities produced represent the sole volatile elements to be managed, since they are conscious of the unsatisfied demand and gather all their efforts in optimising times and resources, in terms of manpower and operations²⁵. Externally, the supply is the focal point of market structures in economies of scarcity; indeed it can be expressed in²⁶:

- The size of companies operating in it.

²² The learning curve (or experience curve) demonstrate that companies can reduce costs when, accumulating production, optimize and improve manpower's performances (e.g. skills development and/or shortcut's learning) and supply chain's operations. See also Wright T.P., Factors Affecting the Cost of Airplanes, Journal of Aeronautical Sciences, Vol.3, No. 4, 1936, pp.122-128.

With regards to the data reported on "Ford T" model, the information have been gathered on the *Ford* website.

²³ Lambin defines a Monopoly as a market where companies have high profits due to: entry barriers, few or none competitors and low negotiation power of both the customers and the suppliers. In addition, with regards to the subject of this dissertation, in 2008, the Author defined the rail transportation market as the clearest monopoly of the Italian State. See also Lambin J.J., *Market-Driven Management, Marketing Strategico ed Operativo*, 5^{ed.}, McGraw-Hill, Milan, 2008.

²⁴ Passive marketing or orientation to product is one of the four stages of the development of marketing notion provided by Lambin. In different market conditions companies can adopt the operative marketing (oriented to sales), strategic marketing (oriented to customer) and Market-Driven Management (oriented to market and culture). See also Lambin J.J., *Le Marketing Strategique. Du Marketing à l'Orientation Marché*, Ediscience, Paris, 1998.

²⁵ Garbelli M.E., *Over-Supply and Manufacturing Localization*, Symphonya. Emerging Issues in Management, n. 1, 2002.

²⁶ See Corniani M., *Demand Bubble Management*, Symphonya. Emerging Issues in Management, n. 2, 2005.

- Market share levels.
- Similarities and dissimilarities between the products offered by different companies.

Another typical example is the market of the High-Speed train's operators, which with respect to the Italian market until few months ago was in a competitive condition of monopoly, with a single supplier (Trenitalia) that is a state-owned company and the main rail operator of the country. In April 2012, due to the deregulation of the market, Nuovo Trasporto Viaggiatori (NTV)²⁷, an operator with a private investment of one billion euros, opened up the competition and it interrupted Trenitalia's monopoly position. NTV introduced a new concept of High-Speed train, with several options in terms of classes, services and prices. Consequently, Trenitalia have adjusted its own offer to the competitor's one and travellers have taken big advantages, especially in terms of prices²⁸ and services provided.

In contrast to the competitive conditions just presented, in situation of dynamic equilibrium between demand and supply, companies centre their interest on marketing instead of products. The selection of products and services is vast and differentiated; in addition, there are a large number of competitors that offer similar supplies, represented by outputs with the same basic functions but different features.

The economies in dynamic equilibrium emerged after the second world, when, as a consequence of the reconstruction efforts and economic recovery, the competition became sharper and the focus of sales departments shifted from products to

²⁷ All the information regarding NTV have been collected on the *Nuovo Trasporto Viaggiatori* institutional website.

²⁸ Before April 2012, Trenitalia offered two options, the typical first and economy class. NTV, through its train Italo, launched a segregation of classes based on three ambiances (Smart, Prima and Class) and five level of services offered. As a consequence, after few months Trenitalia adjusted its own services introducing four brand new classes (Executive, Business, Premium and Standard). In the meanwhile, both the players have adopted a new pricing mechanism, so called Yield Management, which implies limited capacity of the service offered and perishable activities. See also Cappiello G., *Politiche di prezzo e concorrenza basate sul tempo*, Giappichelli, Turin, 2000. "Basically, Yield Management is the process of allocating the right type of capacity to the right kind of customer at the right price so as to maximise revenue". See Kimes S. *The Basics of Yield Management*, in Cornell Hotel Restaurant Administration Quarterly, November 1989. The practise of yield pricing is normally adopted by hotels and airlines, which offer lower rates on unsold inventories, just before they expire. See also Weigand R.E., *Yield Management: Filling Buckets, Papering the House*, Business Horizons, 1999, pp. 55-64.

customers.

One of the first theorists, who introduced the role of marketing in corporate's environment was Drucker; he observed that the purpose of business is *'To Create and Keep a Customer'*²⁹. In addition he stated that the aim of a market-oriented company is the satisfaction of the customers based on loyalty, mutual commitment and powerful communication³⁰. As a consequence, marketing assumed a broader meaning than sales and began to be strategically combined with the different departments of the company. The marketing became the strategic bridge between production, distribution, pricing and sales and emerged the necessity of a concerted analysis of these functions.

Until the eighties, the development of internationalism introduced new models of corporate management that encouraged and stimulated market demand, which was continuously in a situation of equilibrium with the supply.

In competitive conditions of dynamic equilibrium, on the one hand, emerge the capability of corporates to manufacture goods and provide services following mass-production models; on the other hand, become clear the aptitude to push aggressively the market demand taking advantages of the use of the marketing mix³¹. McCarthy classified these tools into four groups defined the four Ps of marketing³²: product, price, place and promotion³³.

Market demand in such circumstances is heterogeneous, with several and different expectations and customer's satisfaction depends on the whole value of corporate's supply³⁴, related to tangible and intangible features. The concept of standardization became obsolete and the demand started to be split in market's segments, that consists of a group of customers recognized as different from one to

²⁹ Drucker P.F., *Managing for Results*, Harper & Row, New York, 1964.

³⁰ Drucker P. F., *The Practice of Management*, Harper & Brothers, New York, 1954.

³¹ Borden defined the Marketing Mix as the set of marketing tools the firm uses to pursue its marketing objectives in the target market. Borden N.H., *The Concept of the Marketing Mix*, Journal of Advertising Research, vol. 4, 1964.

³² McCarthy E.J., *Basic Marketing: A Managerial Approach*, 12th edition, Irwin, IL, 1994.

³³ Lambin considers the four Ps as marketing tools, which make a company more aware of its customers needs. See also Lambin J.J., *Market-Driven Management*, Ed.2, Palgrave MacMillan, London, 2007.

³⁴ See Brondoni S.M., *Mercato globale, risorse immateriali e spazio competitivo d'impresa*, Symphonia. Emerging Issues in Management, n. 1, 2002.

another, who share a similar set of wants³⁵, which translate such differences into market demand³⁶.

In this market conditions, there is a continuous search for equilibrium between supply and demand, which is “naturally” unstable as it can be destabilized by the actions and reactions carried out by competitors to alter the choices made by specific market demand segments³⁷. The response of companies, expressed by the use of the 4Ps, begin to be addressed to products that can be differentiated not only on features and price (*non price competition*), but also in advertising and choice of distribution channels³⁸. As a consequence, marketing tools are utilised to understand the desires of the customers and companies develop new products aimed at satisfying customer's desires³⁹.

Upstream the value chain become prominent the strengthening of the relationship between manufacturers and distributors; indeed, in this context, companies start to create platforms (network) that enable the mobilization of resource when and if the need arises.

Toyota was the first company that adopted lean manufacturing and ‘Just in Time’ approach⁴⁰. In other words, resources are pulled in the assembly line only when needed, rather than increase inventories’ stocks and relevant costs of their management⁴¹. Furthermore, Toyota’s strategy is based on a limited number of suppliers with which it integrates its own specified and standardized operations, aimed at enhance economies of knowledge and reduce costs and lead-time⁴².

The management of Toyota has always focused on long-term relationship with its suppliers and as a matter of facts today the Japanese company is the world leader

³⁵ See note 3.

³⁶ See Valdani E., *Definizione e segmentazione del mercato*, Giuffrè, Milan, 1984.

³⁷ See Brondoni S.M., Gatti M., Corniani M., *Competizione globale, risorse immateriali e responsabilità sociale d’impresa*, in Atti del Convegno AIDEA, Novara, 4-5 October 2002.

³⁸ See note 24.

³⁹ Slater S.F., Narver J.C., *Market-Oriented Is More than Being Customer-Led*, Strategic Management Journal, vol. 20, 1999.

⁴⁰ The new procedures introduced by Toyota in the early fifties created a platform that focuses on ‘pull’ resources rather than ‘push’ them. Brondoni with regard to Just-in-Time stated: ‘In traditional systems (Push Production), in which manufacturing programmes are decided well in advance, long before the moment that demand is met’. See also note 4.

⁴¹ See also Hagel J., Brown J.S., *From Push to Pull - Emerging Models for Mobilizing Resources*, Working Paper, 2005

⁴² The lead-time is defined as the time gap from the purchase order placed by the customer and the delivery.

in automotive market.

On the basis of the theories developed by the Japanese School and Toyota, at the end of the eighties emerged the Market-Driven Management⁴³ as an approach aimed at study and analyse the governance of corporates that operate in open and unstable market's conditions, characterized by policies based on continuous innovation and focalised on competition rather than demand.

Globalization and innovation lead companies to focus on different pattern compared with the ones that drove enterprises in market conditions of supply scarcity and dynamic equilibrium. Indeed, markets' globalization underlines a deep re-thinking of the long-term policies of big corporations, which tend to focus on increase volumes offered (supply-driven management), market competition and demand satisfaction⁴⁴.

Global markets are today mainly characterized by a saturated demand and consequently corporates' supply exceeds the market's request, in terms of quantity and quality.

Starting from the eighties, when internationalization was progressively converting in globalization, researchers have focused the attention on sources and consequences of the relationship between markets and competitive advantages⁴⁵. As a result, MDM replaced the marketing management approach⁴⁶ and then markets and competition began to be the real issues that companies needed to manage, taking the place of market's demand and products.

Slater and Narver defined as Market-Driven all the companies that seek to understand customers expressed and latent needs, and have the capabilities of acquiring and evaluating market information in a systematic and anticipatory manner⁴⁷. Compared to marketing oriented companies, Market-Driven companies

⁴³ See also Brondoni S.M., *Market-Driven Management: meglio e prima dei concorrenti*, in MARK UP, July/August 2005.

⁴⁴ See also Brondoni S.M., *Market-Driven Management, Competitive Customer Value ed economia d'impresa globale*, in Symphonya. Emerging Issues in Management, n.2, 2009.

⁴⁵ Cf. Shapiro B.P., *What the Hell Is 'Market Oriented'?*, Harvard Business Review, 1988.

⁴⁶ Cf. Webster F.E. Jr., *Market-Driven Management*, John Wiley and Sons, Hoboken, 1994.

⁴⁷ See also Slater S.F., Narver J.C., *Customer-Led and Market-Oriented: Let's Not Confuse the Two*, Strategic Management Journal, vol. 19, n.1, 1998; Slater S.F., Narver J.C., *Market-Oriented Is More than Being Customer-Led*, Strategic Management Journal, vol. 20, 1999.

scan the market more broadly, have a longer-term focus and are much more likely to be generative learners⁴⁸.

According to Best, MdM demands initially the reorganisation of the company, shifting the focus from products to the market and, subsequently, the redevelopment of corporate culture and the improvement of the mix of corporate's tangible and intangible factors to respond to the unstable demand and changing competitive environment⁴⁹.

Vallini and Simoni stated that the markets' needs have to be observed and understood and differences in competitiveness are related to differentials in the ability to attract, satisfy and retain customers⁵⁰.

In several researches⁵¹, Day stated that the MdM involves in the marketing process all the functions of the company⁵² and all the stakeholders interested, both internal and external; on the one hand, it makes the company completely opened to the surrounding environment, that today, thanks to the globalization, in most of the companies is the entire world; on the other hand, through MdM, companies can cope in highly competitive markets characterised by over-supply.

Day gave significant contributions to the analysis and development of MdM policies⁵³, defining MdO as companies with superior skills, better than the competition or a specific competitor, in understanding, attracting and keeping valuable customers. Furthermore, Day related the success of Market-Driven companies to the combination of three characteristics:

- A culture oriented outside the company's boundaries, which emphasize on creating competitive advantages and value for customer.
- Capabilities to define, to understand and to anticipate the market demand; in other word, ability in creating a closer relationship with valuable

⁴⁸ Cf. Senge P.M., *The Fifth Discipline: The Art and Practice of the Learning Organization*, Currency Doubleday, New York, 1990.

⁴⁹ See Best R. J., *Market-Based Management*, 5th ed., Prentice Hall, New Jersey, 2009.

⁵⁰ See Vallini C., Simoni C., *Market-Driven Management as Entrepreneurial Approach*, Symphonya. Emerging Issues in Management, n. 1, 2009.

⁵¹ Cf. Day G. S., *The Capabilities of Market-Driven Organization*, Journal of Marketing, 1994. Day G.S., *What Does It Mean to be Market-Driven?*, Business Strategy Review, 1998. Day G.S., *Market-Driven Strategy: Processes for Creating Value*, Free Press, New York, 1990.

⁵² See Day G. S., *Market-Driven Winners*, Symphonya. Emerging Issues in Management, n. 2, 2000-2001.

⁵³ Day G.S., *Creating a Market-Driven Organization*, Sloan Management Review, 1999.

customers, with the aim of anticipate opportunities instead of reacting to threats.

- An organization adaptive and responsive to changing environment, that enables the company to anticipate and respond continuously and rapidly to the requirements of unstable market conditions, through all the aspects that may deliver value to customer (product design, order fulfilment, system of control and measurement of human resources).

MdO, exploiting jointly these three elements, achieve superior capabilities in anticipating and capitalize on changing market conditions and competitors' behaviour.

Global markets determine new competitive approaches, which foreseen a complete revolution of the marketing underpinnings developed until the appearance of globalization. For instance, with regard to the business to consumer market, in over-supplied (saturated) conditions products are normally in a mature or descendent phase of their life cycle⁵⁴ and, as a consequence, in a context where the market supply is complex and structured, the demand is dynamic and unpredictable; customers are not anymore loyal to the same brand or to the same product and their needs are convoluted. For these reasons appears the concept of '*demand bubble*', that Corniani defined as temporary groups of purchasers, held together by a shared interest in the specific features of an offering from a certain company⁵⁵; as a consequence, since demand's segments in global markets are not anymore measurable and accessible, *demand bubble* replaced the concept of demand segmentation. In this perspective, emerge clearly, both in the B-to-B and B-to-C markets, the predominance of supply's intangible features rather than products' tangible characteristics⁵⁶ and, for this purpose, Lambin and Brondoni

⁵⁴ Normally products are in mature or descendent phase in the following cases: demand is highly segmented; new technologies allow the design and realization of new products; the tastes and preferences of customers are rapidly changing. Cf. Lambin J.J., *Market-Driven Management, Marketing Strategico ed Operativo*, 5°ed., McGraw-Hill, Milan, 2008.

⁵⁵ 'Bubbles are the outcome of demand aggregation processes developed by companies to reduce market complexity'. Cf. Corniani M., *Demand Bubble Management*, Symphonya. Emerging Issues in Management, n. 2, 2005.

⁵⁶ More in general, the products' tangible features refer to factors that are relevant in the preferences and processes of choice made by customer (size, shape, weight, material, technology); in addition, these include the

argued that Mdo adopt an *outside-in* perspective that enable to have an anticipatory and proactive approach, focusing on time-to market⁵⁷.

In global markets, characterized by unstable competitive conditions and where relationships are functional rather than geographical, intangible assets refer not only to intangible features of the products⁵⁸ offered but also to Corporate Intangible Assets, defined by Brondoni⁵⁹ as:

- *Corporate Culture*. A set of rules and principles connected to the complexity and transparency of global markets, which is related to the company's personality and is spread in all its internal and external expressions⁶⁰.
- *Corporate's Information System*. It consists in the management of information flows from the market towards the company, and vice versa⁶¹, through the use of advanced ICT systems, which allow the acquisition and proliferation of knowledge within the company itself.
- *Brand Equity*. Is the value of the main intangible resource⁶², it summarizes, on the one hand, all the action related to the creation of a relationship between a certain company and its market (brand) and, on the other hand, the status of the competitive advantage reached in its relevant markets⁶³.

As a matter of fact, in global markets, companies are able to generate added value and consequently a sustainable market proposal only adopting Market-Driven management policies⁶⁴, based on the continuous development of corporate intangible assets, which constitute an integrated system where each of the three

performance of a given product or service.

⁵⁷ See note 17.

⁵⁸ Brand, design and pre/post sales services can be defined as products' intangible features, which constitute an unstable sub-system related to a delineated market's competition, in terms of time and space. Cf. Brondoni S.M., *Patrimonio di marca e risorse immateriali d'impresa*, Giappichelli, Turin, 2004.

⁵⁹ Cf. Brondoni S.M., *Patrimonio di marca e risorse immateriali d'impresa*, Giappichelli, Turin, 2004

⁶⁰ The definition of internal relationships, in global markets, refers not only to corporate's employees but also to all the stakeholders involved in the network (co-makers and partners). Cf. Brondoni S.M., *Market-Driven Management and Global Markets*, in VVAA, *Market-Driven Management and Global Markets*, Giappichelli, Turin, 2007.

⁶¹ See also Mosca F., *Market-Driven Management in Fashion and Luxury Industries*, Symphonia. Emerging Issues in Management, n. 1, 2008.

⁶² The brand represents a key element in the development process of the company, to the extent that it outlines a virtuous circle based on research and development activities and on communication. In this way, the brand qualifies itself as an intangible resource able to create the conditions for the company profitability. Cf. Golinelli G.M., *Ridefinire il valore della marca*, in Sinergie, n. 63, gen.-apr. 2004.

⁶³ See also note 59.

⁶⁴ Cf. Brondoni S.M., *L'eccesso di offerta mette in crisi i consumi*, Mark Up, January/February, 2005.

elements takes advantages from the others. Through the system of corporate intangible assets companies develop abilities to listen to the market and respond earlier and better than competitors.

In a Market-Driven view, companies focalise their own resources on being supplier of solutions, cooperating actively with clients and competitors, in far-flung and interconnected organizations (networks), with the aim of enhance the customization of the supply. The management of unstable market condition through network structures favour knowledge management skills, competitive alliances and outsourcing agreements (with co-makers and external partners)⁶⁵.

In this context, in chapter 4 has been reported the partnership between two global suppliers of the rolling stock market⁶⁶, which operate jointly in order to develop, manufacture and deliver high-speed trains to Italian Railways Company (Rete Ferroviaria Italiana).

In widen competitive spaces (*market-space competition*), companies compete within an existing foreign market structure and capitalize on corporate intangible assets through network alliances with local partners. Indeed, networking in global markets represents a best practise adopted by companies in order to gain access to resources and cope with environmental uncertainty and impediments in their operations⁶⁷. In addition, being part of networks for companies means possibility of acquire international experience and new knowledge, which lead to increased resources' commitment in foreign markets⁶⁸.

In the perspective adopted in the present dissertation that focuses not only on major players of the mass transportation market but also on small and medium enterprises, the networks can compensate for the lack of resources that companies own and directly control⁶⁹. Finally, Market-Driven management approach enable

⁶⁵ See note 4.

⁶⁶ The case presented refers to the partnership between Ansaldo-Breda and Bombardier for the realization of Frecciarossa high-speed trains. Further cases of network of companies operating in the markets of railways and metros are reported in the next chapters.

⁶⁷ Alvarez S.A., Barney J.B., *How entrepreneurial firms can benefit from alliances with large partners*, Academy of Management Executive, 2001.

⁶⁸ Eriksson K., Johanson J., Majkgard A., Deo Sharma D, *Experiential Knowledge and Cost in the Internationalisation process*, Journal of International Business Studies, Second Quarter, 1997.

⁶⁹ Cf. Coviello N.E., Cox M.P., *The resource dynamics of international new venture networks*, Journal of

networks of companies to become suppliers of solutions (integrators and bundlers), offering a combination of goods and service, which create superior added value to their clients⁷⁰.

International Entrepreneurship, 2006.

⁷⁰ See also Lambin J.J., *La nuova complessità del mercato globale*, in VVAA, *Market-Driven Management and Global Markets*, Giappichelli, Turin, 2007.

1.3. Field research

The present dissertation introduces the role of megacities in today's global markets and pays major attention on the need of mass transportation infrastructures.

Today, the economic crisis is felt to a greater extent in Europe, but in the rest of world, rapid urbanization and the related growth of urban centres originate a need of efficiency in urban mobility.

Especially in recent developed and developing countries, big cities hold the role of socio-economical engines of the entire nation and major players of the industry of the mass transport systems are focusing their attention on solutions aimed at cope with soaring population.

In a competitive situation where space cannot be defined any longer within stable and physical borders, related to a geographical or administrative area, companies are bound to operate in networks and need to adapt and interact continuously with several and different stakeholders⁷¹, increasing both the flow of information and critical situations.

The market conditions in developing and emerging countries are absolutely mismatched with the European standards; moreover, in order to compete on global scale and to respond to the increasing demand in emerging countries, companies shall manage the time as a primary variable in terms of client's satisfaction (time-based competition).

In this context, in the present dissertation have been examined the market's conditions of the countries of the Arabian Peninsula, which represent along with China and India the biggest market for transportation infrastructures' suppliers.

In the last decades, GCC countries⁷² have accumulated a surplus in their balance of payment by owning oil, gas and other strategic raw materials, which are traded with developed countries. Indeed, countries as Saudi Arabia, United Arab Emirates

⁷¹Cf. Salvioni D. M., Transparency Culture and Financial Communication, *Symphonya. Emerging Issues in Management*, n. 2, 2002.

⁷² The GCC is the Cooperation Council for the Arab States of the Gulf and gather the following members states: Bahrein, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates. Source: GCC website.

and Qatar have settled long-term investment plans in urban mobility systems (see table 2), which attract global suppliers of urban transportation systems.

Table 2 - Railway and Metro Project Planned in the Arabian Peninsula

Project	Amount	Stage
Qatar Integrated Railway Project (Metros and Railways)	35.000	Tender
Makkah Metro (KSA)	16.500	Tender
Etihad Railway (UAE)	11.000	1 st phase Execution 2 nd phase Tender
Riyadh Metro Network 6 Lines (KSA)	8.000	Tender
Saudi Land bridge (KSA)	7.000	On Hold
Abu Dhabi Metro (UAE)	7.000	Study
Data are in Million \$		

Source: Meed Projects

All the above being stated, a case study in chapter 5, analyse the entry strategy of the main Italian supplier of transportation system, Ansaldo STS, in emerging markets.

The case presented in this paper refers to the project *Princess Noura Bint Abdulrahman University - Automated People Mover*, in which the Author has been personally involved in collaboration with an ASTS' sub-supplier, represented by a small Italian company in charge of the design and installation of the Automatic Train Control Signalling System⁷³.

Ansaldo STS, differently than its competitors, adopts a strategy based on a strong network of suppliers and sub-suppliers, represented by Italian and foreign companies, with which ASTS has encouraged the consolidation of intangible features of supply as a strategic source of added value⁷⁴.

The case remarks the role of foreign companies, in most of the cases European and

⁷³ The signaling system is responsible for train detection and control to prevent crash, hence requires the highest level of safety design in a railway system. The challenge in this field is to demonstrate the required safety in line with the European safety standards.

⁷⁴ Cf. Gnechi F., *Market-Driven Management, Market Space and Value Proposition*, Symphonya. Emerging Issues in Management, n. 2, 2009.

North American, in countries that are willing to invest huge amounts of resources in infrastructures, but experience a lack of technical profiles and of advanced technologies.

Indeed, as remarked by Borghonovi, trading means to convey goods from where they are abundant (low utility), to other places or communities where they are limited or don't exist at all, so they have a higher utility. This is the phase that creates connection between producer of goods and those who need them. Trading increases economic value thus contributing to the increase in the utility of goods and services⁷⁵.

In this context, the current geopolitical situation has led to the appearance of new form of trading that are related to the exchange of technology and expertise from developed countries towards developing ones⁷⁶, in change of natural resources, which abound especially in the GCC countries.

⁷⁵ Cf. Borghonovi E. *Rules and Behaviours for Sustainable Economic Growth in the Global Society*, Symphonya. Emerging Issues in Management, n. 2, 2007.

⁷⁶ See also, DeLeersnyder J.M., *Corporate Culture and Geopolitics*, Symphonya. Emerging Issues in Management, n. 2, 2002.

Chapter 2

2. The concept of Fast Growing Cities

In recent years, many cities, especially in emerging and developing countries, are involved in a rapid urbanization process that is related to several challenges and particularly to an increasing demand of urban infrastructures.

Urbanization is closely bind to economic globalization that, as Borgonovi stated in 2007, is based on the opportunity to benefit from ‘international specialization’ of countries, which in some cases is related to the opportunity to produce goods and provide services in countries with a very low cost of labour and to the possibility to create new large markets in developed areas or in rapidly developing countries (e.g. China, Russia, Brazil and India)⁷⁷.

Table 3 – Population Distribution in Urban Settlements

Urban Areas		Population distribution %	
		2011	2025
Developed Countries	10m or more	10.9	13.1
	5m to 10m	5.6	7.8
	1m to 5m	21.7	21.9
	500k to 1m	9.0	10.7
	Less than 500k	52.8	46.5
Emerging & Developing Countries	10m or more	9.5	13.7
	5m to 10m	8.6	8.9
	1m to 5m	21.2	25.0
	500k to 1m	10.4	11.2
	Less than 500k	50.2	41.1

Source: UNDESA Population Division⁷⁸

As a result, globalization and therefore the de-localization of the production have lead to the creation of commercial hubs settled in strategic places around the

⁷⁷ See Borgonovi E., *Rules and Behaviours for Sustainable Economic Growth in the Global Society*, Symphonya. Emerging Issues in Management, n. 2, 2007.

⁷⁸ UNDESA, *World Urbanization Prospects: The 2011 Revision*, United Nations, New York, 2012.

world. Indeed, in a study released by the UNEP emerge that the 80 per cent of world's GDP is generated in cities⁷⁹ and today more than half of the world's population lives in urban areas (table 3)⁸⁰.

The underway-demographic migration from rural to urban areas can be explained through several motivations; as expected, the main reasons of migration are referable to the opportunities in terms of job and improved services, in other words prospect of a better life. In addition, in developing countries and especially in Africa, urbanization is also related to several conflicts in rural areas.

The direct relationship between urban and economic growth has been experienced in the last two decades in East Asia, where a steady increase in urbanization led to a reduction in poverty. At the same time in Latin America, Africa and South Asia the rapid urban growth has moderately contribute to wealth's creation, up to the nineties; after that, in most of the cases caused a spread of urban slums⁸¹.

In 1970, Tokyo and New York were the only two mega-cities, which account more than 15 millions of inhabitants, respectively 23 millions in the Japanese capitol city and almost 16 millions in the economic and financial centre of the United States. Indeed, reporting the data collected by the UN (see table 4), today the Asian continent alone accounts for more than thirteen megalopolis due to the emerging markets developed in the mid-eighties, the Asian Tigers (Malaysia, Taiwan, Singapore and Hong Kong), followed nowadays by the primary role act by China in the global market, as a manufacturer, trader and consumer.

The same urban rapid growth path involves African big cities and Lagos (Nigeria) represents an example of soaring population, since it moved from 1.4 millions in 1970 up to approximately 12 millions in 2011. As a result, by 2030, the towns and cities of the recent developed and developing countries will make up 80 per cent of

⁷⁹ Rode P., Burdett, R., *Cities: Investing in energy and resource efficiency*, in *Towards a green economy: Pathways to sustainable development and poverty eradication*, UNEP, Nairobi, 2011, pp. 450-489.

⁸⁰ See note 10.

⁸¹ According to UN-Habitat, a "slum household" is a group of individuals living under the same roof in an urban area who lack one or more of the following: durable housing, sufficient living area, access to improved water, access to sanitation and secure tenure. See also, United Nations, *Implementation of the Outcome of the United Nations Conference on Human Settlements (Habitat II) and Strengthening of the United Nations Human Settlements Programme (UN-Habitat): Report of the Secretary General (A/61/262)*, par. 8, New York, 2006.

urban population.

Table 4 - World's megacities demographic growth

	Mega-cities	1970	1990	2011	2025
1	Tokyo (JAP)	23.3	32.5	37.2	38.7
2	Delhi (IND)	3.5	9.7	22.7	32.9
3	Shanghai (CHI)	6.0	7.8	20.2	28.4
4	Mumbai (IND)	5.8	12.4	19.7	26.6
5	Mexico City (MEX)	8.8	15.3	20.4	24.6
6	New York (USA)	16.2	16.1	20.4	23.6
7	Sao Paulo (BRA)	7.6	14.8	19.9	23.2
8	Dhaka (BGD)	1.4	6.6	15.4	22.9
9	Beijing (CHI)	4.4	6.8	15.6	22.6
10	Karachi (PAK)	3.1	7.1	13.9	20.2
11	Lagos (NGA)	1.4	4.8	11.2	18.9
12	Kolkata (IND)	6.9	10.9	14.4	18.7
13	Manila (PHL)	3.5	8.0	11.9	16.3
14	Los Angeles (USA)	8.4	10.9	13.4	15.7
15	Shenzhen (CHI)	0.0	0.9	10.6	15.5
16	Buenos Aires (ARG)	8.1	10.5	13.5	15.5
17	Guangzhou (CHI)	1.5	3.1	10.8	15.5
18	Istanbul (TUR)	2.8	6.6	11.3	14.9
19	Cairo (EGY)	5.6	9.1	11.2	14.7
20	Kinshasa* (COD)	-	-	8.4	14.5
21	Chongqing* (CHI)	-	-	9.4	13.6
22	Rio de Janeiro (BRA)	6.6	9.6	12.0	13.6
23	Bangalore* (IND)	-	-	7.0	13.2
24	Jakarta* (IDN)	-	-	9.1	12.8
25	Chennai* (IND)	-	-	7.4	12.8
26	Wuhan (CHI)	-	-	-	12.7
27	Moscow (RUS)	7.1	9.0	11.6	12.6
28	Paris (FRA)	8.2	9.3	10.6	12.2
29	Osaka – Kobe (JAP)	9.4	11.0	11.5	12.0
30	Tianjin (CHI)	-	-	-	11.9

Data are in millions

Source: UNDESA Population Division⁸²

The urban area of Tokyo, as in the 1970, is the most populous and it accounts more inhabitants than the whole Canada; at the same time, in analysing this data is essential to underline that Tokyo metropolitan area incorporates 87 adjacent cities. Often, megacities arise because of territorial integration and related economic activities with neighbouring settlements, which are functionally linked

⁸² See note 78.

and form an urban agglomeration. Indeed, what emerged from the study of the development of global megacities are two phenomena: urbanization along with suburbanization, in the areas surrounding the big cities.

With regard to the subject of this dissertation, and particularly to the definition and the explanation of the concept of fast growing city, the cases of urban agglomerations as Delhi in India or, even more, Shanghai in China hold particular attention. In recent developed and developing countries big cities are invested by economic, demographic and social transformations, which lead to an unprecedented density of people that can be translated in large amounts of ideas, resources, goods and capitals. In this context, emerge the concept of the *fast growing cities* as urban areas characterized by high potential and high rates of economic and social growth, as a consequence of soaring migration from rural to urban areas. As a matter of fact, migrants contribute to urban and national economic growth, but cities need to be prepared to absorb urban growth.

The urbanization phenomenon and its rapid growth (almost ten times in forty years) emerge clearly from the table 5. Moreover, if are considered the data of 1970, the number of megacities has doubled and it is expected to continue its steady expansion.

Table 5 - Rates of demographic growth

Mega-cities	Increment between		Rate of change	
	1990 - 2011	2011 - 2025	1990 - 2011	2011 - 2025
Lagos (NGA)	+6,4m	+7,7m	+133%	+69%
Dhaka (BGD)	+8,8m	+7,5m	+133%	+49%
Shenzhen (CHI)	+9,7m	+4,9m	+1078%	+46%
Karachi (PAK)	+6,8m	+6,3m	+96%	+45%
Delhi (IND)	+13m	+10,2m	+134%	+45%
Beijing (CHI)	+8,8m	+7,0m	+129%	+45%
Guangzhou (CHI)	+7,7m	+4,7m	+248%	+44%
Shanghai (CHI)	+12,4m	+8,2m	+159%	+41%
Manila (PHL)	+3,9m	+4,4m	+49%	+37%
Mumbai (IND)	+7,3m	+6,9m	+59%	+35%

Source: Author's revision of data collected by UNDESA - Population Division⁸³

Table 5 gives a clear demonstration of the shift of the global economy's core from

⁸³ See note 78.

developed countries to emerging and developing ones.

Historically, the rapid urbanization process has always been related to the industrialization of a specific country. Indeed, after the Second World War in most of the countries defined as more developed⁸⁴, more than half of the population was living in urban areas. Nowadays, in Europe and United States the rate of population growth are the lowest and there are no cities listed in the table from these areas. At the same time, in Bangladesh, Pakistan and Nigeria are expected very high rates of growth; in the middle, big cities in India and China are supposed to increase their population considerably.

In the developed and developing countries, cities are striving in order to face the steady urbanization with critical urban infrastructures; as a consequence, the study of the data reported in this paragraph are used as starting point for the analysis proposed in this dissertation, which aims at explaining the role of transportation infrastructures in urban areas, especially for what concerns metros and railways and their positive impact on local economies, on the environment and on the quality of life.

⁸⁴ The segregation of countries development based on infrastructures' needs, made in paragraph 1.1, lists as More developed the following countries: Canada, Denmark, France, Germany, Italy, Japan, Spain, Sweden, United States, United Kingdom (see figure 1).

2.1. Sustainable Urban Infrastructures

Infrastructures turn out to be vital if analysed in a context of rapid urban growth since these aim at cope with soaring population. Infrastructures, including streets, railways, aviation, water and energy systems, are the backbone of every nation's economy; moreover, in a global point of view, it is crucial the role of these facilities, especially in cities and metropolitan areas, if countries want to be economically competitive.

It is certain that when dealing with infrastructures it is necessary to define priorities related to different scenarios. In developed countries, where urbanization processes began in the first half of the twentieth century, nowadays the local and national policy makers pay major attention on upgrade of existing assets, trying to be the more sustainable as possible. In developed countries, governments are investing in infrastructures modernization, in order to make the systems more energy-efficient, less reliant on oil and more environmental friendly. Lambin in 2009, reporting the data of Rocky Mountain Institute (RMI), stated: 'for the entire world to live as an American or European, we would need two more planets earth to satisfy everyone'⁸⁵.

The global importance of fast growing cities and megacities is reflected on their energy consumption (the 20 per cent of world population living in industrialized countries consumes 80 per cent of the world resources) and related greenhouse gas emissions and induced climate changes. As a result, the need of sustainability in developed countries is fundamental in order to balance the environmental impact and make a better use of finite resources.

The strategies for sustainable urban infrastructures are mainly related to:

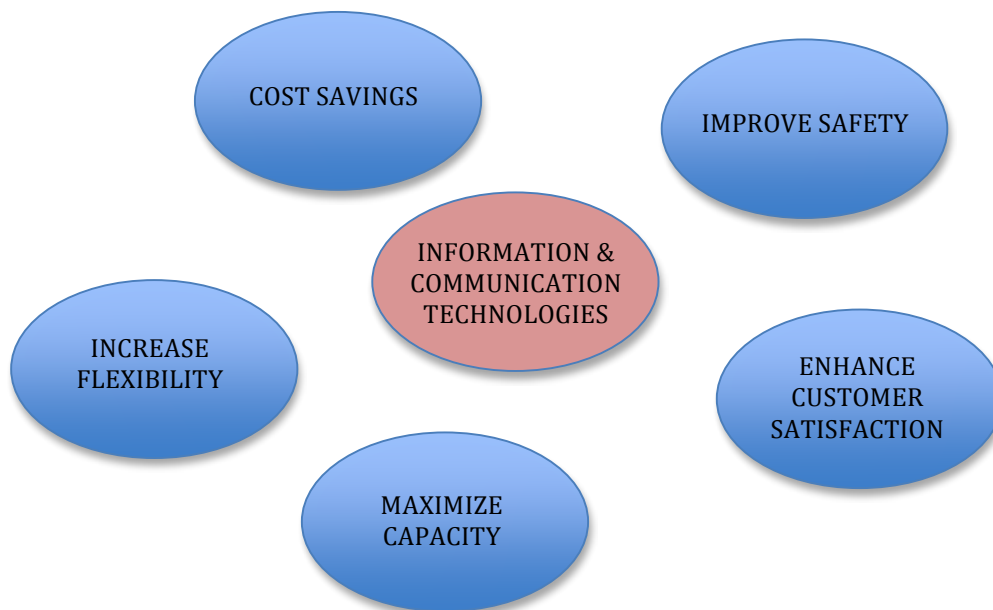
- Reduction of transport and traffic;
- Shift to more efficient transportation systems;
- Enhanced technologies;

⁸⁵ Lambin J.J., *Capitalism and Sustainable Development*, in *Symphonya. Emerging Issues in Management*, n.2, 2009.

The first and the second issues are closely bound; on the one hand, cities shall move toward the reduction of railroad traffic promoting alternative and non-motorized modes, as walking and cycling, which do not involve investment cost and enhance the access to the service. On the other hand, efficient public transportation systems, such as buses and metros, influence urban development and quality of live; furthermore, these means provide affordable transports for low-income groups.

In developing sustainable urban transportation systems, science and industry are very active since there is a strong need for a shift of technologies towards lower and zero emission vehicles. Indeed, emerge the importance of advanced technologies in order to optimise and guarantee entirely safe and adaptable transports of passenger and goods. The use of cutting edge information and communication solutions applied to railways and metros allow the adoption of modern systems such as automatic train control (ATC), which is designed to autonomously perform, part or all, the operations in a driverless but safer mode.

Figure 2 - Primary Impact of ICT on Railways and Metros



Source: Author

Differently than in developed countries, in developing ones the priorities are dissimilar since facilities are in most of the cases non-existent and healthcare, water and waste management, and transportations systems are decisive in their steady development process.

According to the UNDESA⁸⁶, it is foreseen that by 2020 a fifty per cent of the population of Asia will live in urban areas, while Africa is likely to reach the same percentage of urbanization rate only in 2035. In other words, taking as reference the data provided by the United Nations (see table 6), this means that in Asia more than two billions of inhabitants will live in cities, whereas approximately half billion of people will agglomerate in African's urban areas.

Table 6 - Estimated Population by Major Area

Area	Estimated 2009	Estimated 2010
World	6.817.737	6.895.889
Africa	990.045	1.022.234
Asia	4.120.815	4.164.252
Europe	736.855	738.199
Central and Latin America	583.547	590.082
North America	341.490	344.529
Oceania	35.984	36.593
In thousands		

Source: UNDESA

In addition to the data reported in the table above, the urban population is expected to increasingly concentrate in large cities and these megacities, of at least 10 millions inhabitants, will experience the largest rate of growth.

The real issue related to the aforementioned urbanization process is not that cities grow fast, but it is that they are unprepared to absorb urban growth.

In developing countries the data related to infrastructures availability are impressive and the gap with developed countries is wide; the World Bank

⁸⁶ See also note 78.

estimated almost one billion people without access to safe water⁸⁷, 1.6 billion without electricity⁸⁸, 2.5 billion without sanitation, and more than 1 billion without access to telecommunications⁸⁹. The yearly investment in infrastructures, in developing and emerging countries, are estimated to about 7 to 9 per cent of GDP⁹⁰, but limited funding and low effectiveness do not reflect these figures. Nevertheless, China and other recent developed countries, such as Saudi Arabia and UAE, account for several examples of efficient urban infrastructures investments.

In this dissertation has been analysed and recognize the role of mass transportation infrastructures in fast growing cities, whose demand reflects changing needs for mobility by private, companies and government; indeed, mobility and transport are strategic pillars in megacities growth. In recent developed countries the transport sector is moving toward diversification to all transport modes, including railways, ports and airports with the aim of enabling multi-modal transport, strengthen regional integration, facilitate trades and enhance the efficiency of logistic operations, both for private and for companies.

Case 1 – Sustainable transportation system in Lagos

Lagos, the commercial capital of Nigeria, represents an unexpected model of how fast growing cities can handle rising population. Nowadays, it is almost impossible to define the boundaries of the city, since it keeps including smaller cities located in the nearest area.

Lagos used to be an example of urban mismanagement but recent reforms prospect an unexpected but real transformation, which will convert Lagos in a model of Africa's mega cities. A new transportation plan has been developed in the last years taking as starting point the implementation of a capillary bus service, which will be enhanced by a light rail system, which shall start its commercial operation in about five years.

Today, most of Lagos' state spending are focused on urban transportation, the aforementioned bus system has been financed with public and private fund and is utilized by more than two

⁸⁷ WHO and UNICEF, *Joint Monitoring Program Database*, 2004.

⁸⁸ International Energy Agency (IEA), 2005.

⁸⁹ World Bank, *World Development Indicators*, 2006.

⁹⁰ See also, World Bank Group, *Sustainable Infrastructure Action Plan FY 2009-2011*, Washington DC, 2008.

hundred thousand people, reducing sharply journeys and waiting times. The on going light rail project⁹¹ will be based on seven different lines and, has reported by Lagos Transportation Authority⁹², it has the aim of alleviates traffic in the interested areas, introducing an option to road's vehicles, and boost economic activities.

The aim is a complete and integrated multi-modal transport system based on rail, road and water systems, which may cope with increasing transportation demand and may attract foreign capitals.

Source: Information collected by the Author at the World Urban Forum, Naples, 2012.

Moreover, despite the fact that normally local and national governments tend to invest mainly in road and cars, the present work is concentrated on metros and railways, which, in a personal point of view, are more sustainable and leave a long-term imprint on cities.

⁹¹ Global Mass Transit Report website

⁹² LAMATA, Lagos Metropolitan Area Transport Authority website

Chapter 3

3. Global Demand of Urban Rail Systems

Rail transportation market is a complex system that depends on multiple factors, first of which is the availability of infrastructures.

Nowadays global markets are, in most of the cases, involved in a financial crisis that is steadily moving towards a real economy crisis. As a result, especially in developed countries, public investments in infrastructures have suffered a deep reduction of funding.

In this context, the global market of urban transportation systems, according to the data collected by UNIFE and the Boston Consulting Group, does not seem to be affected as other sectors. Indeed, this hypothesis is supported by a study that shows that even in saturated urban transportation markets, as United States and Western Europe, is expected a yearly growth rate between 2 and 2.5 per cent up to 2015⁹³.

Rail-based transport is an outstanding option for an increasing number of travellers. By enhancing the availability and affordability of rail services, including mass transport systems and high-speed rail connections, choice for passengers is being increased.

In accordance with the aforementioned data, a study released by the EU, extended to the rail passenger market in the 27 countries of the Union, shows that the rail transport market is changing; indeed, the opening up of the rail market, the improvement of interoperability and the development of the rail infrastructure have resulted into a growth of the rail market during the period examined in this study (2001-2009) and further growth is expected⁹⁴.

Notwithstanding the foregoing, according with the segregation presented in sub-

⁹³ Fischer F., Geike T., Häberle S., Rambusch R., Ulrich P., *UNIFE World Rail Market Study: Status Quo and Outlook 2020*, UNIFE and BCG, September, 2010.

⁹⁴ EC, Directorate General Energy and Transport (Unit E – Inland Transport), *Situation and perspectives of the rail market TREN/R1/350-2008 lot 2 Final Report*, Netherlands, 2010

section 1.1, the global market of rail systems can be divided into two main competitive scenarios:

- Developed countries, which have invested in transportation infrastructure in the past decades and today are experiencing a situation of stagnation.
- Developing and emerging countries, which are experiencing steep investments in rail-based transportation.

These different scenarios are based on the expectation of a two-speed world: developed markets are expected to experience slow growth, due to the financial crisis, while the emerging markets will continue with their development, resulting in: i) an increase in global trade with growing freight volumes, ii) growing urbanization with a growing demands for efficient mass-transport systems, iii) rising environmental awareness, especially in emerging nations⁹⁵.

In MDC, investments are nowadays focused on making the optimal use of existing infrastructures, on replacing and on upgrading large networks through the implementation of intelligent transport systems, which are in many cases the cheapest way to enhance the overall performance of the transport system, in presence of limited resources.

In most of MDC transports choices are mainly built around cars, but due to both the increasing price of oil and the effect of the crisis – in terms of lower propensity for owning automobiles – urban population is increasingly shifting to public transportation solutions. As a consequence, the target of governments is to try to make public transports more accessible and attractive, both for individuals and businesses⁹⁶. Indeed, on the one hand, at a national level, it is necessary to influence transport choices providing awareness and information; on the other hand, local authorities shall directly provide efficient transport services where companies and residential areas are located⁹⁷.

The data collected by UNIFE, with reference to Europe and based on the short-

⁹⁵ See also note 93.

⁹⁶ See also Department for Transport, *Low Carbon Transport: A Greener Future, A Carbon Reduction Strategy for Transport*, United Kingdom, July 2009.

⁹⁷ In this context, is relevant to remark that one of the consequences of the ongoing crisis is the reduction of national funding to local governments, which are further diminishing the resources and the financing to the development of public transport services.

term outlook, remarks how the crisis is affecting the investments in infrastructures. Indeed, while countries such as Greece and Portugal are postponing the development of high-speed lines, in Spain the expansion of the network has been withdrawn and will be rescheduled later on in the future. On the other side, the demand for extended rail network, both urban and intercity, has kept its moderate growth.

For the aforementioned reasons, fast growing cities and megalopolis are seamlessly investing in urban mass transport systems, which are undergoing revival in MDC, while being developed around the world. In addition, urban transportation and regional integration are nowadays a strong priority since these infrastructures facilitate trades.

In recent developed and developing countries the priorities for the railway sector are the infrastructures, which are necessary for both establishing and improving the access to mobility, of both rural and urban population. Many cities are growing at outstanding rates and there is an increasing need in managing disorganized urban areas. Furthermore, emerging countries are reaching higher income level and urban residents can increasingly have access to cars⁹⁸. Indeed, rapid trends of motorization, related to urban sprawling, and declining modal share of public transport creates a vicious cycle and, as a result, mobility and accessibility are declining rapidly, particularly in fast growing cities⁹⁹.

These circumstances could be overcome through policies oriented to the development of non-motorized transport systems, which require huge capital investment. Such policies are nowadays under development especially in Asia, where, together with China, India and countries such as Saudi Arabia, Qatar and UAE, large investments are dedicated to finance sustainable urban transportation system.

⁹⁸ Acharya S.R., *Motorization and Urban Mobility in Developing Countries. Exploring Policy Options Through Dynamic Simulation*, Journal of the Eastern Asia Society for Transportation Studies, Vol. 6, pp. 4113 - 4128, 2005.

⁹⁹ Gakenheimer R., *Urban Mobility in the Developing World*, Transportation Research Part A, Vol. 33, 671-689, 1999.

Table 7 - Urban Transportation Market's Conditions

AREA	EXPECTED GROWTH	MARKET CONDITION	ORIENTATION
Europe	Low growth, mainly related to upgrading of existing infrastructures	Despite negative expectations, in terms of investment and budgets' increment, W.E. remain the biggest accessible rail market in the world. Can be defined as a Replacement Market	Capacity and technology
North America	Stronger growth than Western Europe	The major growth impulse comes from High Speed systems. As W.E. is mainly a Replacement Market	Technology
Asia - Pacific	Steady growth rate, but lower than recent years. Largest total rail supply market in the world.	The Chinese High Speed network expansion will slow down; the strong growth of the Indian market will be insufficient to compensate the slower growth in the single biggest rail supply market in the world (China).	Cost and Capacity
Africa and Middle-East	Rail infrastructures under development	Urban, freight, and intercity rail network expansion is expected to continue. Extensions or installations of new urban rail systems in the region's large cities.	Cost and capacity

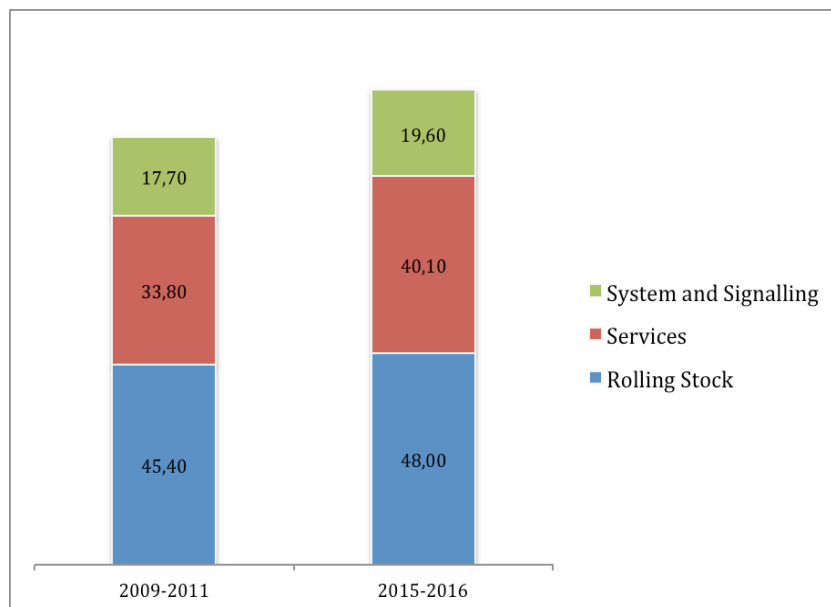
Source: Author revision of UNIFE data from the World rail market study - status quo and outlook 2020.

The table demonstrates that in MDC the demand of mass transportation infrastructures is mainly related to the need of regional and metropolitan integration combined with the renovation and revamping of existing facilities. In emerging countries, it appears clearly the need to face increasing urbanization issues with metros and light rail systems, which can be easily adapted to the cities' requirements, in terms of efficiency, costs and sustainability.

According to the data gathered on the UNIFE's study on the world rail market in 2010, in the figure below are presented the accessible market shares, expressed in

average order intake in a three-year period, and the breakdown of the market by categories.

Figure 3 - Accessible Markets by Segment (in billion \$)

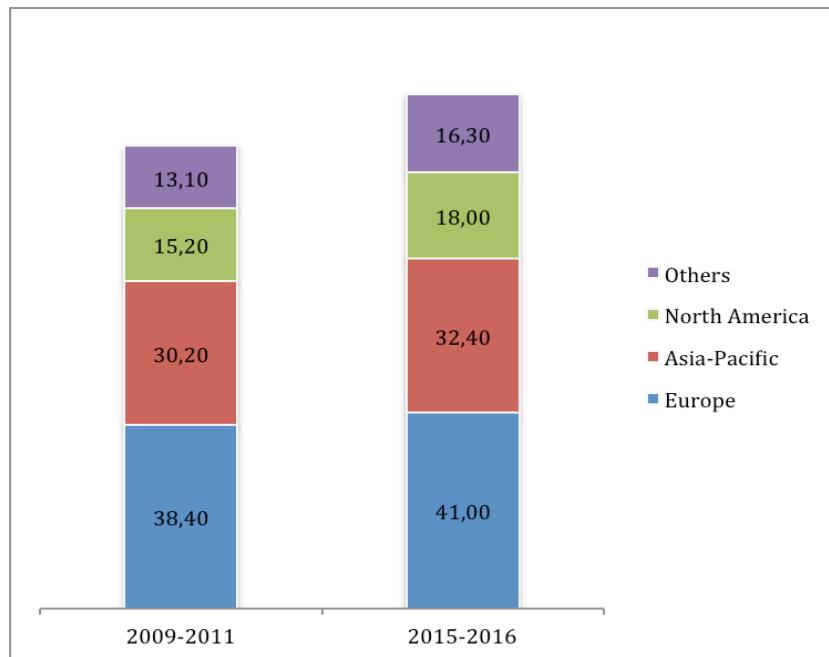


Source: UNIFE data from the World rail market study - status quo and outlook 2020.

In the two-year period from 2009 to 2011 the rail supply market accessible continues to maintain high levels of activities, summarized in about 96.9 billion dollars considering the markets of Systems, Service and Rolling Stock together. Despite the financial crisis and the current economic cycle, further growth is expected up to 2015-2016.

In figure 4 are reported the accessible markets divided by geographical area; from this data it emerges clearly the government's willingness to invest in rail infrastructure to foster economic development. The Asia-Pacific represents the more active area, driven by high-speed and metros projects in China. With regard to the subject of this paper, the growth in the system and signalling market is encouraged by re-signalling of lines in Europe and the development of infrastructure in emerging markets, especially for mass transit applications, such as the new Communication-Based Train Control (CBTC) technologies.

Figure 4 - Accessible Markets by Geographic Area (in billion \$)



Source: UNIFE data from the World rail market study - status quo and outlook 2020.

This figure demonstrates clearly the leadership of the European market, which is fuelled by large replacement orders, placed in recent years, and large options related to some of these contracts.

China is the engine of the entire Asia-Pacific market and it is expected to further increase investments in metros and intercity transportation. India is planning a modernization for metros and locomotives, in order to cope with the needs of its growing economy. In the Southeast of Asia mass transit systems represents the main area of investment, especially in Malaysia, Thailand and the Philippines. Finally, in Australia, cities will continue to invest in light rail systems, while the central government is involved in major investment in the mines' area, in order to enhance the flexibility and capacity of Rio Tinto Iron Ore's mining rail network¹⁰⁰. Countries such as Brazil, Qatar and Russia have been included in the group defined as 'others', in these regions investments are boosted by the development of infrastructures related to the FIFA World Cup and the Olympics. Other countries

¹⁰⁰ The information has been collected on the ASTS website.

with strong economies and growing cities, such as Chile and Peru, are also continuing to invest in mass transit¹⁰¹.

Case 2 - Santiago de Chile Metro System

Santiago de Chile could be defined as a fast growing city since its population is rapidly growing and today accounts for more than 6 million inhabitants. The positive economic cycle in which is involved Chile is leading to an increasing numbers of car holders and, at same time, to a growing demand for mobility. Aligned with the expansion of the city, the metro network has grown ceaselessly since the opening of the first section in 1975. Before the implementation of the metro system, buses were leading the market of the mobility within the city borders and in intercity trips. Nowadays, most of the citizens have steadily shifted from bus to metros; indeed, the Line 1 can reach up to 44.000 passengers per hour and the whole network carries about 2.3 million passengers per day. With demand rising rapidly and in order to respond to a need of higher capacity, Santiago Metro System will see the number of lines moving from five to seven, which means an expansion of the network of about 37 km, in the next five years.

In addition, the Santiago Metro System is also an example of financial success since, in the past decades, it operates without public funding, having achieved a profit every year.

Both the local and the national governments see the public transport as a key factor in the sustainable development of a fast growing city as Santiago, and further expansion of the urban rail network is likely to emerge in the longer term.

Source: International Railway Journal, Santiago. A south American success story, June 2012.

¹⁰¹ All the information has been collected on the *UNIFE World Rail Market Study: Status Quo and Outlook 2020*, UNIFE and BCG, 2010.

3.1. Variables influencing urban transportation systems adoption

The previous paragraph emphasizes on the different market conditions that characterize the global demand of mobility in cities, both in developed and emerging countries.

The needs in fast growing cities are not the same; indeed, while Europe and North America have already a set of infrastructures, in emerging and developing countries the basis of any transportation system are nowadays still missing or, in some cases, under construction.

Nowadays, the accessible share of the market is oriented to four main products: Bus Rapid Transit (BRT), Light Rail, Metros and Commuter Rail¹⁰².

Bus Rapid Transit (BRT) is a form of customer-oriented transit combining stations, vehicles, planning and intelligent transport system elements into an integrated system with a unique identity. This system requires separated lanes and is characterized by rapid boarding, efficient fare collection, comfortable shelters and stations, sustainable technologies and modal integration.

Case 3 – Dar Rapid Transit

Bus Rapid Transit systems are mainly implemented in areas characterized by lack of transportation infrastructures and, nowadays, Africa and Latin America represent primary markets to global suppliers.

In Tanzania, the steady process of urbanization, in which is involved Dar Es Salaam City has lead to an increased need of mobility for residents. As a consequence, the local authorities have implemented a public transport system - based on buses – aimed at the reduction of congestion and journeys time within the capitol city. DART System is being developed in six phases and will be the backbone of the entire city. The first corridor is still under implementation and the entire project shall be completed within four years.

DART represents an example both in terms of mobility solution in fast growing cities, with

¹⁰² The information regarding different systems has been gathered utilising several sources, within which Author's personal experience. See also Transit Cooperative Research Program (TCRP), *Transit Capacity and Quality of Service Manual*, Kittelson & Associates, 1999. Wright L. (Institute for Transportation and Development Policy), Fjellstrom K., *Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities Module 3° Mass Transit Options*, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), 2005. Sieber N., Scholz-Knobloch O., *Modal Choice for Mass Rapid Transit*, International Urban Mobility Forum, Brazil, 2011.

moderate capital investment, and in terms of integration between Public and Private (PPP), since the Government will develop the system infrastructure and private companies will supply and operate bus fleet in accordance with DART service schedule.

In 2015, when DART will be completed, the system will provide efficient and cost-effective urban transport facilities and services to all segment of the population, enhancing safety and reducing environmental impact.

Source: Information collected by the Author at the World Urban Forum, Naples, 2012.

According to Shen¹⁰³, up to the end of the nineties, only half of the cities that have busways have developed a systematic and comprehensive package of measures as part of the city mass transportation network. Today, the aforementioned percentage is increasing and stations of metros' and rail's system are increasingly served by a BRT stop. Today, there are more than eighty BRT systems around the world.

Light rail systems are generally adopted in highly populated urban areas and are characterized by variable frequencies and speed and low capacities. Such systems, which encompass tramways, are usually segregated from other means of traffic by barriers or slightly elevated tracks, or by full grade separation, and board and discharge passengers at track or car floor level.

Metros are the most common international term for subway and heavy rail transit (elevated or underground), which serve high-density urban areas. Metros, in developing cities, carry more than twice the passengers of commuter rail and more than four times the ridership of LRT systems. These systems are the most expensive per kilometre balanced by high capacity and frequency.

Case 4 - Shanghai's high capacity subway.

Shanghai is the most populous city of China and nowadays accounts for more than 23 million of inhabitants. As showed in chapter 2, table 5, Shanghai in the last decades has been also one of the fastest growing cities in the world. Considering the high rates of urbanization growth, the local authorities in 1990 decided to build the first metro system, based on two corridors, North-South and East-West. The public acceptance of the system was high and a large number of individual

¹⁰³ Shen D. et al., *At-Grade Busway Planning Guide*, Florida International University, 1998.

shifted from motorized to public transport, driven by low cost, reliability and the possibility to be relieved from road traffic congestion.

In addition, the Metro generated a huge impact on the environment, indeed assuming that the same passengers would use the car instead of the Metro, the overall CO₂ emissions would be more than double.

The local authorities developed the metro system as an answer to several challenges as climate protection and urbanization and, nowadays, after more than twenty years of operations, the Shanghai Metro System accounts 11 lines, 278 stations and more than 400 kilometres of track; in 2011 delivered 2.101 billion rides, which means the fifth busiest metro in the world.

Source: KfW Bankengruppe, Federal Ministry for Economic Cooperation and Development, Turn the Tide, Frankfurt, 2012.

Lastly, Commuter Rail, are heavy rail systems - also called suburban rail – that serve lower density areas, typically by connecting suburbs to the city centre. Commuter rail usually serves one station in each town, operates at a lower frequency than rail, but has high average speeds.

In general, the basic variables, in terms of features, necessities to determine the adoption of a certain urban transportation system are mainly related to cost, capacity and technology. These three factors, which decisively affect the cities' decision, lie on the basis of the segregation between several systems.

Table 8 – Main variable influencing systems' adoption

SYSTEM	ORIENTATION	MAIN MARKETS
BUS RAPID SYSTEM	Cost	Africa, Latin America, Middle-East
LIGHT RAIL	Cost and capacity	Europe, North America
METROS	Technology and capacity	Asia-Pacific, Europe, Middle-East
COMMUTER RAIL	Capacity	Eastern Asia, North America

Source: Author

In a market affected by global crisis, the cost of the infrastructure represents a crucial factor to take into consideration. Transportation system based on buses is relatively economic to deploy if compared with the other means mentioned above. BRT is rapidly adaptable to pre-existent facilities and its development does not involve excavation, construction of viaduct and expensive rail cabs. As a result, BRT can cost up to 100 times less than Metros, being even more flexible and covering a broaden area. Indeed, the cost of a transportation system is influenced by many factors, which have been summarized in the table below:

Table 9 – Capital costs in different phases

CIVIL CONSTRUCTION	SYSTEM DEVELOPMENT	SYSTEM O&M
Land cost	Design and safety requirements of the system	Labour cost
Labour cost	System features	Management and operational costs
Urban constraints and topography	Competition in the equipment suppliers' market	Taxes
Ground condition (elevated or underground)		

Source: Author's adaptation from Allport R., Urban Mass Transit in Developing Countries, Halcrow Fox, 2000.

The operating costs refer to salaries, fuel and maintenance of both the infrastructure and the rolling stock or buses. Metros and high capacity commuter lines have a relative cost advantage in terms of labour costs; indeed, if each bus requires a driver and could carry a limited number of people (rarely above one hundred passengers), several metro's cabs require a single driver and have higher capacity. Nevertheless, especially in developing countries, the lower wage creates a situation by which this advantage is largely overwhelmed by the other components¹⁰⁴.

¹⁰⁴ See also Wright L., Fjellstrom K., *Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities Module 3° Mass Transit Options*, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), 2005.

From another point of view, buses are extremely cheaper if compared to trains and tramways in terms of purchasing, operating and maintenance costs.

In 2001, a survey of the United States General Accounting Office¹⁰⁵ confirmed that the cost of LTR and Metro systems are much higher if compared to BRT. This survey compared the data of 6 cities, with both LTR and BRT systems, and demonstrated that the operational costs of rail systems are higher than those of BRT: up to 6 - 7 times per hour per vehicle.

A similar study, has been conducted by the WB with reference to developing countries; its finding demonstrates that operating costs per passenger range from US\$0.61 in Hong Kong to \$0.19 in Santiago, while revenues per passenger range from \$0.11 in Calcutta to \$0.96 in Hong Kong¹⁰⁶.

In relation to the subject of this thesis, the main issue considered is the need of cope with rising passengers' number, which demands further investments in order to enhance the capacity.

Indeed, as showed in the figure below (figure 3), the efficiency, expressed in service's capacity (passengers per hour and distances), is the key factor for the decision of which urban transportation system is more suitable to the need of a certain city.

The increased transport demand in fast growing cities is constrained by infrastructures. Indeed, in big cities, due to the lack of available land, the expansion of any transportation system is connected to the possibility of enhance its capacity. This objective could be reached only using in a more efficient way and modernizing the existent infrastructures, through the combination of intelligent transport modes¹⁰⁷.

Nowadays, buses can handle up to 40.000 passengers per hour per direction, while exceeding capacities can be managed only through a rail-based system.

At the same time, the distribution of an existent system influences the needs in

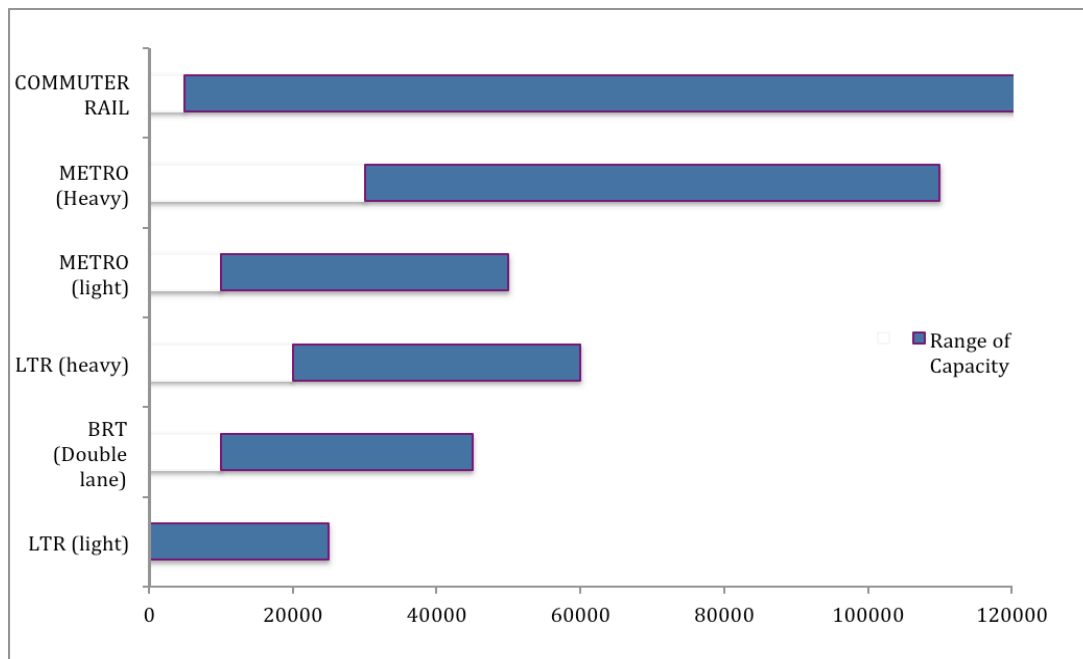
¹⁰⁵ See also United States General Accounting Office (GAO), *Bus Rapid Transit Shows Promise*, Report to Congressional Requesters, Sept. 2001,

¹⁰⁶ See also World Bank, *Cities on the Move: An Urban Transport Strategy Review*, 2001.

¹⁰⁷ See also European Foundation for the Improvement of Living and Working Conditions, *Trends and drivers of change in the European railway equipment sector*, Dublin, 2004.

terms of capacity; indeed, cities as London, Tokyo and New York have several metro and bus lines and in peak hours the capacity is relatively lower compared to fast emerging cities as Hong Kong and Sao Paulo, which have few metro lines.

Figure 5 - Passenger Capacity of Urban Transportation Systems



Source: Author revision of Sieber N., Scholz-Knobloch O., Modal Choice for Mass Rapid Transit, International Urban Mobility Forum, Brazil, 2011.

The capacity can also be expressed in terms of flexibility of the system; as a consequence systems based on buses facilitate plans of future growth, with new routes and technology 's changes, while light rail and metro systems are less flexible and closely bound to long-term investment plans.

Notwithstanding the foregoing, in the last decade, in order to cope with soaring urbanization, fast growing cities are mainly following a strategy based on rail systems, focusing on the expansion of the existent systems and on the construction of new ones.

3.2. New technologies and transformation of mass transportation systems

Nowadays, major transportation challenges are led by technological innovation, which is a key factor to enhance safety, more comfortable services to passengers and reduced environmental impacts. Indeed, in developing new metros systems the primary objective is to provide a safe, reliable and efficient transit service.

Rapidly changing new technologies bring new opportunities to change the development paradigm and to provide new responses to:

- The mentioned trends of urbanization in emerging and developing countries;
- The increasing rate of car ownership;
- The compelling need for a shift toward low emission vehicles and transport modes.

As a result, new technologies represent the one and the only mean that could drive to more sustainable transportation systems, which will be critical to connect production centres and markets, and to improve liveability of exploding urban areas¹⁰⁸.

In global markets, characterized by intense competition, the key factor in preserving the overall competitiveness is the technology, expressed in increment of investments in R&D. At the same time, the technological research is costly to develop and is invariably more expensive when it is first offered to the market.

As described by De Woot, '*Technological progress*' increases the growth potential of those companies that manage it or benefit from it. Companies make it a competitive weapon: their investments in research and development largely exceed those made by governments. Competition is, in fact, based increasingly on a technological struggle aimed not at reducing the competitors' margins, but at supplanting their products with new ones¹⁰⁹. In this context, major industry

¹⁰⁸ See note 89.

¹⁰⁹ cf. De Woot P., *The Challenges of Economic Globalisation: Business, Competition and Society*, in *Symphonya. Emerging Issues in Management*, n. 2, 2002.

players have developed organizational structures oriented to innovation, rapidly adaptable to the instability of global markets and focused on intangible components of the supply.

Schumpeter defined the technological progress as 'creative destruction' and demonstrated the key role of individuals and entrepreneurs in developing such innovations that are the basis of every industrial revolution¹¹⁰. Nowadays, Europe and United States are driving the global market of transportation systems toward sustainability and are providing solutions that can be exported to other areas of the world.

Significant innovation has been implemented in railways over the past 50 years. On the one hand, in the passengers market the development of High-Speed networks has extended the competitive range of rail services; on the other hand, improvements to signalling and intermodal systems have reduced the cost of rail freight services. Both markets have benefited from adoption of GPS and IT systems, which enabled closer integration and control of system operations, reduction of costs and improvement of service quality and safety¹¹¹.

Table 10 - Impact of Innovation on Railways

TECHNICAL INNOVATION	IMPACT ON PASSENGER MARKET	IMPACT ON FREIGHT MARKET
HIGH-SPEED NETWORK	Speed increase and journey's time reduction	Reduced congestion due to the adoption of new infrastructures
INFORMATION TECHNOLOGY	Efficient ticketing and reservation; digital communication	Improved cargo management
INTERMODAL	Better connections with airports and bus terminals	Rails fully participate in containerization trends
SIGNALLING	Improved capacity and safety	Increased traffic density and improved safety

Source: Thompson L., *A Vision for Railways in 2050*, International Transport Forum, 2010.

¹¹⁰ See also Schumpeter, J., *The Theory of Economic Development: An Enquiry into Profits, Capital Credit, Interest and Business Cycle*, Cambridge, MA: Harvard University Press, Cambridge, 1934.

¹¹¹ Cf. Thompson L., *A Vision for Railways in 2050*, International Transport Forum, 2010.

Technological innovation lies on the basis of the competitiveness of the railway transportation markets and allows the adoption of high-quality standards. At the same time, as in every market, the implementation of innovative solutions is accompanied by several barriers, which are mainly related to the possibility of market failures; indeed, in railways and generally in infrastructures market, the development and implementation of innovation is related to huge initial investment, which will entail public and private investors to get a return only in long-term perspective. Nowadays, especially during a period of financial and economic crisis, political and business objectives are more often short and medium-term in nature, while consumers discount future benefits very heavily and are often reluctant to incur extra costs. Furthermore, the governance of technological innovation is not so much an issue of hardware, but is closely bind to the management of the social and economic factors determining the direction and speed of evolution in the global transport system¹¹².

More in general, in railways, innovation and advanced technologies are utilized with the aim of developing integrated transportation networks, which helps both urban and national authorities in making transport systems more sustainable¹¹³. As a matter of fact, to give an example, the European Community in 1996 has adopted the Trans-European networks in transport (TEN-T)¹¹⁴ Guidelines, as an instrument for the development of an integrated transportation network, towards all European countries, through interconnected and interoperable national networks (see figure 6). TEN-T is based on the implementation of 'Soft Infrastructures' such as:

- Traffic management systems for rail ERTMS¹¹⁵, which can optimise the use of the network and improve safety;

¹¹² The information regarding the 'Barriers to Innovation in Transport' have been collected in a study of the International Transport Forum and adapted to the railways and metro context. See also International Transport Forum Secretariat, *Transport and Innovation: Unleashing the Potential*, Canada, 2010.

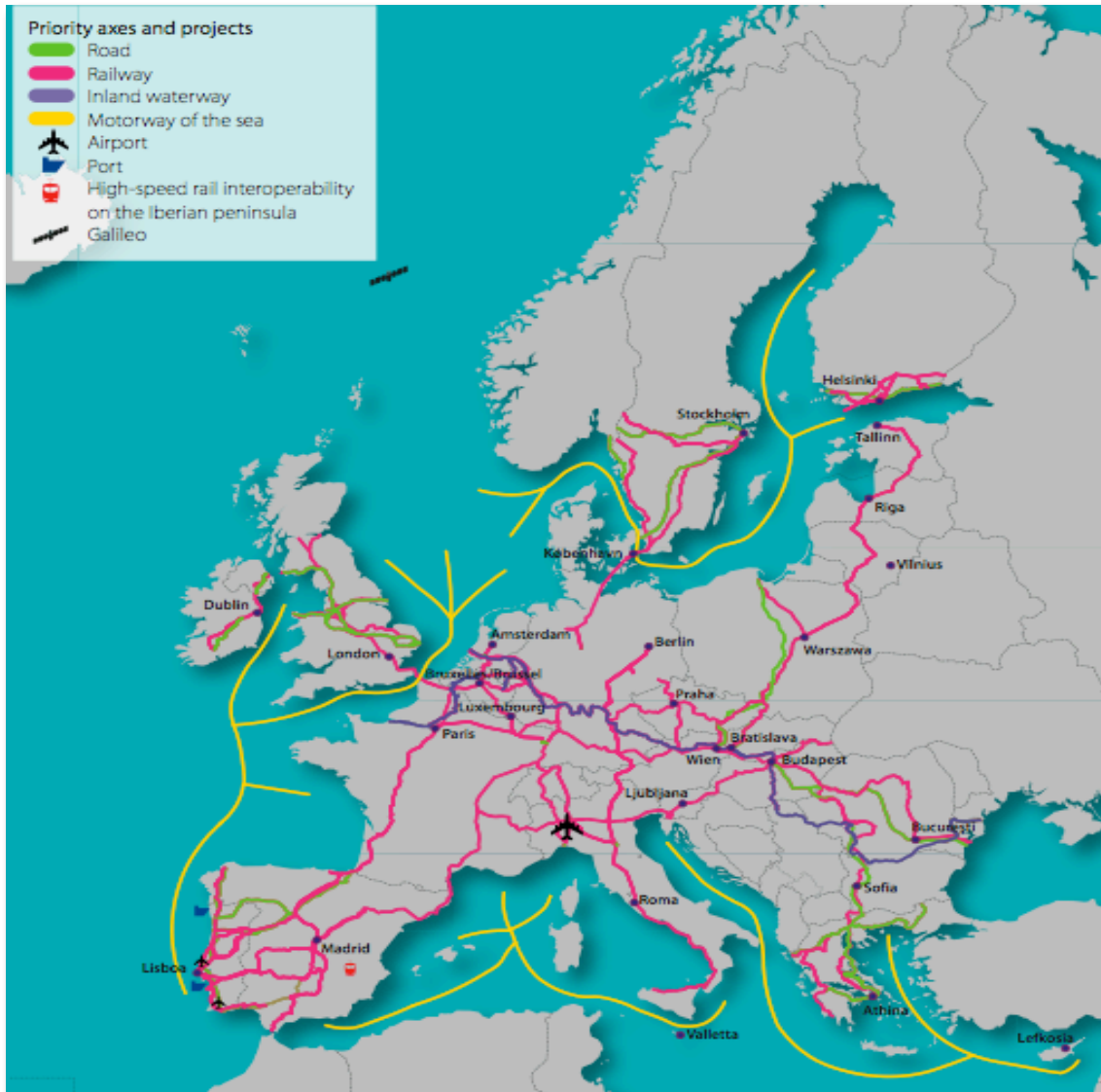
¹¹³ See also EC, Directorate General for Energy and Transport, *Towards an Integrated, Technology-Led and User-Friendly System*, Luxembourg, 2009

¹¹⁴ The information regarding TEN-T have been collected on the European Community and Eurostat websites.

¹¹⁵ ERTMS stands for European Rail Traffic Management System.

- Innovative vehicle technology that can lower emissions, reduce oil dependency and increase comfort.

Figure 6 - Trans-European transport network - Priority axes and projects



Source: European Commission, Energy and Transport DG, 26.10.2004.

As showed in figure 6, TEN-T is a network that involves several infrastructures, as roads, railways, and airports and in land waterways¹¹⁶. Indeed, through the implementation of advanced ICT technologies, the TEN-T guidelines will lead to a

¹¹⁶ The definition of the main layer of infrastructures involved in the TEN-T network has been taken with the EC Decision 884/2004. See also EC website.

better economic integration and cooperation for the European countries and neighbours, by means of:

- Facilitate, improve and develop international rail transport services within Community territory and with third countries;
- Contribute to the gradual creation of the internal market in equipment and services for the construction, operation, renewal and upgrading of the trans-European high-speed rail system;
- Contribute to the interoperability of the trans-European high-speed rail system.

With regards to the subject of this dissertation, in urban transportation systems the increasing numbers of passengers, with higher expectations, is continuously requiring the application of advanced ICT technologies, which lead to the development of Automatic Train Control systems, that allows the adoption of operator-attended or unattended train operation, with continuous speed supervision. This system, through a radio communications-based signalling concept, provides several benefits, as improved schedule adherence, closer headways and enhanced reliability with associated efficiency in terms of maintenance cost reduction¹¹⁷.

Nowadays, in order to improve operational capacity and efficiency of urban transportation systems¹¹⁸, further developments of ATC systems have driven to the implementation of Driverless operations, which have been adopted in most of the new metros project around the world (Copenhagen, Paris, Milan, Riyadh etc.).

In addition, in the last decade, several players of the market of the supply of transportation systems are focusing their R&D efforts on ICT technologies based on wireless application, which enable two-way traffic between a vehicle (train) and its infrastructure or between a number of vehicles¹¹⁹. The large range of wireless technologies can be implemented in different ways and be applied to data

¹¹⁷ See also Allen S., *An Integrated Systems Engineering Approach to Managing the Implementation of New Transit Technologies*, TTC Rapid Transit Expansion Program Delcan-Hatch, Toronto, 1995.

¹¹⁸ Wajima T., Kadono T., Yokose F., *One-person Operation Support System for Urban Railways*, Hitachi Review, Vol. 53, N. 1, 2004

¹¹⁹ See also, Sampson E., *Wireless Technologies and the Transformation of Transport*, International Transport Forum, 2010.

communication systems, which, depending on the need, can improve:

- Safety;
- Traffic and demand management;
- Environmental impact, in terms of emissions reduction and better energy use;
- Provision of information or entertainment;
- Improving convenience and comfort.

In both developed and emerging countries, the railway and metro supply markets are expanding and global players are increasingly introducing new technologies for developing their systems. This approach, would complement the continuing progress made by the railway sector in reducing various external effects, in particular relating to noise and energy consumption, through the use of innovative technology. In the area of safety, the railways' excellent record is due to highly detailed regulation, making rail at least 20 times safer than road¹²⁰. However, despite the significant improvement in terms of productivity and performance made in the railway and metro sectors, there is still a substantial disparity between rail-based means in comparison with other transport modes, which require an essential social shift toward more sustainable transport attitudes, both at national and international level.

¹²⁰ Cf. UIC and UNEP, *Industry as a partner for sustainable development. Railways*, United Kingdom, 2002.

3.3. Macro drivers

The need of mobility has steadily increased since the early industrial era. Successively, industrial revolutions have brought new, faster and relatively less expensive opportunities for both passengers and goods¹²¹.

Several studies show that the mobility is closely bound to economic growth and especially in developed and emerging countries it is expressed in higher standard of living. In a macroeconomic perspective, the data collected by Schäfer and Victor formally confirmed the direct link between economic growth and mobility. In other words, the Authors have demonstrated that for a given percentage of growth in GDP per capita is matched an identical percentage of growth in the distance travelled over a year¹²².

In developing and emerging countries, most of cities are exposed to a growing phenomenon of urbanization, with people leaving the countryside and moving in metropolitan areas. The management of fast growing urban centres creates rising pressure on mobility infrastructures, which can be translated in new needs for both passengers and freight markets.

In the abovementioned countries, cities represent the engine of the entire economy and account up to 80% of GDP¹²³; in other words, cities can be defined as principal responsible of the greenhouse gases emission, which have a significant impact on ecosystems. The increase of global average temperature, sea level rise and recurring extreme climates events are threatening cities and intensifying the risk to their infrastructures, economies and citizens.

At the same time, economic and social growth increase the need of mobility, which is also accompanied by negative side effects such as congestion, social exclusion, accidents, air pollution and energy consumption¹²⁴.

¹²¹ Cf. Crozet Y. *The prospects for inter-urban travel demand*, OECD and ITF, 2009.

¹²² See also Schäfer A., Victor D.G., *The Future Mobility of the World Population*, Transportation Research, 2000.

¹²³ See also note 78.

¹²⁴ See also United Nations, *People and Mobility Promoting non-motorised transport options and compact cities as complements to public transport*, United Nations Human Settlements Programme (UN-HABITAT), Nairobi, 2011.

Table 11 - Macro Trends: Implications and Impact

MACRO TRENDS	IMPLICATIONS	IMPACT ON URBAN RAIL SYSTEM
Urbanization	Increase in traffic	Growth in the need of urban and mass transportation system
Environmental concerns	Shift from motorized to non motorized means	Increased use of railway transport, which is more sustainable and more accessible
Emerging Markets	Shift of the global economy	Need for new railway infrastructures to support economic growth
Increase in global trade of goods	Demand in remote places	Need of railway transport systems for raw materials transportation
Competition with air transportation	High investments in infrastructures	Demand for High Speed Lines, especially in developed countries

Source: Author's Revision of the Sustainability Report 2011 of Ansaldo STS¹²⁵

Economic growth is always accompanied by growing number of car-holders; as a consequence, on-road transport is a significant consumer of energy in the urban environment and it is closely linked to petroleum product consumption. Indeed, especially in Europe and United States, since the 1950, have become apparent the negative effects of urban transportation, expressed in rising car traffic volume and urban congestion. For instance, in Europe, goods traffic has increased by 75% and passenger movements by 110% in the last 25 years; in addition, forecasts show that passenger transport as well as goods transport will continue to grow¹²⁶.

Nowadays, this phenomenon is also in progress in developing and emerging countries. Indeed, over the coming years, the urban transportation sector can be expected to exhibit significant growth in energy requirements in most East Asian countries (first of all in China and India), where rising household incomes and urbanization are fuelling private vehicle ownership and use. As a result, a study of the World Bank, on urban transport in East Asia, shows that in order to reduce

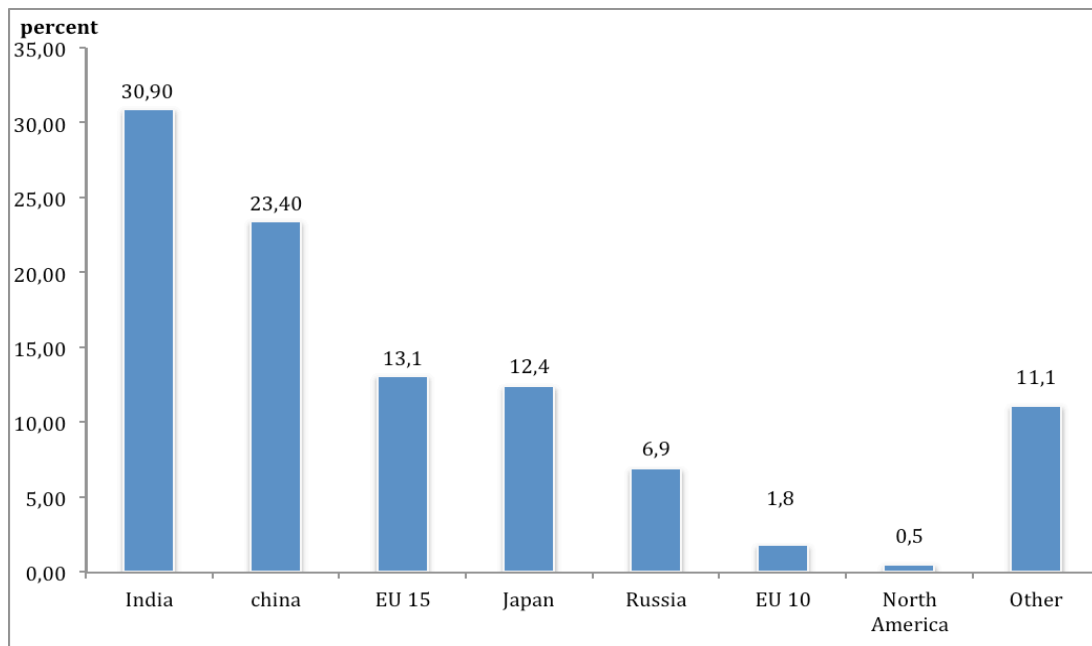
¹²⁵ Ansaldo STS, *Sustainability Report*, 2011

¹²⁶ Cf. VV.AA., *Sustainable Urban Transport*, Final report from the European project Trendsetter, Environmental and Health Protection Agency, Stockholm, 2006.

transport fuel consumption and emissions is necessary an efficient urban planning, based on public transport infrastructures¹²⁷.

Policies oriented to the development and implementation of sustainable urban infrastructures, which can face the predominance of on-road transport, are today adopted in China and India, which represent the largest rail markets in the world (see figure 7), and where the shift in modal split, induced by expanded rail transportation, may lead to a continuous pipeline of new infrastructure projects.

Figure 7 – Percentage of world passengers – km



Source: Thompson L., *A Vision for Railways in 2050*, International Transport Forum, 2010.

Rail-based transport have been encouraged in the last decades, especially in Europe and North America through the introduction of high-speed network and development of urban transportation system, which have offered a wide range of choice to passengers. Indeed, China is not the only country investing in urban transportation systems and an analysis of large urban agglomerations without rail systems shows a potential of over 300 new mass transit systems, mainly in

¹²⁷ Berrah N., Mathur S., Vinuya F., Wang X., *Winds of Change, East Asia's Sustainable Energy Future*, World Bank, Washington DC, 2010.

Asia/Pacific, Africa/Middle East and Russia¹²⁸.

As a matter of fact, at the same time, as demonstrated in a study of the Department for Transport of the United Kingdom, rail journeys will not replace all short haul flights and cannot replace long distance flights, but there is increasing scope over the next twenty years for passengers to travel by train rather than plane¹²⁹.

The construction of efficient and intermodal rail transportation systems besides the deregulation of national rail networks are the main factors that allow an open competition of rail-based systems with air transport. Indeed, market openings have generally led to more efficiency and lower costs and this can be seen in air transport, where the process is more advanced. Furthermore, when is implemented an high-speed rail network, which reduces the duration of the journeys and the distances between cities, this system enters in competition with air transportation; indeed, as demonstrated in the high-speed Italian market, when a monopoly position is broken there are several issues to be faced by the private sector and deregulation can be efficient up to the point that private sector can even upgrade the infrastructure.

¹²⁸ See note 93.

¹²⁹ Cf. Department for Transport, *Low Carbon Transport: A Greener Future, A Carbon Reduction Strategy for Transport*, United Kingdom, July 2009

3.3.1. Environmental and sustainable development concerns

Globalization can be primarily intended as an economic event, but recently it is considered as a political issue too; indeed, it has enhanced citizens and corporates awareness towards social and environmental themes¹³⁰. In a global context, both population and production systems shall not underestimate environmental concerns, which are mainly felt in countries highly dependent on natural resources and with limited adaptive capacity.

Cities are causes and effects of climate changes and responsible for effective policies and innovative solutions in terms of sustainability. In both developed and developing countries, cities face problems caused by transport and increased traffic. As a matter of fact, cities are nowadays responsible for producing about the 70 per cent of greenhouse gases¹³¹ and account to be one of the most influencing factors in climate changes.

In Europe, around 80% of citizens live in urban environment and their mobility account for 40% of all CO₂ emissions of road transport and up to 70% of other pollutants from transport.

Transport presents real challenges as society tries to ensure a more environmentally sustainable future; it is one of the most difficult sector to manage in terms of CO₂, it contributes to climate change and the growth in congestion on our roads, accidents, air pollution, and noise pollution of transport all lead to substantial costs that are borne by people, business, and society¹³².

In order to answer to one of the research question proposed in chapter one – how should urban mobility growth be managed? – cities are required to enhance mobility while reducing congestion, accidents and pollution¹³³.

Especially in developing countries, a growing number of city-dwellers need infrastructures (health, water, energy and transport), but without investments in

¹³⁰ Cf. Arrigo E., *Responsabilità aziendale e performance economico-sociale*, Giappichelli, Turin, 2008.

¹³¹ See also The Worldwatch Institute, *State of the World. Our Urban Future*, Norton & Company, New York, 2007.

¹³² Cf. UIC and CER, *Rail Transport and Environment, Facts & Figures*, November 2008.

¹³³ See also Directorate-General for Energy And Transport, *Report on Urban Transport in Europe*, European Commission, 2007.

the necessary assets cities will become unmanageable and will no longer be competitive.

The management of soaring demand of urban mobility in fast growing cities is one of the most important factors, which can reduce the impact of energy consumption on environment. Furthermore, in order to do so, a shift toward transport modes based on rail seems to be the most efficient and effective way to meet climate changes¹³⁴.

For instance, as already remarked in the previous paragraphs, on-road transport is a significant consumer of energy in the urban environment and is the mean most closely linked to petroleum product consumption. As a matter of fact, the main environmental issues in towns and cities are related to the predominance of oil as a transport fuel, which generates CO₂, air pollutant emissions and noise¹³⁵.

In this perspective a switch from private to public transport or more active modes of travel, such as cycling and walking, can reduce emissions over shorter distances and, where public transport is not a viable option over longer distances, increasing the fuel efficiency of cars will have an important impact¹³⁶.

As agreed by world leaders in 2009 in Copenhagen¹³⁷, part of the total emissions reduction should mostly come from aviation and shipping sector, thus railways seem to remain the most sustainable transportation media. As a matter of fact, especially in urban areas, railways and metros are an excellent lower carbon option, which attract an increasing number of travellers.

In more developed countries, today, almost 50% of the entire railway networks are electrified; in other words, diesel-powered trains have been replaced with electric rolling stocks, which have significant advantages, as:

¹³⁴ More in general has been demonstrated that freight trains are almost three times more efficient than long haul trucks in terms of fuel consumption, in other words railways help cut pollution and reduce both carbon emission and oil dependence. Moreover, with regard to the traffic, statistics demonstrates that rail freight transportation reduces accidents and congestion in comparison with road transportation. See also note 130

¹³⁵ Cf. Commission of the European Community, *Green Paper Towards a New Culture for Urban Mobility*, Brussels, 2007.

¹³⁶ See also Department for Transport, *Low Carbon Transport: A Greener Future, A Carbon Reduction Strategy for Transport*, United Kingdom, July 2009.

¹³⁷ The Copenhagen Climate Change Conference raised climate change policy to the highest political level. More than 40,000 people, representing governments, nongovernmental organizations, intergovernmental organizations, faith-based organizations, media and UN agencies applied for accreditation. Information have been gathered on the UN Framework Convention on Climate Change website.

- Better environmental performance, related to about 20-35 per cent less of carbon emission per kilometre compared to diesel equivalents. This means that electric trains are more environmental friendly.
- Increased capacity and reliability,
- In times of crisis, when petrol has reached its highest level in the last twenty years, electric trains are cheaper to buy and maintain for railway's operators

As a result, in rail transportation is in progress a continuous technology improvement, which allows the reduction of carbon emissions, greater energy efficiency and better services to customers. Indeed, in a condition of constant increment of passenger's numbers, improvements in infrastructures and vehicle efficiency, besides an increased level of capacity, could have benefits across all distances.

In adopting efficient and sustainable urban transportation systems, the role of governments (local, national and international) are crucial, since strong policies and considerable funding are required, even more with an on going economic crisis. However, the last two decades have witnessed the multiplication of other regional, national and local (e.g. city) mechanisms and actors, responding to the climate challenge¹³⁸; as showed in table 12, these include initiatives of multilateral and bilateral entities, private enterprises, NGOs and individuals. In each level, a variety of mechanisms for developing and implementing climate change mitigation measures have been used.

¹³⁸ See also UNHABITAT, *Global report on human settlements 2011. Cities and Climate Change*, Earthscan, London, 2011

Table 12 – Actors responding to the climate challenge.

DECISION MAKERS	ACTION TO BE TAKEN
Governments (national and international)	Cross-sectorial policies oriented to shift from motorized to non-motorized means, development plans, land-use and infrastructure planning, funding, offer incentives for investments in alternative energy sources.
Local Authorities	Municipal plans, land-use and infrastructure planning, create synergies between urban sectors, combine efficient resource policies
Corporates – Global market players	Investment programmes, environmental friendly products, development of technologically advanced solutions, reduction of environmental impact throughout the supply chain
Nongovernmental Organization	Increase climate awareness and education, development of new technologies, represent interests and concerns of vulnerable populations.
Global population	Become more willing to adapt their behaviour to counteract climate change and support sustainability across the world.

Source: Author

Climate change is already taking place and, as showed in table 12, it calls several actors for appropriate action/reactions toward a more sustainable world.

A primary role is ascribable to international and national institutions, which are involved by means of cross-sectorial policies that shall increasingly lead to a shift from motorized and private modes to non-motorized and public means. For instance, the European Council has set several targets oriented to the reduction of greenhouse gas emissions in EU countries, but the achievement of these goals is closely bound to the collaboration of industries. Such global environmental awareness is closely bound to the future of the entire world, but policies oriented to sustainability are in most of the cases onerous in term of coordination between several different countries¹³⁹.

Local authorities are also deeply engaged in the development of urban climate change policies as well as initiatives aimed at reducing GHG emissions. Despite differences in the approaches that municipalities have adopted, policies has

¹³⁹ The difficulties in implementing the Kyoto Protocol, dated 1997, demonstrate clearly that divergences between 'rich' and 'poor' countries are deep and hard to be harmonized.

primarily been focused on initiatives related to energy efficiency and transport¹⁴⁰. In urban areas strategies aimed at reducing GHG emissions are mainly dependent on the form of urban development¹⁴¹, which requires a combination of planning measures with policies oriented to the reduction of the dependence on motorized transport, while focusing on the integration of green areas in the city.

Actually, several cities in developed and emerging countries show a growing interest in the adoption of new public transport infrastructure and technical innovation¹⁴². A survey conducted by Wagner on climate change plans in 30 cities worldwide clearly demonstrated that the most common climate change mitigation actions in transport were the development of public transport, the implementation of cleaner technologies, the promotion of non-motorized transport, public awareness campaigns and the implementation of cleaner technologies¹⁴³.

Case 5 – How cities mitigate climate change??

A first area, in which local authorities are seeking to take action in order to mitigate climate change, is related to the development and implementation of new urban transportation systems. A second area of action is connected to the development of low-carbon vehicles and fuels. In Germany, Hamburg and Berlin have teamed up in the Clean Energy Partnership, which foresees the development of public fuel cell buses and urban hydrogen filling stations. In Rome, the public transport service and local government have been involved in the introduction of over 80 electrically powered buses and 700 methane buses. Other initiatives in the transport sector include demand-reduction and demand-enhancement measures, which involve different policy instruments. Car and bike sharing networks, for example, allow people to borrow or rent a mean of transport, without having to own it, reducing individual purchase and maintenance costs, and storage space requirements. Finally, municipalities may also impose traffic restrictions, such as congestion charges (e.g. Milan Area C – Italy) that may reduce the accesses to the city.

Source: The information have been collected on UNHABITAT, Global report on human settlements 2011. Cities and Climate Change, Earthscan, London, 2011.

¹⁴⁰ See also Bulkeley H., Kern K., *Local government and the governing of climate change in Germany and the UK*, Urban Studies, 2006, p. 2237–2259.

¹⁴¹ See also Lebel L. et al, *Integrating carbon management into the development strategies of urbanizing regions in Asia: Implications of urban function, form, and role*, Journal of Industrial Ecology, 2007.

¹⁴² Technical innovations related to urban transportation systems are mainly related to programmes for the introduction of new technologies, fleet replacement with energy-efficient vehicles and fuel switching.

¹⁴³ Wagner, A., *Urban Transport and Climate Change Action Plans: An Overview on Climate Change Action Plans and Strategies from all Continents*, Sustainable Urban Transport Project (SUTP), GTZ, Germany, 2009.

However, despite a number of improvements, environmental conditions are still not satisfactory: local authorities are facing serious problems to meet the requirements on air quality, such as the limits of particulates and nitrogen oxides in ambient air. Moreover, the development and implementation of 'low-carbon' planning policies by local authorities may encounter:

- Political opposition, related for example to the significant upfront costs of renewing or replacing existing infrastructures, which means that investment in infrastructure is often delayed in favour of more pressing immediate concerns.
- Limited impacts upon the behaviour of individuals who live and work in the city. In some cases, low carbon policies reinforce patterns of inequality in the city by creating niche of 'sustainable' living while failing to address the basic needs of the majority of urban citizens¹⁴⁴.

Because of the significant investments in infrastructures and technology involved, authorities at all level shall be fully engaged with private stakeholders, which in this thesis are mainly global suppliers of transportation systems. As expected, in the transportation industry, several global corporations are nowadays implementing policies oriented to sustainability, which are translated in development of advanced technologies and of brand-new products environment friendly¹⁴⁵. When it comes to emissions and energy consumption, rail transportation is the world's most sustainable mode of mass transit. It generates less than 1 % of global greenhouse gas emissions¹⁴⁶.

The main global players of the urban transportation system industry are increasingly committed in reducing the ratios of GHG emissions by:

- Promoting the development and diffusion of renewable energies;
- Reducing energy consumption and promoting energy saving behaviour

¹⁴⁴ Cf. UNHABITAT, *Global report on human settlements 2011. Cities and Climate Change*, Earthscan, London, 2011, p. 95.

¹⁴⁵ See also Lambin J.J., *Changing Market Relationships in the Internet Age*, UCL Press Universitaires De Louvain, 2008.

¹⁴⁶ See also Bombardier Transportation, *Sustainability Report 2010*, Berlin, 2011.

among suppliers and clients;

- Developing products with lighter weight, lower maintenance costs, fuel efficient, catenary-free,
- Using the best available technologies, in a mix that includes only high-efficiency plants with a low level of emissions;

Case 6 – Tram Wave, catenary-free technology.

Several industry players are spending efforts in improving the environmental efficiency of their system. A recent development of sustainable transportation system have led to the development of a new power supply system for tramways, which allow a perfect integration on the urban environment; this technology provides a power system supply by contact lines on the ground, which can run alongside road traffic and pedestrian, while eliminates the visual impact of traditional overhead cabling.

The power line run beneath the vehicle and only the segment covered by the latter is live, this means that are removed obstacles for pedestrian and road vehicles crossing the rails. In addition, in terms of infrastructure is reduced the environmental impact and the cost of the hardware in the considered urban route.

ASTS has been one the first industry suppliers that has developed ‘Tram Wave’ technology, which offers significant savings on construction costs. In addition, it is also designed for multimodal application since it can become the backbone power line for different vehicle fleets and/or a global network that uses it as a mobile charging station for battery-powered vehicles.

Source: ASTS website. Tram Wave ground-level power-supply system (no overhead lines).

Last but not least, the general population shall become more willing to adapt their behaviour to counteract climate change and support sustainability across the world. Actually, while local authorities can be crucial to the development of sustainable projects, civil society organizations led by NGOs are also important, since they are seeking to promote carbon-saving technologies as suitable cheap alternatives for providing energy to low- income residents. For Examples, NGOs as the Clinton Climate Initiative has recently launched the Climate Positive programme, focusing on large-scale developments in 17 cities on six continents,

which are aiming to become carbon neutral¹⁴⁷.

In summary, there are several opportunities in terms of policy directions for linking climate change responses with urban development; but they call for strategies that involve different level of government and various parties. As a result, where this challenge is met, it increases opportunities and reduces threats to urban development.

It is in this sense that climate change responses can be catalysts for socially inclusive, economically productive and environmentally friendly urban development, helping to pioneer new patterns of stakeholder communication and participation¹⁴⁸.

¹⁴⁷ Information gathered on Clinton Foundation Website.

¹⁴⁸ Cf. Wilbanks, T., *Integrating climate change and sustainable development in a place-based context*, Climate Policy, 2003, S147–S154.

4. Urban Transportation Systems and Global Suppliers

Mobility demand is increasing around the world as economies grow and this is especially the case of developing countries, where an expansion of trade flows and rising personal incomes are increasing the need for transport.

The availability and quality of infrastructures and services enable increased mobility of people and goods, as well as reduced time and costs¹⁴⁹.

For the suppliers of transportation systems the globalization of production of goods and services represents an enormous opportunity, indeed the noticeable growth in global trade and services requires new transport corridors, regional energy pools, and communication rings.

This challenge is even more perceived in emerging and developing countries, which need to have the infrastructures in place in order to compete.

In times of economic turbulence, the rail industry has historically remained flexible and in the last five years local and national authorities have invested in anticipation, due to an expected increase in rail demand. The data provided by UNIFE in terms of market capacity demonstrates that rail is less subject to short-term volatility than other industries¹⁵⁰.

In order to meet the second research question – *Are global market suppliers able to answer to increasing need of sustainable mass transportation systems?* – this chapter deepens the analysis on the market structure of the Light Rail and Metro systems.

The structure of the railway market is based on five main transport segments¹⁵¹:

- Very High-Speed
- Mainline
- Freight
- Light Rail
- Metro¹⁵²

¹⁴⁹ Cf. World Bank Group, *Sustainable Infrastructure Action Plan FY 2009-2011*, Washington DC, 2008, p. 14.

¹⁵⁰ See also Fischer F., Geike T., Häberle S., Rambusch R., Ulrich P., *UNIFE World Rail Market Study: Status Quo and Outlook 2020*, UNIFE and BCG, September, 2010.

¹⁵¹ UNIFE and Roland Berger, *World Rail Market Study, Status Quo and Outlook 2017*, Eurail Press, 2012.

¹⁵² For avoidance of doubt, this dissertation examines the market of metros and light rail systems.

All modes of traffic possess their own structure with their own requirements in terms of the relevant equipment and correspondingly with a differing market development and relevance. Indeed, there are great differences in terms of operation and technology that exist worldwide. As a result, each mentioned segments could be further sub-divided into four main products: Rail control systems, Infrastructure, Rolling stock and Services.

Table 13 - Railway's products market scenario

PRODUCT	MARKET SCENARIO	EXPECTED GROWTH RATE
Rail Control	Investments are related to the renovation of existing system and to the implementation of ERMTS	3%
Infrastructure	Growing market driven by large investment in MENA and Latin America	2.5 %
Rolling Stock	The decrease in the Chinese high-speed segment is compensated by notable investments in metros.	2.5%
Services	High growth rates by a continuously increasing installed base and gradually increasing accessibility of several countries	3%

Source: Author's Revision of World Rail Market Study, Status Quo and Outlook 2017, UNIFE and Roland Berger

For the purpose of this dissertation, from the products listed above it is excluded the infrastructure intended as civil works, track works and electrical equipment. More in general, rail control systems refer to signalling technologies that are crucial for operation, availability and safety of the rail-based system. The automation of existing rail networks and the development of operating systems with new technologies will deliver innovative design. Nowadays, several systems' suppliers offer a wide range of signalling solutions and main manufacturers are developing radio communications-based train control systems, such as ERTMS, ATC, CBTC and Driverless.

Rolling stock products encompass several models of rail vehicles that are adopted in different rail systems (high-speed, commuter, metro, light-rail, tram).

Lastly, Services include solutions for maintenance, spare parts supply, modernization and accident repairs.

In today's global markets there are several suppliers that can manufacture and provide the mentioned products and services, but only five competitors are able to give a full range of transportation solutions.

Table 14 – Main suppliers of urban transportation systems

SUPPLIER	RAIL CONTROL	ROLLING STOCK	SERVICES	COUNTRY of ORIGIN
Alstom				France
Ansaldo STS – Ansaldo Breda				Italy
Bombardier				Germany/ Canada
CAF				Spain
CNR				China
CSR				China
General Electric				United States
Hitachi Rail				Japan
Hyundai Rotem				South Korea
Invensys				United Kingdom
Siemens				Germany
Thales				France

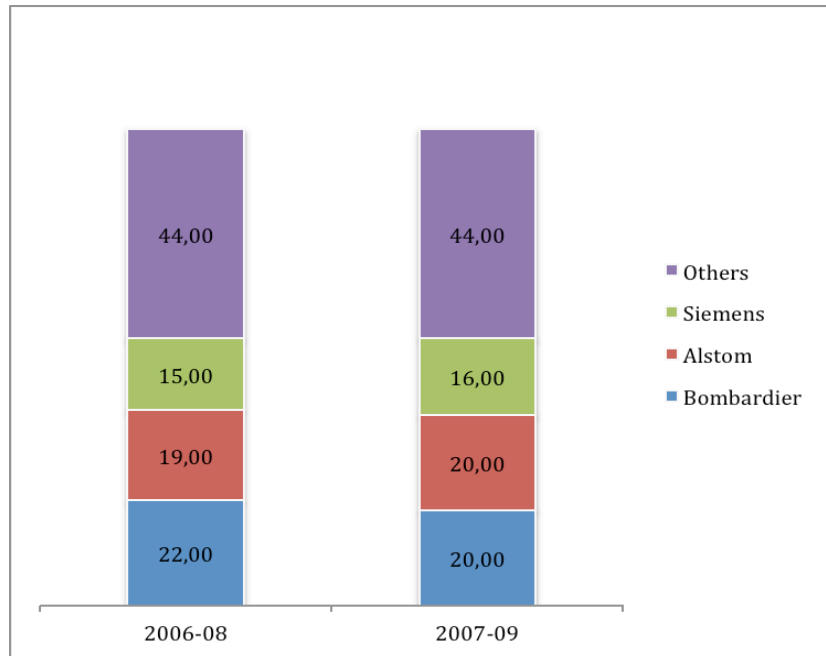
Source: Author revision of Bombardier Transportation market intelligence, BT Annual Report 2011.

As showed in table 14, European manufacturers are at the forefront of new technologies, but especially in the rolling stock industry new competitors are entering the market (e.g. Chinese companies CNR and CSR)

Alstom Transportation, Siemens Mobility and Bombardier Transportation are the major competitors that account for more than 50 per cent of the total market of

rolling stock, rail control solutions and services. Besides these three global players, General Electric and Ansaldo STS with its partner Ansaldo Breda represent other groups that can provide a complete mobility solution.

Figure 8 – Market shares in relevant markets



Source: *Bombardier Transportation Annual Report, 2010.*

Figure 8 shows the total market share for the rail supply industry in the two-year periods 2006-08 and 2007-09; it takes into consideration the published orders for rolling stock and system markets, revenues for services and signalling markets, which totally account for about 51 billion dollars. More in general, Bombardier Transportation (BT), Siemens and Alstom are active in the same markets, but Siemens in addition is also present in the infrastructure logistics and road solutions, thus inflating the German company’s market share.

The country of origin of the main market supplier demonstrate that Europe continues to be the most important market for the rail supply industry, ahead of the North American and Asian-Pacific markets. However, despite this long-term potential for rail products, the European rail supply industry is currently facing a number of structural problems: a declining rail market share where long term

investment has been deferred and a reduction in orders in parts of the industry¹⁵³. Nevertheless, depending on the product segment, country and region, main players are facing competition from specialized and regional competitors. Indeed, in specific product segments such as metro cars and rolling stock Hyundai Rotem, a Korean rolling stock manufacturer, and Hitachi Rail are also active in Asia, the U.S. and Europe.

As a matter of fact, all the players mentioned in table 14 are nowadays targeting emerging and growing markets, in order to take advantage of opportunities resulting in strong pricing pressure in Europe and United States. At the same time, especially in emerging and developing markets, both the increased project size and the enlargement of the scope of the work increase the operational risk for main market supplier¹⁵⁴. Therefore, the opportunity given by globalization to serve a borderless market shall be managed through an appropriate entry strategy. As a consequence, primary international corporations that operate in several industries, such as Bombardier, Alstom, Siemens and General Electric, have successfully established their global presence through a strategy of organic growth in existing and new markets, complemented by targeted acquisition and alliances.

Case 7 – Bombardier opens new markets in Russia

Bombardier represents a model of MdO, which concentrates all the efforts in understanding the demand and create long-term relationship with suppliers in several countries. As a result of the growing opportunities available in the Russia, especially for what concerns the demand for mass transit in Moscow, in 2012 the Canadian-based company entered an agreement with the scope of introduce modern metros and tram in Russia, where significant investment will be boost due to the 2018 football world cup. This agreement will reduce the distances between the different stages of the supply chain and will give benefits to the local economy.

Source: Miller L.S., Bombardier opens new markets in Russia, article published by the online magazine Railway Age, 12 July 2012.

¹⁵³ Cf. European Rail Research Advisory Council, *Strategic Rail Research Agenda 2020*, Bruxelles, 2007, p. 23.

¹⁵⁴ Normally the main suppliers of the transportation solution industry are involved in EPC contracts that include Engineering, Procurement and Construction. In developing and emerging countries the implementation of new infrastructures is accompanied by several need of unprepared clients, which are translated in additional services, operations & maintenance and training.

As demonstrated in many cases, a form of foreign involvement in a new market is related to the direct ownership of foreign-based assembly or manufacturing facilities. In emerging and developing countries, besides large investments in development and implementation of infrastructures, firms find optimal conditions in terms of possibility of reaching cost economies, through cheaper labour and raw materials, foreign-government investment incentives, and freight savings¹⁵⁵.

Differently than major market competitors of turnkey solutions, Ansaldo STS due to its smaller size, compared to the abovementioned corporations, has focused the resources in the internal and main foreign markets, such as United States, Australia, China and India, while in developing and emerging markets it bases its approach on strategic partnerships with local suppliers. As a result, while BT, Alstom, Siemens and GE opt for a ‘make’ strategy, ASTS adopts a ‘buy’ approach¹⁵⁶.

In global markets the competitive environment is getting tougher and primary industry players need to adapt their proposition to several customers’ requirements. Indeed, in stable market conditions, companies investigate methods and process that facilitate the achievement of high levels of production’s standardization; but in global markets urban transportation systems supplier compete in an hyper fragmented scenario, which could be summarized as follow:

Table 15 – Competitive scenario of the global market of rail-based systems

DEFINITION	COUNTRIES	COMPETITIVE CONDITIONS
More developed countries	Canada, Denmark, France, Germany, Italy, Japan, Spain, Sweden, United States, United Kingdom	Supply exceeds Demand
Developing and emerging countries	Australia, Brazil, China, India, Malaysia, Russia, Taiwan, United Arab Emirates, Chile, Mexico, Morocco, Nigeria, Poland, Qatar, Saudi Arabia, South Africa, Turkey	Dynamic Equilibrium between Demand and Supply

Source: Author

¹⁵⁵ Cf. Kotler P., *Marketing Management*, 11th edition, Prentice Hall, New Jersey, 2007, p. 392.

¹⁵⁶ Companies base their ‘make’ or ‘buy’ analysis looking at the expected sales levels and cost of internal operations in comparison with cost of purchasing the product or service (outsourcing). See also Probert D., *Make or Buy Strategy for Manufacturing Business*, the Institution of Electrical Engineers, London, 1997. Koch R., *How to Create and Deliver a Winning Strategy*, 3rd ed., Prentice Hall, Harlow, 1995.

Table 15 reports the segregation into more developed, emerging and developing countries, based on existing infrastructures and already proposed in chapter one. As a matter of fact, it emerges a distinction into an over-supplied situation, especially in Europe and North America, which is ascribable to lower growing rates, to increasing demand for standardised solutions in the railway transport industry, particularly as regards the signalling technology (e.g. ERTMS), and to the pressure on prices¹⁵⁷.

In these unstable market conditions, the focus of industry's suppliers shifts from product to corporate intangible assets, which are mainly based on information and innovation. Indeed, the market proposals are build on technology and innovative solutions (e.g. on-board electronics, information and communication systems) for both passengers and freight transport.

The situation in developing and emerging markets is completely different than in MDC. The considerable growth in emerging areas has evidenced a market scenario in which the demand temporary exceeds the supply, but in general the competitive situation is in dynamic equilibrium between demand and supply, especially due to a reduced number of supplier that can meet the requirements on global scale. Indeed, there is an estimation of more than 300 mass transit systems that will be built in Asia and the pacific region, plus Africa and Middle East. In the mentioned areas the shift in transport modes from private to public may lead to a continuous pipeline of new infrastructure projects.

In these areas, companies in order to reach and maintain a competitive position shall adopt a customer-centric approach driven by an organisation supported by a strong global network of engineering, manufacturing and service locations. In other words, industry's suppliers need to adopt a more integrated, coordinated and efficient approach, both as regards business processes and in relation to staff activities.

In emerging countries authorities must develop infrastructure to increase access and to ensure to their population does not lose out on the increased growth

¹⁵⁷ Cf. Ansaldo STS, *Sustainability Report 2011*.

opportunities of globalization. In this context emerge the need of global suppliers to establish a closer relation of partnership with local authorities, in order to avoid additional indirect costs. As a matter of facts, differently than developed countries, where projects are financed and managed through partnerships between public and private subjects (PPP), in most of the cases in emerging countries the clients are represented directly by local governments, which leave in a second position the economical aspect of the projects itself. Therefore, in global markets, the competitiveness of global suppliers of urban transportation systems in offering turnkey projects is related to the adaptation of their proposal, in terms of products and services, to clients' specific needs, in turnkey projects.

In global markets, continuous technological innovation represents a priority for main market's suppliers¹⁵⁸ and following this approach many companies have redefined their structure enhancing the interaction with clients and sub-suppliers. In order to do so companies need to design their operations so that all the activities are based on flexibility.

Nowadays, supplies' customization and operational flexibility could be effective only if companies are organized in network, through which it is possible, on the one hand, to increase the possibility to reach economies of scale, reducing costs while enhancing the competitive advantages; on the other hand, to take advantages from borderless competition, which is not anymore related to the physical borders of a certain country¹⁵⁹. The previous sentence emphasizes the critical role of suppliers and sub supplier participating in networks with big corporations. These small and medium enterprises if adopt a Market-Driven approach are crucial for the performances of the networks of companies involved in large-scale international project.

¹⁵⁸ See also Brondoni S.M, *Market-Driven management, concorrenza e mercati globali*, Giappichelli, Torino, 2007.

¹⁵⁹ With reference to the advantages of the globalization see also Lambin J.J., *Market-Driven management*, McGraw-Hill, Milano, 2007.

4.1. Corporate factors

In a Market-Driven perspective, companies focalize their resources on the possibility of being provider of solutions aimed at enhancing the customization of their offering, through an active cooperation with clients and competitors. As a consequence, in markets characterized by intense competition companies operate in a wide competitive space, in which adaptation to client requirements and organizational flexibility, besides corporate intangible assets, all represent key factors¹⁶⁰. As expected, the strategic lever is represented by knowledge, information and relationships built within the whole supply chain.

In highly competitive markets, such as Europe and United States, the consolidation and thus the standardization of the urban transportation systems, especially metros and light rail, have given as first outcome the enlargement of the number of industry's suppliers.

As a result, apart from global multi sectorial corporations mentioned in the previous paragraph, companies as Ansaldo STS in order to survive and maintain its competitive advantage need to focus their goals on quality, technology, innovation and costs reduction.

In global markets, it emerges the necessity for suppliers of urban transportation systems to adopt a double strategy, which in the one hand, it shall be focused on the standardization of the output in order to face the demand of interoperability, safety and comfort in markets as Europe and US; on the other hand, the approach shall be oriented to customization and adaptation of products to the requirements of specific clients, which may change from one country to another.

In this perspective, the Ansaldo STS CEO stated: 'Among other things, there has been an unavoidable knock-on effects towards supplier and sub supply companies, given that, quite rightly, customers have become increasingly demanding on behalf of their end users who, equally justifiably do not want just to be transported

¹⁶⁰ See also Brondoni S.M., *Market-Driven Management e mercati globali*, Giappichelli, Turin, 2007.

(commuted) to their destination, they want the journey to be comfortable'¹⁶¹.

Continuous innovation enables the activation of dynamic and flexible manufacturing processes, which have radically enhanced the capabilities of companies to offer a wide range of products maintaining their internal efficiency.

Companies need to increase the efficiency throughout the value chain (design, provisioning and manufacturing) reviewing every process, upgrading level of specialization and reducing plant and skill redundancies. Following this path companies can compete in different regions of the world.

On the basis of what has just been said, it springs the close dependence that is created between business and the environment (the company draws from the environment and not vice versa). It is the overall competitive arena that is constantly being modified, which obliges firms to continually scan the market in order to adapt their strategies to new changing conditions¹⁶².

Indeed, in order to obtain information about the environment of reference, companies require a dynamic management system that enables a continuous adaptation to rapid changes¹⁶³. As a consequence, today's competition demands companies to operate in network organizations, which enable the development of the competitive advantage based on the synchronization of strategies and operations of every single entity that is involved in the network. Moreover, the implementation of an established network of suppliers and sub-supplier reduces the supply risks related to shrinking capacities and failing suppliers.

Lastly, the volatility of demand and the intensified competition of global markets push main suppliers of urban transportation market to build network organizations, which enable dynamic supply chain management and lean manufacturing.

More in general, in global markets companies shall adopt strategies that reflect the

¹⁶¹ Cf. De Luca S., *Transportation Speaks Italian*, supplement to *Finmeccanica Magazine*, n. 19, 2011.

¹⁶² Cf. Brondoni S.M., Musso F., *Ouverture de Marketing Channels and Global Markets*, *Symphonya. Emerging Issues in Management*, n.1, 2010.

¹⁶³ See also Lambin J.J., *Market-Driven Management: Strategic and Operational Marketing*, MacMillan, London, 2000.

ideas of international competitiveness suggested by De Woot, which is based on¹⁶⁴:

- Optimisation of the forecasting methods and action processes, directed by a shared vision;
- Development of key resource for the project: human resources (skills, management and internationalisation), organization, technological knowledge, relations, networks;
- International extension of operational functions, both through internal resources or through alliances and partnerships;
- Enhanced integration of research and development (R&D) in business strategies;
- Capacity to respond swiftly to environmental challenges and opportunities.

The management of these key variables enable companies to sustain revenue growth, while protecting profitability.

¹⁶⁴ See also De Woot P., *The Challenges of Economic Globalisation: Business, Competition and Society*, Symphonia. Emerging Issues in Management, n.2, 2002.

4.1.1. Standardization and Customization

In global markets companies are nowadays increasingly adopting strategies of supply differentiation aimed at building and maintain a competitive advantage.

The differentiation strategies are reflected in the definition of a set of significant differences able to make distinguishable the offer of the company compared to that of competitors¹⁶⁵. As a consequence, the differentiation allows the expansion of the variety of products, and qualifies the company's offerings with certain characteristics in terms of tangible and intangible assets.

The advantages of differentiation are related to the increased value perceived by the client, and therefore the ability to reconcile the needs of clients with certain unique characteristics of the products manufactured and the services provided.

Global enterprises are continuously searching for structures that can minimize costs, on the one hand, and maximize customer value, on the other hand; to this end, it is implied that companies adopt a management strategy that can match activities 'Push', which are based on economies of scale and of experience, and 'Pull', which are characterized by a high degree of flexibility and adaptability to the unstable conditions of global markets.

Indeed, the Market-Driven approach requires a form of integration that takes into account the competitive value of various business processes and aimed at optimizing the performances in relation to costs (fixed and/or variable), the time (time-based management) and the means (rigidity and flexibility)¹⁶⁶.

The combination of push and pull policies depends on the ability to place the decoupling point, which is the node that acts as an intermediary between management of processes aimed at achieving economies of scale and a dynamic management oriented to market's demand. In the global market of suppliers of urban transportation systems, companies cannot anticipate any manufacturing activity until the client releases the order¹⁶⁷, but once it is received time and

¹⁶⁵ See also Kotler P., *Marketing Management*, 11th edition, Prentice Hall, New Jersey, 2007.

¹⁶⁶ See also Corniani M., *Market-Driven Management e politiche d'impresa push-pull*, Symphonya. Emerging Issues in Management, n. 1, 2008

¹⁶⁷ More precisely, in the majority of the countries, urban transportation projects are awarded in public

dynamic relationships in the whole supply chain are crucial. As a matter of fact, especially for companies that operate in emerging and developing markets, time has a vital role in managing the variety and mutability of market demand (time-based competition).

The postponement of activities related to the differentiation of the supply is linked to economic objectives, such as reducing inventory and transportation costs. In addition, on the one hand, it reduces the risk of product obsolescence, and on the other hand, it increases the competitiveness of the company, in terms of reducing the response time to clients' demand (lead-time).

The implementation of such management model has a number of implications, including first of all significant investments of economic resources in order to change the sequence and location of activities throughout the supply chain. In particular, the production is redrawn through¹⁶⁸:

- Standardization, in terms of use of common components that can be used for different products;
- Modular production;
- Reconstruction of the sequences of the entire production process, in order to delay the assembly of specific components of the product and to shift the production to locations closer to the project's site.

In terms of decoupling point, it is important to carefully distinguish between flows of goods and information flows. With reference to the materials, the solution suitable for companies suggests to try to place the decoupling point as far as possible from the final client (e.g. upstream the supply chain). As a consequence, it seems clear to expect that a company that operates according to a push strategy, try to defer the decoupling point (leaving less room for customization); this sentence reflects a conservative approach, which aims to avoid the risks associated to the relationship with the client, such as change of the order. This means that companies tend to standardize the processes of production and handling of goods,

tenders.

¹⁶⁸ See also Lee H.L., Tang C.S., *Modelling the Costs and Benefits of Delayed Production Differentiation*, Management Science, 1997, p. 40-53.

with the intent to anticipate the differentiation of activity.

The anticipation of the decoupling point upstream the value chain aims at reducing several costs in terms of goods, inventory and personnel, which are usually connected to the concepts of flexibility and adaptability to market's demand.

Moreover, in order to increase the information content from the final client, companies can move the decoupling point along the supply chain, up to the moment in which the information penetrate the entire supply chain. In this perspective, policies for managing the flow of goods and materials became 'pull-type', and replace and integrate the 'push' solution¹⁶⁹.

Companies that operate according to a logic of integration between policies push and pull, have the opportunity to take advantage of a diversified system of relationships with the players in the market, by virtue of which it is created a circle where pull policies allow to know quickly the client response, in order to be able to develop certain activities and processes, in which it is possible to adopt standardized activities, associated with the minimization of costs and the maximization of internal efficiency.

There is evidence that a firm's organisational model to maximise the use and benefits from processes of standardization and customization, varies across markets to be supplied. Each strategy will have an impact on overall organisational effectiveness and the delivery of core competence to the market.

In global markets of rail-based systems emerges the need of increasing standardization of suppliers' offerings, ascribable to:

- High competitive pressure on rail products' prices;
- Increased complexity of these products, related to continuous technological innovation;
- Inability to exploit economies of scale because the diversity of national requirements, which adds considerable cost and delay to the acceptance and approval process¹⁷⁰.

The right trade-off between productive standardization and supply customization

¹⁶⁹ See also note 166.

¹⁷⁰ See also Ansaldo STS, *Sustainability Report*, 2011.

could be built at any point of the value chain, and can cover the design, manufacture, assembly and delivery of systems.

From a company internal point of view, a type of modular organization of the production seems to facilitate the creation of a customized offer. In fact, in global markets characterized by high volatility, companies are replacing rigid operations with flexible forms of management, based on the development of relationships with partners both upstream and downstream the supply chain, as well as competitors.

Case 8 – ETR 500 Frecciarossa

In 2009 two competitors of the rolling stock industry, Ansaldo Breda and Bombardier, have entered an agreement for the joint-manufacturing of the superfast train and environmentally friendly ETR 500, which have taken part in the tendering procedure opened by Trenitalia for 50 high-speed trains.

The new train - which will be produced at the Ansaldo Breda of Pistoia and at the Bombardier plant in Vado Ligure (Savona) - will be able to optimize operational efficiency and energy consumption, and will result in the synthesis of the two technology platforms of AB and BT. Bombardier will have roughly 60 per cent of the work and will be responsible for the propulsion and electrical system. Ansaldo Breda will be responsible for the train body and final assembly.

The contract represents for the Canadian company's biggest sale in Italy and one of the biggest in Europe. Indeed, Roberto Tazzioli, President and CEO of Bombardier Transportation Italy, said: "It will be a fast train, reliable, efficient operational level, convenient from the point of view of energy consumption and operating costs and will roominess better than any other means of rail transport". Bombardier has had a presence in Italy for some 30 years and essentially controls the Italian market for electric locomotives. The new Italian contract puts BT and AB at the heart of Italy's effort to modernize its passenger rail system, giving the country trains that are as fast, or even faster, than the high-speed trains in France and Germany. Bombardier and Ansaldo Breda will supply 50 train sets, each capable of carrying 600 passengers. Each train set is 202 metres long and is valued at €30.8-million.

Source: Author's personal information. FINMECCANICA website and The Globe and Mail website

In this context, sharing productive activities can be efficient only if the system is

broken down into parts and modules¹⁷¹. As a result the production process is shared among many actors.

The modular production can bring enormous benefits for companies that participate in the network, and it seems to be the most efficient approach to a strategy of customization, because on the one hand, it reduces business costs, and on the other hand, there is the possibility of differentiating the product, without having impact on the price.

Major industry's supplier as Siemens, BT and Alstom adopt strategies based on modular production and they normally share activities with branches dislocated in several countries (make).

Differently, companies as ASTS and AB base their strategy on a modular production with activities shared in the network of suppliers and sub suppliers (buy), through which 'soft' activities are realized in-house and 'hard' activities are transferred to local third parties, which are more integrate in the reference market and have their own established organization.

Indeed, as stated by Brondoni, *market-space competition* also emphasises global economies of scale, whose value does not depend on the level of exploitation of elementary manufacturing factors but on the 'intensity of sharing' of specific resources in a networking system, i.e. on the sophistication of collaborative relationships between internal, external and co-makership structures¹⁷².

As a matter of fact, there are risks with both extremes; keeping everything in-house can be expensive and inflexible, while going outside can involve unanticipated overhead costs¹⁷³. In general, cost reduction, efficiency and improved service continue to drive many sourcing initiatives.

Nowadays, it is demonstrated by several global companies that corporates' management systems based on flexibility and adaptation to rapidly changing

¹⁷¹ See also Garbelli M.E., *Costi di differenziazione di prodotto e dinamiche competitive*, Symphonya. Emerging Issues in Management, n. 1, 2005.

¹⁷² Cf. Brondoni S.M., *Ouverture de Intangible Assets and Global Competition*, Symphonya. Emerging Issues in Management, n.2, 2010.

¹⁷³ At the same time, the development of partnerships with other companies, in some cases competitors, provides a range of issues to be managed, including the possibility of imitation by competitors and the consequent increase in costs related to research and the conclusion of a new agreement with other subjects.

market's scenario, are more efficient especially in unstable market's conditions. Indeed, the decision of main urban transportation systems suppliers to move toward supply customization and adaptation in emerging and developing countries is based on:

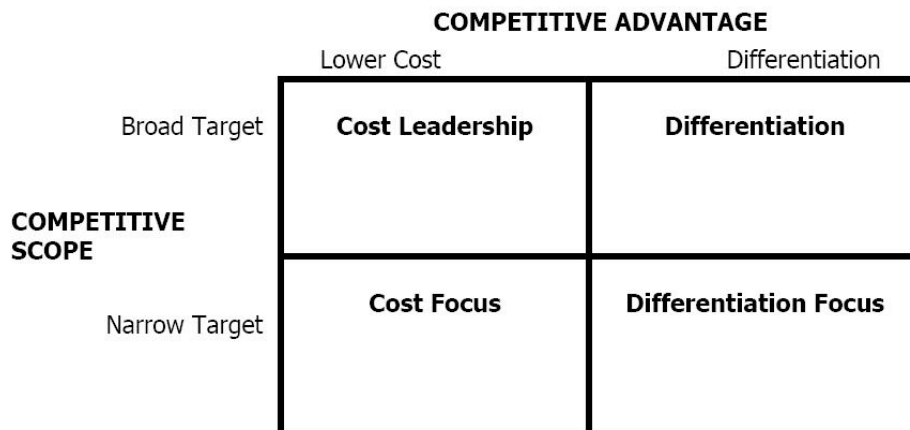
- Changing clients requirements;
- Availability of advanced ICT technologies

In recent projects it has clearly emerged the key role of the clients in actively participate with the supplier in the tender phase with the aim of creating a solution as more respondent as possible to the needs.

Supply and project customization can be considered as advanced differentiation strategies, which can be adopted in highly competitive and unstable market conditions.

In 1985 Porter gave an evidence of the several approaches adoptable by companies operating in the market, which are mainly referable to a cost leadership approach or a differentiation strategies¹⁷⁴.

Figure 9 - Porter Generic Strategies



Source: Porter M.E., *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press, New York, 1985.

In global markets, major provider of urban transportation systems, through a

¹⁷⁴ See also Porter M.E., *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press, New York, 1985.

network of branches and suppliers, can adopt customization strategies, which means a trade-off between manufacturing efficiency and product differentiation.

The conditions that push companies to adopt a customization strategy are¹⁷⁵:

- The market turmoil, the success of personalization is linked to unstable conditions in markets where there is demand – clients - for differentiated products;
- A distortion of classic productive activities, but also of all the relationships that companies have with the various players in the supply chain;
- Organization oriented to knowledge and the sharing of information between all parties involved in the exchange. In terms of adaptation to client's requirements, it is strategic to collect information from customers and in some cases, learning and work directly with them.

In conclusion, it is possible to emphasize that a strategy of supply customization not necessarily can be implemented and can operate efficiently. Indeed, there are many critical internal and external issues that shall be taken into consideration. In fact, the achievement of efficiency depends not only on the opportunity of offering to the clients the right system that meets their requirements, but also to the ability to produce a wide variety of products, reducing the number of activities.

¹⁷⁵ This analysis has been proposed by Blecker and Abdelkafi, and adapted to supply adaptation and customization to client's requirements in the global market of supplier of urban transportation systems. See also Blecker T., Abdelkafi N, *Mass Customization: State of the Art and new Challenges*, in Blecker T., Friedrich G., *Mass Customization: Challenges and Solution*, Springer, New York, 2006.

4.1.2. Differentiation Costs

For companies operating in global markets, differentiation has become over time a strategic lever, since it allows the development of a competitive advantage.

A differentiation strategy is based on the redesign of products, services, processes, and on activities that involve a complete restructuring of the entire value chain, with relevant costs associated. These costs may be direct, when they are connected to: a) inputs necessary to ensure better quality, b) employees' training, c) business communication and marketing, d) after-sales services.

At the same time, the costs to be borne by global corporation could be indirect, when these are referred to the interaction of the variables of differentiation with the variables that influence costs¹⁷⁶.

For effective cost analysis of differentiation shall be considered the different competitive structures assumed by the market.

The economies in scarcity of supply have a market structure in which there are many alternatives to purchase; this means that clients' choices are made between products belonging to different product classes. In this context, the only source of uniqueness of the company can be connected to a particular innovation that introduces a new technology, unique and different.

In economies in scarcity of supply, the cost structure is mainly focused on business operations, in terms of¹⁷⁷:

- Procurement of inputs, related to the shortage of raw materials or their control by few companies;
- Manufacturing and production processes; the structure involves a competitive orientation to the commercial production, this means that the few companies on the market focus on achieving economies of scale and experience.

¹⁷⁶ With reference to this interaction, the differentiation requires a continuous improvement of the product, and this obstructs the exploitation of economies arising from experience curve. One way to reconcile the difference in cost efficiency is to delay differentiation in the final stages of the value chain (postponement).

¹⁷⁷ See also Garbelli M.E., *Costi di differenziazione di prodotto e dinamiche competitive*, Symphonya. Emerging Issues in Management, n. 1, 2005

These costs are also the most influential variable in the decisions determining the selling price.

Unlikely the above situation, in economies in controlled competition, there is a condition of dynamic equilibrium between supply and demand. The competition is much higher and clients' choices are focused on products that have the same functional use; moreover, the needs are specific and suppliers offer different alternatives, which allow a buying choice closer to the clients' needs.

This is the case of emerging and developing markets, where on the one hand there is a necessity to develop new infrastructures, and on the other hand, only few industry suppliers are able to respond to different requirements of several clients.

In such a competitive situation, which is often associated to an oligopoly, there are few companies that control the market¹⁷⁸. The choices of differentiation can be traced to the functional characteristics of the offer, and in this case it is called product differentiation.

The costs of differentiation are interrelated with the possibility to adopt forms of flexible production aimed at saving costs. In order to do so, the use of modular production gives the possibility of externalize processes and in addition allows the production of the common parts with processes that tend to the minimization of costs, by achieving economies of scale; on the other hand, the special parts, represent the actual cost of differentiation and are produced with activity which tends to protect the company, in order to avoid the imitation by competitors.

The differentiation is therefore a key strategy in the economies in dynamic equilibrium and this is demonstrated by the presence of costs related to both tangible and intangible features of companies' proposal.

As reported in table 15, in more developed countries the situation is different. Infrastructures are already present and the demand is mainly related to the renovation of existing assets¹⁷⁹. In these countries emerges a competitive situation

¹⁷⁸ See also Sloman J., *Economics*, 6th edition, Prentice Hall, New Jersey, 2006.

¹⁷⁹ In chapter one and in table 15 has been delineated a segregation between countries based on the existence of urban infrastructures. As a result, the more developed countries - Canada, Denmark, France, Germany, Italy, Japan, Spain, Sweden, United States and United Kingdom - are nowadays in a situation in which the supply exceeds the market demand. This means that besides global players of the industry there are several medium-

of over-supply; more precisely, the supply is higher than the market demand, both in terms of quality and quantity, and as consequence the competition occurs between different goods that have the same function, as part of a complex and structure system. Indeed, the products and services are considered as an integrated system of tangible and intangible assets, in which the latter usually represents the source of differentiation.

In these markets is evident the need of dynamic relationships that see companies entering into strategic and operational partnerships with third parties, with the aim of tackle the high instability of the context. As a matter of fact, it is crucial in order to reduce the cost of competition, the development of relationships with companies upstream and downstream the supply chain, as well as competitors.

More in general, the costs of differentiation are attributable to the reduction of product costs, which are expressed, on the one hand, in terms of flexibility compared to market demands, and on the other hand, these are linked to the respect and the maintenance of certain specific features of the product or service offered.

The need of reducing the differentiation costs encompasses the decision to share the production activities, through organizational solutions based on the principles of lean manufacturing. In other words, the production process is broken down and assigned to different external partners, in order to share the cost of production and to have the possibility to exploit economies of scale and experience. Companies that adopt this approach can implement customization strategies, which allow both compression of the costs and a rapid response to market requirements.

The costs of differentiation represent an important component in terms of development and retainment of competitive advantage. Indeed, a unique and strong market proposal can only be provided if it is reduced and optimized the competitive pressure on companies; nowadays, this goal is achievable through the creation of partnerships with other industry suppliers and competitors¹⁸⁰.

size suppliers, which are increasing their market shares, especially in services' industry.

¹⁸⁰ See also note 177.

4.1.3. Dynamic Supply Chain Management

In the previous paragraphs has been remarked the importance of the network of branches, suppliers and sub-suppliers that allow big companies to compete in several countries.

Supply customization demands manufacturing flexibility, which enables companies to overcome their physical boundaries. The starting point of this process is the solution required by the client and its requirement in terms of infrastructures. Nowadays, in infrastructures' project development clients are directly involved in the proposal phase and the global suppliers of urban transportation system shall have the capabilities to adhere their proposal to urban mobility's needs.

The customization of the supply to client's requirements involve several stages of the entire supply chain and, as already stated, it requires a complete redesign of manufacturing processes. The requirements of supply customization strategy are:

- Obtain more information by clients, co-makers and suppliers;
- Supply goods and provide services that fulfil the need of the client, and involve them actively in the production process;
- Limit the possibilities of customization trying to narrow the range of goods offered;
- Apply a pricing strategy not necessarily 'premium' since costs represent for the majority of client relevant factor especially in time of economic crisis, during which public investment are shrunk.

In global markets, the boundaries between company, suppliers and clients have fallen; this means that businesses shall continuously seek new strategies in order to maintain a competitive advantage over time.

In conditions of market instability is essential to develop relationships with all parties involved in the business. A relational approach lowers the cost of competition and creates network structures, in which companies share with suppliers and clients, and in some cases competitors, a number of activities,

ranging from the organization of the network up to complex tasks such as research and development, marketing and production of goods. The use of a network structure based on competitive relationships allows high levels of flexibility and adaptability to changing market conditions.

As stated by M. Christopher, the term supply chain refers to the 'network of organizations that are involved, through upstream and downstream links, in the different processes and activities that produce value for the products and services offered to the end client'¹⁸¹. The Supply Chain Management was created and developed based on the concept that the processes of supply and distribution can not be limited within the internal activities of the company, but it must be integrated with the network of upstream and downstream enterprises. Indeed, while Logistics refers to tools for the optimization of handling processes, organization and management of materials and finished products, within the company, the Supply Chain Management is an extension of this concept that assumes several links and coordination with upstream suppliers and downstream clients.

Moreover, the concept just presented differs from a strategy of vertical integration strategy¹⁸², in which companies assume control of suppliers and customers. Until few decades ago, this solution seemed to be the most fruitful in both organizational and economic terms. Indeed, in stable markets, companies tend to concentrate their efforts on the production. This perspective focuses on internal limits, according to an *inside-in* approach, rather than on market demand. It seems clear that the choices of control of suppliers - vertical integration - are the solely approach practicable, in order to achieve economies of scale, suitable for the production of large amounts of goods.

In highly competitive scenario, such as global markets, a closed vision within the

¹⁸¹ See also Christopher M., *Logistics and Supply Chain Management: Creating Value-Adding Networks*, 3rd edition, Prentice Hall, New Jersey, 2005.

¹⁸² One of the main reasons that push companies to adopt strategies of integration with other parties is bind to the existence of transaction costs. As analysed by Coase, in 1937, 'The presence of transaction costs lies on the base of the existence of every company. Transaction costs give an explanation of the reason why every corporates' activity is arranged internally (make), rather than through external partners (market's transactions - buy)'.

borders of the company does not seem to be the best practise to adopt, especially in a continuously changing environment. Currently, most of the companies have discovered the benefits in terms of cost reduction related to focus on their core business and outsource all other activities. Clearly, outsourcing complicates the situation if it is taken into account the need for continued coordination of the flow of materials from different suppliers, which are often located in countries other than the manufacturer one.

The outsourcing becomes even more central in an environment like the current one, where constant changes are completely changing the rules of the market. In these terms, the importance of relationships within the entire supply chain plays a key role in all markets, both B2C and B2B. The opportunity to work in networks is realized through the use of a flexible structure that, on the one hand, it increases the value of the company's offering, minimizing the time and differentiating products and services of the company compared to its competitors; on the other hand, this reduces costs and increases the efficiency of the procurement, production and distribution of products.

In global markets, the driving principle shall be the adoption of a Dynamic Supply Chain management system, based on¹⁸³:

- Responsiveness, in terms of the ability to meet the needs of client in short time, with flexible and customized solutions;
- Reliability, which is related to the activities entrusted to external partners;
- Resilience, the global markets are characterized by high turbulence and volatility. All activities and in general the political and economic situation are subject to unexpected shocks, and as a result the supply chain is vulnerable to such events, making the business more exposed to risks. As a result, it is crucial to develop the capability to cope with the mentioned changes in the environment in which the company operates.
- Relationship (partnerships and networks), this emphasizes the importance

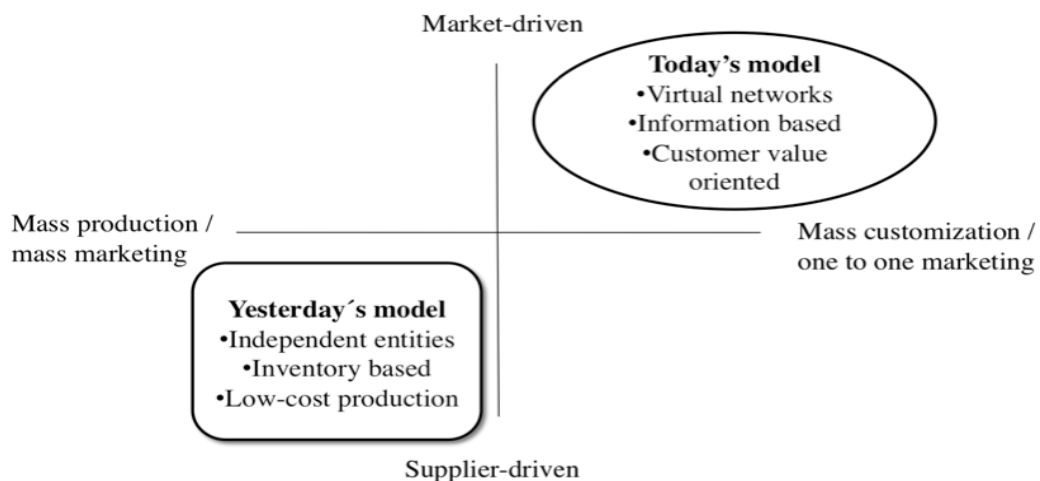
¹⁸³ The four mentioned principles are known as 4Rs of the supply chain management. See also, Christopher M. *Logistics and supply chain management: creating value-adding networks*, 3rd ed., FT Prentice Hall, Harlow, 2005.

of a partnership between client and supplier. There are already many companies that have adopted a 'win-win' approach, in which the relation is created and developed with the goal of mutual benefit to all parties involved in it. For manufacturers and suppliers this can lead to the creation of new entry barriers for competitors, because the more closely the relationship is between the producer (or supplier) and the client, the more it will be difficult for other companies to enter this relationship.

The principles just mentioned seem to be more suitable in a highly competitive environment, where the long-term development of the company is no longer tied to sales volumes or tangible factors of supply, but to adaptation to clients' requirement and corporate intangibles assets¹⁸⁴.

With regards to the subject of this dissertation, in developing urban transportation systems the configuration of the supply chain become *outside-in*, which means that the client is no longer located at the end of the supply chain but at its beginning. This policy, also defined 'Pull', is more consistent in unstable and uncertain market conditions; it highlights the level of service offered and it creates a situation where companies shall adopt high flexibility in all the operations.

Figure 10 – Today Supply Chain



Source: Author revision of "The supply chain of the future", in Christopher Martin, *Logistics and supply Chain Management: Creating Value-Adding Networks*, 3rd edition, Prentice Hall, New Jersey, 2005.

¹⁸⁴ See also Brondoni S.M., Ouverture de "Over-Supply and Global Markets", *Symphonya. Emerging Issues in Management*, n. 1, 2005.

As a consequence, in global markets, the creation of a winning organization passes through the development of a network of flexible suppliers, where each participating party can effectively focus its resources on specific activities. Many companies are still characterized by high levels of hierarchy, by policies of vertical integration and organization of activities based on functions, and these characteristics are difficult to reconcile in unstable market conditions.

Finally the challenge from the point of view of corporate organization is linked to the necessity of having a reactive organization, in the full sense of the word. This requires companies to adopt a MDM approach and to choose a type of horizontal development¹⁸⁵, based on flat processes, with hierarchies reduced to a minimum, and on multi-functional work groups.

¹⁸⁵ See also Wockman J.P., Jones D.T, *From Lean Production to Lean Enterprise*, Harvard Business Review, 1994, p 93-102.

5. Borderless competition and globalization patterns

The growth of cities is an effect of the geographical concentration of the national growth and it is closely bound to economic growth and industrial productions. However, the largest share of population, GDP and financial and non-financial wealth of a country is concentrated in cities and these are the drivers of the national economic growth.

Nowadays, the economic growth of the cities in Western Europe and United States is pulled by the development of service activities, while the role of industry becomes increasingly secondary¹⁸⁶. At the same time, cities in emerging and developing countries are experiencing a growing industrial development phase and it is evident the need of urban mobility.

Globalization implies the transition from a unidimensional competitive space, referred to established physical and geographical borders, to a multidimensional space, where corporates have to compete with several players. In this context, suppliers of urban transportation systems are nowadays competing on global scale, consequently they are experiencing an increasing level of competition, which is sometimes related to new players coming from emerging and developing countries (e.g. Chinese Companies CNR and CSR¹⁸⁷). Moreover, the European and North American rail supply industries are facing additional challenges such as¹⁸⁸:

- Increasing competitive pressure from low-cost Asian manufacturers, some of whom benefit from state assistance;
- Irregular public sector funding for products, which creates uncertainty

¹⁸⁶ Cf. Cappellin R., *Industrial clusters and intermediate cities in Italy: the role of interactive learning in explaining agglomeration economies for industrial and service activities*, XXXII Congress of the Italian Regional Science Association (A.I.S.Re.), *The role of cities in the knowledge economy*, Polytechnic of Turin, 15-17 September 2011.

¹⁸⁷ CSR and CNR were established in 2001, emerging from the former China National Railway Locomotive & Rolling Stock Industry Corporation (LORIC). Nationally, CSR leads in the production of electric locomotives, high-speed electrical multiple units (EMUs), and some types of metros vehicles. CNR is strong in the manufacturing of diesel locomotives, very-high speed and certain types of metros cars. Both companies are engaged in HSR manufacturing joint ventures with the leading international rail manufacturers via subsidiaries Changchun, Tangshan, and Sifang. Cf. Renner M., Gardner G., *Global Competitiveness in the Rail and Transit Industry*, Worldwatch Institute, Washington D.C., 2010

¹⁸⁸ Cf. European Rail Research Advisory Council, *Strategic Rail Research Agenda 2020*, Bruxelles, 2007.

about utilisation of manufacturing capacity;

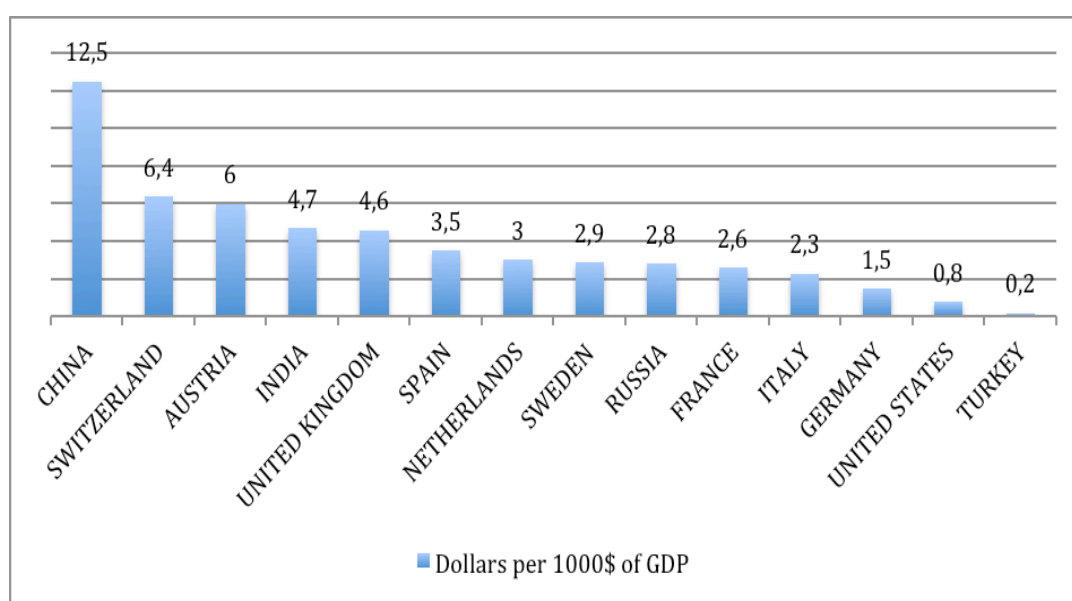
- Some sectors of the rail supply industry need to be further consolidated in order to achieve a more rational and efficient industry structure;
- An inability to exploit economies of scale because of the diversity of national requirements that adds considerable cost and delay to the acceptance and approval process.

Furthermore, there have been changes in global financial conditions that have led to an increase in public and private investments in infrastructures in emerging markets, in particular in Africa, South Asia and the Middle East.

The Asia-Pacific market is continuing its growth and it is confirming the region's strong commitment to investment in rail. For example, mass transit investments continues in India with orders for metro cars, while in China there is an increment in resources destined to urban infrastructures and a need for investment in mainline products, such as locomotives for high-speed networks (figure 11).

Nevertheless, Europe is still expected to remain the world's largest market, mainly pushed by projects in the segments of regional commuters and light rail.

Figure 11 – National Investment in Rail Infrastructure



Source: data referred to 2008 and provided by SCI Verkher in Renner M., Gardner G., *Global Competitiveness in the Rail and Transit Industry*, Worldwatch Institute, Washington D.C., 2010

Nowadays, global suppliers of urban transportation systems have to focus their resources in responding to the growing demand of rail-based infrastructures, outside EU and US, which are driven by the strong need for mobility on the back of rapid urbanization and continued economic growth.

Furthermore, main industry's players can take advantages from the reproduction in emerging countries of the European model of integrated and interoperable transportation network (TEN-T), based on the recent development of the ERTMS/ECTS system.

Case 9 – GCC Railways

GCC Railway Network is a project aimed at creating an integrated rail network connecting the six GCC countries. It is based on national railway's plans under development in UAE, Qatar, Saudi Arabia, Bahrain and Oman. The total estimated value is around 25bn dollars and its completion is scheduled within 2017.

Nowadays, Saudi Arabia is the only country of the region that already have a mainline service and the governments is planning metro projects in Riyadh and Jeddah, which will be fully integrated with the railways network. At the same time, the other countries are implementing new railway line, which will be linked to the main network.

The first phase of the project is already under construction in the UAE's section (Shah, Habshan and Ruwais) and it is managed by a consortium led by an Italian company, Saipem, which is active in the region with several petrochemical projects. Bids for the following phases are under implementation.

Once completed in the six states, the network will carry freight and passengers, and it will be integrated with metros, light rail and tram networks.

Source: MEED Magazine¹⁸⁹.

Rail is currently the most active transport sector across the Arabian region, with governments developing passenger service, freight lines and metro systems. As a

¹⁸⁹ See also Martin M., *Higher spending exposes region to oil price fall*, MEED Magazine, n. 45, November 2011; Fenton S., *Golden opportunity for rail in the Gulf*, MEED Magazine, n. 1, January 2011; Fenton S., *Middle East states explore rail funding alternatives*, MEED Magazine, Rail Supplement, 2011; Salisbury P., *Rail to create retail opportunities in the Gulf*, MEED Magazine, Rail Supplement, 2011; Foreman C., *Saudi Arabia dominates GCC project market*, MEED Magazine, N. 33, August 2011; Fenton S., *Yearbook 2011: Transport outlook - Gulf states push on with transport schemes*, supplement to MEED Magazine, 2011.

matter of fact building railways requires huge investments and in oil-rich countries the governments are bearing the cost of those infrastructures' development.

The conditions of instability that characterize global markets push companies to develop policies oriented to the investigation of innovative solutions, in terms of procurement, manufacturing and response to clients' needs. In this context, especially in emerging markets the time and the space become key factor, for the reason that these could alter the competitive scenario. Indeed, Brondoni notes that 'In global markets, businesses compete according to *market-space competition* logics, in other words with competition boundaries in which space is not a fact, a known and stable element of the decision-making process, but a factor of competition, whose profile is configured and modified by the actions/reactions of businesses and governments'¹⁹⁰.

Furthermore, besides the huge market opportunities, emerging and developing countries present several risk factors, mainly reconducible to country risk, strategic alliances and challenging deadlines.

With regards to the case study presented in the paragraph 5.2, in countries as Saudi Arabia the financial crisis in 2008 led the governments to increase spending to stimulate economic activity. Moreover, anti-government protests around the Arab world (Arab Spring) have seen the wealthy oil-exporting countries announce large-scale financial packages aimed at tackling social tension¹⁹¹.

The case of the Arab Spring, on the one hand could be considered as an opportunity for suppliers of urban transportation systems, but on the other hand, it demonstrates how fragile is the political situation in countries governed by absolute monarchies and diktatorships.

At the same time, GCC countries are increasingly differentiating their productive systems in order to cope with the vulnerability of their economies to oil price shocks, which could be a further opportunity for global suppliers of transportation

¹⁹⁰ See Brondoni S.M, *Market-Driven Management, Competitive Space and Global Network*, Symphonia. Emerging Issues in Management, n. 1, 2008

¹⁹¹ Cf. Martin M., *Higher spending exposes region to oil price falls*, MEED Middle East business intelligence magazine, n. 45, 2011.

industry¹⁹². For instance, the Saudi Arabia is directing its resources to build several entirely new cities as economic hubs and to expand metallurgical and petrochemical industries, in order to create an alternative to its dependence on oil exports and to increase employment. To this end, the governments in several emerging and developing countries are raising barriers to foreign companies, which are translated in forcing global suppliers of the transportation industry in form alliances with local firms¹⁹³. Moreover, especially the Gulf countries have introduced reforms focused in increase the employment for nationals across all sectors of the domestic and aimed at reduce the over-reliance on foreign workers¹⁹⁴.

Lastly, as already remarked in the previous section, infrastructures are a strategic pillar in emerging and developing countries growth. Some countries, as China, Saudi Arabia and Australia, are implementing several programmes, getting public works underway and it is crucial for global suppliers of transportation systems to commit on completing project according to clients' deadlines. As a matter of fact, the time in emerging countries plays a primary role and, for instance, while in Europe a 15km metro system takes at least five years from the design phase up to commercial operations, in Saudi Arabia, as demonstrated by the case study, the same metro system has been implemented in 30 months. This sentence remarks the necessity for global suppliers of urban transportation systems to adopt a Market-Driven approach aimed at responding to the clients' demand earlier and

¹⁹² The mentioned domestic investments are aimed at diversifying and developing the local economies. Indeed, a new generation of GCC leaders increasingly recognize the need to spur local development, both to create jobs and to develop more robust economies. Collectively, GCC has planned \$1.4 trillion on spending on infrastructure and construction projects from 2009 to 2015. Cf. VV.AA., *The new power brokers: How oil, Asia, hedge funds, and private equity are faring in the financial crisis*, McKinsey Global Institute, July 2009.

¹⁹³ The case of Ansaldo STS and Ansaldo Breda in the first metro project implemented in the Saudi Arabia (described in paragraph 5.2) demonstrates the importance of local alliances when dealing in developing and emerging markets. Indeed, the Italian suppliers were part of a consortium led by the main Saudi's construction company – Saudi Bin Ladin Group. In addition, all the hard activities to be performed on site have been sub-contracted to Carlo Gavazzi Saudi Arabia Co.Ltd, a Saudi company, which forms part of an Italian group.

¹⁹⁴ Saudi Arabia represents a typical case of this kind of policies. Indeed, in the nineties has been implemented a country's Saudization program. It is estimated that in the last decade expatriate workers in the kingdom have remitted about SR 585.4 billion. As a consequence, the reform focuses also on the recapture and reinvestment of this capital in the internal market. Cf. Looney R. *Saudization and Sound Economic Reforms: Are the Two Compatible?*, Strategic Insights, Volume III, n. 2, 2004.

better than competitors¹⁹⁵.

¹⁹⁵ See also Brondoni S.M., *Market-Driven Management: meglio e prima dei concorrenti*, in MARK UP, July/August 2005.

5.1. Intangible Assets and International Project Management

Lambin defines the globalisation as ‘the combination of processes that remove regional barriers and favour the flow of capital, goods and information on a global scale, and acceptance of the fact that the world functions as a single whole’¹⁹⁶.

In global markets, the role of intangible resources emerge and become evident especially in large corporations, where the strategies are built on competitive policies based on time (*time-based competition*) and on the removal of physical boundaries, both geographical and between companies (*market-space competition*)¹⁹⁷. As a consequence, in terms of corporates’ management the relationship developed by the company hold a crucial role. Indeed, the instability emphasizes the need to develop a series of alliances, with companies positioned upstream and downstream the supply chain, and with competitors and clients, in order to enable the firm to tackle the high uncertainty of the competitive environment. These represents the main reasons behind the growing development and strengthening of relationships with partners located in all nodes of the supply chain.

In other words, firms in global markets are facing a kind of competition that configures different situations (*market-space competition*), in which the boundaries of competition are not known and stable, in fact these could be continuously changed by industry’s players, through the creation a flexible and adaptable response to the market demand.

The intangible assets are a strategic lever adopted in order to managing the network of relationships that companies develop in the reference market; these relationships are based on high levels of interaction, in real time and without the constraints of physical space, among several stakeholders (business, suppliers, customers, competitors, institutions).

In a corporate internal view, as presented in chapter one, the system of corporate

¹⁹⁶ Cf. Lambin J.J., *Marketing strategico e operativo*, McGraw-Hill, Milan, 2008, p. 31.

¹⁹⁷ See Brondoni S.M., *Global Markets and Market-Space Competition*, Symphonya. Emerging Issues in Management, n. 1, 2002.

intangible assets could be summarized in a management system related to the body of knowledge accumulated by the company, and the number of channels that allow the acquisition of critical information¹⁹⁸.

In global markets, companies are oriented to establish relationships with a wide range of stakeholders and in this context the knowledge is traded for building defendable conditions of competitiveness¹⁹⁹. As a result, networks are complex structures that favour knowledge management skills, competitive alliances and outsourcing agreements (with co-makers and external partners)²⁰⁰.

Nowadays, corporates' alliances represent a stable system of agreements with a competitive scope²⁰¹, since these could alleviate the pressure on the industry's players through the sharing of functions, phases and single operation²⁰².

In this perspective, with regards to the development and implementation of urban infrastructures' projects, it emerges a lack of skills and knowledge especially in emerging and developing countries. In many countries, there is a serious lack of skilled labour in transport, and of sufficient investment in ensuring that the right skill sets and knowledge will be available in future²⁰³.

In countries where infrastructures are not existent and today are under development, international experts and contractors, which can ensure the delivery of required standards, are involved and manage metros and railways projects. As a matter of fact, in emerging countries that have already experienced the construction of several lines of metros and railways, such as China and India, local companies are expanding their technical knowledge and are turning it in a competitive advantage in terms of exploitation of the huge amount of resources destined to infrastructures, offering to global suppliers of the transportation

¹⁹⁸ Cf. Brondoni S.M. *Risorse Immateriali e concorrenza d'impresa*, in VV.AA., *Il sistema delle risorse immateriali d'impresa: cultura d'impresa, sistema informativo e patrimonio di marca*, Giappichelli, Turin, 2002.

¹⁹⁹ See also De Vita P., Testa F., *Relazioni d'impresa e patrimonio di marca*, in VV.AA., *Il sistema delle risorse immateriali d'impresa: cultura d'impresa, sistema informativo e patrimonio di marca*, Giappichelli, Turin, 2002.

²⁰⁰ Cf. Brondoni S.M., *Intangible Assets & Global Competition*, Symphonya. Emerging Issues in Management, n.2, 2010.

²⁰¹ See also Vicari S., Fiocca R., *Le alleanze interaziendali per l'attuazione di strategie commerciali congiunte*, in Fiocca R., *Imprese senza confini*, Etas, Milan, 1987, p.34.

²⁰² Cf. Garbelli M.E., *Il sistema informativo nei network cooperativi di imprese*, in VV.AA., *Il sistema delle risorse immateriali d'impresa: cultura d'impresa, sistema informativo e patrimonio di marca*, Giappichelli, Turin, 2002.

²⁰³ Cf. International Transport Forum Secretariat, *Transport and Innovation: Unleashing the Potential*, Canada, 2010.

industry a lower operational cost. As a consequence, in these markets, international consortia and local players could even render lower bids' rates to clients.

On the other side, in countries where there are no urban transportation systems and railways, the lack of expertise of local players represent a cost for the client and an opportunity for global suppliers and their sub-suppliers. This is the case of Saudi Arabia, further examined in the next paragraph.

In both the cases, the joint participation of several players from different countries spotlights the crucial role of corporates intangible assets in driving the consortia or the joint venture or even subcontracts to offer a proposal the more respondent as possible to the client's requirement.

In cooperative relationships between companies, the information system²⁰⁴ become a critical factor due to the increased need of facts and figures on two different levels:

- Corporate (internal level), it is related to the necessity of maintaining the competitive advantage that is based on the body of knowledge gathered, on the one hand, and to the need of absorb the information coming from the partners, on the other hand²⁰⁵;
- Network (external level), it shall be considered as an autonomous entity and it develops its own need in terms of resources and information.

Networks are characterized by superior grade of elasticity that is necessary in unstable market's conditions. In these non-competitive structures, in terms of management of information flows between several organizations, the network's informative system is decisive in the identification and in the selection of partners, as well as in the management of shared operation (IOS – Inter Organizational System)²⁰⁶.

In global markets, dynamism shall characterize not only the choices of activities'

²⁰⁴ In networks particular attention shall be paid on the information system, which has been defined by Kotler as 'a structure represented by people, tools and procedures, aimed at gather, classify, analyse, evaluate and distribute information destined to the market's decision makers'. See also Kotler P., Armstrong J.G.S., Wong V., *Principles of Marketing*, Prentice Hall, Harlow, 2001.

²⁰⁵ See also Pontiggia A., *Organizzazione dei sistemi informativi*, Etas, Milano, 1997.

²⁰⁶ See also Corniani M., *Sistema informativo aziendale e dinamiche competitive*, Giappichelli, Turin, 2000.

localization but also corporate culture, information system and brand equity, which shall be preserved in a long-term perspective within the companies' assets; furthermore, in a dynamic context, they shall be easily modified, in order to be tailored to partners and to markets' conditions.

5.2. Supply Customization in Urban Transportation Systems. The case of Princess Noura University for Women²⁰⁷

Globalization imposes new competitive borders²⁰⁸, it has modified traditional competitive environment in terms of time and space²⁰⁹, which have become key variables (*time-based competition*²¹⁰ and *market-space management*).

Markets have left behind and revisited the *one size fits all*²¹¹ motto and, nowadays, in open market competition conditions corporates are increasingly adopting form of management of internal and external activities based on projects. As a matter of fact, processes organised according to a sequential logic are transformed into relationships formed within 'project-oriented networks'. New flexible forms of organisation, in other words, that postulate the division of the structures in terms of space, time and the functions performed²¹².

Particularly, this is the case of global suppliers of urban transportation systems; indeed, a project may be defined as a temporary association of factors finalized to the realization of a product or to the provision of a service. In this context, the time plays a key role since the project is developed within a certain amount of months and has unique characteristics. At the same time, projects such as the construction of mass transportation system in fast growing cities have an enduring impact on the urban environment.

As stated by Brondoni²¹³, in open markets, not protected by geographical and administrative boundaries, companies adopt very flexible management behaviour, drawing on intangible resources, designed to exploit global economies of scale in a

²⁰⁷ The information reported in this paragraph have been collected in Author's personal field experience with a small size italian company (Comesvil SpA), which has been involved, as one of the preferred sub-suppliers of Ansaldo STS, in the supply and installation of the signalling system for the PNU project in Saudi Arabia.

²⁰⁸ Cf. Brondoni S.M., *Mercato globale, risorse immateriali e spazio competitivo d'impresa*, Symphonya. Emerging Issues in Management, n.1, 2002

²⁰⁹ Cf. Lambin J.J., Brondoni S.M., *Ouverture de "Market-Driven Management"*, Symphonya. Emerging Issues in Management, n.2, 2000-2001.

²¹⁰ Cf. Rancati E., *Il tempo nelle imprese orientate alla concorrenza*, in Brondoni S.M., *Market-Driven Management Concorrenza e Mercati Globali*, Giappichelli, Turin, 2007.

²¹¹ See also Kotler P., *Marketing Management*, Millennium edition, Prentice-Hall, New Jersey, 2000.

²¹² Cf. Gnechchi F., *Market-Driven Management, Market Space and Value Proposition*, Symphonya. Emerging Issues in Management, n. 2, 2009

²¹³ Cf. Brondoni S.M., *Ouverture de Intangible Assets & Global Competition*, in Symphonya. Emerging Issues in Management (www.unimib.it/symphonya), n. 2, 2010.

networking logic. In sizeable economies of scale, the search for lower manufacturing costs presupposes:

- Complex outsourcing functions;
- Dynamic localisation of plants.

In the market of urban transportation systems the major suppliers are implementing strategies based on the right trade-off between standardization and adaptation; indeed, once developed a unique system this could be reproduced through the customization of features, in other places. Moreover, the organization of the activities in projects enables the adoption of modular production that facilitates the sharing of operation within the network of suppliers, sub-supplier and even competitors.

An effective strategy of customization is construct on the internal efficiency and to a considerable extent to the possibility of adopting standardized products and operations, which could balance the cost of the supply adaptation. In order to do so, main industry players are tying the development, manufacturing and provision of their systems to a limited number of 'preferred sub-suppliers'²¹⁴, with which are tightly integrated. Indeed, in global markets companies share their operations with these suppliers, often requiring co-location of facilities to reduce cycle times and enhance potential for rapid problem solving. In other words, this approach enables to achieve high flexibility in operations by closing the system and significantly limiting the diversity of participants. This approach, rather than "push", focuses on "pull", which means creating platforms that help people to mobilize appropriate resources when the need arises²¹⁵.

Furthermore, in unstable market scenario, it is increasingly difficult to build and maintain long-term relationships with clients. This reason has led companies to

²¹⁴ Big companies in global markets adopt lists of preferred suppliers, which offer significant multiyear cost savings and contribute to client's satisfaction improvement commitments. These suppliers normally participate in competitive proposal and negotiation processes and are selected only if they met several criteria (Economic, financial, organizational, qualitative, environmental etc.).

²¹⁵ Early elements of a pull model began to emerge from Toyota in the early 1950', with its lean manufacturing. Toyota operates its assembly lines with a "just in time" philosophy. Resources are pulled into the assembly line just as they are needed, rather than allowing large inventories to accumulate at various stages of production. In its Japanese operations, Toyota is not quite at the point of attaching a customer's name to each car entering the production process, but it is much closer to executing a true "build to order" system than U.S. car manufacturers. See also Ohno T., *Just-In-Time for Today and Tomorrow*, Productivity Press, New York, 1988.

develop competitive strategies increasingly innovative, based on processes of differentiation more and more refined.

The activation of differentiation strategies requires high versatility and flexibility of production processes, in order to produce an increasing variety of products, without penalizing efficiency.

From the perspective of project customization to client requirements, the most problematic aspect to be analysed is related to how are managed the activities in the whole supply chain. In this sense, Market-Driven Management approach imposes a form of integration, whereby it is applied a push strategy for activities that can be repeated, and it is adopted a pull approach for all the activities that require to the company to be flexible and responsive to market demands. Corporates' policies 'push' and 'pull' refer to the logic underlying the relationship between companies and the clients.

In stable competitive scenarios, such as the urban transportation industry of the beginning of the twentieth century up to the eighties, companies focus their efforts on the improvement of strategies for resource mobilization, which are pushed in advance to areas of greatest need. This approach is especially developed in a stable environment and it requires a deep knowledge of the applications and all its dynamics. The competitiveness of companies is measured in terms of production efficiency²¹⁶, especially in the ability to achieve economies of scale, scope and experience, although these involve a cost structure focused on long-term investments. It is interesting to note that the approach 'push' was originally adopted by major industry's players (BT, Alstom, GE, Siemens) with the aim of promoting internal efficiency; it may limit the flexibility, but at the same time this is a small price to pay for the possibility to reduce costs. However, with increasing uncertainty and competition, the model 'push' is less and less able to provide efficiency.

During the eighties there were the first signs of a new model for the mobilization of resources. The 'pull' approach focuses on creating platforms that help clients to

²¹⁶ Cf. Webster, F.E. Jr , *Industrial Marketing Strategy*, 2nd, John Wiley & Sons, New Jersey, 1984.

find and to access different solutions, depending on their needs. This orientation is driven by the market and it aims the company to identify the needs expressed and to satisfy them. In other words, 'the market is the organizer of the needs that drive the company to the realization of a particular offering that is configured as a response action to the market demand'²¹⁷.

A pull approach tends to be deployed in environments characterized by high instability, as today's global markets, where companies fail to have a deep knowledge of a dynamic and continually changing scenario. This strategy is developed on flexible organizational platforms, designed to accommodate different actors (primarily suppliers and clients). The main motivation that drives companies to adopt policies such as 'pull' is precisely the search for greater flexibility in order to cope with a situation of high uncertainty.

In the last decades this approach has been adopted by ASTS and also other big industry's players are continuously dismissing internal activities - where and if is possible - and outsourcing to external sub-suppliers. The cost structure is no longer based on heavy investments but on the cost of building and maintaining relationships with the various players in the market. In fact, in this context, the primary source of competitive advantage is the ability to respond better and before than competitors²¹⁸, in terms of both material flows and requests from the clients.

As might be expected, the strategies 'push' and 'pull' are not mutually exclusive. In fact, more often the best solution to the current conditions of instability seems to be an effective compromise between the two. In the light of the above, in the transportation systems industry it should be established policies 'pull', given the inability to plan for the long-term and the marked dynamism of competitors and demand²¹⁹, but this would only increase the cost of production, leading companies out of the market for non-competitiveness.

²¹⁷ Cf. Hagel J., Brown J.S., *The Only Sustainable Edge: Why Business Strategy Depends on Productive Friction and Dynamic Specialization*, Harvard Business School Press, Boston, 2005.

²¹⁸ See also Brondoni S.M., in *Market-Driven Management, concorrenza e mercati globali*, Giappichelli, 2007.

²¹⁹ See also cfr. Corniani M., *Market-Driven Management e politiche d'impresa push-pull*, Symphonya. Emerging Issues in Management, Issue 1, 2008.

With regard to the subject of this dissertation, in urban transportation industry today the economic crisis is felt to a greater extent in Europe and United States, but in the rest of world, as reported in chapter two and three, the rapid urbanization path and the related economic growth of urban centres creates a demand of efficiency in mobility and urban transport. In this context, Europe remains the largest market for rail-based transportation systems' suppliers but the growth is mainly related to the development of high-speed network and renovation of existing assets. The instability of the market in more developed countries and the profitable opportunities that emerge in recent developed and developing countries, are both driving global suppliers to shift their focus to areas where rapid development of large urban centres is generating urgent need of efficient urban transportation systems.

Indeed, infrastructures enhance the nation civil works and tackle increasingly advanced engineering and technological quality-related issues.

In spite of the fact that the market of urban transportation is under development in the several cities of the Arab States, including the area of the gulf, the favourite means of transport remains the car, given the large availability and accessibility of oil. Moreover, anti-government protests around the Arab world (Arab Spring) have seen the wealthy oil-exporting countries announce large-scale financial packages aimed at tackling social tension²²⁰.

As a result, in the Saudi Arabia the need to expedite measures to address socioeconomic challenges including unemployment and housing was underscored last year with the announcement of a package of infrastructures, to be implemented in whole country.

The building of new rail-based systems, such as a recently announced high-speed rail system in Saudi Arabia and Riyadh Metro Project, demonstrates the momentum for new advanced rail infrastructure in this region.

The case of Princess Noura University²²¹ is part of the public spending plan under

²²⁰ Cf. Martin M., *Higher spending exposes region to oil price falls*, MEED Middle East business intelligence magazine, n. 45, 2011.

²²¹ The Princess Nora Bint Abdulrahman University, which was inaugurated on 15 May 2011, is located on the

development in the Kingdom of Saudi Arabia, which is trying to cope with soaring population relocating the countries wealth to non-oil sectors, and in this context investments in education and infrastructures represent an optimal starting point.

Notwithstanding that in the Arabian Peninsula is usual the construction of mega-projects in the urban environment, the PNU project stands out for its sheer size and scope. It is possibly second only to another Saudi Arabian education project The King Abdullah University of Science and Technology (KAUST), which was unveiled by King Abdullah bin Abdul-Aziz Al Saud in September 2009²²².

Mobility within the PNU campus is provided by a 12 km women-only light metro, with a total of 14 stations on a main loop. Based on the PNU Driverless Metro project in Riyadh, Saudi Arabia, is an outstanding example of an integrated infrastructure project that is expected to have a huge social impact²²³.

The driverless metro system has been supplied and implemented by Ansaldo STS, which won the contract in 2009. The Italian company, adopting a MDM approach, was selected as main contractor for both a proposal that was completely respondent to the client's requirement and for its commitment to complete the whole metro system in around 24 months. As a matter of fact, the project began in early 2009 and the entire university was built within a 25-month time frame; the massive project have engaged around 75,000 workers, and was designed with the aid of architectural expertise from around the world, including Cairo, Beirut, India and the United States. In this context, Ansaldo has respected its challenge since the installation of the metro system began in September 2010 and nowadays the metro is in its full commercial operations.

Ansaldo STS, in 2008, has adopted a long-term perspective in a market where demand was not yet required to generate the scale of production that will pull costs down over time.

King Khalid International Airport Road in north Riyadh. The project is spread across eight million square meters and has been built with a total investment of £11 billion.

²²² See also KPMG International, *Infrastructure 100: World Cities Edition*, 2012.

²²³ Public transportation system could also have a social inclusive impact; indeed, since in the Saudi Arabia is forbidden to women to drive a car the implementation of a metro system could give to them the possibility of more affordable and available transport mean (e.g. the Dubai Metro has a special metro coach only for women).

Moreover, the Saudi Arabia besides the huge market opportunities presents several risk factors, mainly reconducible to country risk, strategic alliances and, as already seen, challenging deadlines.

Table 16 – The Kingdom of Saudi Arabia. Country risk analysis

POLITICAL	ECONOMIC	FINANCIAL	RATING
The Saudi political system is stable, but regional instability (Egypt, Yemen, Bahrain, Syria) may be a latent risk for the country.	Saudi Arabia is riding the current oil boom wave from a position of strength thanks to a consolidation of economic policies and strengthening of the process of diversification	The banking system has good fundamentals and seems to be able to withstand the effects of the international crisis by adopting conservative policies. Islamic fundamentalism remains an area of concern	S&P: AA- MOODY'S: Aa3 FITCH: AA- Stable outlook

Source: Author revision of several reports ²²⁴

The ASTS identified in the area huge opportunities and nowadays it is recognized as the first metro supplier of the Saudi Market. The case of PNU is an endorsement of the role of ASTS as one of the major global suppliers of urban transportation systems. In this process, the advanced know-how of small and medium enterprises in this field has played a significant role.

As a matter of fact, the result of ASTS has been reached through its close and integrated network of suppliers and sub-supplier, which enable economies of scale and reduction of lead-time. In addition, in PNU Ansaldo STS has also engaged local companies with the aim of reduce the costs of the adaptation to a completely new market.

The case of PNU clearly demonstrates that the competitive advantage of ASTS is build on its organization based on network structures, where the critical condition is to seek continuous development and maintenance of relationships with all

²²⁴ The information regarding the country risk of the Kingdom of Saudi Arabia have been collected on the several reports: SACE, *Paesi del GCC: opportunita' per infrastrutture e oil&gas, ma criticita' per accesso al credito e domanda privata*; Italian Ministry of Foreign Affairs and Ministry of Economic Development, *Rapporti paesi congiunti, Arabia Saudita*, 2011; Interprofessional Network, *Dossier Arabia Saudita, L'impresa verso i mercati internazionali*, Italian Ministry of Economic Development, 2011. Information regarding the country's rating has been collected on rating agencies websites (Standard&Poor, Moody's and Fitch).

actors on the market, starting with suppliers, clients and competitors.

In markets where the competitive space looks increasingly expanded and boundaries are unstable, it seems reasonable to overcome a static view of organizational, managerial and strategic activities and related information, in order to adopt an approach as much as possible dynamic and elastic.

Information systems (internal and between companies) thus become a critical factor for a company's development; collaboration between companies is based on the preparation of specific channels and flows of information²²⁵.

More in general, in both developed and developing countries, for different reasons, transport solutions is a sector in continuous expansion, and the current market condition differ from that of previous years and competition is increasingly harsh. Global suppliers in order to maintain their competitive advantage and survive in unstable market's scenario shall focus on technological innovation and corporate intangible assets to service the increasing requirements of the market, better and earlier than competitors.

²²⁵ Cf. Gnechi F., *Market-Driven Management, Market Space and Value Proposition*, Symphonya. Emerging Issues in Management, n. 2, 2009

6. Conclusion

The growing demand of urban mobility is a consequence of several global trends. In this dissertation the focus has been mainly posed on the urbanization path, which is actually in progress especially in emerging and developing countries, and the relative increasing demand of urban transportation systems.

Fast growing cities around the world are facing several challenges in health, mobility, social development, security, and water and energy resource management.

Cities see themselves faced with the transport challenges since their very survival as a thriving and desirable place to live can depend on a reliable and worthwhile urban transportation system.

In general, the economic literature considers the growth of cities as the effect of the geographical concentration of the national growth and it relates economic growth to industrial productions and exports to other countries. As a matter of fact population, GDP, financial and non-financial wealth of a country is concentrated in cities and these are the drivers of the national economic growth²²⁶.

As urbanization continues the main critical issue is managing the process of urban development for cities in both developed and developing countries, and mobility and transport lie at the heart of any successful city in the future²²⁷.

In developing and emerging countries, as household incomes increase, it is taking place a modal shift toward motorized individual transport. In this context, the decisions of policies makers, both at national and local level, shall be oriented to the implementation of an efficient public transportation system. Indeed, experience in cities of both developed and developing countries demonstrates that public policy can significantly influence resulting pattern of urban transport

²²⁶ Cf. Cappellin R., *Industrial clusters and intermediate cities in Italy: the role of interactive learning in explaining agglomeration economies for industrial and service activities*, XXXII Congress of the Italian Regional Science Association (A.I.S.Re.), *The role of cities in the knowledge economy*, Polytechnic of Turin, 15-17 September 2011.

²²⁷ Nowadays, almost 3.6 billion urban dwellers are distributed unevenly among urban settlements of different size. In 2011, 23 urban agglomerations qualified as megacities because they had at least 10 million inhabitants. See also UNDESA, *World Urbanization Prospects. The 2011 Revision*, United Nations, New York, 2012.

systems as is visible in the contrasting patterns of private automobile domination in most US cities and public transport led multi-modal system in some European and Japanese cities²²⁸.

Fast growing cities should follow a balanced approach in developing urban mobility plans, using complementary mass transportation systems appropriate to local circumstances. In practice, on the one hand, in developed areas cities shall make efforts in order to renovate existing infrastructures and to implement a more integrated transportation network, which will cope with both need of mobility from work to home, and vice versa, and mobility for leisure and travel; on the other hand, especially in developing countries, cities shall focus on the development of particular transportation system, aimed at responding to the need of increasing capacity, while not neglecting other transit modes.

Nowadays, cities could manage urban growth enhancing mobility while reducing congestion, accidents and pollution; as a consequence, fast growing cities have the responsibility to prioritize and manage the demand of mobility through the adoption of an accessible and efficient public transport system, which is functional and easy to use.

Based on the analysis of the global demand, in the present dissertation major attention has been paid on the dynamics underpin the supply of urban transportation systems.

In developing sustainable and multimodal urban transportation systems, first of all it emerges the importance of technology and, for instance, the application of advanced ICT to railways and metros that enable the adoption of state-of-the-art systems such as automatic train control (ATC), which is designed to autonomously perform, part or all, the operations in a driverless but safer mode.

In developing and emerging countries enormous demand for new and traditional rail-based infrastructures represent a huge opportunity for global suppliers of transportation systems.

Today, the competitive space is enlarged and multidimensional; corporates

²²⁸ Cf. Vuchic V. R., *Transportation for Livable Cities*. Center for urban policy research, New Jersey, 1999, pp 128-129

compete without geographical and administrative borders, and if on the one hand it represents an advantage, in terms of markets to serve, on the other hand, there is a larger number of players to compete with. In today's highly competitive global markets, major industry suppliers - Alstom, ASTS, BT, GE and SIEMENS - compete in conditions of extreme economic, technological and socio-political instability. No company can afford to rely purely on its own resources, knowledge and skills, as they did in the past²²⁹.

Moreover, the customization of the supply to several clients' requirements involve several stages of the entire supply chain and, as already stated, it requires a complete redesign of the whole company's processes. Therefore, in conditions of market instability is essential to develop relationships with all parties involved in the business. A relational approach lowers the cost of competition and creates network structures, in which companies share with suppliers and customers, and in some cases competitors, a number of activities ranging from the organization of the network up to complex tasks such as R&D, marketing and production of goods. The use of a network structure based on competitive relationships allows high levels of flexibility and adaptability to changing market conditions.

As a consequence, in global markets, the creation of a winning organization passes through the development of a network of flexible suppliers, where each participating party can effectively focus its resources on specific activities²³⁰. At the same time the development of partnerships with other companies, provides a range of issues, including the possibility of imitation by competitors and the consequent increase in costs related to research and the conclusion of a new agreement with other subjects.

The competitive superiority of Market-Driven firms' would be volatile if not accompanied by adequate capabilities to protect the sources of advantage. In other

²²⁹ Cf. Brondoni S.M., *Ouverture de Intangible Assets & Global Competition*, Symphonya. Emerging Issues in Management, n.2, 2010.

²³⁰ The need of reducing the differentiation costs encompasses the decision to share the production activities, through organizational solutions based on the principles of lean manufacturing. In other words, the production process is broken down and assigned to different external partners, in order to share the cost of production and to have the possibility to exploit economies of scale and experience. Companies that adopt this approach can implement customization strategies, which allow both compression of the costs and a rapid response to market requirements

words, companies have to sustain the competitive advantage that can be obtained by implementing Market-Driven enabling capabilities, which²³¹:

- Shall provide value to the client;
- Shall be difficult to imitate;
- Shall be immobile across firm boundaries²³².

As a consequence, in global markets the competitive advantage is not anymore related to corporate's dimensions and is not based on economies of scale, but it resides on the opportunities to develop several relationships with companies located upstream and downstream the value chain (e.g. manufacturers, suppliers, clients, competitors, governments, etc.), with the aim of creating an organization that can be easily adapted to the continuous evolution of the markets.

Globalisation has accentuated the collapse of spatial boundaries, assisted by the development of telecommunications and transport (and therefore by the evolution in logistics), and consequently this has fostered a gradual consolidation of the intangible factors of supply, and not only corporate²³³.

The strategic lever is therefore closely linked to partnerships developed within a network, by virtue of which, through the exchange of information, companies can take advantages in terms of operational efficiency and effectiveness of the system of supply over the market's demand. Indeed, flexibility in management and operations, competitive adaptability and corporate intangible factors are the key factors that enable the development and the retention of a durable competitive advantage.

In conclusion, the case of Ansaldo STS remarks that the creation of a winning organization that can cope with the increasing instability of global markets and to conditions of both over-supply, in developed countries, and increasing demand of

²³¹ Vallini C, Simoni C., *Market-Driven Management As Entrepreneurial Approach*, Symphonya. Emerging Issues in Management, n.1, 2009.

²³² See also Barney, J. B., *Firm resources and sustained competitive advantage*, Journal of Management, 17(3), 1991, pp. 99-120; Grant, R. M., *The resource-based theory of competitive advantage, implications for strategy formulation*, California Management Review, 1991, pp. 114-35.

²³³ Cf. Gneccchi F., *Market-Driven Management, Market Space and Value Proposition*, Symphonya. Emerging Issues in Management, n. 2, 2009

transportation systems in emerging and developing ones, is related to the possibility of adopting a flexible supply chain, whereby each participating party can focus on its core business while entrusting the upstream and downstream activities to external subjects.

The need to cooperate with other entities within a network is, on the one hand, aimed at ensuring that the offering is consistent with regards to client's requirements, while on the other hand it increases the availability and variety of resources, reducing the risks to which a company is subjected. As a consequence, companies are obliged to identify common objectives for creating the conditions that improve the performances of the network²³⁴. In this context, the role of corporate intangible assets is even more essential in terms of corporate culture and information system, which if effectively integrated into the network enable the development of new forms of competitive advantage, based on the overcome of the physical limits of competition²³⁵ and on strategic and operational synchronization between the different participants in the network.

²³⁴ Cf. Pepe C., *Valori e relazioni d'impresa nelle filiere globali*, *Symphonya.Emerging Issues in Management*, n. 2, 2007.

²³⁵ Cf. Brondoni S.M., *Market-Driven Management, Competitive Space and Global Network*, *Symphonya.Emerging Issues in Management*, n. 1, 2008.

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