

Report

INTERCONNECT Planning Tools for Public Transport and Cross-border Public Services (CPS)

Deliverable 4.2

Introduction of public transport planning tools and their relation with the A-B-C-D planning model developed in INTERCONNECT, and outline of the potentials of implementing cross-border public services in the South Baltic Sea Region.

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**INTER
CONNECT**



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Report on INTERCONNECT Planning Models and Tools for Public Transport and Cross- border/Regional Public Services

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Deliverable 4.2: Multi-stakeholder planning model and decision-making tool for sustainable public transport systems

Activity 4.7

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List of Abbreviations and Acronyms

ABCD	The ABCD planning procedure
CH	2-digits ISO country code for Switzerland
CI	Corporate identity
CNG	Compressed natural gas
CPS	Cross-border public service(s)
CZ	2-digits ISO country code for Czech Republic
DE	2-digits ISO country code for Germany
FR	2-digits ISO country code for France
FSSD	Framework for Strategic Sustainable Development
IT	Information technology

ISO	International standardisation organisation
ITS	Intelligent transport systems
JRC	Joint Research Centre of the European Commission
LNG	Liquefied natural gas
MaaS	Mobility-as-a-service
PDF	Portable document format
PSO	Public service obligations
PT	Public transport
SDG	Sustainable development goals
SPs	Sustainability Principles
SUMP	Sustainable urban mobility plan(s)
TAC	Transport Association of Canada
TERI	The Energy and Resources Institute of India
UNECE	United Nations Economic Commission for Europe
WBCSD	World Business Council for Sustainable Development

1 Background and rationale

In many regions, urban and rural, border and non-border regions alike, the current public transport systems hardly meet the customer's expectations as regards simplicity, quality, density, costs, frequency and general attractiveness. In particular regional, inter-regional and cross-border services are often poorly developed in many European border regions. Even if services exist in border regions, information on cross-border integrated ticket options and multimodal trips are difficult to obtain for public transport users as usually they have to collect information individually for all countries concerned. That way, the benefits public transport offers are often not visible to the public. Consequently, people tend to use the car instead of trains or buses.

To make the situation even more complex, urban and regional public transport planners and operators are facing tremendous dynamics in various fields and thus service provision is challenged from different angles:

- ***Climate change and environmental debates:*** Transport planners agree that there is no alternative for a shift in transport policies towards significant strengthening of public transport to reach the sustainable development goals (SDGs) of climate change actions. However, heavy investments are needed in many regions to improve public transport services (in particular in cross-border context) and service quality.
- ***New vehicle technologies:*** New environmentally friendly powertrain technologies (e-vehicles, hybrid drives, LNG/CNG drives, etc.) and new vehicle concepts (e.g. autonomous vehicles) emerged during the last years and now broadly start entering the markets. Transport operators are thus facing needs to modernize their vehicle fleet and to invest in new technologies, simultaneously pushed by the general public and politicians, even though often there is still uncertainty about the entire range of impacts - positive and negative alike - of these new technologies.
- ***Mobility-as-a-service (MaaS) and new forms of urban mobility:*** In parallel, the monopoly situation of the traditional public transport operators is challenged as new mobility providers enter the markets, offering new types of demand-driven services such as ride-hailing or different renting systems (cars, bicycles, scooters, etc.), most of them based on new smartphone and internet technologies. A side effect of the new MaaS is that they gradually tend to merge private and public transport, at least to

tighten the integration of the two. The challenge is that many new services are emerging at the same time, some of which complementing each other, some of which playing off each other, making it difficult for transport planners and municipality administrations to keep track of the latest market developments and about their opportunities and usefulness for a particular city.

- ***Demographic change and changing demand towards new forms of transport.*** Ongoing changes in the demographic composition of society such as overaging or a decrease in the number of young people and apprentices (all of which are typical users of public transport), combined with changes in values and behavior of people (mostly of the younger generation), necessitate changes in mobility demand, to which transport providers have to adapt their services accordingly. For example, car ownership among young people seems much less desirable today than it still was a few years ago. Nevertheless, this does not automatically mean that the importance of public transport increases, because new forms of mobility are being sought (like car sharing, e-bikes etc.) and new, modern mobility services are appearing on the market.
- ***New planning systems and new options to plan, manage and operate public transport.*** As a result, the developments outlined above also require necessary changes in the planning of transport infrastructures and of mobility services, so that traditional planning approaches need to be reconsidered. For instance, the new sustainable urban mobility plans (SUMP) advocated by the European Commission require a high degree of stakeholder participation, and the strengthening of cross-border transport requires an even stronger interaction of planning authorities from both sides of the borders.
- ***Need for new governance models and for (cross-border) cooperation to improve public transport.*** This eventually also calls for new governance and planning models for public transport, in particular when considering border regions, as cities and regions will find it difficult to cope with these new challenges on their own.

Against these dynamic developments, it is difficult for transport planners to keep track of changes, new and emerging markets and transport and mobility solutions, and in particular to identify where a city or region can be positioned in this phase of transition.

While the outlined processes are basically global processes, cities in the Baltic Sea region are similarly affected by their impacts. In order to strengthen car-independent

forms of mobility and improve public transport systems in the southern Baltic Sea region, nine formal and ten associated partners from six countries (Estonia, Denmark, Germany, Lithuania, Poland and Sweden) work together in the INTERCONNECT project to implement joint actions on personal development, human resource development, pilot studies and public relations, particularly targeting three dimensions of public transport: (1) demand, (2) supply and (3) management.

These three dimensions are reflected in the three INTERCONNECT core work packages:

- Work package 3: Evidence, knowledge and experiences
- Work package 4: Monitoring instruments and business models
- Work package 5: Future governance and institutionalisation

Within these three work packages, INTERCONNECT is expected to develop innovative multi-stakeholder planning approaches for sustainable public transport and to invest in new and more efficient PT services within and between the partner regions.

Since currently user-oriented and sustainable inter-regional and cross-border public transport services have a great but untapped potential to promote socio-economic growth in the South Baltic Sea region, INTERCONNECT initiated cross-sectoral stakeholder dialogues to develop optimal multi-level governance frameworks for cross-border cooperation in public transport. In this process, a wide spectrum of regional actors is involved in developing and testing new planning and management solutions that can support the strengthening of cross-border public transport.

As a result of previous work steps, and in response to the challenges outlined above, the INTERCONNECT case cities and regions of Karlskrona/Blekinge, Klaipeda, Gdansk/Gdynia/Sopot, and Rostock/Gedser (Guldborgsund) already identified the need to develop two easy-to-use tools to support public transport planning in their areas:

- ***Indicator-based self-evaluation tool.*** This tool shall assess the current public transport performance of a city or region based upon selected key transport indicators, by monitoring the indicator performance over time as well as by comparing the city with other cities and regions. The tool should also indicate the strengths and weaknesses

of the transport system of the city, thereby helping decision makers to identify fields of intervention in the public transport domain.

- **Catalogue tool:** Having identified fields of intervention, this tool should support decision makers and public transport planners in identifying potential measures, solutions, projects and actions that will tackle the problems at hand. The tool should allow the user to identify actions or solutions, to indicate their likely impacts, their advantages and disadvantages, spillover effects, essential bounding conditions and prerequisites. The tool furthermore should list good practice examples (i.e. other cities, where the action was already implemented) as well as contact information of solution providers or product designers.

The implementation of public transport services in border regions require involvement of actors from all sides of the border. Over the last decades, **cross-border public services** (CPS) have become role models for implementing public services in border regions - with transport appearing as one of the prominent policy fields. As the INTERCONNECT partners identified CPS as a useful instrument to implement new cross-border PT services, this report will give a brief introduction to CPS based upon the results of the ESPON CPS project.¹

After this introduction, **Chapter 2** gives a introduction to the multi-stakeholder planning model for INTERCONNECT in order to understand how the two tools can be used within the planning process. **Chapter 3** then introduces the basic rationale for the two tools, including the functional requirements of both. **Chapter 4** is the core part of this report, representing the user manuals of the tools (how-tos). **Chapter 5** finally introduces the concept of cross-border public services (CPS) as a means to implement cross-border public transport initiatives, followed by the summary in **Chapter 6**. The report then concludes with references (**Chapter 7**) and the Annex (**Chapter 8**).

¹ For more information see “ESPON CPS – Cross-border Public Services” targeted analysis project at www.espon.eu/CPS.

2 A planning model for sustainable cross-border/regional PT

2.1 Development by guidance of the Framework for Strategic Sustainable Development

As one of the primary objectives of INTERCONNECT is to make the existing public transport system more sustainable, it was agreed to develop a planning model based on the **Framework for Strategic Sustainable Development** (FSSD, Broman and Robert, 2017)². With the overall goal of a sustainable transformation of society, this framework identified a generic 5-level model:

- Level 1: Understanding the present **system/reality** in the city/regions
- Level 2: **Success:** Definition of a vision by framing sustainability principles and success criteria (including thresholds or target values)
- Level 3: **Strategic guidelines** (“developing a plan”)
- Level 4: **Actions**
- Level 5: **Tools:** methods and technical support for decision making and implementation

One of the key characteristics of this framework is that - as a strategic approach - tries to capture and utilize sustainability challenges and sustainability opportunities at the same time in form of a “Creative co-creation of strategic transitions, i.e., a procedure that supports execution of backcasting planning and redesign for sustainability” (Broman and Robert, page 7). The sustainability principles - SPs (Broman and Robert, 2017) defines a sustainable future as follows:

In a sustainable society, nature is not subject to systematically increasing ...

1. ... concentrations of substances extracted from the Earth's crust;
2. ... concentrations of substances produced by society;
3. ... degradation by physical means;

and people are not subject to structural obstacles to ...

4. ... health;
5. ... influence;
6. ... competence;
7. ... impartiality;
8. ... meaning making.

² This framework was developed as a general framework for all types of planning and projects, i.e. not specifically for the transport sector; however, it can be applied here as in other policy areas.

These principles are not only an essential part of the ABCD procedure (as mentioned above), but also fits well into the models when there is a need of assessing if ideas and solutions violates (or contributes) the SPs. In other words (and more relevant to this study), if these ideas and solutions can be a part of a strategic sustainable development of cross-border and regional PT.

FSSD is, according to

Figure 1, operationalized through the ABCD planning procedure (Broman and Robèrt, 2017), which in this study guided planning of research activities, and is a core theme in the developed process model.

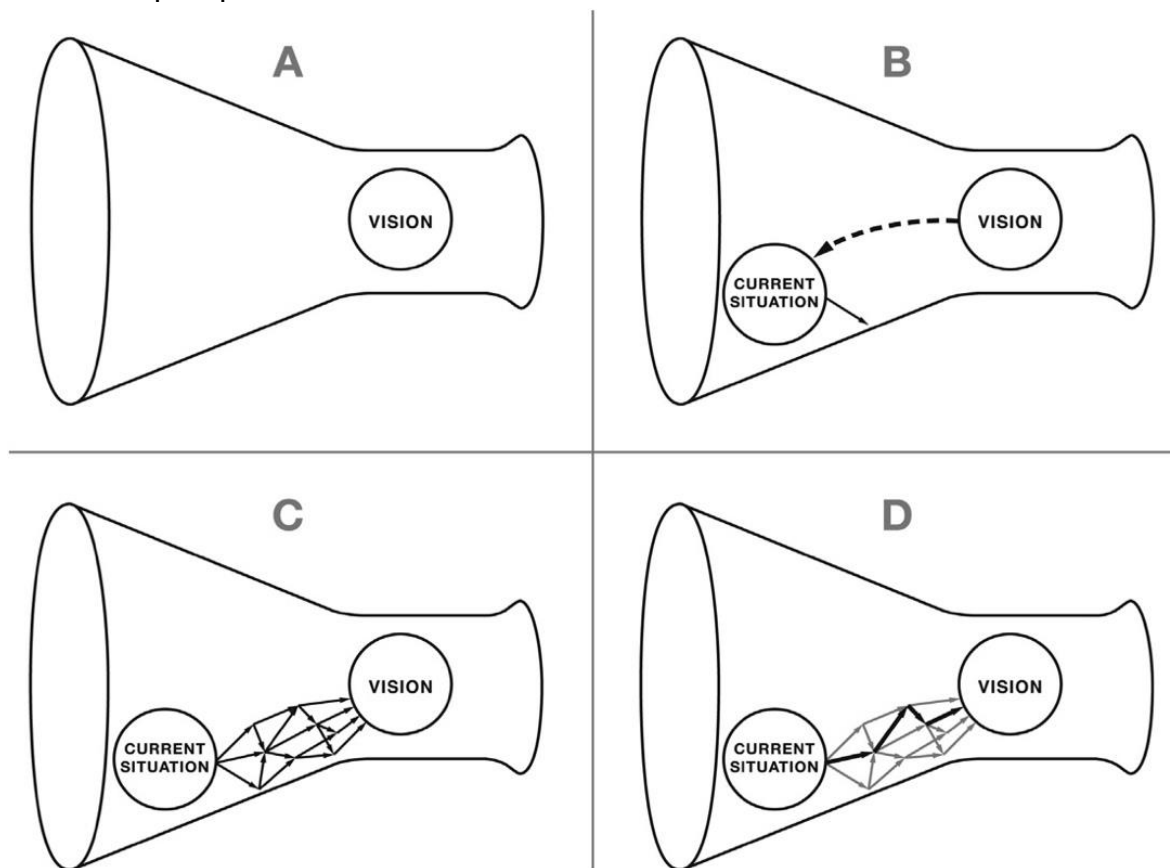


Figure 1: The funnel metaphor and the ABCD-procedure of the FSSD. Reprinted from (Broman and Robèrt, 2017), page 21, with permission from Elsevier.

As illustrated in

Figure 1, a sustainable vision, framed by SPs, is designed in 'A', the current challenges and assets in relation to the vision are analyzed in 'B', possible steps towards the vision are designed in 'C', and these are prioritized into a strategic plan in 'D' that bridge the gap to the vision. Prioritization includes questions about whether actions and goals in

the plan (1) are in the right direction towards the vision and will eventually comply with the Sustainability principles, (2) if they provide sufficient return on investment (ROI), and (3) if they are stable enough to withstand future foreseeable changes and will support rather than counteract other actions/goals in the plan.

All relevant stakeholders³ within the cities and regions should participate in this planning framework, which includes in case of cross-border public transport also participants from regions beyond the national borders.

It is important to stress that the FSSD does not replace formal public transport planning procedures set out by national planning or transportation laws; instead, the method starts much earlier, namely when the strategic goals and measures are identified, i.e. before the development and approval of formal plans. The aim is to identify only those measures that comply with sustainability principles and that contribute to a transition of the public transport system towards greater sustainability.

2.2 The multi-stakeholder planning model for cross-border/regional public transport

2.2.1 The initial planning model for sustainable transport planning

In 2017, Robèrt et al. presented an iterative multi-stakeholder planning process model (Figure 2) that embedded the FSSD and included four interdependent planning perspectives ('Resource base', 'Spatial', 'Technical', and 'Governance'). This initial planning model proved helpful by giving diverse stakeholders with various competences and representing various planning perspectives a common, robust, and easy-to-understand goal and a way of working that was adequate for each of their contexts (Robèrt et al., 2017).

³ That's why it is called multi-stakeholder planning model.

PLANNING PROCESS

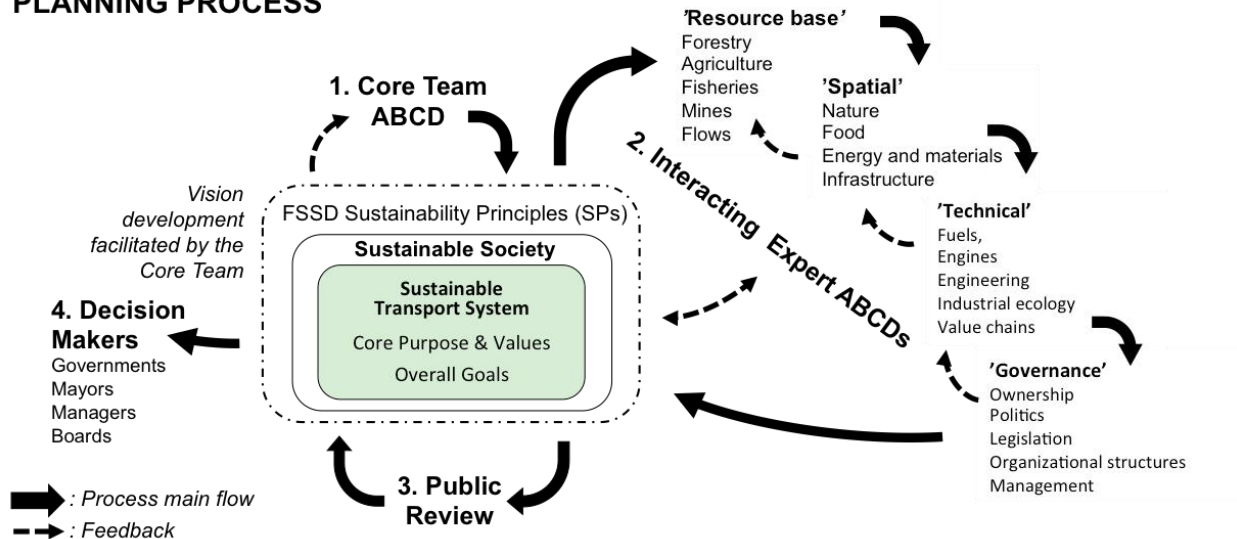


Figure 2: An illustration of the initial planning model for sustainable transport planning (Robèrt et al., 2017)

The initial planning model was applied in cross-sector collaboration among transport stakeholders to develop a sustainable vision for electric vehicles (EVs) in southeast Sweden. It resulted in a vision of sustainable transport, with a focus on EV systems, within each planning perspective, and an initial development plan towards that vision (Borén et al., 2017). After refinement, the authors of that paper also suggested that the planning process model could be applicable to strategic sustainable community planning in any societal sector. This was further refined in a study that used system dynamic to create a roadmap towards fossil free and sustainable road transport in southeast Sweden (Ny et al., 2018).

Based on the initial planning model and experiences from working with municipalities, a PhD project was started in 2016 at Blekinge Institute of Technology (BTH) with a focus on how sustainable development in Swedish eco-municipalities and in the Finnish province Åland could be enhanced. Through participatory action research (PAR) in ten Swedish municipalities and regions, this project has rendered in an evaluation of a further developed planning model for long-term implementation of FSSD across sectors for more cohesive cooperation towards sustainability (Wälitalo et al., 2020).

2.2.2 Context of empirical studies

The INTERCONNECT project has three focus areas - PT demand, supply and governance. One of the working packages of the project is titled "Evidence, knowledge and experience". The main goals of this package include identification of current and

future needs of the passengers in the partner areas; facilitation of a vision co-production for sustainable PT in the region; selection of sustainable solutions to address identified challenges; and development of pathways to achieve the vision. The main part of the evaluation and testing of the models took part in this working package of the project.

The development and testing of the initial planning model was guided by the model itself and the first step was to form a core team, which in this study was represented by researchers at BTH who participated in the INTERCONNECT project. The second step was about engaging stakeholders from different planning perspectives in order to focus on 'resource base', 'spatial', 'technical', and 'governance' while going through the steps of the ABCD-procedure, and this was done through vision seminars in the INTERCONNECT project. The third and fourth steps in the model were not used in this study. It could be argued, though, that the latter steps have been used to some extent as the authors have used feedback from stakeholders in the development of the model. Added to that, the results were further refined with previous experiences and results from several literature reviews.

2.2.3 Summary of the planning model for sustainable cross-border/regional PT

Based on experiences from vision seminars, literature reviews, and model presented for stakeholders in the survey, the following process model were further developed to incorporate feedback from stakeholders from the survey and interviews. The process model comprises four main phases 'Proposal/initiation', 'ABCD', 'Solution', and 'Implementation', which in turn includes subphases (e.g. 'Inception'), and decision gates. A core team is created early in the process to lead the proposal through the process, manage the work in the sub-phases, and in some cases decide on the continuation. The model is expected to be published to the scientific community during 2021, and within that publication described in more detail.

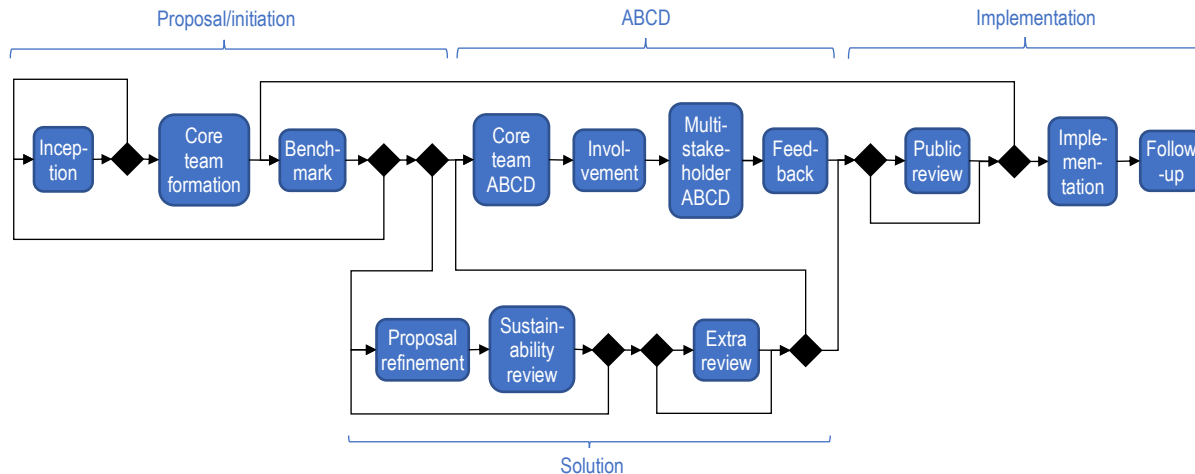


Figure 3: Overview of the process model for cross-border/regional PT planning towards sustainability.

2.3 Relation A-B-C-D planning procedure and planning tools

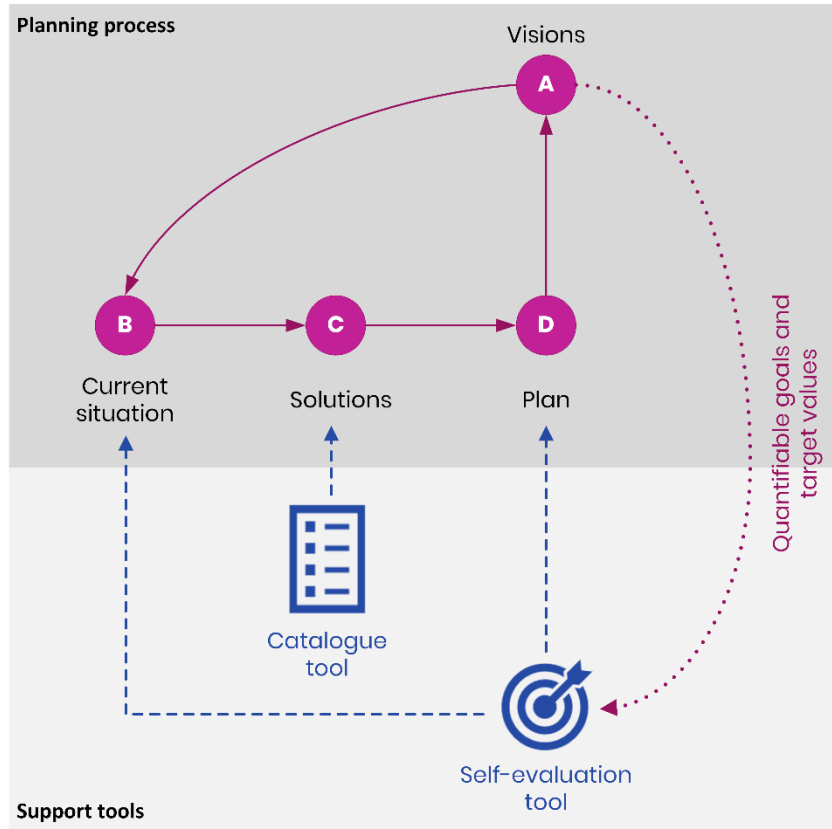
Although it is not the aim of this report to give a complete overview of the A-B-C-D planning procedure, this short introduction to the FSSD and A-B-C-D procedure is necessary to understand how the developed tools fit into this planning process.

Figure 4 outlines the relationship between the A-B-C-D planning procedure and the two tools. Given the complexity and dynamic development of the transport sector, the **Catalogue Tool** supports the stakeholders in **Step C** when identifying possible solutions and interventions. Depending on the current situation of the PT sector in a city or region, not all solutions are feasible or meaningful, also, some good practices⁴ may have already been implemented. The Catalogue Tool provides a comprehensive overview of interventions.

The **self-evaluation tool**, however, can be used in several steps. First of all, in **Step B** it supports the stakeholders in analysing the current situation and in identifying potential intervention fields. By comparing key indicators over time or with other cities, stakeholders can identify weaknesses in their PT sector and based on that can start thinking about appropriate solutions. In **Step D**, this tool can support stakeholders in prioritizing and selecting solutions; and finally, in **Step A** the tool can help to identify quantifiable goals, thresholds and target values as it shows the performance of other cities or regions.

⁴ We prefer to use the term “good practices” instead of “best practices”, because solutions that work “best” in one city may not work at all or only to a lesser degree in another city, since the local conditions differ.

Figure 4. Relationship A-B-C-D planning procedure and support tools.



3 Overview of tools

This chapter outlines the functionalities and structures of the two tools, as well as their internal coherence and rationale. Also, explanations will be given why certain aspects have been dealt with in a specific manner. Chapter 4, afterwards, will then provide detailed user manuals as how to use the two tools.

3.1 Indicator-based self-evaluation tool

The indicator-based self-evaluation (or monitoring) tool should support public transport planners evaluating the performance of the local and regional public transport system. The tool should comprise all INTERCONNECT case study cities/regions, and, in order to allow for comparisons with other cities, a number of selected other cities in the Baltic Sea region.

It was decided to develop a desktop-based Excel tool that can easily be used by all public transport planners in the region.

The main functionalities of the tool are:

- **Comparison:** Compare the performance of the public transport system on the basis of selected key performance indicators over time and across cities and regions. Comparisons should be done in tabular form as well as in form of diagrams. The user shall be able to select the indicator he is interested in, as well as the cities or regions to compare with.
- **Intervention fields:** The tool should also enable aggregating indicator performance to intervention fields. Selected intervention fields include sustainability, social inclusion, traffic and safety, efficiency and others. For each field of intervention, the tool will comprise a limited number of key performance indicators, altogether about 20 to 25 indicators. It is important that each indicator is clearly defined and described in order to avoid misunderstandings among users. Therefore, the tool should also contain a help page with appropriate definitions.
- **Upload mask:** Provide an upload mask allowing the user to enter new or update existing data relevant for his city in a convenient and easy way, with options to add new cities or regions for comparisons. The idea being that each user will enter the relevant data/indicators for his city. Data for selected comparison cities, will however be compiled centrally and come with the tool.

- **Print and Export:** Print and export tables and diagrams, so that comparison results can be copied into and used in other documents and software environments.

3.1.1 Intervention fields and indicators

One of the crucial elements of the tool is the selection of appropriate intervention fields and their associated indicators (Figure 5). As the tool should support planners in making public transport more sustainable, three of the four intervention fields correspond to the corners of the **sustainability triangle**, which are **sustainability** (i.e. environmental protection), **social inclusion**, and (economic) **efficiency**. In addition, a fourth field called **traffic and safety** was added, representing specific mobility aspects.

Figure 5. Intervention fields and indicators.

Sustainability	Social inclusion	Traffic & Safety	Efficiency
<ul style="list-style-type: none"> • Share of E-buses • Share of low emission vehicles • Average CO2 emission per vehicle or per inhabitant • Share of PT on overall trips • Average fuel consumption per bus • Average age of bus fleet • ... 	<ul style="list-style-type: none"> • Share of low floor buses • Number of bus stops per inhabitant or per square km • Share of special fares / tickets for minority groups • Average price for single trip • Average distance to next bus stop • Share of population living within 250 m of PT services • ... 	<ul style="list-style-type: none"> • Number of accidents per vehicle-km • Number of fatalities per inhabitants • Average trip length by car • Average journey time to work (minutes) • Length of mass transit (km) per inhabitant • ... 	<ul style="list-style-type: none"> • Ratio vehicles / employees • Ratio passengers/vehicle-km • Average occupancy rate • Cost-fare revenue ratio • ...

For each intervention field, a couple of key performance indicators has been identified. They have already been used in related tools or in related PT studies by UNECE⁵, EMTA⁶, Transport Association of Canada⁷, The Energy and Resource Institute⁸, EUROSTAT City Indicators⁹, JRC¹⁰, Dingli et al. (2018), Gudmundsson (2016), WBCSD (2015), CIVITAS (2016), Skinner (2019), Sdoukopoulos et al. (2014), the SUMI project¹¹ by DG MOVE, and others, demonstrating their capabilities to measure the performance

⁵ UNECE for urban transport, see <http://www.unece.org/trans/welcome.html>

⁶ EMTA (2019), see <https://www.emta.com/spip.php?article267&lang=en>. This barometer could also be used to compile data for European comparison cities.

⁷ Hollingworth et al. (2010), see <http://www.tac-atc.ca/sites/tac-atc.ca/files/site/doc/resources/report-uti-survey4.pdf> for more information

⁸ Kumar (2014), see <https://www.teriin.org/projects/nfa/2008-2013/pdf/working-paper-12-Sustainable-urban-transport-indicators.pdf> for further information

⁹ See <https://ec.europa.eu/eurostat/cache/RCI/#?vis=city.statistics&lang=en>

¹⁰ Jacobs-Crisioni et al. (2015), see <https://publications.jrc.ec.europa.eu/repository/bitstream/JRC99984/lb-na-27708-en-n%20.pdf>

¹¹ SUMI = Sustainable Urban Mobility Indicators

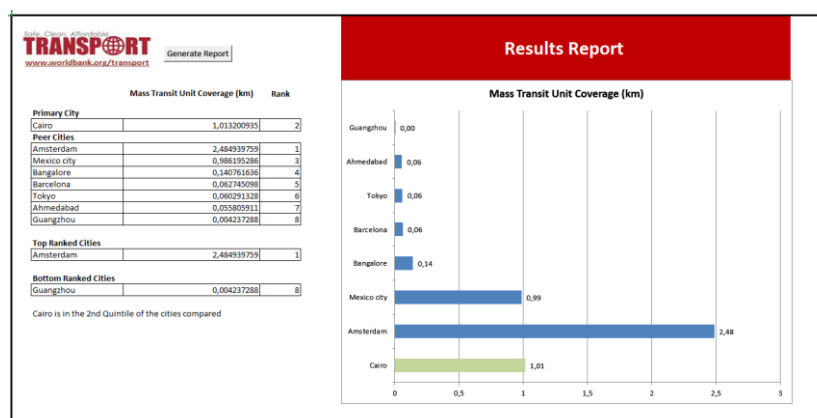
of PT systems of cities and regions. The related approaches also show that basically all necessary raw data are available at local and regional levels to calculate these indicators. Table 5 in the annex gives an overview of which indicators were used in which studies.

3.1.2 Similar tools – raw models

This tool is not the first in its kind, as similar tools were already developed by other stakeholders and in other contexts with slightly different objectives¹². Examples of similar tools are the following:

Urban Transport Data Analysis Tool (UT-DAT by World Bank¹³): Excel tool comparing the public transport performance of global cities with each other. The tool consists of four tabs: The *matrix tab* represents the database, storing raw data as well as indicators in just one table. The *update form* is used to enter new data or update existing data. Two further tabs - *Report1 Graphs* (Figure 6) and *Report2 Scatter plots* - present the comparison results. From the latter two tabs, also reports can automatically be generated. However, the tool only accounts for the most recent year, and also the selection of indicators and cities for comparisons in the two report tabs is not straightforward.

Figure 6: Overview of results page of the UT-Data tool.

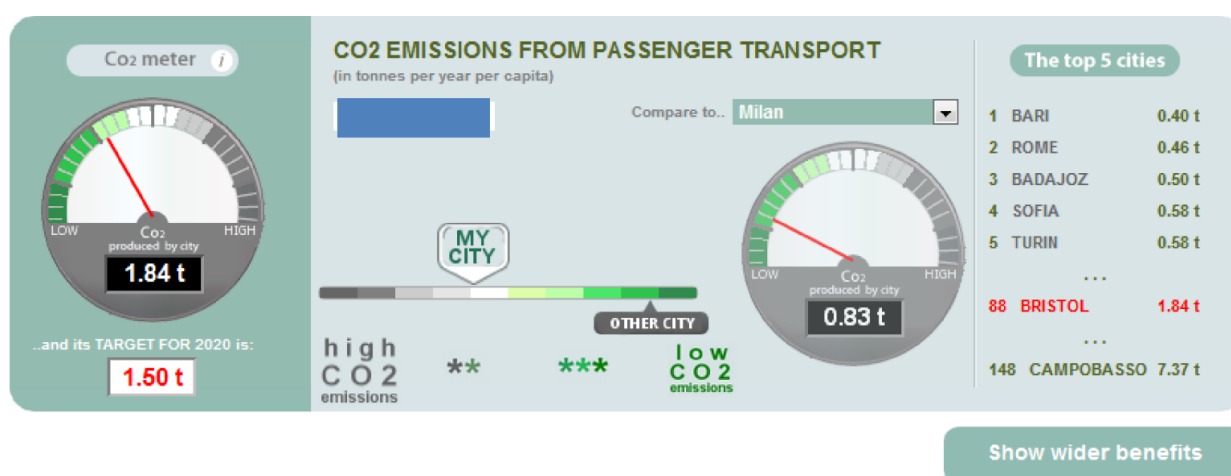


¹² As the contexts differ, against which the tools were developed, it is not possible just to use any of the existing tools for INTERCONNECT.

¹³ See <https://www.worldbank.org/en/topic/transport/publication/urban-transport-data-analysis-tool-ut-dat1>

„My City” Tool (Systematica): This tool developed in the 7th Framework Programme focusses on exploring options for a CO₂ reduction in transport and its impacts on health, safety, budgets, planning and the overall community. Users can select from a long list of cities in Europe (if the desired city is not in the list, the user can find a similar city based on main city characteristics) and can then explore performance of the city in comparisons to other cities and best/worst performers (Figure 7). Comparisons include a ranking of cities, comparisons against a target value, and the option to select one specific comparison city. Further functionalities of the tool are hyperlinks to city websites and reference documents presenting projects to reduce CO₂ reductions.

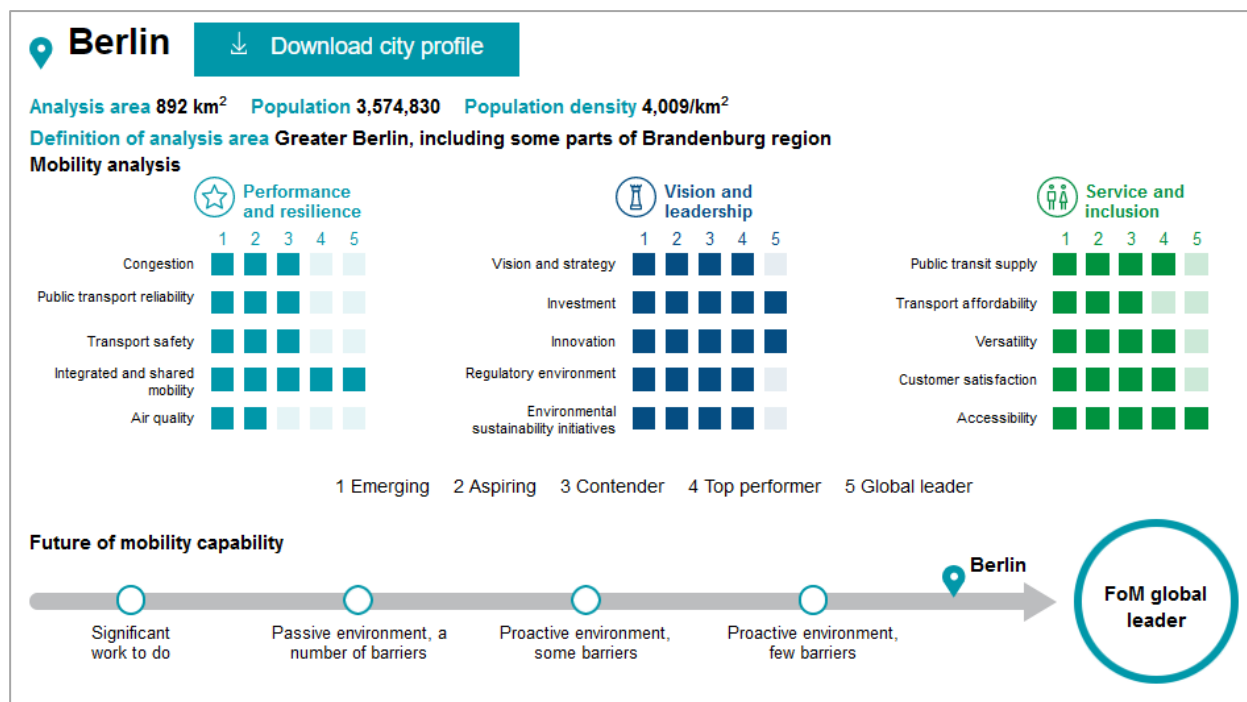
Figure 7. Screenshot of the “My City” tool: indicator performance.



The 2019 Doilette City Mobility Index¹⁴: This index is presented in form of an interactive webmap application where users can select a city from a global set of cities, to identify its profile with respect to three main themes: (i) performance and resilience, (ii) vision and leadership and (iii) service and inclusion. Each of these themes includes five selected key indicators. However, the indicators are not presented in the application with the figures, but with a standardized performance rating from 1 (worse) to 5 (best) (Figure 8). There is no options for users to inspect the raw data or to update or change any data.

¹⁴ See <https://www2.deloitte.com/us/en/insights/focus/future-of-mobility/deloitte-urban-mobility-index-for-cities.html>

Figure 8. Screenshot of Deloitte City Mobility Index for Berlin.



Other related tools such as the NISTO/MAMCA¹⁵, NOVELOG Evaluation Tool¹⁶ or MOMOS¹⁷ focus on project evaluation by multi-criteria-analyses (the two former tools) or simulation approaches (the latter one), however, in doing so they also require to collect key performance indicators. The NOVELOG Evaluation Tool furthermore focuses on logistic solutions rather than public transport.

EcoMobility Shift Plus¹⁸: The EcoMobility SHIFT+ scheme is a methodology rather than a tool to (self)-assess cities' mobility performance, analyze performance, act to improve and establish a path of continuous improvement. The proposed process consists of three steps, which are (1) Self-assessment, (2) Analysis and (3) Acting. The first two steps rely on a set of 23 transport indicators, grouped into three categories: (i) Enablers, (ii) Transport systems and services and (iii) Performance (Figure 9). The overall process is kept comparatively simple and does not require complicated and expensive tools, so that cities in third world countries or developing countries can benefit from the approach as well without the need to spent large resources

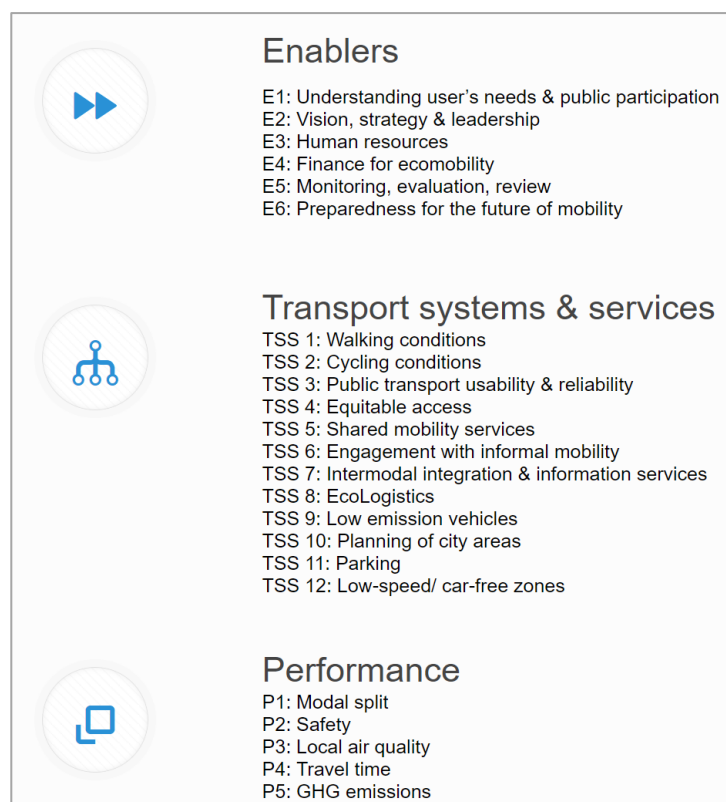
¹⁵ See <http://www.mamca.be/en/the-mamca-software/>

¹⁶ See <http://evalog.civ.uth.gr/>

¹⁷ See <http://www.trt.it/en/tools/momos/>

¹⁸ EcoMobility represents an ICLEI – Local Governments for Sustainability Initiative. See <https://ecomobility.org/ecomobility-shift-plus/> for more information

Figure 9. Proposed EcoMobility SHIFT+ indicators.



3.1.3 Cities and regions for comparisons

The advantages of the INTERCONNECT self-evaluation tool only become apparent through comparisons with other cities and regions. About 10 cities and regions from the Baltic Sea region have already been implemented in the tool by default, but the user should be able to add further cities and regions or replace cities by others, as deemed necessary. It is important to distinguish between cities and regions, as the performance of the PT systems in the core city are usually different from those of the respective agglomerations. The set of cities shall be selected from the entire Baltic Sea region, not only from its southern part, to enable comparisons with the entire Baltic Sea region.

3.1.4 Data sources and data collection

Sometimes it might not be straightforward to find useful data sources to collect data for the performance indicators for the comparison cities and regions. Following are some hints for the users:

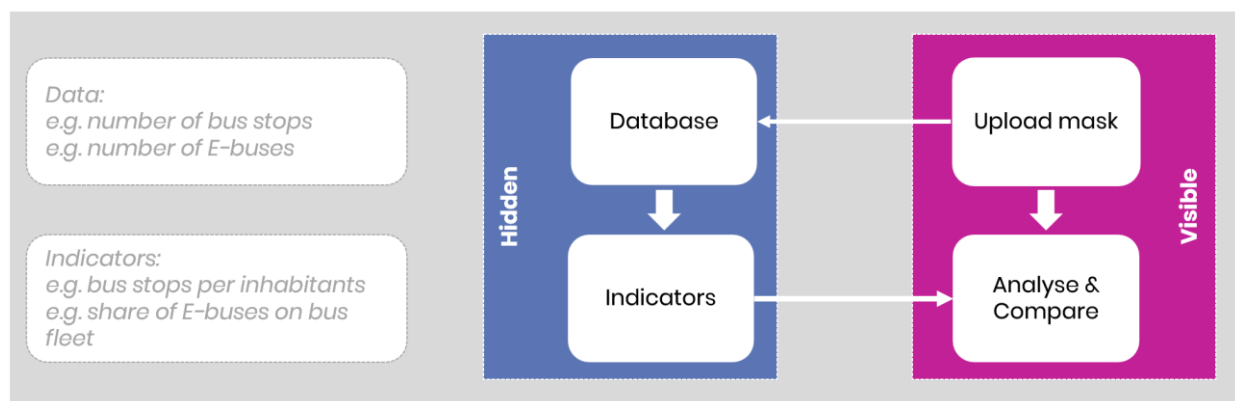
Potential data sources that should be reviewed are first of all websites of the cities and regions itself. Many cities and region administrations or their respective public transport authorities already publish a lot of indicators, which should be visited first when compiling data. Other useful data sources include the PT operators in a city or region, national statistical offices, Eurostat with its Urban Audit, OECD, UNECE, EMTA barometer, and transnational and national public transport associations such as the UITP.

The tool allows the user to enter raw data for several years, as available, and not just for the latest year. That way the tool will be able to analyse the indicator development over a certain period of time.

3.1.5 Structure and components of the tool

The tool consists of four parts, two of which that are visible to the user while the other two are hidden (Figure 10). The two visible parts are the **upload mask**, enabling the user to update data or add new data into the tool, and the **analyse & compare part**, allowing the user to analyse the performance indicators and compare cities and regions. Having updated any dataset, the tool saves the new data into a hidden **database**. The database will store raw data. Based upon the raw data, the tool will automatically calculate the performance **indicators** and store them in a separate table.

Figure 10. Structure of the self-evaluation tool.





Raw data and indicators

Raw data are data that can be provided by or compiled from PT operators or authorities, such as the number of bus stops in a city, or the number of E-buses. Usually, these are stock data. Indicators, in contrast, relate the stock data to other stock data, thereby transforming raw data into something meaningful. Examples are bus stops per inhabitant or the share of E-buses on the entire bus fleet. In the upload mask, the user enters raw data instead of indicators. Some important raw data such as city population or city area are needed to calculate several indicators, while other raw data (for instance, number of E-buses) may only be used to generate just one performance indicators. In the context of this

As good IT practice, the user should not get access to the database and indicators tables, because there is risk that users may inadvertently corrupt the database structure when adding, moving or deleting columns or rows, thereby destroying or limiting the functionality of the entire tool.

3.1.6 Further tool requirements

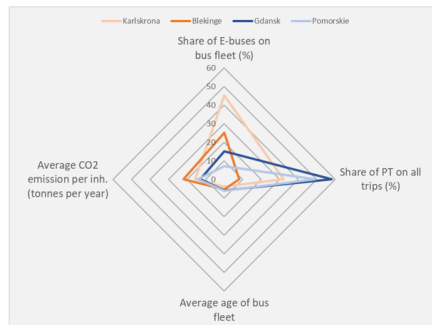
Discussions with the stakeholders revealed that the tool should satisfy the following further requirements:

- a) **Flexibility for future/future enhancements:** The tool shall be developed in a way that it is possible to add further indicators and cities in the future in an easy manner.
- b) **Target and reference values:** It should be possible to enter target or reference values for selected indicators (such as target values defined by the European Commission or by national ministries, or targets set by city administrations as a result of the A-B-C-D planning process) and to compare the actual performance of a city against these target / reference values.
- c) **Indicator selection:** The selection of indicators should be possible in an intuitive and easy way.
- d) **Visualisations in analysis:** The analytical part should present the comparisons in different types of graphs and visualisations, such as line and spider charts, ranking graphs, and others (see Figure 11 for sample illustrations). For example, line charts compare indicator performance over time and between cities or regions. Spider diagrams compare different indicators within one field of intervention, while ranking graphs compare performance of cities from min/worst cases towards max/best cases,

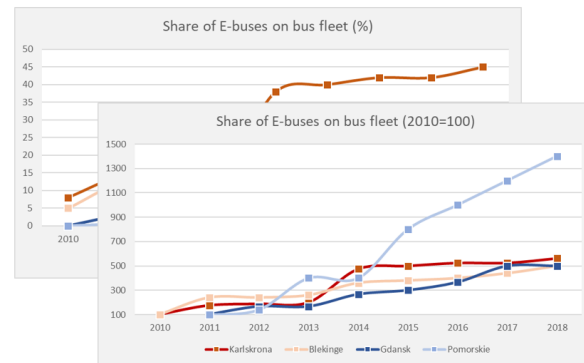
and compare them with target values. It is worth mentioning that the analytical part will analyse and compare the indicators, not the raw data.

Figure 11. Different ways of visualisations for the comparisons.

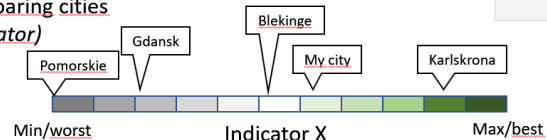
Spider diagrams: comparing indicators
(one diagram per field of intervention)



Line chart: comparing indicator performance over time
(one chart per indicator)



Ranking graph: comparing cities
(one graph per indicator)



- e) **Definitions and instructions:** In order to avoid misunderstanding and misbehaviour of the tool, clear indicator definitions and instructions for data entry need to be provided to the users. This concerns the data input, but also the geographical reference (i.e. whether the data represent the core city, a metropolitan area or an entire region). Appropriate definitions and explanations should thus be given in the upload mask and also in the user manual, along with a description how to add new indicators and comparison cities.

3.2 The Catalogue Tool

In order to close the information gap that PT planners or PT operators face in the light of the dynamic market development, a catalogue tool ("Catalogue of interventions") has been developed supporting actors in the field of public transport to obtain actual overviews about measures, solutions and interventions in the public transport domain to improve PT services in cities and regions.

The INTERCONNECT Catalogue Tool was inspired by a similar tool called **Konsult Online Option Generator**¹⁹ which, in difference to the INTERCONNECT approach, goes beyond public transport and deals more generally with sustainable urban land use and transport measures. In any case, the basic ideas of both tools, as described further below, overlap pretty much.

3.2.1 Scope and functionalities of the catalogue tool

Through consultations with the INTERCONNECT stakeholders and project team, the following scope and functionalities of the tool have been identified:

First of all, the tool shall cover a **broad spectrum** of potential measures, interventions, actions and projects²⁰. It shall be easy-to-use and shall be structured in a **hierarchical manner** reflecting well the character of the interventions, by identifying fields of interventions, subfields and actual actions.

The catalogue should include the results of the assessment on necessary changes to improve public transport and the best practice solutions identified in the INTERCONNECT partner regions (see Jagiello et al., 2018).

At minimum, the tool shall provide the following functionalities:

- Identify and select fields of **intervention, sub-fields** and actual **actions**.
- Identify potential measures, projects, solutions and activities in the public transport sector. Selected individual interventions shall be presented in detail in form of standardized **fact sheets**, providing short descriptions of the said measure, its likely effects and impacts, advantages and disadvantages, spillover effects, essential bounding conditions and prerequisites, as well as contact information of good practice examples, solution providers or product manufacturers. As selection criterion for those

¹⁹ See <http://www.konsult.leeds.ac.uk/> for more information

²⁰ It is suggested to cover a broad definition and wide spectrum of interventions. Interventions here mean technical solutions, products or goods, workflow optimizations, staffing, governance, business models and many more. Also, indirect measures that push users from motorized transport to public transport and accompanying measures strengthening non-motorized transport (NMT) shall also be included, so as new types of mobility services (MaaS). The reason for this broad approach is, that, as outlined at the beginning, new services tend to overcome the traditional divide between private (car) and public transport.

interventions presented with fact sheets, its relevance for sustainable public transport in the cross-border context have been used.

- **Print and export** function to print out (export) the fact sheets
- Appropriate **search and filter** functions allow the user to get a different access to the information and to retrieve the sought-for information in a fast and efficient manner.

This flexible access is important since

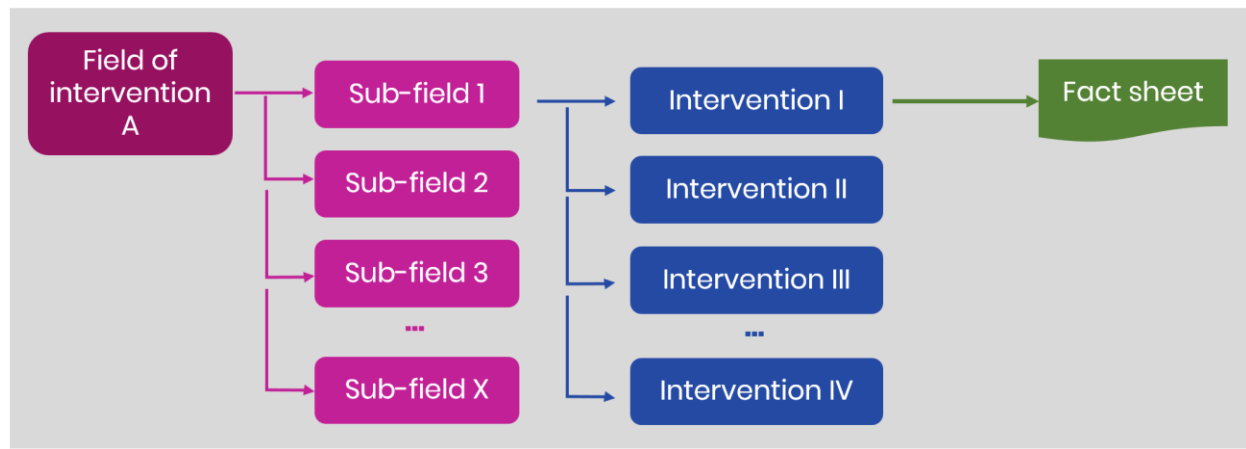
- due to its cross-cutting nature, some interventions might be assigned to two or more intervention fields; however, in the hierarchy each intervention can only be assigned to just one area of intervention;
 - different users and stakeholders might have different ‘mind maps’ as where to find certain interventions in a hierarchical tree. If their personal perceptions differ from the logic of the tool, they might not be able to find the intervention they are looking for;
 - scrolling through a long and comprehensive hierarchy of interventions might be tedious, so that a ‘search & filter’ function will speed up the process of finding the interventions of interest.
- **Links** to further reading, i.e. to good practices or to relevant service providers or goods manufacturers.
 - Ensure that the catalogue can be **updated and extended** at any time in order to keep it up-to-date. For the success and maintenance of the tool it is essential that it will be developed in a way that it is possible to add further fields of interventions, sub-fields and/or interventions in the future, and to add further and to update the existing fact sheets as needed.

3.2.2 Hierarchical structure of the entire catalogue of interventions

Notwithstanding that individual interventions might be assigned to one or more fields; all interventions should be filed in a hierarchical structure so that the user can easily find and access them. At least a **3-level structure** is proposed for this purpose. A schematic overview is given in Figure 12.

The top-level intervention fields should cover the entire spectrum of interventions possible to improve the public transport sector in cities and regions. The name of the intervention fields are as follows (in alphabetical order):

Figure 12. Schematic overview of the hierarchical structure of the catalogue tool.



- Business model
- Comfort
- E-mobility
- Hydrogen mobility
- Information and Communication
- Intermodality
- Maintenance
- Marketing / promotion
- Monitoring
- Organisation
- PT Planning
- Rolling stock and propulsion / powertrain
- Ticketing
- Timetables

That way the user can move down from the desired field of intervention to the associated subfields to the intervention of interest. While this workflow works nicely in situations where the user already knows what he is looking for, it generates unnecessary and lengthy search processes in cases where the user does not exactly know what to find. Therefore, the catalogue tool shall also provide filter, search and find functionalities. Figure 13 illustrates the fields of intervention with their first-level subfields. The figure also demonstrates that the fields of intervention could be further aggregated to the following four themes: **Communication**, **Management**, **Planning** and **Technology**.

Overall, the identified intervention fields account for the results of the series of workshops conducted among the INTERCONNECT stakeholders as part of WP 3, although the labelling of the field of intervention partly differs from the final workshop results (see Table 1 in Borén and Ny, 2018, p.13). Table 6 in the Annex contrasts both.

3.2.3 Fact sheets

While the catalogue of interventions will provide an overview of interventions for improving public transport systems - as complete and comprehensive as possible - detailed fact sheets will, at the stage of this prototype application and due to the budget available, only be developed for a selected subset of interventions and solutions.

The applied selection criteria for selecting appropriate interventions were:

- The solution shall improve the **sustainability** of the public transport (all three dimensions considered)
- Solutions that contribute to improve **cross-border PT**
- **All fields of interventions** shall be covered
- Solutions shall address **actual challenges** and/or shall be based upon **up-to-date technologies**

Together with the project team, the following interventions from all intervention fields have been selected to be presented in form of detailed fact sheets:

Each of these interventions will be presented in a standardized manner on one A4 page, which means that all relevant information should be provided in a concise and appealing way to the reader. Wherever possible, key words and short descriptions with focus on bullet points shall be used. The fact sheets shall also use layout and CI elements of the INTERCONNECT project. Content- and layout-wise, two different types of fact sheets will be developed: one type for presenting general solutions, and another type for presenting products.



Solutions presented by fact sheets

- Power ICE buses and trolleys with biodiesel
- Bus battery electric propulsion
- Train fuel cell propulsion
- Train electric propulsion
- Renewable electricity
- Electric power in ports
- Hybridisation of ferries
- Interconnection with walking and cycling infrastructures
- Optimizing interconnections between long distance, regional and local PT
- Bike onboard
- Travel policy
- Integrated regular interval timetables
- SUMP / MaaS readiness and development
- Methods for accelerated transition to sustainable energy and transport
- Cross-border tickets
- Combined ticketing in agglomeration
- Smart cards
- Smart-phone applications
- Introduction of special fares and offers
- Traffic association
- Fleet management systems
- PT-on-demand services
- Optimization of procurement procedures
- Fast traveling
- Real-time tracking
- Train reliability
- Clean vehicles and terminals / PT nodes
- Special need assistance
- Luggage transfer service
- Safety and security
- Internet and charging stations for e-vehicles
- Improve accessibility

The following information shall be provided through the fact sheets (see Figure 14 for an example):

- Field of intervention, sub-field, action (link to the catalogue of intervention)
- Solution name
- Policy objectives that will be addressed by this solution
- General description
- Prerequisites and conditions for implementing the solution
- Possible combinations with other solutions
- Anticipated effects of the solutions
- Effects for sustainability
- Responsible actor(s) for implementing the solution
- Target group(s) addressed
- Advantages and disadvantages of the solution
- Further information, references and web links

Each fact sheet will be prepared as a separate PDF document, that can easily be downloaded and shared.

A market research and desk / document / literature review shall provide the relevant information required to fill the fact sheets for the selected interventions and to complete the catalog of interventions. Representing the two main drivers in public transport in recent years, SUMP guidelines such as the SUMP self-assessment tool and MaaS guidelines such as the MaaS readiness check list will be part of this review. From these documents, relevant interventions and solutions will be extracted, and also references between the catalogue tool and these documents will be established²¹.

²¹ Based upon the following rationale: If transport planners intend to develop or update a SUMP, or if they plan the introduction of certain MaaS, they will need to follow these guidelines. A reference to the catalogue tool then allows the planners to directly identify those interventions that support the development of the SUMP or the MaaS.

Figure 13. Fields of intervention with first sublevel fields.

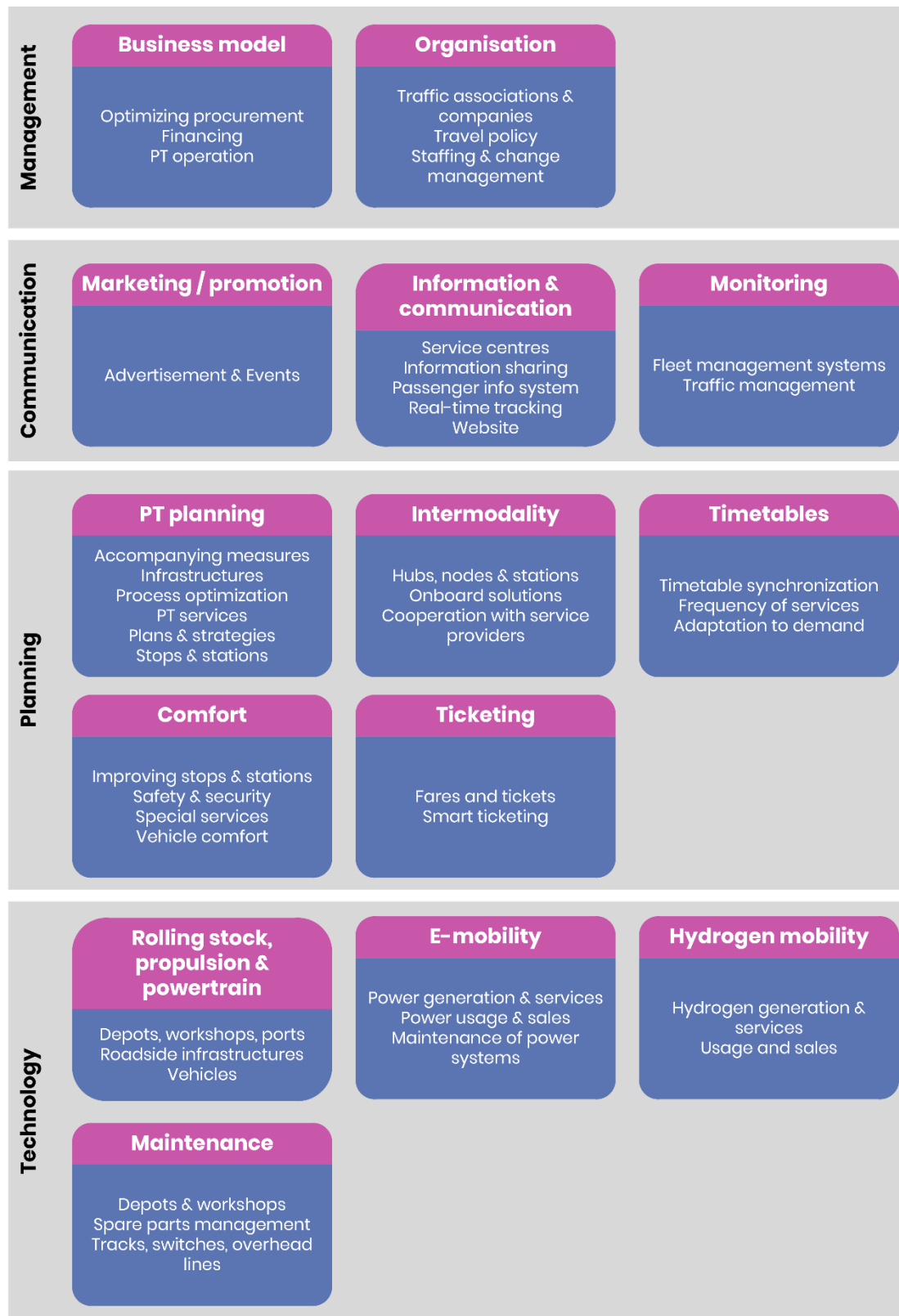


Figure 14. Structure of the fact sheets.

Sub-field: Ticketing	
Product/intervention/action: Smart cards	Policy objective(s): e-Governance, ICT, intermodality, service improvement, innovation, cost reduction
Description: <ul style="list-style-type: none"> • Core function: public transport ticketing • “Smart” refers to enhancement of the core function with applying new technologies and integrating new services for the user • “Smart” can imply including services other than transport and transport payment itself • “Smart ticketing” may change the traditional relation between the user, the tickets and the operator • “Smart ticketing” services may enhance the security of ticketing processes and reduce fraud and operating costs • Potential to simplify the use of PT or to encouraged intermodal/multimodal travels • Smart ticketing systems can generate a variety data useful for planning and operating PT • Smart Ticketing can mean a single ticket for the whole journey. • More often Smart ticketing refers to a single wallet that can contain multiple tickets. 	
Prerequisites/conditions: <ul style="list-style-type: none"> - Ticketing infrastructures in all vehicles - Backend server system to manage and authorize smart cards - Points of sale for smart cards 	Often combined with ... <ul style="list-style-type: none"> - MaaS
Anticipated effects: <ul style="list-style-type: none"> - Simplification of payment and booking procedures - Increasing attractiveness of PT - Increasing ridership of PT 	
Responsible actor(s): <ul style="list-style-type: none"> - PT operator and PT service provider 	Target group(s): <ul style="list-style-type: none"> - PT users
Advantages	Disadvantages
<ul style="list-style-type: none"> ✓ Possibility of distance-based ticketing/pricing ✓ Ease of use ✓ Compatibility with smart phones ✓ Integration with other non-transport services ✓ Replacement of cash 	<ul style="list-style-type: none"> ✗ Check-in/out often required and can be forgotten ✗ Data security can be a concern ✗ Investments in ticketing infrastructure ✗ Lack of acceptance in certain user groups (elderly, kids, tourists and foreigners) ✗ In order to prevent system failures, replacement solutions must be provided
Further information / references / weblinks: Urban ITS Expert Group (2013): Guidelines for ITS Deployment in Urban Areas – Smart Ticketing [https://ec.europa.eu/transport/sites/transport/files/themes/its/road/action_plan/doc/2013-urban-its-expert_group-guidelines-on-smart-ticketing.pdf; 2019-17]. Blythe, P. (2004): Improving public transport ticketing through smart cards [http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.112.7895&rep=rep1&type=pdf]. ...	

Differences between fact sheets and catalogue of interventions

It should however be emphasised that some of the interventions described in the fact sheets represent **higher-level initiatives** / **higher-level objectives** consisting of two or more actual solutions. For example, the intervention **train reliability** is aiming at increasing the reliability of train services by various measures. Appropriate measures could include construction measures such as adding a second railway track or adding new platforms in stations (to increase capacities), but may also include optimizations of the timetables or better maintenance procedures of the train fleet (sometimes train services fail because trains are defective due to poor maintenance). In the catalogue of interventions, these measures are first of all considered as separate measures, since they could also be applied to fulfil other policy objectives.

Similarly, if a fact sheet features certain products (such as passenger information systems or e-bus manufacturers), usually two or more manufacturer of a certain product may be identified in one or several fact sheet, whereas they may be subsumed in one intervention in the catalogue of interventions.

3.2.4 Small catalogue tool and extensive catalogue of interventions

The INTERCONNECT project team has decided to split the catalogue tool into two separate tools:

First, a small and smart web-based catalogue tool focussing of those interventions for which fact sheets are developed. This **small catalogue** will be implemented as a web service under the overall INTERCONNECT website where the intervention fields and the interventions themselves are presented which an option to download the respective fact sheets.

For the extensive **catalogue of interventions**, consisting of more than 170 interventions, it has been decided to develop an Excel tool for this prototype version that can easily be shared and distributed among INTERCONNECT stakeholders and other interested parties. However, this Excel tool will be developed with a view that at later stages it could be converted to an interactive web tool similar to the small catalogue, or into an advanced stand-alone software product. This extensive catalogue will also be embedded into the INTERCONNECT website next to the small catalogue, so that both are easily accessible from one single web resource.

4 User Manuals

In this chapter, the usage of both the self-evaluation tool (4.1) and the catalogue tool (4.2) is explained in form of user manuals. Both manuals will be as short and concise as possible, and as comprehensive and detailed as needed, including a series of illustrative screenshots with accompanying texts. The user manuals are organized as “walk-throughs”, i.e. as typical workflows from start to the end. Finally, the integration into and accessibility of both tools at the INTERCONNECT website is briefly described (4.3).

4.1 The Self-evaluation Tool

One indicator alone does not provide a complete picture of the situation in the public transport sector. In order to be able to assess an indicator value, comparisons are needed: Comparison with other cities, comparison over time or comparison with target values. Sometimes it is also helpful to compare one indicator with another one to understand certain processes or anomalies. All this is the objective of the self-evaluation tool.

The self-evaluation tool is an Excel-based tool that can be started just by opening the Excel file called MULTI-STAKEHOLDER PLANNING AND MONITORING TOOL FOR PUBLIC TRANSPORT SERVICES. Once opened, make sure that your macro settings allow to use macros. If a corresponding message appears, please allow the use of macros.

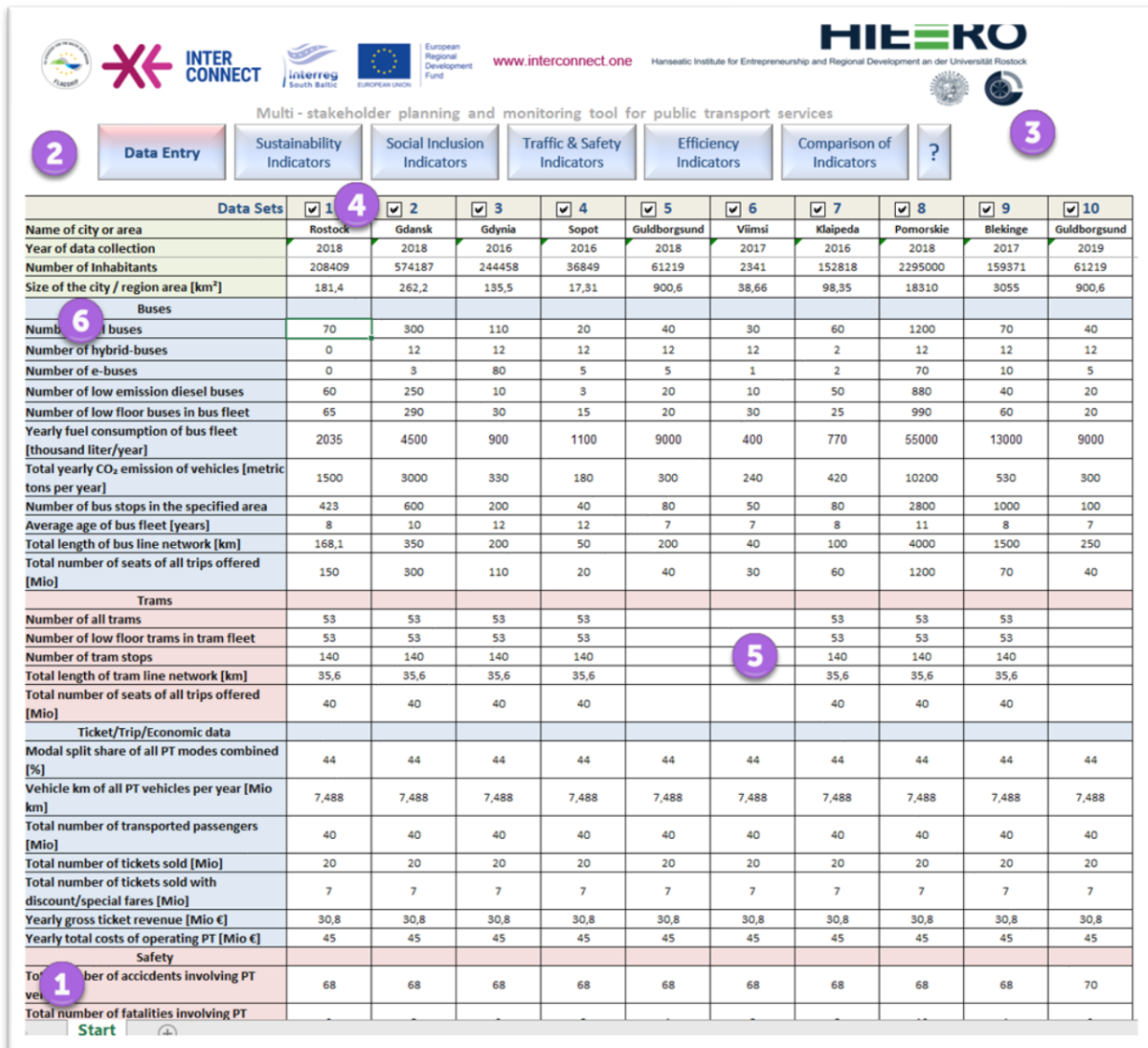
Step 1: Editing your input data (data entry)

Once you launched the tool, its start page opens (Figure 15). The name of the tab is “Start” **1** and the Data Entry button in the header section is highlighted **2**. You may return to the start page anytime by clicking on this Data Entry button. The header section with its seven control buttons is fixed across all steps **3**. The seven buttons are “Data entry”, “Sustainability indicators”, “Social inclusion indicators”, “Traffic & Safety indicators”, “Efficiency indicators”, “Comparison of indicators” and the “Help (?)” button.

At the start page, you can add, edit and organize the input data. By default, data for several cities and/or years are already provided in ten columns **4**; however, they can be edited, replaced, deleted or added by clicking in the respective table cell **5**. The

dataset names are indicated in the leftmost column **6**, organized by themes. If data for a certain indicator are not available, just leave the respective cell blank.

Figure 15. Self-assessment tool: Landing page.



Data Sets	1	2	3	4	5	6	7	8	9	10
Name of city or area	Rostock	Gdansk	Gdynia	Sopot	Guldborgsund	Viimsi	Klaipeda	Pomorskie	Blekinge	Guldborgsund
Year of data collection	2018	2018	2016	2016	2018	2017	2016	2018	2017	2019
Number of inhabitants	208409	574187	244458	36849	61219	2341	152818	2295000	159371	61219
Size of the city / region area [km²]	181,4	262,2	135,5	17,31	900,6	38,66	98,35	18310	3055	900,6
Buses										
Number of buses	70	300	110	20	40	30	60	1200	70	40
Number of hybrid-buses	0	12	12	12	12	12	2	12	12	12
Number of e-buses	0	3	80	5	5	1	2	70	10	5
Number of low emission diesel buses	60	250	10	3	20	10	50	880	40	20
Number of low floor buses in bus fleet	65	290	30	15	20	30	25	990	60	20
Yearly fuel consumption of bus fleet [thousand liter/year]	2035	4500	900	1100	9000	400	770	55000	13000	9000
Total yearly CO ₂ emission of vehicles [metric tons per year]	1500	3000	330	180	300	240	420	10200	530	300
Number of bus stops in the specified area	423	600	200	40	80	50	80	2800	1000	100
Average age of bus fleet [years]	8	10	12	12	7	7	8	11	8	7
Total length of bus line network [km]	168,1	350	200	50	200	40	100	4000	1500	250
Total number of seats of all trips offered [Mio]	150	300	110	20	40	30	60	1200	70	40
Trams										
Number of all trams	53	53	53	53			53	53	53	
Number of low floor trams in tram fleet	53	53	53	53			53	53	53	
Number of tram stops	140	140	140	140			140	140	140	
Total length of tram line network [km]	35,6	35,6	35,6	35,6			35,6	35,6	35,6	
Total number of seats of all trips offered [Mio]	40	40	40	40			40	40	40	
Ticket/Trip/Economic data										
Modal split share of all PT modes combined [%]	44	44	44	44	44	44	44	44	44	44
Vehicle km of all PT vehicles per year [Mio km]	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488
Total number of transported passengers [Mio]	40	40	40	40	40	40	40	40	40	40
Total number of tickets sold [Mio]	20	20	20	20	20	20	20	20	20	20
Total number of tickets sold with discount/special fares [Mio]	7	7	7	7	7	7	7	7	7	7
Yearly gross ticket revenue [Mio €]	30,8	30,8	30,8	30,8	30,8	30,8	30,8	30,8	30,8	30,8
Yearly total costs of operating PT [Mio €]	45	45	45	45	45	45	45	45	45	45
Safety										
Total number of accidents involving PT vehicles	68	68	68	68	68	68	68	68	68	70
Total number of fatalities involving PT vehicles										

The start page allows to edit numbers for either up to ten different cities or regions, or up to ten different years, whatever the user prefers. If he wants to compare a fewer number of cities or years, he may uncheck the checkboxes in the header row. The checkbox status will be honoured in the analytical tabs of the tool.

If the aim is to compare different cities or regions, the user should enter different city / region names in the row labelled "Name of city or area". If he wants to compare numbers

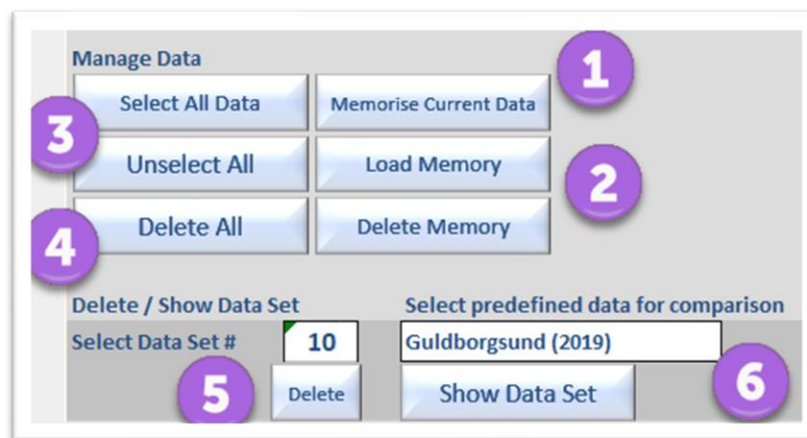
for one city (or region) for different years (i.e. time series), he can enter the same city (or region) name in all ten columns, and indicate the different years in the following row (labelled “Year”).

Don’t change the names, order and sequence of the data sets indicated in the leftmost column as this may harm the proper functioning of the tool. Also, adding new datasets is not possible as it won’t have any effects on the tool.

It is worth mentioned that the datasets that can be edited in the start page does not exactly correspond to the indicators used in the analytical tabs to follow. Rather, the start page provides options to edit the input raw data. The tool then converts the raw data into the required indicators.

The data editing toolbar in the upper right side of the tab (Figure 16) supports the user in managing his data.

Figure 16. Data editing toolbar.



When all edits are finished, the ‘Save current data’ button **1** saves all data. The ‘load memory’ button **2** loads default data again that initially come with the tool, where the delete memory button is used to delete the default data. The ‘unselect all’ button **3** can be used to remove all checkboxes from all columns in the header row, i.e. removing all cities or regions from the analyses. Conversely, the ‘Select all data’ button checks again all check boxes of all columns, so that all cities/regions will be used in the analyses. If the user wants to delete all data from all ten columns, he can press the ‘Delete all’ button **4**. As a result, all columns and cells are empty, so that the user can start

entering new data from scratch. If in contrast he wants only to delete individual columns, he can enter the column number (between 1 and 10, where 1 indicates column 1 and 10 indicates column 10) and press 'Delete' ⁵. If the user wants to load pre-defined default data for a particular city, that name can be selected from the dropdown list ⁶.

This method can also be used to quickly change the order of appearance of the cities: By default, data for Gdansk will be presented in column 2 while data for Guldborgsund in column 10. If the user wants to change these two columns, he first will delete data set # 2 (entering 2 in ⁵), and then select 'Guldborgsund (2019)' from the dropdown list in ⁶ and press 'Show data set'. Next, he deletes data set # 10 by entering 10 in ⁵ and click 'delete', and then select 'Gdansk (2019)' from the dropdown list and press 'show data set'.

Quickly enter time series for one city or region:

If you want to quickly enter a time series over ten years for one city (say, for the city of Klaipeda), this task can be accomplished in XX steps:

1. Delete all present data sets by clicking 'Delete all'
2. Select data set # 1
3. Select Klaipeda (2016) from dropdown list and click 'show data set'. The default data set for Klaipeda will be added in column 1.
4. Select data set # 2 and again click on 'show data set'. The same default dataset for Klaipeda will be added to column 2. Repeat this step for columns 3 to 10.
5. Now default data for Klaipeda are added to all 10 columns.
6. Change manually the years in row 'year' to match the time series

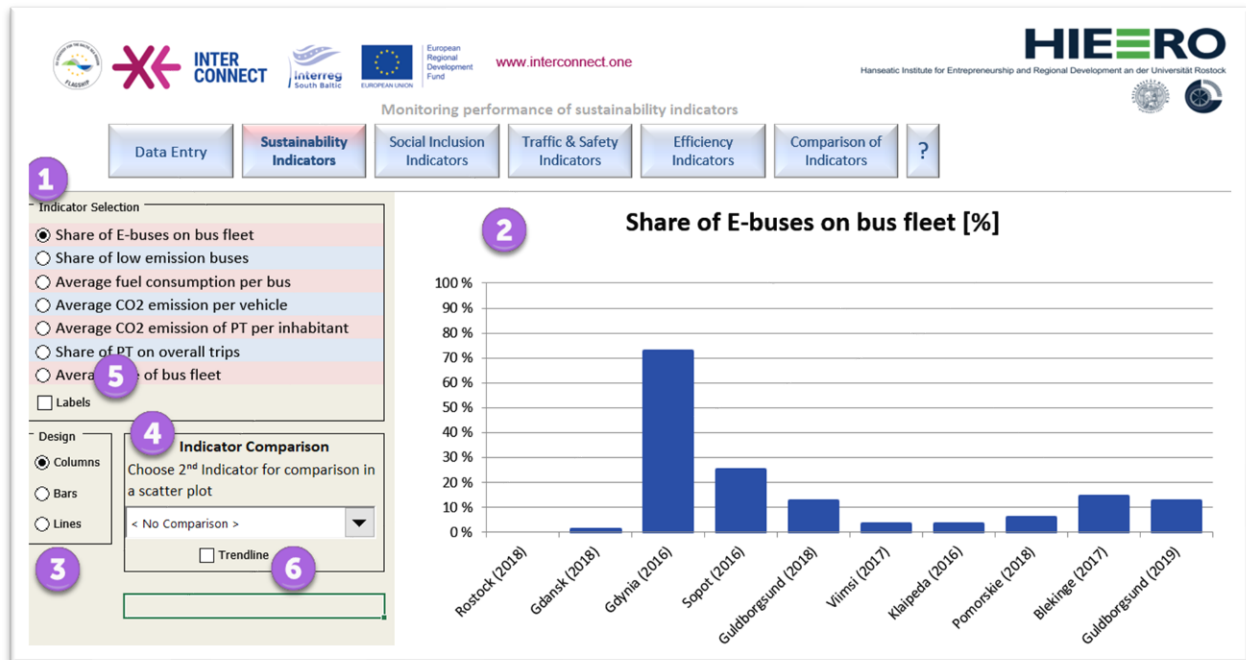
When you are done with the data editing, you may want to analyse the indicator performance for different thematic fields.

Step 2: Analysing sustainability indicators

Sustainability indicators for public transport will be analysed by clicking the 'Sustainability indicators' button in the header section of the tool. Once clicked, the sustainability indicators tab opens (Figure 17).

The section is divided into two parts: the settings part on the left (1 3 4 5 6), and the diagram part on the right-hand side 2 .

Figure 17. The sustainability indicators section.



First the user needs to select the sustainability indicator he is interested in 1 from the option list. He can choose from seven indicators. By default, the first indicator, share of E-buses on bus fleet, is already selected. Once he switches the indicator, the diagram to the right 2 will be updated immediately.

The user has two possibilities to change the appearance of the diagram: he can add labels to the data points by checking the check box 5 , and he can change the diagram design from columns (default) to bars or lines 3 .

Figure 18 illustrates the same indicator with bar charts and the label option checked

Line charts:

The line chart option is only useful if the users wants to compare indicator performance over time, i.e. before switching to line chart he should make sure that he entered time series data in the Data Entry section. Line charts should not be used if different cities are to be compared.

The number and sequence of cities illustrated in the diagram takes account of the settings in the Data Entry tab - i.e. only those cities will be displayed in the diagram whose check boxes are checked in the Data Entry tab, and the sequence in the diagram corresponds to the sequence of columns in the Data Entry tab (Figure 19).

Figure 18. Sustainability indicator section: bar chart with labels option checked.

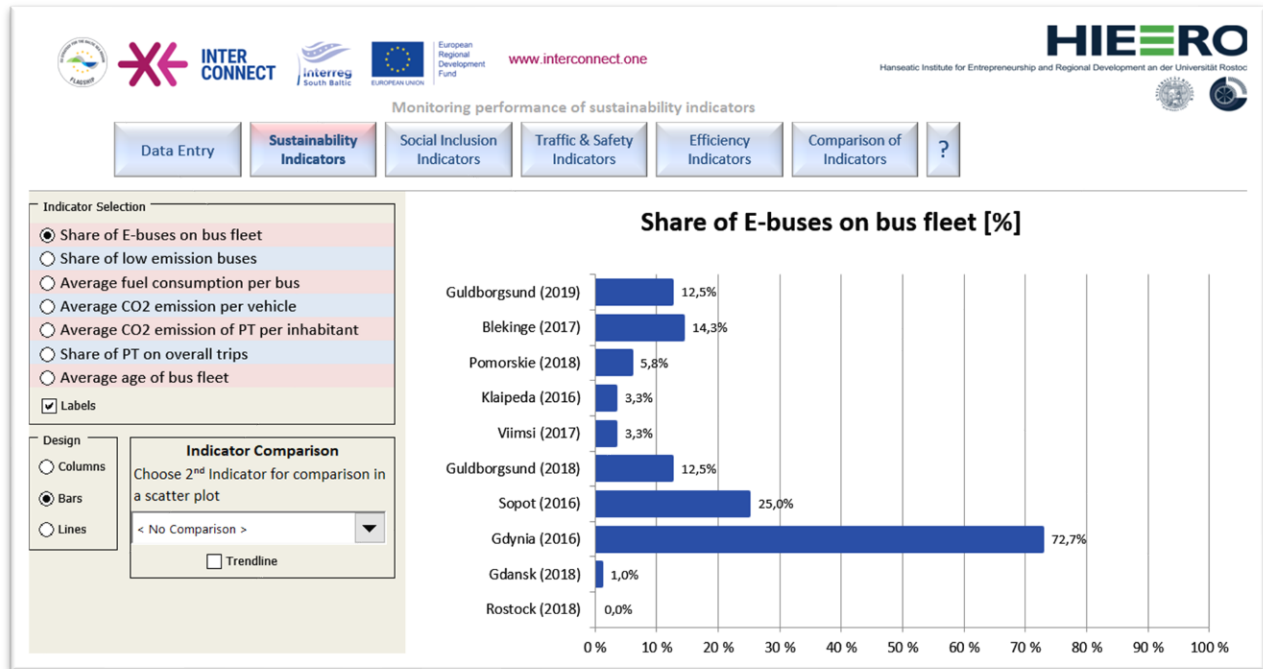
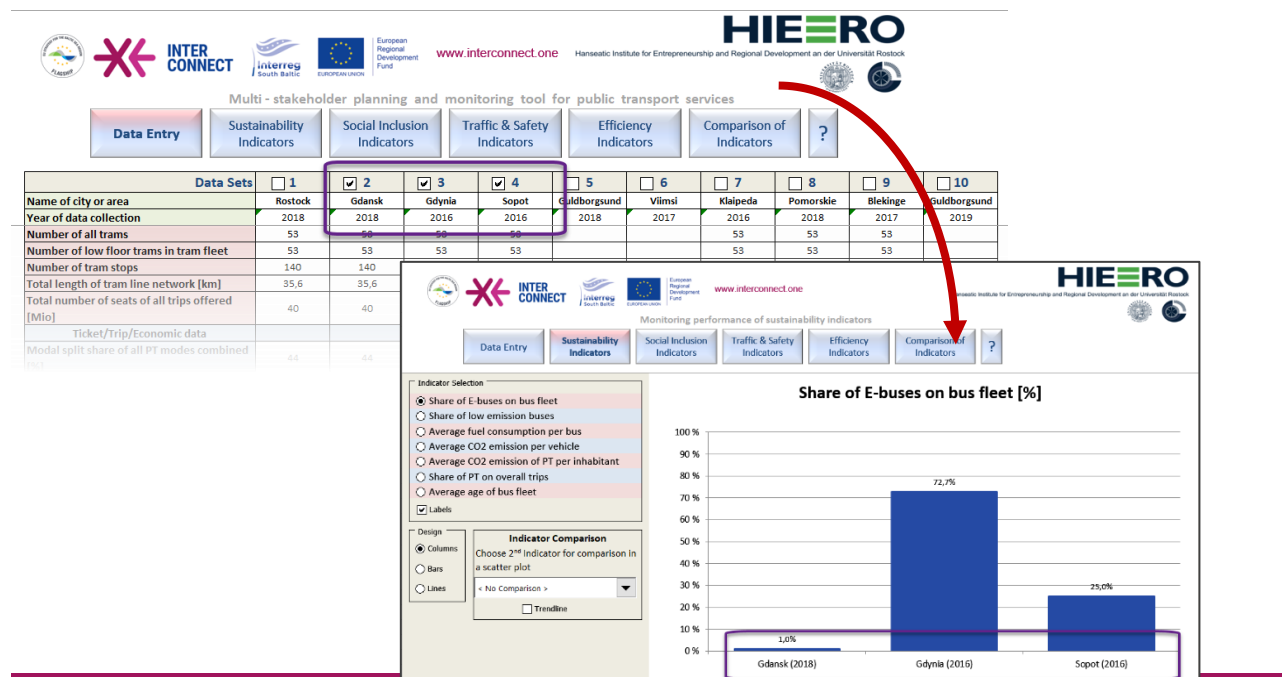
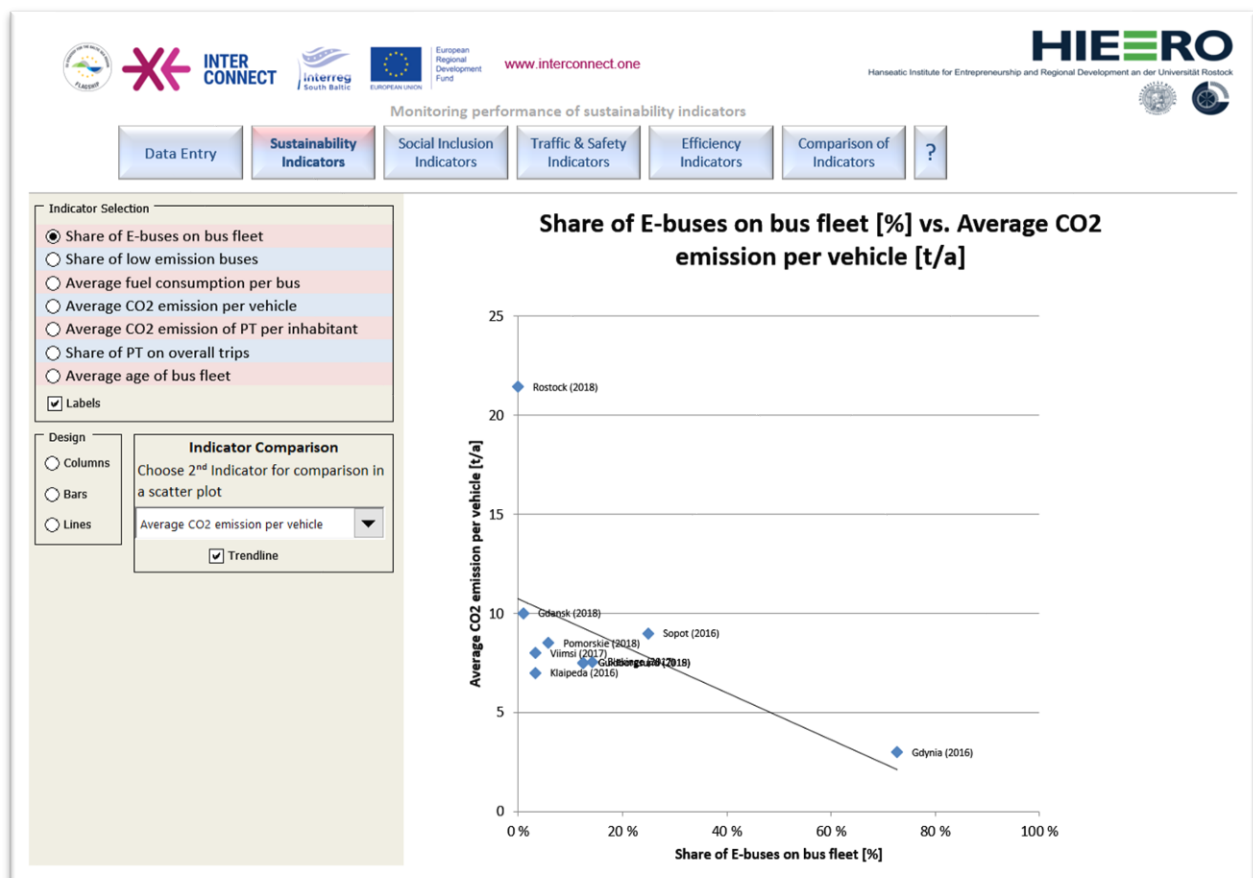


Figure 19. Selection of cities and display of cities in the charts.



The user can also select a second indicator to compare performance of two indicators with each other (4 in Figure 17). In order to enable indicator comparison, he needs to select a second indicator from the dropdown list in 4. Once a second indicator is selected, the diagram changes to a scatter plot, where one indicator is illustrated on the x-axis and the other one on the y-axis (Figure 20). He furthermore can also add a trend line to the diagram (6 in Figure 17).

Figure 20. Indicator comparison (scatter plot with trend line added).



If he finishes the comparison of indicators, he may return to the initial view by selecting 'no comparison' from the dropdown list in 4. The diagram will then switch to single-indicator view (they one that is currently selected in the upper option field).



Exporting or printing charts:

Currently it is only possible to export the charts to other programmes by making a screen shot of the diagram; the charts can be printed by using the standard Excel print command.

Step 3: Analysing sustainability indicators

After reviewing the sustainability indicators, the user may then inspect the performance of social inclusion indicators, related to public transport, by clicking the 'Social inclusion indicators' button in the header section. After that, the social inclusion indicators section opens (Figure 21).

Figure 21. The social inclusion indicators section.



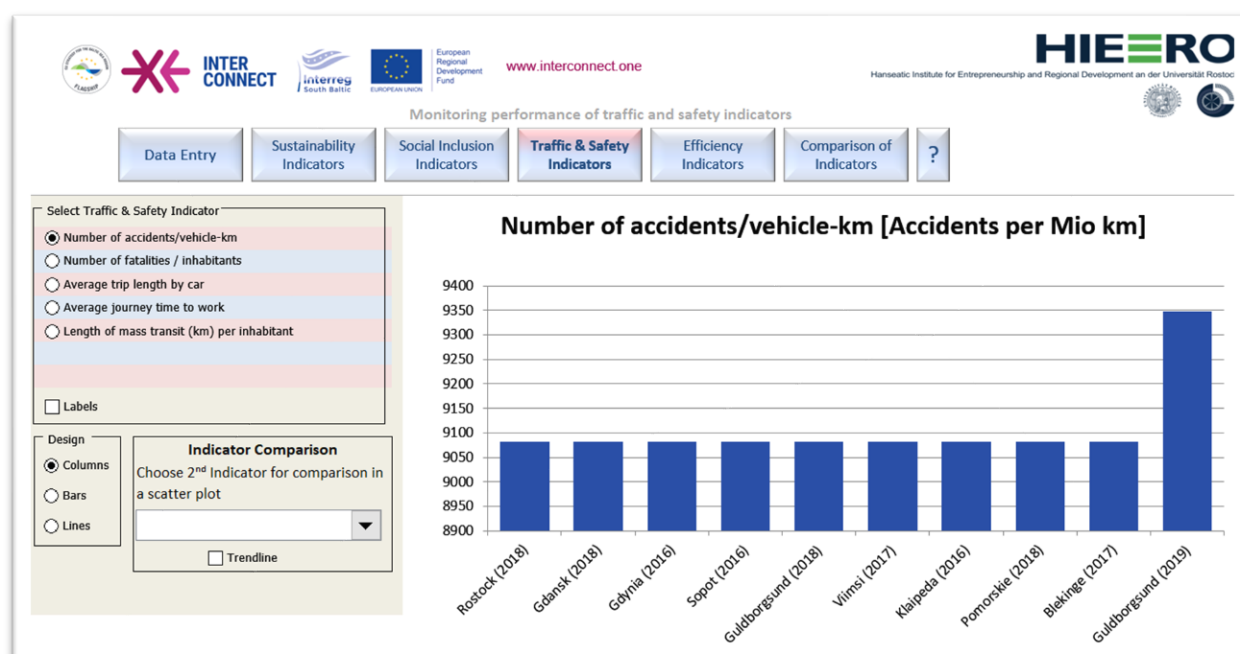
The look&feel and the offered functionalities of this section are similar to the sustainability indicators section: There is the basic distinction between settings on the left and diagram part on the right (2). The user can select between seven social inclusion indicators (1). He can furthermore switch between column, bar, or line charts (3), and may add (or remove) labels (5). Again, it is possible to compare the main indicator with another one by selecting a second indicator for comparison (4). Having selected a second one, the diagram changes to a scatter plot, where one indicator is plotted on the x-axis while the other one is plotted on the y-axis. A trend line may also be added to the chart (6). All changes in these settings will immediately be reflected in the diagram.

Similar to the sustainability indicators, the number and sequence of cities illustrated in the diagram again take account of the settings in the Data Entry tab.

Step 4: Analysing traffic and safety and efficiency indicators

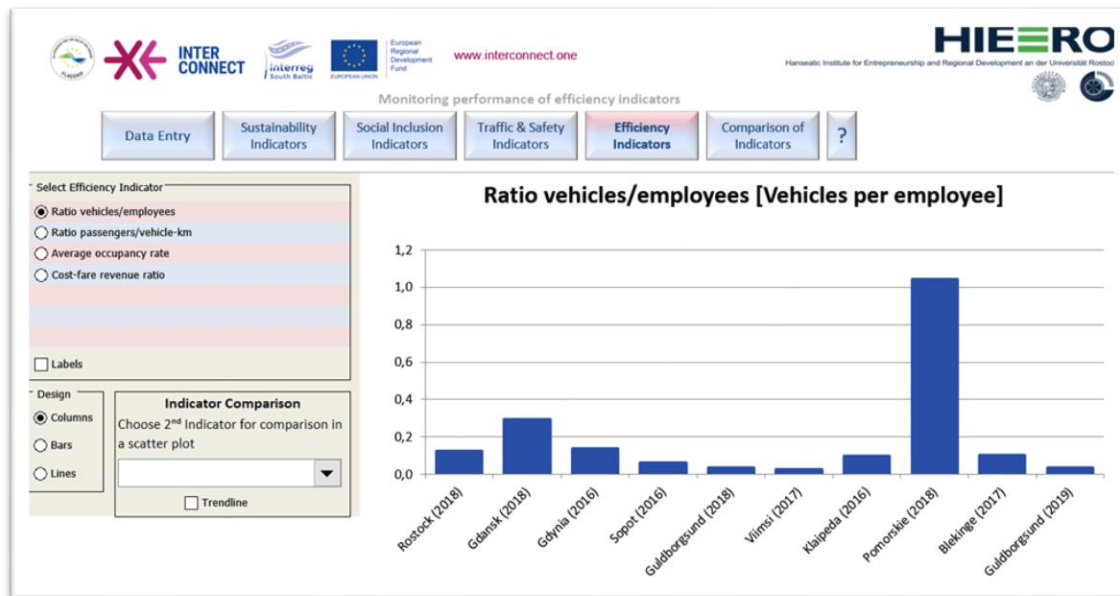
The third and fourth analytical sections of this self-evaluation tool are the section on traffic and safety indicators, which can be accessed anytime by clicking the respective control button in the header section, as well as the efficiency indicators section. Once clicked, any of the two sections open (Figure 22 illustrating traffic and safety indicators, and Figure 23 illustrating efficiency indicators).

Figure 22. The traffic and safety indicators section.



Again, the look&feel and the offered functionalities of both sections are similar to the two previous sections on sustainability indicators and social inclusion indicators (see Step 2 above). The user can select the indicator he is interested in, can switch between different chart types (column, bar and line charts), can add labels, or can compare two indicators with each other.

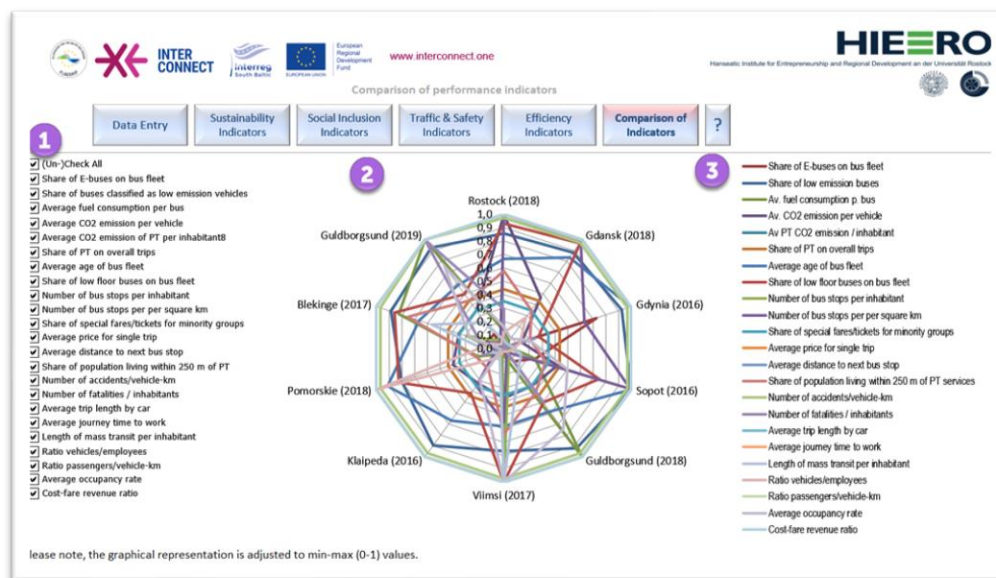
Figure 23. The efficiency indicators section.



Step 5: Comparing indicators

If the user wants to compare more than two indicators, or indicators across different thematic fields, and for several cities/regions, he should click the 'comparison of indicators' button in the header section to access the indicator comparison section (Figure 24).

Figure 24. The indicator comparison section.



The structure of this section differs from that of the other ones. The user interface is divided into three parts. In the left there is the complete list of indicators ¹, covering all indicators of all four themes. By default, all indicators are checked. In the middle ², a spider diagram compares performance of all selected (checked) indicators for all selected cities. To the right is the diagram legend ³.

The indicators to be illustrated in the spider diagram will be selected in the leftmost panel. All indicators that are checked will be displayed in the spider diagram.

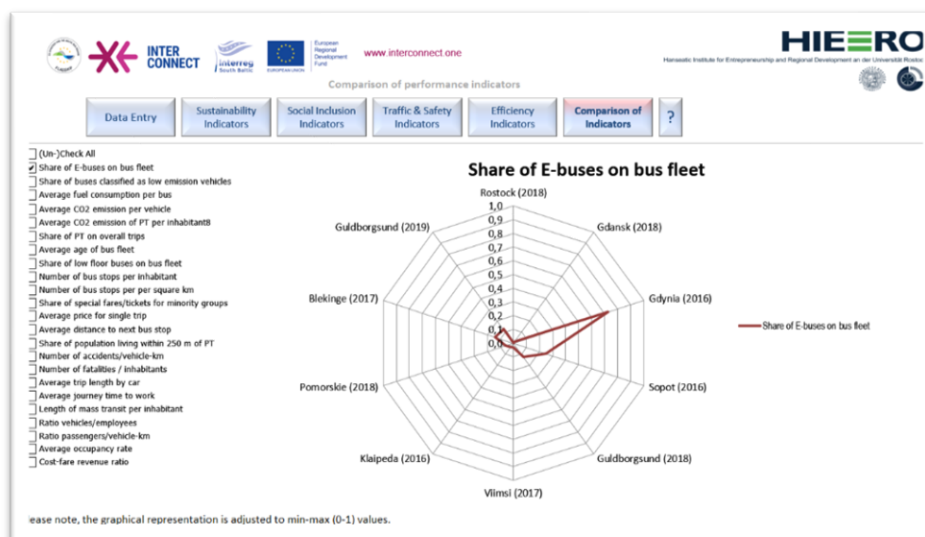
Number of indicators:

Although by default all indicators are selected, it is no good practice to compare all indicators at once, as the diagram then becomes very confusing. It is reasonable to select 50 to 10 indicators for comparison. However, it is also possible just to compare only two or three indicators

If the user wants to quickly (un-)check all indicators, he can use the '(Un-)Check all' options on top of the indicator list. If no indicator is selected, the spider diagram along with its legend disappears; as soon as one indicator is selected again, the diagram reappears so as the legend.

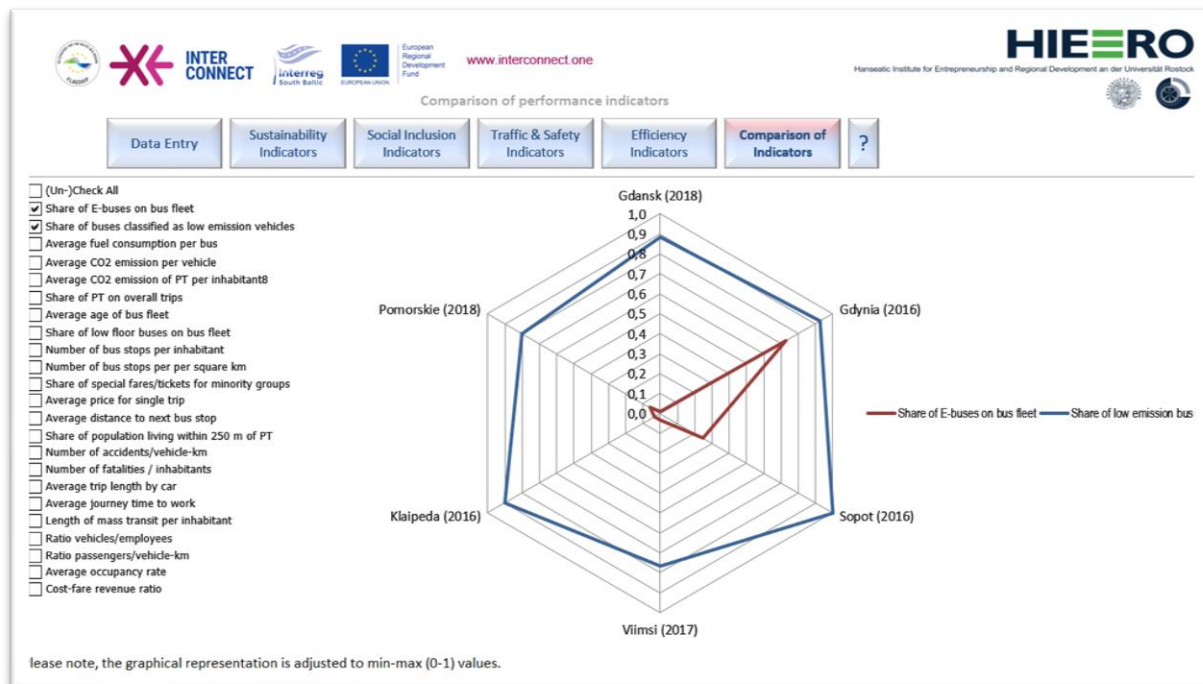
If only one indicator is selected (Figure 25), the spider diagram is best to read; however, it then provides the same depth of information as the other analytical sections although graphically in another fashion.

Figure 25. Comparison of indicators - one indicator.



Each corner of the spider diagram represents one city (or region). The number of cities to display in this spider diagram can be controlled in the data entry section (see Figure 19). At maximum, ten cities can be displayed. If less than ten cities are checked in the data entry table, only the reduced number of cities are displayed in the spider diagram (Figure 26).

Figure 26. Comparison of indicators - reduced number of cities.



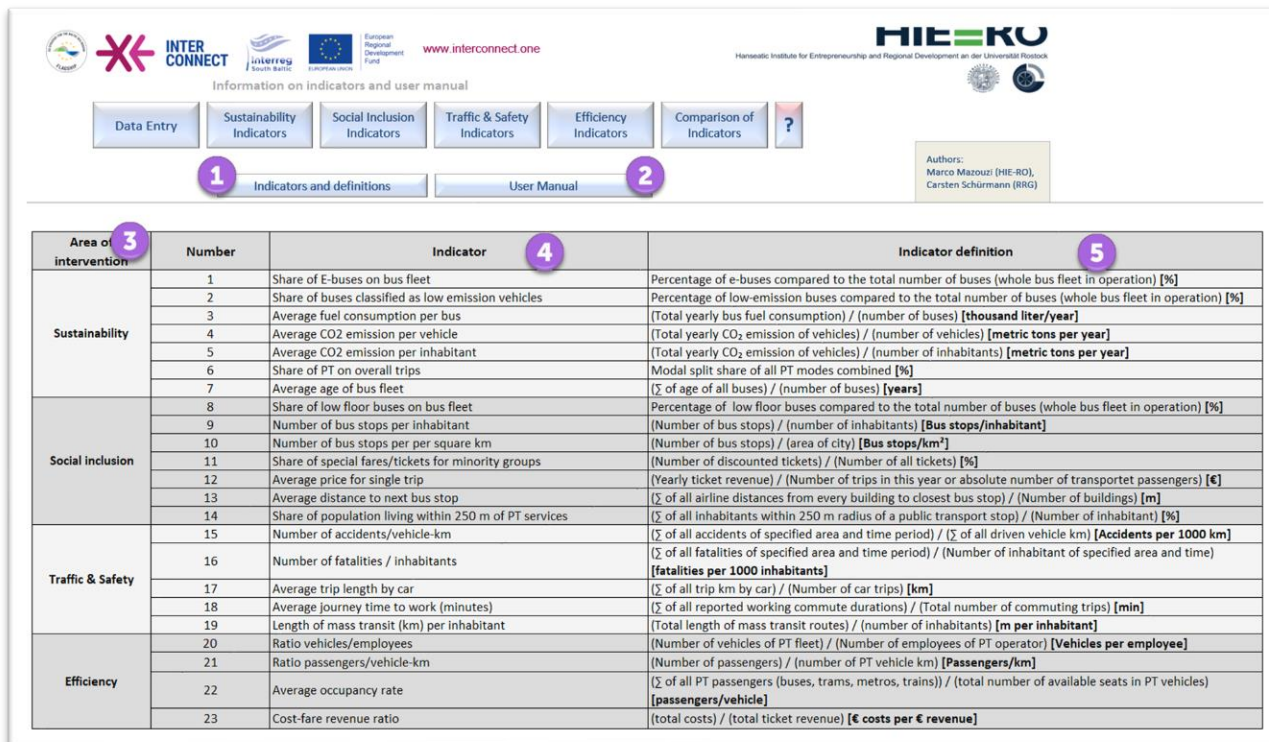
To be able to compare different indicators with different units and dimensions in a spider diagram, all indicators are automatically re-classified to a scale of 0 to 1, where 0 represents the lowest value (minimum) and 1 represents the highest value (maximum). For indicators representing a share or percentage, the 0-1 scale just represents the percentage from 0% to 100%.

Step 6: Getting help

The self-evaluation tool also provides a help section which can be accessed by clicking the '?'-button in the header. Once clicked, the help section (Figure 27) appears with two parts, which are (i) the indicator definition part **1** (default view) and (ii) the user manual part **2**.

The indicator definition part describes the indicators in detail. Indicators ⁴ are grouped by area of intervention / theme ³, and precise definitions including raw data (input data), calculation method and units ⁵ are given. This is useful to know if users want to update data and are uncertain as how indicators are defined and calculated.

Figure 27. The help section - indicators and definitions.



Area of intervention ³	Number	Indicator ⁴	Indicator definition ⁵
Sustainability	1	Share of E-buses on bus fleet	Percentage of e-buses compared to the total number of buses (whole bus fleet in operation) [%]
	2	Share of buses classified as low emission vehicles	Percentage of low-emission buses compared to the total number of buses (whole bus fleet in operation) [%]
	3	Average fuel consumption per bus	(Total yearly bus fuel consumption) / (number of buses) [thousand liter/year]
	4	Average CO2 emission per vehicle	(Total yearly CO2 emission of vehicles) / (number of vehicles) [metric tons per year]
	5	Average CO2 emission per inhabitant	(Total yearly CO2 emission of vehicles) / (number of inhabitants) [metric tons per year]
	6	Share of PT on overall trips	Modal split share of all PT modes combined [%]
	7	Average age of bus fleet	(Σ of age of all buses) / (number of buses) [years]
Social inclusion	8	Share of low floor buses on bus fleet	Percentage of low floor buses compared to the total number of buses (whole bus fleet in operation) [%]
	9	Number of bus stops per inhabitant	(Number of bus stops) / (number of inhabitants) [Bus stops/inhabitant]
	10	Number of bus stops per per square km	(Number of bus stops) / (area of city) [Bus stops/km²]
	11	Share of special fares/tickets for minority groups	(Number of discounted tickets) / (Number of all tickets) [%]
	12	Average price for single trip	(Yearly ticket revenue) / (Number of trips in this year or absolute number of transport passengers) [€]
	13	Average distance to next bus stop	(Σ of all airline distances from every building to closest bus stop) / (Number of buildings) [m]
	14	Share of population living within 250 m of PT services	(Σ of all inhabitants within 250 m radius of a public transport stop) / (Number of inhabitant) [%]
Traffic & Safety	15	Number of accidents/vehicle-km	(Σ of all accidents of specified area and time period) / (Σ of all driven vehicle km) [Accidents per 1000 km]
	16	Number of fatalities / inhabitants	(Σ of all fatalities of specified area and time period) / (Number of inhabitant of specified area and time) [fatalities per 1000 inhabitants]
	17	Average trip length by car	(Σ of all trip km by car) / (Number of car trips) [km]
	18	Average journey time to work (minutes)	(Σ of all reported working commute durations) / (Total number of commuting trips) [min]
Efficiency	19	Length of mass transit (km) per inhabitant	(Total length of mass transit routes) / (number of inhabitants) [m per inhabitant]
	20	Ratio vehicles/employees	(Number of vehicles of PT fleet) / (Number of employees of PT operator) [Vehicles per employee]
	21	Ratio passengers/vehicle-km	(Number of passengers) / (number of PT vehicle km) [Passengers/km]
	22	Average occupancy rate	(Σ of all PT passengers (buses, trams, metros, trains)) / (total number of available seats in PT vehicles) [passengers/vehicle]
	23	Cost-fare revenue ratio	(total costs) / (total ticket revenue) [€ costs per € revenue]

The user manual part ² provides a comprehensive list of commands and functionalities offered by the self-evaluation tool. This list is useful if a user is uncertain as how to use a command or what might happen if he triggers and button.

4.2 The Catalogue Tool

The extensive catalogue of interventions is implemented as Database of Interventions and also available as a Excel tool described below:

Step 1: Starting the Tool

The tool can be launched just by opening the Excel file (either from within Excel, or by double-clicking the file name in the explorer). The file includes four tabs, which are

- Once opened, by default the first tab called “catalogue_interventions” shows up with a table sheet with 11 columns (Figure 28). The first row contains the table headers **1**.

[illegible]

Table 1. Structure of the catalogue tool.

Column	Header label	Contents
A	Area of intervention	Policy theme / area of intervention
B	Sub topic 1	Sub-theme 1
C	Sub topic 2	Sub-theme 2
D	Solution / Action / Product	Actual proposed solution, activity, action or product

E	Description and practical examples	Verbal description of the solution, activity, action or product. As far as possible and useful, practical examples are also given
F	Example cities / regions	Name of cities or regions, where the solution, activity or product has already been implemented.
G	Countries	2-digit ISO country codes of the country (countries) in which the solution, activity or product is already in place.
H	Sample project descriptions	For some solutions, sample project descriptions are given here.
I	Objectives	Policy objectives to be achieved with this solution, activity or product
J	Actors	Actor(s) responsible for implementing the solution, activity or product
K	Target groups	Target group(s) that will be addressed with the solution, activity or product

By default, Excel filters ² are set in the header row allowing the user to filter the columns by using Excel standard functions.

The user may now scroll down through the long list of interventions²², however, it is recommended to use the filters to narrow down the results to quicker find those interventions that are of interest. Sample cities (or regions) (and so country codes) are indicated for many interventions, but not for all.

Using filters to narrow down results (filter & search function):

One filter or a combination of several filters can be used to narrow down the long list of interventions to those which are of prime interest. For example, a user may search for all interventions in the field of „PT planning” that are already implemented in Austria.

In this case, the user may use the filter of column A (**Area of intervention**) and select ‘PT Planning’, and in addition he applies a text filter on column G (**Countries**) to find all entries which include ‘AT’ (i.e. ISO code for Austria) (Figure 29).

Users may also use the Excel standard search function to find interventions that satisfy one or several key words.

²² The term intervention is used here as a collective term for solutions, actions or products.

The columns A (**Area of intervention**), B (**Sub-topic 1**), C (**Sub-topic 2**) and D (**Solution, action, product**) represent a 4-level hierarchy of interventions, from the area of intervention, sub-topics 1 and 2 towards the actual intervention (Table 1).

Sometimes, column E (**descriptions and practical examples**) already includes hyperlinks to websites from where further information can be obtained for a particular intervention; however, if no such hyperlinks are given but a list of sample cities or sample regions is provided, the user can visit websites of the respective city administration or public transport operator to obtain further information.

Figure 29. Filtering of interventions: Interventions for PT Planning in Austria.

A	B	C	D	E	F	G	H
Area of intervention	Sub topic 1	Sub topic 2	Solution / Action / Product	Description and practical examples	Example cities / regions	Countries	Sample project
PT Planning	PT Services	New traditional PT services	New cross-border PT service	New seamless and direct cross-border bus, rail, or tram line (i.e. no need to change services and interchange points) in some border regions, such services are dedicated to specific target groups like tourists (for example, Bavarian Forest), cross-border commuters (like EUREGIO, Greater Salzburg area) or pupils	Bavarian Forest, EUREGIO, Hainburg, Kehl, Luxembourg, Padborg, Salzburg, Strasbourg	AT, DE, DK, CZ, FR, LU, NL	
PT Planning	Accompanying measures	NMT measures (NMT = Non-motorized transport)	Implementation of bike sharing or E-scooter systems	Example is "BicicleLU" in Ljubljana; for e-scooter systems see https://de.wikipedia.org/wiki/E-Scooter ; E-scooter hiring companies in Germany are Bird, Circ, Lime, Tier, and Voi (see https://de.wikipedia.org/wiki/E-Scooter-Verleihsystem#Anbieter_in_Deutschland_für_eine_Liste)	Berlin, Brussels, Cologne, Dresden, Ljubljana, Paris, Vienna, Vilnius, Warsaw, Zagreb	AT, BE, DE, FR, HR, LT, PL, SI	
PT Planning	Accompanying measures	NMT measures (NMT = Non-motorized transport)	Introduction of "shared spaces"	Shared space is an urban design approach that minimises the physical segregation between modes in a road space. This is done by reusing features like kerbs, surface marking, traffic signs and traffic lights. All road users (i.e. car, bus and lorry drivers, cyclists, pedestrians) shall have equal rights in the space. Prominent examples are Dutch cities; see https://de.wikipedia.org/wiki/Shared_Space_für_eine_Beschreibung and https://de.wikipedia.org/wiki/Liste_der_Shared-Space-Projekte_für_einen_Überblick	Aachen, Barmingen, Blomberg, Bohle, Brighton, Buschek, Calau, Donkerbroek, Drachten, Dresden, Duisburg, Eijby, Emmen, Endingen, Ettenheim, Feldkirchen bei Graz, Frankfurt (Main), Gleinstätten, Gnaß, Gmund, Graz, Hamburg, Haren, Haslach im Kinzigtal, Hatten, Kamen, Legden, Lodi, London, Luckenwalde, Maastricht, Nijmegen, Norrköping, Oldeberkoop, Opeinde, Oostervelde, Ostende, Oudehaule, Potsdam, Poynton, Rudersberg, Schweitzingen, Schönebeck (Elbe), Stuttgart, Velden am Wörthersee, Verden, Villach, Vöcklabruck, Wollach, Wolgast	AT, DE, DK, IT, LU, NL, SE, UK	
PT Planning	Public transport plans and strategic planning	Strategy development	Comprehensive SWOT and gap analysis and stock-taking of PT sector including diagnosis of main urban transport and mobility related problems	objective: identification of problems and potential fields of interventions as well as continuous success control (fingerprinting and long-time monitoring); example: SmartCity Strategy of the City of Vienna. All monitoring activities should ideally be embedded into a monitoring and evaluation strategy/plan.	Vienna	AT	
PT Planning	Public transport plans and strategic planning	Strategy development	Develop and apply indicator and monitoring systems, or multidimensional assessment systems	it would be important that cities identify, select and monitor a set of key performance indicators, together with policy objectives (target values), so that the degree of fulfilment of the targets and the performance of the PT sector and the whole transport system can be evaluated. The indicator set should ideally include input, output and outcome indicators, and the indicators should cover qualitative as well as quantitative indicators.	Vienna	AT	

The catalogue of interventions is a 'lively document' which means that new interventions can be added or descriptions or other kind of information can be updated continuously when and to the extent needed.

The columns **objectives** (column I), **actors** (column J) and **target groups** (column K) occasionally include or may make use of abbreviations and/or keywords. These abbreviations and keywords are explained in the three remaining tabs of the Excel file: the tab '**Policy_objectives**' describes and structures the policy objectives that are associated with an intervention (Figure 30); the tab '**Actors**' describes the actors that are responsible for implementing an intervention (Figure 31, left), and finally the tab '**Target groups**' lists and structures the social target group(s) that are (primarily) addressed by a certain intervention (Figure 31, right). The main tab (**catalogue_interventions**) only lists the shortcuts, abbreviations or short names that are listed in these additional tabs.

In many cases, there are several policy objectives and several target groups to be addressed with one intervention, and usually more than one actor is involved in its implementation (i.e. joint and coordinated action), which is reflected in the catalogue by several entries in the respective columns.

Figure 30. Catalogue of interventions - tab policy objectives.

Policy objectives		
Notes:		
Policy objectives indicate what policy fields or objectives should be addressed with a certain intervention/solution.		
Each solution can address one or more objectives at a time.		
Shortcuts may be implemented as alternative keywords		
We may consider to group the objectives into general objectives and sub-objectives.		
Of course, at an abstract level, all interventions shall improve attractiveness of PT and shall thus increase PT usage and increase share of PT.		
Objective	Comments/explanations	Shortcut(s)
Acceptance	Measures to raise acceptance of general public towards PT projects	Acceptance
Accessibility	Improving access to PT for disabled/handicapped people	Access
Attractiveness	Increasing attractiveness of public transport	Attractiveness
Bottlenecks	Removing/tackling bottlenecks in the PT network or at hubs or stations	Bottlenecks
Capacity	Strengthening capacities (links and/or nodes)	Capacity
CEF	Connecting Europe Facility. European Fund to finance TEN-T projects. Applying for these	CEF
Change management	Improving (internal) organization to better meet transport demand	Change
CO ₂ reduction	Measures to reduce CO ₂ emissions	CO ₂
Comfort	Increasing comfort and usability of public transport	Comfort
Controlling	Controlling traffic flows	Controlling
Cost-competitiveness	Measures to become cost-competitive to car or flight travel	Cost
Cross-border	Measures to improve cross-border public transport	Cross-border
Efficiency	Increasing efficiency	Efficiency
e-Government	Implementing solutions for e-Government	e-Government
Energy reduction	Reducing energy (diesel, power, etc.) consumption of all operations	Energy
Fares/ticketing	Improving/changing fares and ticketing systems	Fares, tickets, ticketing
Fleet management	Measures to optimize fleet and vehicle operations	Fleet
ICT	Information and communication technologies	Information, communication, ICT
Impacts	Measures to reduce negative impacts of PT (like noise, barriers etc.)	Impacts
Intermodality	improving intermodal and connectivity of modes of transport	Intermodality
Information	Measures to improve information of general public on PT planning and PT services	Information
Innovation	Implementing innovative, state-of-the-art solutions	Innovation
ITS	Intelligent Transport Systems	ITS
MaaS	Implementing mobility-as-a-service solutions	MaaS
Marketing/promotion	Intensify marketing and promotion activities	Marketing
Monitoring	Implementation monitoring system for continuous success control	Monitoring
Networking & cooperation	Initiate/intensify network activities to improve cooperation	Networking, cooperation
Organisation	Implement new (transport) organisations to better provide PT in the region	Organisation
Pilot study	Initiating pilot actions (state-of-the-art solutions)	Pilot
Planning processes	Improving workflows for planning processes	Planning
Processes	Process and workflow optimization	Process, workflows
Punctuality	Improving punctuality of PT services	Punctuality
Push	Measure to reduce attractiveness of road transport (pushing to PT)	Push
Reliability	Improving reliability and vulnerability of PT services	Reliability
Revenues	Measures to increase revenues from operations	Revenues
Safety	Implementing solutions to increase safety of operations and reduce (severity of) accidents	Safety, accidents
Service improvement	Improving level of service and comfort of PT	Service
Simplification	Simplifying processes (for example, for ticket purchase)	Simplification
Social responsibility	Improving PT services to better account of social issues	Social
Staffing	Adaptation internal staffing to new needs	Staffing
Stakeholder consultation	Improving/initiating stakeholder consultation and public engagement	Stakeholder
SUMP	Developing sustainable urban transport plan	SUMP
Sustainability	improving sustainability of PT system	Sustainability
Technology	Applying state-of-the-art PT technologies	Technology
Traffic flows	Improving traffic flows and traffic management	Traffic

Figure 31. Catalogue of interventions - tabs actors (left) and target groups (right).

Responsible actors to implement a solution		
<p>Note:</p> <p>Some extend, actors and target groups might be the same. Actors however are understood as those organisations/persons who are responsible for implementing a solution, while target groups are those who are the beneficiary of the solution. In some cases, both are the same.</p> <p>Only the main actors shall be identified, although sometimes the main actor will have to involve other actors/stakeholders or to initiate certain formal procedures in order to implement a solution. Still, sometimes more than one actor is involved.</p>		
Actor group	Actor	Abbreviation/short name
Public authorities	Municipality administration/department	Admin
	Politicians	Politicians
	City council	Council
	Stakeholders/NGOs/chamber of commerce, workers unions, religious organisations, environmentalists etc.	Stakeholders
	Police	Police
	Fire department	Fire
	Rescue services	Rescue
	PT Associations	PTA
	PT Planners	Planners
	Bus/tram/metro companies	Ptcomp
Transport operators	Railway companies	Railways
	Ferry companies	Ferries
	Traffic managers	Trafman
	Mobility/service providers (incl. MaaS providers, providers of sharing services like bike or e-scooter sharing, ride-hailing providers etc.)	Mobprov
	Depot/workshop operators	Depots
	Consultants	Consultants
	Manufacturers	OEM
	Software companies	Software
	Companies (as employers)	Employers
Intervention providers, solutions providers, manufacturers		

Target groups or interventions and solutions		
<p>Note:</p> <p>Each intervention/solution may address one or more target groups at the same time</p>		
General target	Target group	Abbreviation/short name
General public	PT users	Users
	Elderly/Retired people	Elderly
	Kids	Kids
	Handicapped people	Handicapped
	Pupils, students, apprentices	Students
	Workers/commuters	Workers
	Cross-border workers	CBW
	Job seekers	Jobseek
	Tourists	Tourists
Public authorities	Municipality administrations	Admin
	Politicians	Politicians
	Stakeholders/NGOs	Stakeholders
	PT Associations	PTA
	PT Planners	Planners
Transport Operators	Bus/tram/metro companies	Ptcomp
	Railway companies	Railways
	Ferry companies	Ferries
	Traffic managers	Trafman
	Mobility/service providers	Mobprov
	Depot/workshop operators	Depots
Intervention providers, solutions providers, manufacturers	Consultants	Consultants
	Manufacturers	OEM
	Software companies	Software

4.3 Integration into INTERCONNECT Website

Currently the two tools described in the previous chapters are stand-alone Excel-based tools. Nevertheless, the aim is to make these tools available to a wide range of users in the South Baltic Region via the INTERCONNECT website (www.interconnect.one).

While the self-evaluation tool is a complex application that can't easily be transferred to an online application, it would be possible to convert the catalogue of intervention Excel file to an interactive online application, which then can also be linked to the fact sheets.

Therefore, a two-stage approach is proposed for embedding the two tools into the INTERCONNECT website.

Stage 1 - Publication of Excel files

In this stage, both Excel files will be made available for download on the INTERCONNECT website. The objectives and functionalities of each tool will be briefly described, and a download link will be provided. This download page should be linked to the website providing the fact sheets (i.e. short list of interventions).

Stage 2 - Converting the catalogue of interventions to online application

In this stage, the catalogue of interventions will be converted from Excel file to an interactive website, where the headers in the Excel file represent filters in the web application. In the web application, the user will be guided by these filters to narrow down its search to finally obtain only those results (interventions) he is actually interested in. Technically, the list of interventions will be converted into an online database (such as MySQL), and through the user interface, the users access (and filter) this database. The main benefit of the online application is that linkages to the fact sheets can be easily implemented via hyperlinks and that the search and filter functions provide greater flexibility compared to the built-in Excel functions.

The self-evaluation tool, however, remains an independent Excel tool that is offered for download at the website.

4.4 Maintenance and update of the tools

It is recommended that the INTERCONNECT project team agrees about how to maintain (and update) the two tools, and who shall be responsible for that. While the self-evaluation tool may only be updated occasionally (for example, if new functionalities are requested or bugs have been detected), the catalogue of intervention requires continuous updates to keep track with latest developments in the public transport sector.

For both tasks, clear responsibilities should be assigned and a road map for the future maintenance and improvements shall be developed.

5 Cross-border Public Services in Transport

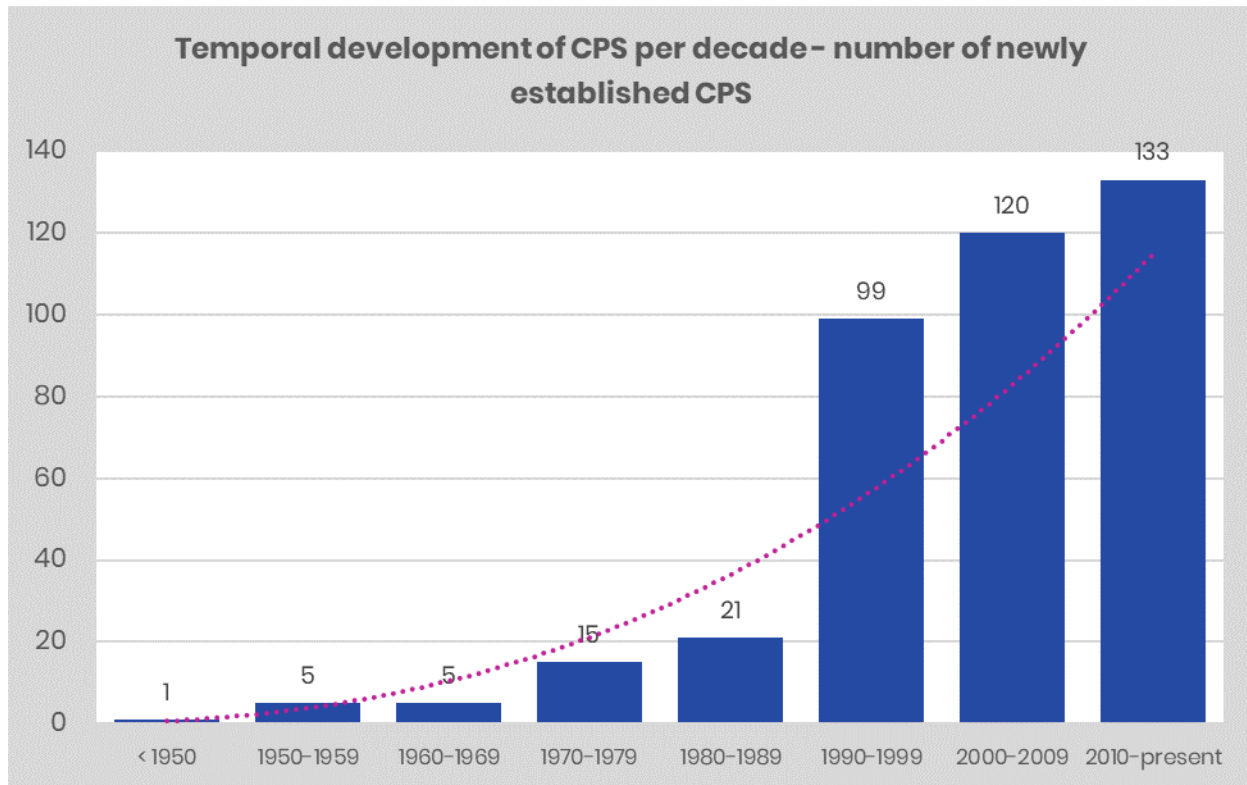
As the South Baltic Sea Region is also a border region, with the Baltic Sea being a natural but also national border, the INTERCONNECT partners are particularly interested how to implement cross-border transport solutions. One example of such a solution is the development of a joint public transport ticket between the regions of Blekinge in Sweden and Pomorskie in Poland, allowing public transport users to travel from Blekinge via the Baltic Sea ferries to Pomorskie (and vice versa) with just one integrated transnational ticket, which is intended to be implemented by the project partners. A cross-border public service (CPS) could be a potential instrument for implementing this ticket.

To support the stakeholders in this initiative, this chapter gives an introduction to the concept of CPS. The INTERCONNECT project partners can of course also use CPS as implementation instrument for other cross-border PT projects.

Cross-border public services are no new instrument to develop public services in border regions. As the ESPON CPS targeted analysis project has recently shown, first CPS were already implemented in the early 1960s in different policy fields such as healthcare, environmental protection, civil protection and disaster management, and spatial planning and tourism. One of the first CPS in the Baltic Sea region was the cross-border bus service between the cities of Flensburg (Germany) and Sønderborg (Denmark), already established in 1950.

A first boost in the development of CPS could be observed in the 1990s in Western Europe with the launch of Interreg programme (Figure 32). But still today the concept of CPS is not widely known among border regions, although it provides potentials for developing all kinds of cross-border public services.

Figure 32. Temporal development of CPS in Europe.

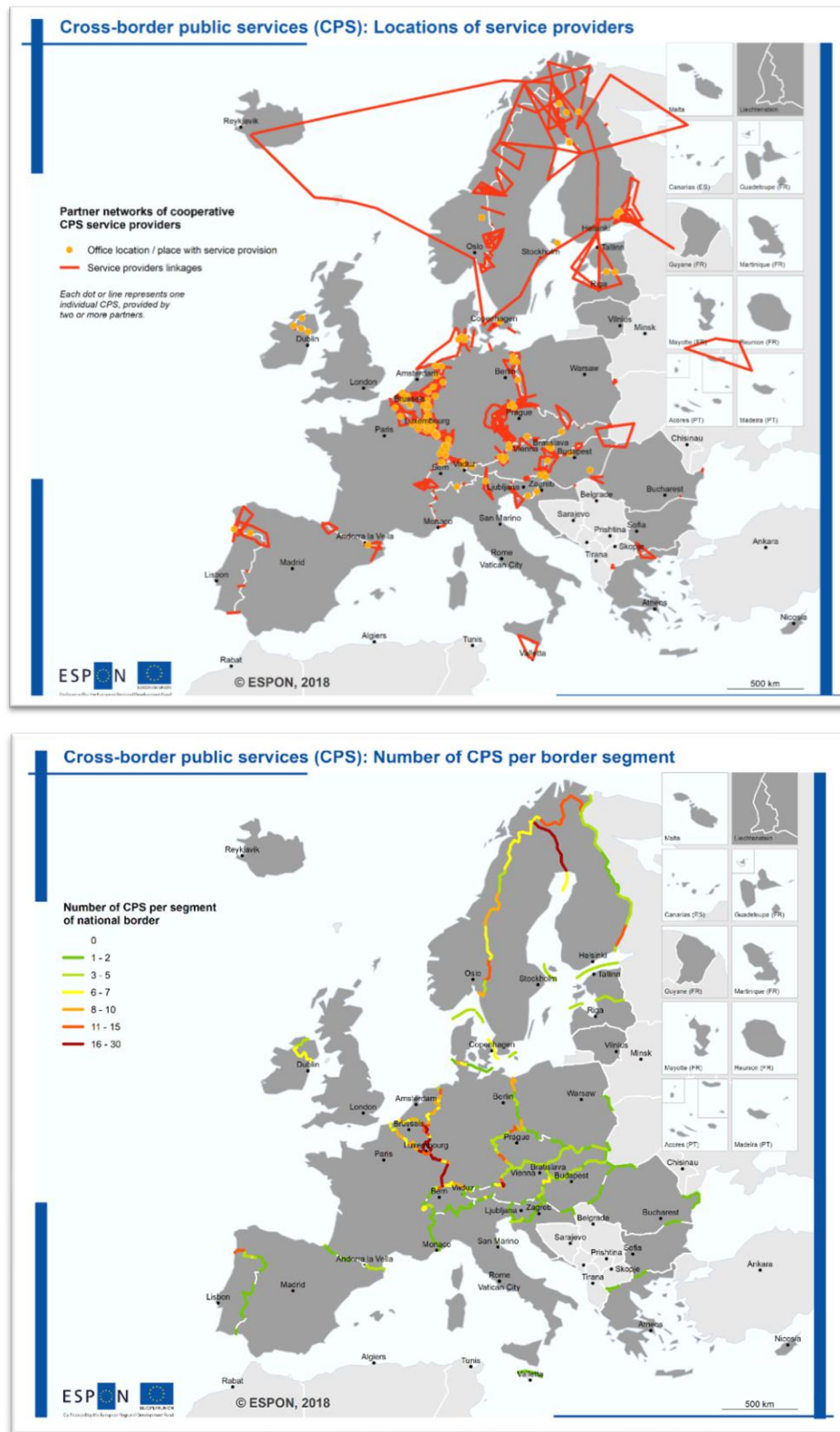


Source: ESPON CPS, Schürmann and Stumm, 2018, 33

Altogether, the CPS inventory compiled by the ESPON CPS project includes a total of 579 CPS in Europe, with highest density of services along borders between the six founding EU Member States and in the Nordic countries (Figure 33). Only few CPS operate today in the Baltic States, and only few crossing the Baltic Sea. To a large extent, the geographical patterns of CPS and their thematic diversity reflect the historical legacies in the border regions and also the traditions of cross-border cooperation. As a matter of fact, CPS not only exist between EU Member States but also with non-EU countries (for example, between Finland and Russia or Norway and Russia).

The spatial extent of a CPS can be local and very small scale, but could also be very large and transnational, covering two or more countries. The CPS with the largest geographical extent in Europe is a labour market CPS called “Halla Norden” covering the countries of Denmark, Finland, Iceland, Norway and Sweden (see Figure 33).

Figure 33. Location of CPS and density along borders in Europe.



Source. ESPON CPS, Zillmer et al., 2018, p. 5-6

5.1 Definition and added value of CPS

What are the key characteristics of a cross-border public service? What makes this instrument unique? To distinguish CPS from other services and from projects, the following definition can be applied. According to this, any CPS

- covers a specified **cross-border area**,
- addresses a **shared problem** or **common development opportunity** that is shared by regions at both sides of the border,
- involves **actors from both sides of the border** (which committed themselves to jointly develop the CPS),
- has a **target group on both sides of the border**, and within that target group
- is **non-discriminatory** to access,
- establishes a **tangible service** that is **visible** and lively,
- is **publicly organised** and delivered either directly or via a concession,
- is **publicly financed**, and
- is **not limited** to a specific timeframe (i.e. is not a “one-off project”).

Usually, one CPS represents one specific service in a particular policy field. Many border regions, however, have already established several CPS in different policy fields, which are organized and operated independently from each other. One of the great strengths of the CPS instrument is that it can be applied to all kinds of policies and themes, i.e. it is not limited to any specific issue.

The overall added value of CPS is that they enhance the functionality of border areas by

- contributing to **reducing negative border effects**,
- contributing to **better connections**,
- supporting **cross-border flows** of people, materials and information,
- creating (thematic) **functional areas**,

- contributing to raise **awareness** of **cross-border possibilities** in different policy fields (such as labour markets, health care, recreation, education, transport, technical infrastructures),
- addressing **gaps** in (domestic) **service provision** or offering **specialized services** (which wouldn't or couldn't be delivered by the private sector),
- making service provision **less costly** and raise its **efficiency** (by increasing service areas and potential demand), thereby helping to maintain services in border areas with low population densities, and
- **sustaining Interreg projects**.

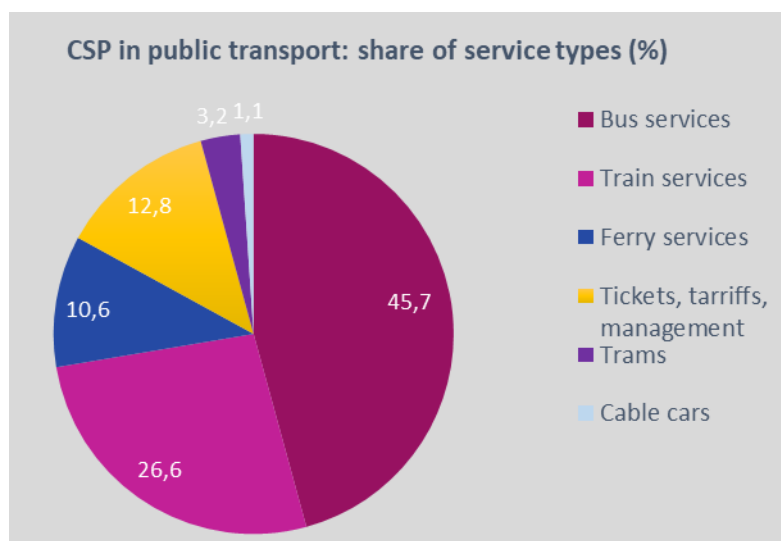
5.2 CPS in Transport – The European Dimension

As the inventory shows, CPS are nowadays applied in various policy fields, most often in environmental protection and civil protection/disaster management (both 20 % each, Table 2). With about 18% of all CPS, CPS in transport rank 3rd among all policy fields indicating the large potentials that CPS are able to provide for developing cross-border public transport services. A further differentiation of the transport CPS reveals that almost 46 % of them represent cross-border bus services (Figure 34), almost 27 % cross-border train services, followed by CPS in ticketing, tariffs and transport management (12.8 %) and ferry services (approx. 11 %).

Table 2. CPS by policy field.

Policy field	Share on all CPS in Europe (%)
Environment protection	20.6
Civil protection and disaster management	20.4
Transport	18.1
Healthcare and social inclusion	11.1
Education and training	9.8
Spatial planning, tourism and culture	9.5
Labour market and employment	5.0
Citizenship, justice and public security	4.7
Communication and broadband	0.9
<i>Sum</i>	<i>100.0</i>

Figure 34. CPS in public transport: share of types of service.



The various existing CPS in the fields of transport can furthermore be grouped into (i) **services**, (ii) **tickets and information**, and (iii) **planning and management**, with increasing levels of integration and complexity from (i) to (iii) (Figure 35). When border regions implement CPS for the first time, they usually start with “low hanging fruits” such as simple bus services to test mutual commitments and trust, to gain first experiences with the cross-border cooperation and to identify starting points for future improvements and for further (more complex) services.

Figure 35. CPS in transport.

Services	<ul style="list-style-type: none"> Bus lines, trams, regional and rapid urban trains, ferries, cable cars Specialized services (like touristic steam trains, hiking buses) Joint icebreaker services Cross-border MaaS services 	Increasing level of integration
Tickets & Information	<ul style="list-style-type: none"> Public transport tickets and integrated PT fare systems Joint internet platform (information, ticketing & sales, service hotlines, etc.) Cross-border mobility apps 	
Planning & Managem.	<ul style="list-style-type: none"> Joint authorities for public transport planning and PT service delivery Joint traffic management centres Joint procurement of vehicles, goods, materials and maintenance/repair 	

If regions observe positive feedback for 'simple' CPS (such as a cross-border bus service), they often enter into processes to develop more complex services (such as joint tickets, harmonized fares) or to extend (geographically and service-wise) the existing service.

When zooming into the Baltic Sea region, today only few transport CPS cross the Baltic Sea, which are

- Rostock - Guldborgsund ticket
- Bornholm ferry between Rønne (Bornholm island, Denmark) and Ystad (Sweden)
- Icebreaker service between Finland and Sweden

The Bornholm ferry service is particularly interesting because it operates under public service obligations (PSO), issued by the Danish government, but connects the Danish island with the Swedish mainland (and not with Copenhagen, as one may assume).

Otherwise, with some exceptions, there are currently almost no landside public transport services (CPS) between countries in the Baltic Sea region. The few existing examples are bus services, but more complex services are lacking.

As a good practice example, the following box illustrates the key characteristics of the Elba-Labe public transport ticket between Germany and Czech Republic. In order to trigger cross-border leisure activities and to attract more tourists in the National Park along that border, stakeholders decided to introduce a cross-border PT ticket. Legally, a contract was signed between the two transport associations. Since there was no such association available on Czech side, it was decided to found a similar association specifically for this purpose, following the German model. Both associations now offer the cross-border tickets, allowing people to use all bus and regional trains in the border region. In order to cope with the different purchasing power levels in Germany and Czech Republic, it was decided to offer the ticket at different prices and with slightly different conditions. After the introduction of the ticket, ticket sales at both sides increased significantly. Meanwhile, in order to cope with increasing and changing demands, the stakeholders decided to offer additional ticket variations such as a family day ticket, which (a) illustrates the flexibility of CPS to react on actual developments, and (b)

demonstrates that CPS are always evolvable and can never be considered to be “ready” or “finalized”.



Good practice example on ticketing: Elbe-Labe ticket (Germany - Czech Republic)

Needs:

- addressing strong cross-border dimension of shopping and leisure activities (national park) of local population and tourists
- easing cross-border use of public transport

Legal and administrative framework:

- contract between transport associations (on Czech side, the association was founded specifically for the purpose of this ticket, as it did not exist beforehand)
- each association offers the joint tickets (however, price for ticket differs at both sides of the border reflecting the different purchasing power)

Results:

- increasing ticket sales since introduction
- meanwhile decision to extent the variety of tickets (e.g. family day ticket) reflecting new and increasing demands

Another strength of the CPS instrument is its flexibility as regards the applied legal backgrounds and financial solutions, as demonstrated by selected transport CPS shown in Table 3. Usually, each CPS is unique in its individual composition of actors, their responsibilities, the legal and administrative frameworks applied, and technical and financial solutions found. CPS always tend to find the solutions that best meet the challenges and framework conditions in a particular border region.

Table 3. Tailor-made legal and financial solutions applied by selected transport CPS.

CPS example	Legal challenges and solutions	
	Legal	Financial
Tram Strasbourg-Kehl (DE-FR)	Different security prescriptions and insurance requirements for	Ticket sales finance provision and deficits shared proportionally

	infrastructure in both countries - tailor made solution found	
Eurodistrikt-Bus for cross-border workers (DE-FR)	EC cabotage regulation limits the use - Special regular service model applied	Joint funding of involved districts / departments, EGTC and ticket sales
Ilztalbahn line in Bavarian Forest (DE-CZ)	As local link does not imply border-crossing of domestic rail services and is operated for historical interest / tourist value no application of EU regulations / directives required	Interreg project for upgrading infrastructure; fund-raising of non-profit association; local public funding and train tickets
Elbe-Labe Ticket (CZ-DE)	Fragmented transportation company structure in CZ - foundation of single transport association in CZ region; then signing of cooperation between both transport associations	Ticket sales finance provision / transfer depending on sales and internal distribution to transport providers. Economic disparities - different price levels for tickets bought in CZ and DE and limits to validity
Geneva joint transport authority (CH-FR)	Public-law based institution based on Karlsruhe Agreement on cross-border cooperation	Administration fees shared among members, costs for bus lines borne by relevant partner

Some conclusion can be drawn from the European-wide analysis of transport CPS:

- A **large variety** of transport CPS already exist in Europe, ranging from individual, simple services such as a cross-border bus line towards tightly integrated systems.
- In contrast to the rest of Europe, there are **only few transport CPS active in the Southern Baltic Sea area**, some of which crossing the Baltic Sea.
- In several cases, CPS in transport are **follow-up services** of other CPS which were earlier implemented. For instance, in the case of the Bavarian-Bohemian forest, first a nature park CPS was established for environmental protection, and after a while they decided to implement some transport CPS in order to provide easy access to that nature park for tourists.
- The applied **legal basis** is quite **different**, depending on the type of service and the existing bilateral agreements. Sometimes this step involves to find *creative solutions*. Possible legal frameworks to be applied include

- (1) European regulations and directives
- (2) General or thematic interstate agreements
- (3) Special agreements at regional level
- (4) Contracts of partners

Existing frameworks should not be considered as obstacles but rather as chances or opportunities; similarly, a lack of legal frameworks in particular cases should also be seen as a chance. If there is a legal framework available in the field of interest, it may however support and simplify efforts to establish a CPS.

- Similarly, actors apply **tailored financial solutions** to share costs and benefits, depending on the type of service, division of tasks and the composition of the actors involved.

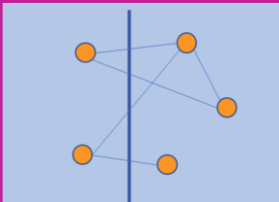
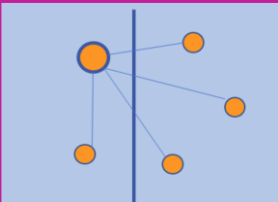
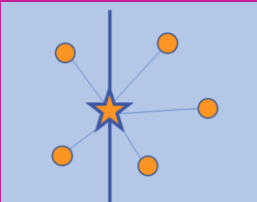
5.3 Implementation Models

The analysis of the CPS has shown that essentially three different implementation models are being used:

- Network model
- Centralised model
- Integrated model

They differ in their management structures and service delivery (Table 4). The network model is the least integrated model, while on the other hand the integrated model includes the highest level of integration, which by way of consequence usually also requires the highest level of formalities.

Table 4. Main CPS implementation models.

Model	Networking model	Centralized model	Integrated model
			

Delivery	Cooperative task delivery through a division of labour between different independent public administrations (local, regional, national) or service providing organisations on both sides of a border.	Unilateral task delivery through an existing public administration (local, regional, national) or service providing organisation on one side of the border, acting on behalf of all partners and for the benefit of both sides.	Delegated task delivery & joint management of the service , by using an already existing cross-border structure / body with own legal personality, seconded by own staff and an own budget.
Management	Shared management of the service through a newly created informal network or formalised network structure involving the relevant organisations from both sides of the border (with or without a joint coordination unit).	One-sided management of the service through the concerned public authority or service provider, either by not involving actors from the other side in domestic management or by involving such actors.	Integrated task delivery & integrated management of the service , by transferring responsibilities for decision making and operational service management to a newly established cross-border structure / body with own public-law based legal personality, directly employed personnel and an own budget.

A general recommendation as to which implementation model should be chosen in each individual case cannot be given, as the appropriateness of the models depends on several factors, which can vary considerably depending on the border region, actors involved and the envisaged application:

- **Type of service:** Some rather simple or standard services such as cross-border bus lines often require only minimal formalities, whereas advanced or new state-of-the-art services such as integrated traffic management centres require huge hardware investments and thus usually require a high level of formalities.
- **Number and composition of actors involved:** If only two actors are involved (one from each side of the border), which by chance already know and trust each other,

a “gentleman agreement” may be sufficient to agree about the cooperation; on the other hand, the more actors are involved and the larger their organizations are, the higher the degree of formalisation usually is. Moreover, if actors have different professional backgrounds (for example, because responsibilities are different in both countries), this could also lead to a complication of formalities.

- **Infrastructure investment needs:** Some services require prior infrastructure investments. The higher these investments are, the higher are often the administrative requirements and thus the formalisation needs.
- **Complexity of the service to be provided:** The more complex the provision of a service is, the higher usually is the level of necessary agreements and formalities to conclude.
- **Scope of the service and size of the target group:** The larger the scope of the service and the larger its potential target group is, the more integrated models should be applied.
- **General status of cooperation:** If a cross-border cooperation is to be set up for the first time by implementing a CPS, it is advisable to start on a small scale with a minimum degree of formalisation. In the event of failure, the service could be easily unwound. If partners have been practicing mutual cooperation for a long time and trust each other, one can directly think about a higher degree of integration and thus formalisation.
- **Experience with cross-border cooperation and mutual trust:** If the actors involved already gained experiences in cross-border cooperation and trust each other well, a lower level of formalities and administrative setup may be required compared to cases where actors don't know each other and have only little experiences in cooperative service provision.
- **Common perception of problem(s) addressed:** Reaching a common perception about the problems to be addressed with the CPS among all involved actors helps to reduce formalisation needs; in contrary, if there is a partly or large mismatch in these perceptions, differences should be solved by appropriate formalities.
- **Indirect effects:** If the envisaged service will have indirect effects on third parties that are not directly involved in the service delivery, an appropriate level of

formalisation should be sought of. Examples are CPS in health care (with effects on health insurances) or labour market CPS (with effects of course for the employers).

- **Costs for service provision:** Actors should put higher emphasis on administrative and formal frameworks, the higher the costs for the provision of a service are.

The following overview (Figure 36), summarizing the above criteria, can be used as a check list for planners in border regions to determine the level of formalities when intending to develop a new CPS. The criteria can be grouped into factors related to the envisaged service itself, to the actors involved, and to the expected impacts of the service. The more check marks are ticked on the right-hand side, the more likely it is that a higher degree of formalization should be considered, and vice versa.

Figure 36. Required degree of formalisation: check list.

		Recommended degree of formalisation	
		low	high
Criteria related to envisaged service itself	Services type	● simple standard	● advanced new
	Services complexity	● low	● high
	Service scope	● small	● extensive
	Provision costs	● low	● high
Criteria related to actors involved	Number of actors	● few similar	● many different
	Organisation types	● small	● large
	Mutual trust	● high	● low
	Cooperation experience	● limited	● experienced
	Cooperation status	● advanced	● beginning
	Common perception	● consistent	● mismatching
Criteria related to „outside world“	Investment needs	● low	● high
	Target group(s)	● small homogenous	● large diverse
	Indirect effects	● limited	● considerable

5.4 Practical Guide – How to implement a CPS in Transport?

As the empirical results of the ESPON CPS project have shown, there is no linear way in developing a new CPS, because existing framework conditions in border regions are very diverse: Some regions already enjoyed a long history of cross-border cooperation and may have already implemented CPS in certain fields, while in other regions the CPS instrument is still unknown and partners will have to come together. In other cases, the scopes of potential CPS were already defined (for example, in regional development strategies), while other regions only start to agree about common problem perceptions.

5.4.1 Building blocks to be addressed

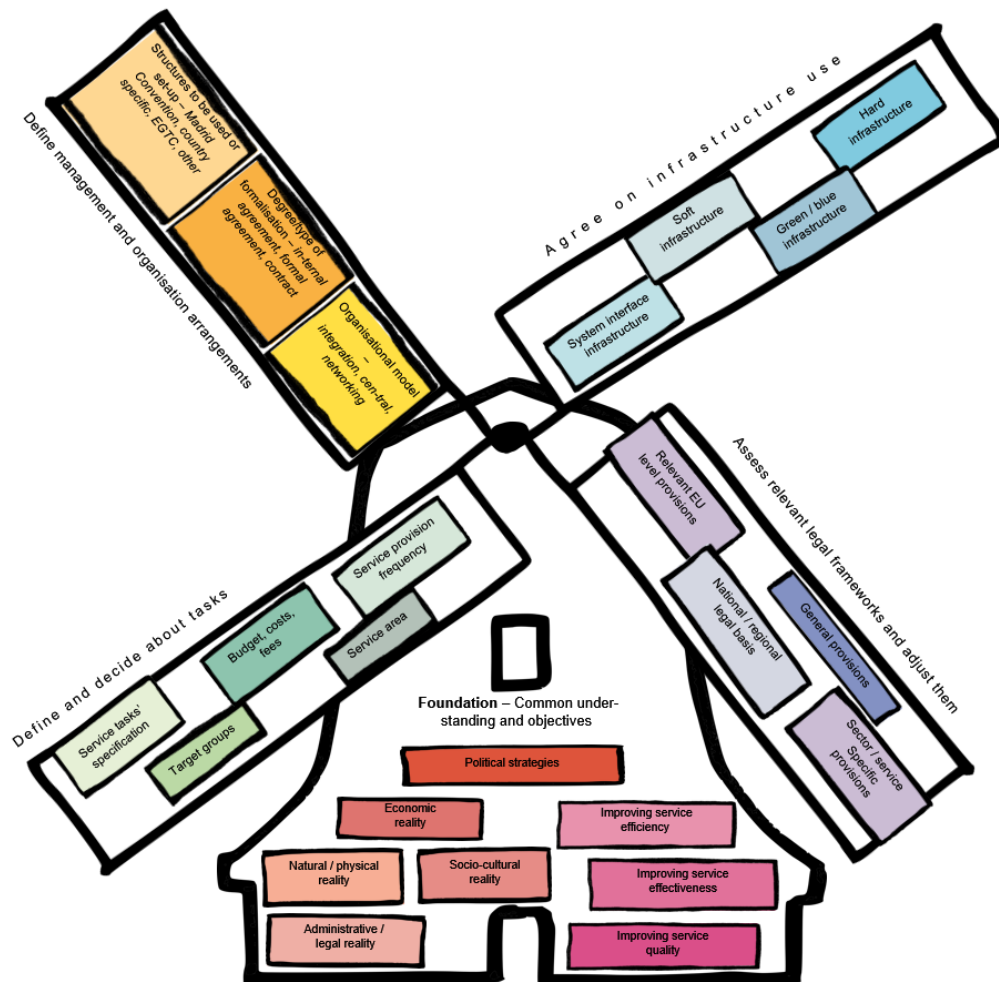
Therefore, instead of thinking in a ‘linear way’ to develop a CPS it is advisable to think of interlinked ‘building blocks’ that need to be addressed when implementing a CPS. For this purpose, the ESPON CPS project developed a ‘windmill model’ to illustrate the necessary building blocks (Figure 37).

Five essential building blocks have been defined:

1. **Foundation - Common understanding and objectives:** In this block, the stakeholders in border regions should reach a common understanding about the problems, challenges and development opportunities, depending on the economic, socio-cultural, natural and physical, and administrative reality in their border region. In order to identify the objectives of the envisaged CPS, these border realities, together with the existing political strategies, determine the scope and focus of the service to be implemented. Objectives could be to improve service efficiency, service effectiveness, service quality, or to address service gaps and to better match service needs of the intended target group(s).
2. **Define and decide about tasks:** In this building block, the stakeholders need to identify the target group and service area, need to specify the task(s) of the service, identify or determine the available budgets, costs and fees for the service, define the provision frequency of the service and other essential characteristics of the service.
3. **Define management and organisation arrangements:** Here, stakeholders have to agree about the structures to implement, the degree of formalisation required and select the desired organisation model (i.e. networking model vs. integrated models).

Some border regions may rely on existing organisation models to develop further CPS, while in other regions new models have to be set up.

Figure 37. Building blocks for CPS development.



Source: ESPON CPS, Zillmer and Holstein, 2018

- 4. Agree on infrastructure use:** Stakeholders have to identify the required soft, hard and green/blue infrastructures that are required to provide the envisaged service, as well as the necessary system interface infrastructures. They also have to identify which partner can provide these infrastructures and have to decide practicalities, for instance who is responsible for infrastructure maintenance. For instance, if partners want to establish a new cross-border bus line, they have to define who will provide the required busses and who will be responsible for bus maintenance.

5. **Assess relevant legal frameworks and adjust them:** The necessary legal basis for the CPS needs to be discussed. Depending on the type of service, relevant EU level, transnational, national or even regional provisions, sometimes also sector or even service-specific provisions may apply. In some cases, these higher-level provisions need to be adjusted to the local conditions. In some policy fields, however, no such provisions are in place, so that border actors can rely on simple contractual arrangements.

Detailed descriptions of these five building blocks and further recommendations are given in the practical guide developed by the ESPON CPS project.

These building blocks are useful to check what is required and also what is possible to set up a new CPS, keeping in mind that not all aspects are similarly important for all border regions and for all use cases.

5.4.2 Empirical evidences

From the empirical works, some typical challenges have been identified that all border regions face at some point when implementing a CPS (see following box). At the same time, the listed challenges provide further valuable guidance on key indicators or key elements to be considered when developing a CPS.

You are not alone - typical challenges when developing a CPS:

- Problems in mobilizing stakeholders (lack of political will or lack of commitment)
- Unbalanced distribution of benefits or costs
- Uncertainty in assessing the likely (positive and negative) effects of a CPS
- Uncertainty in assessing demand for a CPS
- Price and service levels differ in both countries
- Quality standards or technical norms differ in both countries
- Scarce available budget (all partners or only one partner)
- Significant cost differentials between the countries
- Lack of (clear) legal basis
- Cultural and language barriers between the countries
- Unclear competences in the countries or change of responsibilities
- Changing external factors during implementation process

The existing CPS in Europe demonstrate a wide array of potential solutions to each of these challenges. The most successful CPS often manage to generate benefits from these challenges. For example, cost differences could be exploited to build a service on that side of the border where costs are lower, while taking advantage of the higher standards of the other country. Or the lack of specific legal requirements could be exploited to design a service in a way that works best in the border region, without having to take into account the overall (legal) framework.

Other lessons learnt from the empirical survey conducted in ESPON CPS are:

- When designing a CPS, actors should foresee some **flexibility** in the implementation, delivery and management models. As regards the implementation options, actors should keep in mind that there is no right or wrong solution; rather, they should identify options that best meet the needs of the border region (**tailored solutions**).
- Representing one of their greatest advantages, CPS are **evolvable and dynamic**, i.e. they are not considered to be “ready” at any time. Actors are advised to start with low hanging fruits, and, if the first CPS operates successfully, then further develop the active CPS or, departing from that, develop new CPS (**grow and extend as needed**).
- As one of its fundamental characteristics, CPS are developable and manageable by **regional actors**. The most successful CPS were bottom-up approaches. It is advisable not to start the implementation process with the discussion of legal issues, but rather with the scope of the intended service.
- The **political will** and the **mutual commitment** of the border actors are the most important factors for CPS development. Without these two, CPS development will fail. If there is a will to develop a service, regional actors should of course appreciate any support by higher-level or national governments, but they should not wait for it. Instead, they should **just start**. Geographical specificities such as the Baltic Sea or other challenges should be considered as a chance rather than an obstacle for CPS development; such specificities provide options to develop **specialized, unique services** that in many cases won't be offered by private sector.

5.4.3 CPS and Interreg

As per definition, CPS are not a project, and a project cannot be a CPS. Therefore, Interreg projects or Interreg secretariats can't be considered as a CPS. Nevertheless, CPS and Interreg are interlinked in several ways:

1. **CPS sustain Interreg projects:** Here, a CPS is a successor of an Interreg project, thereby sustaining the project. CPS is thus a means to perpetuate temporary restricted Interreg projects (or parts thereof).
2. **Interreg develops foundations for a CPS:** Here, an Interreg project is strategically used to finance and/or develop the foundations for a CPS. In this sense, foundation could represent to build required hard infrastructures such as border bridges, buildings and others, or any required soft and green/blue infrastructures or even the legal basis for the CPS.
3. **CPS supports future Interreg activities:** CPS might be set up in a way that they support future Interreg activities. For example, a CPS on cross-border spatial monitoring system can identify needs or potential of future Interreg projects.

Consequently, this means that wherever possible the development of CPS and Interreg projects should be thought of together, as both complement each other well when properly planned.

The new Interreg regulations proposed by the European Commission in 2019 stress the importance of “functional linkages” within border regions. Establishing CPS in transport could be a mean to fulfil this objective and indeed to strengthening the functional linkages. The proposed regulations furthermore highlight the “5+1” policy priorities, among them

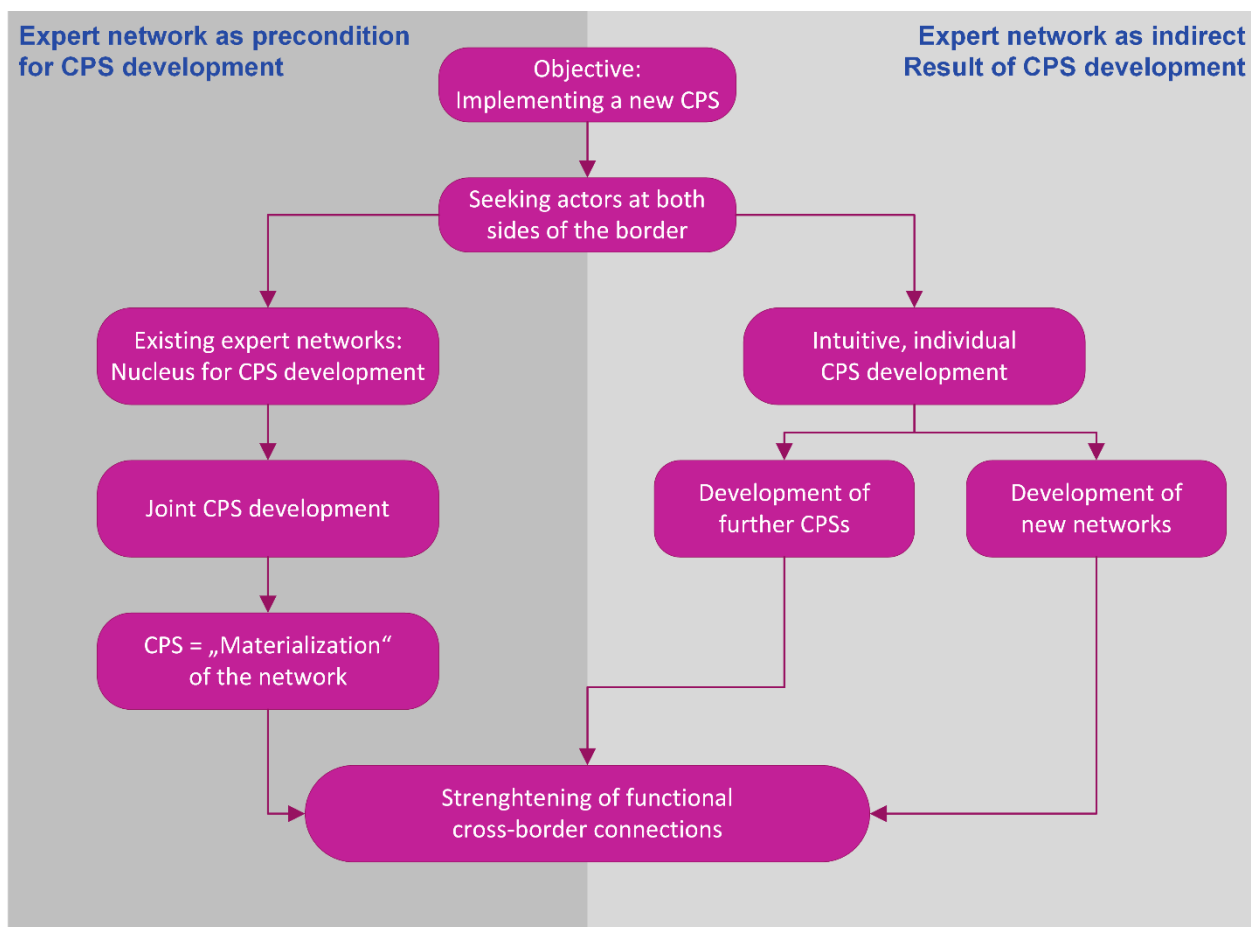
- PO 2 - Energy and risk prevention
- PO 3 - Transport
- PO 4 - Health and education
- Interreg PO - Governance

The CPS inventory shows that good practice examples of CPS already exist for all these policy objectives which could be taken as starting points for developing further CPS.²³

Furthermore, Interreg and CPS together could jointly act as a facilitator for the promotion and implementation of experts' networks in border regions (Figure 38). If border regions intend to develop a new CPS, they usually start with seeking actors at both sides of the borders. Either, existing networks of experts could act as a nucleus for this CPS development, or a new CPS will be developed which, as a side effect of its implementation, will also create a new network of experts.

Either way, in the end the visible CPS and also the new expert network will strengthen functional cross-border connections.

Figure 38. Facilitation of experts' networks through CPS development.



²³ The ESPON CPS project compiled 29 good practice fact sheets in eight thematic fields, giving inspiration to interested border regions.

5.5 CPS for Cross-border Tickets

Regions Pomorskie (Poland) and Blekinge (Sweden) are currently discussing the introduction of a cross-border PT-ticket allowing public transport users to travel by ferry across the Baltic Sea from one region to the other, thereby being allowed to use regional public transport services within both regions with the same ticket. In consequence, the user just needs to buy one ticket and can then, for example, travel from Sopot to Karlskrona. As shown, such integrated cross-border tickets are a typical application for a CPS.

As part of the implementation process, the following questions needs to be addressed by the stakeholders:

- (1) Actors involved
- (2) Preferred implementation model
- (3) Addressed target group(s)
- (4) Provision of vehicles
- (5) Options for selling tickets
- (6) Ticket price
- (7) Ticket conditions
- (8) Scheduling
- (9) Share of costs and revenues among the actors
- (10) Formal requirements
- (11) Division of responsibilities

The following sections provide examples of possible solutions or options for the issues raised. These solutions do not claim to be exhaustive; it is possible that the actors involved will develop further solutions that are even better adapted to their needs.

#1	Actors involved
	In any case, Regions Blekinge and Pomorskie, the cities of Gdansk, Gdynia, Karlskrona and Sopot and the ferry companies must be involved. In addition, the Polish and Swedish railway companies may also be involved. Depending on the options for tickets sales (see below), further partners such as special ticket offices may also be invited to participate in the CPS.

#2 Preferred implementation model

Two implementation models seem possible:

- (a) Network model: each partner remains independent. In this model the partners may establish a steering group (one or two persons per partner) responsible for the design, implementation, and managing of the CPS.
- (b) Integrated model: the partners establish a new organization that is responsible for introducing, managing and selling the tickets, i.e. this organization takes over complete responsibility for the CPS. Such an organization could for instance be implemented as an EGTC.

#3 Addressed target group(s)

The ticket may address different target groups such as tourists, workers (in particular weekend commuters), as well as the general public. Depending on which target group the actors focus on, ticket prices and conditions must be adjusted accordingly to the respective needs of that group (see below). If more than one target group is to be addressed, the partners should consider introducing different types of tickets with individual prices and conditions (such as weekend tickets compared to daily tickets).

#4 Provision of vehicles

The integrated ticket should allow the users to travel from any place in Region Pomorskie to any place in Region Blekinge (and vice versa), so regional and local PT as well as ferry transport will be involved in the trip chains. The necessary vehicles (busses, trams, ferries) will be provided (and maintained) by the partners. Each partner remains responsible for vehicle maintenance, upgrade and procurement.

#5 Options for selling tickets

Different options for ticket sales could be implemented, such as:

- *Central approach*: The ticket is only available from one partner such as the ferry company. While this approach may reduce the administrative overhead for all partners, potential users may not be fully satisfied if usually they buy their PT tickets through other channels.
- *Distributed approach*: Each CPS partner sells the tickets via his regular channels. While this approach probably corresponds to the user's expectations, it may cause additional overheads for the partners.
- *Integrated approach*: The cross-border ferry ticket is included in regular monthly or annual PT tickets, or integrated in other offers such as tourist cards. This approach probably provides the biggest incentives to PT users, because they would now be allowed not only

to use the PT services in their home region, but also fully benefit from the entire PT services in the other region. However, this approach would benefit local residents and disadvantage guests such as tourists, as the latter ones usually don't have a monthly or annual PT ticket.

- *Special distribution channels:* The partners may also decide to sell the tickets via specialised and newly established channels such as special websites. This solution would require rather high marketing and promotion activities in order to promote the new channel.

Any combination of these options may also be selected by the partners, or the partners decide to start with one option (for example, the centralized approach), and add further channels at later stages.

#6 Ticket price

The biggest challenge in identifying the ticket price in a cross-border context is how to cope with different income and price levels of the countries concerned? Shall the same price be issued, whether the ticket is bought by Polish or Swedish people? Or shall different prices be applied like in the case of the Elbe-Labe ticket? An elegant solution to this challenge would be to use the integrated ticketing approach (the integrated tickets can then be still sold by using the price differentials as today).

Apart from this fundamental question, it also needs to be discussed whether special fares for certain groups such as kids, students, elderly, handicapped etc. apply. This very much also depends on the target group(s) the partners are focussing on. The answer to this question would be different if the main target group are weekend commuters, compared to tourists.

#7 Ticket conditions

In addition to the ticket price, the ticket conditions need also to be fixed. As part of this step, the temporal and spatial validity of the ticket need to be discussed, and also which kind of PT services can be used (all busses, trams and trains, or only bussed and trams, or even only special buses?). Also, a combination of the PT service with other tickets such as tourist cards could be discussed.

In any case, the partners need to ensure that the agreed ticket conditions correspond to the addressed target group, ticket sales strategy and the ticket price.

#8 Time tables / scheduling

As the ferry services across the Baltic Sea are the crucial bottleneck of this CPS (in terms of number of daily crossings and duration of crossing), the arrival and departure times of the feeder services in Blekinge and Pomorskie must be well coordinated with the ferry timetables in order for the CPS to be a success. People will complain (and not use the ticket anymore) if the services are poorly coordinated.

#9 Sharing of costs and revenues

Costs and revenues of the CPS shall be shared proper and fair among the partners, reflecting the responsibilities and efforts that each partner provides to run the service. Price differences and different purchasing powers so as currency differences and fluctuations may make it difficult to distribute the expenses and revenues fairly.

#10 Formal requirements

Since the main objective of this CPS is to simplify the movement of people across the Baltic Sea, it complies with one of the fundamental principles of the European Union and thus does not violate EU regulations.

The formal requirements, however, very much depend on the selected implementation model (see above). If the network model is selected, a contract between all partners may suffice; in contrast, the integrated model would require a much higher degree of formalisation.

#11 Division of responsibilities

The partners need to discuss and decide about the division of responsibilities among themselves. This is particularly important if the network model is selected. The allocation of responsibilities should also reflect the division of costs, revenues and efforts for the service provision, as borne by every partner, and vice versa.

Actors should keep in mind that different solutions are possible for each issue addressed above, which means that tailor-made solutions should be found with which all partners are satisfied and which are supported by all partners. The found solutions should also allow for a certain flexibility, enabling the CPS to evolve and grow over time.

The described example of cross-border PT tickets is only one possible CPS within the transport sector in the South Baltic Sea region. Further services could address

- Transport services: seamless bus or rail connections
- Combined mobile apps (working transnational in all major cities in the area)
- Establishing joint PT planning and transport authorities (to better plan and organize cross-border PT)
- Joint procurement of vehicles, spare parts and other goods (to increase efficiency and reduce costs and develop and set joint standards)

Beyond transport, CPS may also be developed in other policy fields such as tourism, culture, education, spatial planning, labour market, environmental protection and civil protection.

Obviously, CPS are only one instrument to implement such activities; EGTCs and Interreg projects would be other options, or any combination of the three.

6 Summary and Outlook

This report highlighted the need for two public transport planning tools and has demonstrated how they could be integrated into the A-B-C-D planning process. The first tool is designed to compare the performance of the public transport sector with those of other cities and regions, thereby identifying its weaknesses and strengths. The second tool aims to support planners in identifying and selecting appropriate measures to improve public transport. The report contains detailed illustrated manuals for both tools on how to use them.

Both tools are available for download on the INTERCONNECT website. In order to achieve a broad user base of the tools, it is also suggested to register them on the CIVITAS website as part of the CIVITAS Urban Mobility Tool Inventory²⁴. That said, both tools are available in a first version. The self-evaluation tool could be further expanded in the future, e.g. by adding further indicators and additional evaluation options, or by incorporating a broader set of cities for comparisons. The catalogue of interventions should be continuously maintained, for example by adding more solutions or by adding new fact sheets and updating existing ones. In addition, the catalogue should be converted from an Excel tool to a completely Internet-based system in the medium term, so that the user experiences much better filter and search options than it is possible with Excel. Also, in a web system direct links between the catalogue and the fact sheets can easily be established.

The responsibility for the continuous updating of the two tools is currently still unclear. The INTERCONNECT partners should agree on who will take over this task in the future. Otherwise there is a risk that the tools will quickly lose their actuality and thus their usefulness and relevance.

As the planning and implementation of cross-border transport projects is even more complex than transport projects in a single region, involving partners, experts and stakeholder groups from two, three or more countries, the report also presented the concept of Cross-border Public Services (CPS) and their potentials in the transport sector. It is based on recent empirical results of the ESPON CPS project. The INTERCONNECT

²⁴ See <http://civitas.eu/tool-inventory?page=1>

project partners may use these guidelines to develop CPS in the South Baltic region, for instance, for the development of cross-border public transport tickets, which is one of prominent examples of using CPS in transport, as the CPS inventory showed.

On the basis of the information available, the INTERCONNECT partners should decide whether a CPS would be a viable way to implement cross-border ticketing systems, and what steps should be taken next.

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8 Annex

Table 5. Proposed performance indicators and their usage in related studies.

Indicators	UNECE	EMTA	TAC	TERI	EUROSTAT/JRC	Sdoukopoulos	EcoMobility	Gudmundsson	WBCSD	CIVITAS	
Sustainability											
Share of e-buses											
Share of low emission vehicles				✓	✓		✓	✓			
Average CO2 emission	✓		✓	✓			✓	✓	✓	✓	
Share of PT trips	✓	✓	✓	✓	✓	✓	✓	✓		✓	
Average fuel consumption			✓	✓							
Average age of bus fleet	✓			✓		✓					
Social inclusion											
Share of low floor buses				✓							
Bus stops per inhabitants	✓	✓				✓	✓	✓			
Share of special fares	✓	✓									
Average ticket price	✓	✓		✓				✓	✓	✓	
Average distance to next bus stop				✓			✓	✓	✓	✓	
Share of population living in close proximity of PT services				✓			✓	✓	✓		
Traffic and safety											
Accidents per vehicle-km	✓			✓	✓	✓	✓		✓		
Fatalities per inhabitant	✓		✓	✓	✓	✓	✓	✓	✓	✓	
Average trip length by car			✓	✓	✓			✓	✓	✓	
Average journey time to work			✓	✓	✓			✓	✓	✓	
Length of mass transit per inhab.	✓	✓	✓	✓	✓	✓					
Efficiency											
Ratio bus fleet / employees	✓										
Ratio passengers / vehicle-km		✓			✓						
Average occupancy rate				✓					✓		
Cost-fare revenue ratio		✓	✓							✓	

Sometimes the above listed indicators vary in name, definition or way of standardisation in the different studies. The indicator “share of e-buses” has not been used in any study since electric propulsion is quite a new technology.

Table 6. Comparison of fields of interventions of the catalogue tool with the signature issues identified by INTERCONNECT stakeholders.

Catalogue tool: Fields of interventions	Signature issues identified by INTERCONNECT stakeholders ²⁵
Business model	Business models
Comfort	Behavioural aspects
E-mobility	Renewable energy
Hydrogen mobility	Renewable energy
Information and communication	Information system
Intermodality	Infrastructure and technical facilities
Maintenance	Infrastructure and technical facilities
Marketing / promotion	Behavioural aspects, Information system
Monitoring	Management schemes
Organisation	Organisation structures, management schemes
PT planning	Urban-rural linkages, cross-border solutions, behavioural aspects
Rolling stock and propulsion / powertrain	Infrastructure and technical facilities
Ticketing	Ticketing
Timetables	Urban-rural linkages, cross-border solutions, behavioural aspects

²⁵ These issues correspond to the policy conclusions of INTERCONNECT Deliverable 3.1 (see Mazouzi et al., 2018, Chapters 3 and 6)