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Authors: Thomas Böhmer / team red Deutschland GmbH

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1 Introduction and CYCLECITIES Project goals

1.1 This report describes the methodology to produce a report on the efficiency of bike-sharing systems (BSS) based on the survey which was conducted within the Cyclecities project in 40 European cities.

1.2 The CYCLECITIES project has the following objectives:

A. To explore (identify, analyze, exchange) current practice in urban mobility management schemes as regards cycling.

B. To identify, analyze and make available good transferable mobility management interventions that have facilitated the integration of cycling and promoted a sustainable reorganization of cities' mobility.

C. To identify strengths, weaknesses, opportunities and threats in integrating cycling within European cities' mobility management.

D. To identify which road categories, in terms of geometry and function, are the most suitable for the development of cycling infrastructure.

E. To record the changes in the geometry and function of different road categories which are caused by the development of cycling infrastructure.

F. To analyze the effectiveness and cost aspects of infrastructures and operation for cycling in European cities

G. To analyze the cost differences between conventional roads and those with cycling infrastructure.

H. To evaluate the effects on accessibility, which are caused by the introduction of cycling in the overall transport organization.

I. To build effective methodologies and support tools for the experimentation and potential adoption of cycling urban transportation strategies.

J. To explore, identify, build consensus on policies and framework conditions that can contribute to the adoption of cycling within European mobility management schemes.

K. To establish a European, multilingual, freely-accessible knowledge and experience base.

L. To disseminate the project results and the field experiences and good practices enhancing awareness on the benefits from integrating cycling in cities' mobility management schemes.

2   Methodology

3   Definition and Approach

The term efficiency generally describes the relation of an intended outcome to the used effort. An "efficient" system will fulfill the requested goal, task or purpose with a minimum input of time, money or other resources. In the world of economy an efficient system will feature a low cost-benefit ratio. This leads the question, which are the goals or benefits intended with the introduction of a BSS, and which are the effort factors to describe establishment and operation of a BSS. It is important to mention, that this factors will vary depending on the system and local conditions.

Based on these elaborations, special performance indicators can be defined which describe the different dimensions of the efficiency of bike sharing systems in Europe. Additionally, further success factors can be identified from sections B to D of the questionnaire (see figure 1).

Section A: BIKE SHARING SYSTEM IDENTITY
Section A includes the BSS information such as title, city and country of operation, as well as the year of implementation.

Section B: USER PATTERNS INFORMATION
Section B focuses on BSS use types, user demographics, user satisfaction and citizens' involvement in planning and decision making aiming to provide insights on BSS assessment from the view of users and citizens.

Section C: COSTS & ECOMONIC RESULTS
Section C addresses the economic results and aspects of the surveyed BSS aiming to capture stakeholder perspectives on the actual costs, economic results and financial sustainability of bike sharing schemes and systems applied in European cities.

Section D: IMPACT AND PROSPECTS
Section D aims to provide insights on the major benefits and challenges of surveyed bike sharing systems in terms of their impact and repercussions as viewed by key individuals and stakeholders. It also aims to identify key lessons learned in planning, deploying and operating BSSs in urban areas that could be useful to European city administrations.

Section E: PERSONAL INFORMATION
Section E includes the respondent info such as position, affiliation in organization and contact details. It will also define the respondent's level of involvement in the BSS case examined.

Figure 1: Structure of the BSS survey questionnaire (adopted from the methodology to collect data on existing bike sharing systems in European cities)

4 Goals of the introduction of bike sharing systems

A whole variety of impacts intended with the introduction of BSSs is connected to the **problems with motorized traffic**: traffic congestion, high level of land use (on-street car use and parking space), accident risk, air pollutant emissions, noise or the separation effect of streets. In that respect, the BSS is used to replace car trips through providing a faster, more direct or more convenient alternative for car use. This effect is increased if the connection between public transport, public bicycles and private bicycles offers a complete and comfortable transport chain for the user destinations. Additionally, BSSs increase the **public awareness and the acceptance of the bicycle** as a mean of daily transport itself. In many cities, also the use of private bikes has increased significantly after introduction of a BSS.

An important issue is the **image building function** of a BSS. Especially the large systems which started since the year 2004 in Lyon, Paris or Barcelona caused significant attention in the national and international press as well as in politics. It gives the city an image of modern lifestyle exceeding the pure transport effects.

Furthermore, BSSs improve **quality of life through better accessibility** within the covering area. Not only tourists can make their trips more convenient and increase the number of activities. Public bicycles also offer the scope for cooperation with hotels and restaurants.

An increasing issue for Europeans are also **health effects** of cycling and BSSs in particular. For many people the use of a BSS might indicate the first step into a healthier lifestyle performed by active mobility.

For private operators, also producing **revenues from user fares and advertising** are important goals connected with BSSs.

Customer satisfaction with the BSS hast to be seen as precondition for reaching the goals. This regards:

- Access for everybody
- Availability of bikes,
- Quality of bikes
- Easiness of registration, payment, renting procedure and bicycle

- Price

Indicators for reaching the goals might be high numbers of users, high usage or a sinking share of car trips made out by household surveys.

5 Factors describing the effort to implement and operate bike sharing systems

Factors will be primarily defined as expenses (costs).

Main expenses for implementation of a bike sharing system will be as follows:

- Bicycles
- Stations
- Distribution and maintenance vehicles
- Maintenance and storage depot
- Operation system

Main expenses for operation of a bike sharing system will be:

- Labour
- Bicycle replacement, maintenance and repair (depending on level of use and vandalism)
- Distribution logistics (depending on location or time inhomogeneity of bike trips, for some systems this is the biggest cost factor)
- Advertisement
- Administration
- Energy, heating and other operating cost

6 Performance indicators for efficient bike sharing systems

Efficient BSSs will combine good performance in terms of reaching the goals, satisfy the customers and having low operating cost.

Based on the previous chapters, the following performance indicators derived from the survey are used to find key elements of efficient and successful BSS.

SECTION B: USER PATTERNS INFORMATION

Proportion of the municipality area covered by the bike sharing system (question 7)

In principle it is desirable to have covered the whole municipality area by the bike sharing system. As a target, the BSS should be available for everybody on every location in the city. Nevertheless it is to consider that not all areas are equally suitable for BSS use. This regards the number of potential users as well as the danger of vandalism or theft. Furthermore it is important not to reduce the density of bikes just to expand the covering area. As a rule of thumb, the next bike or the next rental station should be ideally in eyes view from every point of the covering area.

Average duration of each trip by users (question 8)

This value might be very much depending on the tariff structure of the BSS. Especially the BSSs with a high usage frequency (partly more than ten renting procedures per day and bike) feature a free renting e.g. for the first 30 minutes and increasing prices for the longer renting periods. This also supports the issue that the system is not concurring with public transport (PT), but adding value to the public transport services. For cities with a functioning PT system, short renting periods are desirable in order to use existing bikes in an efficient way. Nevertheless there might be exemptions – e.g. overnight use for commuters to reach their home from the last stop of a PT line or outside of the PT operating times.

Measurement of bike sharing system user satisfaction (question 9)

Measurement of bike sharing system user satisfaction is a quality criterion which demonstrates the intention to improve service quality. The measurement fact is expected to correlate with the real satisfaction of BSS users.

Assessment of the public consultation as regards the implementation of the BSS (question 10)

The quality of public consultation demonstrates the level of intention to solve expected problems prior their appearance already in early planning stages. It is expected to correlate with the real satisfaction of BSS users and other stakeholders.

Assessment of the prevailing citizens' opinions towards the bike sharing system (question 12)

Citizens' opinions show the acceptance of the system within the citizenship and demonstrate the image value of the BSS. It is expected that private/commercial

systems have a lower citizens' acceptance than BSS established by the municipality or by the local PT operator.

SECTION C: COSTS & ECONOMIC RESULTS

Repair / replacement costs due to damages, vandalism and theft compared to the overall operating cost? (question 13)

Low maintenance costs for the system indicate robustness of the chosen technological components and sound planning, but might also reflect the mentality of the citizens (careful use, low level of vandalism). Of course, relation of maintenance costs and level of usage hast to be considered.

Economic results of the bike sharing system in the last 3 years of operation (question 14)

Economic result is the most important value showing the overall economic efficiency. However it is to check, if and to what extend revenues from advertising contributed to the stated result (see question 15).

Revenue of the bike sharing system from different sources (question 15)

It is desirable to have a high percentage of user fee revenues to cover the expenses. It is important to consider, that the image building and advertising effect exists for nearly every BSS, but it is used only for a part of it to create real revenues and balance the economic result.

Assessment of the overall value for money of the bike sharing system (question 17)

This somehow subjective evaluation gives the opportunity to overcome the problem of different calculation systems which were faced in the questions 15.

SECTION D: IMPACT & PROSPECTS

Assessment of the benefits of the bike sharing system (question 18)

Important goals for implementing BSSs are being assessed: reducing traffic congestion, increasing bike use, improving citizens' health, reducing CO_2 emissions / improving the urban environment, increasing tourism, generating revenue, boosting growth / supporting local economy. The answers for "generating revenue" should correlate with the answers for the questions 15 to 17.

Assessment of the major challenges, disadvantages or negative aspects of the bike sharing system (question 19)

It is desirable to have a low amount of problems to face with the system. However this question does not necessarily express whether the problems prevailed or not.

Assessment of the effectiveness in reducing car use and easing traffic congestion (question 22)
This question combines two important goals of BSS implementation which are assessed parallel in question 18.

7 Data processing to identify key factors for efficient bike sharing systems in Europe

The survey data described in chapter 6 will be used to identify

    a) the most efficient and most successful BSS out of the sample

    b) key factors for efficient and successful BSS

In this context "successful" is used in the meaning of reaching the goals (effectiveness). For this part, only the "goal"-related questions will be used. The following procedure is suggested:

1. **Analysis of the data structure** in order to identify possible types or classes of BSSs in the survey. Within one type of BSS, a high number of common features should appear. This analysis can be supported by a cluster analysis tool. Furthermore, analysis of cross-correlations can identify significant relations between the questions.

2. **Analysis of the single questions** described in chapter 6 in order to identify weak and strong points of the whole sample

3. **Identification of BSS with most positive assessments** in regard to reaching the goals as well as being economically strong. Analysis of common features of these BSS.

4. **Description of key factors** for efficient and successful BSS

It is important to mention that the described methodology is focused on the survey data only. Use of other BSS data from the OBIS Project, the EPOMM data base or the World Bike Sharing Map might round up the results by giving more evidence and adding new factors which are not considered in the CYCLECITIES survey.

8 Indicative outline of the report on the efficiency of bike sharing systems in Europe

Introduction

The introductory chapter will outline the scope and context of the Cyclecities project and present the targets and objectives of the report. It will also provide a chapter outline of the report.

Methodology

This section will approach the definition of an efficient bike sharing system and pronounce important issues to consider. It will describe the used data of the Cyclecities survey and the way the data is analyzed.

Data analysis

This section will describe the different steps of data analysis and present the results of each step.
It will include the analysis of the data structure , the analysis of the relevant questions and the Identification and analysis of BSS with most positive assessments.

Conclusions

The conclusive chapter will highlight the key factors for efficient bicycle sharing systems in Europe and give suggestions for improvement of the existing systems.