D5.2 Neutral Solution Packages for each Solution available online on BABLE

30/03/21

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 864242
Topic: LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities

Dissemination level		
PU	Public	X
CO	Confidential, only for members of the consortium (including the Commission Services)	

Deliverable administration

No & name	**D5.2 Neutral Solution Packages for each Solution available online on BABLE**				
Status	Released	**Due**	M18	**Date**	2021-03-31
Author(s)	BABLE GmbH				
Description of the related task and the deliverable. Extract from DoA	**T5.1 Name (Leader) M1 – M36** The aim of this task is to create rich, expert curated, neutral information packages, based on the Use Cases from the LHCs, focused on helping cities implement and replicate these solutions under differing local circumstances. Functions, technological options and lessons learned from similar Use Cases will be combined into interoperable "Packaged Solutions" that can serve as a preconfigured building block for individual project development. Based on the planned interventions in the LHCs, the following packaged solutions are proposed (several of which have already been curated or pre-developed): Smart Micro Grid, Virtual Power Plant Building Energy Management System, Smart Home Systems, Decentralized Local Energy System, District Heating Systems, Public Charging System for Electric Vehicles, Electric Bike Sharing Systems, Electric Bus Systems, Urban Data Platform. More solutions will be added depending on the learnings during the implementation process. The activities in this task will involve in-depth research on the Solutions, followed by inputs from the technical experts in the field coming from the SPARCS partner companies and institutes, experts from Fraunhofer Society, the BABLE expert community and the related Action Clusters from EIP-SCC if feasible. In essence, each packaged solution represents a portfolio of structured information and documents referring to a) Benefits; b) Functions; c) Business Model and financing options; d) Technological options and standardization; e) data-sets and sources f) Driving factors, g) legal requirements.				
Participants	**BABLE**, VTT, ESP, LPZ, FHG, ULEI, SPI, OR, SUITE5, VERD, CiviESCo				
Comments					

V	Date	Authors	Description
0.5	09/01/2021	BABLE	Guidance to deliverable contributors
0.6	10/03/2021	BABLE et al.	First completed draft of deliverable
0.9	10/03/ – 25/03/2021	VTT, FHG; BABLE	Deliverable reviewed, checked, updated, and finalised. QA check completed
1	30/03/2021	VTT	Coordinator submits the deliverable to the EC

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About SPARCS

Sustainable energy Positive & zero cARbon CommunitieS demonstrates and validates technically and socioeconomically viable and replicable, innovative solutions for rolling out smart, integrated positive energy systems for the transition to a citizen centred zero carbon & resource efficient economy. SPARCS facilitates the participation of buildings to the energy market enabling new services and a virtual power plant concept, creating VirtualPositiveEnergy communities as energy democratic playground (positive energy districts can exchange energy with energy entities located outside the district). Seven cities will demonstrate 100+ actions turning buildings, blocks, and districts into energy prosumers. Impacts span economic growth, improved quality of life, and environmental benefits towards the EC policy framework for climate and energy, the SET plan and UN Sustainable Development goals. SPARCS co-creation brings together citizens, companies, research organizations, city planning and decision making entities, transforming cities to carbon-free inclusive communities. Lighthouse cities Espoo (FI) and Leipzig (DE) implement large demonstrations. Fellow cities Reykjavik (IS), Maia (PT), Lviv (UA), Kifissia (EL) and Kladno (CZ) prepare replication with hands-on feasibility studies. SPARCS identifies bankable actions to accelerate market uptake, pioneers innovative, exploitable governance and business models boosting the transformation processes, joint procurement procedures and citizen engaging mechanisms in an overarching city planning instrument toward the bold City Vision 2050. SPARCS engages 30 partners from 8 EU Member States (FI, DE, PT, CY, EL, BE, CZ, IT) and 2 non-EU countries (UA, IS), representing key stakeholders within the value chain of urban challenges and smart, sustainable cities bringing together three distinct but also overlapping knowledge areas: (i) City Energy Systems, (ii) ICT and Interoperability, (iii) Business Innovation and Market Knowledge.

Partners

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EXECUTIVE SUMMARY (BABLE, M18)

1.1 Deliverable description

This deliverable presents the results of the task of creating rich, expert curated, neutral information packages (so-called *Solutions*), based on the Use Cases from the Lighthouse Cities. There are several solutions to urban challenges available on the market. Each solution can be implemented in different variants – responding to local circumstances, the available budget or the needs of the local community. To decide if a solution is suitable for a city and which would be beneficial characteristics of it, in-depth knowledge about the solution itself is necessary.

These *Solutions* help cities understand what different technical systems offer them to solve their problems and what considerations they need to make to implement and replicate these solutions under differing local circumstances.

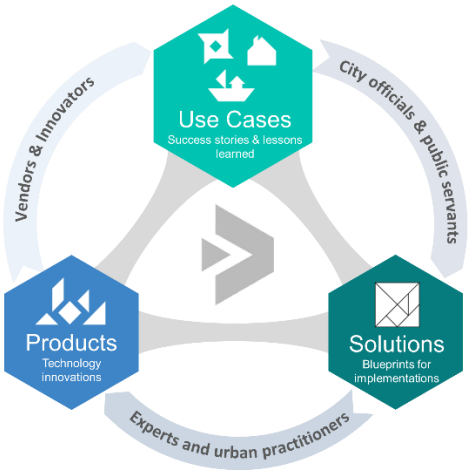

Figure 1 - Relation between Solutions, Products and Use Cases

The content and structure of the *Solutions* aim to break down the complexity of the technical systems (*Products*) offered by the market and aggregate information from individual applications (*Use Cases*) – see Figure 1. In collaboration with a European community of experts, we structured the packaged solutions for smart cities in a way that they are modular, configurable, standardised, and neutral.

The *Solutions* are structured as follows:

- **Description**: main definition of what the general system is able to do and the goals to be achieved by using it in an urban context.
- **Problems to be solved**: the challenges and issues the specific solutions can support in tackling.
- **Functions**: mandatory (what the minimum requirements of the system to provide the basic functionalities are) and optional (what other add-ons are that could be adapted to the local needs) configurations of the system.
- **Variants**: identification of the different options that exist as part of that solution.
- **Benefits**: how can the solution improve the city or some aspects/areas of it.
- **City context**: local factors enabling or limiting the success of such a solution.
- **Supporting factors**: aspects, characteristics, methods promoting the uptake of the solution.
- **Government initiatives**: Policies supporting the implementation of such solutions (EU-level, national level, or local level).
- **Stakeholder mapping:** the main actors involved in the implementation, provision, and maintenance of the product/service, and their interactions.
- **Market potential:** market size, development in the past years, and customers.
- **Cost structure:** resources needed to design, implement, and maintain the system, and fixed and variable costs.
- **Operating models:** reference on who owns the system, who operates it, and who may provide the funding for it.

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- **Legal regulation:** list of relevant regulations governing the application of the solution at the EU or national level.
- **Data and standards:** relevant references to existing open standards, data models relevant for the solution.

This information is relevant for cities because it helps them understand what they can get from the market and what benefits the solution may create to make more informed decisions, while also supports them at the procurement stage providing key information that should be included in the tender documents like the description of the system, variants, and desired functionalities.

The solutions prove to be useful for product/service providers as well since their offers can be connected to the relevant solution supporting them in their communication to the public sector. The products of companies will be linked to solutions and Use Cases, a step that will be followed with the SPARCS consortium in the upcoming months.

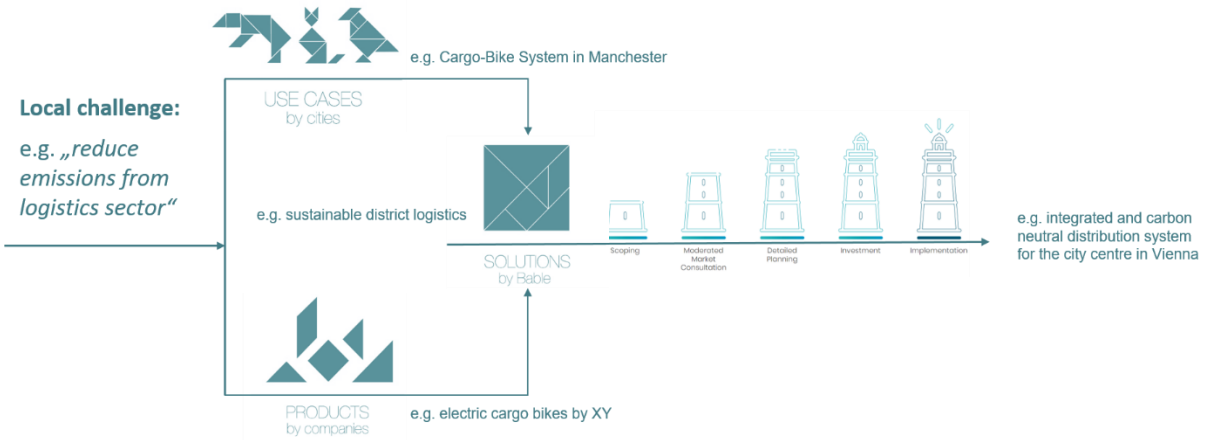

Figure 2 - How the Use Cases, Products, and ultimately, Solutions support the implementation replication of projects, Solutions.

As part of this deliverable, the following Solutions have been researched and made available online based on the planned implementations by the cities of Leipzig and Espoo. Each of them includes a link to the specific webpage where they are publicised.

Energy Solutions

1. Energy Storage Systems
2. Energy Efficient Retrofitting of Buildings
3. Smart Microgrids
4. Building Energy Management Systems
5. Decentralised Local Energy Systems
6. Municipal Energy Saving Systems
7. Peer to peer energy trading
8. Virtual power plant
9. District Heating and Cooling System
10. Smart Home System

ICT

11. Digital Twin
12. Urban Air Quality Platform
13. Urban Data Platform

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Mobility Solutions

14. Bi-directional Electric Vehicle Charging
15. Public Charging System for EVs
16. Bike Sharing System
17. Smart Parking System
18. Electric Bus System
19. Vehicle Sharing System

1.2 Purpose and target group

The purpose of the *Solutions* is to help cities understand what different technical systems are able to offer them to solve their problems and support with information the implementation and replication of these solutions under differing local circumstances. Furthermore, it supports companies with communicating what they can offer to cities in a more structured and practical manner.

The target group for this deliverable are local authorities and companies interested in energy and mobility-related solutions.

1.3 Contributions of partners

BABLE leads the development of the content of this deliverable. Several SPARCS' partners supported the review process of the solution, completing them with relevant insights, expert advice, and feedback that improved the quality of the information.

1.4 Relations to other activities

This deliverable will inform the Fellow City Replication Strategy as well as the Project Development in the Fellow Cities. Furthermore, it will support the communication and dissemination activities of the project.

1.5 Some impressions from the deliverable online

In this section, an example of a Solution on the BABLE platform is presented (Bike Sharing System).

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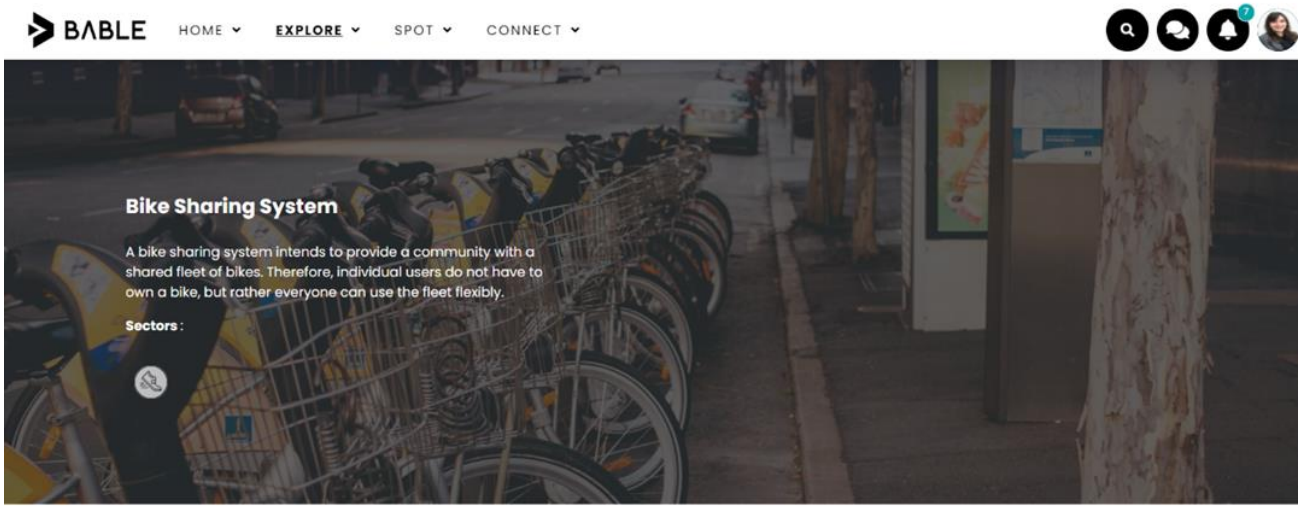

Description
Variants
Cost Structure
City Context
Supporting Factors
Government Initiatives
Stakeholder Mapping
Market Potential
Cost Structure
Operating Models
Regulations
Data and Standards
Use Cases
Related Solutions

Description

A bike sharing system intends to provide a community with a shared fleet of bikes. Therefore, individual users do not have to own a bike, but rather everyone can use the fleet flexibly. Flexible options to use bikes at different locations can increase the attractiveness of biking – and thus the modal share of biking in a city – by providing more convenient options for commuters and recreational users.

For each bike sharing system, it is necessary to ensure the accessibility of the bikes and to manage the location and operation of the bikes. European bike sharing systems mostly use a dock-based concept, where bikes can be picked-up and dropped-off at specific locations. New market entrants are also disrupting the European market with free-floating and hybrid systems.

Bike sharing systems are most beneficial as part of Mobility as a Service (MaaS) systems. Through collaboration with other shared mobility companies as well as public transport, bike sharing can be conveniently fit into existing mobility platforms through integrated ticketing and pricing.

Problems to be solved

Congestion	**Air Quality**	**Climate Change**	**Collision**	**Parking Space**	**Inadequate physical activity (and associated chronic disease outcomes)**

Congestion, air quality, climate change, collisions, parking spaces and inadequate physical activity are all ills affecting the quality of life of citizens. Bike sharing reduces land consumption and pollutant emissions by enabling trips that would otherwise be taken by private cars to be taken by shared bicycle transport. Even in urban areas that already have higher levels of cycling and walking, research supports that increased active travel substitutes for motorised travel – including cycling and e-biking – can substantially reduce mobility-related lifecycle CO2 emissions (Brand et al., 2021). Rented shared bikes cover up to 10,000 kilometres a year and are therefore used more frequently than most private bikes.

Benefits

Bike Sharing Systems have economic, environmental as well as social benefits.

Main Benefits

- Promoting sustainable private transport models
- Promoting sustainable behavior
- Reducing use of fossils in public transport

Potential Benefits

- Promoting active living
- Creating new jobs
- Reducing GHG emissions
- Reducing local air pollution
- Reducing use of fossils
- Reducing need for travel
- Improving social integration
- Promoting sustainable behavior
- Improving public transport accessibility
- Enhanced data collection

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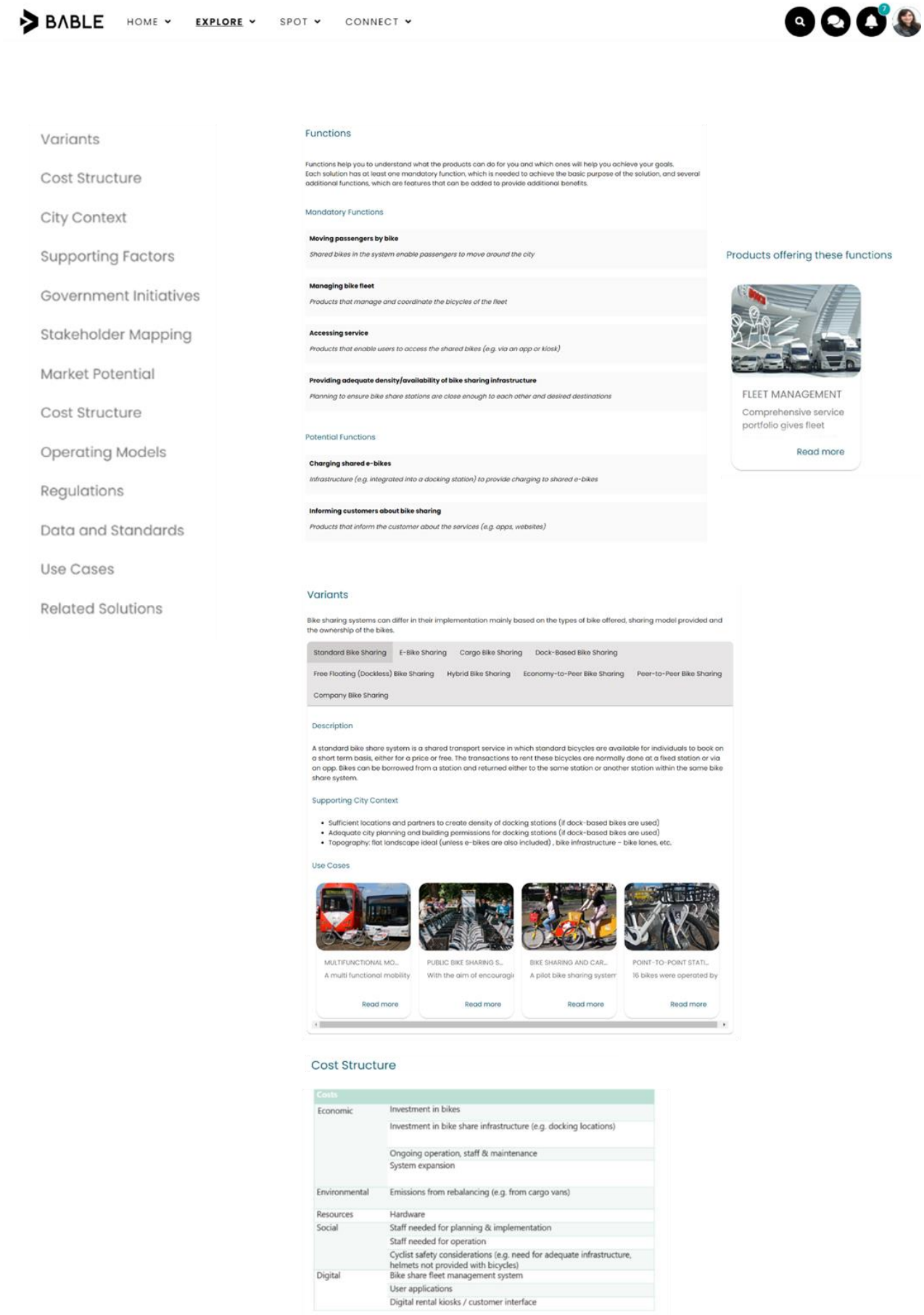

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City Context

1) Size of the city:

There is no significant difference between the modal shares of cycling in small, medium and large cities (i.e. the percentage of trips made by bicycle versus via other forms of transport).

- **Differences in technology:**
  - Large cities: technologically advanced schemes, more slots and bikes per station for automated schemes
  - Smaller cities: low-tech schemes
- **Operational hours:**
  - Large cities: tend to provide a 24-hour service for operation
  - Smaller cities: tend to close the service during the night
- **Pricing model:**
  - Small and medium-sized cities have schemes that are free of charge for at least 30 minutes (75% and 82%, respectively), while in large cities only 60% offer the first half hour for free (OBIS project, 2011).
  - Most systems provide multiple levels of user fees and tickets, range from tickets per hour (or partial hour) or day up to monthly or yearly subscription memberships. To lower losses due to potential bike theft, often users must commit a temporary deposit via credit/debit card or tied to their subscription contract.
  - Many major cities around Europe have signed contracts with private advertising agencies, which supply the city with free (or low cost) bikes in exchanging for advertising rights both on the bikes themselves and related bike share infrastructure.
  - While some cities have and do operate bike sharing as a public service (i.e. paying for the initial investment and operating costs), others also take advantage of national government grants or ongoing subsidies. Public-private partnerships (including through advertising agreements) also support many bike share systems.

2) Climate of the city

Local climate is an important influencing factor for cycle usage in different seasons.

- During the cold season, the bike sharing system demand can be influenced not only by the weather itself but also by cycling infrastructure conditions (e.g. whether snow and ice have been cleared).
  - In times of the year when usage is lower, the operator could limit availability of bikes or even close down the system for maintenance. At times of the year when demand is high, additional staff and maintenance activities might improve service quality.

3) Infrastructure

Existing cycleways ease the usage of bikes and increase safety for riders, but in some cities where bike-sharing systems were implemented so far, the increased bike usage also made the municipality improve cycling way and the related infrastructure (ADFC, 2019). In general, whichever the direction of development, having a higher density of bike sharing infrastructure and available bikes can promote increased bike share uptake and use. Aside from providing infrastructure, bike share system operators and municipalities can also support systems by providing safety equipment (e.g. built in lights on bicycles) and making efforts to limit / target vandalism to bikes.

4) Topography

Including e-bikes in the bike sharing system is especially beneficial in hilly cities and suburbs of cities where people take the bikes to move longer distances towards the city centre.

Supporting Factors

1. **High-density network:** Highly concentrated and comprehensive networks of bikes and widespread program coverage ensures high accessibility
2. **Multimodal integration:** Integration of infrastructures, information structures and payment with other mobility services enables convenient transfers (i.e. MaaS)
3. **Simple handling:** User-friendly, on-demand registration increases usability and reduces entry barriers for new users
4. **Smart data analytics:** Use of data-driven applications optimises pricing and operations while creating additional revenue streams
5. **High-quality bikes:** Easy-to ride but also sturdy and weatherproof bikes ensure a comfortable riding experience and reduce maintenance costs
6. **Support of local authorities:** Support of local authorities (e.g. in terms of bike lanes) and accessibility of public spaces and links to public transport can boost success

Government Initiatives

Many European countries have a national cycling strategy. These strategies help to improve the cycling modal share by allowing federal authorities to mobilise the different stakeholders involved in the promotion of cycling. Some examples of national cycling strategies are:

- **Germany, National Cycle Plan 3.0:** will replace the National Cycling Plan 2020, which aimed to achieve 15% cycling modal share in Germany by 2020. Priority areas for the new 3.0 plan include cycling as a means to tackle climate change and protect environment with goals to continue increasing cycling as a share of total traffic
- **France, PAMA (Action plan for soft mobility – Walking and cycling**): aims to encourage cycling by giving fiscal incentives to people who cycle to work
- **Ireland, Irelands First National Cycle Policy Framework:** aims to achieve a cycling modal share mark of 10% by 2020, up from 2% in 2006. This includes policies related to fiscal incentives, provision of bikes and other indirect tax benefits.
- **Norway, National cycling strategy - Get on Bikes!:** aims at achieving 8% cycling modal share in Norway by 2023, by focusing on funding, infrastructure and communication. (Frost and Sullivan, 2016)

Currently there is no official EU Cycling Strategy. However, with the support of numerous other organisations, the European Cyclists' Federation (ECF) developed its own strategy and set of recommendations in 2017, with many seeing a need for more coordinated cycling action within the EU (European Commission, 2021).

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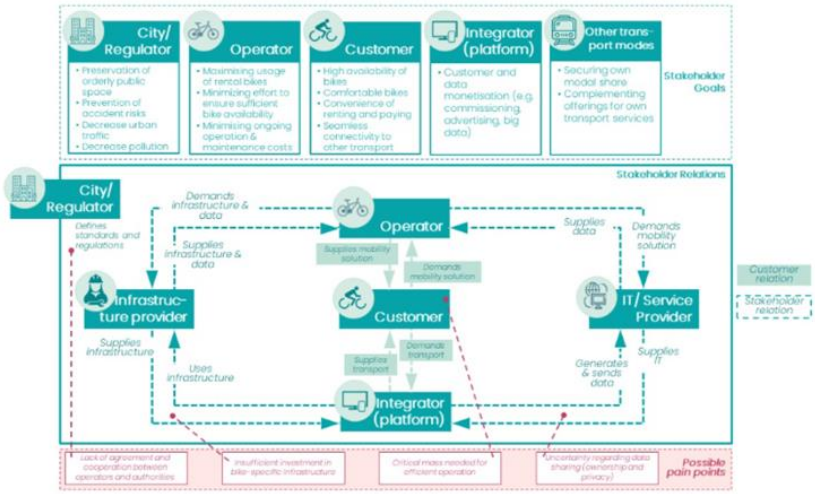
Stakeholder Mapping



Market Potential

Market size: The bike-sharing industry has been steadily growing over the past years. IT-technologies and innovative business models ease the implementation of bike sharing systems. According to a market forecast conducted by Prescient & Strategic Intelligence the global market value in 2018 with 2.8 billion USD. Until 2025 an annual market growth rate of 10.2 % is expected. This results in a global market size of 5 billion USD by 2025, with Europe expected to be the fastest growing market (PS Market Research, 2019).

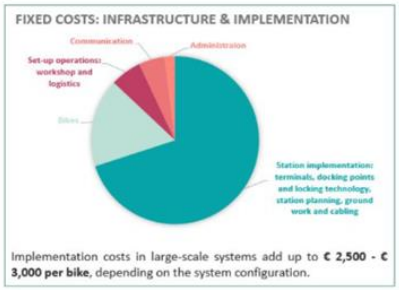
Market development: The European bike-sharing market, in particular, is expected to grow at a compound annual growth rate of **9.4 %** during 2015–2025, from 139,090 bikes in 2015 to more than **340,000 bikes by 2025**. The number of users is expected to more than double by 2025 (Frost and Sullivan, 2016). Since summer 2017, dockless bike sharing models have also penetrated into the European market, first starting with Chinese operators and now also supplied by several European companies and start-ups (European Bicycle Manufacturers Association, 2021).

Potential customers: Bike sharing is especially useful in densely populated areas where the market is already wider for more customers and these customers are in-turn more incentivised to use the system, e.g. through denser networks of stations that are more convenient to meet their needs. Bike sharing is also a popular option among tourists as a way to see a city as well as in university / student-populated cities.

Cost Structure

Resources needed	
Staff for planning & implementation	- BSS experts - Financial and legal experts - Marketing and communication experts - Architects/urban planners for planning the system
Staff for operation	- Mechanics for repairing (possible subcontractor) - Drivers for redistributing (possible subcontractor) - Customer hotline
Hardware	- Bikes, docking points, station terminals - Trucks for bike redistribution (possible subcontractor) - Tools to repair the bikes (possible subcontractor) - Spare parts - Spare bikes
Software	- Back- end - Front- end
Marketing & Communication	- Writing a Marketing & communication concept - Designing advertising material - Keeping the website up to date - Organisation of (media) events - Ensure media presence
Integration with public transport	- Integrating information systems - Integrating tariff systems - Signing in PT stations (e.g. Barcelona) - Usability with the same customer card or account (e.g. Stockholm)
Space	- Public space for stations/bikes - Workshop space for repairing and storing the bikes and trucks (possible subcontractor)

The expenses of a bike sharing system consist of relatively high investment costs for the fleet of bikes and rather low variable costs. The costs for station installation are particularly high, accounting for about 70% of fixed costs. Redistribution cost is an important variable cost component and accounts for almost 30% of operating costs. The following tables provide an overview of the different emerging costs and a price range for each of these costs (Frost and Sullivan, 2016).



Implementation costs in large-scale systems add up to **€ 2,500 - € 3,000 per bike**, depending on the system configuration.

Running costs in large-scale systems are stated **as € 1,500 - € 2,500 per bike and year** in most large schemes.

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Operating Models

Within the currently implemented bike sharing systems, there are different revenue models. Some public bike sharing systems are implemented with a **non-profit strategy**. These usually intend to affect the consumers' behaviour. The government, transport agencies, universities or not-for-profit organisations typically implement such non-profit bike sharing systems. Implementations of a **profitable business model** are applied by advertising companies or by companies who intend to gain profit by the implementation itself. Advertising companies aim to take advantage of the visibility of the bikes in the city and the user community. However, for-profit companies gain a financial benefit from the bike sharing system itself and its fees (Winslow and Mont, 2019).

Operating Model	**For Profit:** • Owned and operated by a private company responsible for fund-raising and costs • Quick raising of return on investments		**Non-Profit:** • Owned and operated by an agency, responsible for fund-raising and costs • Flexible funding	
Financing	**Private:** • Private loans and grants • Advertising and sponsorship • Venture capital		**Public:** • Federal grants • State grants • City funds	
Ownership & Operation	**Private** **Private**	**Public** **Private**	**Private** **Public**	**Public** **Public**
	• Privately owned bikes • Street furniture contract • Third-party operated • Vendor poperated	• Publicly owned/ contractor operated	• N/A	• Publicly owned and operated

Regulations

- ***EU-IVS-Regulation***: Ensuring data access as well as providing EU-wide multimodal travel information services and the provision of EU-wide real-time traffic information services (Russ, Tausz, 2015)
- ***Local measures taken to keep streets organised / tidy from shared bicycles:***
  - Limits on number of operators per city and fleet size per operator
  - Restrictions on parking locations and number of bikes per parking zone
  - Penalty fees for breaches of any kind
  - Requirement to install tracking devices on rental bikes
  - Immediate disposal of damaged rental bikes
- ***EU Green Deal:*** The EU 'Green Deal' includes a Sustainable and Smart Mobility Strategy intent on doubling the cycling infrastructure, which could add momentum to the already rapidly growing interest in bike sharing systems (Bike Europe, 2021).

Data and Standards

- Data model: General Bikeshare Feed Specification (GBFS)
- Standards: **ISO 20614:2017**
- Required Software Functions:

Back-end	Front-end
Station Monitoring	Registration
Redistribution Planning	Rental
Defect Management	Information
Customer Data Management	Customer Data Management
Billing	Payment

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Use Cases

ELECTRIC ASSIST CARGO BIKES (PEDELECS) FOR GOODS DELIVERY IN MANCHESTER

The aim is to promote the

Read more

PUBLIC BIKE SHARING SYSTEM IN TARTU

With the aim of encouraging the use of bicycles and make this a considerable alternative to cars,

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POINT-TO-POINT STATION BOUND BIKE SHARING

16 bikes were operated by HopperPoint as a service for

Read more

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