# D.T1.2.1 SUBNODES STRATEGY

**Version 2.0**

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# 1. Strategic objectives and guiding principles

The SubNodes project's intention was to better connect the hinterland to primary TEN-T hubs via secondary transport hubs, so-called "subnodes". The subnodes act as anchor points for hinterland accessibility and development. The SubNodes project tackled therefore weak intermodal integration of peri-urban hinterland regions to primary TEN-T hubs. Suitable medium-sized cities in these areas should be developed into attractive intermodal secondary hubs (subnodes), which better connect the hinterland (a defined catchment area) to the TEN-T rail network. The project intended to establish this approach in the participating regions and beyond by adopting a Subnodes Strategy, conceptualizing its implementation and testing innovative actions in real-world conditions. Rooted in the Territorial Agenda 2020, SubNodes is a strategic approach to promote polycentric development in the public transport sector in light of changing settlement patterns and locational advantages due to major investments in TEN-T. The development of subnodes on a transnational level is an instrument to better exploit accessibility gains also in the hinterland, therefore SubNodes' transnational added value is to enhance the effects of the transnational TEN-T infrastructure.

Against this background, the Subnodes Strategy has to be understood as a concise policy paper that outlines how the secondary transport network could be better connected to TEN-T via the development of peri-urban and medium-sized cities to "Subnodes hubs".

## Problems and Challenges: Hinterland accessibility and regional development

Over the past decades, substantial investments into the TEN-T railway network have been realized all across Central Europe. The extension of rail tracks has altered the existing network, resulting in new framework conditions for regional public transport systems. The itinerary and routing of the entire secondary passenger transport system, therefore, calls for reorganization – because:

- Public sector actors responsible for the coordination of regional public passenger transport in Central Europe face the common challenge to adopt the regional transport system to the changed infrastructural conditions caused by the upgrade of the TEN-T infrastructure.
- In wide parts of Europe, the intermodal connections between TEN-T hubs and the adjacent peri-urban areas are rather poorly developed. Therefore, in Central Europe still is the need to further develop the secondary public transport network and better connect it with the national and transnational network.
- In many cases, weak intermodal integration between bus and rail characterises the connections to TEN-T hubs, especially in the peri-urban hinterland.

In the interaction between urban areas and their hinterland, a need is expected to realize connections to long-distance transport infrastructure, like high-speed rail, and support sustainable transport modes in a complex environment. According to their needs, intermediate and even rural areas shall be provided with appropriate framework conditions for developing sustainable passenger mobility.

## Objective: Turning small and medium-sized cities into attractive intermodal transport hubs

SubNodes' intention was to enhance the accessibility of peri-urban regions by linking them to the TEN-T nodes via mid-sized cities as transport junctions between TEN-nodes and their hinterland. To move towards this aim, the SubNodes project defined three specific objectives:

- *Establishing intermodal secondary hubs in the hinterland to TEN-T nodes:* Selected medium-sized cities shall be upgraded to intermodal nodes, linking intra-regional transport (mostly buses, but also other modes) to the national and TEN-T network.
- *Making intermodal travelling more attractive to canvass new passengers:* Improved connectivity will only succeed if the potential travellers in the region become real passengers of public transport. This will just happen when the general public regards intermodal travelling as attractive and advantageous.
- *Making transport planners and transport plans better respond to passengers' needs:* SubNodes targets to enhance the capacity of public transport planners for improving intermodal passenger transport in the peri-urban TEN-T hinterland. This means on the one hand better coordination with a variety of other actors and stakeholders (e.g. from neighbouring regions or adjacent transport associations), and on the other hand to gain more experience and knowledge on a scope of transport that is by far less in focus of public and scientific attention than e.g. inner-urban or inter-city transport.

In this respect, SubNodes addressed the need to enhance public planning capacities in order to move towards improved policies on regional public passenger transport, with the ultimate goal of changing mobility patterns by providing efficient, coordinated services linking all public transport systems.

## Achieving the Aims: Hierarchical transport networks

The development of subnodes lays ground to turn medium-sized cities into attractive intermodal secondary transport hubs. Such an intermodal subnode has to be understood as just one element in a hierarchical transport network (Fig. 1). It is the access point to the long-distance transport infrastructure. The hierarchical transport network, therefore, is defined as a system of connections, which includes different types of public transport services (local public transport to high-speed rail) and interchange nodes which make the transfer between the different services possible. Coordinated private transport, public transport and alternative transport services including the transfer options constitute the intermodal transport system within a wider network of cities and their hinterland.

A hierarchy in transport networks is based on five important factors that influence the network:

- spatial structure, including the distribution of facilities and public services,
- demand patterns and transport flows,
- expenses to develop and operate transfer facilities,
- scale benefits due to the concentration of flows, as well as
- intended quality of the transport service across all sub-links along the connections within the network.

These characteristics have a strong influence on the network types and the transport service along the network. Given the focus of intermodal transport to and from the important cities of a region, a many-to-one pattern seems to be most relevant – the connection forms the hinterland to the subnode of the TEN-T network.

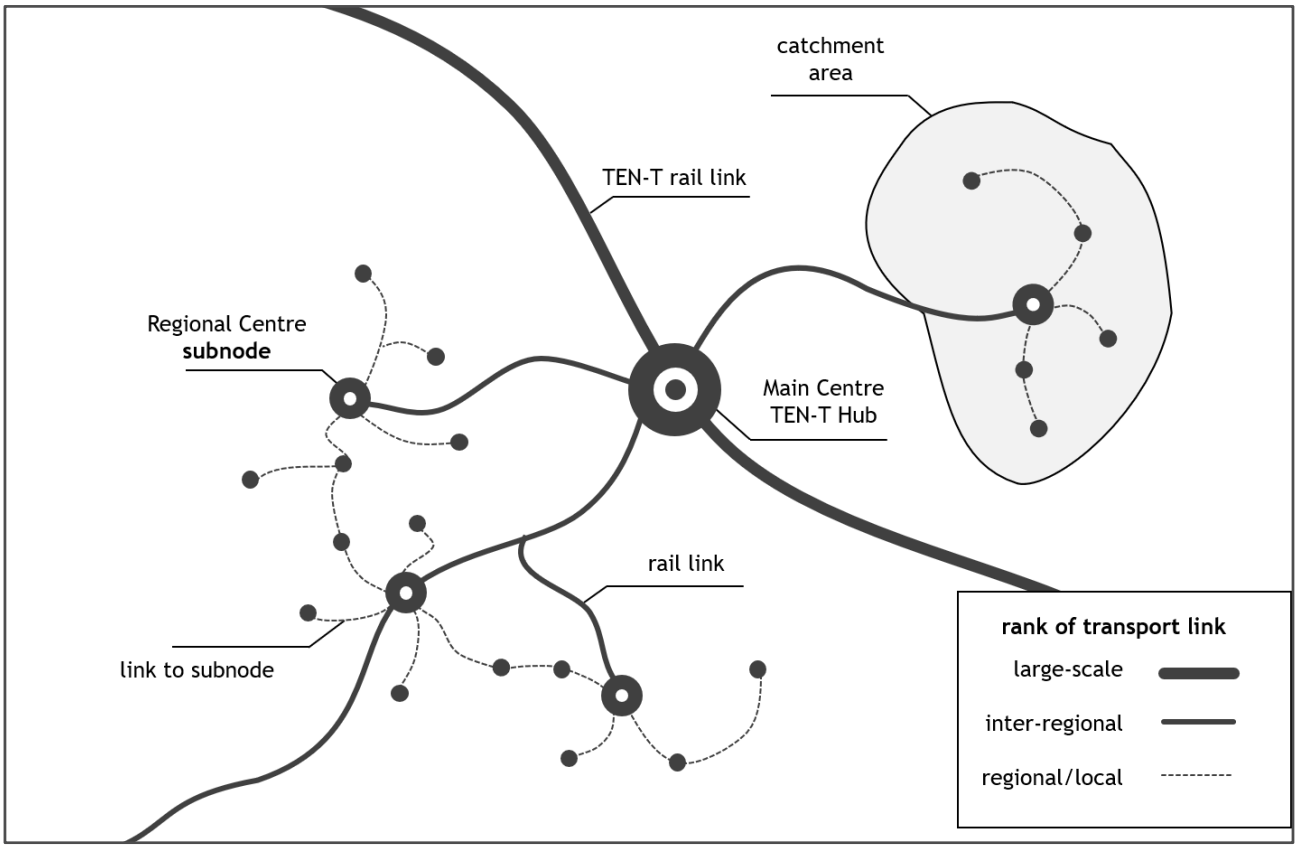


Figure 1: Subnodes within a hierarchical transport network

# 2. What qualifies cities as subnodes – working hypothesis and essential characteristics

The identification of cities, which are qualified as subnodes is one of the first steps for implementing this approach. With the knowledge about the cities, we are focussing on, we are able to improve the quality of connections and infrastructure between main-nodes, subnodes and the hinterland. This could be done via a two-step process: first by the identification of shortcomings, like missing links or a poor quality of services, and second through the recommendation of well-adapted measurements to establish new connections out of the hinterland to the identified subnodes as well as actions to improve the quality of services. There are three perspectives, from which we are able to tackle the task of establishing subnodes as supplement hubs within the TEN-T network:

1. The city as a hub in a wider network of villages and cities of the region and beyond.
2. The transport infrastructure within the subnodes, especially an existing train station and whether the station already qualifies as an intermodal hub for public passenger transport or need particular modification to better fit the needs of the passenger.
3. The quality of the transport network and the reliability of public transport service, which connect the hinterland with a subnode and the subnode with the main TEN-T hubs.

In order to meet the overall aim in turning small and medium-sized cities into attractive intermodal transport hubs by strengthening the conditions for eco-mobility and thus the conditions to reduce motorised private transport, the following hypotheses for further discussions are suggested:

1. Ticketing and pricing systems have to be developed according to the different target groups, like commuters, leisure travellers and tourists or occasional passengers.
2. A regional transport association is able to combine different transport services under one roof, with one unique ticketing system and a transport network beyond the administrative borders of the regions. A regional transport association helps people to understand the all too often fragmented chain from origin to destination as one connection without further hassle about ticketing or schedule issues at system boundaries. Transport associations are able to manage and schedule interchange possibilities from bus to train and other modes of transport across transport operators - they are therefore a key element in organising intermodal transport hubs.
3. The local transport network and service must not only meet needs of the users according to their mobility patterns and commuter flows – this is a demand-driven approach to public transport planning. Public passenger transport could also be improved, when the network design is subject to a supply-directed approach. This implies that a public transport service not only responds to a certain demand but also makes more competitive offers by improving the connectivity of the network by either establishing new or improving existing connections.
4. The definition of intermodal transport includes more than just an intersection of bus and rail service. Particularly in rural areas – where the distances between bus or rail stops are widely spaced in contrast to urban areas – the access way to a stop could be comparatively long. Long access ways to bus or rail stops are considered as one of the key elements that prevent people to use public transport by an otherwise relatively good service. Simply improving the service by increasing the frequency or adjusting the ticketing system, might not necessarily achieve the desired effect to increase the number of passengers. In an intermodal transport chain, passengers can use their bikes to cover the distance between their home and a bus stop. And if a carriage of bicycles even along short journeys is possible, the passengers are more flexible at the destination in terms of their mobility. Therefore, intermodal public transport considers possibilities that cycling offers in either upgrading bus stops with sufficient bicycle parking facility or the carriage of bicycles in buses or trains.
5. With the rise of instant information and mobile communication technology, the expectations of passengers to get informed during disruptions or along a journey are significantly higher as in the decades before smartphones have become widely spread. Pre-journey, as well as on-journey real time information, is standard by now for long-distance public transport and in most major cities with a complex transport system. Therefore, passengers do not only appreciate additional information before or during their journey, but they also expect comprehensive information especially during disruptions or delays. Along with an intermodal transport chain with interchanges between local and long-distance transport services, real-time information and information about journey alternatives with a clear focus on passengers' needs could significantly improve the service and achieve customer satisfaction.

# 3. Identifying Opportunities and Constraints – Discussion of Indicators and Assessment Process

Transport planners, as well as spatial planners, need to understand the spatial configuration, the main transport flows and the weak spots of the current public transport system of their region in order to optimise the organisation of public transport in TEN-T node hinterlands and to integrate new approaches and solutions in the strategic and operational planning. Therefore, a four-step process to identify opportunities and constraints is suggested (Fig. 2):

- In the first step of the approach, a city network which defines the hotspots of a hub-and-spoke system (see fig. 1) within the region should be identified and discussed.
- Each subnode serves as a hub for long-distance passenger transport services for a given catchment area. This could be understood as the hinterland of a subnode in which local public transport of all kinds is the key service to guarantee access to the subnode and therefore to long-distance passenger transport. The most important transport flows could be a good indicator to delineate a catchment area.
- With the knowledge about the most genuine catchment area of a subnode (which does not have to be identical to the given administrative district), an assessment of the transport service in the region will reveal bottlenecks and weak spots. Those identified bottlenecks and weak spots illustrate the need for actions, which have to be initiated to create an appropriate connection between the origins in the hinterland and their subnode.
- The final step then defines measures to qualify or improve subnodes as intermodal transport hubs.

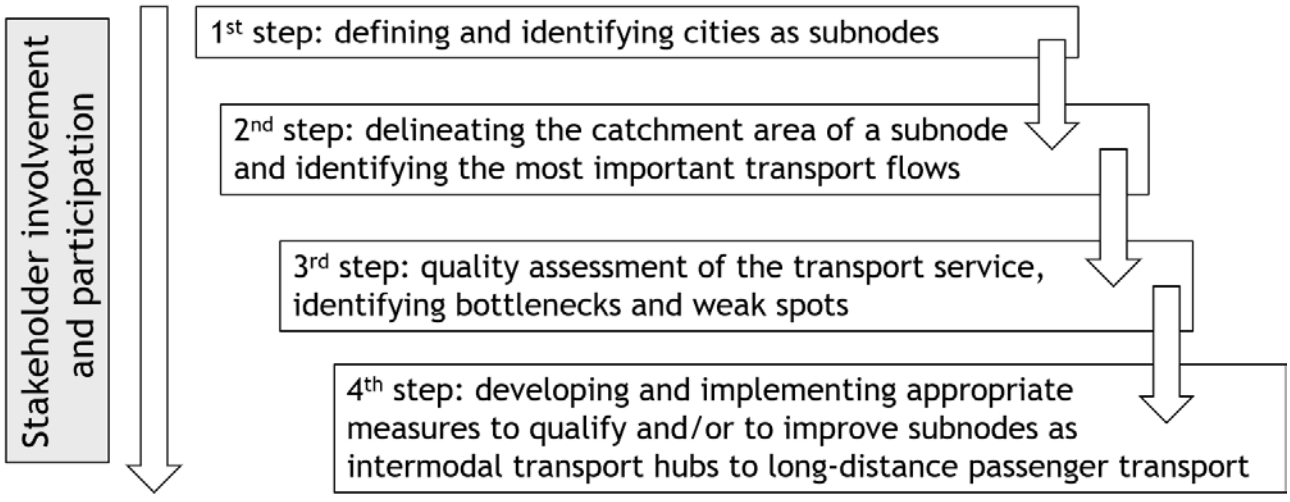


Figure 2: Four-step-process to identify opportunities and constraints of subnodes and the transport system

The four-stage process for identifying opportunities and constraints is supplemented by the interdisciplinary/overarching topic 'Involvement and participation of stakeholders'. This has to be considered through the whole implementation process of the Subnodes approach.

An early-stage involvement is advisable and clear targets must be communicated. The expertise and experiences of regional stakeholders and target groups can be crucial for the implementation of the first

steps, e.g. for delineating the catchment area and/or for identifying regional interrelationships with high importance, independent of the administrative districts. Furthermore, the collaboration with these stakeholders can be helpful for identifying weak spots and bottlenecks and future needs for action. In the course of stakeholder participation, the objectives of participation and involvement have to be made clear and can address different stages, shown in figure 3.

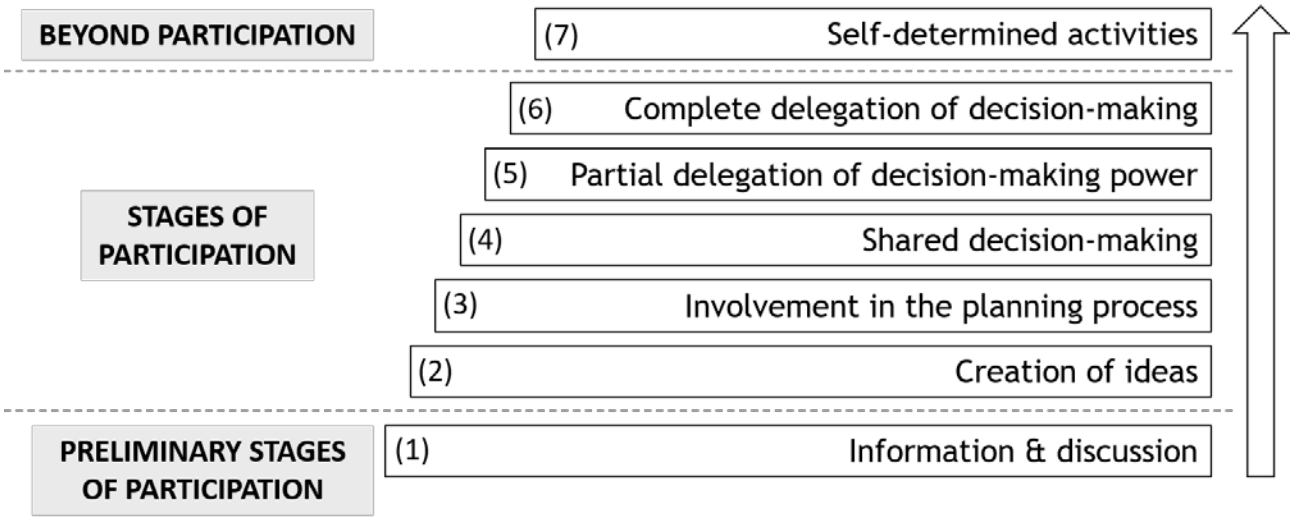


Figure 3: Stages of participation (Source: based on Gernert 1993; Hart 1997: p. 8; Straßburger, Rieger 2014: p. 232 ff.)

In science stages of participation can be subdivided into three different levels: preliminary stages of participation, participation itself and the process beyond participation (cf. Gernert 1993; Hart 1997: p. 8; Straßburger, Rieger 2014: p. 232 ff). First of all, it is important to inform the regional stakeholders about further developments, plans and objectives (1). Subsequently, starting a discussion with the participants and experts is the precondition for the mutual creation of ideas (2). Afterwards, a direct involvement in the planning process is possible and recommended (3). The next stage involves a shared-decision-making with the participants (4). For increasing participation, in the following stage stakeholders should get partially the power to make decisions on their own (5) until decision-making should be completely in the hands of stakeholders (6). Beyond the second participation process stakeholders ideally implement self-determined activities, even after the project (7).

Concurrent to the stakeholder involvement and participation, it is important to analyse target groups systematically at the beginning of the project. Which target groups are really affected and which target groups should be addressed? This has to be clear before the participation will start, because different groups have different expertise and experience that can be important for the process.

The format of participation is crucial for a real-added output of the involvement. The format depends on the target group, e.g. for addressing younger people, it could be helpful to use actual and modern channels, e.g. social media like Facebook and Instagram. Furthermore, the SubNodes project and the experiences of the partners show that face-to-face interviews are often more successful and expedient than big events and it is advisable to take stakeholders to field trips to show them good practices. Therefore, it is helpful to connect to already existing networks and cooperation. Ideally it is advisable to link the stakeholder involvement to these networks and cooperation and extend them.

Also, the participation of ‘strong’ and influential partners of a region is important. These stakeholders can activate and motivate other partners and stakeholders for action and act as a role model and motor for the development of the region.

## Indicators: Defining a subnode

There is a large set of methods which can be used within each step to tackle the specified task. Relatively simple are methods to identify cities as subnodes and to define their catchment area. This could be an indicator-based methodology (Tab. 1). Whereas a catchment area could be defined by adopting methods from spatial planning such as commuting patterns, existing administrative borders, main transport flows or historical relationships. A comprehensive definition of a set of criteria that must be met by a city to qualify as subnodes is the subject of the work paper "Definition of criteria for the identification of central places (subnodes) in the region" (D.T1.3.1).

Table 1: Defining cities as subnodes – possible indicators

| **Indicator** | **Description** |
|---|---|
| population | number of inhabitants, demographic forecast, population density |
| railway infrastructure | kind of railway station, operating railway service (local, inter-regional) |
| passenger road transport | public-transit bus, area covered, infrastructure and position of the main bus station, intermodal connectivity (bus-rail) |
| classification in regional plans | definition of the city in regional plans and/or development plans |
| connections to main-hubs | railway connections to the next TEN-T hub, kind and frequency of the service, travel time |
| service and facilities | catalogue of essential facilities and services of general interest |
| economic aspects | job opportunities, commuter flows, economic potential |

## Assessment of the transport system

As a basis for a quality assessment, the approach of the German Guideline for Integrated Network Planning RIN (Richtlinien für die integrierte Netzgestaltung) is suggested. Guidelines present an approach to evaluate the service quality of entire journeys between an origin and a destination point including access and egress time. The evaluation scheme focuses on indicators that are suitable for quantifying reliability – the time-dependent service quality. The scheme recommends a classification based on six levels of service – from "A" (very good) to "F" (insufficient). This approach can be easily adapted for specific regional characteristics and even the "level of service"-specifications are transferable to match local requirements.

The guidelines also suggest a categorisation of the transport network by defining kinds of quality levels with regard to the connections between different levels of central places within a hierarchical system of centrality. The link between one metropolitan region to another holds the highest rank in the network system – rank 0 – followed by rank I between major regional centres and metropolitan regions and so on (Tab. 2).

Table 2: Rank of a link according to their function in connecting regions and cities

| rank | label | connection-supply | connection-exchange | description |
|---|---|---|---|---|
| 0 | continental | – | MR - MR | link between metropolitan region |
| I | large-scale | MC - MR | MC - MC | link between main centres and a metropolitan region and between main centres |
| II | inter-regional | RC - MC | RC - RC | link between a regional centre and a main centres and between regional centres |
| III | regional | LC - RC | LC - LC | link between a local centre and a regional centre and between local centres |
| IV | local | M - LC | M - M | link between a municipality or part of a municipality and local centres and between municipalities |

MR metropolitan region
MC main centres
RC regional centre
LC local centre
M municipality, part of a municipality

The attributes to define a subnode as well as the assessment method could be the standard for the Subnodes approach. Besides such a standard procedure, the specification of the procedure and the arrangement of indicators could be modified to include local specific characteristics and to respect different national approaches in transport and spatial planning.

# 4. References

Genert, Wolfgang (1993): Jugendhilfe. Einführung in die sozialpädagogische Praxis. München, Basel.

Hart, Roger (1997): Children´s participation: From tokenism to citizenship. Innocenti Essay no. 4, International Child Development Centre, Florence.

Straßburger, Gaby; Rieger, Judith (2014): Partizipation kompakt: Für Studium, Lehre und Praxis sozialer Berufe. Weinheim, Basel.