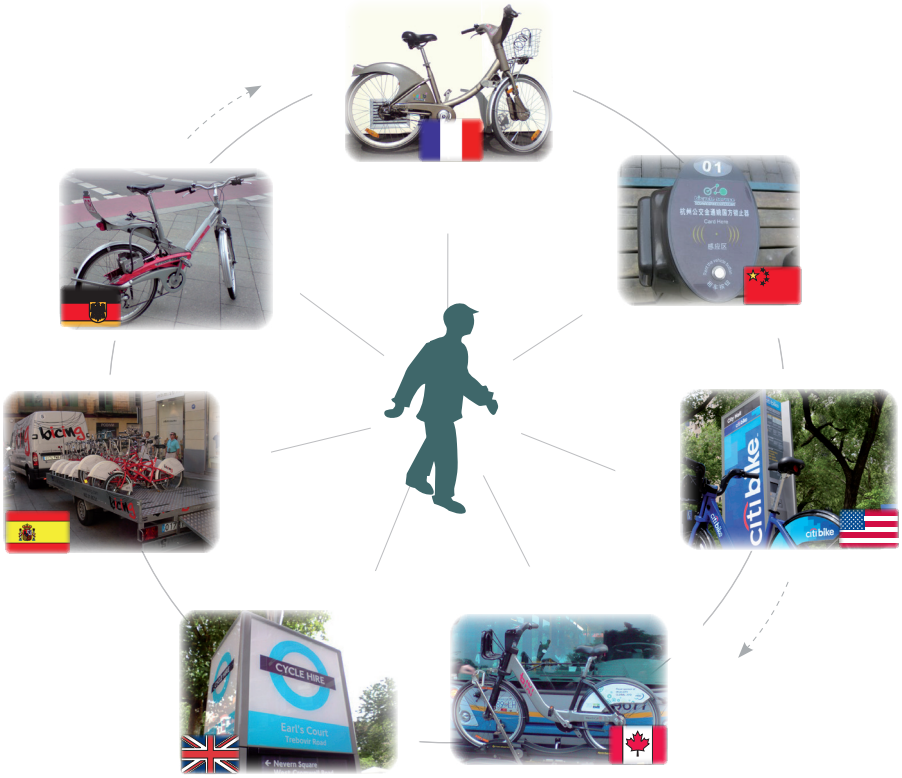
PRIVATE INTERVENTIONS IN A PUBLIC SERVICE: AN ANALYSIS OF PUBLIC BICYCLE SCHEMES



Benoît Beroud — Mobility consultant
Esther Anaya — Cycling consultant

Acknowledgements

To John Parkin who edited this chapter in "Cycling and sustainability", a book co-written by worldwide cycling experts:
To Alberto Castro and Russell Meddin who contributed to this chapter review of this chapter.
To Didier Van De Velde for its typology of transportation governance models.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

About the authors

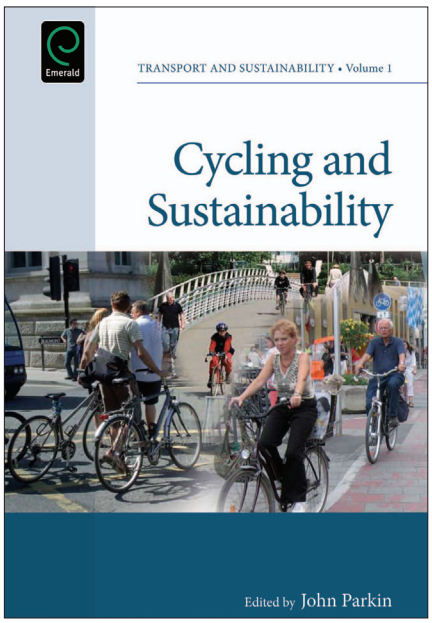
Benoît Beroud is the founder of Mobiped, a French consultancy in sustainable mobility. As a public bicycle schemes expert, he has participated to European projects, writtent French-English publications and given lectures in international conferences. Its others ranges of activities are actives modes, people with reduced mobility public policies and modal choice information. He has been studying public bicycles since 2005.

Benoît Beroud
Mobility consultant
0 (033) 9 51 94 72 80
benoit.beroud@mobiped.com
www.mobiped.com

Esther Anaya is a senior bicycle mobility consultant and independent researcher. She is a graduate in environnemental sciences and cultural studies, and has a masters degree in mobility management. She has undertaken a number of studies about public bicycles including co-authoring one of the first guides to the implementation of public bicycles schemes. She has been studying public bicycles in Spain since 2007.

Esther Anaya
Cycling consultant
Skype: esther.anaya
estheranaya@gmail.com
bicicletapublica.wordpress.com

An extract from Cycling and sustainability



This publication is an extract from:

Benoît Beroud, Esther Anaya, (2012),"Chapter 11 Private Interventions in a Public Service: An Analysis of Public Bicycle Schemes", John Parkin, in (ed.) Cycling and Sustainability (Transport and Sustainability, Volume 1), Emerald Group Publishing Limited, pp. 269 - 301.

Link to the book series homepage :

- www.emeraldinsight.com
- http://www.emeraldinsight.com/products/books/series.htm?id=2044-9941

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Contents

Abstract 4

Introduction 5

1. Public bicycles scheme elementary principles 6
   - The concept ... 6
   - History of public bicycle schemes ... 8
   - Types of public bicycles scheme ... 9
   - Stakeholders ... 11

2. Public bicycles scheme markets 12
   - Worldwide state of the art and statistics ... 12
   - The French market ... 14
   - The Spanish market ... 17

3. Models of governance worldwide 20
   - Schemes Created by Market Initiative ... 21
   - Schemes Promoted by Public Bodies ... 22

4. Building a public bicycle scheme policy 24
   - Creating a Cycling Friendly Environment ... 24
   - Not Buying a Product but Defining a Service ... 25
   - Assessing Public Bicycle Schemes Impacts ... 27

Conclusion 31

References 32

Pictures and charts credits 34

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Abstract

Purpose

The chapter reviews public bicycle scheme implementation processes and impacts and will assist decision makers and stakeholders considering such schemes.

Approach

The chapter customises the Van de Velde typology for describing public and private interventions in public bicycle scheme implementation processes. The chapter considers schemes worldwide, but has a particular focus on France and Spain where these schemes are considered as a public service.

Findings

The authors draw several conclusions on how to optimise public and private involvement in order to achieve the desired impacts. First, public bicycle schemes have to be integrated within cycling and urban mobility policies. Second, local governments have to ensure that contracts with private sector operators make maximum use of the operator's skill, and by so doing will meet multimodal travel behaviour objectives.

Research limitations / implications

The authors draw several conclusions on how to optimise public and private involvement in order to achieve the desired impacts. First, public bicycle schemes have to be integrated within cycling and urban mobility policies. Second, local governments have to ensure that contracts with private sector operators make maximum use of the operator's skill, and by so doing will meet multimodal travel behaviour objectives.

Practical implications

Public decision makers benefit from experience which is able to be assimilated and transmitted through international projects undertaken by international experts in the field.

Social implications

Public bicycle schemes enable relatively easy and cheap access to sustainable modes of transport, and they contribute to an overall transport system with cycling as a prime means of movement, and towards cities which are more pleasant to live in.

Originality

By integrating the main relevant data and publications into this worldwide overview, the chapter forms an essential starting point for future work relating to public bicycle schemes.

Key words

Public bicycles; bike sharing; models of governance; cycling policy; indicators; stakeholders.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Introduction

Public bicycle schemes (systèmes de velos publics), also known as bicycle sharing or cycle hire schemes, began in the 1960s in Northern Europe and during the first decade of the twenty-first century have spread more widely in Europe and to America, Asia and Oceania. City planners support this innovative transport service because it provides a further transport option for short urban-based journeys and promotes cycling more generally. This chapter discusses how public bicycle schemes should be improved such that they become more faithful to their objectives and achieve the desired outcomes.

First, the concept of public bicycle schemes within the larger class of bicycle hire schemes and their history will be summarised. Second, the market for public bicycle schemes will be analysed with a specific focus on France and Spain, two countries with a large number of implemented systems. Then, we customise the typology developed by Van de Velde (1999) to classify existing implementation processes across the world. Finally, the authors provide their view on what they consider as the best ways for optimising the implementation of public bicycle schemes.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

1. Public bicycle scheme elementary principles

The concept

Public bicycle schemes are a mobility service mainly implemented in an urban environment for local trips. They are schemes for hiring bicycles for short periods and, through the lack of personal bicycle ownership and through the sharing of bicycles by a large number of people, they evoke the concept of a public service.

Shared methods of mobility are increasingly being adopted in transport provision not only through vehicle sharing but also through the sharing of space. Examples include lorry sharing for freight transport, private and institutional car sharing and pooling and taxi sharing. There are examples of private parking spaces being shared to prevent the waste of valuable space. Since the concepts of sharing and hiring are also embraced by a range of bicycle hire services, it is important to distinguish the specific and distinct characteristics of public bicycle schemes which are as follows:

- Their availability to almost anyone, the only limitations being an ability to pay by some efficient and effective means which usually requires a bank or credit card. It should be noted that some schemes limit availability to people who have an address in the city or country where the system is installed.
- Their consideration as a public service in law, particularly so in France and Spain, and hence requiring operators to abide by relevant legislation in this respect.
- The local authority or relevant local public administrative body for transport is responsible for the scheme, even though they may subcontract aspects of its operation (Beroud, 2007a).

In addition to the above, and although there are many features of public bicycle schemes, the authors consider two conditions as distinctly characterising a public bicycle scheme. First, **users should be able to drop off a public bicycle in a different place from where it was picked up**. Hence, the user has the opportunity to hire a public bicycle only for a one-way trip or for an occasional, longer duration, round-trip tour. This feature is linked to the pricing structure, which is designed for very short-term use, and in that sense they are distinct from other types of bicycle hire or rental services. One-way use also means that the responsibility of the user is restricted to the duration of the trip, rather than a longer time period during which the bicycle may be idle. A further advantage of such one-way use is that users may choose another means of transport for the return trip, enhancing flexibility very considerably. The second condition is that **hire points are located in the public domain so that there is the possibility of interaction with and accessibility for any public space user**. This implies the full agreement and cooperation of whoever owns the public space, and this would usually be a public body. Table 1 summarises three broad approaches to bicycle hire.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

	Long-Term Hire	Medium-Term Hire	Very short term hire
Period of hire	Usually for periods longer than a week	Usually for partdays, hole days or periods up to a week	Very short term: from some minutes to some hours
Types of service	Hire programmes usually for students or commuters, from bicycle retailers, or "Velo-stations" (bicycle hubs in central urban areas or at railway stations) or other bespoke providers	Hire programmes usually for leisure users from bicycle retailers or "Velostations"	Public bicycle scheme
Access to the bicycles	During opening hours of the shop or service	During opening hours of the shop or service	Possibility of 24 hours per day, 7 days per week
Location for hiring and returning	Hiring and returning location the same	Hiring and returning location the same	Hiring and returning location may be different
Interface with the service provider	Personal, requires hire agreements and checking that the bicycle is in good working order	Personal, requires agreements and checking that the bicycle is in good working order	Self-service with automatic systems for user identification and payment, or staff serviced
Benefits to the user	Having use of a personal bicycle without having to buy one	Having a bicycle which is in good working order, of the right type and with the right accessories	No responsibility for maintenance, night and long-term parking, or theft risk after use. Great flexibility in choice to use for a particular journey

Table 1. Summary of Three Broad Approaches to Bicycle Hire.

While Table 1 attempts to categorise bicycle hire schemes, the concept of public bicycle schemes is still evolving, as it has done since the 1960s. The next section discusses this development through different generations of schemes.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

History of public bicycle schemes

De Maio (2003) summarises the history of public bicycles with reference to three generations of schemes. Differences between these generations are summarised in Table 2 (Beroud, Clavel, & Le Vine, 2010c).

	First Generation	Second Generation	Third Generation
Financial and time incentives to return the bicycle	None	Financial with a coin similar to supermarket trolleys (approximately h2)	Identification of the user, financial and time incentives with a pricing policy which encourages rapid turnover
Examples	White Bikes in Amsterdam (1965)	Fonden i bycyklen in Copenhagen (1995)	Vélo à la carte in Rennes (1998), V?lo?v in Lyon (2005), Bicing in Barcelona (2007) (Fig. 1) and V?lib? (vélos en libre-service) in Paris (2007)
Principles	Bicycles are left in the public realm	Bicycles are parked at docking stations	Registration and identification
Limitations	Bicycles are stolen, painted, broken and not repaired	Anonymous users keep the bicycles as cost is low and there are no time limits on use	Vandalism, empty stations and full stations

Table 2. The Three Generations of Public Bicycle Schemes.

De Maio (2009) suggests improvements from third- to fourth-generation schemes will concern methods of check-out and return, ease of use, the flexibility of return station location, tracking of the bicycles and mileage, bicycle and station design, powering of the stations, incorporation into other modes of transport, distribution, business models and theft deterrence.

Meddin (2010) considers that 'transit integrations will be a hallmark of fourth-generation bicycle sharing schemes, along with the possibility of advance booking. RFID (radio frequency identification) integrations with mobile phones allow greater payment capabilities and compatibility across multiple bicycle-sharing systems'.

Shaheen, Guzman, and Zhang (2010a) talk about 'Demand responsive, multimodal systems [y] characterized by: 1) flexible, clean docking stations, 2) bicycle redistribution innovations, 3) smartcard integration with other transportation modes, such as public transportation and car-sharing, and 4) technological advances including GPS (global positioning system) tracking, touch screen kiosks, and electric bikes'.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Beroud et al. (2010c) consider that the common link between the generations is not related to their technological capability. System evolution has been related to capabilities which decrease information asymmetry between the user and operator, and methods to keep bicycles in a working state to enable subsequent users to ride them. Fourth-generation systems might also include incentives that focus on non-users to discourage vandalism. Solutions might include video surveillance at docking stations (e.g. Brescia, Italy) or secure boxes for storage of the parked bicycles (e.g. Grenoble, France, and Bilbao and Vitoria, Spain).

Camera and light on a docking station (Bicimia in Brescia, Italy)

Technological evolution is still driving trends in new scheme implementation, particularly so far as payment mechanisms are concerned. Where such payment mechanisms are common to other modes, for example, the same RFID card for several transport services including public transport and vehicle parking, they clearly contribute to sustainable multimodal mobility. Some examples include the Navigo card in Paris and Oura card in Lyon which allows use of the public bicycle scheme. 'Citizen cards' with several transport and other additional municipal services are available in Gijon, Ponferrada and A Coruna in Spain. Besides increased security through control of the users through registration (and non-users through video surveillance), technological advancement is also enabling the collection and dissemination of real-time information which may then be disseminated through the Internet, mobile telephones and at docking stations. These data are useful for operators in ensuring an even supply of bicycles and for users to check availability of a bicycle for hire, and a slot for the return of the bicycle. Developments are also taking place in the energy efficiency of automated systems to reduce the expense of construction and operating costs.

As identified in Table 1, there are two main types of public bicycle schemes:

- Automatic schemes with technological methods for user identification and payment,
- Manual schemes which are serviced by human operators. These are now described in more detail.

Type of public bicycle scheme

Public bicycle scheme docking stations are generally self-service stations as this is more economical and allows for investment in a larger number of docking stations, which in turn maximises the number of possible trips. However, some docking stations have operator servicing.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Self-service public bicycle schemes

With third-generation self-service systems, the user retrieves a bicycle after interacting with a kiosk or electronic interface using a stored data card, debit or credit card, a mobile phone or a personal identification number (PIN) or other code. Evidence suggests that systems which use stored data cards have higher trip rates per bicycle. For example, a card-based system in Oslo, Norway, has two and a half times more trips per bicycle than a phone call–based system in Berlin, Germany. A main reason is that identification costs are free with a card in Oslo although users have to pay for each telephone call in Berlin (Beroud, 2007b). To identify users and bicycles, these systems require well-specified human-to-machine and machine-to-machine equipment which communicates with a central database.

With no other staff interaction, there is no assessment of the bicycle's mechanical fitness for use. Such assessments are performed as part of programmed visits to the station. In addition, some third-generation systems allow the user to notify the system that there is a fault on a bicycle on its return to a docking station as in London. Other systems are able to detect automatically a fault when something is wrong with the bicycle. These alerts allow the system operator to provide a maintenance visit.

Identification on the parking plot (Vélib' in Paris, France)

Keys are distributed by the shopkeeper to access to these traditional bicycles (Victoria-Gasteiz, Spain)

Staff-service public bicycle schemes

These services are able to use equipment of a lower specification than those which are self-service. Usually, the user receives and drops off keys directly from a member of staff. There are two main types of staff-serviced system depending on the location of the bicycles relative to the staff.

Bicycles may be parked in a public space, perhaps adjacent to existing bicycle parking facilities. They are secured with an ordinary U-lock, chain or cable lock. The staff issuing the keys for the locks may be a public employee and be based in a nearby civic centre, sports centre or tourist offices. The direct and estates costs for the operator are then shared between the system and other functions the operator may have within the local authority. Such staff are not in a position to oversee or check the fitness for use of the bicycles when they are checked in or checked out. The waiting time for the user may be variable depending on other tasks the employee needs to undertake. Alternatively, bicycles may be stored at dedicated premises in the public realm, perhaps for example in specially adapted containers or other suitable secure buildings. The premises will also be used as a maintenance workshop and a warehouse. Members of staff are in charge of the issue and collection of the bicycles as well as their repair. In this case, it is possible to check immediately the fitness for use of the bicycles on return. While in Spain, there are few manual systems, and some systems have been converted from being staff serviced to being self-service (e.g. after inauguration in 2006, Santander was converted to being automatic in 2008), there are examples of manual systems in Switzerland and Italy (the Milleeunabici system in Firenze, 2011).

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Stakeholders

There are principally four main types of stakeholders in public bicycle schemes.

1. **The promoter** may be defined as the originator of the initiative and the body who is in overall management control of the scheme. Generally, the promoter will be a public body, such as a local government, which is responsible for public highways, public space and local transportation policy. If the promoter is a private organisation, for example, a privately or publicly owned company or a not-for-profit organisation, it will need to work closely with the relevant local government bodies and seek appropriate permissions for use of public space and to carry out the activity of the scheme. While promoters are ultimately responsible for the scheme, some aspects of the operation or running of the scheme may always, in law, reside with a public administration. Clearly, schemes are highly unlikely to be successful without the full backing of the local transport administration. Governance regimes developed for public bicycle schemes vary depending on whether the initiative is of public or private origin and this will be discussed in section 'Models of Governance Worldwide'.

2. **Public space users** include both users and non-users of the public bicycle scheme. The scheme will have a positive impact for those using the scheme as it will provide further journey possibilities and options. Non-users will be impacted by the scheme as it will assist in introducing more cycling into an urban area and bring new urba furniture into the urban landscape.

As with many industries such as public transportation, railways, telecommunications, electricity, gas, waste and post, public bicycle schemes are a network-based industry (Beroud, 2007a). As a consequence, provision and operation answers to different economic rules, and that is why it is necessary to distinguish them from operations that are not network based.

3. **Equipment providers** will be the contractors with the skills and expertise to provide the necessary bicycle and docking station equipment, and communications hardware and software. The providers may be contracted directly to the scheme promoter or the scheme operator.

4. The **scheme operator** is contracted to run the public bicycle scheme for the scheme promoter. The operator has the skills to maintain the bicycle in a mechanically suitable condition and balance bicycle supply with demand. The operator is also responsible for relations with the customer, information provision and communication. The running of the service could be contracted to a succession of different scheme operators.

The number of public bicycle schemes has grown rapidly in the first decade of the twenty-first century, particularly third-generation schemes. The next section provides a worldwide overview of third-generation schemes and presents a more in-depth review of the evolution and current context of the markets in France and Spain.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

2. Public bicycle scheme markets

Worldwide state of the art and statistics

Arguably, the first of the third generation of public bicycle schemes was the one implemented in Portsmouth (United Kingdom) in 1996; however, it terminated in 1998 (De Maio, 2009). At the beginning of the twenty-first century, the only public bicycle scheme operating was in Rennes (France), installed in 1998. After the deregulation of the European outdoor advertising market, the American company Clear Channel introduced an innovation by proposing a public bicycle scheme for Rennes Metropole as part of the outdoor advertising contract in order to differentiate its proposal from its main competitor, JC Decaux (Huré, 2010). Since then and up to 2010, that system has been joined by 318 other schemes and their worldwide distribution in 29 countries is shown in Fig. 2.

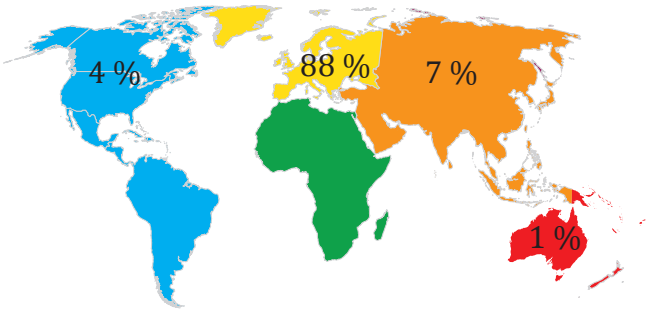


Fig 2. Worldwide distribution of the 319 Third Generation Public bicycle Schemes as at 2010

There are contrasting views about the exact number of schemes that have been implemented, partly based on different public bicycle scheme definitions. Shaheen et al. (2010a) suggest there are 135 bicycle-sharing programmes operating in 160 cities with over 235,000 bicycles for hire. So far as third-generation schemes are concerned, De Maio (2010) suggests there were 238 by the end of 2010. Beroud et al. (2010c) reckon there are 460 cities with a public bicycle scheme, with 203,000 bicycles and 13,600 docking stations. These figures were mostly compiled after having contacted most of public bicycle providers and operators. However, schemes provided and operated by OV Fiets in The Netherlands and the Centro in Bici schemes do not exactly comply with the above definition of public bicycle schemes. Leaving these out of the count and integrating more accurate information about the Spanish market, leads to the 319 schemes as shown in Fig. 2, with approximately 200,000 public bicycles and 13,500 docking stations in September 2010. The United Nations (2011) suggests there were 375 bicycle-sharing schemes operating in 33 countries with 236,000 bicycles. The largest system in the world is in Hangzhou in China, which has 50,000 bicycles and 2,177 docking stations (Tang, 2010) and will reach 60,600 bikes at 2,711 service points at the end of 2011 (Meddin, 2011b).

The phenomenon of public bicycles has spread rapidly across Europe in the first decade of the twenty-first century. However, it looks like the rate of increase is slowing down because of the lack of resources. In 2009 and 2010, however, there has been the beginning of an expansion to other continents including the Americas, Asia and Australia. Public bicycles have been implemented mainly in cities with low cycling use, but which have a willingness

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

to increase it. Promotion by public sector bodies dominates. With worldwide progressive expansion of public bicycle schemes, a market has developed for diversified technology, systems, innovations and patents. Important emerging features of schemes which allow them to be considered more firmly as part of the overall transport offering of an urban area include their integration with other forms of transport (through, e.g. use of the same RFID card for public bicycles and public transport services), the promotion of journeys which use more than one mode, the exploration of new funding formulas and the growing importance of mobility operators as stakeholders.

The World map of public bicycles schemes (http://bike-sharingblogspot.com)

France, Spain and also Italy are the countries which have implemented a significant number of public bicycle schemes. The next section focuses particularly on the French and Spanish markets in order to provide a context for a discussion on the dynamics and increasingly diversified market for public bicycle schemes.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

The French market

The Cycling Context

As in many occidental countries, a cycling culture has been overtaken by the development of a car culture. The first decade of the twenty-first century has, however, seen a renewed interest in civilising cities with a view to promoting sustainable forms of transport, including cycling.

The French cycling modal share for all trips has decreased from 4.5% in 1982 to 2.9% in 1994 and to 2.7% in 2008 (CGDD, 2010). The leading friendly cycling cities are Strasbourg (9% of modal share), Bordeaux, La Rochelle and Chambery. A number of other cities have implemented and marketed public bicycle schemes and so are becoming more bicycle friendly.

Although there is no national cycling policy yet, a designated 'Monsieur Velo (Mr Bicycle) at the French Ministry of Transportation has been in post since 2006. His mission is to coordinate action across all ministries which may have an impact on the cycling use. France has five administrative levels: State, regions, departements, multiple city authorities and cities. In overall terms, the State proposes law, and finances research programmes and institutional agencies such as Centre d'etudes sur les reseaux, les transports, l'urbanisme et les constructions publiques (CERTU, Centre for studies on networks, transportation, urban planning and public works). Regions are in charge of inter-urban rail transportation. Departements work on roads and school transportation. Multiple cities authorities are associations of adjacent city authorities and promote public transport and urban travel plans. Individual cities manage their street networks (Assemblees des Communautes de France, 2010). Cities and multiple city authorities have a financial tool for some transportation projects: 'Le Versement Transport'. They tax all organisations within their jurisdiction and which employ more than nine people (Ministere du developpement durable, 2007). To use 'Le Versement Transport', a public bicycle scheme has to be operated by a public body, or be integrated in a public service delegation contract (Club des Villes et Territoires Cyclables, 2007). On cycling issues, cities develop urban cycle tracks, although departements build inter-urban cycle tracks such as longer distance 'Veloroutes' and 'Voies Vertes'. Multiple city authorities define cycling master plans. Recently, regions have become more concerned to improve the attractiveness of the railway network and have been promoting inter-modality with the bicycle as an access and egress mode. Several laws provide the legislative and regulatory framework for cycling in France and these are summarised in Table 3.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Name of the law	Year	Comment
The road law (Le code de la route)	1921–1958 – 2000	Cyclists have to follow the same rules as car drivers
Law of inland transportation (Loi d'Orientation sur les Transports Int rieurs)	1982	Provides the framework for transport authorities legal competences
Law on air and rational use of energy (Loi sur l'Air et sur l'Utilisation Rationnelle de l'énergie)	1996	Cycling has to be encouraged in multimodal urban travel plans
Law on solidarity and urban renewal (Loi Solidarit et Renouvellement Urbain)	2000	Cycling facilities should be implemented whenever highway renewal works take place
The street law (Le code de la Rue)	2008	Enables multi-modal shared areas and cycling two abreast in areas subject to a 30 km/h speed limit. It does not replace the road law
Law of financing of social welfare (Loi de financement de la S curit sociale)	2008	Enables companies to co-finance 50% of their employees' subscription to public bicycle schemes, in the same way they can co-finance public transport pass costs for daily trips
The national commitment to the environment (Engagement National pour l'Environnement)	2009 - 2010	Encourages work travel plans and the development of car pooling, car sharing, walking and cycling. It empowers local authorities to implement public bicycle schemes. Before, there was no legal framework to implement public bicycle schemes

Table 3. Legislative and Regulatory Framework Relevant to Cycling in France.

Public bicycles in France

La Rochelle was the pioneer city and implemented a first-generation scheme in the 1970s. It encountered the same problems of theft and vandalism of the first-generation scheme in Amsterdam. The first of the third-generation schemes appeared in 1998 in Rennes, with the next two schemes appearing in 2005 in Lyon and La Rochelle. The success of the Ve´lo'v scheme in Lyon, as well as the 2008 elections, encouraged many other cities to consider developing their own schemes. Ten schemes were inaugurated in 2007, including Vélib' in Paris. From 2008 to 2010, 19 other schemes followed.

As of September 2010, 32 public bicycle schemes were in operation in 92 cities, including main cities and city suburbs. Of the 41,483 bicycles in public service in France at the end of 2010, more than half were in the Paris system. There are five cities with more than 1,000 public bicycles: Lyon, Marseille, Toulouse, Nice and Bordeaux. Twenty-two cities have between 100 and 500 bicycles and only one city, Montelimard, has fewer than 20 bikes (Beroud et al., 2010c). Lille, one of the five largest French cities, has just inaugurated its own service in September 2011 during the European Mobility Week with 2,000 public bicycles.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

The number of implementations in 2011 and beyond would reduce for three reasons: the impact of the economic crisis of public funding, cities preferring cheaper options than public bicycle schemes to develop cycling, and the market saturation of cities of a suitable size (with more than 100,000 inhabitants) for public bicycle schemes.

All French schemes have been promoted and supported by public bodies. Eighteen of the 32 schemes operate under agreements with multiple city authorities. There are four main types of contract as follows:

- The integration of the public bicycle scheme as part of an outdoor advertising contract.
- The integration of the public bicycle scheme as part of a public transport contract.
- A service contract specifically for a public bicycle scheme.
- A service operated in-house by a local authority.

Contract specifically for a public bicycle scheme. with the name of the local government (Le Vélostar in Rennes, France)

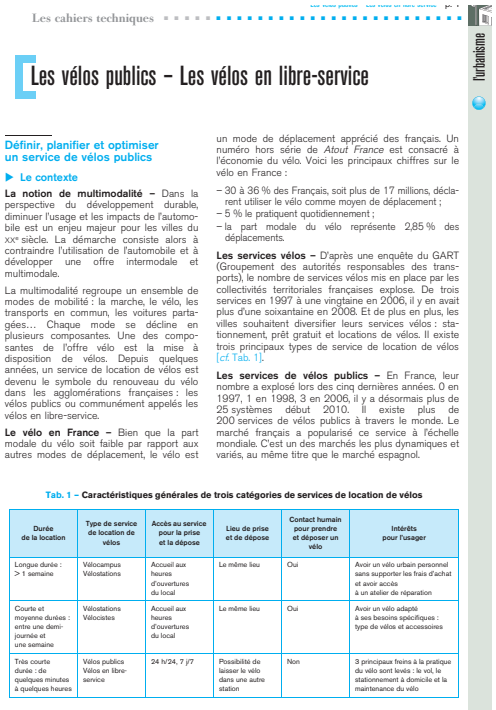
There are seven equipment providers in the market – Clear Channel, JC Decaux, EFFIA, Flexbike (Homeport solution), Smoove, Deutsch Bahn Rent and Veolia – and six service operators – Clear Channel, JC Decaux, EFFIA/Keolis, Transdev, Veolia and the City of La Rochelle. Veolia and Transdev have recently merged. There is clearly overlap between the equipment providers and the system operators, which include two international outdoor advertising companies and three leading European public transport operators. Only one multiple city authority, Rennes Metropole in 2009, has changed its provider and operator. Politicians have found public bicycle schemes to be very good for creating a dynamic, young, environmentally friendly image for the city and the presence of the scheme is a continuous and visible reminder to their electors of their investments and actions. In Lyon and Paris, both majority administrations have been reelected. Some politicians, however, seem to consider a public bicycle scheme as being the only investment required to help develop more cycling. Public bicycles should be considered as part of a cycling master plan and not a master plan itself (see section 'Creating a Cycling Friendly Environment').

There are two examples of case law which give to public bicycle schemes the status of a public service. In the case of Ve´lo'v in Lyon (2006), a bicycle rental company called Holiday Bike considered public funding only to Ve´lo'v as unfair competition. The court ruled that the duration of the Holiday Bike rental (one day) and the Ve´lo'v hire (very short term for a one-way trip) indicates that what is being offered are two different services. Moreover, they found that Ve´lo'v contributes to decreasing pollution and traffic congestion. Overall, the

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

court found that the service has a public interest that is not answered by private companies, and hence its existence and public funding is justified.

Vélib' in Paris (2008) was extended to a suburb of Paris, although the initial contract was concerned only with Paris itself. Clear Channel registered a complaint because there was no new tender for the new expanded market. The French State Council decided that the public bicycle scheme could be extended to a distance of up to 1.5 km around Paris on the basis that it could improve the service offered for Parisians or people who may commute into Paris. Overall, they considered that the service was not aimed specifically at trips internal to each of the 30 suburbs of the city (Beroud, 2010b).



Les cahiers techniques

Les vélos publics – Les vélos en libre-service

Tourisme

Définir, planifier et optimiser un service de vélos publics

▶ **Le contexte**

La notion de multimodalité – Dans la perspective du développement durable, diminuer l'usage et les impacts de l'automobile est un enjeu majeur pour les villes du XXe siècle. La démarche consiste alors à contraindre l'utilisation de l'automobile et à développer une offre intermodale et multimodale.

La multimodalité regroupe un ensemble de modes de mobilité : la marche, le vélo, les transports en commun, les voitures partagées… Chaque mode se décline en plusieurs composantes. Une des composantes de l'offre vélo est la mise à disposition de vélos. Depuis quelques années, un service de location de vélos est devenu le symbole du renouveau du vélo dans les agglomérations françaises : les vélos publics ou communément appelés les vélos en libre-service.

Le vélo en France – Bien que la part modale du vélo soit faible par rapport aux autres modes de déplacement, le vélo est un mode de déplacement apprécié des français. Un numéro hors série de *Atout France* est consacré à l'économie du vélo. Voici les principaux chiffres sur le vélo en France :

– 30 à 36 % des Français, soit plus de 17 millions, déclarent utiliser le vélo comme moyen de déplacement ;
– 5 % le pratiquent quotidiennement ;
– la part modale du vélo représente 2,85 % des déplacements.

Les services vélos – D'après une enquête du GART (Groupement des autorités responsables des transports), le nombre de services vélos mis en place par les collectivités territoriales françaises explose. De trois services en 1997 à une vingtaine en 2006, il y en avait plus d'une soixantaine en 2008. Et de plus en plus, les villes souhaitent diversifier leurs services vélos : stationnement, prêt gratuit et locations de vélos. Il existe trois principaux types de service de location de vélos (cf. Tab. 1).

Les services de vélos publics – En France, leur nombre a explosé lors des cinq dernières années. 0 en 1997, 1 en 1998, 3 en 2006, il y a désormais plus de 25 systèmes début 2010. Il existe plus de 200 services de vélos publics à travers le monde. Le marché français a popularisé ce service à l'échelle mondiale. C'est un des marchés les plus dynamiques et variés, au même titre que le marché espagnol.

Tab. 1 – Caractéristiques générales de trois catégories de services de location de vélos

Durée de la location	Type de service de location de vélos	Accès au service pour la prise et la dépose	Lieu de prise et de dépose	Contact humain pour prendre et déposer un vélo	Intérêts pour l'usager
Longue durée : > 1 semaine	Vélocampus Vélostations	Accueil aux heures d'ouvertures du local	Le même lieu	Oui	Avoir un vélo urbain personnel sans supporter les frais d'achat et avoir accès à un atelier de réparation
Courte et moyenne durées : entre une demi-journée et une semaine	Vélostations Vélocistes	Accueil aux heures d'ouvertures du local	Le même lieu	Oui	Avoir un vélo adapté à ses besoins spécifiques : type de vélos et accessoires
Très courte durée : de quelques minutes à quelques heures	Vélos publics Vélos en libre-service	24 h/24, 7 j/7	Possibilité de laisser le vélo dans une autre station	Non	3 principaux freins à la pratique du vélo sont levés : le vol, le stationnement à domicile et la maintenance du vélo

French handbook on public bicycles (Beroud, 2010b)

The Spanish market

The Cycling Context

Despite cycling being popular in the 1920s in Spain, the Civil War and the post-war economic crisis limited the manufacture and purchasing of bicycles until the late 1950s (Sanz, 1999). Cycling use increased during the 1940s and early 1950s, but soon in the 1960s, the car industry began to develop and the status of the bicycle declined, specially in large cities. It was not until the 1980s and 1990s, some began to construct facilities for cycle traffic, but most work was directed towards a use of the bicycle for leisure purposes. In 1988, there were 70 km of cycling infrastructure in Spanish cities and by 1997 this had increased to 565.9 km (Bergua & Benaito, 1997). At the beginning of the first decade of the twenty-first century, bicycles had timidly recovered a position where they were beginning to be used for everyday mobility and the presence of the bicycle continues to increase, but its presence is still only modest in relation to the other modes of transport.

Transport surveys still do not offer reliable data about bicycles. According to National Institute of Statistics (INE, 2009), 1.3% of the adult (over 16) Spanish population uses the bicycle as their main mode of transport. Some of the larger cities with higher modal shares for bicycles are Zarautz (15%), San Sebastian, Sevilla, Barcelona, Vitoria-Gasteiz and Zaragoza (between 2% and 6%).

There is no national cycling master plan in Spain. The infrastructure master plan (Minis-

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

terio de Fomento, 2005) proposes the creation of a non-motorised transport plan, but this has not been drafted yet. At the local level, many municipalities have developed cycling master plans, the first being written in the 1990s, and local transport master plans have started to take cycling into account. In some regions like Catalonia, transport regulations oblige to take cycling into account in local mobility plans.

Cycling as a means of transport is regulated by national, regional or local law. Central government regulations historically have covered inter-urban trips for sport and leisure, but there is a modification of the law, although it's pending of approval, that includes regulations for urban cycling, which are currently covered by local bylaws. This historic legal separation of urban and non-urban cycling has generated a great deal of variability at the local level. Legal interpretation can also be difficult if there is a contradiction between national and local law, with local law remaining valid if there is no formal complaint or case law to support it. As an example, Sevilla's bylaw allows bicycles in pedestrian zones, which is contrary to national law. Case law upheld the bylaw.

Public bicycles in Spain

The first documented Spanish public bicycle scheme was created in 2002 in Castellbisbal, and this was quickly followed in 2003 and 2004 by small third- generation schemes installed by JC Decaux as part of outdoor advertising contracts in Cordoba and Gijon, respectively. A large human operated public bicycle scheme also started in Vitoria in 2004.

The year 2006 was important for public bicycle schemes. First, the market saw the introduction of two new technologies: 'Bicicard' (bicycle card), a smartcard payment system developed by the Technological Institute of Castilla-Leon region; and 'On-roll', a mobile telephone-based enrolment technology. Second, the National Energy Agency (IDAE) had started to provide subsidy for public bicycle schemes.

'Bicing' in Barcelona was inaugurated in 2007. It has been the most important and well-known public bicycle scheme in Spain to date and has resulted in 'Bicing' being incorrectly thought of as synonymous with public bicycle schemes. It was financed with car parking revenues, which have helped its credibility as an environmentally well-balanced policy measure. On the back of increasing levels of cycling, the scheme has had far more use than forecast and has helped promote and disseminate the idea of public bicycle schemes.

The red painting contributes to identify the docking station (Bicing in Barcelona, Spain)

While technology has continued to improve up

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

until the end of the decade, implementation has slowed down because of the economic crisis and the recognition of the technical and financial complexity of the schemes. More expertise and research is required to plan and develop schemes because they are seen as important transport systems rather than simply as bicycle hire schemes. More and different funding sources are needed because outdoor advertising companies have become more reluctant to offer comprehensive public bicycle schemes. This is evidenced in the reduction in the number of companies tendering for public bicycle schemes (resulting in the tender for an enlarged Barcelona scheme being declared void and the Madrid scheme being postponed).

As at 15th August 2011, there were 147 public bicycle systems in 197 municipalities with 26,289 bicycles and 2,050 docking stations (Anaya & Castro 2012).

Public bicycles in Spain (Anaya & Castro 2012)

(Victoria-Gasteiz, Spain)

In Spain, the discourse around energy efficiency has been very important to the success of public bicycle schemes. Grants for implementation came from the National Strategy for Energy Efficiency for the period 2004–2012 (IDEA, 2008), and these grants are awarded for 70% of the initial implementation and enlargement costs for schemes which offer a minimum of 50 bicycles based on a sound business case. The total grant for public bicycle schemes given in the period 2005 to 2010 is estimated as h25 million.

There are no judicial cases relating to the definition of public bicycle schemes, and it seems that there is a consensus to define them as public services, which are covered by existing regulations. In the case where schemes have been promoted as private initiatives, the local authority would need to take on some responsibility for maintenance for them to be regarded as 'public'.

After describing the French and Spanish markets, we now widen the scope and provide an analysis of the phenomenon of public bicycle scheme implementation across the world.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

3. Models of governance worldwide

Public bicycle schemes across the world have a wide range of reasons for implementation and consequently demonstrate a range of organisational forms. Fig. 3 is inspired by Van de Velde's typology to categorise several examples from four continents (Van de Velde, 1999).

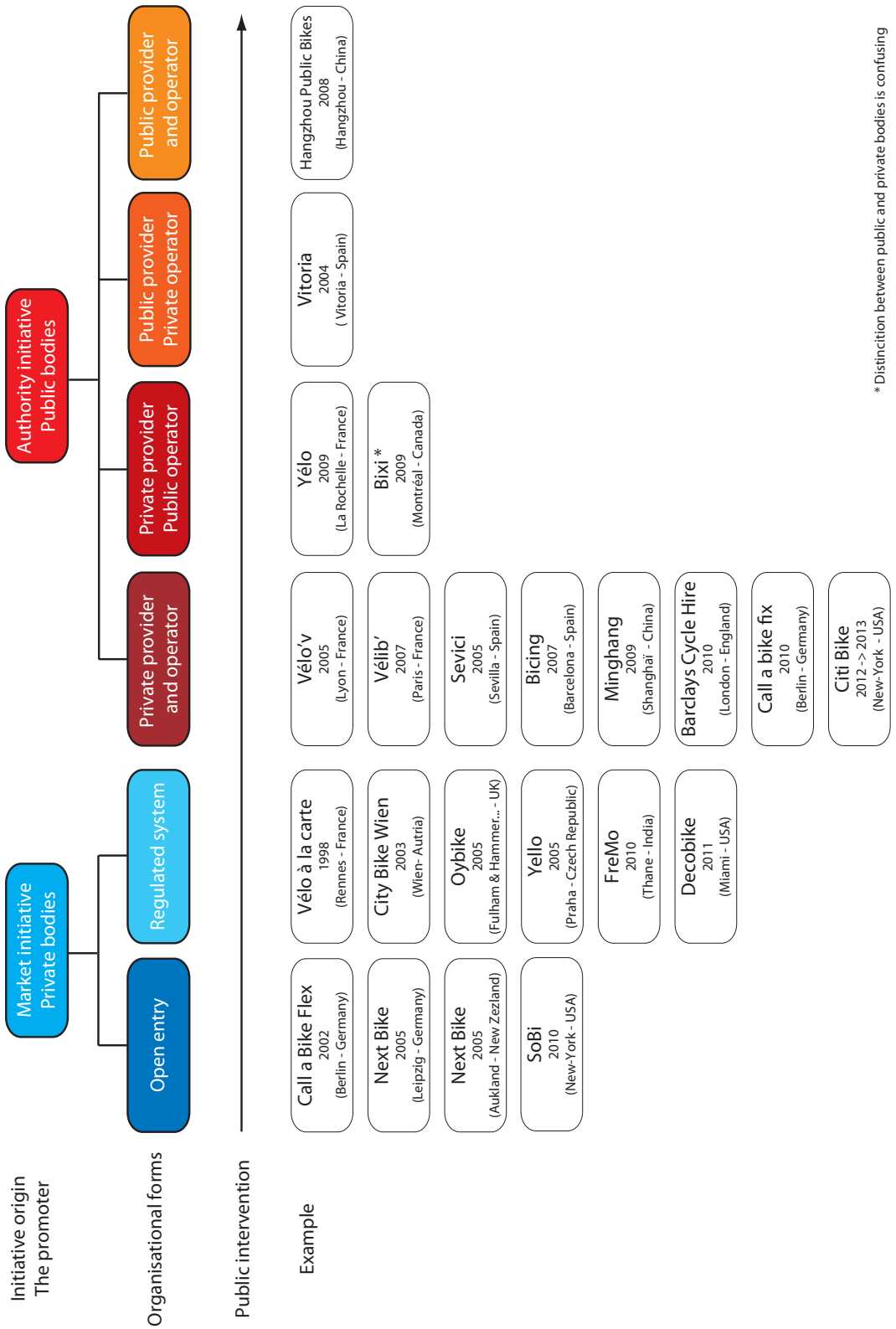


Fig. 3. Organisational Forms of Public Bicycle Schemes Worldwide. Source: Beroud (2007a), Dhingra and Kodukula (2010), Tang (2010), Anaya and Castro (2012), Meddin (2011a).

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Schemes created by market initiative

Market-based initiatives result when a private sector organisation decides itself to offer public bicycles as a service in order to make a profit. Schemes which have been developed as privately led market-based initiatives may be classified in two ways: as open entry systems or regulated systems. Open entry occurs when there are no modifications required to public space, and when public bicycle parking for the scheme is not different from private bicycle parking in the public space. Private stakeholders can act without any public sector intervention. There is usually no requirement for any form of agreement with the local authority and any public sector influence on the scheme is limited to existing transport and planning law.

This open entry model has been developed mainly in Germany, with bookings being made by mobile telephone and with bicycles being left in the public space. Such schemes are a little less visible than schemes with designated parking spaces and so the bicycles are less easily located by prospective daily users. This is one of the reasons why both the 'Call a Bike Flex' scheme, operated by Deutsche Bahn Rent, and 'Next Bike' have recently developed docking station–based systems. Deutsche Bahn public bicycles activity does not seem to be financed just from rental income and is more a way to develop loyalty of multi-modal customers. 'Next Bike' sells advertising on bicycles, which are well placed to be very visible within the public realm, such as shopping areas and transport hubs, where there are a lot of people. Although it is self-financed, use is low.

Contrary to open entry schemes, regulated schemes require local government authorisation because of the way that public space is used. In most cases, the local authority will approve a scheme if it can be shown to satisfy a public policy aim of cycling promotion. In 1998, The Greater Rennes government (France) authorised the civil engineering work required for a public bicycle hire scheme offered in a tender as an additional benefit for an outdoor advertising contract proposed by Clear Channel. Such additions to tenders have been subsequently offered in a similar way in Cordoba (2003) and Gijon (2004) in Spain, and in Vienna (2003) in Austria by JC Decaux. 'Oybike', in a similar way as 'Next Bike', has adopted a business model which uses advertising on the bicycle. However, the 'Oybike' system requires docking stations using existing cycle racks, and a pilot service began in 2005 in the London Borough of Hammersmith and Fulham (United Kingdom). A local cyclist organisation objected to the racks being unavailable for non-scheme cycle users. The scheme ceased operation in 2009. Homeport, a Czech Republic delivery company, adapted its expertise to the bicycle field by providing docking stations to Oybike in Prague in a scheme called 'Yello' which began in 2005. They fixed the docking stations to their own specific bicycle racks in the public realm, and in order to receive permission, they have to pay the City of Prague the symbolic price of one Czech crown per day per station.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Schemes promoted by public bodies

Acting as a transport authority, a local government may decide to introduce a public bicycle scheme as part of its sustainable transport policy for citizens and visitors. It may do so for a variety of specific reasons which could include providing an additional alternative mode of transport after analysing cycling short holidays (Lyon, France); limiting the environmental footprint of transport (Paris, France); improving air quality (San Francisco, USA); limiting road traffic congestion (Washington, USA); developing and offering high-technology transport systems (Spain, with a transition from operator serviced to self-service); promoting cycling as an everyday transport option; improving the quality of life and attractiveness of an area; increasing the number of trips by public transport in conjunction with a bicycle to reduce the number of single occupancy cars; improving the image of the city; providing a means of covering the 'last mile' in a city area without needing a bus, rail or metro service (Translink, 2008). The authors consider that many items are not well integrated in planning steps. Cities often said that renegotiations of contracts are very difficult, and they learn by 'doing'. As independent consultants specializing in public bicycles, our mission is to assist local governments to explore all items of public bicycle scheme procurement before launching tenders.

Once it has been decided to implement a public bicycle scheme for whatever reason or mix of reasons, a provider is required to implement the system and an operator to run the service. The right-hand side of Fig. 3 presents four ways of achieving this. The equipment for, and construction of, the scheme may be provided by a private contractor, with the operation being undertaken either by that contractor or by the local authority. Alternatively, the local authority may procure and construct the scheme components itself, and again either sub-contract the operation or maintain the operation in-house.

The most common approach is to let the implementation and operation as a single contract, as has been done in Oslo (Norway), Lyon, Paris (France), Gothenburg (Sweden), Stuttgart (Germany), New York (USA) and in many other cities. The contract may be integrated with a street furniture and outdoor advertising contract (Sevilla – Spain and Paris – France). The emphasis in such contracts was considered to be the value of the advertising revenue to the contractor, and so the effects of the local, national and international economy have great influence. Reality is far different. In Lyon, JC Decaux has clearly publicised the public bicycles systems, independently of advertising revenues (Beroud, 2007a). This historical model would become scarce particularly if political requirements mean a greater level of transparency for the use of public funds (Beroud, 2011). Alternatively, the contract may be integrated with a public transport contract (Bordeaux and Lille, France). Companies providing these services are transport service providers that have a diversified range of services including tubes, tramways, buses or car sharing. Finally, contracts may be offered which are focused solely on the provision of a public bicycle scheme not linked to advertising or other transport services (Barcelona, Spain;

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Orleans and Rennes, France). Organisations bidding to provide a public bicycle scheme may be single entities (as has been the case with advertising-related contracts) or joint ventures with the provider being a separate entity to the operator (London – UK, New York – USA, Avignon – France). London, and now New York, rely on sponsoring, different to advertising, to partly finance their programmes.

The local authority may wish to retain control over the operation of the scheme in order to ensure it is being run in a way entirely consistent with its policy, to link with other transport services and so that it can respond to changes in the market without having to renegotiate a contract with a service operator. Such a scheme operates in La Rochelle (France). Flexbike, a retailer of Homeport technologies, provided equipment. This is an example where the public body operates the service but contracted its infrastructure provision.

Contrary to La Rochelle, the city council in Vitoria (Spain) developed its own software for operating a public bicycle scheme and has developed the remainder of the scheme by purchases and donations of bicycles with parking being provided in suitably vandal proof night storage facilities. Once the city had established a ready to be operated system, it contracted a private company to continue its operation and so this is an example where the public body implemented the scheme but then contracted its operations. The final type of scheme is where the local authority both implements and operates the scheme, perhaps with some support from a non-governmental organisation (NGO) such as a cycle promotion charity or not-for-profit company. The Centre d'Initiative et de Gestion Locale is an NGO in Esch-sur-Alzette, Luxembourg, which helps create employment, and has been appointed to create and operate a system in partnership with the local authority. This scheme will meet the social objectives of providing local employment as well as transport objectives. The largest public bicycle scheme in the world, in Hangzhou, China, has been created and is operated by the city government (Tang, 2010).

The range of contractual relationships between the scheme promoters, providers and operators demonstrates a range of different goals and different cultures. It is interesting to note that public initiatives to create public bicycle schemes started only after private initiatives had already created a level of interest.

There remains a lack of research on the impacts of different types of scheme and comparative performance analysis between different models of implementation and operation. It is not possible to suggest whether one model is likely to be a better model than another. However, it is possible to make some judgements on the measures which might optimise the performance of public bicycle schemes.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

4. Building a public bicycle scheme policy

In this final section, we only consider schemes promoted by public bodies. This is not because schemes initiated by the private sector should be discounted or because public sector promoted schemes appear now to be the most common. Public sector–based initiatives can best integrate with and support wider transport policy and, to be successful, public bicycle schemes need to be of a certain size which requires a level of public intervention (Beroud, 2007a). Finally, this model is the only one that allows public bicycle schemes to be regarded as a public service.

We will discuss the integration of public bicycle schemes with other cycling, transport and urban policies to create a cycling friendly environment – the mission of decision makers – and the impacts of different attributes of public bicycle schemes.

Creating a cycling friendly environment

A local government has the powers to create an environment which is suitable for cycling. And public bicycle schemes will be most effective when implemented alongside a range of other complimentary policy measures.

An essential prerequisite is an overall land use policy to reduce travelling distances and to prioritise walking and cycling. The instruments of such a
policy will include limits on the sprawl of urban areas and the creation of mixed land uses. Second, transport policies and plans need to consider the needs of every mode of transport, preferably prioritising the needs of walkers, cycle users and those with reduced mobility. The needs of public transport and, finally, motorised modes follow. Constraints on car parking are an important way of reducing car use, with the development of multi- modal alternatives satisfying the demand for travel.

Finally, policy specifically relating to cycling has to be developed which, in accordance with the recommendations of BYPAD (2003), includes planning, implementing actions and monitoring of the effects of those actions. Cycling policy has to focus on the six components of the cycling system (Beroud, 2010a) as shown in Fig. 4.

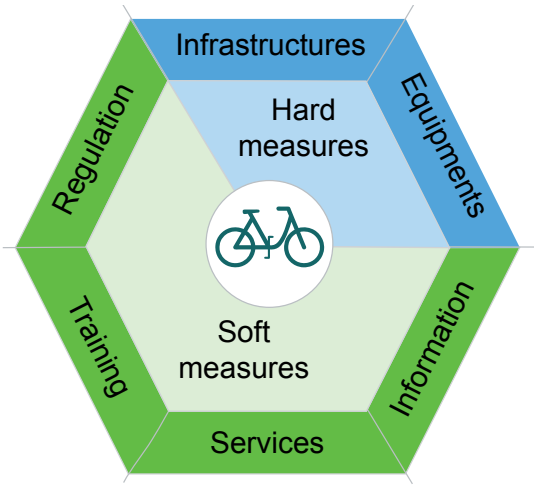


Fig. 4. The Six Components of a Cycling System (BIMOMO typology - Mobiped)

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

At best, all issues relating to cycling, including public bicycle schemes, should be encapsulated in a single policy document, coupled with a coherent action plan, programme for implementation and budget. Such a policy document would derive from an overall cycling strategy in proper relation to the rest of active modes policy, transport policy and land use planning.

Public bicycle scheme are also successful because they impact each of these six components of the cycling system (Mobiped, 2010). A public bicycle scheme is very much embedded within its urban environment and maximum benefit may be derived from it by implementing a wide range of hard and soft measures which may also be implemented for the benefit of cycling more generally. In particular, however, relative to general cycling promotion, public bicycle schemes may require an enhanced level of advertising, cycle training and general civic campaigns about respect, share and use of public space.

Not buying a product but defining a service

Local authorities are best placed to offer public services such as public bicycle schemes. They need to take responsibility for the planning and management of schemes and this section describes methods to ensure maximum benefit is derived.

A feasibility study needs to be specified to determine whether a public bicycle scheme will support land use and transport planning objectives and to suggest the most appropriate way of scheme implementation. A variety of concepts for public bicycle schemes have been described above and the most suitable concept for a particular location will depend on local political will and inclinations, financial and other resources available to the local authority, relevant local regulations and the policy objectives which the scheme will need to satisfy. It is important that local governments define a service rather than think they are buying an existing product. The next stage involves the procurement of a contract for delivering either the necessary equipment or the operation of the scheme, or both. This will involve preparing a suitably defined specification in terms of equipment type and property, as well as the quality of the service to be provided. Particularly important is the way that the scheme will be maintained, the bicycles will be redistributed between docking stations, how the customer interface, including revenue collection, is undertaken and how general communication and marketing is performed. The local authority needs to be particularly concerned about the skills and attributes of the potential providers and operators and with the way the contract is set up in respect of data to understand revealed mobility behaviour. Each local authority has to decide how they will share investment and commercial risk with the operator, and this will be influenced by whether decisions on a range of operational matters are taken by the local authority or by the private sector operator, as summarised in Fig. 5. In France, the commercial risk is partly shared

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

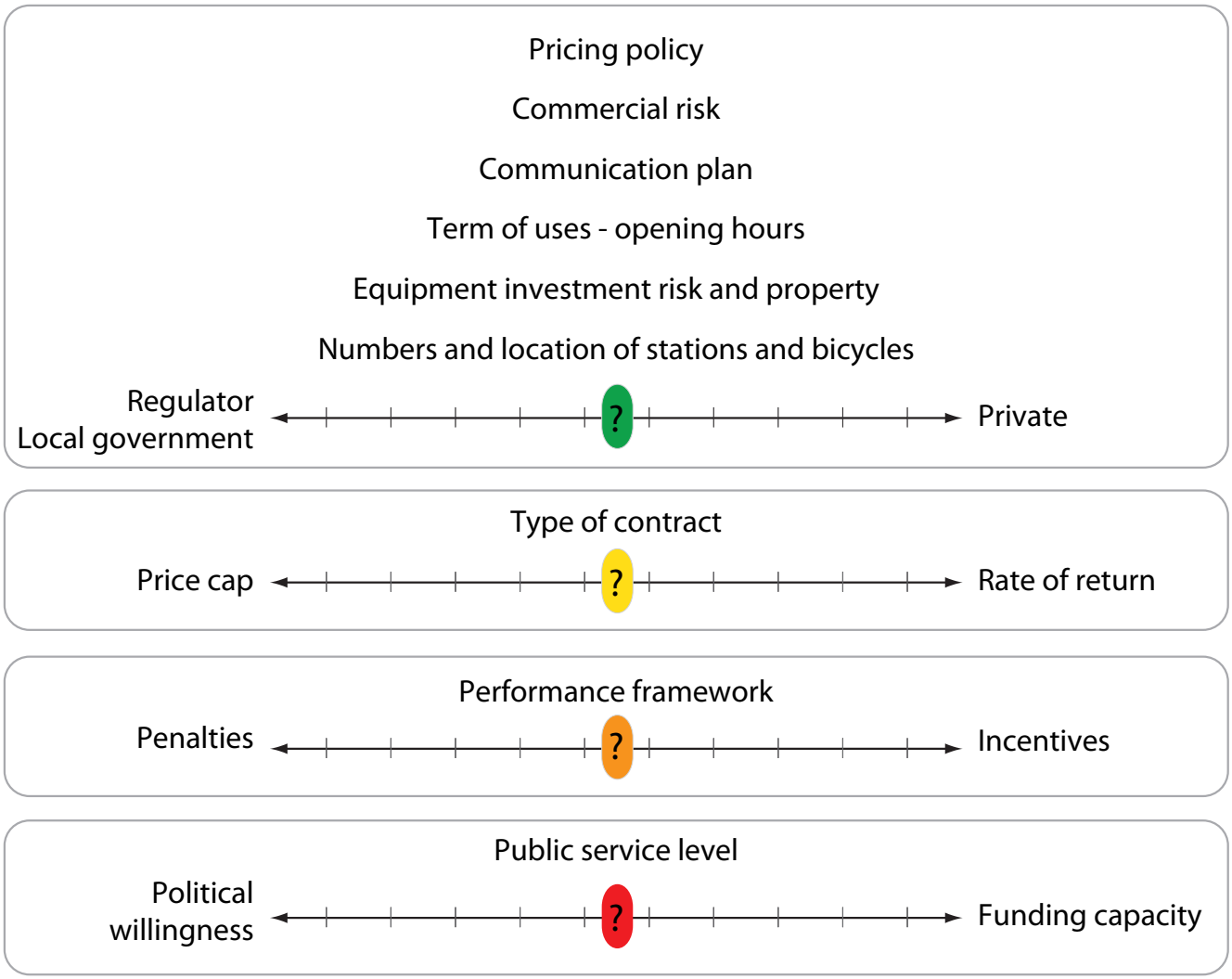


Fig. 5. Summary of Risk Sharing

by the operator and the regulator. When the operator responds to a tender, it includes maintenance and equipment renewal costs and liabilities depending on component life- cycle costs. If the maintenance costs are higher than foreseen, the operator bears the additional costs. The length of contracts is often more than 10 years and the redeployment equipment in other cities helps operators to decrease the commercial risk. But high vandalism could lead to high additional costs. In Paris, JC Decaux has convinced the city of Paris to sign an endorsement in order to share the cost of vandalism (Ville de Paris, 2009).

Currently, the commercial risk is mainly borne by local authorities who decide on the way that members of the public may join and use the scheme and the pricing. In return, they receive the revenue from the scheme. The model of pricing which allows the first half-hour of use to be free is paradoxical, because revenues will generally come from longer duration use of the scheme by tourists, who are not the primary targets for increase in sustainable mobility.

Historically, the public regulator defines the characteristic of the service and the operator has to fulfil the obligations created as a consequence of this characterisation. Operator performance is mainly based on its capacity to

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

provide the service effectively and efficiently. They have no incentive to increase the use of the service, but they may receive penalties if docking stations are full or empty, or if the satisfaction rate amongst users is low.

Greater Rennes, again, has innovated by requesting in the tender an objective of a minimum of 2,500 rentals a day (Beroud, 2010b). In the future, we could imagine that the promoter will give to experienced operators a higher level of responsibility for maximising demand. Operators will be able to bring high levels of private sector expertise to demand and hence revenues and overall cycling modal shares.

Once the provision and operation contracts are signed, a critical issue for any form of public service contract, such as a public bicycle scheme operational contract, is that good channels of communication are specified between the scheme promoter and the contractor charged with operating the scheme. At best, these will be enshrined within the contract and may, for example, specify the frequency of meetings and reports and their content, as well as actions to be taken in specific circumstances such as emergencies.

It is important that a scheme is monitored in use so that feedback can be used to adjust the performance of a scheme. This may be achieved against a battery of indicators (membership renewal percentage, rent per bike per day and so one) as specified in the contract for operation and with free access to operating data. Additional information, which will also be very helpful at the feasibility stage includes data available from within the local authority, for example, relating to travel behaviour, reports, handbooks (Beroud, 2010b; IDAE, 2007; OBIS, 2011) and publications on the performance of other similar schemes, and learning partnerships between cities, which may include conferences, exchange visits and web-based communication.

Assessing public bicycle scheme impacts

Public bicycle schemes have impacts which directly relate to the three pillars of sustainability: the environment, society and the economy. This section aims to make decision makers aware of possible impacts other than the ones they expect and the needs of data to assess public bicycle scheme impacts that are often not evaluated or are under-evaluated.

Environmental effects

In comparison with a similar journey made by motorised transport, cycling produces much less carbon dioxide, a greenhouse gas which promotes climate change. Public bicycle schemes are frequently justified on the basis of their carbon dioxide emission reducing potential as well as their air pollution reducing potential. Dekoster and Schollaert (1999) highlighted that 50% of trips in urban areas are less than 5 km in length, and that these trips are quicker by bicycle. A public bicycle scheme with a suitable density of docking stations can offer a level of service that would support trips of such a length and facilitate short trips with sustainable modes is part of the solution to the pressure for urban sprawl

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

with its concomitant resulting additional greenhouse gas emissions.

While public bicycle schemes can support the needs of short-distance trip makers, the schemes themselves are not fully carbon neutral. The redistribution of bicycles between docking stations and the operation and maintenance of the scheme does have associated carbon dioxide emissions. As all cities, London is unbalanced because of use for commuting trips. Barcelona and Paris have an additional unbalanced usage at stations due to topography as people are reluctant to cycle uphill. Consideration has been given to users contributing to rebalancing, and they would need to be appropriately motivated, for example, through free or reduced cost use at appropriate times in unpopular directions. A user who returns a bicycle to a high-level station in Paris receives free additional time, designated as Velib þ , which, for scheme members, may be stored for future use. Significant monitoring and analysis, such as has been undertaken by Raviv, Tzur, & Forma (2010), is now being undertaken by schemes across the world to develop algorithms for maximising the efficiency of operation in order to maximise the benefits of the scheme to users and the environment. Public bicycle users who previously used motorised vehicles for the same trip comprised less than 10% in cities like Barcelona (Ajuntament de Barcelona, 2007). In Lyon, 5% of Velo'v users would have used their car if this public bicycle scheme would have not existed. Car trips shifted toward Velo'v represented in 2008 less than 0.01% of all car trips for inner Lyon and Villeurbanne. For Lyon and all it suburbs, the percentage diverting to the scheme was less than 0.001% (Beroud, 2010a). Clearly, the savings in carbon dioxide may only be claimed for those trips which would have otherwise used motorised transport. It is a more complex task to estimate the carbon dioxide emissions savings from the switch people might make from public transport to a public bicycle scheme.

Other considerations include the manufacture and recycling of bicycles and equipment used in the schemes, with Van den Noort (2007) suggesting that 90% of their bicycles and materials can be recycled, and the energy source for docking stations, which frequently is from solar panels.

Social effects

Public bicycle schemes which are well designed and adapted to the local context could have interesting social impacts because of the enhanced and distinct form of mobility which they offer. This could result from easy access to cycling, low costs for travel, and near universal access. Easy access to cycling is especially relevant in places where the access to cycling is limited by economic or cultural barriers. People can cycle without having to commit to buying and maintaining a bicycle and the availability of a scheme will allow them to work out whether they intrinsically like cycling for the sorts of journeys they make. A public bicycle scheme in this way may open up an unknown volume of 'hidden' demand and consequently put a lot of new cyclists on the streets. In Lyon, 96% of users in the first years would not have taken a bicycle for the trip made with Velo'v (Beroud, 2007a). Such a release of demand may cause conflicts with other users, as it did with walkers in Barcelona. This highlights the need, discussed above, for training to ensure appropriate behaviour. There are many types of pricing structure, but

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

a feature of most schemes is their relatively low cost compared with public transport. Typically, for a member of a scheme, a user pays an annual fee that permits unlimited use, with a time limit for individual journeys. The more use a person makes of the scheme, the cheaper it becomes per trip, particularly in relation to the costs they might have had to incur in purchase, maintenance and storage of their own bicycle. Contrariwise, depending on the popularity of the scheme and the way that bicycles are redistributed to docking stations, there is the risk of incurring 'waiting time' or the risk of not finding a convenient docking station for the return of the bicycle near to the destination.

Public bicycle schemes are conceived of as providing universal access for anybody who is physically able to cycle. It does require the prospective user, however, to have some form of payment card and possibly a mobile telephone. Scheme operators, may, in addition, place restrictions on use by certain types of user, particularly casual users, and this is in order to limit the extent to which the distribution of bicycles across docking stations may become unbalanced. For example, in Barcelona it was decided not to make the system available to tourists and visitors (to obtain a card for use of the system, a Spanish address is required and it takes around 10 days for the card to be delivered), because they could overuse stations located in tourist places and unbalance the service. Conversely, some schemes have adopted progressive pricing policies to promote social inclusion and equity. For example, in Sevilla, registered students do not have to pay an initial deposit. The nature of the system is such that it is possible to provide the service even in areas where the demand may be relatively low, hence enabling the possibility for some members of society to be more mobile than they would otherwise be. In Paris, the new pricing policy integrates specific rates for students, as well as for people for which one-way trips last more than half an hour. By paying h39 a year rather than h29, they benefit from
45 minutes free of charge for each new rental.

The presence of public bicycles in the streets contributes to the visibility of cycling and cyclists and this helps to enhance the perceived 'legitimacy' of cycling which may also lead then, for example, to reduced motor traffic speeds creating an even more appropriate environment for more general, non-public bicycle scheme–related cycling.

Economic effects

The costs of implementing a bicycle hire scheme are fairly readily identified. The benefits are a little harder to define and sometimes quite difficult to evaluate in monetary terms. Any cost–benefit analysis would need to comply with the standards for transport investment appraisal adopted by the country implementing a scheme. This section discusses scheme benefits that should be taken into account. Further work is required in this field of inquiry, however.

Cost–benefit analysis has been made publicly available for a number of schemes including Washington (linked with bus transit, Metropolitan Washington Council of Governments, 2009) and a French government study which showed that costs were broadly balanced by benefits (but in fact the authors recognised that the data was incomplete, Commissariat General au Developpement Durable, 2010);

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/ distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Bicing in Barcelona, Spain (Bea & Anaya, 2009), and health impacts study of Bicing in Barcelona (Nazelle, Rojas-Rueda, & Nieuwenhuijsen, 2011) which concludes that the health benefits of increased physical activity outweigh the increased risks from accidents and exposure to air pollution.

Costs may be summarised as follows:

- Capital costs (bicycles and docking stations and other public realm infrastructure such as hard-standing around the stations)
- Operational costs (including maintenance, bicycle redistribution and sales costs)
- Negative externalities associated with bicycle redistribution and maintenance trips which generate atmospheric pollution and carbon dioxide emissions.
- The opportunity cost of urban space (the public space occupied by public bicycles has a value that is being invested in the system, and hence is not available for any other service which may have a greater public benefit). Bea and Anaya (2009) assumed an alternative use to be car parking. In Lyon, public space use is more efficient for use as a public bicycle scheme than for use as car parking (Beroud, 2007a)
- Health costs including those resulting from road traffic accidents and exposure to air pollution
- Travel time costs (resulting from waiting times to access a bicycle or additional time required to return a bicycle)

Benefits may be summarised as including

- Reductions in emissions thanks to the modal switch from motorised vehicles or public transport.
- Reductions in overcrowding on public transport.
- Reduction in motor traffic congestion.
- Health benefits including reduced absenteeism from work.
- Accident cost benefits as a result of fewer journeys being made by motorised transport.
- Increased accessibility. Trips that would not have been made if the public bicycle scheme did not exist serve to increase the accessibility.

These calculations will depend on initial assumptions. These assumptions are based on estimated or real figures that will vary by city.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

Conclusion

Public bicycle schemes offer a novel form of public service. Despite being at an early stage in evolution, there are a wide variety of ways that schemes have been implemented and operated, and which have different degrees of private and public sector involvement. On the basis that they are fundamentally a public service, local governments and transportation authorities need to ensure that they carefully specify schemes in order to meet local policy objectives. Decision making about scheme implementation will revolve around developing a suitable management arrangement for the scheme such that it will satisfy transport objectives and maximise the benefits of the scheme to the locality.

Private stakeholders, who were the first to start providing and operating public bicycle schemes, have specific skills and experiences which are necessary to making public bicycle schemes a commercial success. Any scheme promoted by a public body should ensure that a private or public sector operator has incentives to decrease costs and improve revenues and attract the maximum number of users away from car use.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

References

- Ajuntament de Barcelona. (2007). Estudi d'habits de mobilitat dels usuaris del Bicing. Market Aad.
- Anaya, E., & Castro, A. (2012). Balance general de la bicicleta publica en Espana 2011.Fundacion ECA-Bureau Veritas, 2012, Barcelona, Spain.
- Assemblees des Communautes de France. (2010, Novembre 30). Clarification des competences dans le champ des transports et de la gestion des mobilites, 23pp.
- Bea, M., & Anaya, E. (2009, May 14). Cost benefit evaluation of bicing. Paper presented at ECOMM, 2009, San Sebastian-Donostia, Spain. Retrieved from http://www.epomm.eu/ ecomm2009/6_bea.pdf
- Bergua, E., & Benaito, J. (1997). Las vı´as ciclistas en el Estado espan˜ol. Velo-city 1997. Retrieved from http://habitat.aq.upm.es/boletin/n6/aeber.html
- Beroud, B. (Directeur de memoire: BAUMSTARK L.). (2007a). Velo'v: un service de mobilite de personnes a transferer? Comparaison des systemes automatises de location de velos sur l'espace public en Europe – 2eme version, Master Recherche Transports, Espaces, Reseaux. Lyon: Universite Lumiere Lyon II, Laboratoire d'Economie des Transports, 1st version on 25th September 2006, 2nd version in March 2007, 118pp.
- Beroud, B. (2007b, Septembre). Les experiences de velos en libre service en Europe. Transports urbains, no. 111, 5pp.
- Beroud, B. (2010a, Janvier). 4 years down the path, what is the mobility impact of Velo'v? Mobility, The European Public Transport Magazine, 16, 2pp, pp. 96–97.
- Beroud, B. (2010b). Les velos publics – les velos en libre service. Cahier technique des Editions WEKA, Paris, 20pp.
- Beroud, B. (2011, October 13–15). After 2011, what is the future of public bicycles? Paper presented at the 3rd Conference on Public Bicycles in Spain, Santander, Spain, 3pp.
- Beroud, B., Clavel, R., & Le Vine, S. (2010c, October 11th). Perspectives on the growing market for public bicycles: Focus on France and the UK, European Transport Conference Publication, Glasgow, Scotland, 25pp.
- BYPAD. (2003). Bicycle Policy Audit, European Project. Retrieved from www.bypad.org. Accessed on 26 August 2011.
- Club des Villes et Territoires Cyclables. (2007, mai/juin). Le velo en libre service. Ville et Ve´lo, no. 27, 13pp.
- Commissariat General au Developpement Durable. (2010, Decembre). La mobilite des Franc- ais, Panorama issu de l'enquete nationale transports et deplacements 2008, La Revue du CGDD Service de l'observation et des statistiques, pp. 65–82.
- Dekoster, J., & Schollaert, U. (1999). Cycling: The way ahead for towns and cities. European Commission, Directorate-General for the Environment. Retrieved from http://ec. europa.eu/environment/archives/cycling/cycling_en.pdf
- De Maio, P. (2003, July). Smart bikes: Public transportation for the 21st century? Transportation Quarterly, 57(1), 9–11.
- De Maio, P. (2009, May). Bike-sharing: Its history, models of provision, and future. Paper presented at Velo-city 2009 confer-

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

ence. Brussels, Belgium.

- De Maio, P. (2010). 2010 Year-end wrap-up. The Bike-sharing blog, 31st of December 2010. Retrieved from http://bike-sharing.blogspot.com/2010_12_01_archive.html. Accessed on 26 August 2011.
- Dhingra, C., & Kodukula, S. (2010, August). Public bicycle schemes: Applying the concept in developing cities. GTZ Sustainbale Urban Project, New Delhi, 32pp.
- Hure, M. (2010, Juin). Le role des acteurs prives dans la mobilite des villes mediterraneennes: les velos en libre-service a Barcelone et a Marseille, Transports urbains, no. 117.
- IDAE. (2007). Guıa metodologica para la implantacion de sistemas de bicicletas publicas en Espana, 124pp.
- IDAE. (2008). Plan de Accion 2008–2012 de la Estrategia de Ahorro y Eficiencia Energetica en Espana, E4.
- INE. (2009). Encuesta Hogares y Medio Ambiente 2008. Retrieved from http://www.ine.es/ revistas/cifraine/0609.pdf.
- Meddin, R. (2010). Bordeaux's new V3 bike-sharing flirts with 4th generation tech. The Bike- sharing blog, February 22, 2010. Retrieved from http://bike-sharing.blogspot. com/2010_02_01_archive.html. Accessed on August 26, 2011.
- Meddin, R. (2011a, March 15). DecoBike a concession to the Art Deco of Miami Beach. The bike sharing blog-spot, March 15, 2011 ase. Retrieved from http://bike-sharing.blogspot.com/2011/03/decobike-concession-to-art-deco-of.html. Accessed on August 26, 2011.
- Meddin, R. (2011b). The bike-sharing world: First week of June 2011. The Bike-sharing blog,June 1, 2010. Retrieved from http://bike-sharing.blogspot.com/2011/06/bike-sharing-world-first-week-of-june.html. Accessed on August 26, 2011.
- Metropolitan Washington Council of Governments. (2009). TIGER Regional Priority Bus Project Documentation, Bike Sharing and Transit Centers BCA Model. Retrieved from http://www.mwcog.org/transportation/activities/stimulus/tiger/documents.asp? COMMITTEE_ID ¼ 254.
- Ministere du Developpement Durable. (2007). Le Versement Transport, February 27, 2007.Retrieved from http://www.developpement-durable.gouv.fr/Le-versement-transport. html. Accessed on August 26, 2011.
- Ministerio de Fomento. (2005). Plan Estrate´gico de Infraestructuras y Transporte 2005–2020. Retrieved from http://www.fomento.es/MFOM/LANG_CASTELLANO/_ESPECIALES/ PEIT/.
- Mobiped. (2010). The BIMOMO methodology. Retrieved from http://www.mobiped.com. Accessed on 26 August 2011.
- Nazelle, A., Rojas-Rueda, D., & Nieuwenhuijsen, M. (2011). Bicing in Barcelona, Spain: A description and estimated health impacts. CREAL, Barcelona. Retrieved from http:// si.easp.es/eis2011/wp-content/uploads/2011/04/Bicing_HIA_granada.pdf
- OBIS. (2011). Optimising bike sharing in European cities, supported by Intelligent Energy Europe, 90pp. Available at http://www.obisproject.com/palio/html.wmedia?_Instance= obis&_Connector=data&_ID=971&_CheckSum=431477623
- Raviv, T., Tzur, M., & Forma, I. A. (2010). Static repositioning in a bike-sharing system.Tel Aviv University.

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.

- Sanz, A. (1999). La bicicleta en la ciudad. Ministerio de Fomento, Madrid.
- Shaheen, S., Guzman, S., & Zhang, H. (2010a, March 15). Bike sharing in Europe, the Americas and Asia: Past, present and future, 2010. Transportation Research Board Annual meeting, 19pp. Washington, USA.
- Tang, Y. (2010). Bike-sharing systems in Beijing, Shanghai and Hangzhou and their impact ontravel behaviour. Department of Urban planning, Tongji University. Urban Transpor- tation Planning Research Group, 14pp.
- Translink. (2008). Translink feasibility study, volume 1, 2008. Retrieved from http://www.translink.ca/B/media/Documents/cycling/Public%20Bicycle%20System%20Investigation/Public%20Bicycle%20System%20Investigation%20Part%201%20-%20Environment%20Scan.ashx.
- United Nations. (2011, May 2–13). Bicycle-sharing schemes: Enhancing sustainable mobility in urban areas. Prepared by Peter Midgley, Global Transport Knowledge Partnership International Road Federation, New York, NY 24pp.
- Van den Noort, P. (2007). 33 questions and answers to learn everything there is to know about
- Velib', the Public Bicycle in Paris, Velo-Mondial.
- Van de Velde, D. (1999). Organisational forms and entrepreneurship in public transport, Part 1: Classifying organisational forms. Transport Policy, 6, 147–157.
- Ville de Paris. (2009, Decembre 4). Avenant No. 2 au marche no. 0761001 Relatif a la mise en place d'une flotte de velos a destination du public et de mobiliers urbains d'informations a caractere general ou local et accessoirement publicitaire, 7pp.

Pictures and charts credits

Benoit Beroud

- Pictures page 1 (France, UK, Canada, Italy, Spain, Germany), 8 (Italy), 9 (France), 15
- Charts: page 11, 19, 23, 25

Esther Anaya : Pictures page 9, 17 and 18 (Spain)

Angle Zhang: page 1 - Picture of Hangzhou (China)

Alta Bike Share: page 1 - Picture of Citi Bike (United states)

This chapter is © Emerald Group Publishing and permission has been granted for this version to appear on the authors website: www.mobiped.com and bicicletapublica.wordpress.com. Emerald does not grant permission for this chapter to be further copied/distributed or hosted elsewhere without the express permission from Emerald Group Publishing Limited.