BIKE SHARING SYSTEMS. EFFECTIVENESS, IMPACT AND ASSESMENT

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BIKE SHARING SYSTEMS. EFFECTIVENESS, IMPACT AND ASSESMENT

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1. BSS AND THE CYCLECITIES PROJECT

1.1. INTRODUCTION

In 2004, OECD started his report on National Policies to Promote Cycling by stating that “Cycling is increasingly recognised as a clean, sustainable mode of transport and an essential part of an inter-modal plan for sustainable urban travel.” Today, 10 years later it is widely admitted that bicycle is the solution to urban problems such as traffic congestion, high cost of living, land use consumption and also environmental and health problems. Elliot Fishman (2013) indicates that the common response of the contemporary urban policy seeking to overcome challenges presented by car dependence is to replace car journeys with bicycles.

Increased uptake of cycling leads to reduced land consumption as 10 bikes can be parked in the space required for one car. One lane of typical road can accommodate 2,000 cars per hour – or 14,000 bikes. Cycling is also connected to the increase of life expectancy as higher proportions of commuter cyclists are correlated with lower risks of casualties, in addition to the improvement of their health.

Concerning the investments for the revitalization of the neighborhood, cycle-friendly cities present higher levels of quality of life and environment and then they attract individuals & businesses.

Background

The most valid and widely used definition for a BSS is the following: “Bike Sharing Scheme is a self-service, short-term, one-way-capable bike rental offer in public spaces, for several target groups, with network characteristics”

(OBIS" [1] dictionary). ECF[2] gives its own definition: "Bike Share Schemes [BSS], known also as Public-use Bicycles (PUB's), bike sharing or smart bikes, are short-term urban bicycle rental schemes that enable bicycles to be picked up at any self-serve bicycle station and returned to any other bicycle station, which makes bicycle-sharing ideal for point-to-point trips". Another definition can be found in Wikipedia[3]: "A bicycle sharing system, or bike share scheme, is a service in which bicycles are made available for shared use to individuals on a very short term basis. Bike share schemes allow people to borrow a bike from point "A" and return it at point "B"".

Bike sharing gains popularity as it offers a transportation alternative to increase bicycle use by integrating cycling into the transportation system. The principle of bike sharing is to offer a short-term access to bicycles on an "as-needed" basis without the costs and responsibilities of bike ownership. Shaheen et al. (2010) summarize the benefits of bike sharing as flexible mobility, emission reductions, physical activity benefits, reduced congestion and fuel use, individual financial savings and support for multimodal transport connections.

Today more than 600 cities in 49 countries host advanced bike-sharing programs, with a combined fleet of over 500,000 bicycles. Urban transport advisor Peter Midgley notes that "bike sharing has experienced the fastest growth of any mode of transport in the history of the planet."

1.2. ELEMENTS OF IMPACT AND EFFECTIVENNES

Efficiency in the literature, is described as a process, method, plan, etc. that uses the lowest amount of inputs to create the greatest amount of outputs. In this research, it is considered that an efficient BSS combines good performance in terms of reaching its goals as set during the deployment, satisfy the customers and has low operating cost.

The introduction of a BSS has profound impact on "creating a larger cycling population, increasing transit use, decreasing greenhouse gases, and improving public health" as reported by DeMaio (2009).

This paper intend to consider through a qualitative method the impact and the efficiency of European BSS. This work will set light on the factors that show

how and why changes occur in a city due to a BSS, how and why it is successful or not and which are its benefits but also its main challenges.

2. METHODOLOGY APPLICATION

The survey on key facts and figures of European BSS intended at gathering evidences on their effectiveness and impact on urban mobility management. The aim of the survey is: to collect up-to data facts and figures reflecting the current state in European bike sharing schemes and to gather valuable evidence, coming from those directly involved, on the impact, assessment and effectiveness of bike sharing systems. Our methodology included 2 phases as shown in Figure 1.

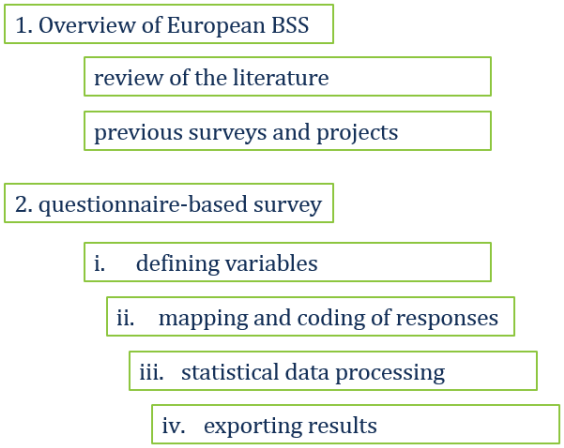

Figure 1. The methodological process of the research

Starting point of the research was an overview of the current situation of BSS by review in the literature, in previous surveys and projects like the OBIS project. In the next phase of the research, a survey questionnaire was developed leading to the collection of additional, up-to-date evidence and providing more in-depth insights on the effectiveness, value-for-money and overall impact of current bike sharing schemes and systems in European cities as voiced by those directly involved in planning, deploying and operating BSSs. Data were collected through the collaboration networks of the CycleCities project partners (123 responses, 57 complete questionnaires). It was focused on specific aspects of BSS relating to their effectiveness, associated costs, value-for-money and their overall impact. Data processing and analysis, was facilitated by a preparation stage of data consolidation

which followed a four-step process. The first step was to define variables. Nominal, ordinal and interval variables were defined in order to facilitate responses coding. Nominal variables aimed at establishing a profile for each participant. Ordinal variables were used in questions related to costs, revenues and characteristics of the BSS implementation. Interval variables were used to identify levels of agreement to statements and possible variations or correlations. Prior to data processing, valid responses were reviewed, grouped into categories and mapped to defined variables based on relevance, priority and question type (step two). The third step was the statistical data processing. Microsoft Excel and SPSS were used to process collected data from survey responses and fields from desk research. Specifically, pivot table data summarization tool was used to automatically sort data and return descriptive statistics of prior specified data. Data were exported summing up and visualising results (step four). Exported results were compared to imported data for any inconsistencies and data processing was repeated if required. Finally, exported results were listed in tables, visualised in graphs and included in the analysis report.

3.1. RESPONDENTS

The analysis of the submitted questionnaires regarding the respondent's involvement in BSS's deployment revealed most of the participants (42,5%) were involved in "Planning/ designing" of a BSS, followed by those who work in "Daily operation, performance and maintenance" (35%).

3.2. BIKE SHARING SYSTEM IDENTITY

The majority of the cities for which data were collected are medium-sized (40%), followed by small-sized (26%) and large-sized cities (24%). XXL cities represented the 9% of the sample, while 1% were the Global cities according to OECD definition[6].

The majority (87,5%) of the BSSs that participated in the research have been constructed the last 4 years (2010-2013). There were very interesting results as it concerns the comparison between the year of decision for the

implementation of a BSS with the year of actual implementation, which are demonstrated in Figure 2

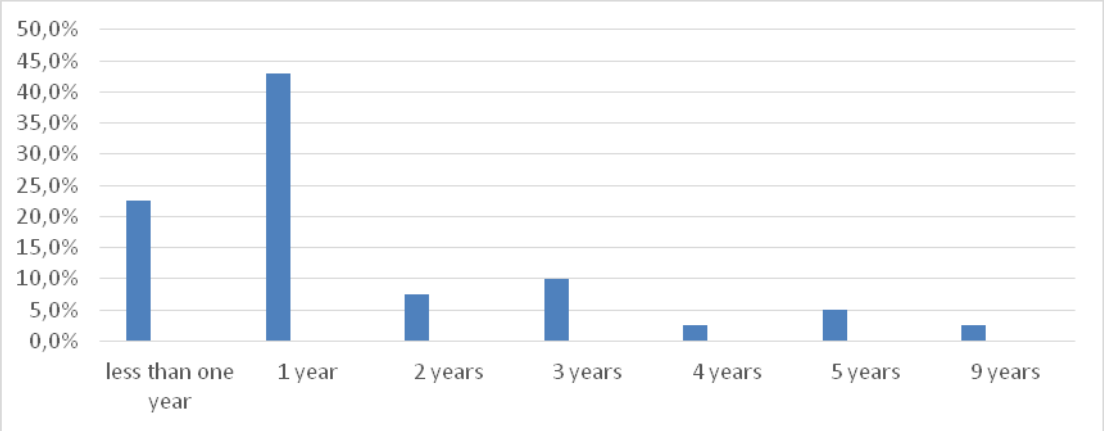

Figure 2: Time required for BSSs implementation

The response with the highest frequency regarding the proportion of the municipality area covered by a BSS was found to be “10-30%” (29%).

3.3. USER PATTERNS INFORMATION

The analysis regarding the BSSs’ user groups revealed that the primary group of BSS users are commuters to work / school (62%), followed by tourists (19%), people on leisure time (16%) and local residents (3%). The average trip duration by a bike hired from BSS is for the 59% “0-30 mins”, followed by “30-60 min” and “60-120 min” (15% each) and “120-240 min” (11%).

The most frequent ways of measuring the satisfaction of BSSs users is through system user metrics (40%) and through regular polls or user surveys (25%). As it concerns the ex post evaluation of public consultation procedures regarding the implementation of BSSs, it was revealed that the procedure which obtained the highest sum of positive opinions was participation events in local community councils (26%), followed by “questionnaires / online consultation” (25%).

Trying to identify the prevailing citizens’ opinions towards the BSS, the findings showed to be “Favorable” (58%), followed by “Rather favorable” (34%), while responses “Indifferent” and “Rather negative” were left far behind.

3.4. COSTS AND ECONOMIC RESULTS

The questionnaires concerning the repair/ replacement costs due to damages, vandalism and theft compared to the overall operating cost revealed that the estimation with the highest frequency (68%) was <10% of the overall operating cost followed by 10%-25% of the overall operating cost (21%).

"Revenues, in the last 3 years of operation, were lower than expenses" is the response with the highest frequency (25%). It is followed by "not available data" (22%), "Revenues are much lower than expenses" (19%), "Revenues exceed expenses" (9%) and "Revenues are equal to expenses" (9%). In another 9% of the cases collected, BSS use was free of charge. Analyzing the responses about the main sources of revenues, the predefined responses with the highest frequency were "User fare" and "Advertisement" (28%), followed by "Contract with public authority" (20%) and "Grants/Donations" (19%).

The examination of the submitted questionnaires regarding who covers the deficits in case of negative economic result, the highest frequency was found to be "The city administration" (47%), followed by "The private operator" (44%). The respondent's assessment of BSS's overall value for money revealed that the predefined estimations "Low", "Considerable" and "Rather high" were selected by the 24%. The overall value for money was found "High" in the 21% of the cases and "Rather low" in 7%.

3.5. IMPACTS AND PROSPECTS

As it concerns the benefits of BSSs, in the majority of the cases "Increasing bike use / cycling uptake" was considered "Very important" and it was followed by "Improving citizens' health". The ranking of the benefits is presented in the Figure 2

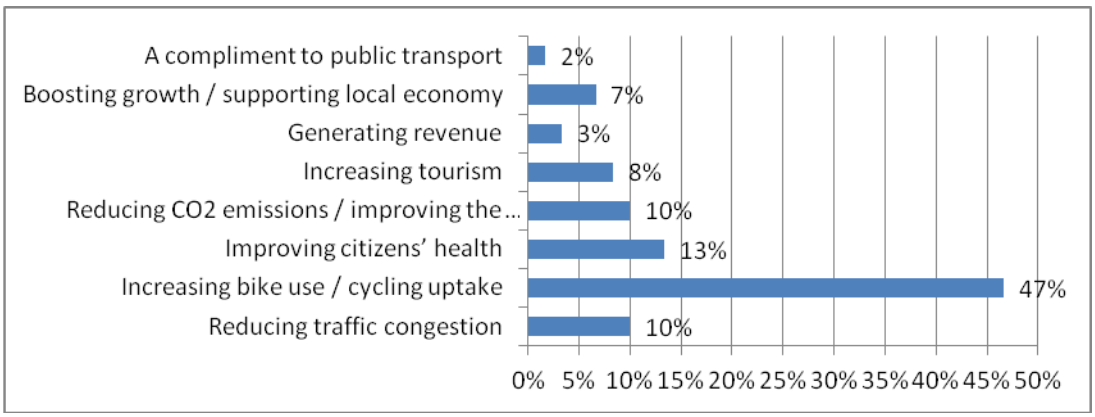

Figure 3: Importance of BSS' benefits

The most important challenges, disadvantages or negative aspects of BSS were considered to be the high operating cost, the high startup cost and the lack of political support. Safety issues were evaluated as insignificant parameters.

The most frequent physical and policy measures implemented in combination with the deployment of the BSS were cycle routes (24%), awareness raising campaigns (22%) and the partnership with public transport sector (21%). Responses with low frequency were relevant to parking regulations.

The most important additional policy to increase BSS' value for the city and improve its performance is the expansion of the system, followed by the extension of bicycle network and the combined actions involving other transport modes.

Concerning the respondent's assessment on the effectiveness of BSS in reducing car use and easing traffic congestion, the highest frequency of responses was found to be "Neither effective nor ineffective" (44%), followed by "Rather effective" (33%). Considering the future of BSS the prevision with the highest frequency was found to be the expansion of the system (74%), followed by the prospect only to maintain it (18%).

Finally, the answers regarding the most valuable lessons learned in deploying and operating the BSS, were grouped into 16 different lessons. The most valuable were found to be that good spatial planning of BSS stations is essential and that "the implementation of BSS is a good measure to promote cycling and change mobility habits (19%each)[7].

3. CORRELATION ANALYSIS

Correlation indicates the relationship between variables. It is used to understand whether the relationship is positive or negative, but also the strength of the relationship. The analysis that follows is based on a correlation matrix[8] of relevant parameters of the survey.

There was found no relation between the proportion of municipality area covered by the BSS and other factors. This appears because it might be beneficial to have a large BSS covering the whole municipality area, but it is

contradictory to the basic design principle which requires a high density of stations which is not feasible if the network of station is expanded in the outskirts of a city.

The average duration of each trip is highly correlated to the relation of revenues and expenses. In all systems with average trip duration up to 30 minutes expenses exceed revenues. None of the systems that presents balanced expenses and revenues is found below the 30 minutes limit for the average trip duration. The BSS that have profits are allocated in the 60-120 min class on trip duration. This is due to the fact, that pricing schemes with a limit of 30 minutes free of charge are encouraging short-time use of the public bikes. But this correlation also reveals that users accept to pay if they need a public bike for more than the free time provided.

Highly correlated were found to be the primary user group and the level of public consultation through polls and voting. Adequate public consultation of this kind is only found for the commuter oriented BSS. High correlation is found for different kinds of public consultation as: public meetings, polls and voting and public information centers. If involvement in public consultation is planned, these three participation modes are sufficient when they are used together. In other cases all three are being considered (somewhat) insufficient.

An important correlation occurs between the source of total revenue and the public opinion. All the systems registered as totally financed by advertisement are rated with highest score for the public opinion. This is not as much the case for BSS with a high percentage of financing from user fare, public authority or donations. This might be due to the fact that advertising companies present a professional image of the BSS.

Furthermore, the effect of increasing tourism as major benefit is strongly correlated with the average economic result of the BSS. For systems with a positive revenue-expense ratio the effect on tourism is assessed very high and vice versa. The major benefits of the increase in bike use are directly correlated to the benefits of reducing traffic congestion, improving citizens' health and reducing CO2 emissions / improving the urban environment. Also,

the systems with high repair costs are correlated with bad expectations for generating revenue and economic growth in the region.

High investment costs as a major challenge of the BSS is significantly correlated to the need for additional funding to improve the system. The importance of additional funding is also correlated to the assessment of public consultation, especially trough information centers. Systems with adequate or sufficient public consultation feature a high importance of additional funding. Lower prices for users as an important measure to increase the system's value for the city is highly correlated to the positive assessment of the effect on local growth of the BSS as well as to the need for initiatives to involve local communities in decision making and combined actions involving other transport modes.

The need for improved user registration procedures, monitoring and/or IT systems is seen, especially for the successful systems,, as responsible for a positive public opinion, for good value for money assessment and for expectations to expand the system. This is due to the perception, that local experts from "successful" cities have more options for improvement in mind than those from the less successful cities.

4. CONCLUSIONS

During the 20th century we were focused on how to increase property, on how to grow our cities and generally on welfare. Nowadays we realize that this "hyper consumption" model is not sustainable and it is not possible to continue in that way. During the first decade of the 21st century, the world decided that sustainability is an urgent necessity that should affect all the aspects of our lives. The growing need for sustainability (in terms of economy, environment and society) leads the cities to adopt cycling as a highly beneficial solution. The "new reality of cities" along with the boom of technology and the uptake of collaborative consumption are the factors that favored the bloom of BSS.

The research conducted aims at setting light on the weak points but also on the advantages of BSS. The weak points set the example on what should be corrected or improved when a successful BSS is desired. The results are useful for cities trying to introduce or expand a BSS because they focus on

the knowledge acquired of the experts. They are also beneficial for cities that are trying to introduce cycling as in many cities, the use of private bikes has increased significantly after the introduction of a BSS. The positive results increases if the connection between public transport, public bicycles and private bicycles offers a complete and comfortable transport chain for the user's destinations. It is noteworthy that BSS increase public awareness and the acceptance of cycling as a mode of daily transport.

Furthermore, BSS are closely connected with the improvement in the quality of life through better accessibility within the covering area. Not only tourists can improve their mobility, but also residents become more active. Diagram 1 visualizes the goals of the introduction of bike sharing systems and their interrelations.

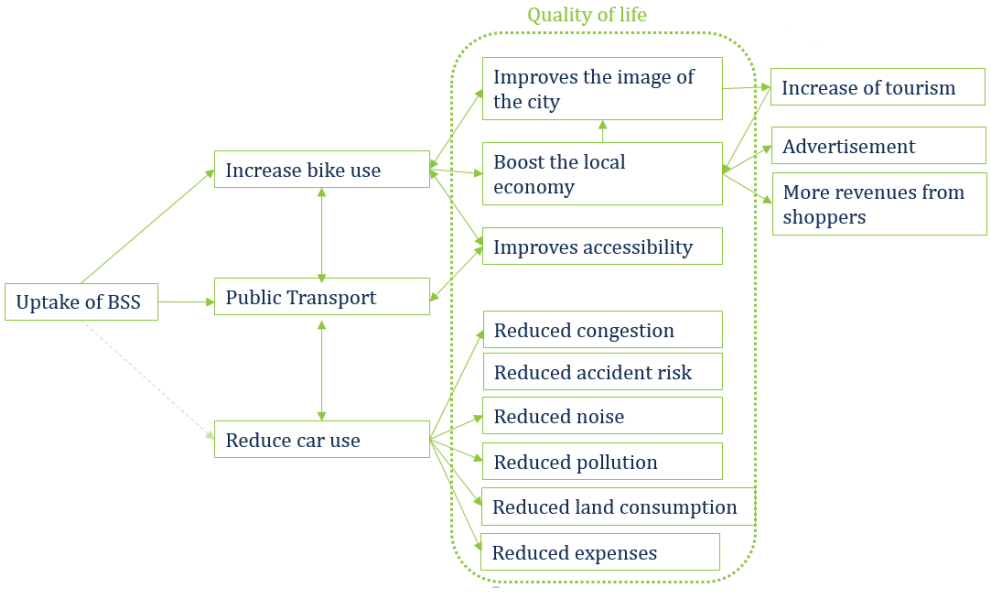

Diagram 1: Impacts from the introduction of bike sharing systems

Another issue of priority that was highlighted and an additional quality of life aspect are health effects of cycling and of 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 BSS. The precondition for reaching these goals is customers satisfaction regarding accessibility for all, availability of bikes, quality of bikes, easiness of registration- payment- renting procedure- bicycle and fares. An important issue is the public consultation performed for the operation of a BSS.

From the overall process of this survey a major reveal was that BSS provide the city with lifestyle and liveability, beyond the transport perspective.

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NOTES

[1] http://www.obisproject.com/

[2] http://www.ecf.com/advocary/mobility/bike-sharing-scheme/

[3] http://en.wikipedia.org/wiki/Bike-sharing

[4] European Regional Development Fund

[5] In most cases the responses mentioned in the text are those with the highest percentage.

[6] Cities in Europe. The new OECD-EC Definition. http://ec.europa.eu/regional_policy/sources/docgener/focus/2012_01_city.pdf

[7] The analytical results of the survey are available from the author

[8] The correlation matrix was made by Cyclecities partner: Regional Development Agency for the Region of Leipzig