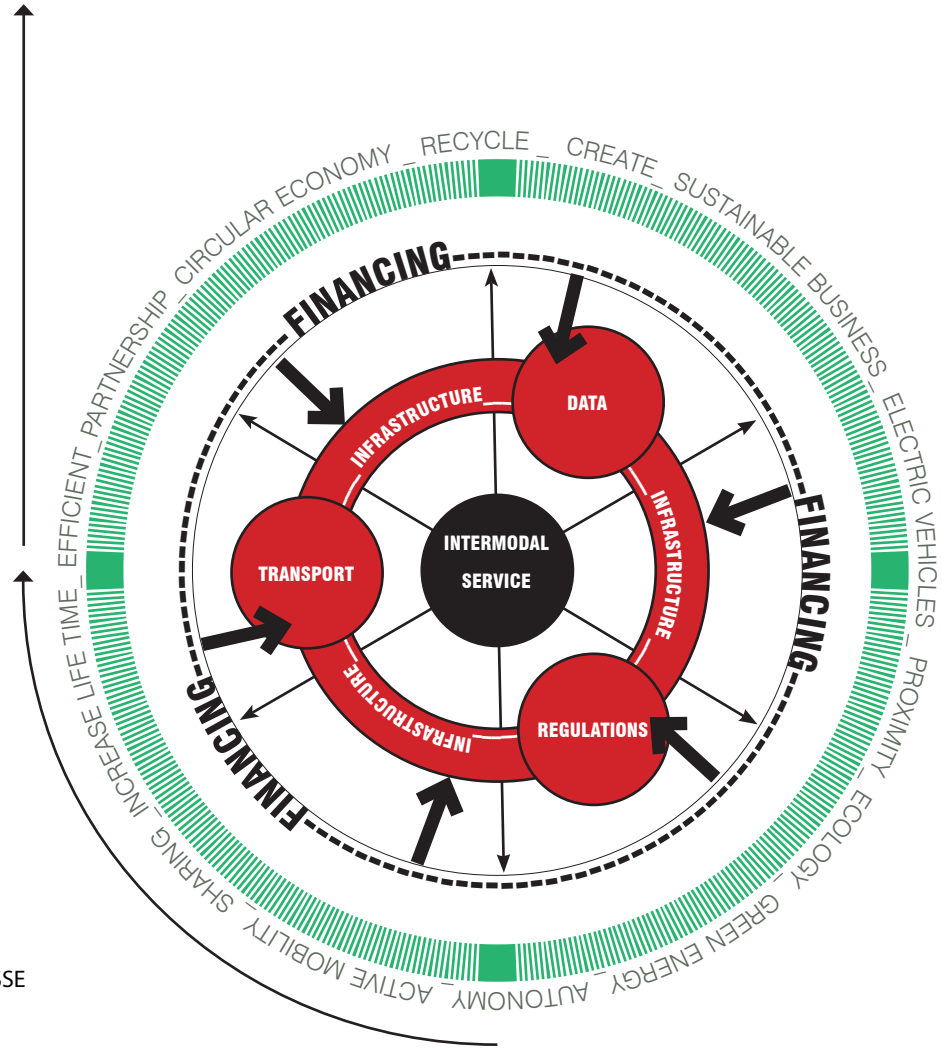
Solvay Brussels School
Economics & Management

SUSTAINABLE MOBILITY IN BRUSSELS

TOWARDS AN INTEGRATIVE AND USER-CENTRIC APPROACH

Case Studies: Brussels, Munich and Milan

MBA Programme | IBFP-International Business Field Project



TEODORA CAPELLE | SEBASTIEN VERCRUYSSE

MOTO: Based on the idea that innovation lies in associating ideas, people, stakeholders and win-win situations, there is no doubt that today smart partnerships are the cornerstone of a user based integrative mobility solutions.

PROJECT ACKNOWLEDGEMENT

The present study, the "Sustainable Mobility in Brussels" is an extension of our final MBA project assigment at Solvay Business School Brussels and Ecole de Pont ParisTech. The original assignment was prepared within the framework of the IBFP – International Business Field Project. This project was realised by MArch Teodora Capelle and Ir. Sebastien Vercruysse. The objectives of the study were defined by Solvay Business School in collaboration with Febiac-Fédération Belge de l'Automobile & du Cycle. ***However, the views expressed in this document are not necessarily those of the Solvay Brussels School or FEBIAC.***

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AN INTEGRATIVE & USER-CENTRIC APPROACH

SUMMARY

PROJECT DESCRIPTION

The present study analyses the potential of successful mobility strategies, projects and initiatives across Europe to address the challenges the city and region of Brussels is experiencing, today. Focussing on **accessibility**, the study starts from the assumption that a fluid and efficient mobility within the city is crucial for the economic development and health in densely urbanised areas. Results of the study are mapped in an ecosystem of interchangeable multimodal solutions, through the perspectives of user needs and based on key stakeholders' observations. Its conclusion draws on the need to associate ideas and opportunities outside traditional mobility projects in order to bring effective and sustainable accessibility solutions. The study provides a short case on the new Park and Ride Brussels projects.

OBJECTIVES

OVERALL OBJECTIVES

Spanning public and private strategies, tactics, projects, regulations, and new business models, the present research aims to identify suitable best practices for solving mobility issues in Brussels. Making use of successful stories, such as Munich and Milano's mobility policies, the research will highlight the importance of cooperation among industries, businesses, people and public decision-makers towards innovative and integrative sustainable solutions for each city user. In the era of digital innovation, cities like Brussels have to be ready to embrace, adapt and test, in a lean way, potential opportunities to create **convenience, a healthier, and more dynamic social environment, a place for an efficient economic exchange flow.**

SPECIFIC OBJECTIVES

The analyses and benchmarking of Brussels against other cities try to broaden the mobility debate. It aims to involve all stakeholders in an active way not only as negotiators looking for a compromise often **a 0-sum game** but rather as active players, associating their resources and knowledge in order to maximise the overall value creation. The project will concentrate on efficient and productive processes, spanning over the mobility value chain from initiative to implementation.

PROBLEM STATEMENT

Confronted with a high level of density and urbanisation, ageing of the population and expected exponential growth worldwide, cities are facing problems to access resources and deal with increased environmental damage. These problems have a huge impact on the economic environment, creating new types of asymmetries within the settlements dynamic, impacting the inhabitants' quality of life. Brussels is a specific case. Not only different local and international scales of activities are interacting with the local day-to-day life, but the city must also deal with powerful segments of urban users and city revenue contributors and non-contributors: inhabitants, communities, local administrations, European institutions and commuters. These are users with different needs and strong bargaining power that have to be accommodated within the same spatial infrastructure.

PERCEIVED NEEDS

Today, worldwide, there is a need for efficiency and effectiveness in the flow of activities. It means that mobility issues have to be tackled **from a life, work, activity *life cycle* perspective, integrating actions beyond the physical human or/and goods shift.** This is the major challenge of the mobility discipline. Spanning over several knowledge areas and activities, it requires a new approach and methodology, leadership and strategy based on processes and continuous

interaction with the users, unlike in a classical project stream. These may not be enough if main stakeholders' visions and objectives are not aligned. However, the growing mobility pressure in Brussels and the important economic impact seem to make all industry actors aware of the urgency to find solutions through collaboration.

CONSTRAINTS

Governance is playing a key role in Brussels. Different levels of administrative and superposed decision-making layers reduce the leadership and its capacity to tackle the problem efficiently.
Financing the infrastructure is a global constraint.

BENEFICIARIES

Direct and indirect beneficiaries
The research stresses the necessity to address **city inhabitants and visitors (commuters, business and European affairs travellers and tourists)** as separate segments, focusing on their interaction, within **a multi and intermodal mindset, where mobility is a tailor made service.** These two segments are not the only users of the infrastructure. Freight transportation that links suppliers and providers in/outside the city are also direct beneficiaries of the road system. They are major economic value creators of the cities. Therefore, mobility involves delivery logistics and the whole dynamic of economic exchange starting from production to the end user.

OPPORTUNITIES

Financing challenge and the opportunity of technology
Back in the 90's, deregulation and privatisation reduced the power and capability of authorities to tackle infrastructure aspects. In the aftermath of the 2008 financial crisis, in a period of high economic volatility, investment in infrastructure has represented a challenge for the most of the public authorities. Public and private organisations have started to focus on the optimisation of their existing assets.
Today, digital technology breakthrough is at turning point. There is an increased hope to create services rather than traditional tangible products requiring new hard infrastructure and mass production traditional chains. This change in paradigm integrates user's behaviour transformation, changes in the revenue stream models, a new positioning of the user in the centre of the innovation. In the mobility field, the automotive industry recently became an important player able to test new models and innovative ways.

The higher degree of convenience that Internet and the digital tools of the WEB 2.0 (Jelassi, Enders, and Martínez-López) are offering, open the possibility for both cities and communities (public and private) to shape easier, cheaper and user-friendly solutions. Making use by the best practices, the paper will focus on the potential or ongoing use of these models to articulate and cope with the mobility issues, by integrating more options to users and by connecting space and time with the mean of a better usage.

GOVERNANCE, STRATEGY AND POLICY CONSTRAINTS

Solutions that efficiently respond to the end-user needs are often diluted by the normative ecosystem. Although, cities are equipped with high-quality strategies, many objectives are not achieved. Policies often have an adverse effect (Agence de dévelopement territorial Région de Bruxelles-Capitale) and none of the less the process to change obsolete or counter-productive policies is not fast enough to adapt to the users' needs. Today, cities representatives, politicians and policy makers start to recognise the challenges technology creates and the difficulty to keep pace with it. Their discourse transposes awareness and a call for action, deregulation necessary to encourage innovations. ("FMS Debate on 'Mobility as a Service' — Forum for Mobility and Society")

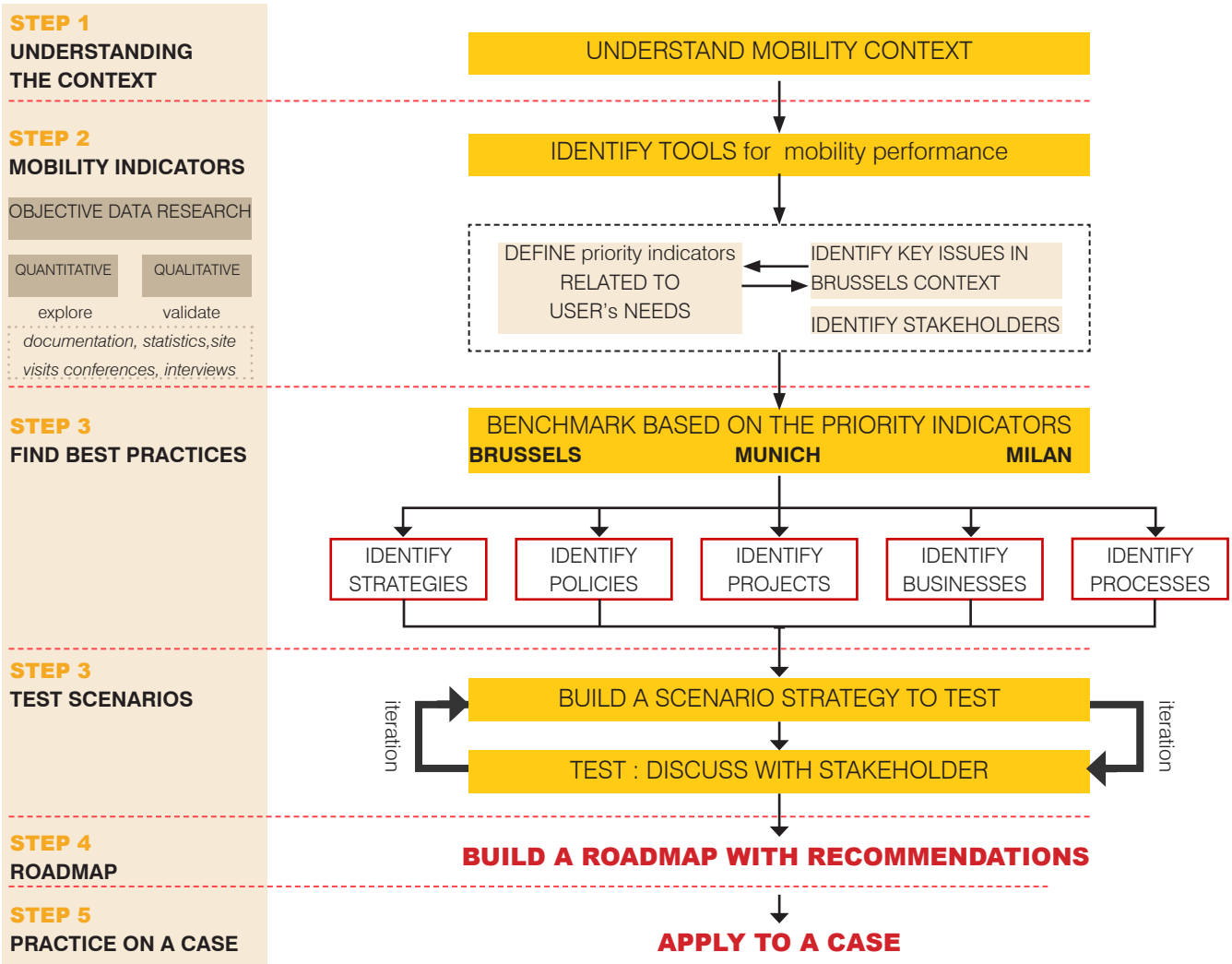
PARTNERSHIP OPPORTUNITIES

Based on the idea that innovation lies in associating ideas, people, stakeholders and win-win situations, there is no doubt that today smart partnerships are the cornerstone of a user based integrative solutions.

1 METHODOLOGY

JOB DESCRIPTION/ ACTIVITIES

1. The project will analyse the general global mobility context and its challenges. It will outline the important shift, mobility discipline and practice is experiencing today towards integrative approaches.
2. The study will identify key issues and criteria defining the mobility structure of Brussels region, called qualitative and quantitative indicators, in order to find common denominators for benchmarking Brussels with Munich and Milano. These performance criteria will touch upon the whole mobility ecosystem (transport, infrastructure, traffic management, planning) in a broader way, while focussing on integration and optimisation.
3. Mobility performance indicators will allow external benchmarking and the best practices identification. Best practices solutions will be categorised as follows: Strategies Solutions - Policies Solutions - Projects Solutions - Business Model Solutions and Processes Solutions.
4. The application of best practices solutions to Brussels case will be assessed and validated during the study via different tools that enhance and integrate continuous feedback from the client, and major private and public stakeholders.
5. The fifth step will describe all the recommendations (through a roadmap). This will help Febiac to bring pertinent solutions to the current mobility issues in Brussels. Recommendations are considered as the starting point of an action focus debate.



Data collection methodology uses traditional research tools to explore data by qualitative research and validated by quantitative tools. The analyses and conclusion will be based on active learning techniques, which integrate active client, user and stakeholders-participation.

MEETINGS

DOCUMENTATION

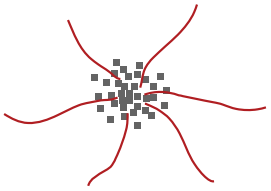
CONFERENCES

FIELD WORK

2 MOBILITY CONTEXT

2.1.DEFINITION

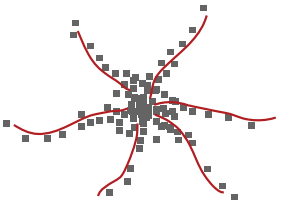
Mobility allows people to access tangible and intangible goods. It goes beyond a simpler physical spatial link by connecting humans to vital resources, social environments, education and health services. It is the essential condition for the local and global economic exchange. It defines the whole community dynamics and accessibility needs, driven by the day-by-day activity cycles.
Mobility does not represent an end in itself but a rather a mean “to reach opportunities available at destinations” (Levine).



initial city structure (scheme)

2.2.GENERAL BACKGROUND

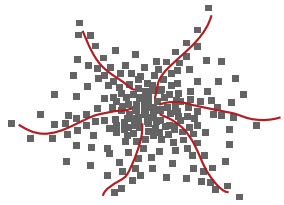
The present study identifies several key issues that explain mobility development and give insights on its future nature: the urbanisation trends, the increasing power of the regions, the economic benefits and the environmental challenges. It highlights the disruptive trends such as the digitalisation, macro and micro economic exchanges, the social and behavioural changes which require new value propositions to increase accessibility. Understanding these key issues allows shaping an effective intermodal solution.



corridor development (scheme)

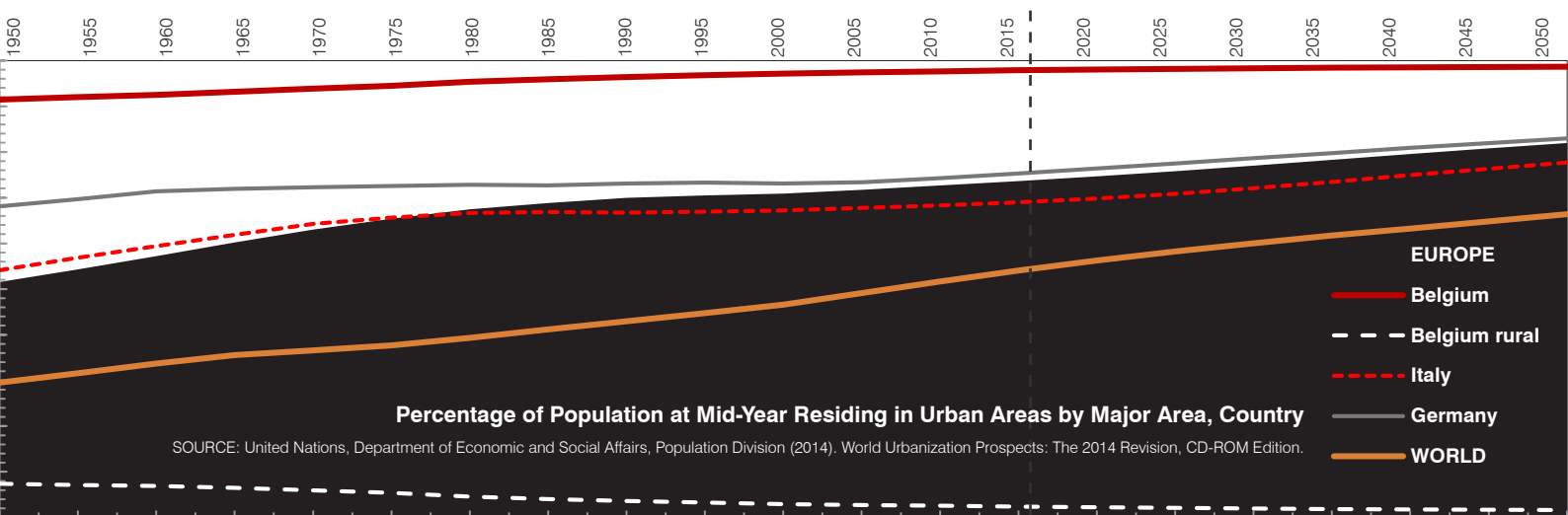
2.2.1 URBANISATION

Urbanisation is one of the **key drivers of mobility and accessibility.** *In the last decades, cities have become engines of the global economy. Increased attractiveness of the cities has led to an unprecedented population growth and extension of the land coverage.*
Since the Second World War and the development of new models of transportation, **urban sprawl** has replaced at a rapid pace the traditional compact city. For the first time, inhabitants have had the choice to benefit from **affordable qualitative dwelling at the periphery, while having access to the economic dynamic of the city centres.** In the developed countries, especially in the Western Europe and the North America, territorial dispersion evolved from a corridor development along the main accesses to the city towards a diffuse regional occupancy (Viganò). These new urban entities called “city regions” (Albrechts) are characterised by **intense economic exchange, production, supply, and consumptions places of increasing mobility**. The dynamics of the population increased, with a continuous internal and external migration. Worldwide urbanisation is estimated at 70% by 2050, whereas Belgium tends towards 100% (fig. 2). Concomitantly, urban structure evolved towards functional silos that concentrated movements. All these trends overwhelmed existent territorial infrastructure, often transforming roads from an accessibility enabler to a constraint.
Real estate prices followed the **logic of attractiveness and accessibilities, accentuating differences within the city and contributing to concentration and congestion.**



urban sprawl - dispersion (scheme)

CHALLENGES: Through the process of economic transformation, city-regions gained political control and the power to shape specific development policies through decentralised strategies and local decisions. As stakeholders confirm, the national government as a unique interlocutor was recently replaced by a multitude of powerful local authorities, with high impact on mobility aspects such as regulations and partnerships.



Percentage of Population at Mid-Year Residing in Urban Areas by Major Area, Country

SOURCE: United Nations, Department of Economic and Social Affairs, Population Division (2014). World Urbanization Prospects: The 2014 Revision, CD-ROM Edition.

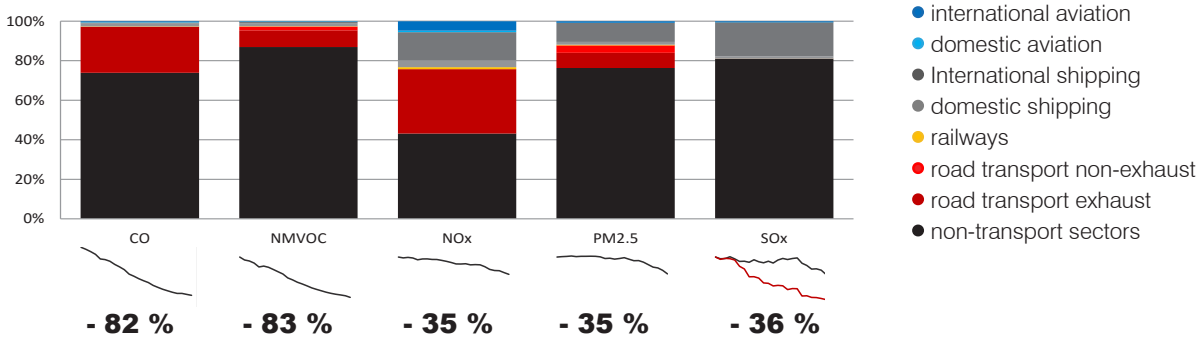
2.2.2 ENVIRONMENT

In 2006, cities and urbanised areas used more than 70% of the world's energy and accounted for 40-50% of global CO2 emissions. (United Nations Environment Programme). The transport industry represents 23% of the world CO2 emissions (International Energy Agency). In Europe, greenhouse emissions from transport sector represent 19.63% of the total emissions (European Environment Agency EEA).

More and more environmental policies are regulating the market, the automotive industry, and the city planning. Car users and organisations are becoming more conscious about pollution's impact on human health. The automotive industry is looking forward to finding new technological and innovative solution. In Belgium, CO2 emission of newly registered passenger cars has been reduced by 27.2% from167g/CO2/km to 121.5g/CO2, since 2000, according to the Federal Planning Bureau (FPB).

OPPORTUNITIES Electric car, shared transportation and the autonomous connected cars are potential opportunities to solve environmental bottlenecks efficiently. Circular economy is another process-based approach where product development would involve a better usage of resources and waste reduction (European Automobile Manufacturers) Association).

Contribution of the transport sector to total emissions of the main air pollutants



1990-2013 Decline in emissions from all transport sectors across the EEA-33. Emissions are expressed as the percentage over 1990 levels.

2.2.3 MOBILITY ECONOMIC BENEFITS AND COSTS

Benefits

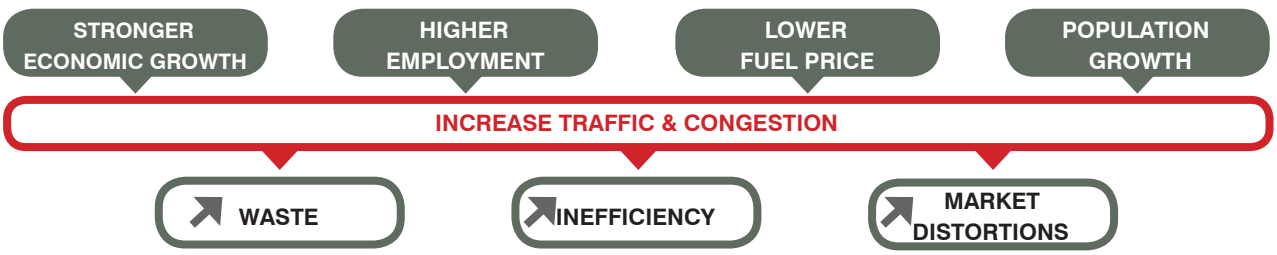
In the context of a delocalised global economy, mobility is the cornerstone of the economic exchange. For example, transportation (land water air together with support activities) solely represents 5% of the value added in the total economy in Belgium and 4.5% in the European Union. These figures focus on one aspect of mobility. Coped with connectivity, mobility and the new service approach is likely to generate more effective economic exchanges. Expectations about future technological advancement are well illustrated by the valuation of new mobility service companies. As an example, the market valuation of UBER, a five years old company, outgrew that of General Electric, a more than 100-year top organisation.

Costs

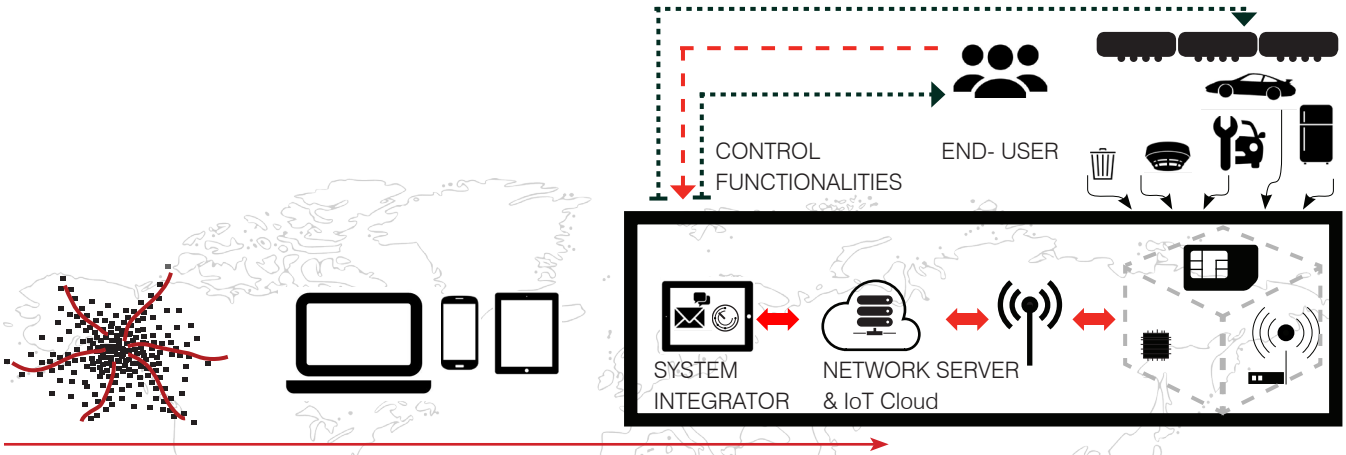
Despite the importance of the value created by transportation, the cost of today's mobility starts to have a reverse impact on social and economic environment. The OECD estimates the cost of congestion at 1 up to 2 % of the GDP (PWC, Une Fiscalité Intelligente Pour Une Meilleure Mobilité). CEBR- Centre of Economics and Business Research calculates the cost based on **opportunity cost of the time spent in the vehicle, the cost of fuel and the cost of environmental damage**: "Households across [London, Paris, Stuttgart and LA] are estimated to incur cumulative costs amounting to $1.1 trillion over the period 2013-2030". (Cebr)

OPPORTUNITIES Increased energy production from renewable sources is one of the main objectives to achieve the secure and sustainable energy mix as defined in the European Energy Security Strategy. Renewable sources are on the US government agenda and start to play an important role in China's future development. According to BP Statistical Review of World Energy 2015. In 2014, the segment represented 6% of the world consumption and included hydropower, wind, solar (11% of European energy production), and biomass.

CONSTRAINTS The demand and the supply disequilibrium, high volatility and the competitive prices of fossil fuel are possible incentives for users to deviate from clean energy approach.



KEY DRIVERS AND EFFECTS OF CONGESTION ACCORDING TO THE Traffic Scorecard 2015 (INRIX)



PLACE

TRADITIONAL PHYSICAL

infrastructure, constructions, vehicles trains, airplanes ships

SPACE

INFORMATIONAL

computers
exchange of goods and services via computer interaction

U-SPACE

TRANSCENSION AND INTEGRATION OF PLACE AND SPACE

ubiquitous network
physical and informational are fully integrated.

U SPACE creates value and changes mobility patterns through:

- real-time and space context solutions
- remove temporal and spatial physical interaction, (e.g. e-learning, e-banking, synchronisation/ update which enhance efficiency and reduce physical mobility and waste
- convenience by creating services that reduce the conscious need to physically interact
- amplification of the user's experience

DIGITAL TRANSFORMATION *Adaptation of concepts after Jelassi and Porter 2014 and 2015 (see bibliography)*

2.3 TRANSFORMATION TRENDS

2.3.1 DIGITALISATION

Mobility patterns are modified by the **increasing digitalisation of the human life and activities.**

Internet revolution and connectivity have modified our need to move, reducing distances or replacing activities by the mean of informational space and tools such as e-payments, e-banking e-commerce, etc. These changes completely reshaped the B2B, B2C G2C2B industries like banking, telecom, financing, procurement.

During 2000-2010, the emergence of the **WEB2.0** has brought a paradigm shift from software as a product to software as a service (SAAS), characterised by a four-factor model: **interaction orientation, customisation, user-added value, social networking**. (Jelassi). Human activities tend to move in "*the anytime" and "anywhere"* "ubiquitous" space that enables to reach the maximum of users with customised real-time solutions.

Customer-to-Customer (C2C) and Pear-to-Pear (P2P) models, the optimisation through shared economy and circular economy are the new layers for future value creation ecosystems. **"Changing consumer preferences around ownership"** (Gao et al.) is likely to be an important consequence that will completely change accessibility and mobility. Open data is opening a huge potential for mobility services development brought by the availability of open data.

OPPORTUNITY: THE ECONOMIC *Real-time MAXIMISED* OUTPUT

The post-2008 high volatile environment led to macro and microeconomics ongoing transformation processes that redefine economic exchanges, value chains, mobility and the labour environment. The difficulties to cope with unpredictable events and their random systemic impact require flexible approaches and resilience. Digitalisation has the potential to improve the efficient allocation of resources necessary to maximise the output adapted to a continuous change in demand. Technology pushes products to become data driven solutions services. "Today's value is likely to be created on the campus rather than a fix mass production site". (Frayssinet).

2.3.2 BEHAVIOUR AND SOCIAL CHANGES

Bottom-up innovation is not only transforming the user into a value producer but also is changing the societal power balance in regard to policy makers.

2.4 NEW USER PROFILE

2.4.1 MULTIMODAL PROFILE

In a context of digital transformation and a high volatile environment, there is a generally perceived shift in the mobility patterns. There are a lot of assumptions, studies, surveys, that try to grasp users' change in preferences. The quick adaptations to the internet, connectivity through smart and mobile devices brought a new culture more open to change and options. It creates a **convenience culture** of the users demanding more and more end-to-end trustworthy efficient solutions. Today, users are discovering new patterns of mobility, connectivity and accessibility.

Young people profile: In Europe, reports identify a decrease in the motorisation rate, young people are expected to postpone car acquisition (Cornet et al.), car sharing usage is growing and public transport is increasing its market share. Although behaviour is very different across the old continent (Puhe), "new millennials" are the multimodal adepts looking forward being always connected, optimising their time, reducing their ecological footprint. They look for convenience and are less attracted by a social status related to a product (Cornet et al.), but rather by a mix of customised services.
Working people are also pressured by change. Digital transformation affects organisations. Flexibility in working hours and the growth of temporary contracts (Fressinet) are also changing mobility patterns of this segment. Disruption in the value chain, the growing need for real customised solutions, require different structures and drive a different dynamic of motion. It is supposed, that more flexible organisations will require a reshape of the labour markets (Fraysinnet). Technological and societal innovation is already impacting our behaviour. (Wulfhorst).
Elderly people see their life expectancy increasing. In Europe, they benefit from a good health system that allows them to be socially active and mobile. It seems their mobility habits have a strong impact on the modal mobility split. ((Lebrun et al., "Cahiers de l' Observatoire 2 ")

2.4.2 CHANGE IN PATTERNS

In the last couple of years, there are several general observed changes in the mobility patterns that correspond to the identified profiles described above: day traffic is increasing but the pick hours do not increase (Sessing), rush hours are spread over a longer duration, especially in the evening ((Lebrun et al., "Cahiers de l' Observatoire 2 "), there is an increase in the usage of the public transport and car sharing (l'Institut Bruxellois de Statistique, "13.6").
In freight transportation, the e-commerce has increased the deliveries inside the city while customise buses are an increasing trend. (Monneaux)

FIRST MILE LAST MILE

2.4.3 LAST MILE

For the completeness of the current ecosystem of multimodal transportation, the last mile is the missing link of the multimodal value chain. It concerns the extension of mobility offer up to the destination point. The success of flexible and customised offers shows that there is a strong demand that can't be met either by traditional public transport model or by the private car that misses more and more parking places.

2.5 BUSINESS IMPLICATION

The active role of the consumer as a game changer

The new consumer-centric and mobility producer profile is changing the mobility industry. Smart systems create and increase the possibility for user to integrate services from decentralised systems for a better fit within his value chain (Porter and Heppelmann, 2014). It gives control to the user to decide which is the best solution for his needs.

Change management

This situation allows for the emergence of new business models, and ultimately put incumbents in difficulty. Traditional transport operators have grown in silos as natural monopolies. They have to look forward to creating new types of services to cope with a new competition ecosystem. Automotive industry does not focus anymore on the products and focus on mobility solutions. Other entities such as public transport operators or administration hope to create local platforms and compete with established data companies.

It is likely that models from other **industries that experience transformation processes will represent the background of future mobility innovation**.

OPPORTUNITY: MOBILITY AS A BUSINESS

The real-time usage of maps, navigations, social networking, digital interaction and analytics provide accurate information about users needs. Data companies and platforms developers identified the needs and are looking forward to bringing effective solutions to their users. Google, Uber, Didi, Apple and the automotive industry and many others are investing in the development of applications dealing with connectivity, efficient flows, real-time alternatives to congestion, maximisation of the road occupancy by real-time planning or usage of autonomous mobility and maximisation of parking capacity by enhancing better space usage and occupancy.

Larry Page	**$0.1B**	ZEE AERO
Apple	**$1.0B**	DIDI DACHE
Saudi Arabia	**$3.1B**	UBER
GM	**$0.5B**	LYFT
VW	**$0.3B**	GETT
Porche	**$0.055B**	INRIX

On going investments in mobility (up to June 2016)

DIDI DACHE	**$0.1B**	LYFT
DIDI CHUXING	**$0.5B**	OLA (INDIA)
DIDI CHUXING	**$0.4B**	GRAB
UBER	**+**	DIDI DACHE

On going investments in mobility (August 2016)
source Finacial times 3 August 2016

2.5.1 MOBILITY AS A SERVICE - MULTIMODAL PLATFORM

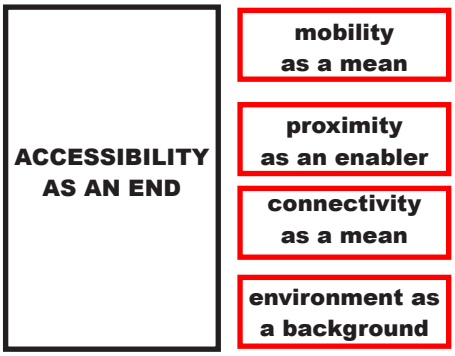
In the last couple of years, with the growing usage of the mobile applications and platforms, there is a new hope for solving mobility issues. For example, MAAS is a movement involving mobility stakeholders all over Europe- public-private entities, industries, local governments etc. They focus on providing options by integrating all existent services in a unique platform. They believe “millennials need more choices”. (“FMS Debate on ‘Mobility as a Service’”). Discussion with stakeholders from Belgium, Netherland, Germany revealed public authorities aim to develop public controlled integrated systems. However, big data players have already introduced efficient and user-friendly platforms. Some public bodies such as operators or decision makers from Finland (“FMS Debate on ‘Mobility as a Service’”) or London (Reed) are conscientious about their limitation and look forward to private public partnership, deregulation, etc., As long as operators have a customer data base and direct contact, benefits from partnership represents advantages for both transport and data companies.

2.6 MOBILITY AS A NEW CONCEPT DISCIPLINE

2.6.1 THE SHIFT-INFORMATION AND TECHNOLOGY

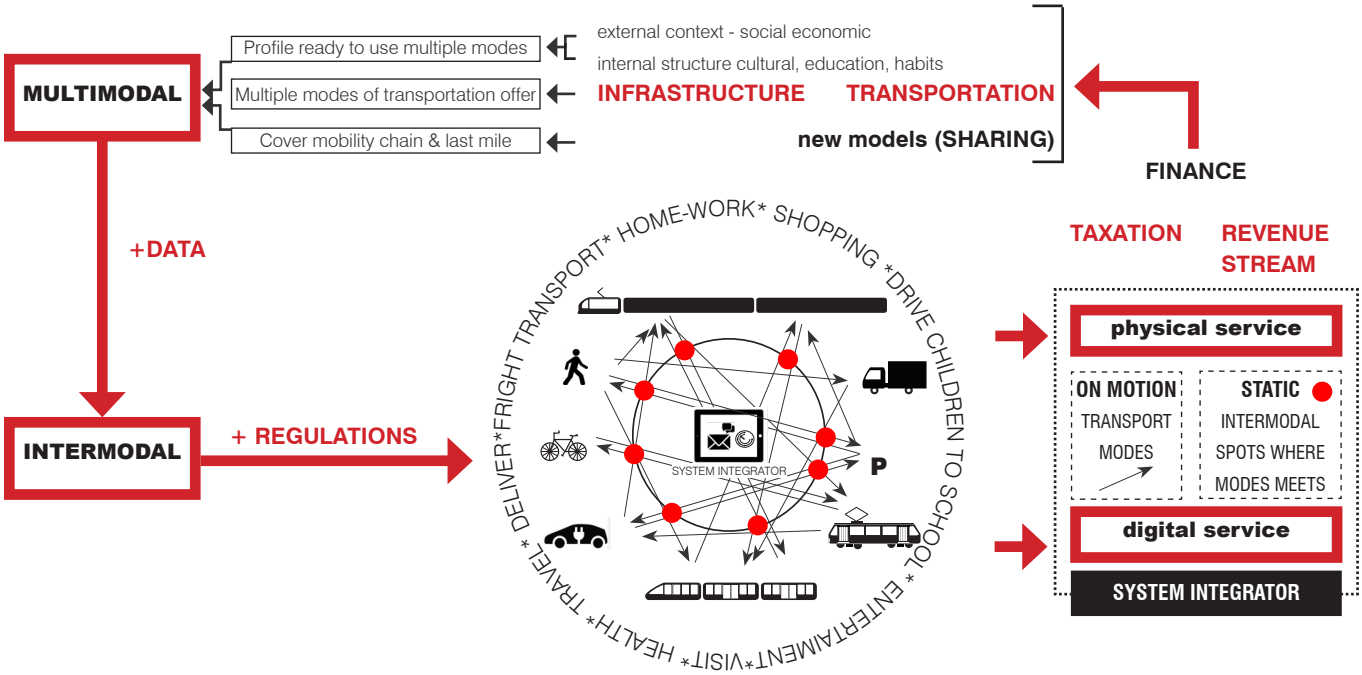
Through history, technology breakthroughs have improved human motion capabilities. Innovation has continuously changed the human perception related to time and space and reshaped human behaviour and the patterns of movement. Digital transformation is expected to disrupt the existent infrastructure and the logic of the traditional transportations models. High expectations are placed on technology to solve the bottleneck problems that mobility is experiencing today.

Mobility is a complex discipline covering several knowledge areas. Based on the key issues stakeholders raised, this study focuses on the binomial relation mobility-connectivity as a mean for providing accessibility. New value proposals are needed to meet the new multimodal profile. Intermodality is an integrated solution, requiring a mix of bottom-up, top-down management that integrates a user's life-activity value chain approach.



Scheme adapted after Jonathan Levine

2.6.2 FROM MULTIMODAL PROFILE TO INTERMODAL SOLUTIONS



Intermodal is a function of **data** management and available **multimodal** modes, driven by both **users** and **operators**.
It is constrained by the social **behaviour factors**, such as acceptability, mobility rhythm and routine. It is driven by life patterns and today, life patterns are changing due to the fast **technology** development. Therefore, it also reflects user's openness to using the technology and innovation.

Intermodal function is using the existent **infrastructure** and it is constrained by **regulations** and the dilemma faced by regulators in regard to the private data usage. Safety, reliability and insurance are the main concerns of policy makers. Finally, it challenges the **tax** based mobility system. Under the current legislation, application and platforms for shared economies and pear-to-pear models are identified as enablers and are not submitted to taxation. From a financial perspective, new business models have a different approach to privacy issues and capture value by a different revenue stream.

1. **INFRASTRUCTURE** comprises:

- Fixed infrastructure such as road networks, railways, metro, etc. Off-street parking and fuel supply are also included.
- Semi-flexible such as bus stations, electric supply, on-street parking
- Digital infrastructure for connectivity network includes GPRS, G5

2. TRANSPORTATION (or the multi-modal offer) deals with a mature freight and people transportation models, such as train, tram, metro, car, planes, etc Customised and shared transportation services is a new flexible emerging layer. Digitalisation and communication are replacing physical journeys by new telecommuting models (e-banking).

3. DATA is the new resource for the mobility: it aims to use information to benefits users and customers. It comprises two aspects: gather the data from the customer, provide open data information to customers and users. Gather data, understand user's movement patterns help identifying customer segments and offer tailor-made solutions. OPEN DATA give information to people and allows them to choose the right solution for them. Integration of the multimodal modes depends on the access to the real-time public open data from operators and governments, and the interchangeability between the users' data bases.

4.INTERMODAL. The use of a single interface that allows the user to switch rapidly and with no effort from a transport mode to another is today's dream and dilemma of the operators and public decision makers. Centralised traffic management and the infrastructure planning departments are undermined by the real-time navigation and re-routing systems. Nowadays, the mobility consumer can choose the use of the most efficient mode, the customised based service. These bottoms-up and top-down approaches influence the traffic flow of multimodal transportation modes. Within this newly created ecosystem, the last and first mile concepts are becoming key issues

5. REGULATIONS are playing an important role in the way innovation is implemented and how competition is encouraged to serve the user for the best. For instance, environmental regulations are a proven important game changer.

6. TAX REGULATIONS. Platforms for B2C or C2C or P2P models are considered enablers and are not fiscally regulated. Public authorities use taxes to cover infrastructure and transport costs such as maintenance and development. Confronted with different problems such as environmental issues they have the dilemma between applying charges and/ or incentives.

7. FINANCING AND THE REVENUE STREAM Today, the value created and captured by the new business models is opposing traditional subsidised systems. Platforms for B2C or C2C use end-to-end transaction, removing all the noise from intermediaries, lowering the price for the consumer and maximise the revenue for the service provider.

	FIX or and MATURE	SEMI-FLEXIBLE	FLEXIBLE or and DIGITAL
INFRASTRUCTURE	(rail)roads, off-street parking,	stations, electric supply, parking	infrastructure for connectivity (Internet of things network)
MULTIMODE (TRANSPORTS)	private/public transport operators	on-demand shared transportation	communication replacing physical transportation
DATA	static licenced data		real-time
INTERMODAL	centralised traffic management	last mile first mile concept	user as a planner, navigations, re-routing, journey planning
REGULATIONS	policies	when not adapted to innovation	regulations cope with digital innovation
TAXATION	Taxes and charges		platforms that gather data are taxed
FINANCE	revenue stream /resources	price (time, distance, location)	new business models

3 BRUSSELS CONTEXT

3.1 GENERAL

Brussels Region is the capital of Belgium. It hosts the European Union Executive and legislative institutions such as the European Commission and European Parliament. Belgium, Brussels, Flemish and Walloon's governments and other important public institutions have their headquarters in Brussels Region City.
With **1.2 million inhabitants**, the Brussels Region has **a heterogonous** population located within **19 administrative entities**.

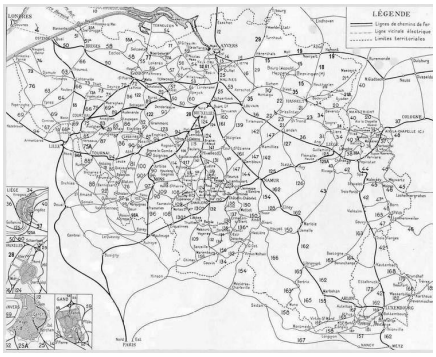
The city region has a strong economic performance in terms of Gross Domestic Product (GDP). It provides approximatively 700,000 jobs of which 35% are situated in the centre area. Important multinational offices have their headquarters situated within the regional limits.

3.2 MOBILITY

Related to the general overview of mobility drivers presented in the first chapter, Brussels has his own specificity. In the United Nation ranking (graph page 8), Belgium has one of the highest, if not the highest, global urbanisation rate. It has a high territorial density and an extremely dense traffic infrastructure that finds its routes in the historic development of the country (Wanet). The centrality of the infrastructure offers a high accessibility to Brussels. However, in the recent year, saturation creates congestion, leading to environmental problems.

Congestion is one of the most visible symptoms of deficient accessibility. Last April, in Brussels, the idle time spent in congestion accounted 85.4 hours/ year. (INRIX) and placed the city in the first most-congested urban areas in Europe.

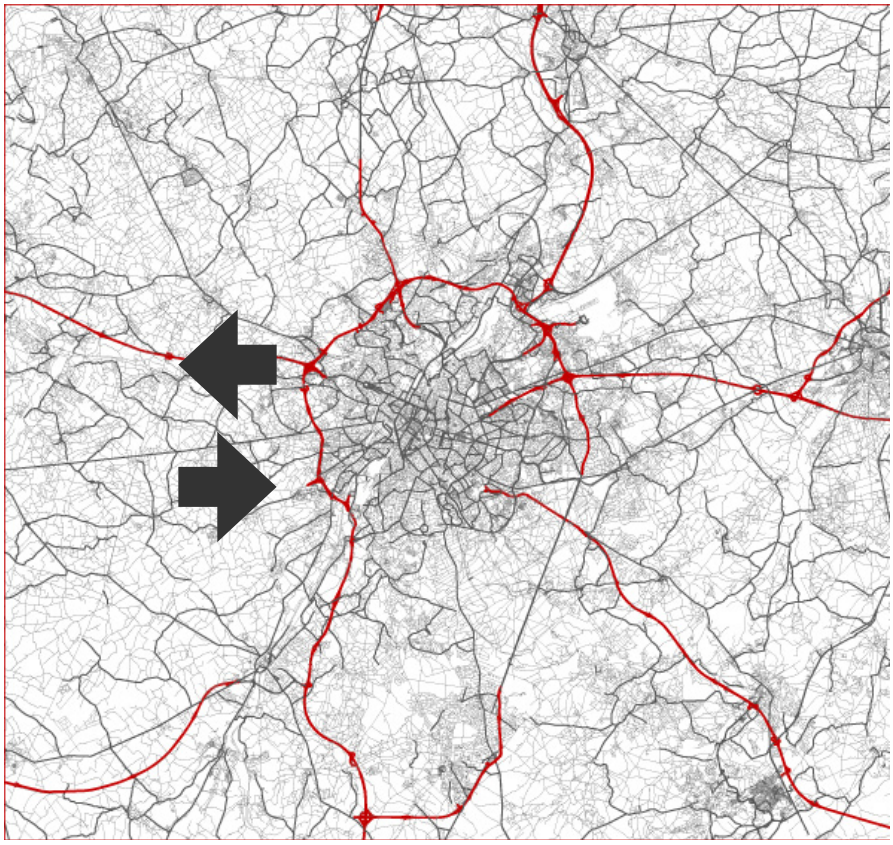
"*Mobility in the Brussels sub-region is an issue which became critical in the political and economic agenda of the country. Not only are mobility issues highly costly to the Belgian economy, but also they impact the welfare of workers and citizens on a day-by-day basis*" (FEBIAC). According to PWC, the cost of the congestion is estimated to 2% of the GDP equivalent to 8M Euros.



The railway infrastruture 1932 source: http://www.oude-spoorlijnen.be/Belgie1932.JPG

Congestion is considered a major mobility problem, by 78% of people working in Brussels. (Andrew and Pawels).

BRUSSELS' centrality (no adminstrative limits are indicated)



Between 2004 and 2009 there is a **6% increase** in the overall indicator of the **travel time by car** between different two points of the city.(Lebrun et al., "Cahiers de l' Observatoire de la mobilité de la Région de Bruxelles-Capitale 2 - Les pratiques de déplacement à Bruxelles")

INFRASTRUCTURE development influenced the urbanisation and the mobility in Brussels. in the last years, pattern of movements have changed due to structural societal changes as described in the chapter 2.2.2. According to (Lebrun et al., "Cahiers […] 2 ") journey to **work** represents 11-12% of Brussels inhabitants reason, while it stands for 47.2% for people entering the city every day. Approximatively 5% of the journey reasons concern access to **educational institutions** (3.8% journey reason for people entering the city).
For **shopping** 13.2%, and respectively 5.4%. Although changes are observed, **it is likely that work, education, new delivery volumes represent overlapping activities and are the main drivers of congestion.**

SHOPPING

RETAIL BUSINESS DENSITY

Number of commerce per hectare

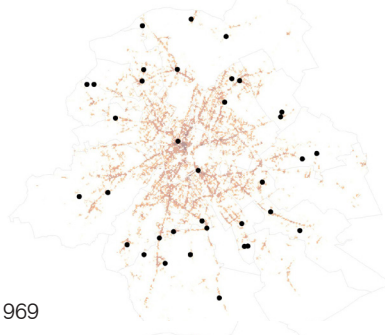
source: (Brussels UrbIS)

Commerce and local business structure evolved very fast in the last decades. The proximity commerce was replaced by large department stores that concentrate mobility in certain spots of the city.

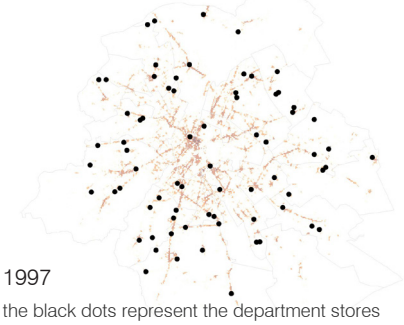
New regulations that attempt to soften the impact of unoccupied offices had the revert effect: it concentrates housing and it limits the natural development and scale-up of proximity business. (Agence de dévelopement territorial).

There is no yet an assessment of the freight transport impact following the raise of the e-commerce.

1950



1969



1997

the black dots represent the department stores

WORK

According to the Brussels Institute for Statistics and Analysis, Brussels has **1,175,173** inhabitants. There are **690,393** active jobs that account the number of employees and freelancers. **356,350** are moving inside Brussels to reach their working place. The rest of the jobs are occupied by people living outsides the administrative boundaries. **365,883** of active people living outside the region and are supposed to access everyday Brussels, by different means. Only **66,178** Brussels residents are working outside the region.

OFFICE DENSITY

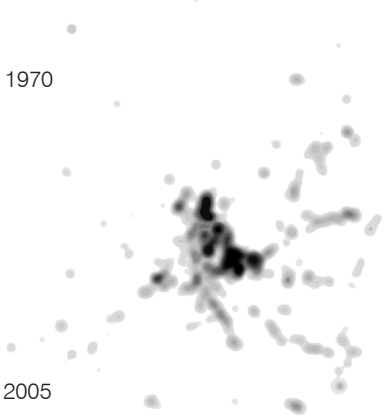
Number of businesses per hectare

source: (Brussels UrbIS)

Since 1950, the number of the offices has grown and continues to concentrate in the centre of the city, saturating the public transport and the inner belt.

1950

1970



2005

EDUCATION

212,097 Brussels kindergarten, primary and secondary school children are moving inside the city to attend education institutions, while only **9,378** have their schools outside the region. However, **35,663** scholars are coming every day to Brussels.

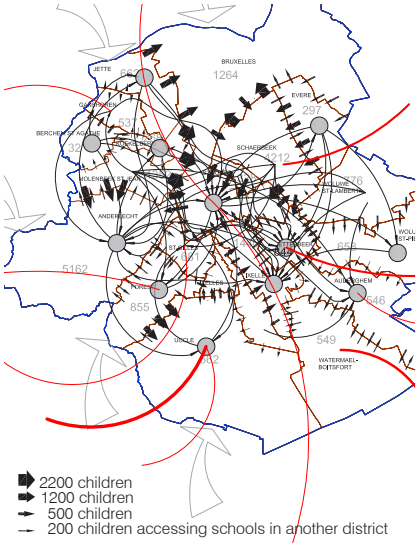


Image: secondary school “commuters”

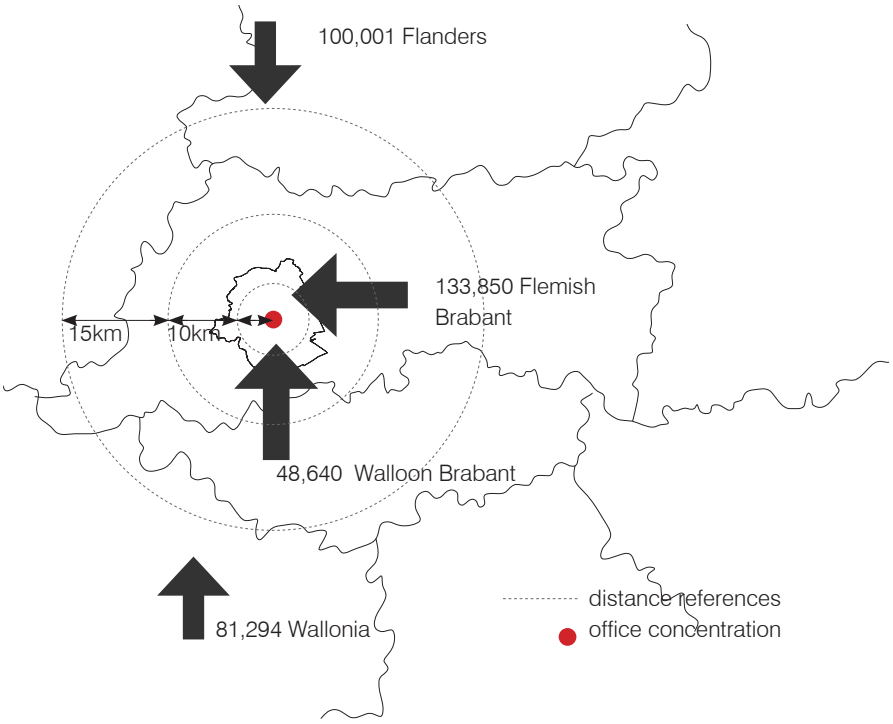
EDUCATION

Movements

Interpretation of the figures from (IBSA)for the secondary school. Distance from the residents to the school.

Despite the on-going legislative changes that tried to cope softly with the lack of educational infrastructure in Brussels, the analyses above shows that there is an important movement linked to education that is likely to add traffic in rush hours.

However, school represents a potential for improving mobility by enhancing proximities, if policies can be redirected towards qualitative improvements of the system.



NUMBER OF COMMUTERS (l'Institut Bruxellois de Statistique, '13.6_mobilite_transport_pratiques_deplacement_20160325.xlsx')

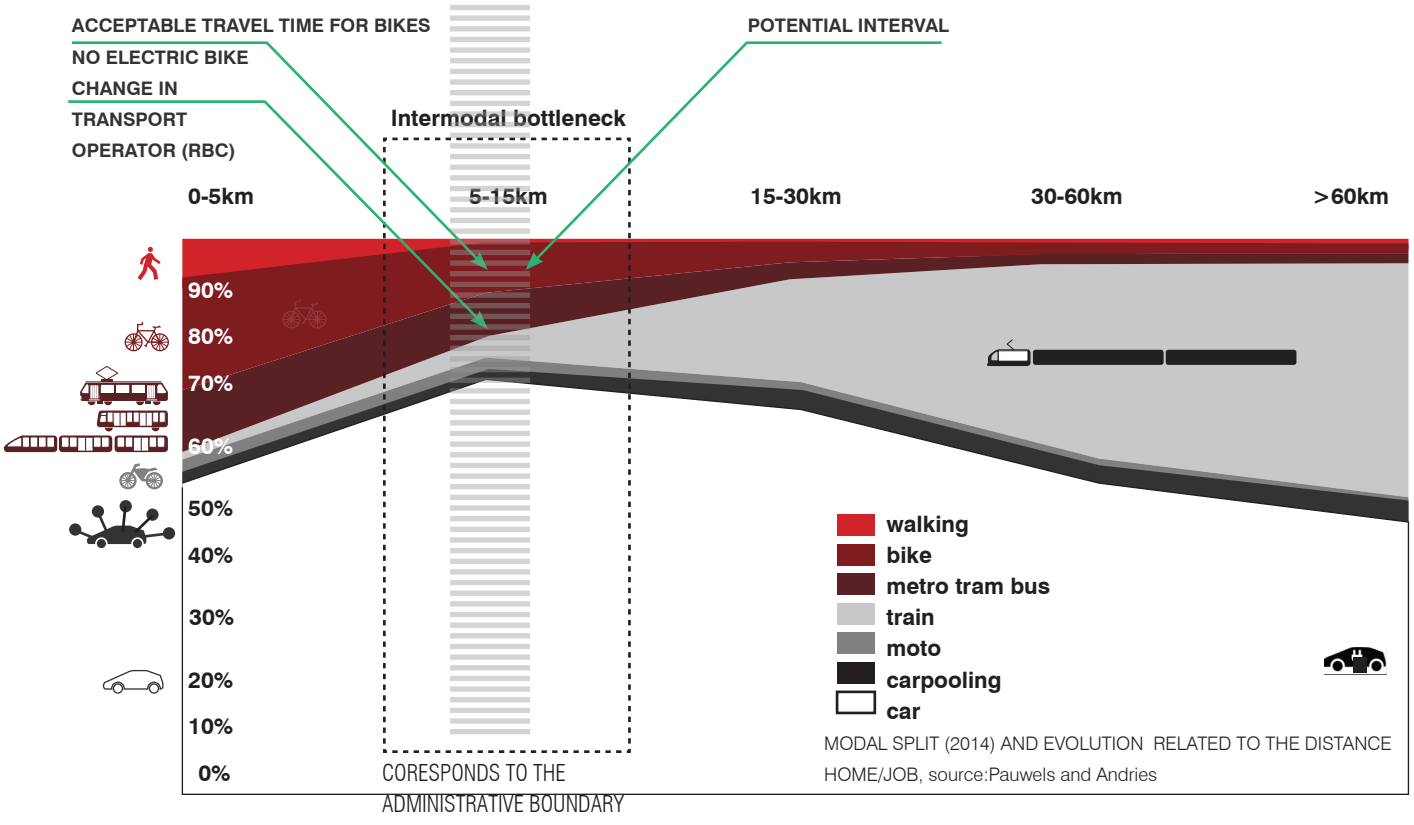
WORK PATTERNS OF MOVEMENT COMMUTERS

Although commuting represents a European and global trend, commuters in Brussels are considered as a special category on every regional stakeholder's agenda. Brussels has an 18.4% unemployment rate, while 50% of the jobs are employed by city non-residents who pays their taxes outside the Brussels Region. The city has insufficient budget, whereas the value produced in terms of the GDP is one of the highest in Europe.

Therefore a special attention on the movement patterns of commuters is believed to provide insights about solutions to mitigate congestion.

		BRUSSELS AS THE WORKING PLACE
RESIDENCE	BRUXELLES	4.4km
	FLANDERS	30.3km
	WALLOONIA	44.3km
	BELGIUM	25.1km

average distances between the residence and the working place (Pauwels and Andries)



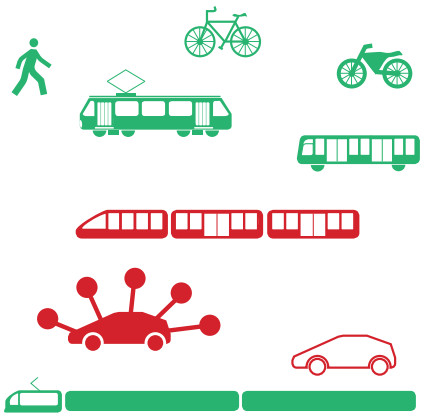
CORESPONDS TO THE ADMINISTRATIVE BOUNDARY

MODAL SPLIT (2014) AND EVOLUTION RELATED TO THE DISTANCE HOME/JOB, source:Pauwels and Andries

	2014	2005-2014	2010
walking	**3.4%**	**+33%**	**25.3%**
bike	**3.0%**	**+148%**	**2.5%**
metro tram bus	**34.1%**	**+6%**	
train	**19%**	**+27%**	**27.9%**
moto	**1.1%**	**+38%**	**0.8%**
carpooling	**1.2%**	**-49%**	**NA%**
car	**45.1%**	**-16%**	**42.6%**

EVOLUTION MODAL SPLIT (2005-2014) FOR PEOPLE WORKING IN BRUSSELS disregarding their residence source:Pauwels and Andries

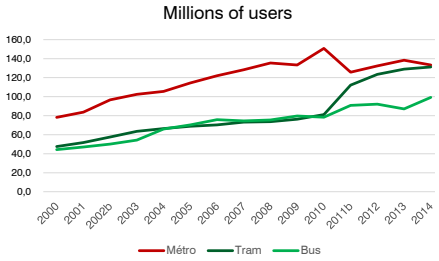
MODAL SPLIT TOTAL TRIPS (IN AND OUT THE CITY AND WITHIN THE CITY) (source BELDAM 2010)

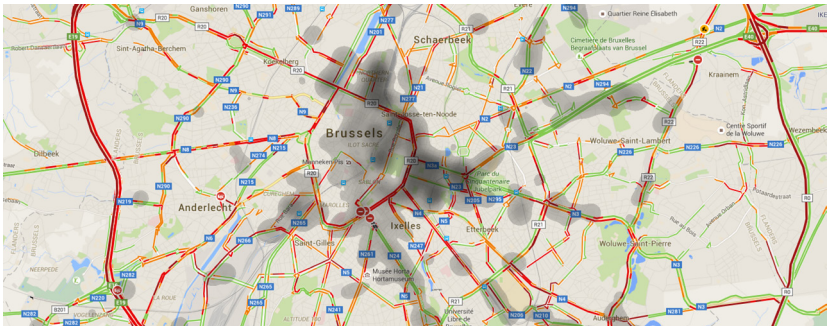


CHANGES IN THE MODAL SPLIT

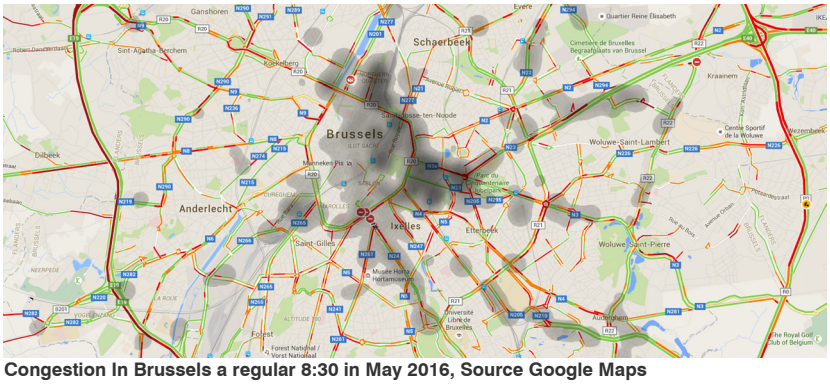
There are several changes in the last years. However, and despite the IRIS I and IRIS 2 official mobility strategy, changes are still lower than expected.

In the last years, the public transport has experienced a strong increase in its usage. However, statistics shows a possible cap, due to the maturity of these modes and the saturation and limitation of the infrastructure.
Although the modal split changed in favour of alternative modes, congestion seems not to be directly related to the transformation of the user's patterns of movement.





Congestion In Brussels Public Transport Strike 27 Of May 2016, 8:30 AM Source Google Maps



Congestion In Brussels a regular 8:30 in May 2016, Source Google Maps

CONGESTION AND THE CITY

Although there are changes in patterns of movement, congestion hours are still linked to accessing the work, shopping and education. Freight transport (Lebeau, Macharis) is believed to play an impact on the road traffic.

However, comparing the traffic maps at the left, in a normal working day and during a public transport strike, we observe that some corridors are always saturated, whereas other are highly impacted by the lack of public transport.

There are two possible conclusions, first linked to the fact that some areas are better connected with the end destination of the user. The second shows that congestion arises from bottlenecks- that impact the fluidity of the flows.

3.3 WHAT USERS SAY

	bikes	pubic transport	car
safety (infrastructure)	63%		24%
insecurity feeling	10%	18%	
coverage		13%	
congestion			60%
misorganisation	17% (douche)	20%	
quality and confort		14%	
ponctuality		21%	
long journey		28%	
PMR		9%	
no security for storage	19%		
no storage (parking)			36%
additional cost			14%

According to Pauwels and Andries, the mobility problems linked to the access the work place are as follow. Bikers encounter safety problems that are likely to be linked to the lack of infrastructure. Public transport suffers from inefficiencies related to time such as the duration of the trip, transfer time and punctuality. Car users are complaining about congestion and a general lack of parking spaces.

	Brussels	Flanders	Walloon region	no decision
Attractiveness for the foreign investors 2015	38%	34%	11%	17%

As positive points, Brussels region is associated with a good traffic infrastructure accessibility, while being simultaneously criticised by investors for tits traffic congestion.

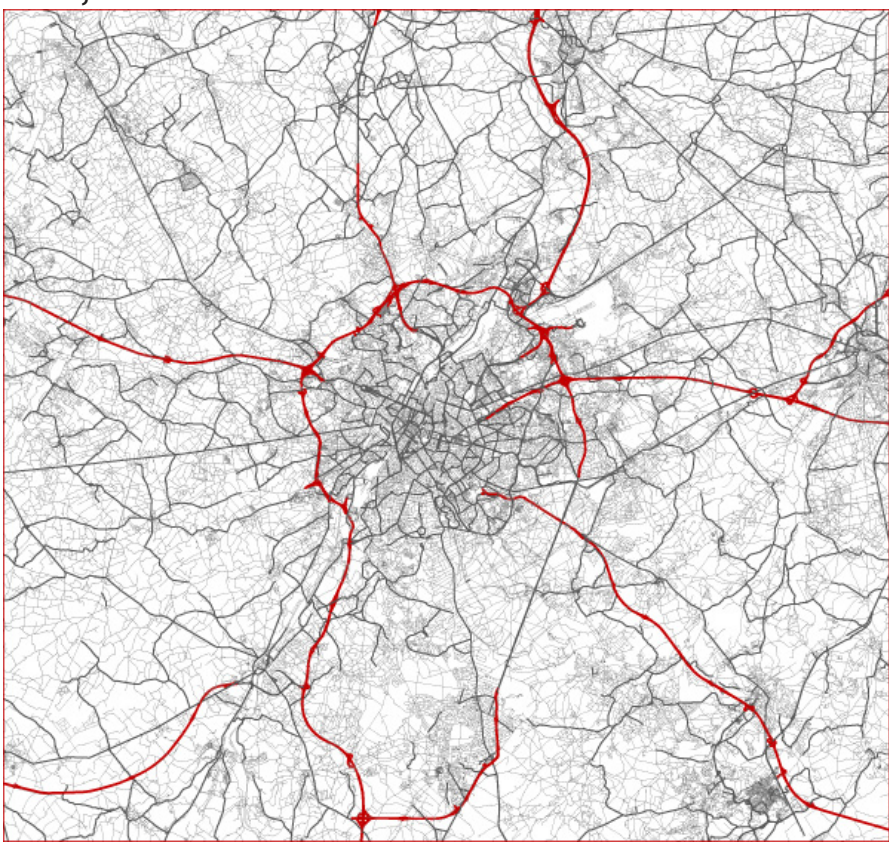
3.4 GENERAL CONCLUSIONS

INFRASTRUCTURE	Densification. Limited physical space for extension
TRANSPORTATION	Different level of subordination. Visions are not aligned . No integration
DATA	No integration. Different companies, interests, barrier to enter.
INTERMODALITY	No integration, difficulties to cooperate between regional entities
REGULATIONS	Not efficient/ the time to legislate and implement is very long.
TAXATION	Company car advantage compensates highly taxed salaries.
FINANCE	Unbalanced tax allocation - the city does not benefit from the taxes of all its users.

4 BENCHMARK BRUSSELS MUNICH MILAN

ANNEXE 1 explains the meaning and the interpretation of the data used for benchmarking

71,745 GDP



94,306 GDP

BRUSSELS 2015

ADMINISTRATIVE BOUNDARIES

161.4 km²

7,281 inhabitants/km2

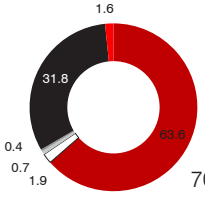
1,175,173 inhabitants (+7.86% since 2010)

18.5% unemployment/ #inhabitants (217,407)

5 Average **70h** Wasted in Traffic 2015 (-4.2 hours in 2014)

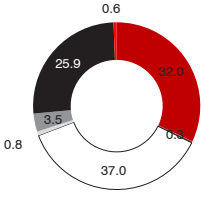
356,350 COMMUTERS IN (160 000 BY CAR)

66,168 COMMUTERS OUT



33.4% trips in/out the city

700 000 trips in the morning



66.6% trips within the city

MUNICH 2015

ADMINISTRATIVE BOUNDARIES

310.8 km²

4,897 inhabitants/km2

1,521,678 inhabitants (+10.09% since 2010)

4.6% unemployment/ #inhabitants (73,041))

8 Average **53h** Wasted in Traffic 2015

348 855 COMMUTERS IN

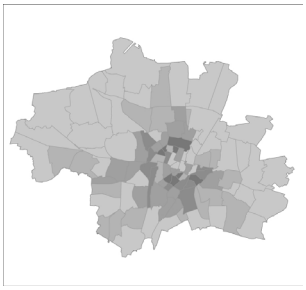
154,345 COMMUTER OUT

- total car
- taxi
- walk
- moto
- bike
- public transport
- other

44,000 GDP

MILAN2015

ADMINISTRATIVE BOUNDARIES

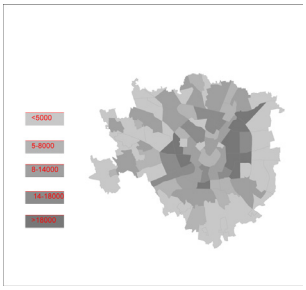


182 km²

7,357 inhabitants/km2

1,337,155 inhabitants (+8.63% since 2010)

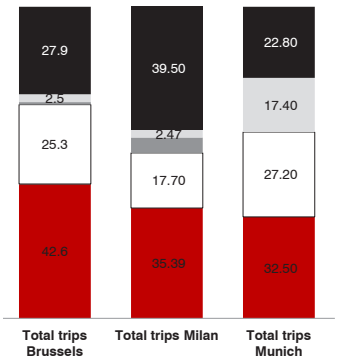
12.5% unemployment/ #inhabitants (181,175)



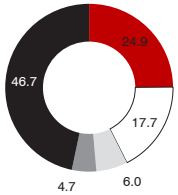
10 Average **52h** Wasted in Traffic 2015

850,000 IN (aprox **525,000** COMMUTERS IN)

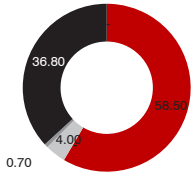
270,000 OUT



Modal split total trips



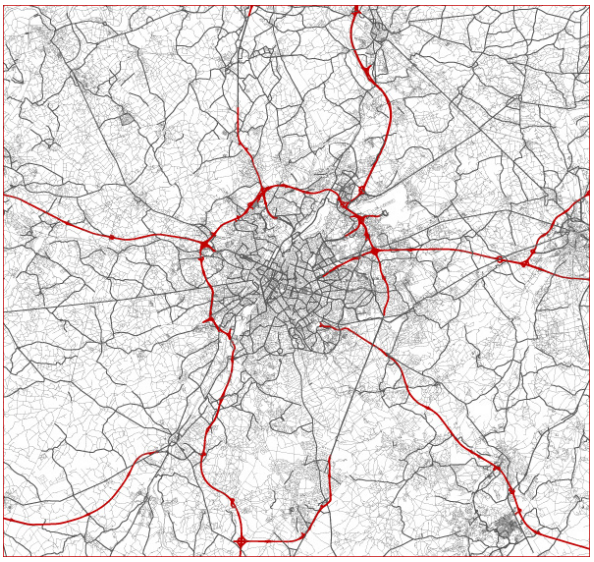
2,277,000 trips in/out the city



2,978,000 trips within the city

TEODORA CAPELLE | SEBASTIEN VERCRUYSSE

GOVERNANCE &strategies



BRUSSELS

IRIS II

Designed by the Brussels Mobility and approved in 2010, IRIS II mobility plan has had a regulatory status since 2013.
The plan concentrates on pollution and greenhouse gas emission reduction such as it is described in the Regional Development Plan (2002)

It has a voluntarist approach that aims to influence demand, focus on price mechanisms and ultimately aims to reshape mobility needs. It recognises the importance of territorial development and promotes active mobility and the use of public transport. The plan's target is to reduce the traffic load 20% by 2018. ((Monneaux).

Other important objectives are related to road network safety, a rational usage of the private car, the increase of sustainable alternatives in an inter/multimodal perspective, parking management by different correlated regulations, the improvement of the transport of goods. In order to guarantee the future implementation, the plan proposes improvements of the governance capacity. The plan calls for a consultation process to include important administrative department in the design of the public space. It praises for a strong and qualitative administrative apparatus that can be monitored by continuous evaluation of the role of the plan within the regional policies and regulations. IRIS II foresee cooperation between the mobility stakeholders such as the operators, regions communes, and federal government within a formula that should establish beforehand the roles and the decision making process.

The Iris II Plan also provides an evaluation of the previous IRIS I (1998) results. It points out that several important measures from the 1998 plan had not been implemented. After ten years of IRIS I, the evolution of mobility in Brussels was causing 'concerns' and the trend was indicating a 'warring' growth in mobility need. (e.g. 30% more kilometres driven on secondary roads)
The identified problems were the non-cooperation between administrative entities and decision makers, procedural and operational missing links, bottlenecks, delays estimated at seven years, uncoherent measures.(Bruxelles Mobilite et al.)
Although IRIS II identifies the implementation challenges of the previous plan, it also has problems in materialising the objectives set for 2015. Several measures experience significant delays: the reduction of the traffic load by 6% to 10%, automation of the metro, the 15000 member for the car-sharing versus two-thirds at the end of 2014, the 27% waterway freight traffic (2006 Master plan). This also highlights the financing needs problem.
To meet the 1,350 M for the 2010-2015, the plan identifies taxation measures, discriminated by pollution rate and praises for a bigger allocation of financial resources via the federal state and the 'economic world' which represents businesses. However, there is no measure linked to the available budget; the government should decide. The problem of the commuters is raised: occupying 50% of the jobs they use Brussels' infrastructure with little participation.

The IRIS plan it is not updated to face the new challenges and opportunities brought by the digitalisation and open data. Some measures, not yet implemented are likely to be irrelevant, soon; the background study of IRIS II was done in 2001. New strategic aspects are on the Mobility Minister Agenda. IRISII will be up-dated and this will coincide with the new Sustainable Development Plan of Brussels which includes new actors and a regional and territorial perspective. The question is how these strategies that always proved delays in application would be able to deal with the fast changes of the society and technology today. There is little concern about operations.

COMPETENCIES PUBLIC AUTHORITIES - scheme

EUROPEAN

WHITE PAPER Single Eu Transport Area | Energy and Environment | Rail, road, air, water transport | Inter-trans modality | Inteligent transport and navigation | International Enlargement

European policy sets a common framework and shared goals, national and local action is essential to achieving many of these. In line with the subsidiarity principle, European Law sets out clear boundaries to the competences of the Eu when it comes to legislation at the city level. (PWC, NBGD 4 - National Legal Frameworks for Urban Vehicle Access Regulations)

FEDERAL

AIR TRAFFIC | RAILWAYS

"The federal state also has powers for exemptions and restrictions on the powers of the communities and the regions".Federal legislation available when regional one doesn't exist yet.

REGIONAL

power in the fields linked to regional and territorial matters

environment	economy	public works	credit	intercommunal utility companies
employment	housing	Transport without SNCB	agriculture	water policy
energy	foreign trade	town/country planning	nature conservation	supervision of the provinces

SIXTH STATE REFORM →

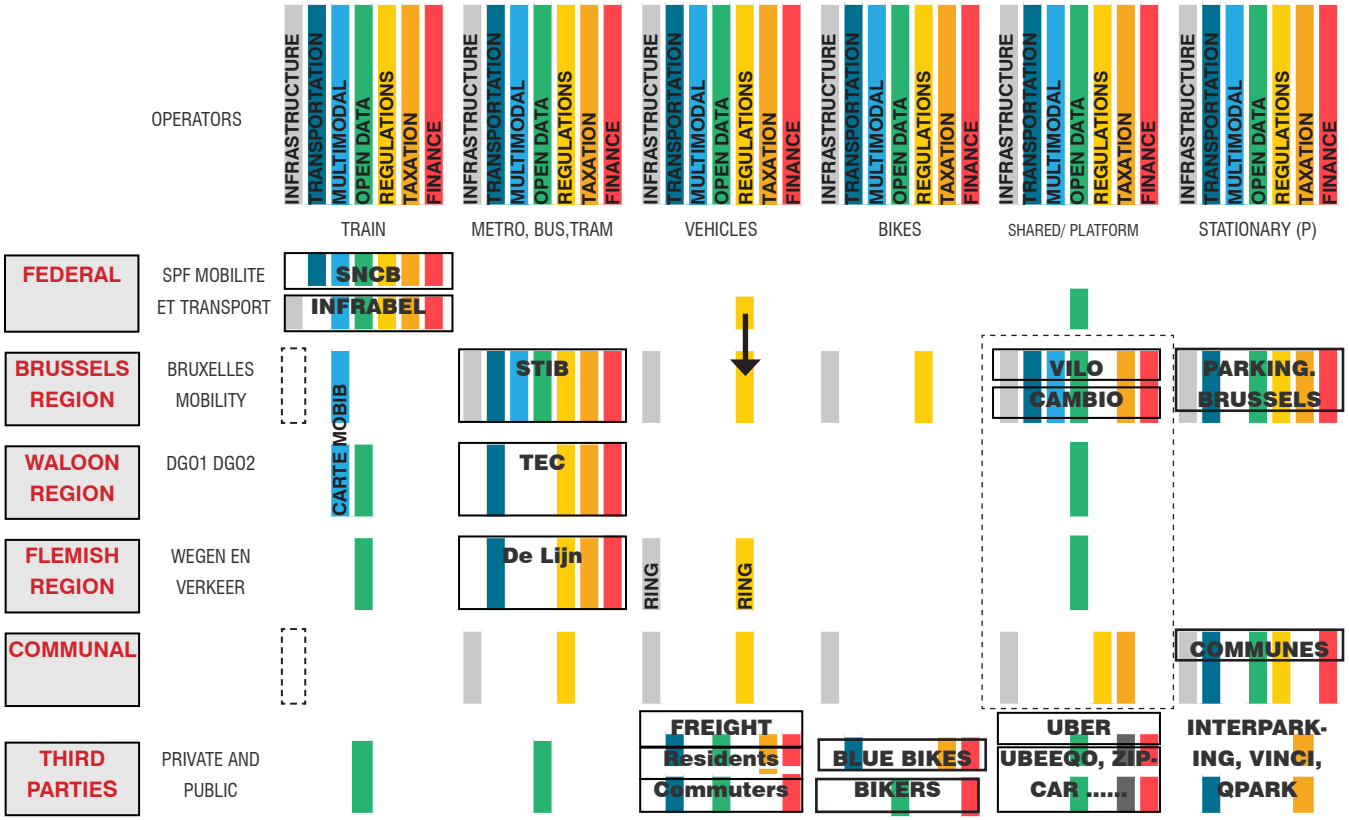
metropolitan areas policies | mobility infrastructure policies and road code | direct link | indirect link

COMMUNAL

PUBLIC ORDER | PUBLIC WORKS | civil registry | HOUSING | EDUCATIONS

a high degree of autonomy and powers. Although under the supervision of higher authorities, the local autorities can do "*whatever is not forbidden to do*!" source: (Belgium Federal Public Services), (European Union), (Davister)

PUBLIC AND PRIVATE TRANSPORT STAKEHOLDERS



TEODORA CAPELLE | SEBASTIEN VERCRUYSSE

GOVERNANCE &strategies

MUNICH

THE INZELL INITIATIVE

"An initiative by **BMW and the City of Munich** to jointly discuss traffic problems and look for solutions apart from current political discussions" (10-Jahre-Inzell)

The Inzell Initiative was born in 1995 as a platform that actively involves industry, science, public offices, businesses, politics and the citizens through the voice of local councils. By the means of working groups and forums they formulate together visions, strategies and identify coherent short-term feasible projects. As visions were different at the beginning, stakeholders identified 11 key issues and trades-offs in order to align goals and be able to materialise coherent projects. It looked forward on **transforming initiatives in processes for a fast, efficient and effective implementation.**

Today, the Inzell Initiatives brings together more than 70 stakeholders.
The initiative is supported by a strong public ecosystem, such as:

The city of Munich. Organised in **'thinkers'**- the city council and "**doers"** the public administration (Donti), public authorities uses the collaborative stakeholders dialogue as basis for the mobility and urban policies.

MVV Münchner Tarif- und Verkehrsverbund. In 1972, the Bavarian government and the German federal railways established the Traffic Association Munich (MVV) to ensure a better integration of the public transport association of the region. The association coordinates 40 companies.

Since 1995, Inzell Initiative brought a new culture of policymaking. It built trust by the fast (see scheme) accomplishment of specific projects that were discussed and designed during the forums. (TSCHOERNER)
With a very pragmatic approach, the city focused step by step on key issues that used to be considered solutions for a better mobility. For the last 20 years, this allowed the fast finalisation of the projects such as the parking management scheme, the electronic time-tables, etc. The evaluation of these achievements provides helpful insight about the importance of aligning strategies and operations.

THE AUTOMOTIVE INDUSTRY

The automotive industry is a key economic driver for the region. The industry is active in the implementation of sustainable ecological measures and policies. Today, different players from the industry focus on the multi-modal transit in Munich and join forces with the city. Munich 2050, the last Inzell Initiative, leverages on different knowledge fields and capabilities in order to implement innovative actions with focus on the technological innovation. Automotive industry works on CO2-neutral electric car, autonomous cars and focuses together with the city on car sharing scaling up and operational improvements.

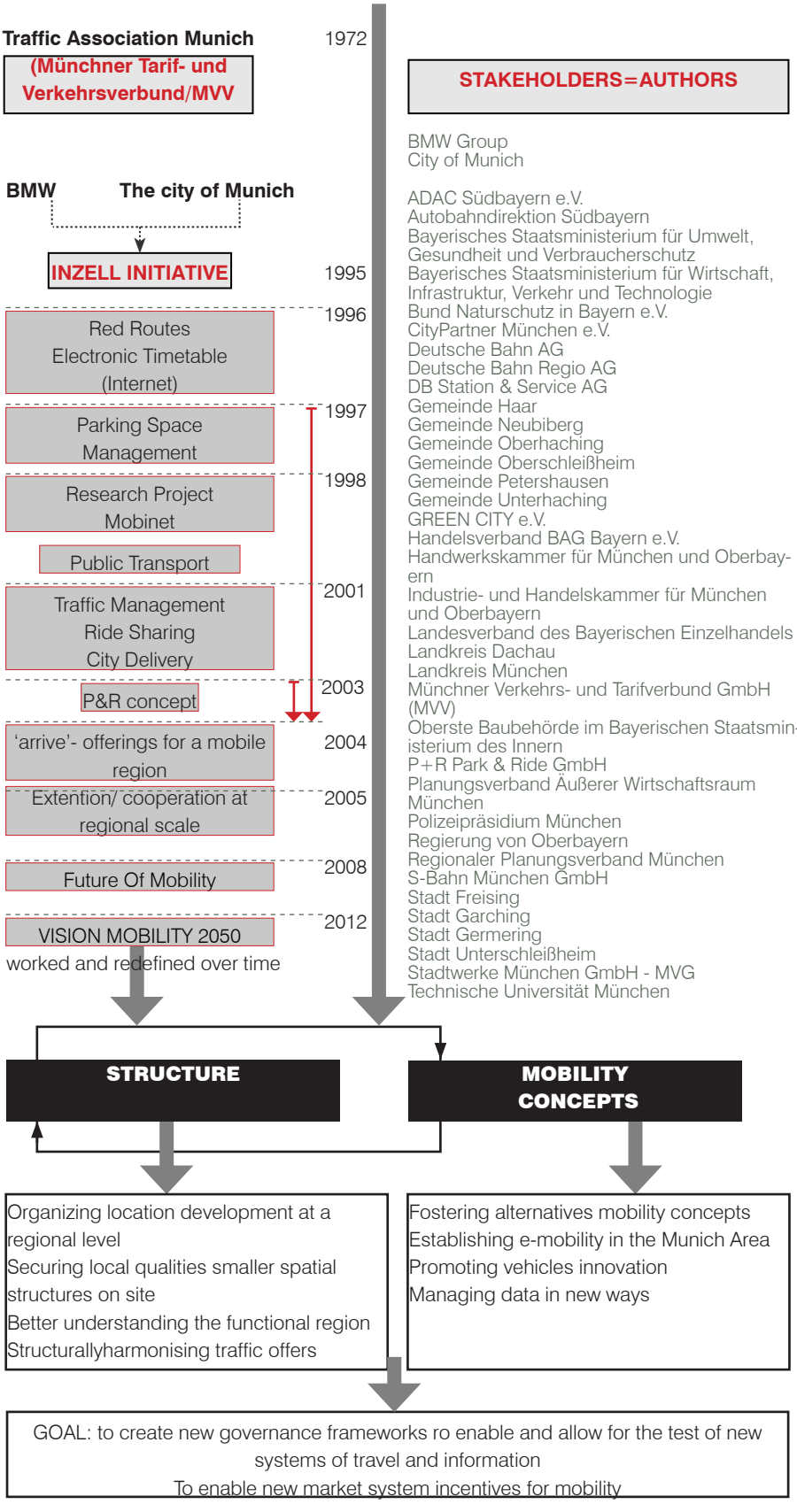
The German automobile club, ADAC , promotes the use of the public transport and the Park and Ride for a better accessibility and decongestion of the city centre. Since 1980, they are working on emission/ particulate reduction policies. They monitor the public transit and try to push forward innovation in the traffic telematics.

THE VISION MOBILITY 2050

The Vision Mobility 2050, is a guideline of mobility development designed around three pillars: accessibility planning and user expectation. It focusses on how to approach customer and to provide technical instruments related to infrastructure and services. The project looks both to planning and to the organisation model that should carry the implementation. It enhances the regional cooperation and how to transform initiative into processes.

The strategy leaves room for revision. Although Open Data is not yet effectively in place, the impact of navigation planner tools has already changed the perspectives. The city of Munich is conscient about the change, about the speed of innovation versus the slowness of the policy erection. Therefore it aims to integrate a flexible iterative process that can cope with fast transformation, uncertainty but nonetheless innovation.

SOURCE SCHE: TSCHOERNER and 10-Jahre-Inzell



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GOVERNANCE &strategies

MILAN

THE AREA C

Before explaining the strategy development and governance structure of Milan, it is worth reminding the AREA C policy that evolved from an Ecopass system to a congestion charging scheme. It is an urban vehicle access regulation that initially focused on emission pricing in order to increase road safety, the quality of the public transportation, the quality of environment, the fluidity of the road freight distribution within the city centre of Milan (8.2sqm). (PWC, NBGD 4 - National Legal Frameworks for Urban Vehicle Access Regulations Second Round of Consultation Non-Binding Guidance Documents on UVAR Schemes N° 3/6 DRAFT FINAL). Today in the area C are allowed only Diesel vehicles Euro 4 or Euro 3 with a diesel particulate filter (DPF) and Petrol Euro 1 for a charging tailor made fee related to the duration, type of transport, residence, etc., (Comune di Milano, "Area C")

The success of the measure is translated into a decline of 30.1% of traffic, a 34% reduction of carbon emission and a 50%reduction of total accidents, within the area. (PWC)

THE SUSTAINABLE URBAN MOBILITY PLAN (SUMP)

The Sustainable Urban Mobility Plan (SUMP) in Milano is an illustration of the European initiative on an integrative approach related to mobility in European cities. This initiative gathers experiences and successful measures in a comprehensive road map, explained on the next page.
The SUMP in Milan is the result of a process spread over almost three years. It started in 2012 and was coordinated by the city of Milan Planning and Mobility Programming department and AMAT (the Milan Mobility Agency).
It involved technical input from environmental, urban planning departments and metropolitan regional institutions. Ultimately the plan was evaluated by a scientific committee, appointed by the municipality.
Stakeholders' meetings and debates helped identify the key issues of the mobility in Milan. The plan was confronted several times with user's ideas, perception on needed improvements, by the means of conference, and other communication tools. The plan identified the priorities such as the need to evaluate the demand, to analyse of the potential of the railway network, public transport, biking,evaluate the policies concerned with demand management and the improvement of logistics.

Key objectives

The plan promotes a shared mobility governance with co-ordinated strategies and tools. It aims to combine urban development, innovation and sustainability, according to:

- Fulfil the accessibility need by other means than the private car
- Reshape the allocation of public space towards active and shared transportation
- Safety of all the mobility users
- Promote innovation in environmental friendly mobility services and modes
- Improve energy efficiency and reduce environmental impact
- Reduce social costs of mobility measures
- Optimisation of the public resources

Source: (Comune di Milano, "PUMS")

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The Sustainable Urban Mobility Plan (SUMP) in Milano was adopted in 2015. Although it is too early to evaluate the implementation like is the case for the Area C, there are on-going projects described in the next chapters that will highlight the direction and potential of the plan.

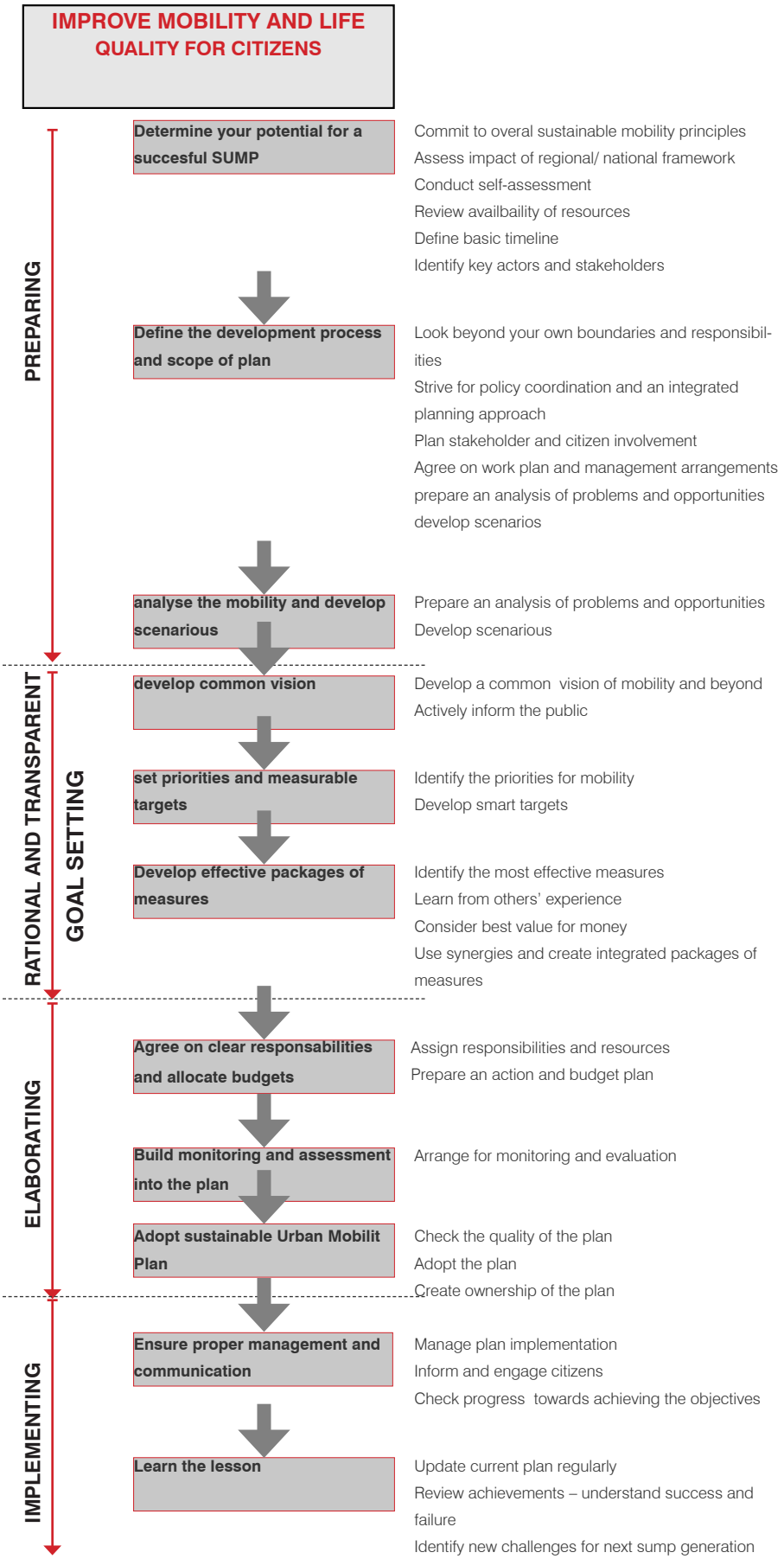

IMAGE: The Sustainable Urban Mobility Plan (SUMP) guideline of the European Comission project ELTIS- The urban Mobility Observatory.

SOURCE: ELTIS

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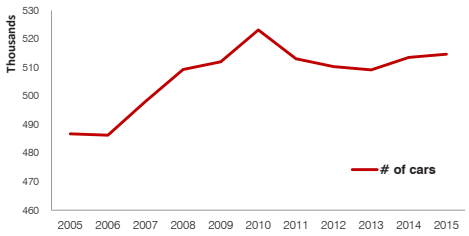
FIXED INFRASTRUCTURE

ROAD INFRASTRUCTURE consists in local or main supply collectors/ distributors roads. As illustrated in the benchmark the road system is related to the urban structure. Munich is a wider spread city. Reconstructed after the WW2, it benefits from larger roads and therefore a capacity impossible to be met by old medieval cities. Within their administrative boundaries, traditional cities like Brussels and Munich have limited available space to increase the infrastructure. However, congestion is not spatially equally distributed and rather concentrated around bottlenecks.

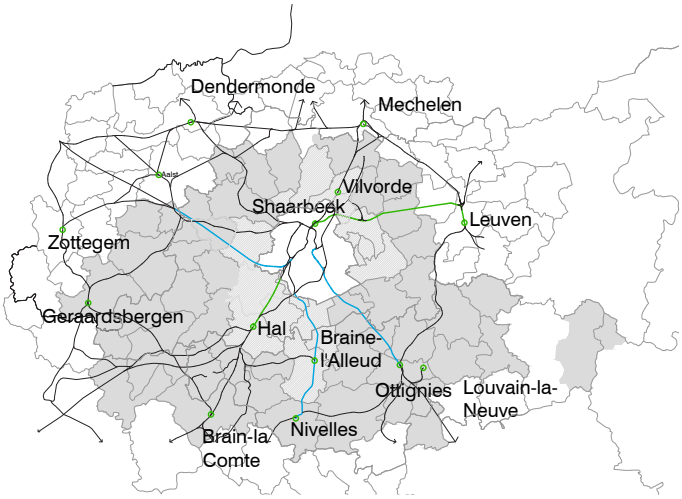
Comments on registered cars per 1000 citizens:

- The number of cars didn't decrease in Brussels, but the population and the migration in the city increased (IBSA 13.1).
- Company cars in Brussels represent 1/3 and figures might be misleading if cars are used by commuters.
- In Munich, the aggressive implementation of car sharing scheme increased in the short term the average motorisation rate (Landeshauptstadt München)

ROAD LENGTH (km)	2013.5	
Road length/AREA (km/km²)	12.5	
# registered cars for 1000 citizens (2010-2015)	438	-8.79%



Evolution of the number of registered cars in Brussels (IBSA)



regional express railways

regional express railways under construction

railways system

Commuters accessing the "enlarged" Brussels region -between 30-64% share of commuters (from the active population) 2001 (Beelen)

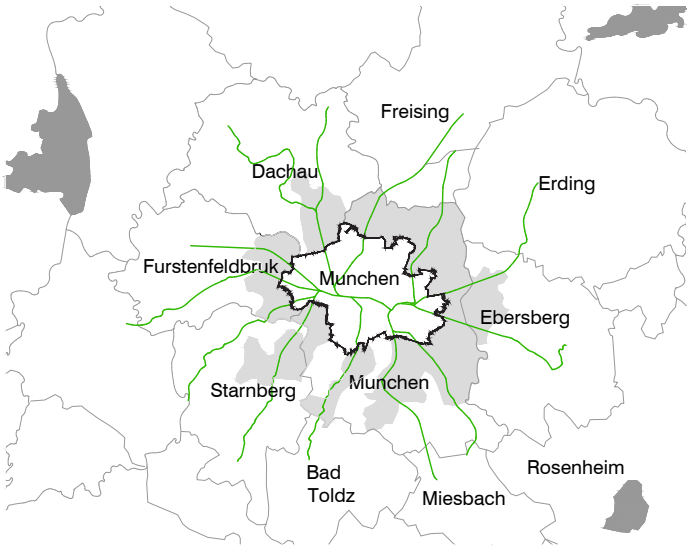
area assimilitated to Brussels region 2001 (Beelen)

Map data source: (Beelen and "Dix Questions » Le RER – Lavenir.net »") note: the card considerd a metropolitan area outside the city boundaries.

	2180	
	7.01	
2010-2015	449	3.96%

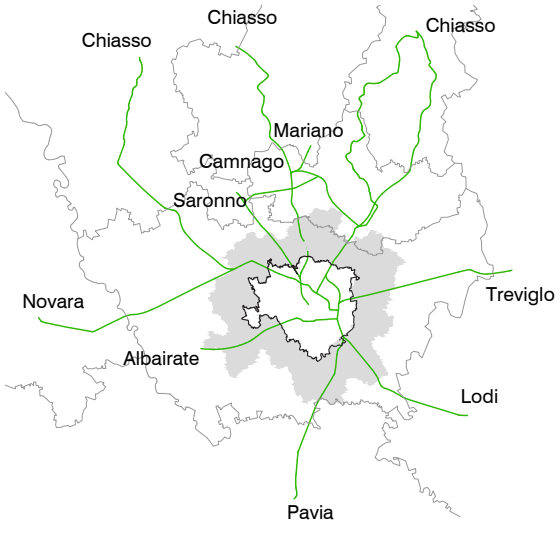
Note: the number increased in 2011 due to car sharing system 2011

	2023.63	
	11.14	
2010-2015	514	-11.74%



regional express railroad

50% share of commuters



regional express railroad

The sustainable urban Mobility plan identifies and integrates ia critical area linked to the economic exchange between the city and the region. The activity is also linked to the concentration of commuters. (no figures available).

Map data source: ((Moeckel and Nagel)

Map data source: (Comune di Milano, "PUMS")

RAIL INFRASTRUCTURE

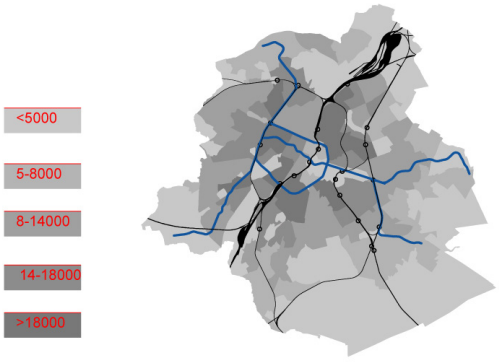
The three cities have a balanced distribution of rail infrastructure in the territory. Brussels has a high accessibility and a specific situation: the North-South junction enable direct links from and to all the corners of country.

Historically, cities in Europe benefited of a strong railroad infrastructure linking industrial hubs and cities. Once the movement between the cities and the outskirts intensified, the Regional Express Railway has been developed as a transit train. Depending on the contexts Regional Express Railway complements or makes use of the existent corridors.

railway infrastructure Brussels

METRO INFRASTRUCTURE

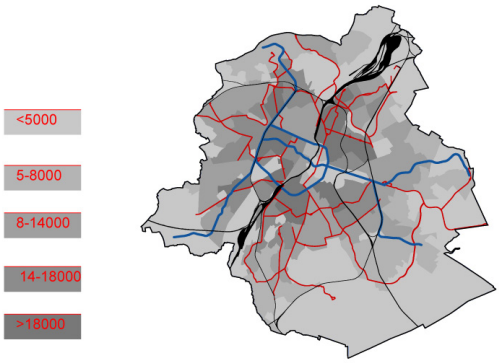
The Metro infrastructure in Brussels is less developed. Only some areas are served by the metro. In Munich and Milan the metro has a radial structure



metro Brussels

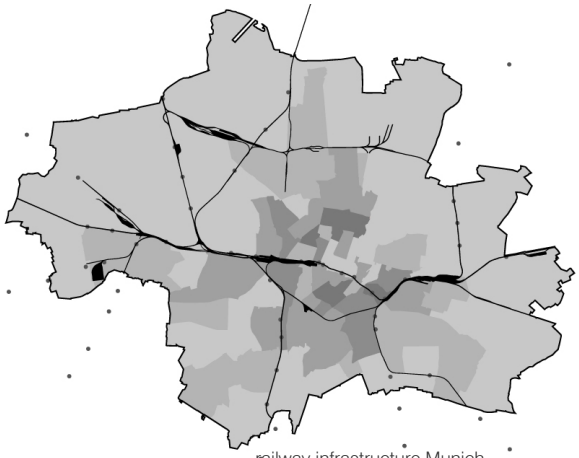
TRAM INFRASTRUCTURE

In both Munich and Milan, tram rails are reinforcing the radial system of metro. It doesn't cover the periphery like in Brussels, but it is organised to serve the centre of the city.
In Brussels, there is a web network of underground and surface lines, with less hierarchy.

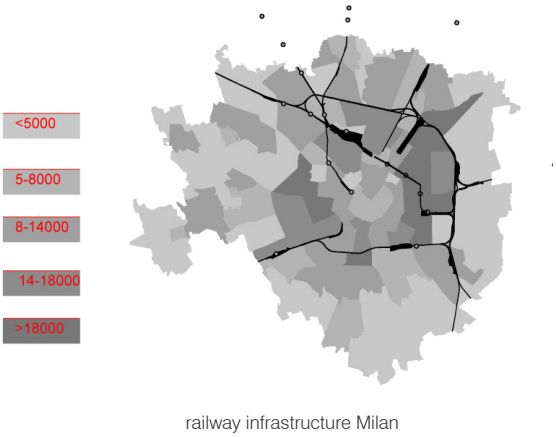


tram Brussels

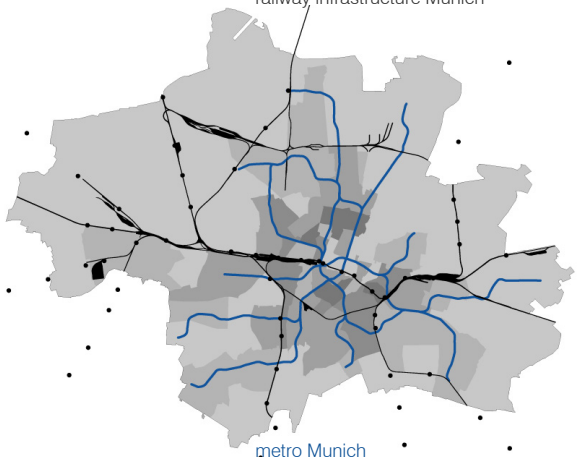
Following the IRIS 2 Plan, the Government of the Brussels-Capital Region
- extension the downtown pedestrian areas (Plan piéton);
- create new bike lanes (new 80km in 2020).
- new project of P & R (refer to Business Case).
- studies for EV charging stations. Sources: IRIS II



railway infrastructure Munich

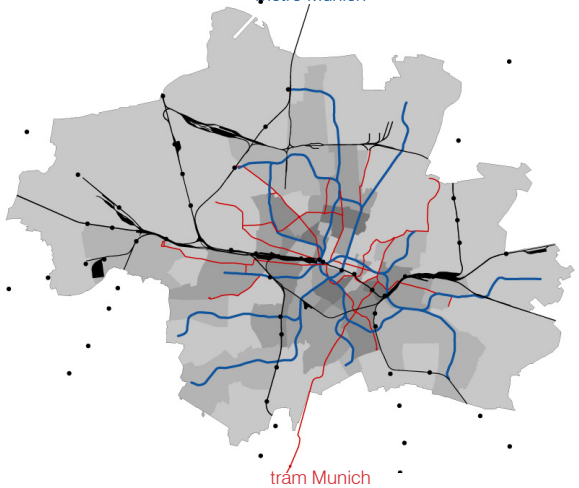


railway infrastructure Milan



metro Munich

metro Milan



tram Munich

tram Milan

- new underground line (U9),
- modernise station to improve accessibility, flow and capacity (Sendlinger Tor und Marienplatz).
- MVG supports the development of a new area (Steinhausen – connect existing households and businesses) by installing new tram lines.
- private companies (BMW, Siemens) installed (along A9) fast charging stations for EV (sponsored by the German Federal Ministery of Transport and Digital Infrastructure).
Sources: MVG;

- For the “Expo 2015 world fair”, Milan’s metro opened the final section of Line 5 (fully-automatic), first of two new lines being built (PPP projects)
- improvements are underway to Milan's original three lines.
-projects to upgrade the other existing metro lines and tram lines and projected the construction of a new Metro line (Line 6) to improve the quality of the multimodality.
Sources: IRJ - International Railway journal

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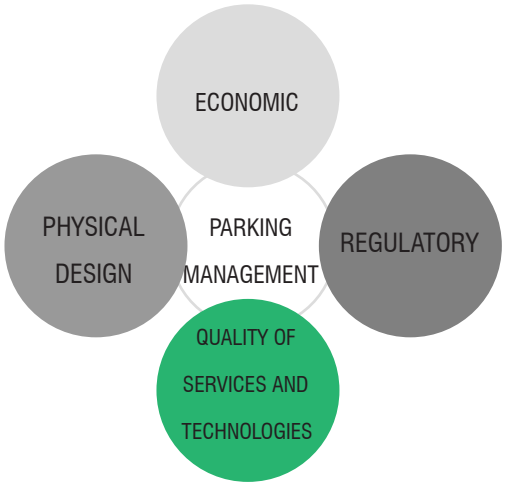
FIXED INFRASTRUCTURE

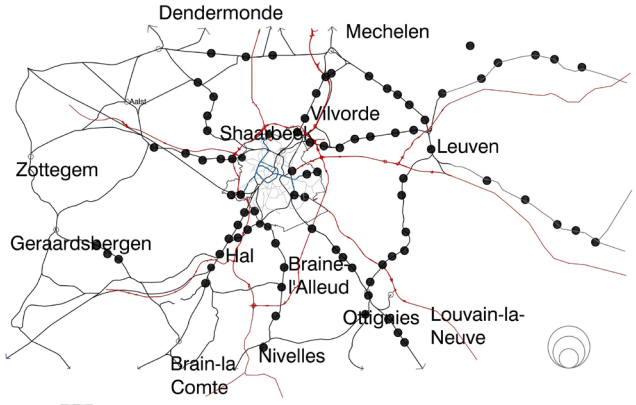
PARKING MANAGEMENT

Parking infrastructure is part and parcel of the parking management ecosystem. If on-street parking uses the existent road infrastructure, the off-street needs huge investment in its own infrastructure.

However, according to UITP study, building parking is not enough to solve mobility problems. Policies and strategies in different areas has to be linked in order to have a sustainable parking solution.



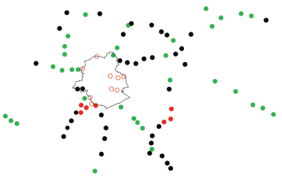
BRUSSELS



source:Parking Brussels

parking

different owners and operators situated in 3 different regions and a dozen of communes

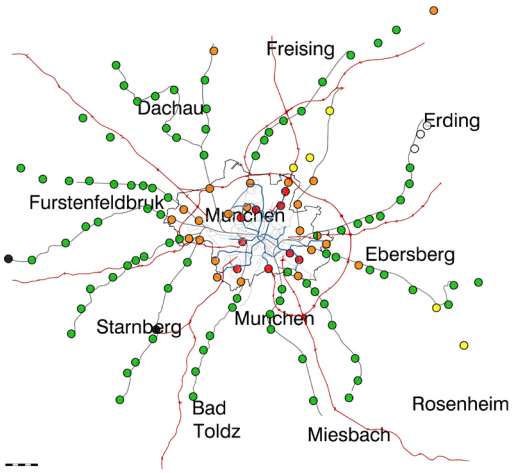


There are 19 000 transfer parking places organised in 218 parking around Brussels serving 89 railway stations. 64% (14300 places) are the national railway property and the rest are municipal parking places. Only 4800 places are payable around 10 railway stations: Leuven, Liedekerke, Vilvoorde, Heverlee, Dilbeek, Asse, Braine-l'alleud, Ottignies, Nivelles et Wavre. (Wauters).
There are extra 1900 parking places in the Brussels Region.
265 000 available on street parking
500 000 off street (25000 public off street (public parking)
250 000 private garages, 223000 for offices, commerce, school industry)

Off-street Parking inside the city 10200 places (annexe 3)

19,000 transfer parking

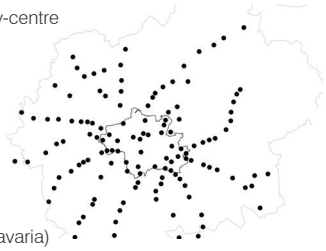
MUNICH



source:MVV

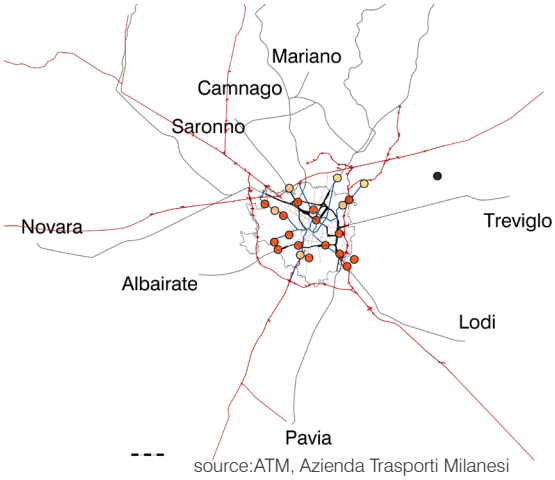
Parking prices related to the distance periphery-centre

- free parking
- 0.5 euros/day
- 1.0 euros/day
- 1.5 euros/day



- only one operator VMM, only one region (Bavaria)

MILAN



source:ATM, Azienda Trasporti Milanesi

Parking prices related to the distance periphery-centre and the duration. Ranking:

- the cheaper for subscription
- the cheaper for short stay < 5h
- the price increase with the duration
- the most expensive (city centre)

Image to the right:

- only one operator ATM, only one region (city)

At 39 P + R facilities and four City Park facilities, MUNICH provides more than 11,000 parking spaces for cars in the city and the surrounding area. Pricing is related to the proximity to the centre: the closest to the city, the more expensive.

15,800 parking places represent 3% of the flow of cars that total enters the municipal area (Comune di Milano, "PUMS")

11,000 transfer parking

15,800 transfer parking

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PUBLIC TRANSPORT

MULTIMODAL OFFER

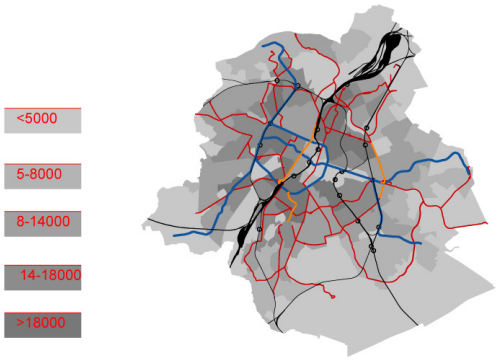
BRUSSELS

PUBLIC TRANSPORT

As a general observation, Munich and Milano use a hierarchic allocation of the public transport. It seems that each mode feed and relates to another. In both cases, the coverage of the metro system is a radial developed system, whereas in Brussels it completes the offer of the inner ring and serves only some areas.

The stakeholders in Brussels raise the problem of the transition between modes (even between the same type of modes). Some trips are very time consuming because of the shift.

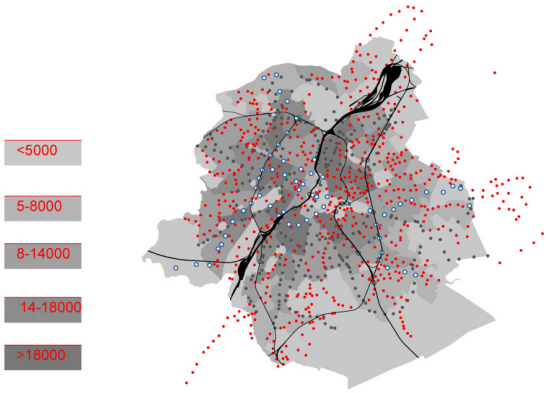
Despite dense rail infrastructure that served its industrial era, Brussels has not completed its express high speed RER project. The project started 20 years ago, but it accounts for considerable delays and budget increases.



Métro (km network)	12.5	39.9
Tram(km network)	438	133.4
TROLLEYBUS (km network)		
Bus (km network)		365.5

BUS DEVELOPMENT

In red: bus stations. There is an obvious difference. In both Milan and Munich cases, the centres of the city are served by “fixED” infrastructure public transportation such as tramway and metro and train. Buses are used to cover the periphery. In Brussels, bus stops are uniformly distributed all over the territory. In Brussels, buses have their own lane.
The distance between stops is very small in Milan. This is likely to explain, the lower speed of the public transport.

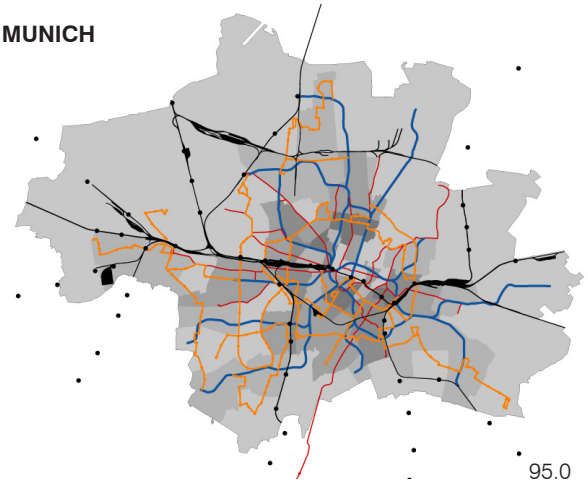


	Distance between	
Train stops		
Metro stops	69	589
Tram stops	291	403
Bus stops	1879	419

Cronos speed bus- is not consider separately.

- extension of the tram lines and metro
- modernization of the bus network
- acquisition of electric buses

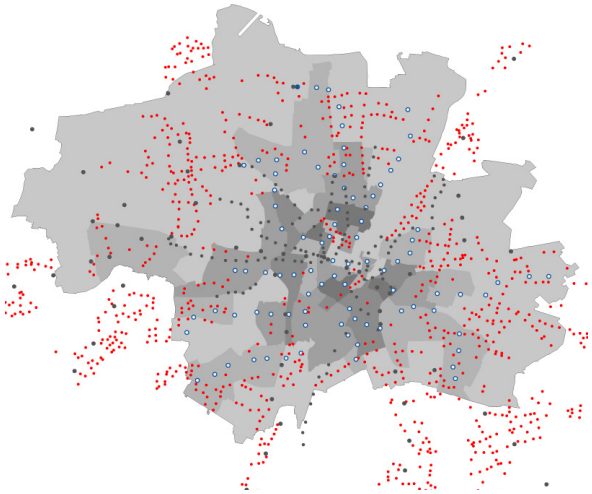
MUNICH



95.0

79.0

467.0



Distance between

Train stops		
Metro stops	100	948.0
Tram stops	166.0	474.0
Bus stops	968.0	482.0
trolley stops		

Following a study of public transport sponsored by ADAC (German Motor Club) in 23 European cities, Munich was the only city to score “excellent” on travel time, comfort and information availability.

- integrated services (New PT connections, E-charging station, Bike sharing, Car Sharing), allowing the company to move from a traditional PT corporation integrated mobility service provider. Sources: MVG report, September 2016

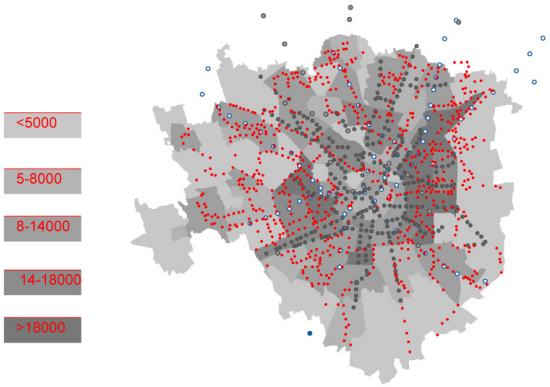
MILAN

12.5 89.0

438 173.2

38.5

887.0



Distance between

Train stops		
Metro stops	82	1085
Tram stops	703	246
Bus stops	2.479	357
trolley stops	203	190

In Milan, ATM (metro-bus-tram-trolley bus) and Trenord (rail) are integrated and offer an intermodal transport system for customers. ATM offers others integrated services like bike and car sharing and a series of other services mainly related to transportation around the city. The company manages 21 interchange car parks, the SostaMilano system, controlling parking areas and payment systems. All these services allow the company to have good understanding and facilitates the establishment of an effective modality. (ATM Group activities)

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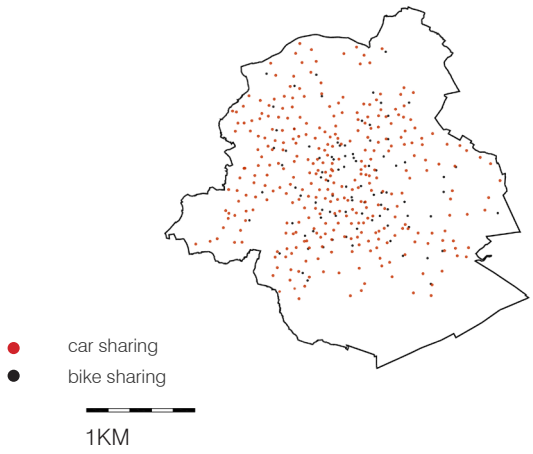
NEW MODES

NEW SHARING ECONOMY - LAST MILE OFFER

Sharing economy and platform based exchange models completes multimodal solutions and have the potential to meet unfulfiled user needs. In the last couple of years, there is a tremendous change. Car and bike sharing are scaling up rapidly and there is a lot of hope in this model for solving mobility problems:

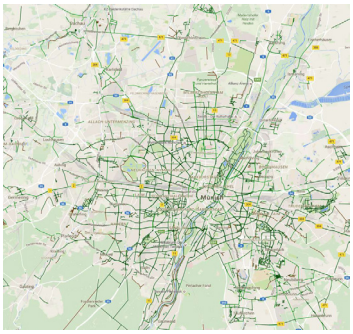
1. Evaluation of car sharing systems shows a decrease in motorization rate and therefore a decrease in congestion patterns. *"every new vehicle shared with normal utilisation replaces between 4 and 8 vehicles, which reduces the pressure on parking spaces."*
2. Car sharing and bike sharing are last mile solution, as far as traditional public transport had difficulties to cope with customisation.

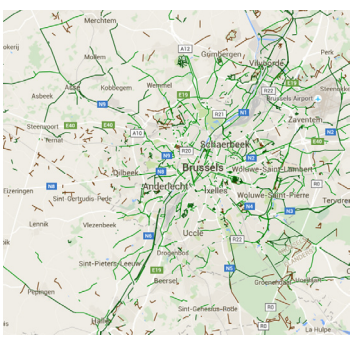


Bike sharing

Bike sharing has cultural roots. Its development is linked to infrastructure and safety aspects. A city like Brussels has to scale up its cycling culture. Not only the topography but the security are very important issues (page 16).

Despite investments and coverage of bike station, the modal split analyses show that the coherence of a network is essential for a successful policy. Without coherent infrastructure it is difficult to sustainably extend a bike sharing offer. Through Google and other apps the user can assess the coherence of the bicycle network.



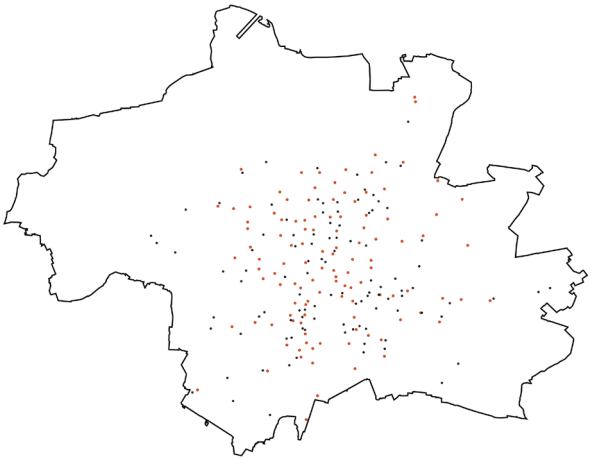


Car sharing in Brussels

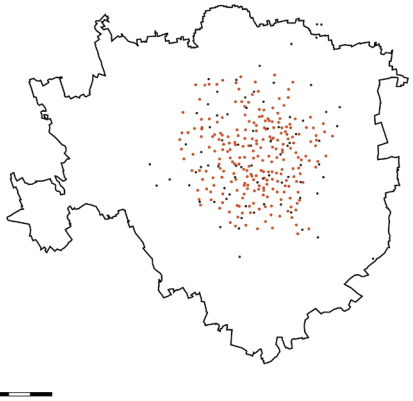
Since 2002 Brussels government has implemented measures to promote the development of car sharing. The Iris 2 Plan had set a target of 25,000 customers by 2020. Cambio was the 1st operator joined in 2011 by Zen Car, electric vehicle operator joined Cambio. In 2013, the Government of the Brussels-Capital Region approved a decree on procedures of using parking spaces in the street. The car sharing operators had to obtain an authorization valid for a period of 5 years. In June 2016, the government authorised the arrival on the market of operators offering a free-floating Service (One way). Previously reserved for operators providing round trips, today, these vehicles can park free on-street but on regulated parking places that accept cards derogation (grey areas, green, blue and event) Furthermore, one of the objectives of the Brussels region is the electrification of this type of service. Studies are underway to analyse the impact on the creation of the necessary infrastructure.

COMPANY	UBEEQO	ZENCAR	CAMBIO	ZIPCAR	CAR2GO	DRIVENOW
ARRIVAL	06.2016	02. 2011	2002	09.2016	10.2016	07.2016
SERVICES	round trip	round trip	round trip	free-floating	free-floating	free-floating
# OF CARS	45 (Matcha) Different size	57 Electric Vehicle	380	200-250 (Peugeot 208)	250 (Smart Fortwo)	300 (BMW s, MINI)
BUSINESS MODEL	subscription + commission based model	commission based model	subscription + commission based model	subscription + commission based model	commission based model	commission based model
SERVICE	Car sharing + Service cars with driver + long-term rental	EV car sharing	Car sharing for people who want out of the city		One registration for different location (professionals)	

+FREE FLOATING 2013



1KM



Car sharing in Munich

In 2010, Munich had to face the requirement of car-sharing companies to grant special permit for parking in parking licence zone. To be sure the demand is justified in regard to the public interest, and that the parking rule adoption would make more parking spaces available and reduce the number of car in the city, the city launched a pilot project with limited duration and number of vehicle. The project report concludes with 3 guidelines.

1- Car-sharing companies should be supported in providing a service that is as attractive as possible

2- The parking spaces gained on public roads as a result of reduces car ownership should no longer be available for parking private cars and instead be used for other purposes in the public interest /

3-Agreements should be reached with the car-sharing companies guarantee a minimum standard of quality of the car-sharing services).

The study concluded with those major's topics:

Parking spaces for private cars:

The car-sharing services lead to a reduction in the distances driven by car. The driving distance is related to the given up of a car/decision not to purchase a car.

The car-sharing services have an overall positive impact under the following conditions:

The City of Munich has to develop a parking area policy and the public transportation providers have to bring high quality services to the users.

The impacts of different solutions depends on their integration and coordination with existing solutions (fit inter/multi-modality) and on offering to user the best level of quality.

The customer experience must to be great.

Car sharing in Milan

The first of three privately managed 'free-floating' car sharing schemes was introduced in 2013 following research to identify the fastest route to widespread adoption (Eurocities). Currently, there are five companies providing car sharing services.

The city of Milan which has a significant rate of car per citizen ratio launched the services in 2005 (Car Sharing Italia Srl). At the end of 2013, the City of Milan puts into effect an innovative system of sharing mobility, named "EQ Sharing", an entirely electric car sharing service. The concept consists of a halfway service between the bike sharing and car sharing. At the same time, the city launched the Digital Areas (Recharging systems for private/public EV-phones-WIFI-NFC technology). Those stations are placed near the main transport nodes.

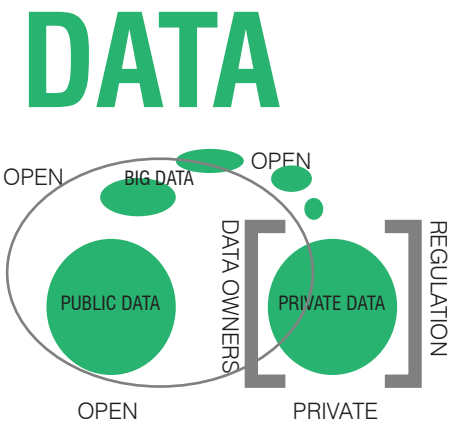
Sources: CAR-SHARING Development strategy in Milan, Arch. Valentino Sevino, 2014

http://transport.mos.ru/common/upload/docs/1443535035_ValentinoSevino.pdf

Companies

Car2go
Enjoy
E-go
Lead me
Share'Ngo

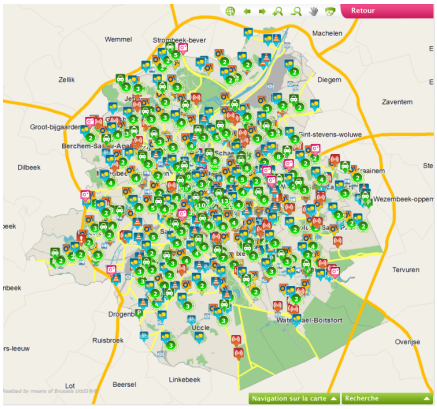
Soon moto Sharing

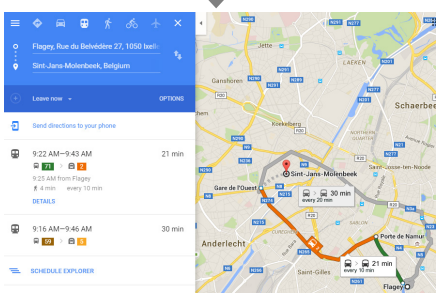


FROM MULTIMODAL TO INTERMODAL

Public and private entities can offer a multitude of transport modes, today. However, the more modes, the more complex and confusing for the user the system became. Since 2013, public data has become available at large scale.[1] This leads to a strong change in the mobility ecosystem. Application, navigation tools are trying to offer the intermodal efficient customised solution.

1 *DIRECTIVE 2013/37/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 June 2013 amending Directive 2003/98/EC on* the re-use of public sector information





BRUSSELS

Open data is part of the smart cities strategy. *"The aim is to promote innovation through new services that use open data, to improve the quality of life"* of the city users. source http://opendatastore.brussels/en/. SInce 2015 the information is

Open Data - new law (DeCroo)
European Directive implementation

Online Open Data platform of the City of Brussels (2014/2015) http://opendata.bruxelles.be/explore/

Public transport:
- regional roads and cycle routes, public transport network
- station STIB (bus, tram, metro stops) and scholar busses

Railroads
- railways station location and train schedule **(not real-time)**

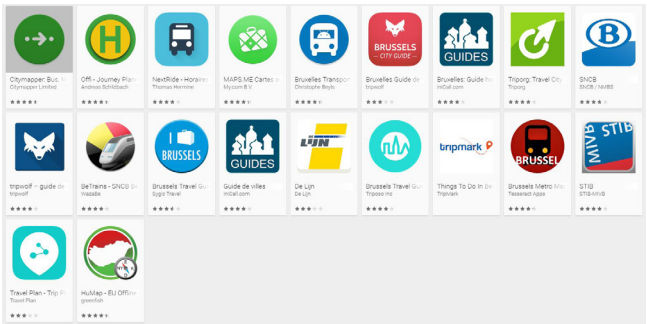
Mobility:
- location of the Villo! stations: availability (bikes, bike stands) **in real-time 107230 downloads.**
- location of the Cambio! stations, Zen Car (EV)
- location of the Collecto stops 1495 downloads
- location of parking for disable people, motocycles, tourist buses, taxi, streets and sectors related to the parking cards
- public parking (data from private management companies)
- events and traffic work Traffic service levels

http://opendata.bruxelles.be/page/news/

APPLICATIONS

Brussels's subscription to GOOGLE TRANSIT STIB and SNCB
- STIB (metro, bus,tram)
- SNCB (rail but not real-time yet)

STIB and SNCB have their own



search google "mobility route planning app Brussels " **120 results**

MUNICH

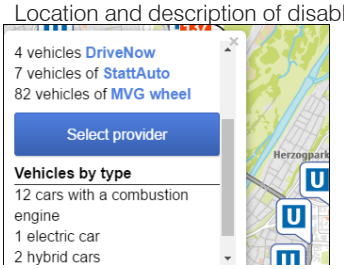
Open Government strategy (transparency, participation and collaboration) based on the feedback of the 2010-11 MOGDy contest and project for the digitalisation of the City of Munich. **City offered a small incentive to community developers for the creation of useful applications.**
Two important areas: e-Government and Open Government

1995 Licences/ beginning of discussions
2013 E-Government Act (EGovG)
2015 Bavarian E-Govermnet Act

Open Data Portal (February 2015)

Public transport: "*There is neither an open data provider like in Zurich nor an official API documentation by the MVG "*
Information is provided directly in an application

Location and description of disabled parking spaces

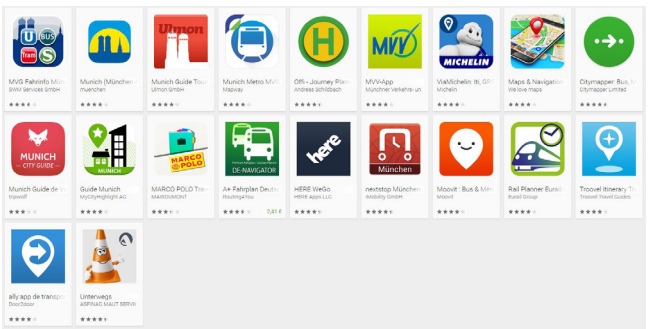


https://www.opengov-muenchen.de/

APPLICATIONS

Munich subscription to GOOGLE TRANSIT
- Deutsche Bahn AG
- MVG - Münchner Verkehrsgesellschaft mbH

own application MVG Fahrinfo München
https://carsharing.mvg-mobil.de/?loc=48.139166,11.56524



search google "mobility route planning app munich" **309 results**

MILAN Traffic & transport (725 download) 1st

The city of Milan launched an open-source platform for PC and mobile applications (SUPERHUB, co-funded by EU) for developing customised urban routes, combining public and private real-time data. The test version has the flexibility to adapt to the users' preferences. Suitable for new services B2B, B2G, G2C segmented

2014

Open Data Portal (february 2015)
http://dati.comune.milano.it/

pedestrian areas, restricted traffic zone (ZTL) and zone 30

Public transport: Azienda Trasporti Milanesi (ATM)
- localisation of surface and underground lines paths,
- localisation of bus stops and stops of the subway lines
- lines schedules of urban surface and Metro lines
- correspondence between routes and stops

Railroads
- the location of the rail network and of train stations

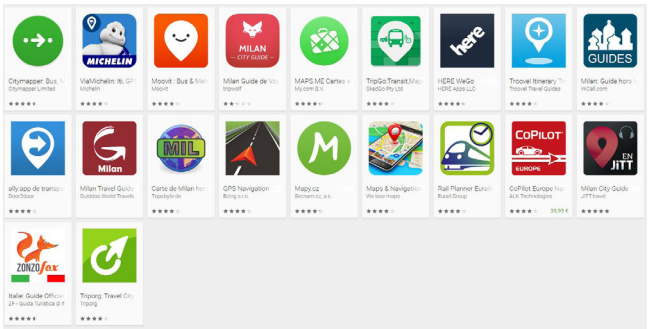
Mobility:
- location of park and ride
- location of parking areas for Bike Sharing (BikeMi)
- location of parking areas for Car Sharing (lead me)
- the location of electronic gates
- location of the parking areas
- interactive consultation on the inputs in Area C

location of public car parks

souse: http://dati.comune.milano.it/

APPLICATIONS

Milan subscription to GOOGLE TRANSIT
COMUNE DI MILANO
RegioneLombardia (No Routing)
Trenord (railway)



search google "mobility route planning app milan" **302 results**

REGULATIONS

not applicable

foreseen

		BRUSSELS
CARS	**Regional car toll**	Not applicable
	LEZ (Low emission zone)	The Brussels-Capital Region will implement a Low Emission Zone in 2018. Phase 1: applicable for diesel Euro 2 vehicles Sources: Urban Access Regulation in Europe
	Wide spread parking management	Regional parking policy plan aims to harmonizing rules and pricing in the different municipalities. By 2018: reduce by 16% unregulated spaces road Sources: Plan Régional de Politique du Stationnement
	Wide spread speed limits	Centre Brusels 30km/h Urban areas: 50km/h; National roads: 90km/h; 4-lane road: 90km/h-120km/h (central reservation); Motorways:120km/h
	Redistribution of road space: redistribution of car lanes	Program AVANTI Public transport priority
	Expansion of car sharing offers	Additional car-sharing services (Free-floating June 2016) + the electrification of this type of service.
PUBLIC TRANSPORT	**Expansion of PT infrastructure**	Management contract STIB: Additionnal public transport connections and tram extension
	Increase of service frequency	Frequency increase (during school holidays, extension of beaches, schedules in the morning, evening and weekend Increase the commercial speed of public transport (Avanti)
CYCLING	**Introduction of multimodal ticket**	IRIS 2: intensify coordination between the four operators for supply, ticketing, pricing, etc.. Existent MOBIB, jump ticket (combining train, tram, bus in Brussels)
	Cycle paths	Plan vélo 2010-2015 : separate cycle paths or bike lanes or signalisation for the 320 km of existent regional roads (2 years built 23km)
	Extensive promotion of cycling	Plan vélo 2010-2015 By 2018: 20% of trips are made by cycling (60 000 euros for vélo promotion campaign)
WALKING	**Extensive promotion of walking**	Plan Piétonier By 2020/40: 35% /40% of trips are made by walking

Sources: Projet d'accord de majorité 2014/2019

mature

implemented

recent

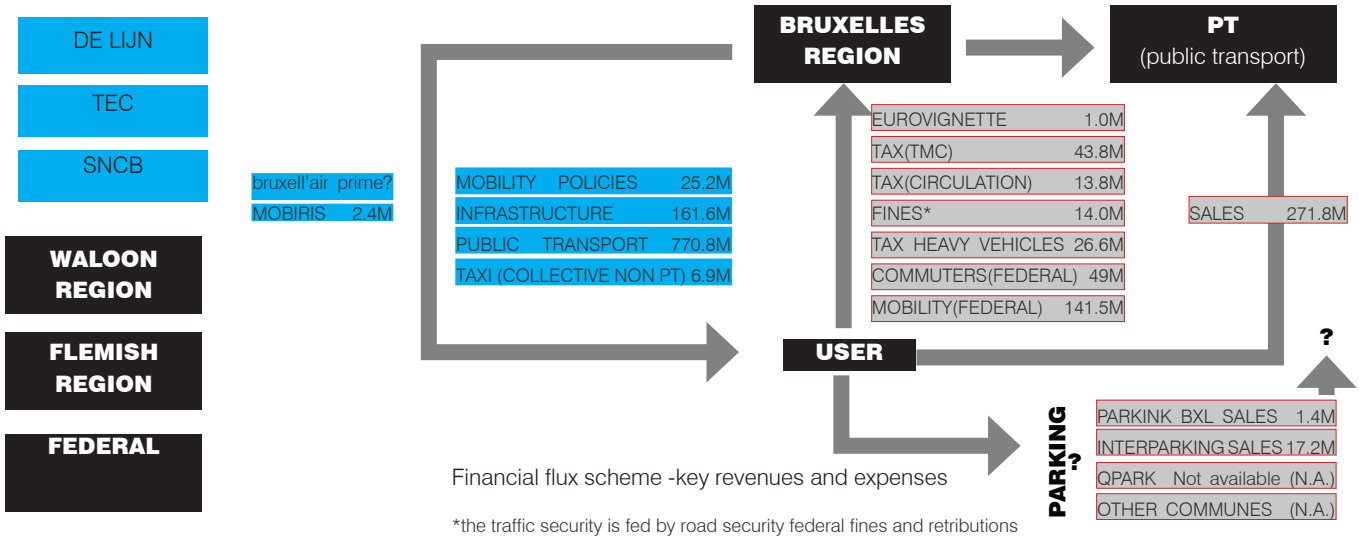
MUNICH	MILAN
Not applicable	Milano Area C: Low Emission Zone & Charging Scheme combined Sources: Urban Access Regulation in Europe
Implemented In 2008: restricted access of heavy-duty and high-emission vehicles (Euro 1) A National Framework sets out the Emissions Classes (4 classes) and main rules that can be used by cities for LEZs in Germany.	Milano Area C: Euro 1-4 vehicles (without a particulate filter) and 2-stroke motorcycles Daily charges: Standard: 5 - For service vehicles: 3 - For residents 2. Free access: EV, motorcycles and mopeds, hybrid vehicles, bi-fuel, CNG and LPG
Since 2010 (MOBINET test), various districts have been subdivided into parking zones, with different criteria applying to their use. Limitation and Cost based on location and time of day.	Orientation of demand, incentives and disincentives of the access and parking (Tide) Sources: PUMS 2015
Urban areas: 50km/h ; National roads: 100km/h; Motorways:130km/h (advisable)	Urban areas: 50km/h; National roads: 90km/h; 4-lane road: 110km/h; Motorways :130km/h – 110km/h (wet weather)
Shifting traffic strategy: reduce the road space in favour of PT and optimizing it for commercial transport	Redistributing public space for active mobility Sources: PUMS 2015
Development of E-mobile offer and improvement of the integration with other means of transport	PUMS : Extend the range of services shared to reduce the number of car owners (parking)
Transport Development Plan Additionnal public transport connections	Live within 500 meters of a subway station or a commuter train line (From 30,5% to 41,6%) Sources: PUMS 2015
Munich's town planning commission cooperates with MWG to improve continuously the quality and extend the services to face the growth of the city (MVG)	Improvement waiting times and service speed Sources: PUMS 2015
MVG as the overall service provider for multimodal transport Source: Multimodal transport systems Objectives – strategies – projects 2014	Open-source multi-modal travel information (SUPERHUB) Existing PT multimodal ticket (Urban Ticket) Sources: ATM
Expansion of the bicycle network to 1400 km (500 km of main routes; 500 km of subsidiary routes; 400 km distribution network)	From 120 km in 2010 to 160 km in 2013 with further cycle lanes to be added in 2015 (extension from 9% of the urban road network to 25%) Sources: PUMS 2015; sootfreecities
Highly promoted by the city (Bicycle Masterplan 2009), Sources:	Improving the bike share service Sources: PUMS 2015
Highly promoted by the city Sources: Transport Development Plan	Extending pedestrian zones Sources: PUMS 2015; sootfreecities

Sources: Urban Access Regulation in Europe, official website city of Munich, Transport Development Plan, Masterplan „Bicycle Traffic in Munich", Inzell

TAXATION FINANCE

	BRUSSELS
TOTAL TAX REVENUE 2015	**4.1 billion euros**
BIGGEST SPENDING (SHARE)	**23.5% spent on mobility**
MOBILITY BUDGET	**Mobility budget 964.5M**
ENVIRONMENT TAX IMPACT	On the table: Future tax for polluting diesel vehicles, Company car tax is based on CO2 emissions challenged. Electric and plugin hybrid (<50g CO2/km) vehicles are exempt from registration tax; Incentives for electric and hydrogen powered cars (0g CO2/km) The government of the region is in favor of km taxation
SPLIT	**667M** 64% grant public transport **19M** 2% port and canal **41M** 4% water policies **308M** 30% Bruxelles Mobilité activities 3% Mobility Policies 9% investments and maintenance of metro infrastructure 2% program AVANTI 5% regional roads maintenance 5% roads maintenance 3% maintenance of the tunnels 1% taxi 2% other

DIFFERENT ECOSYSTEMS



Financial flux scheme -key revenues and expenses

*the traffic security is fed by road security federal fines and retributions

source: adaptation after (PWC 2011), annual reports 2015 STIB, PARKING BRUSELS INTERPARKING BUDGET des recettes et des dépenses, pour l'année budgétaire 2016 EXPOSE GENERAL

MUNICH

6.8 billion euros
(35% business tax, 17.8% income tax)

24% spent on education and sport (biggest share)

9% OF THE INVESTMENT BUDGET spent on mobility

Annual circulation tax for cars registered as from 1 July 2009 is based on CO2 emissions Electric vehicles are exempt from the annual circulation tax (10 years)

822.2M (2015-2019) investments construction metro infrastructure

413.9M investments for Munchen infrastructure (from total costs 1252.8M related to 2015-2019 investments in municipal federal and national roads, which includes infrastructure outside Munich ownership, traffic management, mobility plans, traffic safety and 829M invested in the Munich ring)
22M euro "Munich eMobil" provides for commercial traffic: any electric vehicle (2,3 or 4 wheel) receives 1000 euros for the old combustion engine car and 500 euros if he charges with green energy
The city plans 100 EV charging- 200 terminals for 2017
4M "Smarter Together

MILAN

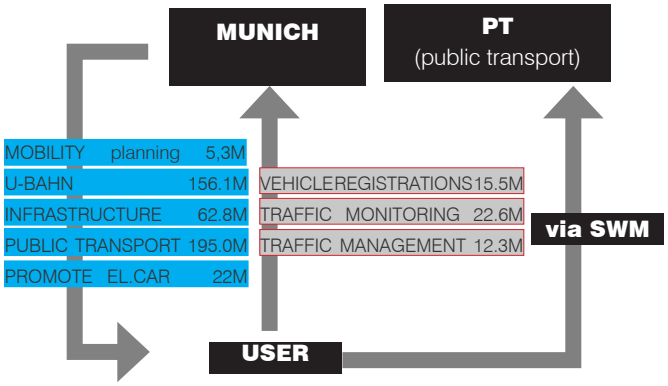
Total tax revenue in 2015 is 7.8 billion euros

27% spent on mobility

NoC02 Taxation
EV are exempt from the annual circulation tax (5 years)
2012: Urban congestion taxation (to increase speed PT; decrease CO2 emission; decrease the number of accidents)

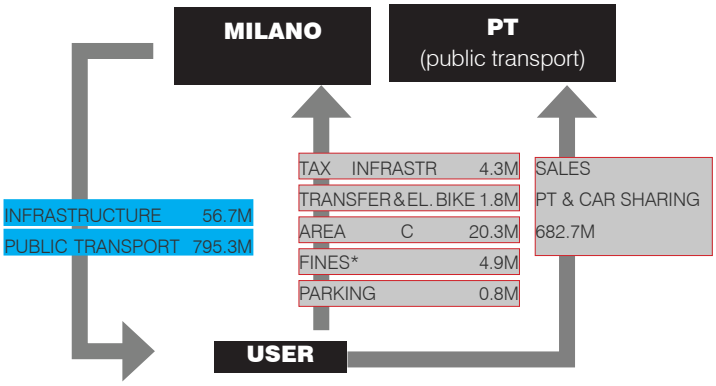
The resources of the Area C 2012 (in total, over 20 million 300 thousand euro).

Thanks to the Area C, 13M euro were allocated for the public transport: metros, trams and buses and for the implementation of the second phase of the bike sharing in Milan
From interchange parking Comasina 3 million for zones 30, up to 20 million to create and upgrade lanes and bike paths.
Source:("Bilancio Economico")



Financial flux scheme -key revenues and expenses

Note: No information was found on parking revenues
SOURCE: (Redaktion, "Schwerpunkt Straßen- Und Brückenbau (MIP)") https://www.muenchen.de/rathaus/dam/jcr...421d.../Allgemeiner_Teil.pdf



Financial flux scheme -key revenues and expenses

http://mediagallery.comune.milano.it/cdm/objects/changeme:53765/datastreams/dataStream9848167034495493/content?pgpath=/SA_SiteContent/SEGUI_AMMINISTRAZIONE/GOVERNO/Commissioni_consiliari/02_Bilancio_Patrimonio_Tributi

5 STAKEHOLDERS

ACKNOWLEDGEMENT

In the present paper, mobility stakeholders stand for decision-makers, transport and infrastructure operators, traffic management experts, academics.

During the study, stakeholders' opinion has been continuously checked against our assumptions on mobility field changes. Reports, documents, formal and informal interviews and conferences, used in the present study, helped to grasp the complexity of the mobility environment. This approach allowed us to draw insights beyond official strategies as well as assess difficulties linked to the processes behind decisions and results. The list of documents, interviews and conferences is in the bibliography.

WHAT SHAREHOLDERS SAY ABOUT THE MOBILITY IN BRUSSELS

Discussions around the mobility scope push forward ideas about various visions authorities and operators follow when they deal with mobility. During a conference in spring 2016 in Brussels (Reed)– the Transport for London central public transport operator shared its objectives to the audience: "**keep the city working and growing, make life better, meet ahead urbanisation and growing population**". The same enthusiasm is not present in Brussels.

Here, stakeholders talk about **governance problems, political dissonance** between the different decision levels and administrative entities. According to some stakeholders, **ideological** debates are replacing a problem-solving approach.

Other actors identify structural problems that have added complexity to the situation over the years. For instance, the current model of mobility system is a result of subsidised schemes that are difficult to change. Supply and demand are tributary to this system. Education, work and urban policies are not taken into consideration, and so on.

Commuters are often mentioned as an issue for the mobility and financing problems. There is a tendency to believe that Brussels has more commuters than other cities.

In the last years, proximity and densification concepts gainED a lot of political terrain in Brussels region.

Thanks to the revival of the circular economy concept, some stakeholders are starting to perceive a link between sustainability and economic developement.

WHAT SHAREHOLDERS SAY ABOUT THE MOBILITY IN MUNICH

In recent years, technology re-shaped the mobility ecosystem. Stakeholders, including those in the City of Munich, public transport companies, private companies and universities, are conscious about the implication, although they can't predict the exact outcome of this on-going innovation trend. They realise they have to anticipate change, keep the pace with it and be ready to capture the value create in real-time.Today, policies are not synchronised with the technological breakthroughs, while the user requires more and more real-time, customised, credible and meaningful solutions.

Although Munich **mobility policies are built on partnership**, stakeholders say there is a **need for more collaboration** between industries, public-private actors at aggregate level - today, collaboration should be extended to all industries.

Traffic management is driven by connectivity, data management processing, and more and more application development.

Administrative boundaries are a constraint for solving the commuters'problematic. However, **commuters are considered part and parcel of the municipality value creation.**

Growing population increases real estate prices in the centre of Munich and generate more pressure on Mobility. **Densification might be a problem for the quality of the city.** Accessibility has a price on the market!

In Munich ecology and economy go together for several years. Milano wants to leverage mobility on shared economy.

Two main ideas, often mentioned by the stakeholders are the need to set the customer convenience as a common goal and the necessity to change the mobility paradigm.

First, the user should be at the centre of the projects. This will unify stakeholders' goals, solve governance problems and optimise design. Secondly, the change of paradigm would tackle mobility from an intermodal perspective to be developed rather than a constraint. To write a roadmap based on these two fundamentals, "user-centric" and "intermodal", the study presents stakeholder's opinion on the six criteria, identified in the previous chapters: infrastructure, transport, data, intermodal, regulation, financing.

INFRASTRUCTURE BRUSSELS

The infrastructure in Brussels is saturated. Space is limited and every actor of the road is trying to enlarge its share.

The infrastructure in Brussels has yet to be completed such as the extension of the metro, tramway and the train. Some operators explained that their success for increasing their offer lies in additional infrastructure. The future RER is tributary to upfront parking system (P&R and B&R) and their ability to feed the trains' capacity efficiently. The RER is using existing infrastructure. Some lines are not yet provided with four tracks. This creates difficulties to accommodates the urban speed train along with regular trains and creates a terminus issue.

Additional infrastructures such as a parking, roads, etc. involves several stakeholders. That makes work coherently on an integrated offer difficult for the operators. Therefore user's mobility value chain is disrupted across different incoherent offers.

Another question is the efficient use of the existent infrastructure capacity.

INFRASTRUCTURE MUNICH

Milan and Munich have strong infrastructure. Although extension is foreseen for different segments, efficiency of existent assets is the word of the day. Active mobility infrastructure is also very developed and separated from the car traffic.

Main public policies in parking management were done in partnership with the automotive sector. Today both are looking together for the future.

Munich has an old history of improvements and centralised traffic data management. Therefore discussions around infrastructure are not part of the main topic.

Optimisation of infrastructure through traffic management such as speed adaptation or limitation is one of the first steps to take. In order to solve the congestion and environment problem.

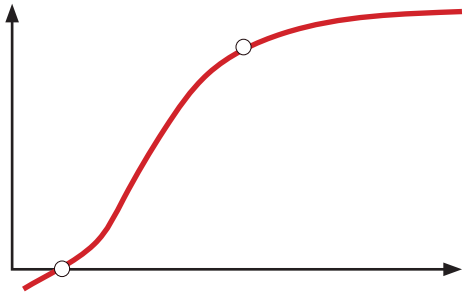
Redesigning streets raise concerns about increasing congestion. People are afraid that bottleneck may arise creating congestion and pollution. However, city works together with the automotive industry to test pedestrian strategy within the city

Pressured by fast changes, some public organisation integrates those changes in their structure and operation, other add new models within their business portfolio. However, all encounter mature business challenges such as inertia and time delays related to change management processes.

TRANSPORTATION BRUSSELS

MULTIMODAL PROFILE: Stakeholders agree on a profile change: “always on” workers, people are not anymore mo-no-mode. They are flexible, on-demand, collaborative and co-working profiles. People became mobile which means that several activities are done while moving.

There is a growing MULTIMODAL offer, outside tradition-al ones. New modes offer solutions for problems such as congestion the lack of parking place, real-time need. Public transport operators are aware of the paradigm changes in the value proposal of transportation mode: public transport at its beginning enabled people to access work and jobs, recently it was considered as a tool to de-congest the cities and today is confronted with the growing of substitute services. Although public transport has seen an increase in usage, the offer has to be improved and completed especially for the last mile, e.g. the bike share system. There is a high acceptability of the “unified experience” concept and what a veritable “multimodal ticket” would bring. However, some stakeholders feel their profitability menaced, once the clients data based will be shared with other companies. The problem from public operators perspective is that private modes are often competing rather than comple-menting (e.g.Germany and Brussels, stakeholders talk about the private buses which compete the train’s subsidised offer). Similarly, not all modes are easy to combine. Make the transit from a mass transportation system to a car sharing system which replies to a customised solution is a difficult task. Other stakeholders claim that car sharing should be tackled from the mobility transit chain perspective, in order to reinforce public transport. Free floating on small areas is likely to become a competitor for active mobility. (walk and bike)



start-up/ new business models vs. mature transport modes

TRANSPORTATION MUNICH

Young urban generation increases the use of multimodality, but car didn’t lose the meaning. Family changes, children, divorces, etc., are often calling for an extended usage of car.

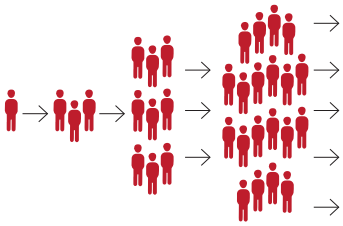
The automotive industry is focusing on the shared economy as a new business model to test.

- Free floating has exponentially increased the usage of car-sharing
- Car sharing reduce the number of parking, and local emission, but can cannibalise the public transport, too
- The strategies today should focus on the last mile key issue in order to address customer need for convenience
- Acceptable travel time should become a planning tool for transportation
- Marketing and advertising including communication are crucial tools to transform user in an efficient operator

Public authorities are aware of the challenges the transportation is experiencing. They try to have a value chain approach and integrate new modes in their operation. They work actively with car sharing companies. They monitor the impact of the car sharing and flee-floating. Regarding the bike sharing program, their attention is focused on operational issues such as how to solve the supply bicycles in real-time and be sure all the users are served.

DATA BRUSSELS

Data usage has the potential to improve system's efficiency. However, the infrastructure needed to gather, process and integrate user's information is not yet available.
Identify and understand user's movement patterns are difficult for the Brussels' public transport. There is no ticket validation procedure for trips and it is hard to link this information with the user's profile. Interaction and gathering data from the user is a privacy issue for authorities, while social media and platforms such as Facebook, Waze, etc., gather user's information without too much concern. *"The content that you share to all users is neither private nor confidential and you should not have any expectation of privacy with respect to it" ("Free Community-Based Mapping, Traffic & Navigation App").*
Widely accepted by the users, personal information became third parties property. Often driven by viral networking, these new entities are becoming powerful by the establishment of direct contacts with the customers.
Google is an example that has both data and direct contact with the customer. It is not a surprise that stakeholders often see such a system as a threat to their business. However, there is no idea about common strategies based on partnership in order to tackle these new players. Only the car industry, is investing in platforms based on collaboration.



Following De Croo law, Open data in Brussels is available but not yet in real-time for all the services. This is the case for the railway schedule. There are still security issues that have to be solved in order to transfer data outside organisations. Open data is accessible for third parties on an open licence basis. Encourage the use of the open data to develop application is very important for some operators. It gives the possibilities to develop solutions traditional operators do not have capabilities for. The application and platform development ecosystem is very competitive. Therefore, results are high quality, while innovative applications and services are able to capture the long tail- customers for whom tailor made solutions are usually too expensive to be provided by traditional operators. An application for people affected by colour blindness is a good example. Data sharing should be geared by management and communication/ what people can do with/ re-route, re-time, reduce, and revise travel.

DATA MUNICH

Public data is difficult to get and is bigger.
Private data is an issue which stops the public authorities to bring effective solutions to mobility. SINGLE ACCESS is an issue.

Big data and smart city concept need infrastructure for connectivity.

The city together with other stakeholders such as the university they are trying to monitor users and assess the impact of route planner.

They would like to know what data is necessary for a congestion assessment tool? "How", "which" and "why" are necessary question when collecting data.

Because communication between stakeholders is difficult, data can help understand the impact of each mode on the congestion.

The city would like to use the data to create its own application. Being directly involved together with the public operators, they are looking very carefully at these apects.

INTERMODAL BRUSSELS

Life pattern is driving inter-modality.

For user's convenience, integrating a unique pricing model would be beneficial. But according to several stakeholders, there is a counterintuitive idea that ticket integration would negatively impact the bottom line. Sharing databases is seen as reducing the power of the operator. The intermodal card in Brussels is a collection of subscription but prices are not integrated and MOBIB card can't be charged (although there are some formula train, tram bus). A multi-modal ticket involves a change in business model and revenue stream. Some operators have a pay per km system while other have a pay per trip. It takes a long time to negotiate interconnected offers.

Everybody thinks about their customers, customer retention and how to get the most of it. Operators think only about their own offer to the customer and not within the user's entire mobility chain. How to transfer the money and to account all the operations? In Swiss, there is an independent body which distributes the revenue from the inter/multimodal offer. Intermodal requires operations correlations between modes. This can be done by having unique objectives, such as: taking the mass out of the transit make the best use of the easiest path understand feasibility and customer expectation to plan a less crowded route. The multimodal choice should integrate saturation of the network (real-time) in the route planning. Commuters in Brussels are long distance commuters and this makes the difference with other cities. Change management is an important aspect in dealing with commuters. Change behaviour (such as coming 15 minutes earlier at work) can have a big impact.

5% of desynchronization is enough to solve congestion issues *reduce, and revise travel.* Advertising and real-time information can help the users to actively participate to the congestion solution by changing their schedule. De-synchronisation means to find the optimal trade-off between money and time.

INTERMODAL MUNICH

Some stakeholders consider that intermodal travel behaviour requires a specific individual pre-condition linked to socio-economic and demographic characteristics.

There is little known of people using new modes and about their risk profile.

Integrating acceptable travel time in the mobility planning is an important issue. Stakeholders have different points of reference, but all agree that the congestion curve exceeds user's acceptability at rush hours. Different approach vis-à-vis acceptable travel time:

- if traffic longer 1.5 than by car, people won't change the mode
- more than 2 switches can deter the user to become intermodal
- if travel time takes 10-15 minutes more with an extra mode, the user won't change the mode
- 60-70 minutes per day is the total accepted time for mobility

Acceptable travel time in the travel and destination decision-making process is a function of the utility and time.

Another issue is raised about the algorithms. Often there is no compatibility between the systems so data is not interchangeable.

REGULATIONS BRUSSELS

Regulations lie behind the patterns of movement. Regulation cannot cope with the fast changes. Innovation goes faster than the politicians. Regulation should be developed in a lean way, at the same time new infrastructure is developed (e.g. car sharing). Some stakeholders are claiming that deregulation has the potential to push innovation and preserve Europe's competitive position in a changing world.

TAX REGULATIONS BRUSSELS

Road charge introduces flexibility, but it is not always accepted by the society. The political and social context are important drivers that should be considered when looking for taxation solutions. Although technology challenges tax system, technology can't be stopped, because people use it. Therefore regulation should be flexible enough

Incentivise rather than punish the driver: opposing policies related to charging schemes.

FINANCING AND THE REVENUE STREAM BRUSSELS

When talking about the financing fluxes, one of the issues mentioned by most of the stakeholders is linked to the commuters.

Benefits from public parking are not leveraged for building meaningful projects.

REGULATIONS MUNICH

Regulations are considered very important. It seems that public stakeholders hope to counter the new mobility movement by creating barriers to enter through regulation. Once again, other stakeholders realise that this strategy is not enough anymore and praise for a de-regulation.

TAX REGULATIONS MUNICH

Munich and Milano have less difficulties to tackle with taxes. However, cultural, social and economic conditions are playing an important role. Drastic measures such as in Milano can be applied when a situation becomes extreme.

FINANCING AND THE REVENUE MUNICH

Commuters are in the middle of discussion. However, Milan and Munich are counterbalancing these issues with the value created by commuters.

Milan is using the parking revenue to support active mobility.

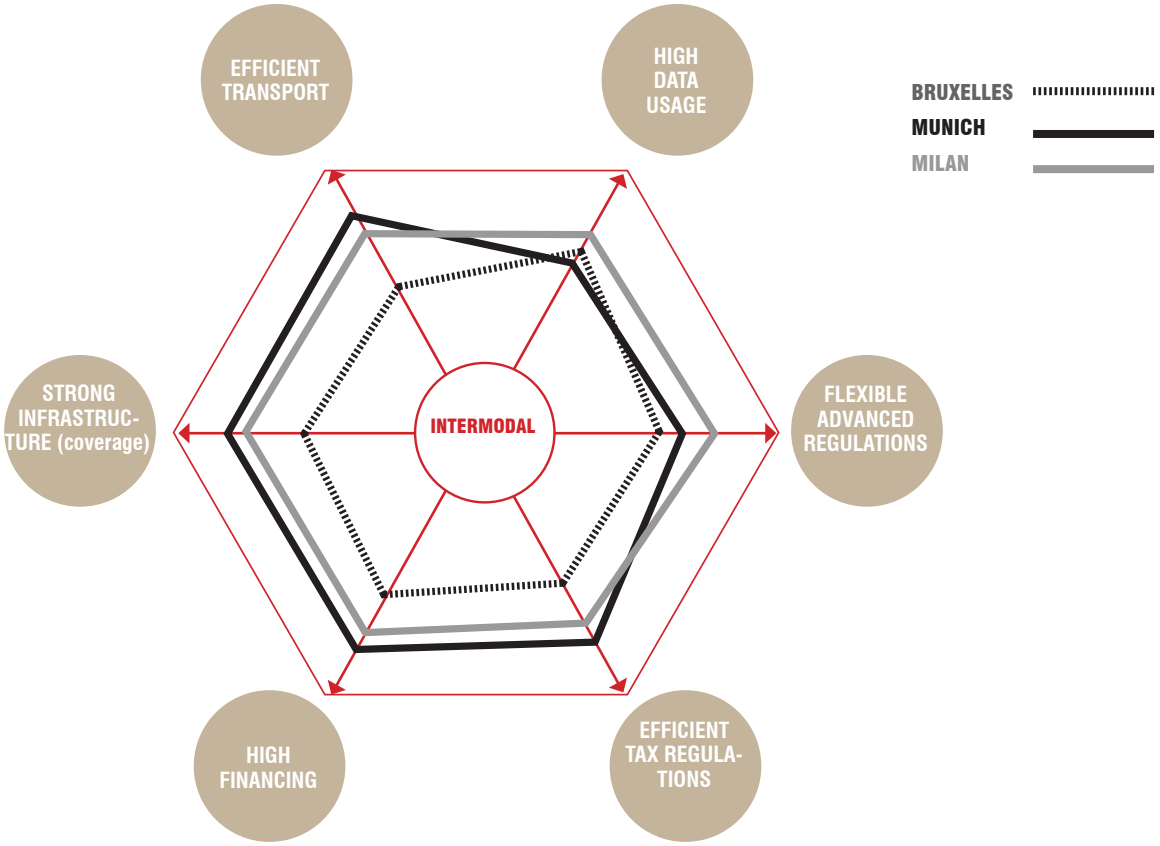
MAIN CONCLUSIONS

	WHAT STAKEHOLDERS SAY IN BRUSSELS	WHAT STAKEHOLDERS SAY IN MUNICH AND MILAN
GOVERNANCE	In Brussels, stakeholders talk about **governance problems, political dissonance** between the different decision levels and administrative entities. Structural problems that have added complexity to the situation: education, work and urban policies are not fully integrated in the mobility discourse. Commuters are often mentioned as an issue for the mobility and financing problems. There is a tendency to believe that Brussels has more commuters than other cities. Proximity and densification as a tool to solve congestion, became important.	Stakeholders, public transport companies, private companies and universities realise that policies are not synchronised with the technological breakthroughs, They have to anticipate the change, keep the pace with it and be ready to capture the value create in real-time. Although in Munich **mobility policies are built on partnership**, stakeholders say there is a **need for more collaboration** between industries, public-private actors In Munich, ecology and economy go together. Quality, users and citizen are central. **Commuters are part of the municipality value creation.**
INFRASTRUCTURE	The infrastructure in Brussels is saturated. Space is limited and every actor of the road is trying to enlarge its share. The infrastructure in Brussels has yet to be completed. Building infrastructures involves several stakeholders and ends up in a 0 sum game result. A lot of stakeholders doubt about the efficient use of the existent infrastructure capacity.	Milan and Munich have strong infrastructure. Although extension is foreseen for different segments, efficiency of existent assets is the word of the day. Optimisation of infrastructure through traffic management. Active mobility infrastructure is very developed separated and safe. City works together with the automotive industry to test pedestrian strategy within the city
MULTIMODE (TRANSPORTS)	Stakeholders agree on a profile change: “always on” workers, people are not anymore mono-mode. There is a growing MULTIMODAL offer, outside traditional ones, which implies changes in the value proposal of transportation mode. How to integrate a user mobility chain approach and a “multimodal ticket” if private modes are often competing rather than complementing the public ones. Not all modes are easy to combine.	Young urban generation increases the use of multi-modality, but car didn’t lose the meaning. Public authorities are aware of the challenges the transportation is experiencing. They try to have a value chain approach and integrate new modes in their operation. They work actively with car sharing companies. They monitor the impact of the car sharing and flee-floating and look for optimisation.

DATA	Data usage has the potential to improve system's efficiency. However, the infrastructure needed to gather, process and integrate user's information is not yet available. . Inentify and understand user's movement patterns are difficult data and direct contact with the customer are the key issues, but data is a privacy problem to the public entities	Public data is difficult to get and is bigger. Private data is an issue which stops the public authorities to bring effective solutions to mobility. SINGLE ACCESS is an issue. They would like to know what data is necessary for a congestion assessment tool: "How", "which" and "why" are necessary question when collecting data. Data allows to understand the impact of each mode on the congestion
INTERMODAL	According to several stakeholders, there is a counterintuitive idea that ticket integration would negatively impact the bottom line. Sharing databases is seen as reducing the power of the operator. A multi-modal ticket involves a change in business model and revenue stream	Some stakeholders consider that intermodal travel behaviour requires a specific individual pre-condition linked to socio-economic and demographic characteristics. There is little known of people using new modes and about their risk profile. Integrating acceptable travel time in the mobility planning is an important issue.
REGULATIONS	Regulations lie behind the patterns of movement. Regulation cannot cope with the fast changes. Innovation goes faster than the politicians. Regulation should be developed in a lean way, at the same time new infrastructure is developed (e.g. car sharing). Some stakeholders are claiming that deregulation has the potential to push innovation	Regulations are considered very important. It seems that public stakeholders hope to counter the new mobility movement by creating barriers to enter through regulation. Once again, other stakeholders realise that this strategy is not enough anymore and praise for a de-regulation.
TAXATION	Road charge introduces flexibility, but it is not always accepted by the society. The political and social context are important drivers that should be considered when looking for taxation solutions. Although technology challenges tax system, technology can't be stopped, because people use it. Therefore regulation should be flexible enough	Munich and Milano have less difficulties to tackle with taxes. However, cultural, social and economic conditions are playing an important role. Drastic measures such as in Milano can be applied when a situation becomes extreme.
FINANCE	When talking about the financing fluxes, one of the issues mentioned by most of the stakeholders is linked to the commuters. Benefits from public parking are not leveraged for building meaningful projects.	Commuters are in the middle of discussion. However, Milan and Munich are counterbalancing these issues with the value created by commuters.

6 CONCLUSION

Inter-modality is a mix of solutions. Comparing practices in Brussels, Munich and Milano gives us an idea about the importance of the processes and partnership behind results. The potential to apply best practices successfully lies in the capacity to understand the context, use existent resources and associate stakeholders to create valuable options and solutions that meet the user's need. Ongoing shifts in the mobility concepts, infrastructure and operators, organisational ecosystems, power balances and user's behaviour are still important key issues that influence the application of an optimised, efficient and effective intermodal solution. A best practice cannot simply be applied or imposed; technology has increased user's power. The public can easily sanction inefficiencies and incompatibilities. Centralised and voluntaristic plans must become iterative, communication-based programs, focusing on clear objectives and tailor-made solutions for cities and citizens. Although during meetings, conferences or within political discourses, cities are presented as having specific mobility problems, the three cities, Brussels, Munich and Milan are in the top 10 cities and not surprisingly are confronted with similar problems. As a general observation, strategies on paper have similar long-term goals. Operations seem to be the major difference and this is reflected in the results.



INFRASTRUCTURE	WEAK COVERAGE	UNIFORM DISTRIBUTED INTO THE TERRITORY
TRANSPORT	LOW TRANSIT	NEW OFFERS CORELATION
DATA	LOW NUMBER OF MOBILE APPLICATION	HIGH NUMBER OF APPLICATION DEVELOPPEMENT
INTERMODAL	SILOS	PARTNERSHIP
REGULATIONS	CONSTRAINTS	FLEXIBLE REGULATION
TAXATION	UNBALANCED	FOCUSED ON INCOME EXPENSES/ PROFITABILITY GEARING
FINANCE	HIGH DEBT	LOW DEBT HIGH INVESTMENT LOW INVEST IN PT

VISION AND STRATEGIES

CUSTOMER CENTRIC INTEGRATION MODEL

In order to respond to customers needs and increase their participation in solving mobility problem, efficient integrative solutions should always be designed from the user perspective.

Creating a context that encourages partnership and association of stakeholders.

In the regionalisation context, this is a difficult task, but different solutions should be tested. Local public transport might increase its market share, also serving commuters; and policies can enable partnership development. Deregulation of some gearing tools should be considered. Partnerships should look forward to competencies and added value from other industries and fields, rather than traditional one.

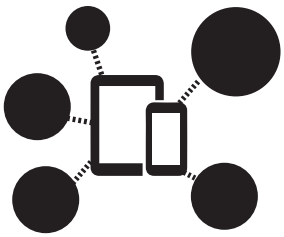
Sharing economy: take advantage of the current trend of sharing economy in order to create more value for mobility users. Sharing economy can bring together stakeholders and provide services that cover users needs. Giving more value to the user will increase the value of services and products for all stakeholders.

Increase revenue and user experience

Other services should be integrated along the motion experience. Not only more attractive to passengers, movement would provide productive time.

Use user experience in real-time to improve service and accessibility.

Open data encourage platform development: encourage developers to bring integrated solutions. Competition will push innovation forward and create different systems for different user's segments.

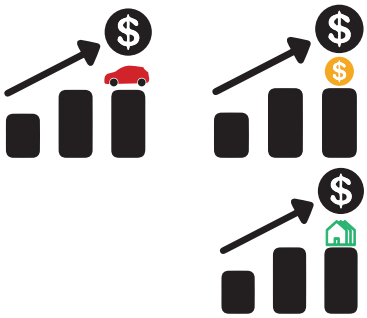


Structural improvements

Education is a key issue that help to cope with commuting as a phenomenon. Empower people by providing qualitative basic education.

Solving school infrastructure problems Encourage spatial proximity, by continuously testing results and adjusting solution.

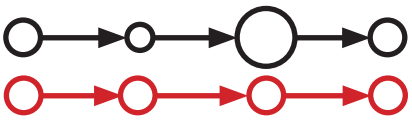
New tax policy: from work flexibility to company car policy there are different measures that can improve mobility without punishing the citizen. Maintain a range of choices for the road users, while working towards a better mobility. Build change focusing on trades-off.



Optimisation

Solving bottlenecks before building new infrastructure. As infrastructure in Brussels is not uniformly distributed in the territory, there is a need of prioritisation of intervention.

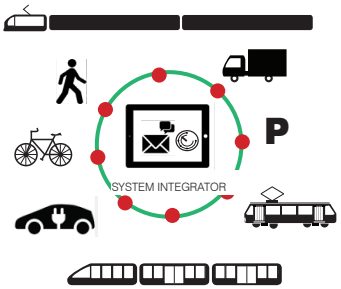
As special attention should be directed towards the use of unused assets



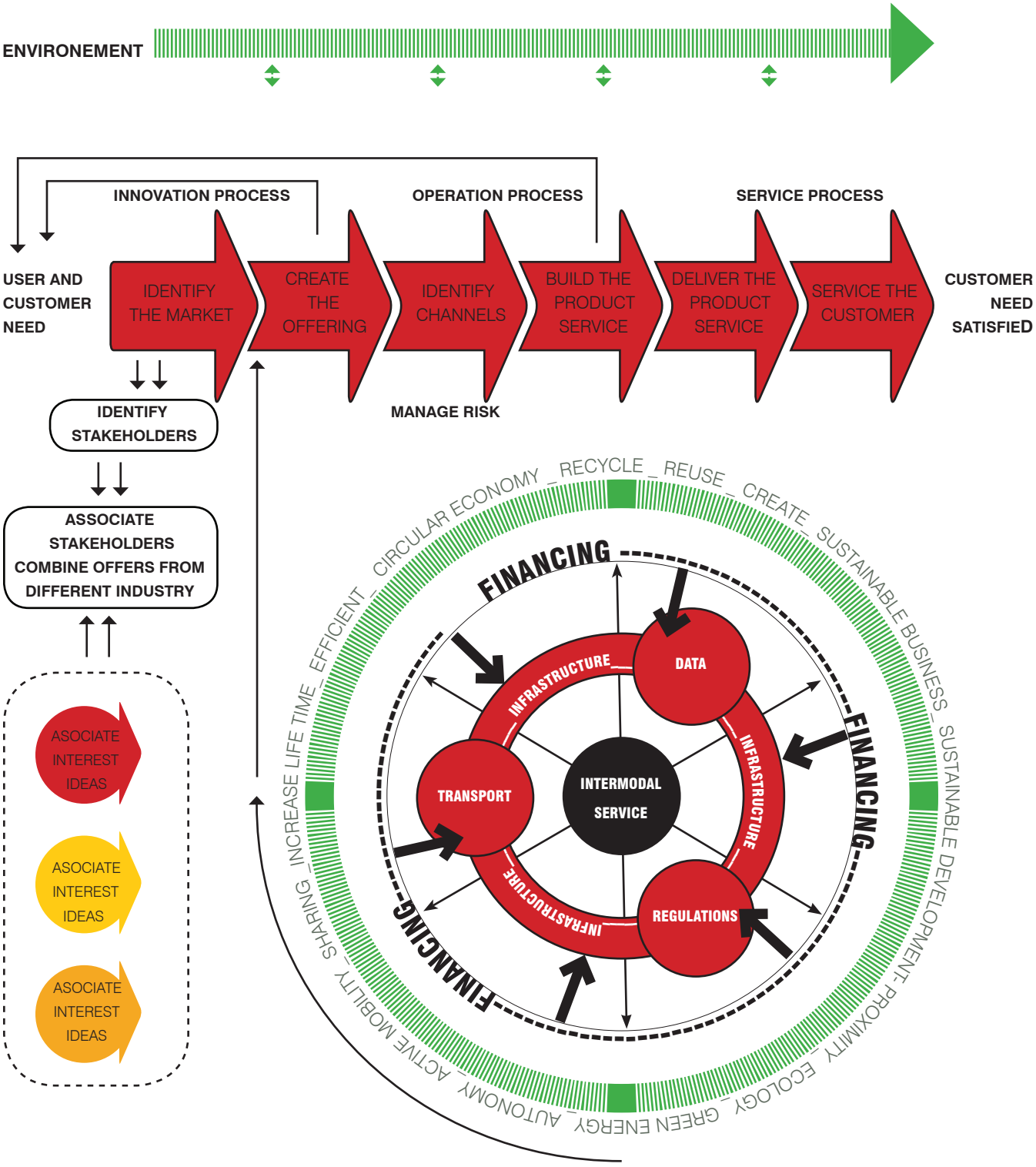
physical fluidity

Inter-modality

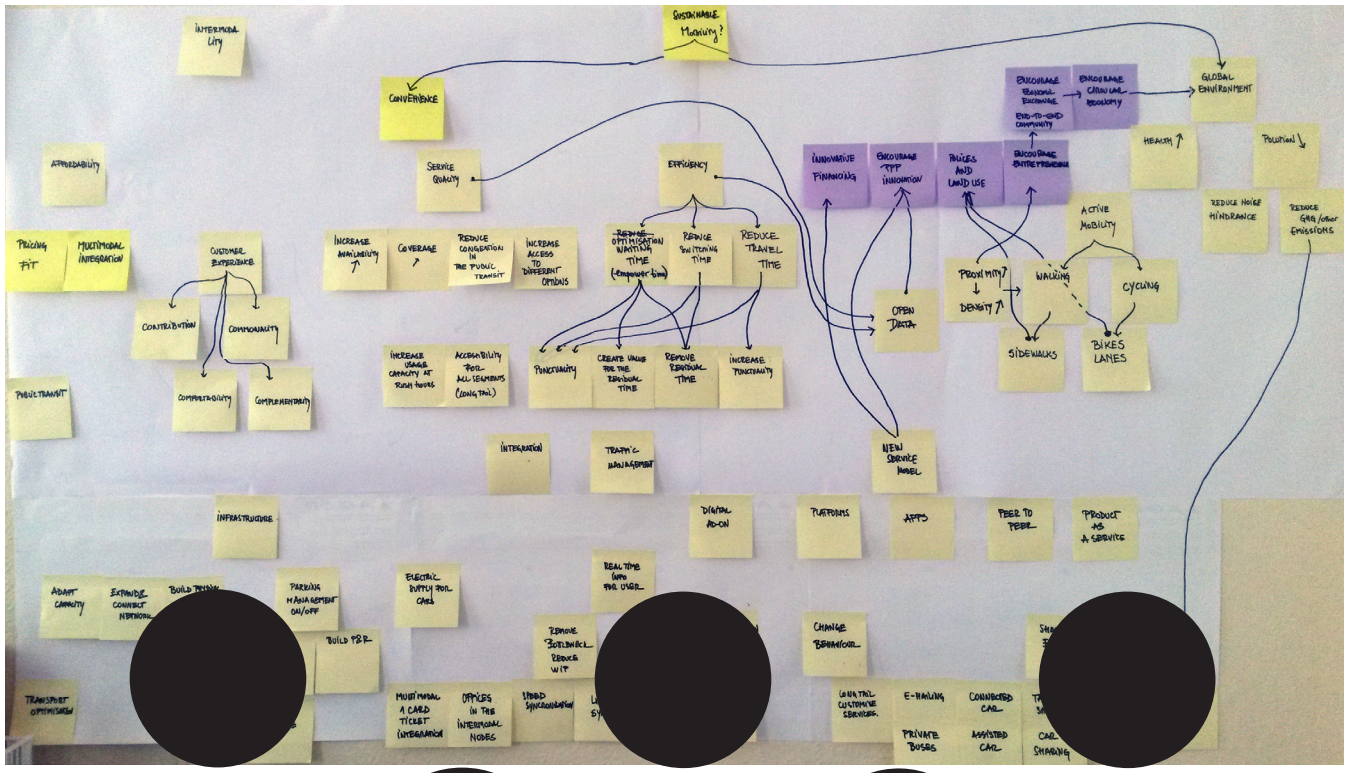
Inter-modality needs good infrastructure, transport, data, intermodal, regulation, financing.

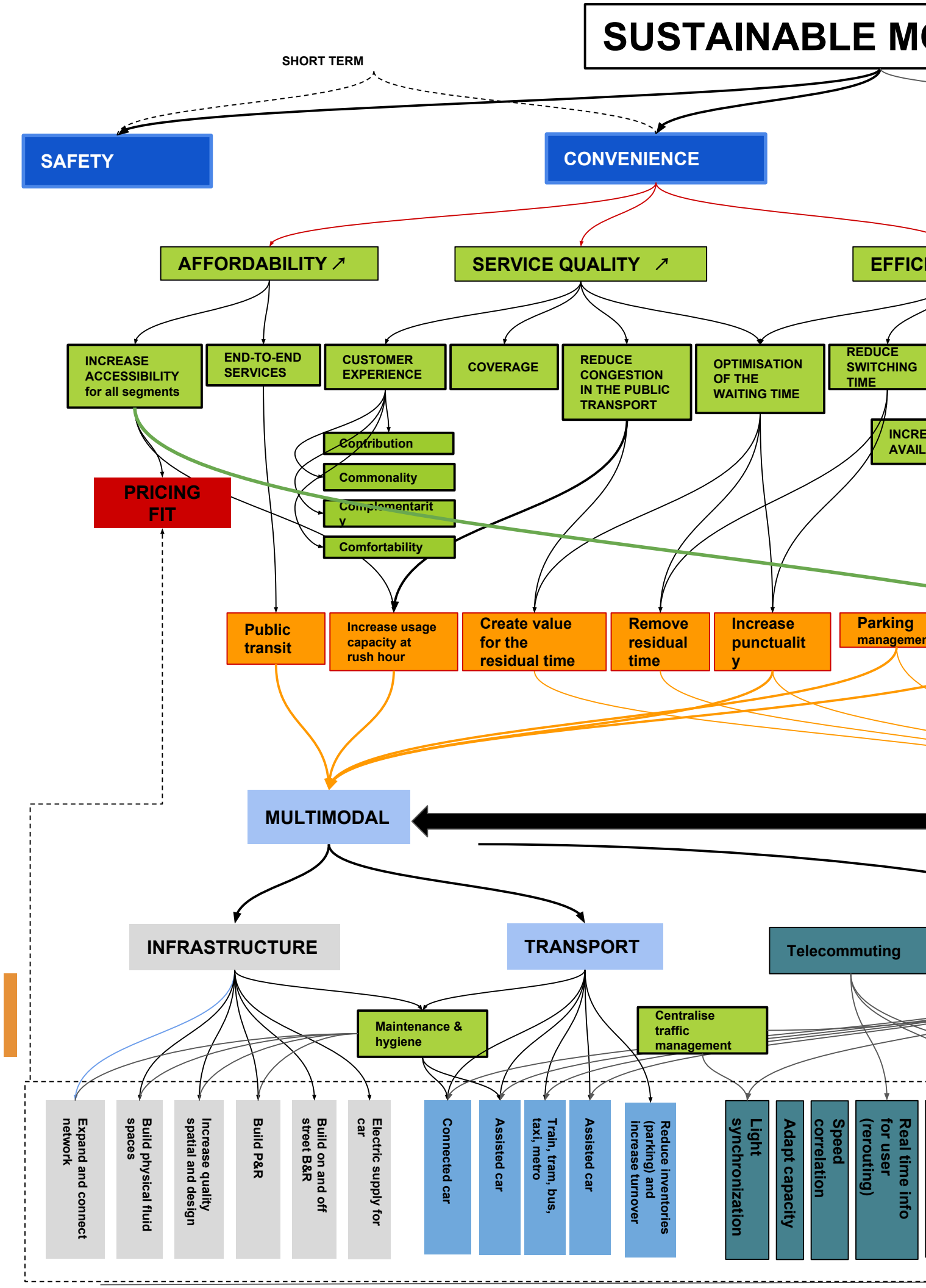


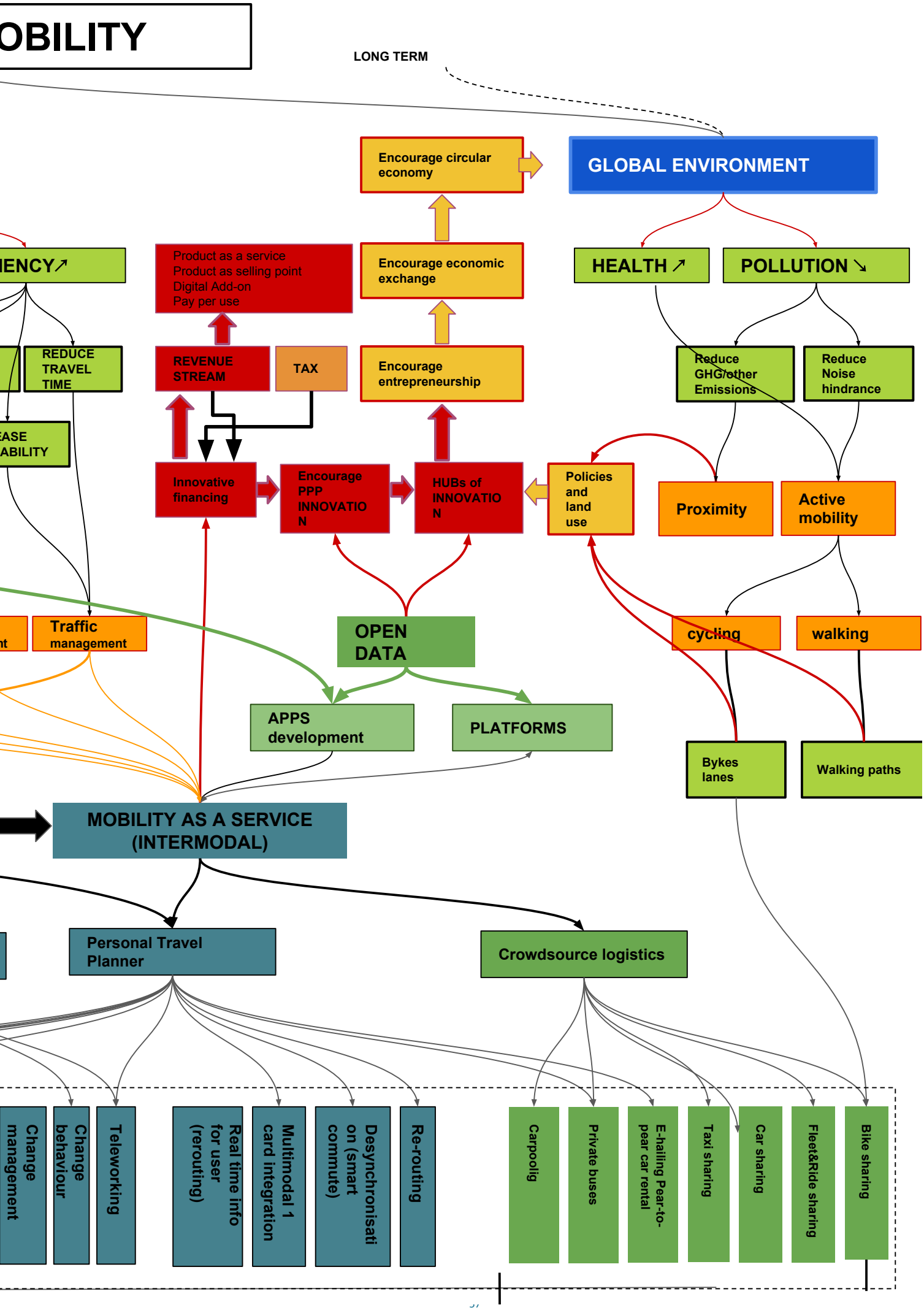
VALUE CHAIN APPROACH



BUILDING A MAP TOGETHER WITH THE STAKEHOLDERS




SUSTAINABLE M
SHORT TERM
SAFETY
CONVENIENCE
AFFORDABILITY ↗
SERVICE QUALITY ↗
EFFIC
INCREASE ACCESSIBILITY for all segments
END-TO-END SERVICES
CUSTOMER EXPERIENCE
COVERAGE
REDUCE CONGESTION IN THE PUBLIC TRANSPORT
OPTIMISATION OF THE WAITING TIME
REDUCE SWITCHING TIME
INCRE AVAIL
Contribution
Commonality
Complementarit y
Comfortability
PRICING FIT
Public transit
Increase usage capacity at rush hour
Create value for the residual time
Remove residual time
Increase punctualit y
Parking managemer
MULTIMODAL
INFRASTRUCTURE
TRANSPORT
Telecommuting
Maintenance & hygiene
Centralise traffic management
Expand and connect network
Build physical fluid spaces
Increase quality spatial and design
Build P&R
Build on and off street B&R
Electric supply for car
Connected car
Assisted car
Train, tram, bus, taxi, metro
Assisted car
Reduce inventories (parking) and increase turnover
Light synchronization
Adapt capacity
Speed correlation
Real time info for user (rerouting)


OBILITY
LONG TERM
Encourage circular economy
GLOBAL ENVIRONMENT
ENCY↗
Product as a service
Product as selling point
Digital Add-on
Pay per use
Encourage economic exchange
HEALTH ↗
POLLUTION ↘
REDUCE TRAVEL TIME
REVENUE STREAM
TAX
Encourage entrepreneurship
Reduce GHG/other Emissions
Reduce Noise hindrance
EASE ABILITY
Innovative financing
Encourage PPP INNOVATIO N
HUBs of INNOVATIO N
Policies and land use
Proximity
Active mobility
Traffic management
OPEN DATA
cycling
walking
APPS development
PLATFORMS
Bykes lanes
Walking paths
MOBILITY AS A SERVICE (INTERMODAL)
Personal Travel Planner
Crowdsource logistics
Change management
Change behaviour
Teleworking
Real time info for user (rerouting)
Multimodal 1 card integration
Desynchronisation (smart commute)
Re-routing
Carpoolig
Private buses
E-hailing Pear-to-pear car rental
Taxi sharing
Car sharing
Fleet&Ride sharing
Bike sharing

POTENTIAL PROJECTS- TOWARDS AN OPERATIONAL APPROACH

	OBJECTIVES
GOVERNANCE	Look forward for creation an operational authority based on an economic approach rather than politic
INFRASTRUCTURE	Priorities project for a balanced coverage of public transportation
TRANSPORT	Correlate offers
DATA	Encourage the “app” development
INTERMODAL	Find a common denominator for all traffic modes
REGULATIONS	Revision of the mobility strategic and regulatory plan” IRIS 2” with a focus on flexibility, customer centric integration and the integration of new technologies based on the usage of the data.
TAXATION	New taxation system based on trades-off
FINANCE	Profitability as a common goal of all operators (based on a synergetic approach)

POTENTIAL PROJECTS

Implementation of a project Create a public entity for the coordination of public transport modes and integartion of new private ones
Implementation of a project "Optimization of infrastructure by the increase of car-sharing services and the promotion of carpooling to commuters" with focus on user mobility chain. Implement upfront tests and monitoring to insure the efficiency
Implement a project: New business model and new customer acquisition **As an alternatives: decrease the number of operators in Brussels, by refining the business models of operators and customise the service according to the segments**
Implementation of a project to allowed creation of integrated platforms in a competitive and high qualitative standard way; "Open data as an integrated mobility service".
Implementation of a project "Establishment of an integrated pricing offer for public transport and shared services"
Implementation of a new regulatory/ mobility policy: The plan should integrate operational methodology by integrating policies that allows the testing of solution before implementation, MVP (Minimum Viable Product) approach in order to identify real time customer needs and behavior. **- Focusing on realistic measures** **- Set up priorities** **- Use data to choose only solutions that reply to the need and mobility chain of the user** **- Identify stakeholders and working groups for each action**
Implementation of a new tax legislation: Adapt the tax system to the new business models and revenue generation.
Implementation of a project: New business plan for transport public operators: capture the value according to segments and the mobility value chain and synergies created with other transport modes (shared, etc.,)

The traditional P&R concept should be re-contextulised as stakeholders are questioning its capacity to really solve mobility problems today.

7 CASE STUDY

The present report illustrates the application of a user based approach throughout a small case study.

Current situation

The administration intends to increase the Park and Ride (P&R, B&R) offer at the outskirts of the Brussels Region. This aims to complete the actual offer of 1590 parking places (7 parking) situated at the regional limit and the extra of 471 owned by the national railway company. It involves several projects, each in different advancement phase. Brussels regional agency for parking is in charge of the parking policies application.

There is a demand from car users for park and ride facilities, illustrated by the figure, section 3.3 and the IBM study 2015. As stipulated in the 2009 governmental agreement and several other official documents, the project is also present on the government's political agenda, with a strong motivation to build several off-line transit parking. According to the calculation made by Parking Brussels Agency, there is the possibility to build 10,000 parking places and capture 3 to 4% of the traffic entering to the city. The calculation combines the necessary capacity with the financial aspects and available space resources. It is based on the estimation of modal split statistics and the propensity of the commuters to use different modes related to the distance. It's a complex analysis, identifying flexible and routine activities within the travel chain of a generic commuter profile. It integrates measures in order to avoid counterproductive results, such as the shared use of the parking by the neighbourhood. Moreover, Parking Brussels Agency works to integrate digital solutions. Shared use of existent private parking is part of the strategy.

Analysis

Demand for park and ride (P&R) is often mentioned in the media; analyses and surveys prove the demand is there (IBM study). The present case study will try to tackle the future P&R offer from a customer centric and sustainable aspect;

The benchmarking with Milano and Munich reveals that Brussels region and its surroundings benefit from an important number of parking (19,000). The high numbers of operators, with their different visions, makes managing these spaces inconsistent. The railway company strategy (who owns most of the parking spaces) is to provide parking upfront to feed their transport mode (the future speed train). The Brussels region can provide park and ride at its outskirts, within the value chain, in order to rely the user to a public transport hub.

Stakeholders point that the calculation of the Region does not consider opportunity cost and financial risk related to pricing, multimodal offer and return on investment. The proximity to an intermodal spot dedicated to public transport is questioned by some, who see the car as a competitor of the collective transport offer. The risk that congestion is not mitigated by such a measure is also an important aspect. Not always a fast transport is available next to the P&R proposed by the city. Other remarks stress the increase of traffic generated by the P&R. None of the less, public authorities in Munich are saying: *P&R is not a solution anymore.*

Applying the user integrated approach

An efficient and sustainable P&R should be assessed from a multi/inter-modality approach and linked to a profound societal digital transformation. This mean that it is not enough to add some pieces, but rather that its design must start based on new premises.

From an operations perspective, mobility flow and efficient use of assets request the reduction of stocked cars and high turnover. Infrastructure flexibility should allow multiple usages and a functionality for the regularly unused periods. The present study shows the need to focus on co-creation and on the idea of a hub that can be optimised by the integration of complementary activities. It means activating these places, adding content, sharing spaces and accessibility, in a circular economy framework.

This requires a very careful user analysis, linking the demand to the user profile and offering a tailor-made solution that works not only for the customers but for the city, as well.
Linking with distribution centre to make use of the space during the night and weekend time. Adapting to the demand: prepare buildings for future use/ re-use/ or extension.

ROAD MAP

Following the users need approach, described in the previous chapter, the case study highlights particular issues that are fundamental in transforming a proposal into sustainable and operational actions that maximise the value for the users and the city.

In this context there are fundamental questions that should be addressed and linked with the users, the value proposal and problems as they arise. What does a Park and Ride project want to solve? Respond to a demand, solve congestion or fulfil a long-term political promise? If park and ride is the answer to a request as some recent studies and media show, this demand should be linked with a clear segment that lies behind the inter/ multi-modal demand. This will allow for testing and furthermore shape the project coherently.

CURRENT PARK AND RIDE OFFER IN BRUSSELS REGION (source: after the Brussels Parking Agency)

SITES	STALLE	DELTA	HERRMANN	CERIA	ROODEBEEK	CAINHEM	ERASME	TOTAL
CAPACITY	380	350	200	199	189	172	100	1590

Is P&R reply to a request (demand)?
Of whom?

IS A GENERIC REQUEST?

This means the respondent associate it with an efficient solution for the mobility but it is not personally concerned.

Is a request from a potential user which identifies this solution to its own needs?

IS A SPECIFIC REQUEST?

Does the repondent has a multimodal behaviour and the flexibility need it?

Are the respondents ready to use this service?

Solve congestion?
Which are the users that can impact congestion by shifting to a P& R service?

LIFE TIME

use the most congested road through the city

participate to the creation of bottlenecks

Does he has an alternative or incentive to deviate?

Serve for people that do not influence the system

Are the people asking for a P&R candidates to solve the congestion problem?

What should be the absolute value to be achieved from such a project? Maximise the value of a Park and Ride project to solve mobility problems by replying to a user need, offering a value proposition that solve user's problem, create convenience, and be a sustainable business.
It would look forward to limiting the traditional P&R inefficiencies, by using data towards an intermodal solution for more activities and users that can benefit from the infrastructure. Enlarge the cake, allowing local entrepreneurs and communities to use infrastructure, will make the project profitable, removing the burden of infrastructure costs from the shoulder of the whole society.

Knowing that infrastructure cost are difficult to be covered by the traditional P&R, innovative ways have to create a sustainable ecosystem that reduces waste. This is one of the main questions.

Does it create value?

bring convenient solutions

maximise infrastructure use

increase travel time to inacceptable

can create value for other kind of users

not only respond to commuters but enlarge the offer for local communities

increase local wealth

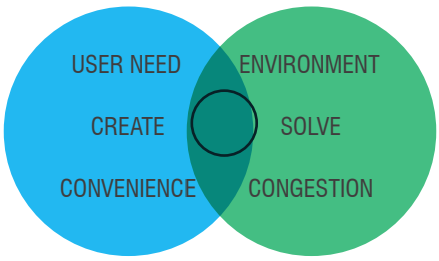
operations management data usager

Is P&R sustainable?

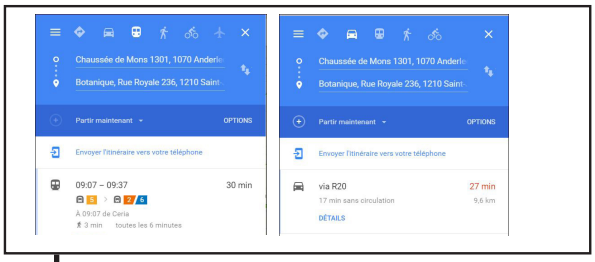
From a product to a service

Direct or indirect value

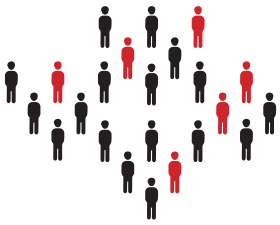
reuse profit for other projects



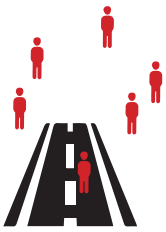
INTEGRATE BEHAVIOUR ASPECTS AND ACCEPTABLE TRAVEL TIME



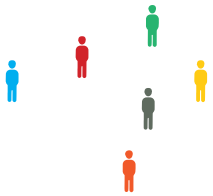
IDENTIFY USERS NEEDS



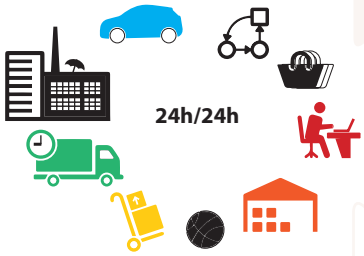
IDENTIFY MOBILITY PATTERN MINIMUM VIABLE PRODUCT



IDENTIFY LOCAL NEEDS THAT COULD COMPLETE THE OFFER



DEFINE THE VALUE PROPOSION



IDENTIFY USERS THAT PARTICIPATE TO CONGESTION

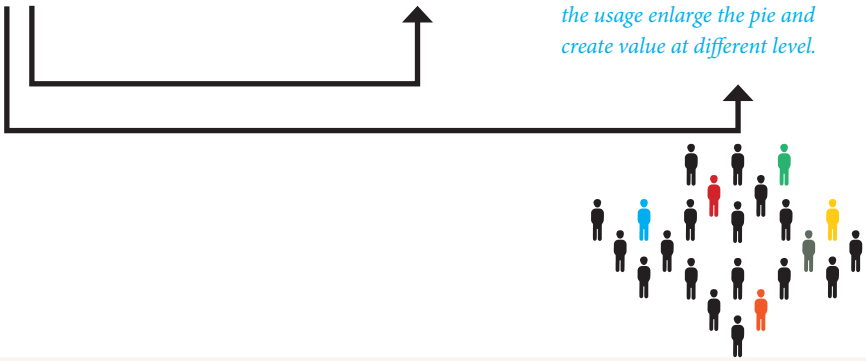
TEST WITH NO COST THE VALUE PROPOSAL

use temporary on-street parking space to see who is testing?

IDENTIFY STAKEHOLDERS THAT CAN INCREASE THE SERVICES

An iterative scheme of a process involving local stakeholders (looking for solutions, innovation entrepreneurship) will enhance the usage enlarge the pie and create value at different level.

OPTIMISED THE USE OF THE INFRASTRUCTURE LOOK FOR SYNERGETIC SOLUTIONS



IDENTIFY STAKEHOLDERS

Institutional stakeholders

ANALYTICS DATA

Process data

IDENTIFY STAKEHOLDERS

Local stakeholders

B2B B2C C2C P2P

FLEXIBLE APPROACH USE EXISTENT EXPERIENCE

CUSTOMISE SOLUTIONS START DISCUSSION WITH THE COMMUNITY

GIVE URBAN VALUE TO THE LOCALS

INTEGRATE SEVERAL FUNCTIONS

CONNECTING NODES AT THE CITY LEVEL

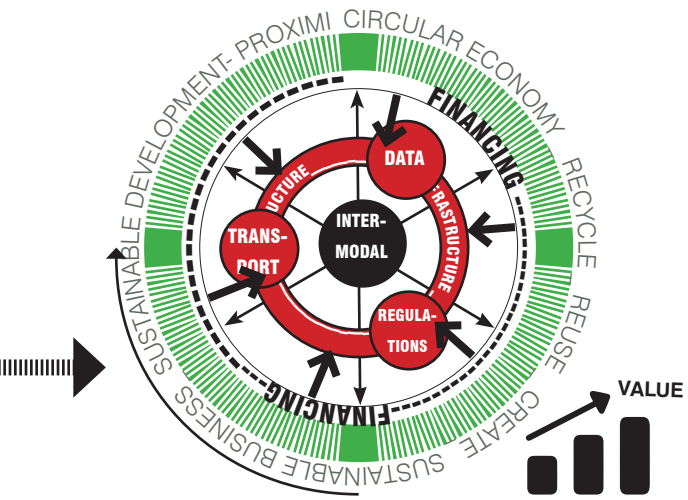
ANTICIPATE INTEGRATE THE CHANGE IN THE DESIGN

PRICING = TRADES-OFF ACCESSIBILITY

1 **2** **3** **4**

DEFINE A SPATIAL PHySICAL OBJECT THAT CONTAINS ACTIVITIES

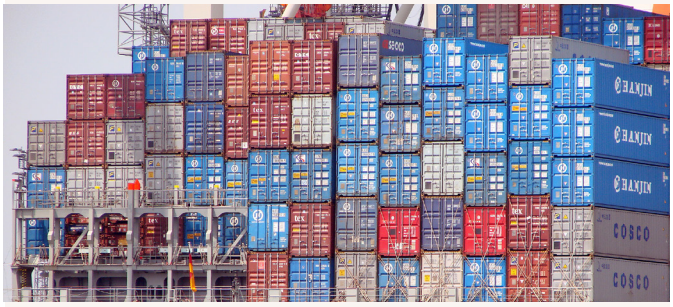
ADAPTING TO THE DEMAND PREPARE BUILDINGS FOR FUTURE USE/ RE-USE/ OR EXTENSION.



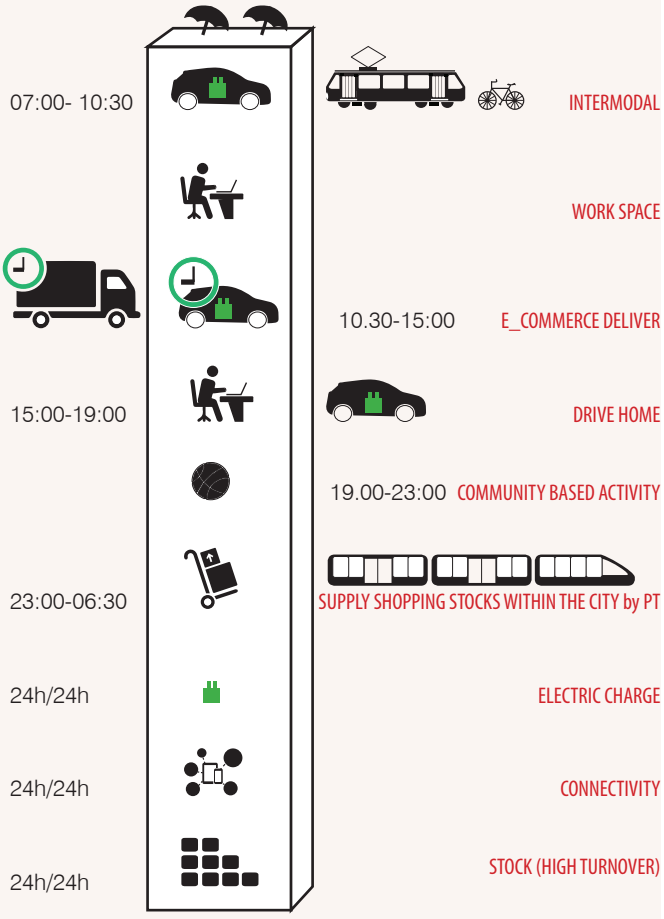
REUSE RESSOURCES COMBINE PARKING AND FREIGHT VALUE CHAINS

A scenario is linking freight, distribution with parking and congestion mitigation.

Transform the parking in a distribution place during the day- involve AOM industry to look for a car prototype - a shared vehicle that can bring people and after distributes e-commerce goods in the city;



new shared car protype



8 ANNEXES

ANNEXE 1

Brussels

161.4 km² ("Chiffres-Clés de La Région de Bruxelles-Capitale — Fr")
7,281 inhabitants/km2
1,175,173 inhabitants (+7.86% since 2010) (l'Institut Bruxellois de Statistique, "1.1_population_evolution.xls")
18.5% unemployment/ #inhabitants (217,407) (l'Institut Bruxellois de Statistique, "7.2 Unemployment")
5 Average 70h Wasted in Traffic 2015 (-4.2 hours in 2014) (INRIX)
356,350 IN COMMUTERS (l'Institut Bruxellois de Statistique, "13.6_mobilite_transport_pratiques_deplacement_20160325.xlsx")
66,168 OUT COMMUTERS (l'Institut Bruxellois de Statistique, "13.6_mobilite_transport_pratiques_deplacement_20160325.xlsx" 6)
33.4% IN OUT (Lebrun et al., "Cahiers de l' Observatoire de la mobilité de la Région de Bruxelles-Capitale 2 - Les pratiques de déplacement à Bruxelles")
66.6% INTERNAL MOVEMENT (Lebrun et al., "Cahiers de l' Observatoire de la mobilité de la Région de Bruxelles-Capitale 2 - Les pratiques de déplacement à Bruxelles")
2,313,256 Number of vehicles counted in 2008 on the roads

Mode	Trips towards or from RBC	Internal trips to RBC	Total trips
Car	63.6	32.0	42.6
Taxi	0.0	0.3	0.2
Walk	1.9	37.0	25.3
Moto	0.7	0.8	0.8
Bike	0.4	3.5	2.5
Public T	31.8	25.9	27.9
Other	1.6	0.6	0.9

(l'Institut Bruxellois de Statistique, "13.6_mobilite_transport_pratiques_deplacement_20160325.xlsx")
Calculation: the transport mode used for the biggest distance of the trip. However, the methodology might differ for each city and the benchmark might not be accurate.

Munich

310.8 km²
4,897 inhabitants/km2 (Landeshauptstadt München)
1,521,678 inhabitants (+10.09% since 2010) (Landeshauptstadt München)
4.6% unemployment/ #inhabitants (73,041) (Munich Department of Labor and Economic Development)
10 Average 52h Wasted in Traffic 2015 (-4.2 hours in 2014) (INRIX)
348 855 IN COMMUTERS (Redaktion)
154,345 IN COMMUTERS(Redaktion)
483,000 Number of vehicles enter the administrative borders (Zorn and Lonhard)
http://velo-city2013.com/wp-content/uploads/20130613_elisabethZorn.pdf
(Wuppertal Institut für Klima, Umwelt und Energie

Mode	Total trips Munich
Car	32.5
Taxi	-
Walk	27.2
Moto	-
Bike	17.40
Public T	22.8
Other	-

GmbH)
(l'Institut Bruxellois de Statistique, "13.6_mobilite_transport_pratiques_deplacement_20160325.xlsx")
(Comune di Milano)
Calculation: The transport mode used for the biggest distance of the trip
Note: There is no split in the calculation of the trips in Munich. In Milano and Brussels, the calculation concerns movement inside the city as well, movements outside). However, the methodology might differ for each city and the benchmark might not be accurate.

Milan

182 km² (Settore Statistica Comune di Milano)
7,357 inhabitants/km2 (Settore Statistica Comune di Milano)
1,337,155 inhabitants (+8.63% since 2010) (Comune di Milano,)
12.5% unemployment/ #inhabitants (181,175) (Comune di Milano,)
10 Average 52h Wasted in Traffic 2015 (Intix)

2.978.000 trips within the city (Comune di Milano,)
2.277.000 trips in/out the city (Comune di Milano,)

Mode	Trips towards or from Milan	Internal trips to Milan	Total trips Milan
Car	58.5	24.87	35.39
Taxi	-	-	-
Walk	N.A	17.70	17.70
Moto	4	6.04	4.94
Bike	0.7	4.71	2.47
Public T	36.80	46.68	39.50
Other	-	-	-

recalculation of the official data, integration of the 17.70% walking

(Comune di Milano)
Calculation: The transport mode used for the biggest distance of the trip. The SUMP (Milan's Sustainable Urban Mobility Plan) calculates walking separately. In order to compare the three cities walking was reintroduce in Milan's mechanised modal shift. However, the methodology might differ for each city and the benchmark might not be accurate.

ANNEXE 2

Brussels			Munich		Milan	
Métro (km network)	12.5	39.9		95.0	12.5	89.0
Tram(km network)	438	133.4		79.0	438	173.2
TROLLEYBUS (km network)						38.5
Bus (km network)		365.5		467.0		887.0

		Distance between		Distance between		Distance between
Train stops	69.00	589	100.0	948.0		948.0
Metro stops	291	403	166.0	474.0	82	1085
Tram stops	1879	419	968.0	482.0	703	246
Bus stops					2.479	357
trolley stops					203	190

source:
(Lebrun et al., "Cahiers de l' Observatoire de la mobilité de la Région de Bruxelles-Capitale 1 - L'offre de transport à Bruxelles")
(Lebrun et al., "Cahiers de l' Observatoire de la mobilité de la Région de Bruxelles-Capitale 2 - Les pratiques de déplacement à Bruxelles")

source: (MVV, "Network & Stations")

source: (Comune di Milano)

ANNEXE 3

1 P. Ecuyer - Rue de l'Ecuyer 11-17	493	Interparking
2 P. Grand-Place - Rue Marché aux Herbes 104	992	Interparking
3 P. Alhambra - Boulevard Emile Jacqmain 14	191	Interparking
4 P. Centre - Rue du Damier 26	780	Q-Park
5 P. Pacheco - Boulevard Pacheco 7	344	Q-Park
6 P. Parking 58 - Rue de l'Evêque 1	589	Interparking
7 P. Royal – Rue Royale	200	Besix Park
8 P. Dansaert - Rue de Flandre 60/Pl du Nv. Marché aux Grains	150	Q-Park
9 P. Dansaert – Place du Nouveau Marché aux Grains 2	211	Q-Park
10 P. Deux Portes - Boulevard de Waterloo	626	Interparking
11 P. Porte de Hal - Boulevard de Waterloo 103A	500	Interparking
12 P. Passage 44 - Rue de l'Ommegang 16	530	Interparking
13 P. Lepage - Rue Léon Lepage 23-31	691	Q-Park
14 P. Toison d'Or - Avenue de la Toison d'Or 20	340	Interparking
15 P. Albertine - Place de la Justice 16	714	Interparking
16 P. De Brouckère - Place De Brouckère	490	Interparking
17 P. Sablon-Poelaert - Place Poelaert	500	Interparking
18 P. City 2 - Rue des Cendres 8	380	Interparking
19 P. Rogier - Place Rogier	509	Interparking
20 P. Botanique - Boulevard du Jardin Botanique 29-31	381	Interparking
21P. Monnaie - Place de la Monnaie 25	589	Interparking

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SUSTAINABLE MOBILITY IN BRUSSELS

TOWARDS AN INTEGRATIVE AND USER-CENTRIC APPROACH

Case Studies: Brussels, Munich and Milan

MBA PROGRAMME IBFP- INTERNATIONAL BUSINESS FIELD PROJECT