SUSTAINABLE URBAN MOBILITY AND COMMUNTING IN BALTIC CITIES

INTERMODALYZER

A BENCHMARKING SCHEME TO ASSESS THE CITY'S TRANSPORT SYSTEM WITH REGARD TO INTERMODALITY

SUMBA

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1. INTRODUCTION

A well-developed and connected local and regional transport system with a greater role for public transport, cycling, walking and new mobility concepts will help to make transport more sustainable and persuade users to shift to environmentally friendly modes of transport. This will improve the quality of life in cities by reducing local emissions, congestion and, in the long term, changing the urban design by redistributing transport space.

New and emerging mobility concepts such as car and bike sharing, ride hailing or ride sharing, new information and communication technologies and the increasing integration of public transport enable to combine different forms of transport modes on one route, called intermodality, and are seen both as an opportunity for a sustainable transport system and as a way to improve the accessibility of areas in a cost-effective way. However, these opportunities are countered by a lack of infrastructure, supply and information and financial/tariff links between the transport modes as well as the differing interests and administrative responsibilities of the actors involved.

The project SUMBA (Sustainable Urban Mobility and Commuting in Baltic Cities) addresses these problems and develops transferable approaches for the analysis, evaluation and more sustainable design of transport with a focus on the creation of intermodal transport services for commuter relations. Not only within the Baltic Sea region cities have different strengths and weaknesses in this area and can learn from each other. A starting point for cities is to see how they are positioned in the intermodality issues and which cities may have better addressed certain issues. The Benchmarking scheme at hand, called INTERMODALYZER, serves this purpose and will enable cities and metropolitan regions to evaluate their transport systems with regard to intermodality and identify potential for improvement.

1.1 Objective of the Group of Activity “Developing a benchmarking scheme”

The objective of the Group of Activity (GoA) 2.5 “Developing a benchmarking scheme” was to develop a set of indicators for the evaluation of a city’s transport system with regard to the intermodal combination of different modes of transport. The main target group are urban and transport planners, politicians and other experts in the field of transport. It was therefore an important objective that the target group should be able to evaluate their cities themselves and that the scheme should not just evaluate a pre-selected number of cities against each other. This has an impact on the methodology, the choice set of parameters and their characteristics. Furthermore, the scheme is intended to serve as an entry-point to better transport planning by taking intermodality into account as well as to raise the professionals’ awareness for this topic. Therefore, the main focus was on an easy application of the evaluation scheme to assess the general situation regarding intermodality without extensive data research or data collection. This has implications both for the number and depth of detail of the individual indicators and for the diversity of the issues to be addressed.

The process of benchmarking involves comparing performance against similar institutions, organisations or companies to gain some understanding of best practices within a particular topic. Benchmarking therefore also enables the identification of best practice solutions and is only the first step in the improvement process. Within the project and its second work package (WP2) the benchmarking scheme is also the first step in the cities’ process and is complemented by a more intensive SWOT analysis as well as a collection and analysis of existing solutions.

1.2 Scope of the study and limitations

As mentioned above, the benchmarking scheme aims to address the issue of intermodality in passenger transport and focuses on topics that address the combination of different modes of transport as well as the change of modes. Accordingly, topics such as commercial transport and the conditions for individual modes of transport (e.g. cycle paths) are not addressed, knowing that the desired modal shift is also dependent on such aspects. However, as discussed in chapter 3.2, a number of benchmarking schemes that focus on aspects for specific transport modes already exists.

Mobility behaviour and the underlying decisions are very complex and subject to a wide range of individual decision parameters. Criteria are weighted differently by the users. The present comparative index cannot and does not intend to weight the indicators; rather all criteria are equally weighted. The authors are aware that for example the aspect of political climate thus counts as much as having an integrated ticketing system. However, the index does not claim to be able to quantify a link between individual indicators and possible changes in mobility behaviour.

Furthermore, public transport is subject to constant change. New travel modes and business models are emerging, making it increasingly difficult to identify a boundary between public and private transport. In this paper, however, the integration of different modes of transport and aspects of intermodality are discussed in general terms and are not necessarily limited to the current conventional modes of public transport. Moreover, the scheme offers the possibility to add new aspects without having to redesign the evaluation scheme in its entirety.

1.3 Working method and the structure of the document

The benchmarking scheme was developed in an iterative process involving the project partners and further experts. Based on an extensive literature research, the analysis of existing indices and the insights from the SWOT analysis (GoA 2.2), a potential first set of indicators has been identified. The aim was to use mostly quantitative indicators. An examination of data availability in the partner cities revealed that, on the one hand, data availability was neither given in all cities nor on the same level of detail and, on the other hand, the partner cities are very heterogeneous among themselves. One of the objectives in the selection of indicators was to make the evaluation scheme as easy as possible to use without intensive data processing or data gathering, and to enable interested parties to carry out the evaluations themselves.

Based on these requirements, the topics to be covered and their correspondence in indicators were developed in further steps and presented and discussed at project and expert meetings. This document presents the results of this process in the form of the selected thematic areas and indicators. The document is structured as follows: Chapter 2 provides a definition of terms and a short overview of relevant aspects for intermodal users, chapter 3 shows how the indicators have been selected and then presents them in chapter 4. The results of the partner cities are presented in chapter 5 and chapter 6 gives an outlook on the further procedure. The report concludes with a detailed presentation of the background and ways of evaluation for each indicator along with a scorecard for interested cities (chapter 7).

2. INTERMODALITY IN PASSENGER TRANSPORT

To enable cities to assess their transport system in terms of intermodality, this chapter provides a definition of intermodality together with background information on relevant aspects from the user's perspective.

2.1 Multi- and Intermodality – Definition and delimitation

The terms multimodality and intermodality will often be used interchangeably, but it is useful to highlight the difference. Multimodality is defined as the use of different means of transport during a given period of time such as a day or a week (Ahrens et al. 2010; Chlond 2013). Intermodality, on the other hand, is a special form of multimodality, defined as the combination of different means of transport on a single journey (Jones et al. 2000). A particular focus of intermodality is therefore the change from one mode of transport to another, whereas this is not relevant for multimodality (Beutler 2004; Von der Ruhren and Beckmann 2005). Furthermore, there are different interpretations as to whether the combination of different public transport modes such as bus and tram should be considered as intermodal transport. Consequently, the degree of intermodality depends on the definition of intermodality used (Jarass and Oostendorp, 2017).

In the SUMBA project, we understand a combination of at least two public transport modes (e.g. bus and tram) as intermodal transport, since the required transfer is a key element of intermodality, as suggested by authors such as Diaz Olvera et al. 2014; Gebhardt et al. 2016; Yeh 2008. As the use of public transport always includes walking, at least five minutes are required to include walking as a separate means of transport that can be part of an intermodal journey (Diaz Olvera et al. 2014).

2.2 Relevant aspects for intermodal users

The use and combination of different means of transport on a single route is not an end in itself, rather, the benefits must outweigh the negative effects such as distances to be covered, waiting times and requirements regarding orientation (Preisendörfer and Diekmann 2009). In order to choose intermodal transport connections despite these negative aspects, reliability, short waiting and travel times, flexibility and time efficiency are therefore important criteria for users. The main quality criteria for intermodal transport connections are smooth and time-efficient journeys, e.g. short distances between means of transport, short waiting times and reliable connections. In addition, the literature also describes characteristics related to the conditions at the transfer point such as safety, information or comfort.

With a focus on intermodal travel behaviour, the DLR Institute of Transport Research conducted an empirical study in various districts of Berlin in 2016 with about 1000 responses (n=1,098). The results underline the above criteria by adding the following results (Oostendorp and Gebhardt 2018):

- Purpose of the journey: The daily use of intermodal combinations is particularly high for work and educational trips, and to a lesser extent for leisure activities, partly because these do not take place daily;

- Spatial aspects: No significant spatial differences were found in the total proportion of people making intermodal journeys, but the combination of bicycle and public transport attracts more users in urban areas, while the use of the car in combination with public transport is significantly higher in suburban areas;

- reasons for intermodal driving behaviour: Travel time and (time-efficient) access to the main transport mode are important reasons for choosing intermodal combinations, e.g. the combination of bicycle and train;

- Combination of bicycle and public transport: the “flexible use” of this combination is appreciated by users. For one third of these users, the possibility of using bicycles within public transport is the reason for using this intermodal combination, as it allows flexibility at both origin and destination;

- Combination of car and public transport: the main reasons for choosing this combination were “flexible use” and “few changes needed”, what in turn underlines the key factor of accessibility of public transport (see above);

- Transfer possibilities: The majority of all respondents rated reliable connections, short waiting times at the transfer point and short transfer distances as very important. Aspects such as safety, information, weather protection, cleanliness and existing alternative connections were rated as very important or important by more than 50% of all participants. Unexpectedly, car or bike sharing facilities are of very little importance.

In selecting the indicators for the assessment scheme, these research findings were taken into account and are indirectly reflected in individual indicators. A one-to-one mapping of the aspects was not expedient with regard to the objectives.

3. BENCHMARKING SCHEMES

The following section provides an overview of the methodology of benchmarking and existing benchmarking schemes in the context of urban mobility.

3.1 Background information

The concept of benchmarking, first introduced in the Japanese economy after World War II and further developed as a management tool by Xerox Corporation in the 1970s, is used by many private and public organizations and companies. In the simplest terms, the process of benchmarking is about comparing a performance on a number of measures in relation to a carefully selected benchmark. It aims to show advantages and deficits in comparison to competitors or similar organisations and thus also to identify issues requiring change and the scale of potential improvement. Furthermore, possible best practice solutions can be derived.

Especially in complex processes like transport, there is an interest in measuring both, status and progress towards the overall objectives with a multidimensional set of indicators. With regard to transport, other important aspects of comparative studies include the ability of cities to assess and to monitor their transport policies and to fulfil their regulatory role, the ability of urban transport service providers to identify performance gaps and to set targets and measures to close them, and the ability of citizens, governments and service providers to gain greater credibility through better information and more transparent and comprehensible decision-making (Worldbank 2011). Moreover, benchmarking also provides awareness regarding the overall topic which is a main goal within the project SUMBA.

However, there are also concerns about such benchmarking schemes. Aspects such as a further increase in competition between different stakeholders, the (subjective) selection of indicators, and the lack of correlation between the selected indicators and the overall objective are criticised. Despite these criticisms, rankings can open up opportunities for cities to identify and assess their potential for improvement and to sharpen their profile vis-à-vis other cities.

3.2 Existing benchmarking or assessment schemes

In order to get an overview of existing evaluation schemes as well as to avoid a possible parallel development of a benchmarking scheme with focus on intermodality, existing evaluation concepts have been researched in a first step. The focus was both on the overarching question and on the degree to which aspects of intermodality were represented. As a result of this research, it can be stated that a large number of evaluation schemes related to transport already exist. The spectrum of what is evaluated ranges from rather global perspectives such as livable cities and sustainable urban transport to rather small-scale perspectives on individual means of transport such as cycling or walking. Intermodality always plays a certain role in the context of these assessment schemes even if it is not directly addressed. An integrated transport system that enables intermodal route chains is seen as an essential component in the creation of sustainable transport systems. However, aspects directly related to intermodality are missing in the corresponding indicator sets or are rather considered on a highly aggregated level. On the other hand, suitable sub-networks of transport modes are important for the establishment of intermodality, e.g. a well-developed network of cycle paths is essential for the use of the bicycle on some sections. For a comprehensive research on such schemes and a collection of indicators see Litman 2016. The present benchmarking scheme attempts to close this gap between the perspectives by focusing on the conditions for intermodality and the connection of different modes of transport and the transfer itself.

When evaluating these benchmarking schemes and the indicator sets, it becomes clear that even in part they are only of very limited use for the purposes of the SUMBA project. Many indices have in common that their application requires a high degree of data availability and data processing. Furthermore, certain indices explicitly refer only to metropolitan areas and are not necessarily

applicable to cities of different sizes and transport systems. This contradicts the objectives and requirements of the benchmarking scheme being developed as outlined in chapter 3.3.

3.3 Selection of indicators

The ambition when creating the benchmarking scheme was to obtain an easy to use benchmarking scheme, an independent application by interested cities without supervision, and an applicability for all cities in the Baltic Sea region and beyond, regardless of their conditions. Against this background, the following aspects had to be taken into account when selecting the indicators and their level of detail:

- Diversity of cities with heterogeneous conditions regarding urban environment, transport system, spatial structures and user needs,
- Evaluation of both the city and the functional urban area with the same set of indicators,
- Significant differences in data availability,
- Definition of a maximum value to evaluate against.

Against this background, the present study represents a conceptual work towards identifying a possible first set of indicators. It provides a framework, is openly structured and can be further developed and improved by adding supplementary indicators.

Intermodality, understood as the use of different means of transport on one route, requires an integrated transport system (see Olofsson, Z., Freij, K. B. 2017 for an in-depth analysis of integrated transport systems). As explained in Chapter 2.2, intermodality is not an end in itself, but the benefits must clearly outweigh the disadvantages of the changeover and the associated barriers. The more these barriers are removed or their perception is reduced, the more motivated the user is to travel intermodally rather than directly by car. The aim should consequently be to ensure that travelling by different modes of transport appears seamless to the user. Therefore, the motive for integration is the expectation that the quality for customers will be improved (and in a second step the frequency of use) if the barriers between the parts of the transport system are removed and synergies are created through coordination between them (May et al 2006).

Against this background, the starting points for the selection of possible indicators were the dimensions and aspects with regard to an integrated transport system identified in preparation for the SWOT analyses (Gade 2018). These were assigned possible indicators, evaluation guidelines and data sources and prioritised in their importance. The aim was to develop indicators that were quantitative and measurable, following the SMART principles (Specific, Measureable, Achievable, Relevant, Timebound), see Worldbank 2011 for more details.

These initial results were discussed and further developed with the partners in workshops at the project and expert meetings. Based on these results, the partner cities evaluated themselves in a first round and documented the data availability as well as the effort for data research. It emerged that data availability, data quality and level of detail are very heterogeneous and that the evaluation scheme can only be applied to a limited extent without monitoring. Furthermore, it became clear that the selected indicators considered individual means of transport rather than the combination of means of transport.

As a consequence, an even stronger focus was placed on aspects that are relevant for an integrated transport network and the process of changing over. This also includes abandoning the consideration of individual transport networks such as the bicycle network. The project partners are aware that the conditions in these transport networks are of great relevance for the integration of a certain transport mode into intermodal travel chains. However, sets of indicators already exist for sub-networks of the transport system, such as Copenhagenize for the bicycle-friendliness of cities. The proposed 12 indicators therefore focus on aspects related to intermodality within an integrated transport system and address different levels of integration.

4. THE INTERMODALYZER

The following chapter gives an overview of the categories selected for the INTERMODALYZER, a brief description of the indicators together with background information. A more detailed description of the indicators as well as evaluation and calculation options can be found chapter 7 of this document.

The study proposes twelve indicators that measure aspects related to intermodality in six categories as shown in Figure 1- Intermodal culture, intermodal planning, organisational integration, fare integration, information integration, and infrastructure integration. These categories result from considerations on which levels the conditions for an intermodal transport system must be achieved. For each indicator there can be a maximum of one point, in total the value 12 represents the current maximum of the evaluation scheme. The evaluation of the indicators is carried out on a case-by-case basis by selecting qualitative answers or in the form of a calculation scheme. A detailed description of the indicators and the basis of calculation are given in chapter 7.

The evaluation of a city can be carried out both for the city itself and for its functional urban area (FUA). It is recommended to carry out the evaluation for both, as different aspects have to be taken into account and the results and possible improvement potentials can vary considerably. The following is a brief introduction to the subject areas and the indicators summarised in them.

FIGURE 1 CATEGORIES INCLUDED IN THE INTERMODALYZER

4.1 INTERMODAL CULTURE

To implement a mobility transition towards a more sustainable, resource-efficient mobility and an integrated transport system, a strong political will along with an active and passionate political involvement as well as a support from the society is required. This is assessed by using the indicator **"Political climate"**. Furthermore, new and emerging mobility concepts such as car and bike sharing, ride hailing or ride sharing, new information and communication technologies and the increasing integration of public transport require a variety of preconditions in order to be successful. The indicator **"Preparedness for new and emerging mobility concepts"** reflects the extent to which the study area is prepared for this.

4.2 INTERMODAL PLANNING

Transforming the transport system and the transport behaviour of its users towards strengthening intermodal transport is a long-term process. Taking into account both planning times and the durability of the built environment, it is of great importance how and to what extent today's transport and urban planners address the issue of intermodality. This topic area is dedicated to this aspect. The indicator **"Preparedness for intermodal planning"** covers the extent to which the issue of intermodality is taken into account at the various administrative levels and departments dealing with (urban and transport) planning issues and the extent to which the necessary knowledge is available. In contrast, the indicator **"Strategic planning culture"** reflects the incorporation and priority of intermodality in the respective city's/area's strategic urban and transport planning documents.

4.3 ORGANISATIONAL INTEGRATION

Another essential aspect for the development of a well-integrated public transport system is the cooperation of all transport operators and mobility providers as well as the involvement of relevant stakeholders in the decision-making processes, especially when new service providers and mobility offers come onto the market. From the users' point of view, integrated transport is about the availability of a coordinated transport service across different transport modes, operators and administrative boundaries, which allows seamless travel and minimises the effects of changing modes of transport. Thus, the aim must be to remove possible barriers between modes of transport and providers. Accordingly, aspects such as sufficient information, secured connections or a coordinated tariff scheme are important to the users.

This requires a coordinated cooperation between different actors both within a city and between the city and its functional urban area, preferably by setting up an organisational unit to formalise cooperation, e.g. as a transport authority or association. This organisation combines several functions, responsibilities and jurisdictions of the involved stakeholders on several levels.

The indicator **"Coordinating institution"** addresses the cooperation of relevant actors in terms of the level of institutionalisation, the involvement of all relevant actors and the quality of the cooperation.

4.4 FARE INTEGRATION

Further elements of integration are the aspects related to the purchase of a ticket, represented by three indicators. The indicator **"Unified fare scheme across different means of transport and operators"** reflects the availability of a fare system across different modes and operators, as this is not yet widely implemented.

Cities and their hinterland belong mostly to different administrative units, and the same applies to cities within a metropolitan region. In connection with financing of public transport and the ownership of the operators, administrative boundaries can also represent tariff boundaries with the consequence that separate tickets have to be purchased for cross-border journeys. This potential barrier is addressed by the indicator **"Unified fare scheme across municipal borders"**.

The third indicator **"Integrated ticketing"** deals with the possibility of booking and paying for different means of transport using a single platform. The availability of a platform for an end-to-end booking or payment of the selected means of transport supports intermodal travel behaviour. Such platforms can be web-based solutions, an app or, as often possible, a (rechargeable) payment card, such as the Oyster card in London.

4.5 INFORMATION INTEGRATION

For the planning and realisation of intermodal travel chains, information and routing systems that support travel planning across different means of transport are very important. These systems must enable the user to select the means of transport to be considered individually. This means that the user must be able to decide which combinations are acceptable to him, e.g. public transport and bicycle or public transport, bicycle and bike sharing. The indicator **"Intermodal routing system"** therefore assesses the availability of such an information platform as well as how many of the available mobility options are represented.

4.6 INFRASTRUCTURE INTEGRATION

The last topic area deals with infrastructural support in linking the various means of transport. Within this topic area, indicators are used to evaluate the availability of existing transfer points and the design of new transfer points for established approaches such as Park & Ride **"Park & Ride interchanges"** and Bike & Ride **"Bike & Ride interchanges"**. The indicator **"Mobility hubs"** on the other hand deals with the more recent concept of mobility hubs as places of connectivity where different travel options – walking, cycling, transit and shared mobility – come together. They go beyond bimodal concepts such as Park & Ride or Bike & Ride. By providing an integrated package of mobility services, facilities and supporting technologies, they help to better connect high-frequency public transport with the travellers' point of origin or destination by offering on-demand travel options. The spatial concentration of mobility options offers the user the advantage of short distances when changing means of transport.

5. RESULTS FROM PARTNER CITIES

With the aim of achieving comparative results between the partner cities in the SUMBA project as well as testing the INTERMODALYZER, the partner cities have evaluated themselves.

Figure 2 shows both the overall evaluation of the cities, their functional urban area (FUA) and the average across all partner cities as well as the evaluations per topic area.

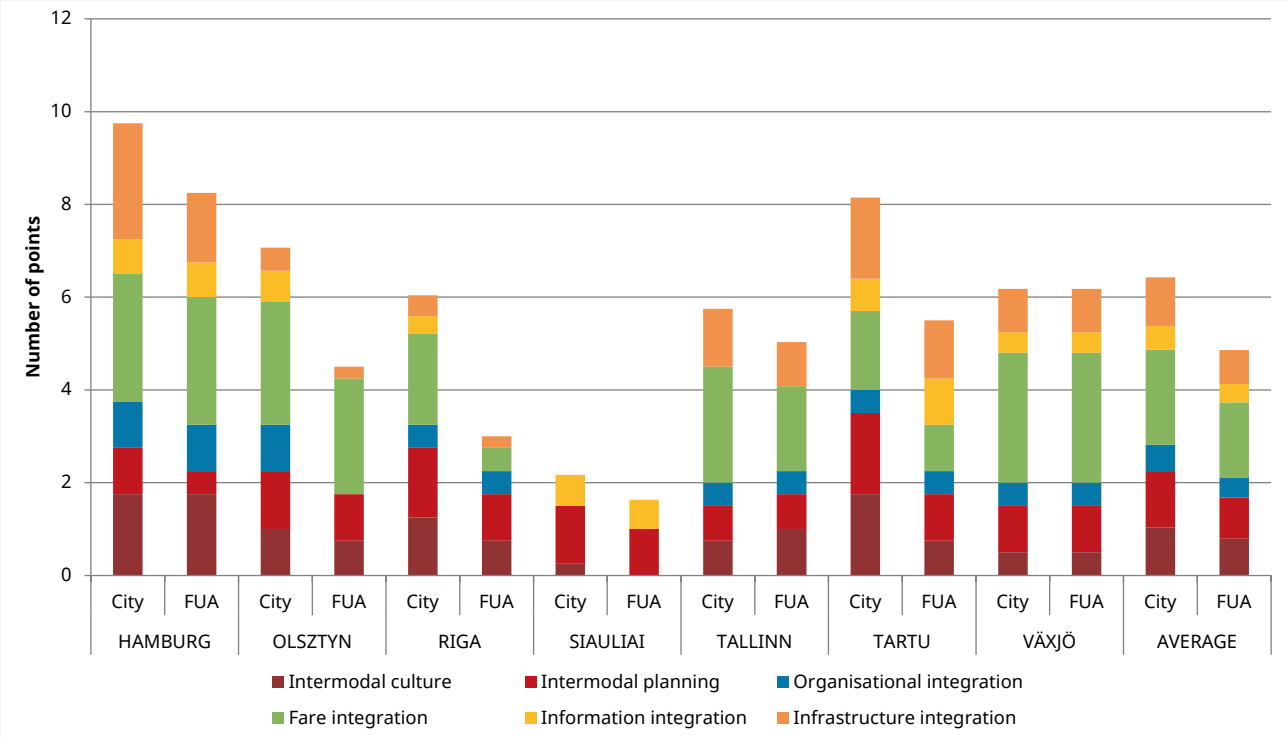

FIGURE 2 RESULTS FOR PARTNER CITIES

As shown in Figure 2, on average the cities scored 6.4 points, slightly more than half of the possible points, whereas the FUA scored 4.9 points across all agglomerations, which is significantly lower. The difference is particularly large in Riga, where the FUA scores only half the city's points. Across all cities, the reasons for this are in particular the political will and planning competence, which are considered to be significantly lower; there is also room for improvement in the areas of fare integration. When comparing the cities among themselves, the cities of Hamburg, Olsztyn and Tartu come out positively. The city of Hamburg is ahead in the fields of infrastructure and fare integration and is the only city to be rated fully prepared for new and emerging mobility concepts.

In Figure 3, the city ratings for each indicator are shown in the form of a heat map, the darker the colour the closer the indicator is to the maximum value 1. In the field of intermodal culture it is striking that intermodality is not a political priority in the majority of cities, active political participation for changes towards sustainable mobility and promotion of intermodality exists only at certain levels, land-use and transport planning still revolves mainly around the interests of car drivers and there is a lack of efforts to reduce private car use. However, in some cities like Hamburg and Tartu there is a fundamental openness towards new offers and the promotion of sustainable transport and intermodal services. These cities are also the ones that feel well prepared for new and emerging mobility concepts.

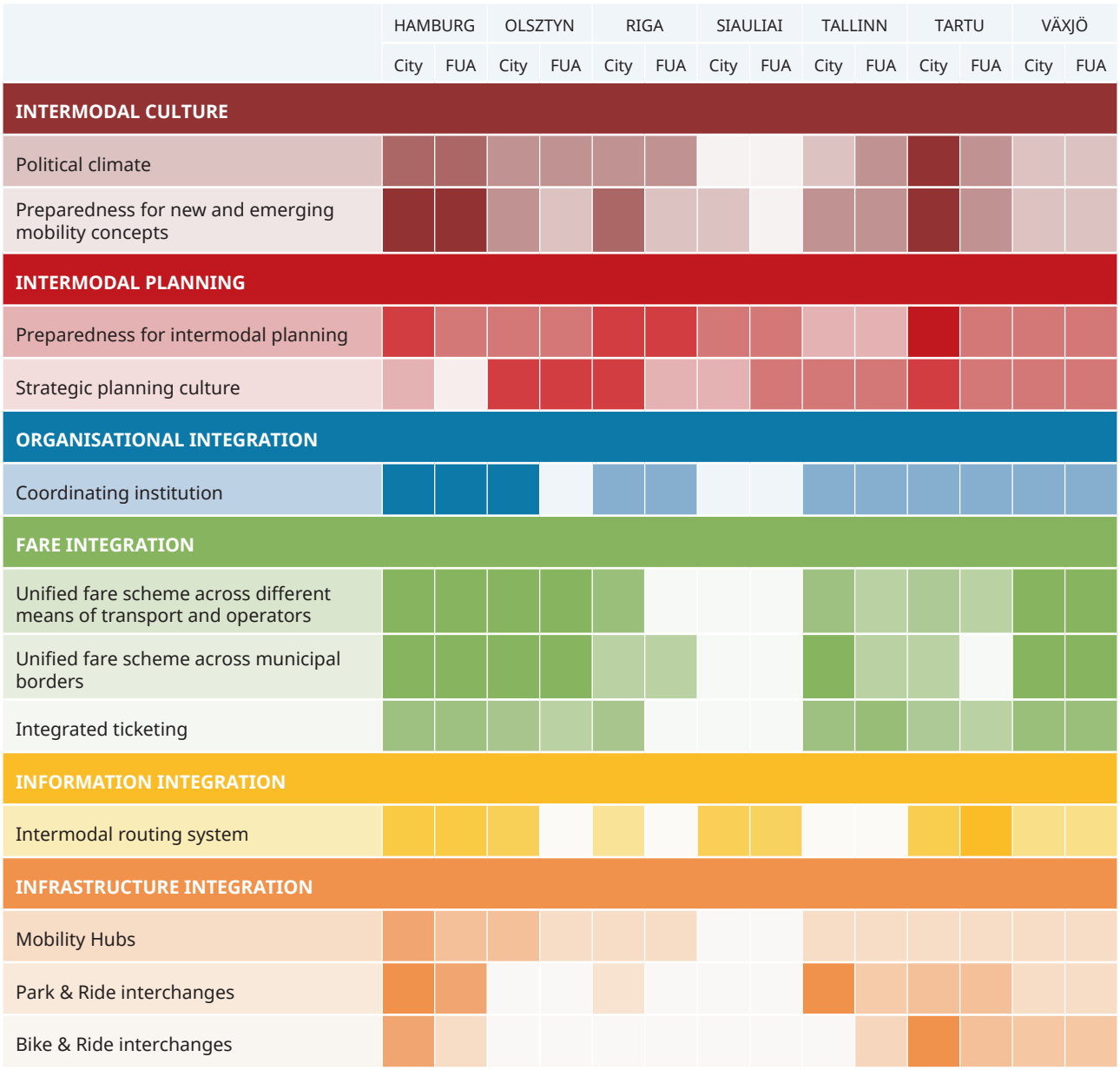

FIGURE 3 HEATMAP OF RESULTS

When it comes to intermodal urban and transport planning, it is clear that there are major differences between the city and its FUA. In cities urban and transport planners are familiar with intermodal mobility concepts and in many cases strategic planning documents containing measures to improve intermodality exist or are in the process of being approved. However, when the FUA is considered, it becomes clear that different administrative levels with different interests are involved and this affects coherent planning. In many cases the areas outside the city limits are already subject to national planning levels with correspondingly different priorities. This can be remedied by regional mobility councils or similar coordinating institutions as many cities have established.

In the field of fare integration most cities have now developed a system where different PT means of transport can be used with one ticket, especially if all urban transport is provided by one operator. In some cases, however, the railways or private providers are not involved in such solutions, the tariff association in Hamburg being an exception, as all providers without exception can be used with one ticket. The same applies to trips to the surrounding municipalities as there is a tariff scheme for the agglomeration of Hamburg. In most other partner cities, however, for journeys within the functional urban area, which cross the city boundaries and include a combination of urban and regional trans-

port, the purchase of several tickets is necessary. The reasons for this are, on the one hand, different operators for regional buses and the national railway and, on the other hand, the lack of a superordinate tariff association. This differentiation is also evident in the aspect of integrated ticketing; for such journeys within the FUA, continuous ticketing is only offered for combinations of certain means of transport. In the cities, however, there are technical solutions to pay for different means of transport with one platform, although not all available offers such as bikesharing are integrated yet. The city of Hamburg offers an interesting example: the SWITCHH app is explicitly geared to intermodal transport and offers integrated ticketing for all means of public transport except on-demand services plus two car-sharing and one bikesharing provider are also integrated.

For the planning and realisation of intermodal travel chains, information and routing systems that support travel planning across different means of transport are very important. However, in the cities there are only limited solutions which in many cases only allow routing within the public transport system together with walking. Applications that allow routing of combinations of public transport with your own bike or car are not yet available. For the consideration of intermodal journeys within the FUA there are significantly fewer solutions available.

In the field of infrastructure integration, there is room for improvement for the majority of the partner cities. The relatively new topic of Mobility Hubs as places of connectivity, where different ways of travelling - on foot, by bicycle, transit and shared mobility - come together, has so far been discussed in most cities only at the level of initial ideas or concepts. Exceptions are the cities of Olsztyn and Hamburg; in Olsztyn a concept has been developed and is currently being implemented. In Hamburg, the majority of the defined Mobility Hubs have already been implemented within the framework of SWITCHH. With regard to the infrastructural integration of public transport and bicycle or car through P&R or B&R stations, the partner cities studied have not yet exhausted their potential. B&R in particular has only played a subordinate role to date. This is partly due to the relatively small size of the cities, the status of the bicycle itself and the lack of a bicycle infrastructure. Park & Ride plays a greater role in the FUA, the challenges are often insufficient capacities at established P&R stations and the fact that P&R stations have not yet been implemented.

Overall, it can be concluded that there are many efforts of the partner cities to enable intermodal travel chains, but many individual aspects still need to be addressed. The assessment scheme INTERMODALYZER has shown the potentials and enables the participating cities to set priorities for improvement.

6. OUTLOOK

The increasing focus of governments on results requires that initiatives to improve urban transport are supported by sufficient information. The INTERMODALYZER developed in the SUMBA project could be a useful tool for this purpose. It could be shown that there is a useful set of indicators to illustrate the aspects of intermodality. The cities were also able to evaluate themselves based on the descriptions. Furthermore, the objective of addressing the complexity and issues of intermodality in passenger transport in cities was achieved.

However, during the development of the scheme it also became clear that the requirements formulated at the beginning of the project, such as an easy to use benchmarking scheme, an independent application by interested cities, applicability for all cities in the Baltic Sea region and beyond, posed major challenges. Since benchmarking should, however, be developed as a long-term process and not as a one-off exercise, this also applies to the creation and establishment of the INTERMODALYZER. Therefore, in a next step further cities will be invited to evaluate themselves and give feedback on the use of the INTERMODALYZER. On the basis of this feedback, the indicators and their evaluations will be adjusted if necessary.

7. SCORECARD AND DETAILED DESCRIPTION FOR SELF-ASSESSMENT

Scorecard for your city

	City	FUA
Intermodal culture		
Political climate		
Preparedness for new and emerging mobility concepts		
Intermodal planning		
Preparedness for intermodal planning		
Strategic planning culture		
Organizational integration		
Coordinating institution		
Fare integration		
Unified fare scheme across different means of transport and operators		
Unified fare scheme across municipal borders		
Integrated ticketing		
Information integration		
Intermodal routing system		
Infrastructure integration		
Mobility Hubs		
Park & Ride interchanges		
Bike & Ride interchanges		

INTERMODAL CULTURE

POLITICAL CLIMATE

The intention of this indicator is to map the political landscape and how it relates to the aspect and promotion of intermodal transport services.

Background information:

To implement a mobility transition towards a more sustainable, resource-efficient mobility and an integrated transport system, a strong political will along with an active and passionate political involvement as well as support in society is required. This also includes sufficient and secured financing for appropriate measures.

Assessment scheme / calculation of the indicator:

What is the political climate regarding non-motorized transport and the combination of different transport modes?

Rated from the intermodal transport being non-existent on a political level to active and passionate political involvement.

0 point	Intermodal transport is non-existent on a political level
0.25 point	
0.50 point	Active political participation only at certain levels and not fully supported by society
0.75 point	
1 point	Active and passionate political involvement

INTERMODAL CULTURE

PREPAREDNESS FOR NEW AND EMERGING MOBILITY CONCEPTS

Background information:

New and emerging mobility concepts such as car and bike sharing, ride hailing or ride sharing, new information and communication technologies and the increasing integration of public transport require a variety of preconditions in order to be successful. These can be aspects such as:

- Governance structures – a clear allocation of responsibilities within the administration;
- Legal framework – The adaptation of the legal framework to support new mobility concepts;
- Market opening – An opening of the market for new mobility solutions such as ridesharing;
- Public space – Concept and availability of public space for needs of operators such as bike stations or the implementation of mobility hubs;
- Data availability – To what extent are urban data also available to third parties as a data basis for analyses and for integration into own applications (e.g. real-time timetable data).

Assessment scheme / calculation of the indicator:

To what extent is the study area prepared for the new and emerging mobility concepts?

Rated from the intermodal transport being non-existent on a political level to active and passionate political involvement.

0 point	The study area is not prepared for new and emerging mobility concepts.
0.25 point	The study area is not prepared for new and emerging mobility concepts, but first steps have been taken and more are in progress.
0.50 point	The study area is only partially prepared for new and emerging mobility concepts but open aspects are actively addressed.
0.75 point	The study area is well prepared for new and emerging mobility concepts; the outstanding aspects are currently being implemented.
1 point	The study area is fully prepared for new and emerging mobility concepts.

INTERMODAL PLANNING

PREPAREDNESS FOR INTERMODAL PLANNING

This indicator should cover the extent to which the issue of intermodality is taken into account at the various and the extent to which the necessary knowledge is available.

Background information:

Transforming the transport system and the transport behaviour of its users towards strengthening intermodal transport is a long-term process. Taking into account both planning times and the durability of the built environment, it is of great importance how and to what extent today's transport and urban planners address the issue of intermodality. For example, when planning new residential and commercial areas, is attention paid to accessibility by different means of transport, both spatially and infrastructurally; are intermodal combinations preferred and appropriate infrastructures considered (e.g. mobility hubs in these areas, fewer or no parking spaces, etc.)? Or, in the case of urban infrastructure renewal, are opportunities taken to promote other modes of transport (e.g. by creation of cycle paths or construction of parking facilities for bikes)?

Assessment scheme / calculation of the indicator:

How much emphasis is given to intermodality by government planners at the various administrative levels and departments and are they well-informed about international best practice?

0 point	Car-centred urban and transport planners, intermodality does not play a role and planners are not well informed about international best practices.
0.25 point	Only some urban and transport planners are familiar with intermodal mo bility concepts, and the planning process is beginning to be geared towards them on individual planning level sonly; the private car plays the most important role in mobility aspects.
0.50 point	The majority of urban and transport planners are familiar with intermodal mobility concepts but do not plan pro-actively towards them.
0.75 point	The majority of urban and transport planners are familiar with intermodal mobility concepts and plan accordingly; however, there are still gaps in the knowledge of international best practice.
1 point	Active and passionate urban and transport planners who think intermodal first.

INTERMODAL PLANNING

STRATEGIC PLANNING CULTURE

This indicator should reflect the incorporation and priority of intermodality in the respective city's/area's strategic urban and transport planning.

Background information:

The issue of intermodality must not only be considered at the level of concrete measures, but also requires a strategic urban and transport perspective. This ensures that objectives on different time and planning levels are achieved and do not conflict or compete with each other.

At European level, the concept of Sustainable Urban Mobility Plans (SUMP) was developed and continuously refined for this purpose. The objective of SUMPs is to achieve a balanced development of all relevant modes of transport while encouraging a modal shift towards more sustainable modes. It takes into account the whole functional urban area and provides for cooperation between different policy and administrative sectors and with local residents and other stakeholders. Where possible, this includes an assessment of the strengths, weaknesses, opportunities and constraints of the different transport modes. The promotion of intermodality plays an important role in this context, as it is capable of combining individual strengths and opportunities of the different modes of transport with the aim of making public transport and non-motorised transport more competitive, efficient and attractive for users.

The annex of the European Commission's Urban Mobility Package 'A concept for Sustainable Urban Mobility Plans' identifies intermodality as one of the issues to be addressed in a SUMP. It states that a SUMP should contribute to a better integration of the different modes of transport and identify measures specifically aimed at facilitating seamless transitions between different modes of transport. Therefore, the objective of this indicator is to reflect the consideration of intermodality in strategic planning documents, including the identification of concrete measures and actions.

Assessment scheme / calculation of the indicator:

Is there a strategic planning document (SUMP or equivalent) for your city that explicitly addresses the issue of intermodality in passenger transport and states concrete measures and actions?

0 point	No such document exists or is under development.
0.25 point	Such a document exists, but the issue of intermodality is not explicitly addressed, it contains only limited information and vision on how to promote intermodality, or it does not specify concrete measures and actions.
0.50 point	Such a document exists and covers the promotion of intermodality, but it does not specify concrete measures and actions.
0.75 point	Such a document exists and covers the promotion of intermodality including measures and actions partially implemented.
1 point	Such a document exists and covers the promotion of intermodality and is fully in line with time and action plan.

ORGANISATIONAL INTEGRATION

COORDINATING INSTITUTION

The indicator addresses the cooperation of relevant actors in terms of the level of institutionalisation, the involvement of all relevant actors and the quality of the cooperation.

Background information:

For transport users, integrated transport is about the availability of a coordinated transport service across modes, operators, and administrative borders, which allows seamless travel and minimises the impact of changing modes. Accordingly, aspects such as sufficient information, secured connections or a coordinated tariff system are important to the users. This requires coordinated cooperation between different actors both within a city and between the city and its functional urban area, preferably by setting up an organisational unit to formalise cooperation, e.g. as a transport authority or association.

The relevant actors may differ from city to city and may include, among others, the transport companies and operators (private or public) operating in the city as well as in the functional urban area, mobility providers for sharing schemes, and relevant administrative units at state, municipal and/or district level (e.g. transport-related planning departments). The areas of responsibility may include topics such as public transport routes and timetables and their coordination, the development of mobility hubs or transfer points (e.g. P&R stations) and the implementation of a uniform tariff system. The organisational unit can be assigned further tasks by the authorities and transport companies involved, e.g. in the areas of tendering for public transport services, monitoring quality criteria and providing other services such as centralised information.

Assessment scheme / calculation of the indicator:

Is there an institutionalised form of cooperation involving relevant actors?

Rated from the intermodal transport being non-existent on a political level to active and passionate political involvement.

0 point	No, there is neither an (institutionalised) form of cooperation nor a corresponding organisation.
0.25 point	There is a (institutionalised) form of cooperation, but it does not include all relevant actors OR the organisation is in the process of being established.
0.50 point	There is a non-institutionalised form of cooperation that includes all relevant stakeholders. – OR – There is an institutionalised form of cooperation, a corresponding organisation exists, but not all stakeholders are involved or the cooperation only functions to a limited extent.
0.75 point	There is an organisation for cooperation involving all relevant actors, but cooperation is limited.
1 point	There is an organisation for cooperation involving all relevant actors and cooperation is well established and fully operational.

FARE INTEGRATION

UNIFIED FARE SCHEME ACROSS DIFFERENT MEANS OF TRANSPORT AND OPERATORS

This indicator reflects the possibility of changing between different means of transport and transport operators in PT within a fare scheme.

Background information:

An important element of an integrated public transport system is the integration of tariffs and fares with the aim of removing barriers to access to public transport. Ideally, fare and tariff integration should complement network and timetable integration to maximise the benefits for both users and PT providers. That becomes obvious when considering cities in which no unified fare system has been implemented so far and a ticket has to be bought every time boarding a public transport vehicle. Such systems are often characterized by a large number of lines offering direct connections without the need to change, but with a low frequency. The introduction of a tariff system allows for an optimised network structure and, if necessary, more frequent connections between key areas of traffic demand.

Assessment scheme / calculation of the indicator:

The indicator is calculated as the quotient of the number of combinations of means of transport and transport operators within the largest tariff scheme (numerator) and the number of all combinations of means of transport and transport operators within the study area (denominator). For this purpose a single ticket is considered.

$$\text{Points} = \frac{\text{Number of transport means (per operator) included in the fare scheme}}{\text{Number of transport means (per operator) in the city}}$$

The following example should clarify the calculation: Transport provider A operates both bus and tram lines and offers a ticket that allows changing between these bus and tram lines. In addition, Provider B operates another bus network (e.g. for the lines to the hinterland), but this is not integrated into the tariff system and requires the purchase of another ticket if used. Provider A's tariff system is considered to be the larger of the two (e.g. in terms of area covered or number of lines) and will be considered. According to the calculation rule, the value for the combination of means of transport and transport operator (numerator) is two (Tram A and Bus A), and the number of all combinations of means of transport and transport operators (denominator) is three (Tram A, Bus A, Bus B). Accordingly the indicator value is two divided by three = 0.66.

0 point	No, there is no uniform tariff system.
0 < x <= 1	The calculation is made as indicated above.
1 point	A uniform fare scheme exists which integrates all lines and transport operators regardless of the type of transport.

FARE INTEGRATION

UNIFIED FARE SCHEME ACROSS MUNICIPAL BORDERS

This indicator reflects the possibility of travelling across municipal borders with a single ticket.

Background information:

In the majority of cases, cities and their hinterland belong to different administrative units, and the same applies to cities within a metropolitan region. In connection with financing of public transport and the ownership of the operators, administrative boundaries can also represent tariff boundaries with the consequence that separate tickets have to be purchased for cross-border journeys. This can be particularly relevant for commuters from the FUA. To eliminate this relevant barrier to the use of local public transport, the aim should be to have a uniform tariff system within the entire functional urban area.

Assessment scheme / calculation of the indicator:

The indicator is based on the availability of single tickets across municipal borders in your functional urban area.

0 point	No, there is no unified fare scheme across municipal borders within the functional urban area.
0.50 point	Yes, but only partially, for example only for certain operators, lines or means of transport.
1 point	Yes, a unified fare scheme exists which allows travelling across municipal borders within the functional urban area with a single ticket.

FARE INTEGRATION

INTEGRATED TICKETING - AVAILABILITY OF A PLATFORM FOR CROSS-BOOKING AND PAYMENT

The possibility of booking and paying for different means of transport on one platform supports and promotes intermodal mobility behaviour. The availability of such platform is reflected by this indicator.

Background information:

The use of different means of transport on an intermodal journey requires separate booking and/or payment in many places. The availability of a platform for the end-to-end booking or payment of the selected means of transport supports intermodal travel behaviour. Such platforms can be web-based solutions, an app or, as often possible, a (rechargeable) payment card, such as the Oyster card in London. All transport operators and means of transport available in the study area, including new mobility concepts such as bike-sharing, will be considered. If several platforms exist, please select the most suitable platform according to your opinion (e.g. includes most means of transport, largest user group, etc.).

Assessment scheme / calculation of the indicator:

In a first step please select the most suitable platform according to your opinion (e.g. includes most means of transport, largest user group, etc.). The next step is to check how many transport means per operator are included in the payment platform.

The indicator is calculated as the quotient of the number of combinations of means of transport and transport operators included in ticketing platform (numerator) and the number of all combinations of means of transport and transport operators within the study area (denominator). Please distinguish between different means of transport in PT, e.g. bus, tram, and subway as in some cases not all transport means within PT can be covered by the integrated ticketing system.

$$\text{Points} = \frac{\text{Number of transport means (per operator) payable with the platform}}{\text{Number of transport means (per operator)}}$$

If the identification of exact numbers is not possible due to data availability or only with disproportionate effort, the information can also be estimated.

0 point	There is no such platform available.
0 < x <= 1	The calculation/estimation is made as indicated above.
1 point	All transport means available in the city are covered by a single platform which allows possibility for the user to choose user to choose the means of transport to be combined.

INFORMATION INTEGRATION

INTERMODAL ROUTING SYSTEM

This indicator depicts the information possibilities for intermodal route chains in the study area.

Background information:

For the planning and the realisation of intermodal travel chains, information and routing systems that support travel planning across different means of transport are very important. These systems must enable the user to select the means of transport to be considered individually. This means that the user must be able to decide which combinations are acceptable to him, e.g. public transport and bicycle or public transport, bicycle and bike sharing. Accordingly, solutions that only include the routing for public transport or bicycle or car are not appropriate.

In order to be able to represent as many user interests as possible, it is desirable to include all means of transport available in the study area. This encompasses public transport systems, bicycles, sharing schemes as well as private vehicles. Furthermore, the integration and consideration of real-time data is essential for both punctuality and availability of vehicles (e.g. scooters, bicycles and cars) from sharing schemes.

Assessment scheme / calculation of the indicator:

For the assessment, make yourself aware of the means of transport that exist in your study area and the information and routing systems. Please select the platform (website, app) that you think is most appropriate (e.g. covers most means of transport, the largest user group, etc.) and determine how many of the identified means of transport it covers.

The indicator is calculated as the quotient of the number of transport means covered in the information/routing platform (numerator) and the number of all available means of transport within the study area (denominator).

$$\text{Points} = \frac{\text{Number of transport means included in the system}}{\text{Number of available transport means within the study area}}$$

If the identification of exact numbers is not possible due to data availability or only with disproportionate effort, the information can also be estimated.

0 point	There is no such platform OR offers the possibility for the user to choose the means of transport to be combined.
0 < x <= 1	The calculation/estimation is made as indicated above.
1 point	All transport means available in the city are covered by a platform which allows possibility for the user to choose user to choose the means of transport to be combined

INFRASTRUCTURE INTEGRATION

MOBILITY HUBS

This indicator should reflect developments in the concepts and set-up of Mobility Hubs.

Background information:

Mobility Hubs are places of connectivity where different travel options – walking, cycling, transit and shared mobility – come together. They go beyond bimodal concepts such as Park & Ride or Bike & Ride. By providing an integrated package of mobility services, facilities and supporting technologies, they help to better connect high-frequency public transport with the travellers' point of origin or destination by offering on-demand travel options. The spatial concentration of mobility options offers the user the advantage of short distances when changing means of transport.

In particular, existing hubs and stations of mass transit such as train stations or transfer stations are ideally suited for the implementation of an intermodal Mobility Hub and offer new solutions for access to public transport by addressing "first-mile/last-mile" gaps or connections.

Assessment scheme / calculation of the indicator:

Is there already a concept for setting up intermodal mobility hubs and what is the status of implementation?

0 point	No such concept exists or is under development.
0.25 point	points First ideas exist and possible concepts are available.
0.50 point	A concept for implementation within the study area is available, financing has been secured and implementation is underway.
0.75 point	A concept for implementation within the study area is available, financing has been secured and majority of the defined mobility hubs have been implemented.
1 point	A concept for implementation within the study area is available, financing has been secured and all defined mobility hubs have been implemented.

INFRASTRUCTURE INTEGRATION

INTERCHANGES WITH PARK & RIDE FACILITIES

The indicator reflects the promotion of intermodality through establishing interchanges with P&R facilities.

Background information:

The concept of Park & Ride (P&R) describes the principle of providing parking facilities for passenger cars near public transport stops in order to enable a transfer from private transport to public transport. This is linked to the objectives of reducing car traffic and congestion in city centres and reducing the number of parking spaces to enable new uses for public space.

The selection of suitable stops for P&R depends, inter alia, on the geographical location and connection to the road network, parking capacity and demand, and the frequency and capacity of public transport services. Whereas in the past the focus was mainly on stops with (rail-bound) high-capacity local transport services such as regional, suburban or underground connections, bus and tram stops are now also gaining importance. Therefore cities and municipalities are required to define suitable locations.

For the calculation or estimation of the indicator only suitable stops with sufficient capacity should be considered. The indicator thus records whether a) a suitable concept for implementing Park & Ride exists, b) the degree of implementation and c) the availability of sufficient parking spaces.

Assessment scheme / calculation of the indicator:

In a first step it has to be checked whether a concept for the study area exists which identifies and names suitable stations according to selected criteria. The next step is to check how many of the designated stops are equipped accordingly.

The indicator is calculated as the quotient of the number of appropriately equipped stations and the number of all relevant stations within the study area.

$$\text{Points} = \frac{\text{Number of relevant PT stops equipped with P\&R facilities}}{\text{Number of relevant PT stops within the study area}}$$

If the identification of exact numbers is not possible due to data availability or only with disproportionate effort, the information can also be estimated.

0 point	No concept for implementing such P&R stops exists OR no stop has been equipped so far.
0 < x <= 1	The calculation/estimation is made as indicated above.
1 point	All relevant PT stops are equipped with P&R facilities OR no such facilities are needed within the study area.

INFRASTRUCTURE INTEGRATION

INTERCHANGES WITH BIKE & RIDE FACILITIES

The indicator reflects the promotion of intermodality through establishing interchanges with Bike & Ride facilities.

Background information:

On intermodal routes which include cycling and public transport, the bicycle is often used on the way to and from high capacity public transport, both within a city and in the surrounding area. The primary goal in setting up B&R is to increase the attractiveness of the local public transportation system and expand the catchment area of stations and stops.

The demand of land as well as the equipment of B&R stations can vary according to requirements, ranging from open or covered bike racks, to lockable storage facilities such as bicycle garages, all the way to monitored parking facilities with additional services. Again, cities and municipalities are required to define suitable locations and equipment.

For the calculation or estimation of the indicator only suitable stops with sufficient capacity should be considered. The indicator thus records whether a) a suitable concept for implementing Bike & Ride exists, b) the degree of implementation and c) the availability of sufficient parking spaces.

Assessment scheme / calculation of the indicator:

Similar to the assessment of P&R stops, in a first step it has to be checked whether a concept for the study area exists which identifies and names suitable stations according to selected criteria. The next step is to check how many of the designated stops are equipped accordingly.

The indicator is calculated as the quotient of the number of appropriately equipped stations and the number of all relevant stations within the study area.

$$\text{Points} = \frac{\text{Number of relevant PT stops equipped with B\&R facilities}}{\text{Number of relevant PT stops within the study area}}$$

If the identification of exact numbers is not possible due to data availability or only with disproportionate effort, the information can also be estimated.

0 point	No concept for implementing such B&R stops exists OR no stop has been equipped so far.
0 < x <= 1	The calculation is made as indicated above.
1 point	All relevant PT stops are equipped with B&R facilities.

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ABOUT SUMBA | WHY DO WE NEED SUMBA?

More and more people chose to live in suburbs while they continue to work in cities, resulting in high number of daily commuters. Commuter traffic is still dominated by private cars, resulting in problems such as

- congestion
- air pollution
- high demand of parking spaces
- higher costs of public transport.

SUMBA will address commuter transport and help to mitigate these problems!

OUR ACTIVITIES

The urban transport system can be reshaped to an intermodal network that off ers a combination of various transport modes, including bike and car-sharing. This helps cities to achieve a more attractive and environmentally friendly commuting system. SUMBA will develop and test tools that help urban and transport planners to assess, plan, and integrate intermodal mobility solutions into transport plans and policies of their cities and municipalities.

OUR PARTNERS CITIES

Hamburg (Germany)
Tallinn city, Union of Harju municipalities (Estonia)
Tartu (Estonia)
Riga (Latvia)
Växjö (Sweden)
Šiauliai (Lithuania)
Olsztyn (Poland)
Associated cites Gdynia, Warsaw suburban region, Słupsk municipality (Poland), and Helsinki (Finland)

EXPERT PARTNERS

German Aerospace Center, Institute of Transport Research
Baltic Environmental Forum Latvia, Estonia and Germany
Earth and People Foundation

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