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Contents

Abbreviations

BSS	Bike sharing system(s) / bike sharing scheme(s)

1. INTRODUCTION

This document is the output of the INTERREG IVC CYCLECITIES project „report on the efficiency of bike-sharing systems integrated in mobility management schemes “. The title in short form is “efficiency of bike sharing systems in Europe”.

The aim of this report is to analyze a survey conducted on current bike sharing systems in 40 European cities in terms of their efficiency.

1.1. CYCLECITIES’s objectives and outputs

CYCLECITIES aims to build and share knowledge and facilitate good practice transfer and experience exchange among European cities on the integration of cycling into urban mobility management schemes. It specifically aims to:

- ✓ exchange experiences and make transferable good practices on mobility management and cycling available to European stakeholders.
- ✓ establish consensus on policies towards sustainable European mobility management schemes.
- ✓ establish a European, multilingual, freely-accessible knowledge and experience base.
- ✓ disseminate field experiences and project results as a means to enhance awareness on the integration of cycling in urban mobility management schemes.

At the core of the project’s main outputs is a series of good practice guides on:

1. land use planning
2. urban mobility management strategies
3. cities participation strategies
4. architectural design of cycling infrastructure.

In the framework of part 2 improvement of the application of bike sharing schemes as important part of an overall mobility management strategy is to be researched.

1.2. Scope and use of the report

The report on the efficiency of bike-sharing systems in Europe is part of activity 4.2.1: "Collection of facts and data on existing cities' bike-sharing systems". This activity aims to conduct a survey, collect data and analyse the data in order to produce the following outputs:

1. a report on cities' bike-sharing systems facts & figures (systems installed, suppliers, user satisfaction, assessment feedback, etc.)
2. a report on the efficiency of bike-sharing systems integrated in mobility management schemes
3. recommendations for using bike-sharing systems in European cities.

As bike sharing schemes are considered a natural part of mobility management schemes, the survey and the following reports will not focus on implementation questions too much.
The general purpose of analysing the CYCLECITIES bike sharing systems survey is to:

- present up-to-date facts and figures on bike sharing systems currently in use in European cities
- provide evidence on the effectiveness, impact and assessment of certain bike sharing system cases
- allow for valuable insights on the decisive, success factors for sustainable bike sharing systems based on city experiences and lessons learned.

To do so, the bike sharing system survey addresses the following questions:

- Which are the most effective BSSs currently in use in European cities?
- What are the main facts, figures and features of these BSSs?
- To what extent, BSSs currently in use have recently proven successful in encouraging short distance cycling (walking, cycling) at the expense of private cars?
- How do those involved in deploying and operating BSSs view their impact and effectiveness?
- What are the critical factors defining high use rates for BSSs?

- What are the key lessons learned in planning, deploying and operating a BSS within an urban setting?

This report concentrates on the questions of efficiency of bike sharing systems.

1.3. Outline of the report

After clarifying what is to understand by an “efficient” bike sharing system and elaborating the main factors of this efficiency, potential performance indicators will be deduced from the survey questions within a methodology chapter. The main chapter “data analysis” is describing the survey sample and their data quality, the process of defining certain types of bike sharing systems from the sample and analysis of the data especially in respect to the efficiency of bike sharing systems.

2. Methodology

2.1. Definition and Approach for efficient bike sharing systems

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)

2.2. Goals of the introduction of bike sharing systems

This chapter will consider the "output" side of the efficiency definition and reflect the necessary goals that are or might be intended with installation and operation of BSS.

A whole variety of impacts intended with the introduction of BSS 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, BSS 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, BSS 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 and an additional quality of life aspect are **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 BSS.

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

Figure 2 visualizes the goals of the introduction of bike sharing systems and their interrelations.

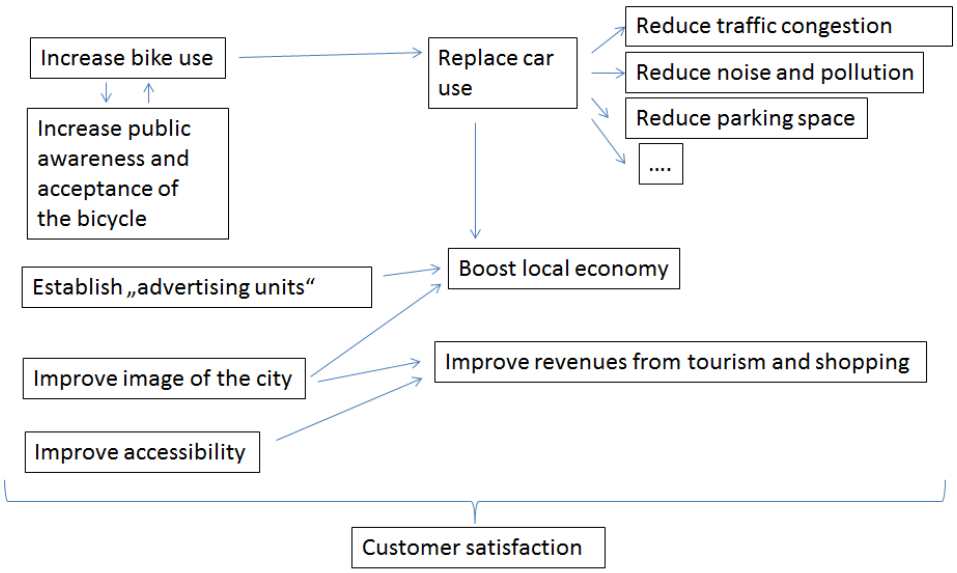

Figure 2: Goals of the introduction of bike sharing systems

2.3. Factors describing the effort to implement and operate bike sharing systems

This chapter will consider the “input” side of the efficiency definition and reflect the different aspects of effort necessary for implementation and operation of BSS. Effort 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

Other factors describing the effort-side like lobbying or political initiatives to implement a BSS are hardly to monetize, but still existing.

2.4. 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 considerations in the chapter, the following performance indicators derived from the survey are potentially usable to find key elements of efficient 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 CO2 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.

3. Data analysis

3.1. Assessment of the survey sample and data quality

The data set resulting from the survey consists of 40 records with two of them being only very partially filled1. The other records contain small gaps due to missing data or the wish not to answer the respective question. Basic analyses with descriptive statistics from the survey are to be found in the report "Facts and Figures".

It is important to remark that the survey is not directly data based, but is the result from questioning local experts and expressing their personal assessment. Some questions even request the personal opinion of the local expert. Due to his or her knowledge, position and mentality the records will be subjective biased. Similar systems might get different assessments from different persons. But it is assumed that the subjective biases will be balanced out within the view on all records and makes it possible to find tendencies at least. Unfortunately the way to use "hard" data directly was not possible in the scope of the project because data is mostly not compatible or not available.

3.2. BSS-typology of the sample

In order to find a systematic approach to the efficiency of BBSs the 40 available cases in the sample have to put in order by clustering to cases of high similarity.

The sample had been analyzed using SPSS two-step clustering method and hierarchical cluster analysis to find groups of similar BSS with high distinction to other groups of BSS. These groups will define certain "types" of BSS with each type including a high number of common features. The BSS types will be used to characterize the single BSS for analytical purposes.

[1] Malaga (SP) and Pamplona (SP)

Clustering trials by using the whole set of relevant variables brought no useful results. That means statistical analysis of the existing sample brought no indication for distinctive general classes of BSS to consider (e.g. expensive high-tech-solutions with free access for the first 30 minutes strongly supported by a public authority and low-tech-solutions oriented on advertising revenues and smaller effect on traffic and environment). This might be due to the small number of cases and the occasionally appearing missing values. Additionally the fact, that the relevant variables in the survey are rated on a nominal or ordinal scale, makes it difficult to receive sound effects. Therefore, the above mentioned clustering techniques partially in combination with indexing techniques had been used to aggregate variables within certain fields of interest.

Firstly, the **kind of use** had been considered which is reflected by the different answers on questions 6 ("primary user") and 7 ("main use" and "secondary use"). Two user-type clusters had been identified:

1. Clear orientation on commuting as primary use, no other use mentioned (6 BSS[2])
2. Multi-use systems where different purposes and/or target groups are mentioned; more than one kind of use (commuting leisure time, shopping, tourism and other purposes) seemed to be important according to the given answers (23 BSS[3])
3. Clear orientation on leisure time and/or tourism use, no other use mentioned (9 BSS[4]).

Furthermore, indicators for the **overall success of the BSS** had been considered and aggregated: the opinion of the public (question 12), the opinion of the local expert regarding "value for money" of the BSS (question 17) and the expectations of the future development of the BSS. Four classes of success-types had been identified:

[2] Gothenburg (SE), Ioannina (GR), Koper and Izola (SI), Milan (IT), Valence(SP), Verona (IT), Zagreb (HR)
[3] Warsaw (PL), Ljubljana (SI), London (UK), Zagreb (HR), Verona (IT), Gothenburg (SE), Lorient (FR), Anatolki (GR), Clermont-Ferrand (FR), Brompton Dock (across the UK), Maribor (SI), Ioannina (GR), Ruhr Area (DE), Karditsa (GR), Cuneo (IT), Berlin (DE), Thessaloniki Eco-AUTh (GR), Velenje (SI), Parma (IT), Koper and Izola (SI), Wroclaw (PL), Opole (PL), Örebro (SE)
[4] Padova (IT), Vilamoura (Loulé), Thessaloniki Easybike (GR), Leipzig (DE), Island of Usedom (DE), Kavala (GR), Municipality of Didymoteicho (GR), Belfort (FR), Hamburg (DE)

1. Very successful systems with full support from citizens as well as high or rather high "value for money" assessment of the local experts; all systems with the perspective of being extended in the next years (10 BSS[5])
2. Successful systems with rather favorable citizens' opinion towards the system and considerable to rather high "value for money" assessment; mostly with the perspective of being extended in the next years (8 BSS[6])
3. Indifferent systems with an even higher (favorable) citizens' opinion than the above category, but with mostly low "value for money" assessment and mostly no plans for future extension (10 BSS[7])
4. One not successful system with the most negative evaluation from the public as well as from the expert, which will be discontinued (1 BSS[8]).

Concerning the **economic effects** of the BSS, the questions 14 (Average economic result in the last three years) and 18e to 18f (evaluation of increasing tourism, generating revenues and boosting growth / supporting local economy as major benefits) had been used to define four classes of economy types of BSS:

1. Profitable systems with revenues exceeding expenses of the system and mostly positive assessment of additional effects for tourism and local economy (4 BSS[9])
2. Self-sustaining systems where revenues and expenses are balanced and the effects for tourism and local economy are highly valued (9 BSS[10])
3. Unprofitable systems with revenues being lower than expenses, but considerable benefits for tourism and local economy growth (13 BSS[11]).

[5] Zagreb (HR), Clermont-Ferrand (FR), Ioannina (GR), Ruhr Area (DE), Velenje (SI), Parma (IT), Koper and Izola (SI), Vilamoura (Loulé), Thessaloniki Easybike (GR), Kavala (GR)
[6] Nafpaktos (GR), Brompton Dock (across the UK), Maribor (SI), Karditsa (GR), Leipzig (DE), Island of Usedom (DE), Municipality of Didymoteicho (GR), Hamburg (DE)
[7] Poznan (PL), Nuremberg (DE), Valence(SP), Verona (IT), Cuneo (IT), Berlin (DE), Thessaloniki Eco-AUTh (GR), Wroclaw (PL), Opole (PL), Belfort (FR)
[8] Örebro (SE)
[9] Padova (IT), Thessaloniki Easybike (GR), Leipzig (DE), Island of Usedom (DE)
[10] Milan (IT), Ljubljana (SI), Cuneo (IT), Zagreb (HR), Ruhr Area (DE), Kavala (GR), Brompton Dock (across the UK), Karditsa (GR), Ioannina (GR)
[11] London (UK), Clermont-Ferrand (FR), Vilamoura (Loulé), Lower Austria, Velenje (SI), Nafpaktos (GR), Municipality of Didymoteicho (GR), Berlin (DE), Thessaloniki Eco-AUTh (GR), Gothenburg (SE), Lorient (FR), Nuremberg (DE), Belfort (FR)

4. Highly subsidized systems where generating revenues and (astonishingly) local growth are considered as unimportant, but benefits for tourism are still mentioned as prevalent (11 BSS[12]).

Finally, the variables describing effects which increase **quality of life** had been analyzed: answers to questions 18a to 18d (evaluation of reducing traffic congestion, increasing bike use, improving citizens' health and reducing CO2 emissions / improving the urban environment as major benefits) and question 22 (effectiveness in reducing car use and easing traffic congestion). The following four classes had been identified:

1. High effect on improving quality of life with major benefits on reducing traffic congestion, increasing bike use, improving citizens' health and reducing CO2 emissions mainly being assessed as very important and a rather high effectiveness in reducing car use and easing traffic congestion (9 BSS[13])
2. Medium effect on improving quality of life, where increasing bike use is still a very important issue, but health, environmental considerations and traffic effects are less important and the effectiveness in reducing car use and easing traffic congestion is on medium level (18 BSS[14])
3. Low effect on improving quality of life where increasing bike use is still important, but other issues regarding quality of life are rated mostly slightly important or insignificant; the effectiveness in reducing car use and easing traffic congestion is on a low level: assessed between "neither effective nor ineffective" and "very ineffective" (11 BSS[15]).

Figure 3 gives a final overview of the used BSS-types.

[12] Anatolki (GR), Verona (IT), Parma (IT), Koper and Izola (SI), Poznan (PL), Valence(SP), Opole (PL), Maribor (SI), Hamburg (DE), Wroclaw (PL), Örebro (SE)
[13] Milan (IT), Ljubljana (SI), London (UK), Anatolki (GR), Padova (IT), Clermont-Ferrand (FR), Vilamoura (Loulé), Verona (IT), Cuneo (IT)
[14] Lower Austria, Warsaw (PL), Zagreb (HR), Ruhr Area (DE), Velenje (SI), Parma (IT), Koper and Izola (SI), Thessaloniki Easybike (GR), Kavala (GR), Nafpaktos (GR), Brompton Dock (across the UK), Karditsa (GR), Municipality of Didymoteicho (GR), Poznan (PL), Valence(SP), Berlin (DE), Thessaloniki Eco-AUTh (GR), Opole (PL)
[15] Gothenburg (SE), Lorient (FR), Ioannina (GR), Maribor (SI), Leipzig (DE), Island of Usedom (DE), Hamburg (DE), Nuremberg (DE), Wroclaw (PL), Belfort (FR), Örebro (SE)

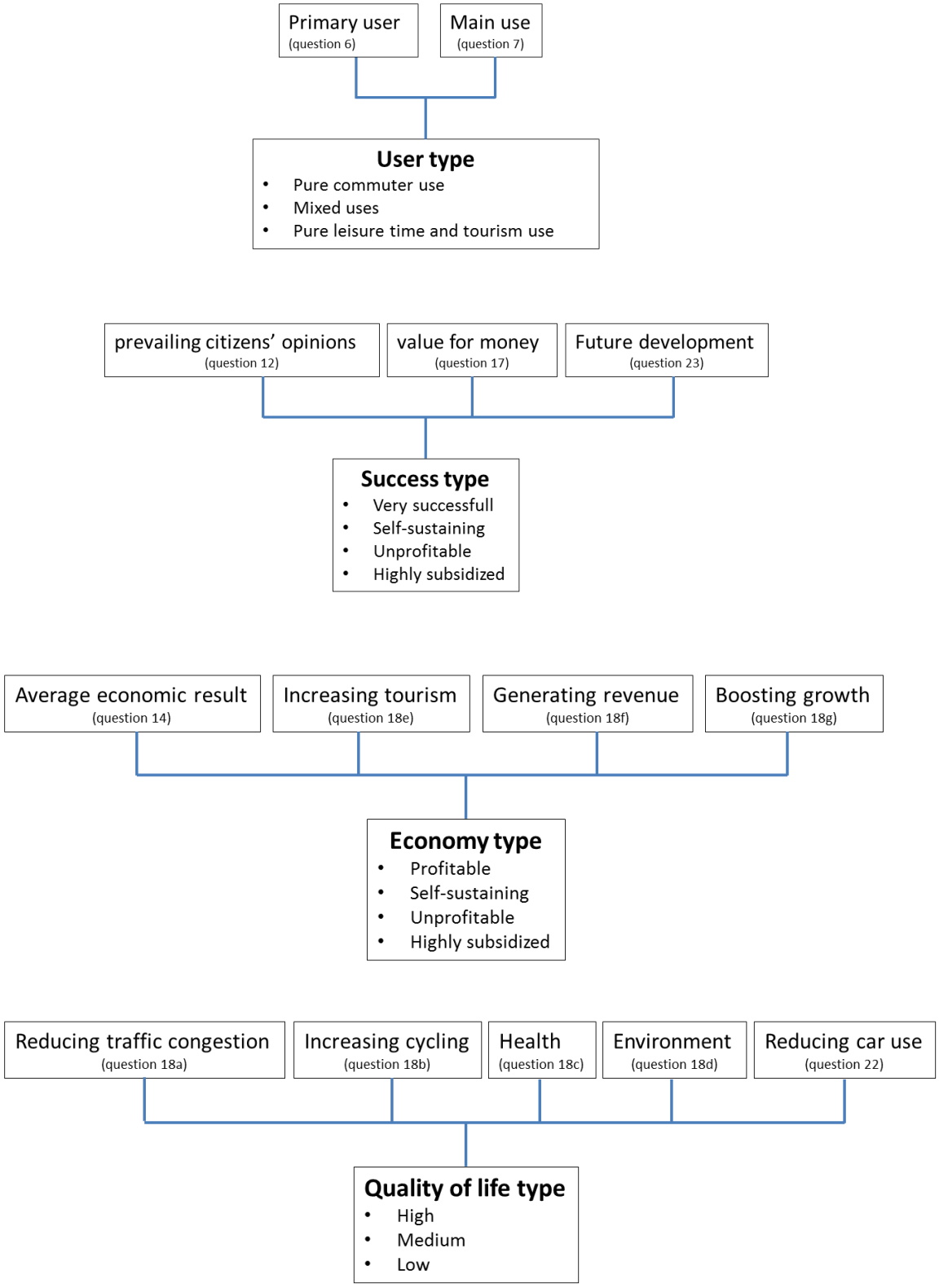

Figure 3: Typology of the BSS in the CYCLECITIES survey

3.3. Correlation analysis

Next step on the analysis of the CYCLECITIES survey data on BSS will be the assessment of the data structure. To what extend and how are the different aspects (questions) of the survey connected? Appendix 1 shows the correlation matrix of relevant parameters of the survey. Numbers with stars mark significant correlations between parameters on different significance levels. Highly correlated parameters are marked with yellow background color. Despite of the obvious correlations[16] there are some interesting relations between the different parameters of the survey.

The **average duration of each trip by users** is highly correlated to the **economic result** of the BSS. For all systems with average trip duration up to 30 minutes expenses exceed revenues - in most cases considerably. Of course 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. None of the systems with balanced expenses and revenues is found below the 30 minutes limit for the average trip duration. The three profit making BSS with available data on trip duration are allocated in the 60-120 min class. It is to conclude, that in general user would like to use the public bikes for longer average durations than 30 minutes and that they might be willing to pay for it.

[16] e.g. the user type is deduced from the primary user, the economy type from the cost-revenue-ratio, see chapter 3.2, but also the direct correlation between the similar questions 18a (congestion reduction as major benefit) and question 22 (effectiveness of congestion reduction) and the opposing correlation between the shares of total revenue from user fare and advertisement (questions 15a and 15b)

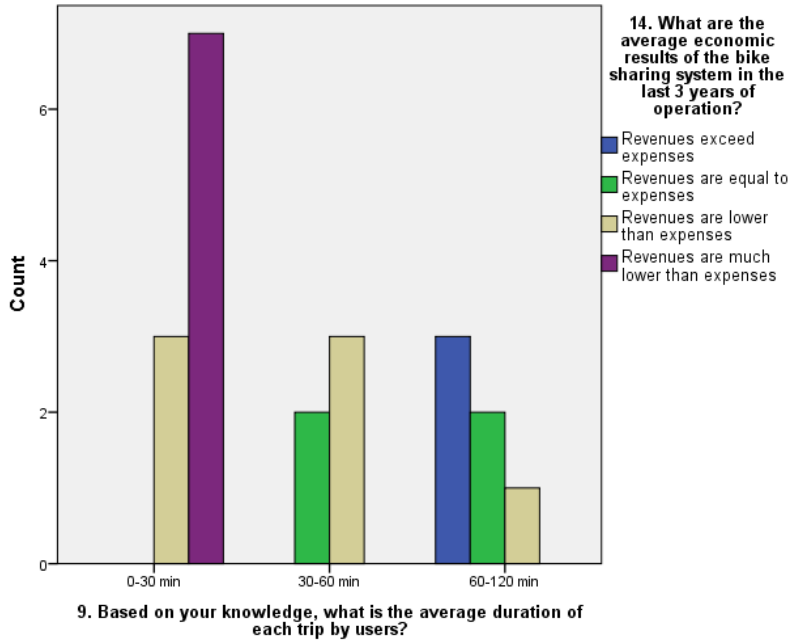

Figure 4: average duration of each trip by users vs. economic result

Also highly correlated are 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 the different kinds of **public consultation through**

- **Public meetings**
- **Polls and voting and**
- **Public information centers.**

If involvement in public consultation is intended, this three participation channels are used together. In other cases all three kinds are being used (somewhat) insufficient.

For the proportion of the municipality **area covered by the BSS** no relation to other factors had been found. This might be caused by two contrasting phenomena: it might be beneficial to have a large BSS covering the whole municipality area with a large number of bikes and bike stations, but on the other hand the basic design principle requests a high density of stations within "view distance" from each other which is not feasible in the outskirts surrounding the inner city area.

An important correlation occurs between the **share of total revenue from advertisement** and the **public opinion**. All the systems which are registered as totally financed by advertisement[17] 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. An interpretation of the data could be that advertising companies take care on the image of the BSS on a very professional way.

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.

As it is to expect from logic, assessment on the major benefits for **the increase in bike use** is 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 logically correlated with bad expectations for **generating revenue and economic growth** in the region.

High **investment costs** as 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 the 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**. Also, a couple of other measures to increase the system's value for the city are correlated in a positive manner.

[17] Gothenburg (SE), Ioannina (GR), Koper and Izola (SI), Milan (IT), Valence(SP), Verona (IT), Zagreb (HR)

Surprisingly, the **need for improved user registration, monitoring and/or IT systems** is seen especially for the successful systems according to the "**success-type**" which features a high public opinion, good value for money assessment and expectations to expand the system. This might be due to subjective effect, that local experts from "successful" cities have more options for improvement in mind than those from the less successful cities.

3.4. Considerations on the efficiency of bike sharing systems

The survey does not provide all information stated in chapters 2.2 and 2.3 to define the level of reaching the goals and to compare it with the necessary efforts. But the available variables allow identification of BSS with most positive assessments in regard to reaching the goals of BSS as well as being economically strong. Furthermore, analysis of common features of these BSS may lead to new insights.

The BSS types introduced in chapter 3.2 deliver already the necessary aggregate for efficiency considerations. The quality of life typology combines the main goals intended with the establishment of BSS: increasing bike use, reduction of car use and traffic congestion, health effect and environment protection. The economy typology reflects the financial effort together with the expected economic benefits which could offset the effort from a macroeconomic view. However it has to be remarked again for all mentioned features that the available data is based on subjective assessment and not on real data.

Figure 5 shows the cross-relation between economy type and quality of life type of the BSS in the sample. The yellow area marks the cities which are doing well in terms of economy and quality of life effect according to the given information in the survey.

Effect on quality of life	Economy			
	Profitable	Self-sustaining	Unprofitable	Highly subsidized
High	Padova (IT)	Cuneo (IT) Ljubljana (SI) Milan (IT)	Clermont-Ferrand (FR) London (UK) Vilamoura (Loulé)	Anatolki (GR) Verona (IT)
Medium	Thessaloniki Easybike (GR)	Brompton Dock (across the UK) Karditsa (GR) Kavala (GR) Ruhr Area (DE) Zagreb (HR)	Berlin (DE) Lower Austria Didymoteicho (GR) Nafpaktos (GR) Thessaloniki Eco-AUTh (GR) Velenje (SI)	Koper and Izola (SI) Opole (PL) Parma (IT) Poznan (PL) Valence(SP)
Low	Island of Usedom (DE) Leipzig (DE)	Ioannina (GR)	Belfort (FR) Gothenburg (SE) Lorient (FR) Nuremberg (DE)	Hamburg (DE) Maribor (SI) Örebro (SE) Wroclaw (PL)

Figure 5: Allocation of survey samples with respect to economy type and quality of life type oft the BSS

Now what are the common features of the yellow marked BSS (economy-type better than unprofitable and quality of life type better than low)? Unfortunately a correlation analysis gives not very much additional information. Of course the “efficient” systems show significant correlation to the variables which had been used to define the economy type and quality of life type of the BSS. Furthermore the year of implementation correlates on low level of significance: the “efficient” systems had been implemented only in the recent years since the year 2010 with increasing numbers (see Figure 6). This could be due to an important change of BSS technology, but just as well only a sign for a euphoric mood of the involved persons in the first years of operation. A more reliable correlation exists towards the assessment that lower prices for users would increase the value of the BSS for the city (see Figure 6). Finally, clear correlation is found for the fact that all the “efficient” BSS are going to be extended according to the survey.

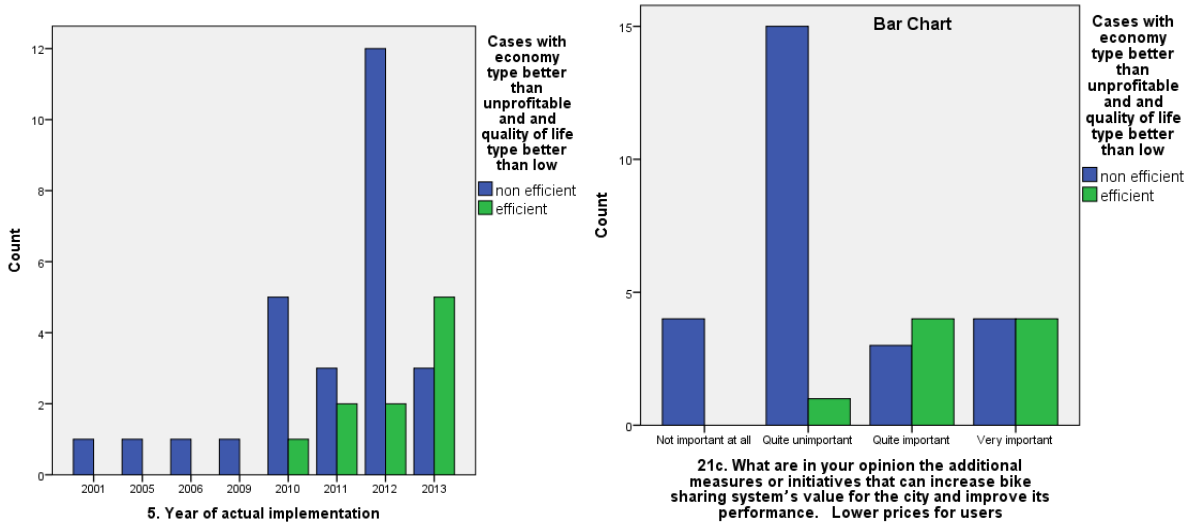

Figure 6: „Efficiency" rating of the BSS vs. year of implementation of the BSS and importance of "lower prices for users" as additional measure

Appendix 1: Bivariate correlation matrix of relevant survey parameters

Nonparametric Correlations (Spearman's rho)	05_Year_I	06_Prime_User_Coded	08_Area_coded	09_Trip_Time_coded	10_Satisfaction_Measure_coded	11_Public_Consultation_community_councils	11_Public_Consultation_public_meetings	11_Public_Consultation_polls_and_voting	11_Public_Consultation_public_information_centers	11_Public_Consultation_questionnaires_online_consultation	12_Public_Opinion	13_Repair_Costs	14_Cost_Revenue_Ratio_coded	15_Revenues_user_fare	15_Revenues_advertisement	15_Revenues_public_authority	15_Revenues_grants_donation	16_Deficit_Covering_coded	17_Value_for_Money	18_Benefits_congestion_red	18_Benefits_cycling_uptake	18_Benefits_health	18_Benefits_CO2_environment	18_Benefits_tourism	18_Benefits_revenue	18_Benefits_growth	19_Disadvantages_operating_cost	19_Disadvantages_investment costs	19_Disadvantages_user_price	19_Disadvantages_safety	19_Disadvantages_bad_maintenance	19_Disadvantages_political_support	19_Disadvantages_public_consultation	21_Added_Value_networkextension	21_Added_Value_better_maintenance	21_Added_Value_price_reduction	21_Added_Value_registration_monitoring_IT	21_Added_Value_funding_for_system_expansion	21_Added_Value_awareness_raising	21_Added_Value_local_communities_involvement	21_Added_Value_multimodality_measures	22_Car_Use_Reduction	23_Future_Development	User_Type	Success_Typ	Life_Quality_Type	Economy_Type
05_Year_I	1,000	,038	,041	,157	,070	-,116	,393	,069	,075	-,222	-,296	-,233	-,132	,129	-,074	,273	0,000	-,305	-,084	-,185	-,129	-,445	-,198	-,051	-,178	-,436	,349	,158	,358	,359	,375	,348	,127	,079	,133	,232	,067	,204	-,042	,120	-,064	-,198	-,121	,124	-,112	-,355	-,192
06_Prime_User_Coded	,038	1,000	-,056	,111	,319	-,141	-,188	-,551	-,278	-,223	-,071	,064	,125	,299	-,254	-,035	-,194	,202	-,189	,288	,117	,004	,148	-,204	,025	-,126	-,134	-,188	,203	,086	-,045	,059	,033	-,065	-,083	,103	,138	-,191	,024	,016	-,074	,179	-,166	,541	-,202	,153	,104
08_Area_coded	,041	-,056	1,000	,050	-,271	,098	-,106	,170	,216	-,023	,207	-,043	,003	,311	-,098	-,368	,308	,225	,009	,011	-,051	-,247	-,089	-,169	-,137	-,305	-,119	-,206	,118	-,274	,014	-,014	,216	,210	,102	,004	,176	-,147	,302	,292	,323	-,286	,229	-,076	,095	-,127	-,101
09_Trip_Time_coded	,157	,111	,050	1,000	,288	-,321	,068	-,104	-,370	-,306	,230	,145	-,613	,014	-,138	-,210	,273	,013	-,165	,158	-,039	,021	-,030	-,263	-,248	-,227	-,345	-,340	,423	,294	,195	,202	,054	-,104	,151	,226	,272	,092	-,027	,155	-,038	,218	,039	,131	-,150	,096	-,277
10_Satisfaction_Measure_coded	,070	,319	-,271	,288	1,000	-,144	-,005	-,289	-,257	-,111	-,160	,238	-,157	,110	-,009	,053	-,086	-,139	,182	-,082	-,085	-,173	-,193	-,004	-,009	,099	,044	-,021	,271	,357	,209	,052	,111	-,087	0,000	,124	,041	,183	,018	-,039	-,067	,084	-,074	,071	,218	-,094	-,065
11_Public_Consultation_community_councils	-,116	-,141	,098	-,321	-,144	1,000	,274	,019	,276	-,067	,170	-,189	,247	-,142	,019	,408	-,338	-,150	,260	-,196	,200	,294	-,099	,150	-,063	-,236	,169	,179	-,211	-,231	-,309	-,164	,183	,324	-,241	,288	,115	-,142	,380	,110	,567	,095	,022	-,097	,255	,117	-,008
11_Public_Consultation_public_meetings	,393	-,188	-,106	,068	-,005	,274	1,000	,563	,624	,038	-,084	-,420	-,390	-,065	,017	,321	-,054	-,232	,118	-,404	-,052	-,269	-,436	-,182	-,383	-,510	,248	,379	,286	,153	-,035	,110	-,131	,157	-,099	,367	-,092	,355	,049	,418	,272	-,306	-,153	,136	,041	-,334	-,451
11_Public_Consultation_polls_and_voting	,069	-,551	,170	-,104	-,289	,019	,563	1,000	,702	,470	,035	-,057	-,199	-,236	,105	,055	,399	-,116	,089	-,399	-,397	-,160	-,286	,001	-,086	-,165	,058	,389	,132	,079	-,072	,150	-,179	,158	-,008	,177	-,250	,380	-,097	,343	,264	-,437	,055	-,294	,083	-,349	-,163
11_Public_Consultation_public_information_centers	,075	-,278	,216	-,370	-,257	,276	,624	,702	1,000	,216	-,203	-,152	,283	-,260	,198	,195	,174	-,128	,116	-,363	-,251	-,324	-,363	,136	-,005	-,293	,291	,654	-,066	-,216	-,301	-,094	-,126	,085	,043	,320	,000	,512	,126	,364	,368	-,588	-,139	-,226	,057	-,333	,016
11_Public_Consultation_questionnaires_online_consult	-,222	-,223	-,023	-,306	-,111	-,067	,038	,470	,216	1,000	-,090	-,068	,273	-,236	-,042	,295	,339	,263	,381	-,076	-,036	-,004	,078	,265	,086	,062	,041	,200	,076	,164	,056	-,030	-,182	,067	,087	-,167	-,184	,081	-,113	,068	,054	-,278	,129	-,068	,216	-,114	,162
12_Public_Opinion	-,296	-,071	,207	,230	-,160	,170	-,084	,035	-,203	-,090	1,000	,144	-,195	,239	-,409	-,180	,194	-,052	,131	,281	,231	,392	,231	-,082	-,079	,116	-,203	-,400	,219	-,038	,045	,227	,153	-,363	-,051	-,176	-,300	-,378	,132	-,133	,216	,365	,509	-,059	,387	,398	-,097
13_Repair_Costs	-,233	,064	-,043	,145	,238	-,189	-,420	-,057	-,152	-,068	,144	1,000	,242	-,184	,223	-,209	,317	-,008	,054	,263	-,200	,177	,158	,084	,487	,536	,041	-,103	-,181	,068	-,064	-,127	-,243	-,213	,142	-,318	-,438	,284	-,111	-,144	-,243	,429	,312	-,333	,143	,177	,408
14_Cost_Revenue_Ratio_coded	-,132	,125	,003	-,613	-,157	,247	-,390	-,199	,283	,273	-,195	,242	1,000	-,408	-,202	,440	,128	-,199	,271	,008	,114	-,084	,031	,625	,479	,343	,525	,298	-,402	-,332	-,183	-,063	,030	-,057	,267	-,167	,027	,226	-,090	-,093	-,245	-,176	,379	-,353	,295	-,030	,964
15_Revenues_user_fare	,129	,299	,311	,014	,110	-,142	-,065	-,236	-,260	-,236	,239	-,184	-,408	1,000	-,526	-,332	-,211	,015	-,030	-,006	-,180	-,092	,039	-,370	-,285	-,294	-,064	-,185	,357	-,057	,056	-,091	-,009	,086	-,162	-,130	-,077	-,387	,284	-,124	,083	-,103	-,042	,322	,049	-,018	-,331
15_Revenues_advertisement	-,074	-,254	-,098	-,138	-,009	,019	,017	,105	,198	-,042	-,409	,223	-,202	-,526	1,000	-,367		,348	-,082	-,195	-,263	-,019	-,062	,066	,110	,241	,100	,281	-,370	-,030	,177	,072	,121	,144	,173	-,031	,059	,398	,109	,313	,286	,133	-,160	-,361	-,208	-,096	-,131		
15_Revenues_public_authority	,273	-,035	-,368	-,210	,053	,408	,321	,055	,195	,295	-,180	-,209	,440	-,332	-,367	1,000		-,370	,340	-,040	,436	-,101	-,047	,495	,102	-,256	,261	,305	-,057	,027	-,094	,114	,336	,157	,064	,324	,289	,006	-,133	-,117	-,023	-,150	-,123	,004	,249	-,051	,255		
15_Revenues_grants_donation	0,000	-,194	,308	,273	-,086	-,338	-,054	,399	,174	,339	,194	,317	,128	-,211			1,000		,184	,292	-,175	-,093	-,269	-,068	-,046	,068	-,298	-,311	,354	,351	,296	,329	,228	-,219	,263	-,165	-,025	,206	-,025	,294	-,100	,105	,279	-,094	,268	-,071	,090		
16_Deficit_Covering_coded	-,305	,202	,225	,013	-,139	-,150	-,232	-,116	-,128	,263	-,052	-,008	-,199	,015	,348	-,370		1,000	,004	-,053	-,022	,070	,175	-,109	-,174	-,059	-,174	-,012	-,014	-,142	,050	-,094	,057	,205	-,074	-,209	,031	-,253	,330	,178	,252	,033	,125	,076	-,153	-,003	-,194		
17_Value_for_Money	-,084	-,189	,009	-,165	,182	,260	,118	,089	,116	,381	,131	,054	,271	-,030	-,082	,340	,184	,004	1,000	-,054	,303	,181	,145	,436	,027	,226	,214	,203	-,013	,053	,040	,027	,203	,077	-,054	-,180	-,473	,123	,108	,025	-,020	,212	,445	-,215	,911	,123	,393
18_Benefits_congestion_red	-,185	,288	,011	,158	-,082	-,196	-,404	-,399	-,363	-,076	,281	,263	,008	-,006	-,195	-,040	,292	-,053	-,054	1,000	,537	,541	,690	-,100	,284	,190	-,360	-,538	-,125	-,206	-,100	-,013	,089	-,559	-,174	-,274	-,176	-,296	-,227	-,134	-,222	,517	,184	,268	-,003	,766	,139
18_Benefits_cycling_uptake	-,129	,117	-,051	-,039	-,085	,200	-,052	-,397	-,251	-,036	,231	-,200	,114	-,180	-,263	,436	-,175	-,022	,303	,537	1,000	,447	,533	,143	-,014	,027	-,235	-,293	-,044	-,323	-,135	-,107	,135	-,179	-,206	,039	-,073	-,337	,060	-,054	,038	,376	,012	,213	,226	,553	,037
18_Benefits_health	-,445	,004	-,247	,021	-,173	,294	-,269	-,160	-,324	-,004	,392	,177	-,084	-,092	-,019	-,101	-,093	,070	,181	,541	,447	1,000	,600	,083	,075	,239	-,373	-,202	-,182	-,325	-,295	-,062	-,086	-,273	-,331	-,123	-,400	-,275	-,066	-,052	,103	,565	,126	,072	,174	,752	,014
18_Benefits_CO2_environment	-,198	,148	-,089	-,030	-,193	-,099	-,436	-,286	-,363	,078	,231	,158	,031	,039	-,062	-,047	-,269	,175	,145	,690	,533	,600	1,000	,143	,210	,328	-,103	-,240	-,306	-,317	-,160	-,120	-,034	-,413	-,138	-,359	-,363	-,350	-,083	-,299	-,013	,531	,146	,237	,170	,781	,124
18_Benefits_tourism	-,051	-,204	-,169	-,263	-,004	,150	-,182	,001	,136	,265	-,082	,084	,625	-,370	,066	,495	-,068	-,109	,436	-,100	,143	,083	,143	1,000	,440	,311	,456	,358	-,288	-,109	,171	,080	-,007	,078	,099	-,193	-,087	,180	-,059	-,218	,061	,065	,141	-,468	,417	,105	,620
18_Benefits_revenue	-,178	,025	-,137	-,248	-,009	-,063	-,383	-,086	-,005	,086	-,079	,487	,479	-,285	,110	,102	-,046	-,174	,027	,284	-,014	,075	,210	,440	1,000	,573	,169	-,056	-,557	-,117	-,216	-,104	,073	-,163	-,105	-,337	-,233	-,003	-,244	-,435	-,205	,211	,232	-,278	,035	,123	,640
18_Benefits_growth	-,436	-,126	-,305	-,227	,099	-,236	-,510	-,165	-,293	,062	,116	,536	,343	-,294	,241	-,256	,068	-,059	,226	,190	,027	,239	,328	,311	,573	1,000	-,032	-,139	-,532	-,138	-,167	-,227	-,217	-,326	-,031	-,645	-,484	-,017	-,327	-,526	-,448	,533	,370	-,348	,330	,281	,563
19_Disadvantages_operating_cost	,349	-,134	-,119	-,345	,044	,169	,248	,058	,291	,041	-,203	,041	,525	-,064	,100	,261	-,298	-,174	,214	-,360	-,235	-,373	-,103	,456	,169	-,032	1,000	,473	-,044	,166	,310	,190	,092	,140	,309	-,023	-,071	,224	,127	-,032	,108	-,239	,242	-,250	,252	-,332	,248
19_Disadvantages_investment_costs	,158	-,188	-,206	-,340	-,021	,179	,379	,389	,654	,200	-,400	-,103	,298	-,185	,281	,305	-,311	-,012	,203	-,538	-,293	-,202	-,240	,358	-,056	-,139	,473	1,000	,053	-,036	-,077	-,054	-,238	,222	,170	,077	-,004	,484	,092	,146	,237	-,497	-,263	-,228	,049	-,444	,114
19_Disadvantages_user_price	,358	,203	,118	,423	,271	-,211	,286	,132	-,066	,076	,219	-,181	-,402	,357	-,370	-,057	,354	-,014	-,013	-,125	-,044	-,182	-,306	-,288	-,557	-,532	-,044	,053	1,000	,441	,477	,315	,082	,014	,232	,331	,124	,119	,119	,334	,202	-,297	,048	,255	-,055	-,340	-,386
19_Disadvantages_safety	,359	,086	-,274	,294	,357	-,231	,153	,079	-,216	,164	-,038	,068	-,332	-,057	-,030	,027	,351	-,142	,053	-,206	-,323	-,325	-,317	-,109	-,117	-,138	,166	-,036	,441	1,000	,583	,385	,009	-,062	,354	,124	,112	,057	-,083	,009	-,145	,001	,036	,278	,054	-,401	-,079
19_Disadvantages_bad_maintenance	,375	-,045	,014	,195	,209	-,309	-,035	-,072	-,301	,056	,045	-,064	-,183	,056	,177	-,094	,296	,050	,040	-,100	-,135	-,295	-,160	,171	-,216	-,167	,310	-,077	,477	,583	1,000	,510	,290	,128	,405	-,017	,156	,141	,108	,118	-,005	-,014	,191	-,044	,049	-,228	-,120
19_Disadvantages_political_support	,348	,059	-,014	,202	,052	-,164	,110	,150	-,094	-,030	,227	-,127	-,063	-,091	,072	,114	,329	-,094	,027	-,013	-,107	-,062	-,120	,080	-,104	-,227	,190	-,054	,315	,385	,510	1,000	,517	-,138	,073	,179	-,061	,180	,052	,351	,070	-,017	,224	-,025	,077	-,116	-,083
19_Disadvantages_public_consultation	,127	,033	,216	,054	,111	,183	-,131	-,179	-,126	-,182	,153	-,243	,030	-,009	,121	,336	,228	,057	,203	,089	,135	-,086	-,034	-,007	,073	-,217	,092	-,238	,082	,009	,290	,517	1,000	,098	-,095	,313	,258	-,095	,294	,178	,278	-,001	,171	-,045	,160	,025	-,073
21_Added_Value_networkextension	,079	-,065	,210	-,104	-,087	,324	,157	,158	,085	,067	-,363	-,213	-,057	,086	,144	,157	-,219	,205	,077	-,559	-,179	-,273	-,413	,078	-,163	-,326	,140	,222	,014	-,062	,128	-,138	,098	1,000	-,165	,271	,215	,139	,315	,326	,229	-,331	-,253	-,141	-,125	-,473	-,070
21_Added_Value_better_mainanance	,133	-,083	,102	,151	0,000	-,241	-,099	-,008	,043	,087	-,051	,142	,267	-,162	,173	,064	,263	-,074	-,054	-,174	-,206	-,331	-,138	,099	-,105	-,031	,309	,170	,232	,354	,405	,073	-,055	-,165	1,000	,137	,412	,163	,088	,066	-,022	-,162	,159	-,058	-,005	-,346	,070
21_Added_Value_price_reduction	,232	,103	,004	,226	,124	,288	,367	,177	,320	-,167	-,176	-,318	-,167	-,130	-,031	,324	-,165	-,209	-,180	-,274	,039	-,123	-,359	-,193	-,337	-,645	-,023	,077	,331	,124	-,017	,179	,313	,271	,137	1,000	,504	,202	,344	,524	,413	-,347	-,471	,208	-,330	-,233	-,346
21_Added_Value_registration_monitoring_IT	,067	,138	,176	,272	,041	,115	-,092	-,250	,000	-,184	-,300	-,438	,027	-,077	,059	,289	-,025	,031	-,473	-,176	-,073	-,400	-,363	-,087	-,233	-,484	-,071	-,004	,124	,112	,156	-,061	,258	,215	,412	,504	1,000	-,154	,252	,172	,275	-,197	-,337	,101	-,520	-,234	-,150
21_Added_Value_funding_for_system_expansion	,204	-,191	-,147	,092	,183	-,142	,355	,380	,512	,081	-,378	,284	,226	-,387	,398	,006	,206	-,253	,123	-,296	-,337	-,275	-,350	,180	-,003	-,017	,224	,484	,119	,057	,141	,180	-,095	,139	,163	,202	-,154	1,000	-,078	,359	-,205	-,421	-,185	-,327	0,000	-,341	,155
21_Added_Value_awareness_raising	-,042	,024	,302	-,027	,018	,380	,049	-,097	,126	-,113	,132	-,111	-,090	,284	,109	-,133	-,025	,330	,108	-,227	,060	-,066	-,083	-,059	-,244	-,327	,127	,092	,119	-,083	,108	,052	,294	,315	,088	,344	,252	-,078	1,000	,326	,594	,010	-,104	,141	,009	-,153	-,302
21_Added_Value_local_communities_involvement	,120	,016	,292	,155	-,039	,110	,418	,343	,364	,068	-,133	-,144	-,093	-,124	,313	-,117	,294	,178	,025	-,134	-,054	-,052	-,299	-,218	-,435	-,526	-,032	,146	,334	,009	,118	,351	,178	,326	,066	,524	,172	,359	,328	1,000	,428	-,308	-,065	-,047	-,124	-,232	-,248
21_Added_Value_multimodality_measures	-,064	-,074	,323	-,038	-,067	,567	,272	,264	,368	,054	,216	-,243	-,245	,083	,286	-,023	-,100	,252	-,020	-,222	,038	,103	-,013	,061	-,205	-,448	,108	,237	,202	-,145	-,005	,070	,278	,229	-,022	,413	,275	-,205	,594	,428	1,000	-,050	-,104	-,038	-,043	,006	-,389
22_Car_Use_Reduction	-,198	,179	-,286	,218	,084	,095	-,306	-,437	-,588	-,278	,365	,429	-,176	-,103	,133	-,150	,105	,033	,212	,517	,376	,565	,531	,065	,211	,533	-,239	-,497	-,297	,001	-,014	-,017	-,001	-,331	-,162	-,347	-,197	-,421	,010	-,308	-,050	1,000	,304	,086	,317	,684	,155
23_Future_Development	-,121	-,166	,229	,039	-,074	,022	-,153	,055	-,139	,129	,509	,312	,379	-,042	-,160	-,123	,279	,125	,445	,184	,012	,126	,146	,141	,232	,370	,242	-,263	,048	,036	,191	,224	,171	-,253	,159	-,471	-,337	-,185	-,104	-,065	-,104	,304	1,000	-,362	,644	,112	,396
User_Type	,124	,541	-,076	,131	,071	-,097	,136	-,294	-,226	-,068	-,059	-,333	-,353	,322	-,361	,004	-,094	,076	-,215	,268	,213	,072	,237	-,468	-,278	-,348	-,250	-,228	,255	,278	-,044	-,025	-,045	-,141	-,058	,208	,101	-,327	,141	-,047	-,038	,086	-,362	1,000	-,317	,115	-,337
Success_Typ	-,112	-,202	,095	-,150	,218	,255	,041	,083	,057	,216	,387	,143	,295	,049	-,208	,249	,268	-,153	,911	-,003	,226	,174	,170	,417	,035	,330	,252	,049	-,055	,054	,049	,077	,160	-,125	-,005	-,330	-,520	0,000	,009	-,124	-,043	,317	,644	-,317	1,000	,215	,395
Life_Quality_Type	-,355	,153	-,127	,096	-,094	,117	-,334	-,349	-,333	-,114	,398	,177	-,030	-,018	-,096	-,051	-,071	-,003	,123	,766	,553	,752	,781	,105	,123	,281	-,332	-,444	-,340	-,401	-,228	-,116	,025	-,473	-,346	-,233	-,234	-,341	-,153	-,232	,006	,684	,112	,115	,215	1,000	,109
Economy_Type	-,192	,104	-,101	-,277	-,065	-,008	-,451	-,163	,016	,162	-,097	,408	,964	-,331	-,131	,255	,090	-,194	,393	,139	,037	,014	,124	,620	,640	,563	,248	,114	-,386	-,079	-,120	-,083	-,073	-,070	,070	-,346	-,150	,155	-,302	-,248	-,389	,155	,396	-,337	,395	,109	1,000

**. Correlation is significant at the 0.01 level (2-tailed)

*. Correlation is significant at the 0.05 level (2-tailed)