ESPON BSR-TeMo
Territorial Monitoring for the Baltic Sea Region

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Part C | Scientific Report

Volume C2 | The Territorial Monitoring System

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The partnership behind the ESPON Programme consists of the EU Commission and the Member States of the EU27, plus Iceland, Liechtenstein, Norway and Switzerland. Each partner is represented in the ESPON Monitoring Committee.

This report does not necessarily reflect the opinion of the members of the Monitoring Committee.

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This basic report exists only in an electronic version.

List of authors

Nordregio
Lisbeth Greve Harbo
Gunnar Lindberg
Linus Rispling
Anna Berlina
Gustaf Norlén

University of Gdańsk
Jacek Zaucha

Aalto University
Tomas Hanell

RRG Spatial Planning and Geoinformation
Carsten Schürmann

Stanislaw Leszczycki Institute of Geography and Spatial Organization Polish Academy of Sciences
Tomasz Komornicki
Piotr Rosik
Rafał Wiśniewski

BGI Consulting Ltd.
Inga Bartkeviciute
Jonas Jatkauskas

Geomedia LLC
Rivo Noorkõiv

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1. Conceptual framework

The records of efforts to establish territorial monitoring systems for the BSR are long and instructive. Probably the first initiative was that of VASAB, with its attempt of 1996 which is mentioned in Volume C1. With the establishment of ESPON the work on territorial indicators was then undertaken for the entire EU territory including the EU-associated countries. In 2008 two seminars were organised by ESPON: a workshop on territorial indicators and indices in April and a workshop on monitoring territorial dynamics in November. And next, in 2010, the ESPON launched a project titled INTERCO (ESPON 2.1.1), dedicated to this effort, and in 2011, in relation to this project, ESPON organised a workshop titled: "Assessing Indicators for Territorial Cohesion".

Despite those efforts, in contemporary literature one can find only three[1] comprehensive conceptual attempts to elaborate the monitoring systems for territorial cohesion covering EU territory which were carried through to the end (Farrugia, Gallina 2008; Medeiros 2011; ESPON 2011[2]). These efforts are very different content-wise and of different usability. Only the ESPON monitoring system is based on firm political endorsement that can make INTERCO indicators implementable in practice. The selection process of ESPON indicators has combined scientific advice and a discourse with the final beneficiaries i.e., policy makers (ESPON stakeholders). This has allowed the ESPON indicators to become policy-oriented.

In many cases the conclusions from the research, as summarized by Farrugia, Gallina (2008, 34), were rather pessimistic. They pointed out that the existing statistical situation of the EU made it impossible at that time to build any relevant index of territorial cohesion at the regional level which could embrace the three dimensions of the ESDP. The INTERCO project overcame those limitations by establishing a wish list of indicators.

The best example, out of the available ones, of translating policy discourse into the features of the territorial monitoring system can be provided by the case of INTERCO. The indicators were selected on the basis of their relevance for the EU 2020 Strategy, the Territorial Agenda 2020 and the aims within territorial cohesion, such as: reducing territorial inequalities in access to services, improving the natural environment, reducing poverty and exclusion, increasing territorial innovation and enhancing territorial governance. The indicators were chosen for the following seven dimensions of territorial cohesion, identified on the basis of the territorial cohesion objectives: (i) economic performance and competitive-ness, (ii) environmental qualities, (iii) social inclusion and quality of life, (iv) innovative territories, (v) access to services, markets and jobs, (vi) territorial cooperation and governance, and (vii) polycentric territorial development (ESPON 2012). Finally, some selection criteria were applied to allow permanent gathering of information on the indicators and ensure their usefulness for the policy makers. According to the criteria, the indicators should:

[1] Also ESPON 3.3. Project (ESPON 2006b) developed a comprehensive set of indicators related to the dimension of the development referred to as the 'quality', covering also the quality of the territory. Those indicators cannot, however, be taken as a system for measuring the territorial cohesion or territorial development. They rather measure the socio-economic development in space. The same is true with regard to OECD Regional Database. Finally, the EEA (2010) also developed a list of potential territorial indicators to support the environmental dimension of territorial cohesion. That attempt covers mainly ecological aspects of the latter, though.

[2] Also the ESPON Project KITCASP aims at the elaboration of a core set of key indicators of territorial cohesion, economic competitiveness and sustainable development to keep spatial planners at the national level informed, drawing on ESPON research and datasets available in the case studies.

- show a clear direction of change,
- show the value of a direction of change (e.g. larger is better – or worse),
- be sensitive to policy change and be able to measure the outcome or impact of a policy measure,
- be available for time series, i.e. the data should be updated regularly, preferably annually and the costs of updating data should be reasonable,
- be available at sub-national level, preferably at NUTS3,
- focus on the added value of territorial cohesion and cover its dimensions and not so much on economic or social cohesion,
- be easy to calculate and to use by the end-users.

For each of the territorial themes, "a number of so-called 'top indicators' were selected by means of the INTERCO combined analytical and participatory process, taking into account data constraints" (ESPON 2011, 3). The indicators were divided into four categories: (i) those indicating changes, disparities and territorial assets/opportunities (Ch), (ii) those showing territorial structural elements (St), (iii) those portraying the contextual situation of regions, and the framework conditions (C), (iv) those that are important but cannot be computed due to different reasons (the wish list) (W).

The results of the selection by the ESPON Monitoring Committee (of June 2012) are presented in table 1 below. The indicators in grey have been added to the INTERCO indicators by the ESPON stakeholders.

Table 1 ESPON Territorial indicators

Annex 1. Indicators for Territorial Cohesion - grouped per theme and category
(The indicators in grey are added to the INTERCO indicators by ESPON stakeholders)

Categories: / Themes	Change (Ch)	Structure (St)	Context (Co)	Wish list (W)
Economic performance and competitiveness	- Unemployment rate		- GDP per capita in PPS - Old age dependency ratio - Labour productivity in industry and services - Labour productivity per person employed - Primary employment rate - Tertiary employment rate	
Environmental qualities	- *Air pollution: PM10 - *Air pollution: Ozone concentrations - *Soil sealing per capita (St) - *Accessibility to Natura 2000 (St)	- Wind power potential	- Potential vulnerability to climate change - Fresh water resources - Noise pollution - Photovoltaic potential - Aggregated Natural Hazards	- Natural resources (Co) - Biodiversity (St) - Mortality, hazards and risks (Co)
Social inclusion and quality of life	- Disposable household income - Proportion of early school leavers - Quality of housing - % in risk of poverty		- Life expectancy at birth - Gender imbalances - Difference in female-male unempl. rates - Ageing index - % of households very low in work - Deprived persons	
Innovative territories	- Population aged 25-64 with tertiary education - Creative workforce - % of high growth firms		- Intramural expenditures on R&D - Employment rate 20-64 - Birth rates and survival rates of firms	
Access to services, markets and jobs	- Access to compulsory school (St) - Access to hospitals (St) - *Accessibility of grocery services (St) - Access to university (St) - Access to primary health care - Households with broadband access	- *Accessibility potential by road - *Accessibility potential by rail - *Accessibility potential by air		
Territorial cooperation and governance	- *Cooperation intensity - *Cooperation degree		- Variation in corruption, discrimination & victimization	- Use of integrated place based strategies (Ch) - Use of functional regions (St) - Use of territorial impact assessments (Co)
Polycentric territorial development		- *Population potential within 50 km	- Net migration rate	- *Polycentricity index (St)

* The Indicators marked with an * have intrinsic territorial dimensions meaning that they
- include the notion of distance, i.e. all the "accessibility" indicators + "Population potential within 50 km"
- are calculated using areas/volumes (soil sealing, air pollution)
- relate 2 or more territories (the cooperation indicators)

The lessons learned for the BSR-TeMo project are the following:

Firstly, the INTERCO project has encountered problems with measuring such a complex and heterogeneous category as territorial cohesion. The solution was flexibility of the indicator system i.e. the ability of the system to serve different policy objectives (ESPON 2011, 9).

Secondly, the INTERCO project (ESPON 2011, 8) underlined a trade-off between flexibility and stability of the monitoring system. On the one hand the system should allow comparable measurement and comparison over time; on the other hand it should react to the changes in territorial goals and objectives. The project tried to resolve the dilemma by making a distinction between data (which can be organised using a thematic thesaurus) and indicators (which would be linked to specific dimensions of territorial cohesion – e.g. the territorial objectives identified by the INTERCO project). The strive towards stability was probably the main reason why originators of the project after analysing different, politically approved territorial objectives, considered as foundations and essence of the territorial cohesion (e.g. priorities of the Territorial Agenda of EU 2020) came up with their own set of six and then seven objectives (dimension of the territorial cohesion) which were regarded as more versatile[3].

Thirdly, the INTERCO project paid a lot of attention to the simplicity and usefulness of the system for policy makers. This should be considered as one of the key factors for success. For instance, an idea of composite indicators was clearly rejected by a vast majority of the stakeholders during the discussions held (ESPON 2011, 9). Therefore it was decided to elaborate some sets of indicators under the project.

Fourthly, the INTERCO project recognized the importance of data constraints, in particular lack of relevant data collected periodically at the NUTS 3 level. As a result the INTERCO system is unable to measure e.g. progress in the state of biodiversity and in renewable energy production and consumption, since such information has been collected only at the national level so far.

Fifthly, the INTERCO project underlined the importance of the contextual indicators (e.g. life expectancy) that were not related to the outcomes of concrete policies but shaped the context for such policies by describing the complexity of the various situations in the EU.

The general conclusions on the desired shape of the BSR territorial monitoring system, expressed in the inception report, hold true after in depth analysis of the practical attempts to establish such systems for EU or/and parts of Europe. However, additional conclusion should be added on the institutional preconditions for the systems success.

The TPG strives towards a monitoring system that is user friendly, receptive to the needs of its main users (the stakeholders) and sufficiently stable (to allow for inter-temporal comparison) but also flexible enough to remain useful in the future. Its design and development is done in close collaboration with the stakeholders that should gain a feeling of ownership in this process. Efforts are done to pass responsibility for its further development and maintenance to the key stakeholders and to furnish them with instruments signalling real needs of adjusting the system to the new circumstances and demands.

[3] "The recurrent updates of the policy objectives and documents had forced us to take a flexible attitude in the course of the project, rendering the current results more in line with the future shape of Europe but also more adaptable if any changes should take place in the future as well " (ESPON 2011, 8).

2. Elements of the territorial monitoring system

2.1. Overall framework

A territorial monitoring system consists of numerous elements. First and foremost the indicators and the data for these but to view it in its totality, it is important to emphasise that analysis and methodological considerations when analysing the development and comparing the indicators across the territory are equally important elements of a well-functioning and relevant territorial monitoring system.

The full extents of the TeMo territorial monitoring system can be illustrated as in figure 1 below. While the TeMo publications, including the ESPON deliveries, and the TeMo *Presentation Tool* are the tangible outputs of the TeMo project, the full set of elements to the left comprise the actual content of the territorial monitoring system.

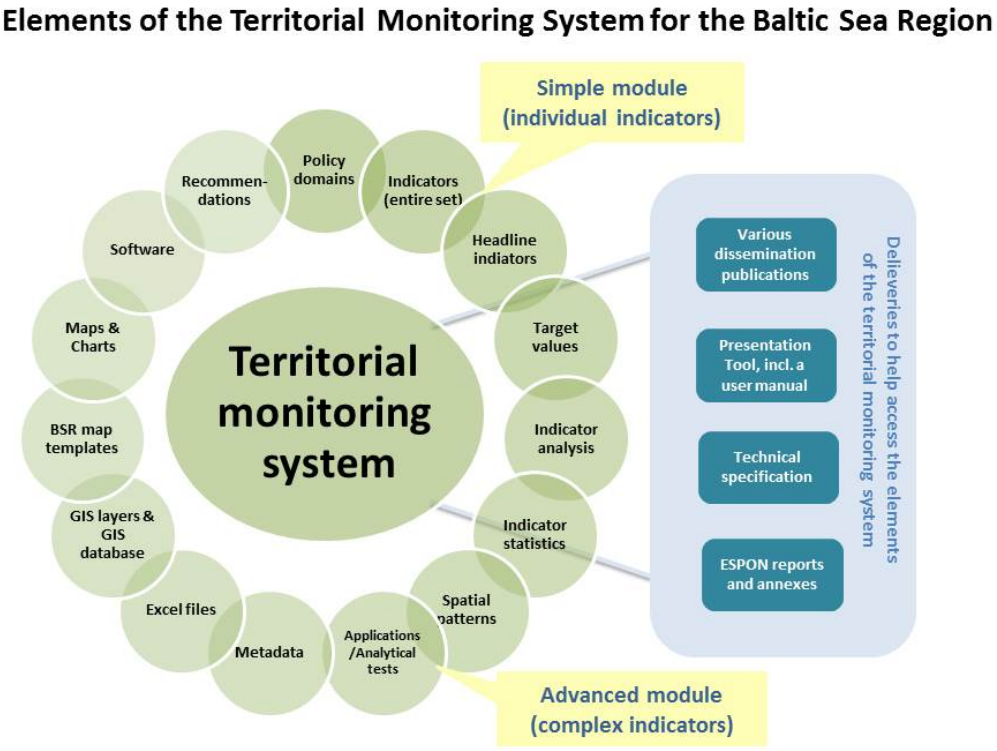


Figure 1 The elements of the TeMo territorial monitoring system

2.2. Selection of domains, subdomains and indicators

Based on 1) the project specifications, the inception report, and the interim report 2) the ideas and comments put forth by the Steering Committee, 3) renewed input from ESPON on indicators, 4) a meeting with Russian data experts in St Petersburg, and 5) the internal expertise of the TPG, we developed a final set of domains, subdomains as well as indicators included therein.
We have opted to divide the five main domains into subdomains in order to enable better conceptual coverage and analytic clarity. This is a similar method utilised particularly within the European Commission (e.g. EU 2020 or EU Sustainable Development Strategy monitoring systems).

Before we go into the detailed description of each domain and indicator we would like to point out that it is evident that no strict compartmentalisation can be made between the different domains. For example, unemployment could just as easily be viewed in terms of social cohesion and not only from an economic point of view. We do however deem it neither possible nor sensible to forcefully try to eradicate all overlapping between the different (sub-) domains. In the end it is nevertheless the end-user of the system that will make a qualitative assessment as to the contents, coverage and scope of the separate indicators.

The full list of domains, subdomains and indicators can be found in table 2 below. We have after thorough consideration opted for labelling the domains precisely as has been done in the INTERCO project. This decision is supported by the ToR of the project.

In table 2, under each domain, we added a second heading illustrating the relevance of the domain from a BSR perspective, i.e. the Baltic raster explained in Volume 1, and some normative aspects for better understanding why this perspective and these indicators have been included.

Table 2 List of domains, subdomains, and indicators

Domains	**1. Economic performance and competitiveness**
Baltic raster / Normative aspect of domain	Place-based economic development. Development of territorial assets/territorial capital. Context indicators.
SUBDOMAINS AND INDICATORS	**Macroeconomic development**
	GDP per capita
	GDP per person employed
	Labour market
	Unemployment rate, total
	Employment rate (20-64 years)
	Demography
	Net migration rate
	Total population change
	Economic dependency ratio

Domains	**2. Access to services, markets and jobs**
Baltic raster / Normative aspect of domain	Balancing territorial development, diminishing territorial divides or alleviating their consequences. Maintaining at least the existing polycentricity level of the settlement structure. Ensuring accessibility, connectivity and parity of access to transport and ICT infrastructure, development of TEN-T.
SUBDOMAINS AND INDICATORS	**Potential accessibility**
	Accessibility potential by road
	Accessibility potential by rail
	Accessibility potential by air
	Multimodal accessibility potential
	Spatial structure
	Functional areas: access to cities

	Population potential within 50 km
	Border crossings
	Internet
	Households with internet access at home

Domains	**3. Innovative territories**
Baltic raster / Normative aspect of domain	Ensuring high quality of urban nodes, and their networking with focus on diffusion of innovation and enhancement of knowledge-based development. Emergence and development of regional clusters of competition and innovation.
SUBDOMAINS AND INDICATORS	**Human capital**
	Population with tertiary education (25-64 years)
	Employment in technology & knowledge sectors
	Financing and institutions
	Gross-domestic expenditures on R&D, business
	Gross-domestic expenditures on R&D, total

Domains	**4. Social inclusion and quality of life**
Baltic raster / Normative aspect of domain	Brought forward at the stakeholder workshop in Potsdam, as result of present economic, financial and social crisis in Europe
SUBDOMAINS AND INDICATORS	**Social inclusion**
	At-risk-of-poverty rate
	Severe material deprivation rate
	Youth unemployment rate (15-24 years)
	Gender imbalances
	Health
	Life expectancy at birth, in years
	Self-assessed general health status

Domains	**5. Environmental qualities**
Baltic raster / Normative aspect of domain	Wise use of the sea space. Eco-resilience: i.e. green networks, ecological corridors and preservation of areas of high ecological value. Development of renewable energy resources (also on the sea) and the BSR transmission grid.
SUBDOMAINS AND INDICATORS	**Consumption and production**
	New soil sealing per capita
	Air pollution (PM10)
	Eutrophication
	Natural resources
	Fragmentation index

Through the work on selecting the most policy relevant domains, it was clear that some other domains should also be covered by the monitoring system since they are important for territorial cohesion, e.g. a domain on governance was considered as very desirable. However, this has to remain as a 'wish domain' due to lack of appropriate (quantitative) indicators. For instance, as it has also been concluded in the ESPON TANGO project, governance is path-dependent and very sensitive to context wherefore it is difficult to create good general indicators of such a domain. This perspective on the lack of one-directional indicators for monitoring the policy domain of governance was also supported by e.g. stakeholders from Russia. Thus, the TPG chose not to include the domain at all rather than maintain a domain with low quality indicators. This opinion was also supported by the stakeholders. When good indicators for governance are developed the territorial monitoring system can of course be expanded to also include this domain.

A starting point for the selection of indicators was that it should ideally be possible to cover them by available data on regional level, or data that was possible to produce in order to include in the TeMo project. Ideally, the selected indicators should also be covered by comparable data from all regions of the BSR, here with special attention to Russian and Belarus data, and there should ideally be data available from several years, in order to provide for time series.

On the other hand, the relation of each tentatively selected indicator was examined against the BSR policy goals and challenges. The results of those investigations are presented in Table 3 below. As a result of this assessment, only policy relevant indicators were selected for the final proposal of the TeMo indicators.

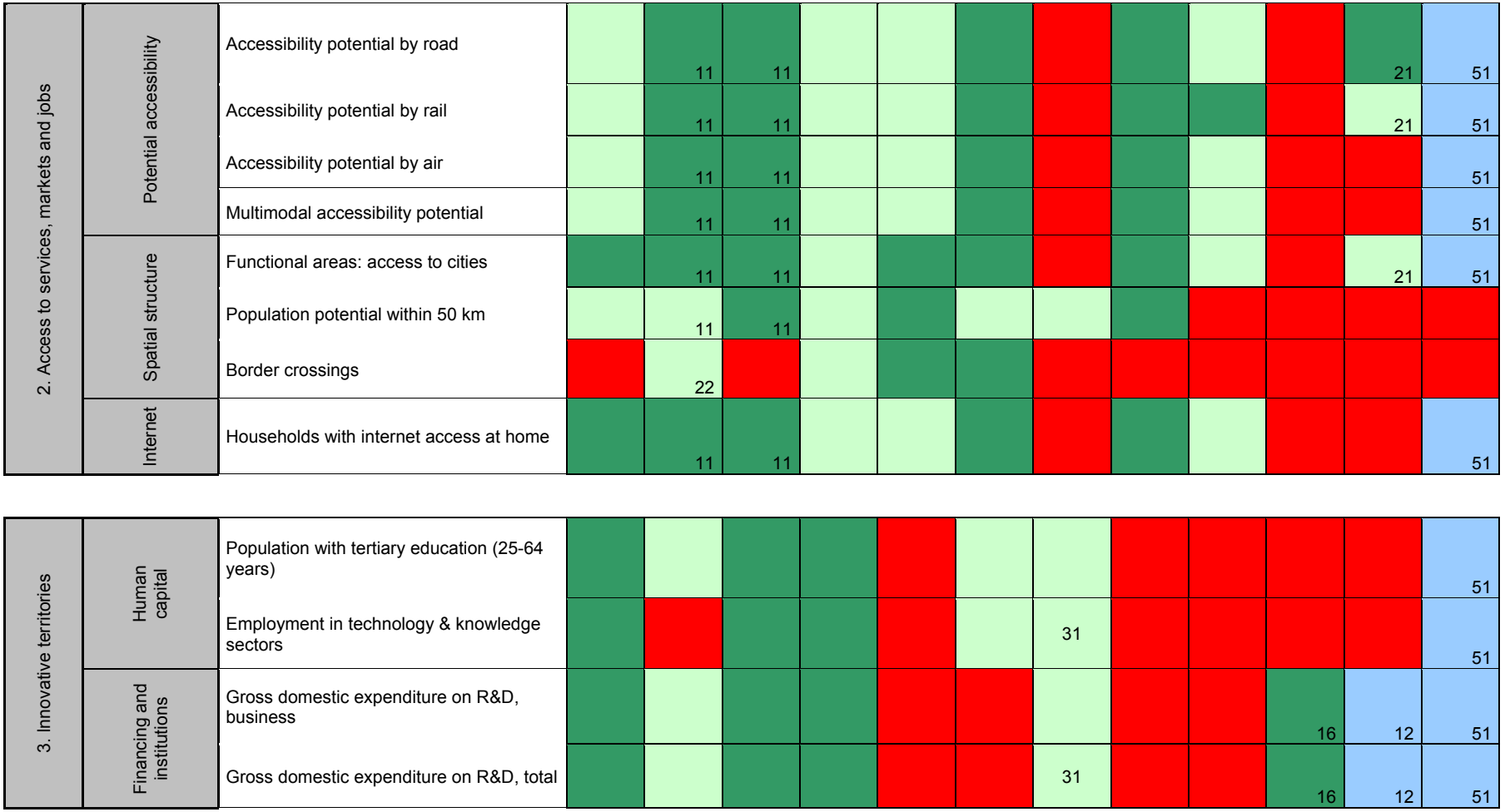
Table 3 Comparison of the chosen indicators with the BSR policy goals

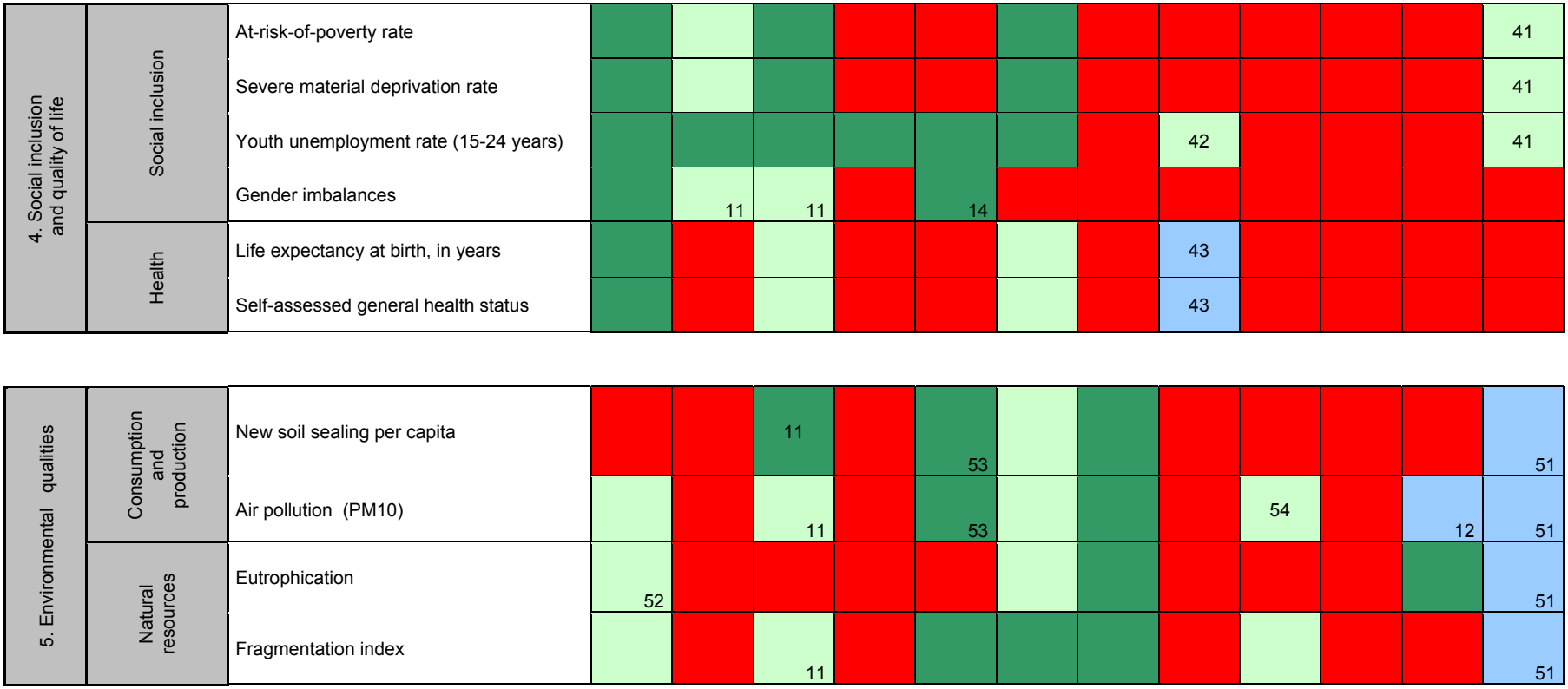
Legend: General usage for measuring concept:

= Typically used | = Occasionally used | = Not generally used

= Not currently used, but could have tentative contribution potential | (nr) Numbers in cells refer to specific comments below the table

			12 main components of BSR-specific territorial development arenas											
Domain	**Subdomain**	**Indicators**	**DIVIDES**	**POLYCENTRICITY (SGEI)**	**QUALITY OF CITIES**	**CLUSTERS OF INNOVATION**	**FUNCTIONAL AREAS**	**TERRITORIAL CAPITAL**	**ECO-RESILIENCE**	**ACCESSIBILITY**	**SUSTAINABLE TRANSPORT**	**ENERGY**	**SEA SPACE**	**GOVERNANCE**
1. Economic performance and competitiveness	Macroeconomic development	GDP per capita		11	11		14					16	12	
		GDP per person employed		11	11	15	14					16	12	51
	Labour market	Unemployment rate, total			11		14							
		Employment rate (20-64 years)		11	11		14							
	Demography	Net migration rate		11	11		14							51
		Total population change		11	11		14							
		Economic dependency ratio			11		14							


2. Access to services, markets and jobs
Potential accessibility
Spatial structure
Internet
Accessibility potential by road
Accessibility potential by rail
Accessibility potential by air
Multimodal accessibility potential
Functional areas: access to cities
Population potential within 50 km
Border crossings
Households with internet access at home
3. Innovative territories
Human capital
Financing and institutions
Population with tertiary education (25-64 years)
Employment in technology & knowledge sectors
Gross domestic expenditure on R&D, business
Gross domestic expenditure on R&D, total



Notes:

11	If used for urban LAU 1 or at least Nuts 3 regions
12	If measured for sea areas or sea branches
14	For comparison of different functional areas
15	For identification of emergence of innovative branches
16	If measured for energy sector
21	To ports
22	Important indicator for accesibility to SGI
31	If related to green technologies
41	As a measurement on efficiency of social protection progra
42	Accessibility to employment
43	Could be used as a proxy for accessibility to health care fac
51	Measure of governance failures or sucesses
52	East-West divide
53	For identification of functional areas
54	If measured from transport

2.3. Simple and advanced module

It was outlined in the ToR that the project implementation should envisage a "two level" monitoring system: a basic monitoring module containing simple indicators, showing basic and easily-explainable/-understandable development trends, and a more advanced module containing more sophisticated and complex/combined indicators. Another aspect of the division into a basic and advanced module was that this division could also provide a resource prioritization for the future updates of the monitoring system, in that it was envisaged that the data for the simple indicators would be easier to obtain and require less calculations and explanations.

However during the project process it became clear that the desired intentions behind this suggestion could not be honored in the outlined two-level structure.

What has emerged from the conceptual and policy oriented work package is a need for a comprehensive and integrated understanding of the process of territorial cohesion, and thus, such a division of indicators would be rather detrimental. Apparent simple indicators can contain very complex information and also need high level of analytical skills to explain their impact on territorial cohesion. Thus it is better for dissemination, presentation, analysis, testing and construction of the visual presentation tool to keep the system together and follow another approach.

Therefore, rather than dividing the indicators onto two module 'levels', we have developed a simple module containing thematically organized indicators – based on the policy domains identified in work package 1 – and an advanced module containing 10 separate complex indicators that can be used to cross-sectoral and cross-indicator monitoring of the major aspects of territorial cohesion in the BSR.

To bode for the disappearance of update ranking between the indicators in the original division of indicators into simple and advanced indicators, we propose the concept of the headline indicators to point to the indicators that should be prioritised in future updates. These are selected on the basis of conceptual and statistical significance within their policy domain, and will be explained in detail in chapter 3.2. The headline indicators thus functions as a short list of indicators for each policy domain, but it is of course important to point out that one indicator is not sufficient to cover a whole policy domain, nor is it sufficient to identify development trends for territorial cohesion in the BSR.

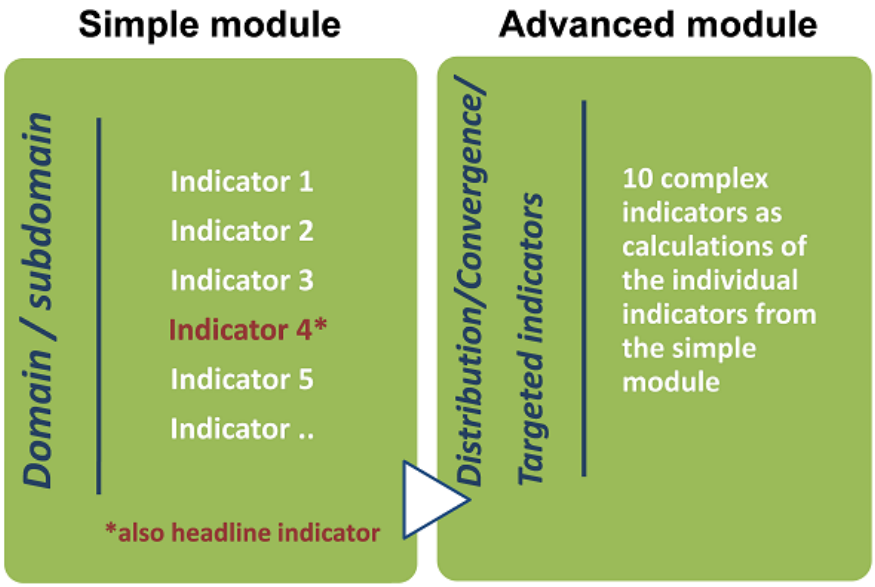


Figure 2 Schematic overview of the simple and the advanced module

Summing up, it can be argued that the main part of the monitoring system – the simple module - is the compilation and analysis of the chosen indicators, while the advanced module address standardized cross-indicator analysis options by relating different indicators with each other, and by producing advanced indicators through statistical procedures (such as GINI coefficients etc.), see figure 2 above.

3. Domains, indicators and headline indicators

3.1. Domains and indicators

The final list of domains and indicators of the TeMo territorial monitoring system consists of 29 indicators listed in the structure of 5 thematic domains and 12 subdomains, see table 4. Table 4 also provides some information on spatial level and data availability for each indicator.

In the following, we describe each domain and indicator in more detail with regard to what it describes, where else it is used, and also some considerations on data availability.

Domain 1: Economic performance and competitiveness

For the first domain, **Economic performance and competitiveness**, no major challenges were encountered. One reason for this may be that this issue is in measurement terms rather well covered e.g. by the EU2020 strategy.

Subdomain: Macroeconomic development

GDP per capita (in PPS) refers to the total value of all goods and services produced within a territory during a given period (here converted into purchasing power standards in order to accommodate transnational comparison). Although it is the most widely used measurement of economic activity and included as a headline indicator e.g. for the EU Sustainable Development Strategy (SDS), it has over the years been criticised for bypassing the core issues of material well-being (national income, real household income, consumption, environment, and so on)[4]. However, as it still constitutes the principal indicator for European regional policy (e.g. for confirming eligibility) it has as such to be included in any territorial monitoring system. It is included also in the INTERCO list of indicators.

GDP per person employed (in PPS) refers to the same indicator as above, but with number of employed persons as the denominator. Included on the INTERCO list it is used as an indicator for labour productivity (i.e. how much output a given number of persons are producing). For measuring regional production it alleviates the measurement problem of commuting and provided a more truthful picture of regional productivity than does GDP/capita.

[4] For a recent review of the shortcomings of GDP, see for example the Report by the Commission on the Measurement of Economic Performance and Social Progress: http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf

Table 4 Overall data availability, based on previous data releases

Indicator	Over all data availability*, based on previous data releases *) Gaps may exist for certain regions.	Spatial level
Economic performance and competitiveness		
GDP per capita	Yearly	NUTS-3/Oblast
GDP per person employed	Yearly	NUTS-3/Oblast
Unemployment rate, total	Yearly	NUTS-3/Oblast
Employment rate (20-64 years)	Yearly	NUTS-2/Oblast
Net migration rate	Yearly	NUTS-3/Oblast
Total population change	Yearly	NUTS-3/Oblast
Economic dependency ratio	Yearly	NUTS-2/Oblast
Access to services, markets and jobs		
Accessibility potential by road	Every 5 years (2001, 2006, 2011 …)	NUTS-3
Accessibility potential by rail	Every 5 years (2001, 2006, 2011 …)	NUTS-3
Accessibility potential by air	Every 5 years (2001, 2006, 2011 …)	NUTS-3
Multimodal accessibility potential	Every 5 years (2001, 2006, 2011 …)	
Functional areas: access to cities	Irregular (2011 …)	Grid, NUTS-3
Population potential within 50 km	Irregular (2008 …)	Grid, NUTS-3
Border crossings	Every 5 years (2000, 2005 …)	Border crossings
Households with internet access at home	Yearly	NUTS-2
Innovative territories		
Population with tertiary education (25-64 years)	Yearly	NUTS-2/Oblast
Employment in technology & knowledge sectors	Yearly	NUTS-2
Gross-domestic expenditures on R&D, business	Yearly	NUTS-2
Gross-domestic expenditures on R&D, total	Yearly	NUTS-2
Social inclusion and quality of life		
At-risk-of-poverty rate	Yearly	NUTS-2/Oblast
Severe material deprivation rate	Yearly	NUTS-2
Youth unempl. rate (15-24 years)	Yearly	NUTS-3/Oblast
Gender imbalances	Yearly	NUTS-3
Life expectancy at birth, in years	Yearly	NUTS-2/Oblast
Self-assessed general health status	Every 2 years (2006, 2008, 2010 …)	NUTS-2-3
Environmental qualities		
New soil sealing per capita	Irregular (2006 …)	NUTS-3
Air pollution (PM10)	Irregular (2009 …)	NUTS-3/Oblast
Eutrophication	Yearly/Irregular (2009, 2010 …)	Per sea area
Fragmentation index	Every 7 years/Irregular (2002, 2009 …)	NUTS-3

Subdomain: Labour market

Unemployment rate (total) is included as an indicator in the EU SDS. It is the most widely used indicator of labour market performance but is connected with a number of measurement imperfections and should be considered as a complementary indicator to employment rate. It can be viewed both from an economic and from a social point of view, in the latter case particularly when disaggregated either by gender, age, education or at the level of the individual. Only data from Labour Force Surveys (LFSs) are comparable across countries. It is included in the EU SDS as well as in INTERCO.

Employment rate (for persons aged 20-64 years) is included as an official indicator in the EU SDS and is furthermore a headline indicator of the EU 2020 Strategy's "Smart growth" and "Inclusive growth" priorities, aiming for 75 % of the 20-64 year-olds to be employed by 2020. It is also on the INTERCO list of indicators. It refers to the number of persons aged 20-64 years that are employed as a share of all persons of that age. Concerning such normative goals, there are some measurement challenges included in that a high employment rate of e.g. persons aged 20-24 years would de facto imply that they do not attend education, which in the long run for some would be counterproductive.

Subdomain: Demography

Net migration rate and Total population change (and as their subtraction also natural population change) are traditional indicators when measuring regional polarisation and often also used as measurements of regional attractiveness (or lack thereof). Net migration is included as an official indicator for the EU SDS as well as in INTERCO. Typically, regional net migration rates constitute only between 5 and 15 % of the total gross migration volumes.

Economic dependency ratio refers to the theoretical number of persons supported by the nr of persons employed. Three principal types are commonly used: total dependency ratio equalling 0-14 years plus 65+ years as a share of persons employed. Such indicator can be used to assess the (theoretical) financial burden of supporting these age groups.

Domain 2: Access to services, markets and jobs

The TA2020 acknowledges the crucial importance of service provision and accessibility for territorial connectivity and integration in a broad sense by stating that "*Fair and affordable accessibility to services of general interest, information, knowledge and mobility are essential for territorial cohesion. Providing services and minimizing infrastructure barriers can improve competitiveness and the sustainable and harmonious territorial development of the EU*". Sufficient accessibility thus helps balancing territorial development, helps diminishing territorial divides or alleviating their negative impacts. In the Baltic Sea Region context, accessibility to services, markets and jobs is key to ensure that every part of the territory is able to benefit from well-being standards, and from equal development potentials, by providing access and connectivity to transport and ICT infrastructures, facilities and services, especially for remote, isolated, sparsely populated areas and areas with harsh climatic conditions.

Subdomain: Potential accessibility

The four indicators on accessibility potential (by road, rail, air and multimodal) measure the market potential of regions and thus the locational advantages a region enjoys from the existing transport systems. How accessible is a region, and how many people can be reached from a region in reasonable time? The higher the accessibility potential for a region is, the higher is also its attractiveness for economic and social activities in that region. All four indicators are proposed since good accessibility by one mode does not suppose equally good accessibility for another mode. Instead, often region enjoy good accessibility by one mode but poor accessibility by another.

Subdomain: Spatial structure

Functional areas: access to cities: This indicator replaces the discarded indicators "access to cities: cities within reach" and "functional areas". The new indicator is defined as the number of cities of more than 50,000 inhabitants that can be reached from any point within 60 minutes car travel time. Good access to cities, as the spatial centers for public and private service provision, is of prime interest for people´s daily life. Fair travel times to these centers should thus be one of the political objectives of spatial policies. Establishing or maintaining a functional polycentric system of cities and towns will be of benefit for all people. The more cities that can be reached, the higher is the centrality of this place, and the more options residences have to travel to any of these cities. In other words, similar to ESPON 1.1.1 this new indicator "counts" the number of overlapping service areas; but the new definition is more easily comprehensible. Furthermore, the new indicator had been included in the ESPON TRACC project.

While the previous indicators deal with physical infrastructure and the levels of accessibility they provide, the following two indicators focus on territorial structures and functionalities. They pick up main priorities of the ESDP, TA2020 on "*polycentric and balanced territorial development of the EU [is] as key element to achieving territorial cohesion*", by promoting polycentric patterns at all spatial levels helping to reduce territorial polarization. Concentration and connection are the main challenges of polycentrism, as they help achieving a critical mass and allow surrounding areas to benefit from agglomeration effects (ESPON INTERCO, 2012, 106).

The population potential within 50km is a proxy for the demand for provision of public (and private) services, for (minimum) market potentials and for the level of polycentricity. A radius of 50 km airline distance is considered a typical distance for daily commuting trips to go to work or education, to go shopping, to visit other services or visit friends and relatives. Similarly, from the viewpoint of shops or service provides, this distance is considered a reasonable service areas for their products, customers or workers. This indicator is also able to assess the urban-rural divide for the Baltic Sea Region. Urban (or agglomerated) areas are likely to have high population potentials, while rural areas are expected to experience a lack of potential. The degree to which rural areas fall behind urban areas can be analyzed with this indicator.

For the Baltic Sea Regions, border crossings are still a major concern between the countries of the European Union on the one hand, and Russia and Belarus on the other hand. Complicated and lengthy custom clearance procedures, and long waiting times at border control points are still obstacles to free movement of goods and persons. This indicator measures the border waiting times for trucks at major border crossings, differentiated by inbound (into EU) and outbound (out of EU) traffic, and thus addresses one major issue of the East-West divide in the BSR.

Subdomain: Internet

While the previous indicators measure physical infrastructures (i.e. transport networks) in relation to certain physical destinations, the indicator households with internet access at home is looking at the digital infrastructures, i.e. access to information. Fast internet access is nowadays fundamental to all economic activities, and everyday life can no longer be imagined without internet as indispensable source of information and mean of communication.

Domain 3: Innovative territories

This domain lays at the heart of the EU 2020 Strategy's "smart growth" priority. It contains indicators both of an input and of an output character, enabling regional comparison of a cost-benefit type.

Subdomain: Human capital

Population with tertiary education (25-64 years) can be viewed as a crude indicator of the level of more advanced skills of the population of a region and as an input indicator of innovation. Tertiary educational attainment in the age group 30-34 years[5] is a headline indicator of the EU 2020 Strategy's "Smart growth" priority, aiming for at least 40 % of 30-34–year-olds completing third level education by 2020. In contrast, in the EU SDS indicator set, focus lays on reduction of those with the lowest level instead. Striving for a higher level of persons with tertiary education may be seen as a general normative goal, but the level reaches a vertex at an unspecified point depending on the economic structure of the region, and in many regions skilled labour could be a more critical resource. In the context of "innovative territories" it is nonetheless a justified indicator on the existing human capital endowments of a region.

Share of employment in technology & knowledge sectors is a summary indicator of employment within a selection of high-technology manufacturing and knowledge-intensive high-technology service branches. The selection of included branches focuses on the level of knowledge intensity of the economic activity of the region[6] rather than on e.g. the educational level of the population or the labour force. It may thus be viewed more as an output indicator for the innovative capacity of a region.

Subdomain: Financing and institutions

Gross domestic expenditures on R&D (as a share of GDP) in 1) business and 2) total is a headline indicator of the EU 2020 Strategy's "Smart growth" priority, aiming at combined public and private investment levels to reach 3 % of EU GDP by 2020. It is also included in the EU SDS as well as in the INTERCO list of monitoring indicators and is a typical input indicator for innovation as high investment do not automatically yield high output. It refers to the relative share of a regions' GDP generated from R&D –related activities that, in the long run, may help create new products/services and boost creation of new jobs. We have

[5] Data for this age group is only available at NUTS 1 level, whereas data for the age group 25-64 years is available at NUTS level 2, whereupon the latter was chosen for this monitoring system.

[6] These include the crude branches of manufacturing of aircraft spacecraft, medical, precision and optical instruments, watches and clocks, pharmaceuticals, medicinal chemicals and botanical products, office machinery and computers as well as radio, television and communication equipment and apparatus, and within services research and development, computer and related activities, post and telecommunications as well as financial intermediation.

here chosen to subdivide this indicator by sector of performance into private (e.g business enterprise) sector and total, respectively.

Domain 4: Social inclusion and quality of life

The EU Sustainable Development Strategy as well as the EU 2020 Strategy, and particularly its "inclusive growth" priority, both emphasise the importance of poverty reduction and combating social exclusion. Also the "GDP and Beyond" initiative with its focus on human well-being is closely connected to this domain. All indicators in this domain stem from the monitoring systems of these strategies.

Subdomain: Social inclusion

The at-risk-of-poverty rate is included in the Laeken, the EU SDS and in the EU 2020 Strategy indicators. Within the target for "Inclusive growth", the EU 2020 headline goal is that at least 20 million people should be lifted out of the risk of poverty *or social exclusion* by the year 2020. A person is defined as being in risk of poverty if his/her equivalised (by household size) income after social transfers is below 60 % of the corresponding national median. Although it is calculated per individual, its primary measurement unit is the household. The at-risk-of-poverty rate should not be confused with the AROPE[7] indicator, which partially contains the former. The at-risk-of-poverty rate is useful for comparing some distributional aspects of monetary well-being but being a relative indicator (related to the national median), it should not be utilised for cross-country comparisons of absolute levels of poverty.

Severe material deprivation rate targets persons having their living conditions severely constrained by a lack of resources. The indicator is defined as the share persons experiencing at least four out of nine following deprivations items: cannot afford: 1) to pay rent or utility bills; 2) keep home adequately warm; 3) face unexpected expenses; 4) eat meat, fish or a protein equivalent every second day; 5) a week holiday away from home; 6) a car; 7) a washing machine; 8) a colour TV; or 9) a telephone. As such this indicator allows for direct cross-country comparison of material poverty. The indicator is a headline one for the EU 2020 Strategy and it is also included in the EU SDS set of indicators.

Youth unemployment rate (15-24 years) can be viewed as an "early warning indicator" for future social exclusion. It is included in the EU SDS set of indicators and defined as unemployed persons aged 15-24 years as a share of all persons of that age group *in the labour force*. Interpretation of this indicator must be done cautiously, as a high youth unemployment rate does not necessarily imply that a large share of the total number of youth are unemployed (as they may be off the labour force, typically studying). It is therefore also at times calculated with the total population of that age as the denominator, which provides a more accurate picture of the relative volume of young unemployed persons.

Gender imbalances in a region is assessed by the ratio of male-female aged 25-39. Unbalanced gender compositions in a region hint at social problems, and are obstacles for further demographic and economic developments.

[7] The AROPE indicator (People at risk of poverty or social exclusion) is defined as the share of the population in at least one of the following three conditions: 1) being below the poverty threshold; 2) being in a situation of severe material deprivation; or 3) living in a household with very low work intensity.

Subdomain: Health

Life expectancy at birth (in years) is one of the principal global indicators for mortality. Included in the Laeken list of indicators, it reflects improvements in living standards and the establishment and improvement in health systems. It can thus be viewed as a partial output indicator of the quality of the health care system in general also incorporating aspects of public health awareness etc. It is a theoretical indicator where general trends of mortality are transposed on a new born child. Alongside low levels of fertility the gradual increase in life expectancy is however also one of the contributing factors to the ageing of the population. The BSR shows considerable variations in life expectancy, reflecting the socioeconomic divide of the region.

Self-assessed general health status is widely utilised as an output indicator of the quality of the health care system and is included in the Laeken list of indicators. We are here utilising ESS (European Social Survey) data, where respondents are asked the question "How is your health in general? Would you say it is "Very good", "Good", "Fair", "Bad", or "Very bad"." We utilise this subjective indicator as a proxy to the objective indicators on health care personnel and expenditure, which have proven to be very difficult to measure comparatively across countries. The EU-SILC (Survey on Income and Living Conditions) will tentatively produce also regionalised data on this topic in forthcoming rounds.

Domain 5: Environmental qualities

Sustainability is essential in the Europe 2020 Strategy of smart sustainable and inclusive growth and has in recent years been emphasised within the overall concept of green economy (or green growth). Many of the thematic objectives of cohesion policy (and recently in the objectives of the common strategic framework of the EU) emphasise reduced emissions, investments in clean-tech, renewable energy, and adaptation strategies as the core of policy. A greening of the economy is aimed at decoupling growth from energy consumption and emissions, and emphasises the aspect of a clean environment as a territorial capital which is an integrated part of a placed based development. From a Baltic Sea Region perspective we have recognised in this perspective some important aspects of the domain which we have tried to cover but not always successfully. These include aspects such as a wise use of the sea space, eco-resilience (i.e. green networks, ecological corridors and preservation of areas of high ecological value), development of renewable energy resources (also on the sea) and the BSR transmission grid for energy. Within the domain of environmental qualities we have defined four indicators which focus primarily in emissions and use of land. These are indicators which captures the state of air and water as well as the quality of land and landscapes. This will combined provide a picture of the state of the environment as a territorial capital or capacity.

Subdomain: Consumption and production

New soil sealing per capita is a measure of how much land is converted to a "built" surface in a wider definition. Hence this indicator is associated with land take for economic development and is associated with settlement structures and demographic development. Since soil sealing is associated also to the resilience and buffering capacity of nature this is an important indicator, as well as indicating the quality of landscapes for recreation and human well-being.

Basic air pollution (PM10) is depicted at the NUTS 3 level since this data is available as even raster data. The indicators shows measurements on number of

days PM10 exceeds norm value, i.e. the average number of days in the year where "particular matter" (PM, particulates) exceeds the norm value.

Eutrophication (HEAT index from Helcom) is an important indicator for the quality of the Baltic Sea and an indicator for how successful measures are to prevent the leakage of nutrients from agriculture and sewerage plants around the sea.

Subdomain: Natural resources

The final indicator, the fragmentation index, is our attempt to overcome the lack of data on biodiversity and landscape qualities at the NUTS 3 level and propose a "proxy" indicator for the value of landscapes and possibility for larger habitats and green areas for plants, animals and humans.

3.2. Headline indicators

The principal task of a monitoring system is its ability to provide direct policy advice. Simplicity and sensitivity to rapid changes are key features that should be strived for. If a monitoring system consists of a large number of specific indicators, then a frequent updating of these consumes considerable time and resources. Due to resource efficiency, a limited number of variables are usually chosen to be collected more frequently than the remaining large mass of indicators in a monitoring system.

Such indicator short lists or headline indicator systems are the norm rather than the exception in most comprehensive and frequently updated policy strategies, the EU 2020 strategy, the EU Sustainable Development strategy, the Lisbon/Gothenburg strategy, OECD Green Growth strategy, and a large number of UN monitoring systems, to mention but a few.

If properly chosen, the limited set of indicators can generate warning signals much faster than the complex set of information and at the same time point out the need for more comprehensive analysis to be undertaken. In an ideal case, this limited group of indicators is not only more resource effective (i.e. easy/economic/etc.) to collect, but they are also able to provide a general picture of what the entire monitoring system is measuring. They may be missing out on some particular details or aspects, but by and large they are able to efficiently communicate the principal trends.

We feel that this would be sensible also in the context of the BSR TeMo, and hence we have introduced *suggestions* for one or a few headline indicators for each domain. We wish to stress, that this suggestion for these headline indicators is not in any way connected to the question of the so called "complex indicators", which is a totally different issue and discussed in detail in chapter 2.4.

An effective headline indicator should be:

a. conceptually representative for a larger group of indicators;
b. frequently updated by the provider;
c. of limited time lag with regard to data used for its construction;
d. easily available for different types of territorial units; and
e. of direct policy relevance.

The identification of these indicators is based on a comparative analysis, where aspects such as the conceptual coverage of the entire domain, the policy relevance of the indicator, data availability for entire BSR, time series availability and update frequency, data time lag, the territorial level used, availability within the European Statistical System, as well as the assessed effort for possible data modification required, are considered.

In addition to these criteria, we have also conducted a Principal Component Analysis of the available data in each domain. This analysis in practice provides us with a statistical ranking of each indicator per domain in the sense of how much each individual indictor is able to explain the variation in all other individual indicators in that domain. In other words, it provides a statistical assessment of which is the "leading" or most "overarching" indicator per each domain.[8]

Table 5 below presents the assessment criteria used in justifying our suggestions for a headline indicator per domain.

[8] In the domain "Innovative territories", the nr of variables examined is small and the PCA results should be considered indicative only.

identification of headline indicator(s) for each domain

Assessment criteria									
ptual ge of domain	Policy relevance of indicator	PCA (Principal Component Analysis) results for domain	Full data availa-bility for entire BSR	Time series availabi lity	Data update freq-uency	Data time lag	Territorial level	Available within the European Statistical System	Require-ment for data modifi-cation
igh. s ptually aspects nomic mance.	Very high. Primary SF eligibility indicator, EU2020 and SD-strategy headline indicator	Highest ranking	Yes	Yes	Annual	2-3 years	NUTS 3 (SNUTS 2 for BY & RU)	Yes (except BY & RU)	None (except for inclusion of BY & RU)
igh. s ptually aspects sical ibility	High. Included freq. in Cohesion reports and is part of official territorial typologies	Highest ranking (functional areas and border crossings excluded from the PCA)	Yes (in principle)	Yes (but limited	Infre-quent, currently ca. 5 years	1-2 years	NUTS 3 (SNUTS 2 for BY & RU, but in theory could be SNUTS 3)	No	Requires high external input. Only few institutions in the EU have capacity to perform
high, but tion not s the of high nput, gh R&D not s ng in te	Very high. Headline indicator for EU2020 strategy	Second highest ranking. (Tertiary education attainment highest, but gap very small). (Indicative	No. (BY, NO & RU missing, NO could be esti-mated from existing data)	Yes	Annual	2-3 years (tied to national accounts /GDP)	NUTS 2	Yes	None (apart from possible inclusion of NO, BY and RU)

Domain	Suggested headline indicator	Assessment criteria									
		Conceptual coverage of entire domain	Policy relevance of indicator	PCA (Principal Component Analysis) results for domain	Full data availa-bility for entire BSR	Time series availabi lity	Data update freq-uency	Data time lag	Territorial level	Available within the European Statistical System	Require-ment for data modifi-cation
4. Social inclusion and quality of life	At-risk-of-poverty rate	Very high in terms of social inclusion, lower (and more indirect) in terms of QoL	Very high. Headline indicator for EU2020 strategy	Ranking only 4/5. The gap to nr 1 "Subjective health" however fairly small	No (BY and RU missing, but could in theory be esti-mated)	Yes	Annual	1-2 years	NUTS 2	Yes	None (apart from possible inclusion of BY & RU)
5. Environmental qualities	New soil sealing per capita and/or Eutrophication	Moderate	High for both. Eutrophication 1/4 thematic segments of HELCOM Baltic Sea Action Plan, soil sealing freq. in land use policy discourse e.g. due to link to urban sprawl	None performed (not possible for technical reasons)	Eutrophica tion: yes (Soil sealing; BY, NO & RU missing, could be estim. from land use data)	Eutrop hicatio n: yes Soil sealing : no	Eutrophi cation: frequent Soil sealing; Infre-quent, currently ca. 10 years	2-3 years	For soil sealing: NUTS 3 For Eutrophica tion: Baltic Sea subregion s	No	Both require high external input (HELCOM & EEA)

In addition to these five to six headline indicators, we also propose to utilise any or all of the proposed "Ten indicators for measuring territorial cohesion in the BSR" (chapter 3.3) as macro level headline indicators for the entire BSR. The application of any or all of these on primarily GDP would most likely be the most feasible approach, since GDP would in any way be collected and no additional effort would thus be needed for this more frequent data collection.

3.3. Advanced module: ten indicators for measuring BSR territorial cohesion

We here bring forth a proposition for **ten separate complex indicators** that cover all major aspects of territorial cohesion in the BSR, i.e. 1) distribution, 2) convergence, and 3) specifically targeted BSR territorial cohesion objectives.

The chosen indicators have a clear territorial character since they each in their different form are able highlight the interplay and performance of the regions of the BSR and they make extensive use of the ESPON territorial typologies. Each indicator (with the exception of number 8) is also fully inclusive in the sense that they take into account all regions of the BSR.

These indicators are nothing new in a technical sense; on the contrary, all are based on well-established and long–proven methods. We have merely consistently streamlined these indicators in a coherent manner for addressing, in all their forms, the specific territorial cohesion objectives of the BSR.

In comparison to any single indicator, the first strength of this palette is that it allows for a comprehensive measurement including multiple corroboration opportunities in order to safeguard a sound interpretation of the trends observed.

The second strength of this set of indicators is that they can be applied on any variable in the monitoring system, provided that it meets certain below listed simple criteria. The collection of indicators is therefore highly flexible.

Concrete examples of how these ten indicators have been applied can be found comprehensively in Volume 3 of the Scientific Reports (Case study on Territorial Cohesion).

Following is a short description of each of the proposed ten indicators together with the rationale and objective for utilising them.

Distribution indicators (1-3)

The three first indicators measure overall cohesion in a distributive manner, each from its own specific point of view.

(1.) The Gini Concentration Ratio (GCR) is one of the most widely utilised inequality indicators. It measures the dispersion of a phenomenon and it operates within the range 0-1, where a value of 0 would indicate perfect equality (i.e. in our case that all regions would be exactly the same) and a value of 1 in turn maximum inequality (i.e. that all that is measured would be concentrated into a single region alone). A GCR value of e.g. 0.45 could be interpreted as the amount (45 %) required to be shifted for perfect equality to take place. Apart from being non-spatial, the GCR has the analytic limitation that it reacts in relative terms equally on changes within the middle band of regions as it does to changes in the extremes, which is troublesome, for it is most often occurrences at the extreme ends of the scale that are of interest to policy.

(2.) The Atkinson index seeks to address this shortcoming of the GCR by introducing a sensitivity parameter (ε value) that enables giving greater emphasis to, in our case, small or low performing regions. It operates on a similar scale as the GCR, i.e. 0 would indicate perfect equality and a 1 maximum inequality. When applied in the testing phase (Scientific Report Volume C) the sensitivity parameter is set at 0.8, which implies that greater weight is given to changes among the lower performers. By comparing the results of the Atkinson index to those of the GCR, we are able to draw conclusions whether the changes in inequality stem from the changes in the lowest performers or not.

(3.) The 80/20 ratio (also known as the Kuznets ratio) is a simple bivariate analytic technique that concerns the relationship between the highest (top 20 %) and the lowest (bottom 20 %) performers. It is calculated as the ratio between these two and does as such not concern itself at all with what happens in the three middlemost quintiles. The higher the value, the larger is the discrepancy between the two extreme groups, and vice versa. A value of e.g. 8.0 indicates that the best performing group (i.e. the top quintile or the highest 20 % of regions) has eight times more of what is measured than the corresponding lowest performing group.

Convergence indicators (4-5)

The following two indicators measure the *process* of convergence by means of two commonly used standard techniques. By applying both methods in parallel, one can obtain a picture whether the process of convergence – or lack thereof – is of a *sigma type* (i.e. reduction of disparities in general) or of a *beta type* (i.e. convergence through a catch up of the low performers).

(4.) Sigma-convergence occurs when disparities in general are reduced. It is commonly measured simply by the *coefficient of variation*, which is calculated as standard deviation divided by the mean of all regions. The higher the value, the larger are the overall differences between all regions, and vice versa. This indicator is very sensitive to extreme outliers and can be used as a supplement to e.g. the GCR. A catch-up process of the poorest performers affects the value as much as would similar reductions among the best performers.

(5.) Beta-convergence concerns itself primarily with disparity reduction via a catch-up process by the poorest performers. It is measured by means of a linear regression model where the dependent variable is the level of the region at beginning of a period and the independent variable the change that has occurred during this particular period. By looking at the unstandardised "b" regression coefficient from each model, one can obtain a picture of how much the growth rate is affected by the initial level. A negative rate implies increasing convergence, as it de facto (on average) implies that the lower a region's performance is, the higher has been its growth rate. A positive value indicates the opposite, i.e. a pull-off by the best performers.

Targeted BSR territorial cohesion indicators (6-10)

The remaining five indicators are targeting five specific aspects of territorial cohesion with particular relevance in a BSR context. Simple though they are from a methodical point of view, they nonetheless are able to provide a more diversified picture of different aspects of territorial cohesion in the BSR with a clear focus on regional specificities, and may be used in addition to the more traditional indicators described above. One aim of these is to capture the three

principal divides of the BSR. Each indicator is bivariate meaning that it compares two groups of regions against each other. The last four of these indicators are based on four different DG Regio territorial typologies (supplemented by information on Belarus and NW Russia) and as such can only be applied on data available at NUTS level 3. Each indicator is calculated as a straightforward ratio, and for example a value of 1.3 would indicate that the numerator (e.g. "east" in the "east/west ratio" or "south" in the "south/north ratio") has 30 % more of the measured entity than has the corresponding denominator.

(6.) The east/west ratio compares the amount of a phenomenon in eastern BSR to that in western ditto. Eastern BSR is comprised of the new German Länder, the Baltic States, Poland, Belarus and NW Russia. The Nordic countries and former West Germany including the NUTS 3 region of Berlin are in turn classified as Western BSR.

(7.) The south/north ratio is based on the DG Regio typology of sparsely populated areas (supplemented by information on NW Russia and Belarus). All regions classified as sparse in the typology (i.e. less than 12.5 inhabitants/km² at NUTS 3 level or less than 8 inhabitants/km² at SNUTS level 2 in NW Russia and Belarus) are classified as "north, the remaining areas as "south".

(8.) The urban/rural ratio is based on the DG Regio Typology on urban-rural regions supplemented by information on NW Russia and Belarus. The indicator compares the class "predominantly urban regions" with the class "predominantly rural regions". The latter class includes both regions "close to a city" as well as "remote" regions. This indicator hence excludes the middlemost category of the typology ("Intermediate regions") and is able to provide a crude picture on relative changes between the top and bottom section of the urban-rural hierarchy.

(9.) The non-border/border ratio is based on the DG Regio typology "Border regions - internal and external" supplemented by information on Belarus and NW Russia. It compares the external border regions of the BSR to all remaining regions. Based on this typology, there are no external border regions identified in Denmark and BSR Germany.

(10.) The coast/inland ratio is based on the DG Regio "Typology on coastal regions", where coastal regions are classified on basis of the (low, medium, high or very high) share of population living within the coastal zone. Our indicator compares the entire group of coastal NUTS 3 regions to all other regions.

4. Discarded indicators

This chapter contains reflections on proposed specific indicators and/or broader conceptual themes that have been considered by the TPG but subsequently discarded from further development. In general, the future functionality of the monitoring system implies that the number of included indicators should be kept as low as possible, which is the primary reason for discarding most of the following indicators. In a limited number of cases their inclusion would have been justified even in light of the future scarce resources available, but issues such as actual data availability or the future effort/cost of obtaining these has nonetheless excluded them from further development.

Domain 1: Economic performance and competitiveness

Newly created jobs was proposed as a concrete indicator. Such information is not available as such in any collective data sources (such as Eurostat) but can be nationally collected in a smaller number of BSR countries. In a state of employment growth, some instances do estimate this by comparing gross number of persons employed between two periods in time thus assuming that no existing jobs are lost and all employment addition hence consists of "newly created jobs". However, such an assumption is misleading since the net flow of jobs on a labour market does only reflect a small share of the total gross volumes to and from the market. For example, in Finland the net increase in new enterprises typically only accounts for around ten percent of the overall increase in such. Job vacancies would be another way to proximally estimate the nr of new jobs. At Eurostat, there are data at NUTS 2 level on the number of job vacancies per region. However, when examining actual entries in the data base, data only exist for the three Baltic States (that are NUTS 2 regions in themselves). Hence, the TPG does not see any feasible possibilities of including this in the monitoring system even at a proximal level.

Part-time employment has been proposed as another concrete indicator to be included in the monitoring system. Such information does exist at Eurostat at NUTS level 2 for the EU MS in the BSR as well as for Norway. The TPG has however difficult to establish how a low or high share of part-time employment respectively should be interpreted on a normative basis? In theoretical literature such interpretations are twofold and primarily based on the individual's own conception of the desirability of part-time employment. Also from a macroeconomic point of view, part-time employment can be assessed both from a negative (e.g. less productivity per employee) and from a positive (e.g. easier entry on and better attachment to the labour market for some strata of society) perspective. Hence, bearing in mind that the auxiliary information value of this indicator is limited, the TPG has not found a justification of its inclusion in the monitoring system considering the limited overall scope and expected future functionality of the system.

Also long-term unemployment was proposed as one tentative indicator. Regional data for this is available at Eurostat at NUTS level 2. This data is based on labour force surveys and would need to be estimated for NW Russia and Belarus. However, a test (for the year 2011) with those 289 NUTS 2 regions within the ESPON space where data was available revealed that as much as 85 % of the regional variation in long-term unemployment rate can be explained by the general unemployment rate. The TPG thus decided that the expected auxiliary information on this issue would not justify its inclusion in the monitoring system in a situation where the number of variables that feasibly can be included is limited.

Some sort of indication on services of general interest has also been called for. Bearing in mind that collective data sources (such as Eurostat, OECD) do only have employment data at a one digit NACE level, statistically identifying such services is not feasible. In addition, the widely varying societal structures within the BSR would in all likelihood render any meaningful comparison very difficult even if such branches of general interest could be identified.

In addition there was a proposal of including variables on more qualitative labour indicators such as capital intensive, labour intensive or intelligence intensive employment. The TPG withholds that the variable on employment in technology and knowledge-intensive sectors of manufacturing and services partially addresses this issue.

One indicator for this domain, the birth rate and survival of firms, was finally considered by the TPG but discarded due to lack of reliable and comparable regional data. The actual existing definitions of a firm or enterprise and when it is (statistically) considered born or dead vary substantially across all BSR countries and the challenges related to regionalising them (e.g. are all activities registered on the HQ address only or are they regionalised, and how) rendered any meaningful comparison impossible. In addition, most such information has to be purchased on a case by case basis (e.g. from chambers of commerce), which would have substantial implications for the future maintenance of the monitoring system.

To reduce the total number of indicators in each subdomain, the TPG reviewed the indicators in the domain on economic performance and competitiveness and decided to discard Total GVA per economic branch (primary, manufacturing, services), Total employment per economic branch (primary, manufacturing, services), and Demographic dependency ratio(s) since it was concluded that the economic development trends would be sufficiently covered by the remaining indicators in this domain.

Domain 2: Access to services, markets and jobs

The TPG initially considered the inclusion of data on ferry services/maritime traffic, air traffic connections as well as train connections into the monitoring system. As such information generally has to be collected on a case by case basis, and this type of accessibility is already addressed by other indicators, it was decided not to pursue these indicators.

The TPG also considered including general information on intra-BSR cargo flows. Such information is by default available only at the level of countries. It was therefore decided to discard this from further development.

The TPG finally considered including the rate of urban primacy at the regional level as a concrete indicator in the monitoring system. While conceptually of high relevance for the system, methodical issues however do pose some serious obstacles for developing this further. Utilization of urban morphological zones or functional areas could have constituted concrete paths for developing such an indicator comparatively for the BSR. The TPG however decided to discard this indicator due to the sheer amount of work included in updating such information in the future. ESPON 4.1.3 used a much easier definition for this indicator: share of largest city population to total population in %. While it is rather easy to compute, this indicator is somewhat questionable at NUTS-3 level since, for instance in Germany, all these largest cities are individual NUTS-3 entities, i.e. their share by definition is 100% for this entity, and zero for the surrounding entity. Functionally, the NUTS 3 boarders should not be so important for the

benefits of polycentricity, so a useful indicator for urban primacy should go beyond these limitations.

The TPG was suggested to replace the indicator on households with access to internet at home by households using a high speed internet connection (as included in the ESPON Territorial Observation 4). However, the TPG concluded that technology has overtaken the necessity of access to high speed internet at home as an indicator of high accessibility with mobile internet access becoming the new standard for internet accessibility. Furthermore, Eurostat provides two indicators, "Households with internet access to the internet at home" and "Households with broadband access", both covering the NUTS-2 level. However, both of these suffer from poor data availability, primarily missing data entries for several of the BSR regions, and thus there is also no reason to choose the broad band internet indicator over the other on the grounds of data availability.

The TPG was asked to replace the indicator on access to (IC) train stations since buses in many regions is the only mean of public transport. TPG concluded that accessibility would be sufficiently covered by the remaining accessibility indicators.

Finally it was concluded that a new, single indicator, functional areas: access to cities, would replace the previously proposed indicators access to cities: cities within reach (in terms of travel time) and functional areas (as defined in ESPON 1.1.1). These two indicators are not easily comprehensible, in contrast to the new indicator. With this substitution the indicator definition was also slightly changed. Functional areas: access to cities is thus a combination and substitution of the former two.

Domain 3: Innovative territories

The TPG was asked to consider the summary innovation indicator from the ProInno Europe Innovation Scoreboard. In this comprehensive and comparative analysis of innovation performance of 2011, 24 innovation-related variables are at the national level merged into a single composite scoreboard. For 2009, also a regional innovation scoreboard has been created. This utilises regional data (mostly NUTS 2 with some modifications, e.g. Denmark is treated as a single region) for 16 variables, some of which stem directly from the standard Eurostat data base and some of which are derived from the CIS (Community Innovation Survey) of 2006. Re-creating this information for NW Russia and Belarus is not possible. Although it would be possible to include this scoreboard into the data base, the TPG is if the opinion that since the updating of it is not certain, since NW Russia and Belarus are not included, and most importantly, since the interpretation of this information requires a thorough understanding of the actual method of creating this synthetic indicator, it should not be included into this monitoring system. Method wise the TPG acknowledges the merits if such a composite index and will tentatively consider something similar with the actual data at hand for the entire BSR.

Population with primary education was further suggested as an indicator in this domain as this may constitute an important factor for regional economic growth. The TPG decided not to include this into the monitoring system in order to save resources.

Early leavers from education and training, included both in the EU SDS and the EU 2020 set of indicators as well as in the Laeken list of social policy indicators, was in this domain considered by the TPG as an early warning indicator on future challenges related to knowledge and skills. It was subsequently considered to be included in the "Social inclusion and Quality of life" domain instead, but was

subsequently discarded due to lack of space and difficulty of estimation in NW Russia and Belarus.

Research centres (without any specific operationalisation) was by the TPG considered as an auxiliary indicator to regional performance in R&D, but was subsequently discarded due to the difficulties in operationalising it. Among the assessed issues were questions related to what constitutes a research centre and where is it precisely located. While data and location of universities may be gathered for the BSR quite easily, data collection for private research centres such as research department of big companies seems not feasible; however, for many regions the latter ones are the dominating research centres.

Creative workforce at a conceptual level was considered by the TPG as an indicator in the spirit of Richard Florida's "creative class" theory. It however turned out that in order to statistically identify this segment of employment, data at the N.A.C.E. three digit level would be needed. Such data does not exist in most BSR countries at the regional level, whereupon this indicator was subsequently discarded.

Mean years schooling was by the TPG considered both in the domain of "Innovative territories" as well as in "Social inclusion and quality of life". Such an indicator, available sporadically in some BSR countries (e.g. Finland), refers to the mean number of years the (target) population has been in education. It has the advantage that it captures the overall level of education of the entire (target) population rather than a given segment (such as tertiary or secondary, etc). Lack of data however hindered further development of this indicator into the monitoring system.

The TPG was asked to remove patent applications filed to the EPO as an indicator of innovation.

Domain 4: Social inclusion and quality of life

Healthy life expectancy (HALE) was proposed as a concrete indicator for the monitoring system. It is calculated as the average number of years that a person can expect to live in "full health" by taking into account years lived in less than full health due to disease and/or injury. Reconstructing such an indicator at the regional level for the BSR would be very difficult since it would imply considerable estimation of severity-adjusted prevalence of diseases. The TPG is of the opinion that the two included variables on life expectancy and subjective health independently cover most of the (expected) regional variation in HALE.

The household structure was also proposed as an indicator. Although such data for the EU MS is available at NUTS level 2, and possible to estimate for Norway, Belarus and NW Russia, the TPG decided to discard this from further examination due to the ambiguity of how to interpret the information.

Very old persons was also proposed as a concrete indicator in this domain. Such information is available. Due to the size limitations of the monitoring system, the TGP however opted for not including this information into the system despite the obvious well-being –related issues available. The TPG believes that the two selected indicators on Demographic dependency ratio and Economic dependency ratio cover most of the explanatory power.

Receivers of social aid would have been an interesting indicator of regional poverty. Such information has however to be collected from national sources

only, and such data is (expectedly) not comparable across countries. The TPG therefore decided not to develop this issue further.

Disposable income per capita (in PPS) was considered by the TPG as a complementary indicator to the poverty-related ones, capable of reflecting absolute differences in monetary poverty. However, a testing with 248 NUTS 2 regions across the EU revealed that it correlates rather strongly with GDP/capita (OLS R^2=0.75 for log. data). It was hence subsequently discarded in order to save resources.

Quality of housing is deemed as a primary measurement of material well-being and here considered by the TPG as a complementary indicator to the material deprivation one. Lack of comparable data however implied it to be discarded from further development. The EU-SILC (Survey on Income and Living Conditions) will tentatively produce also regionalised data on satisfaction with accommodation in forthcoming rounds.

Standardised death rate was by the TPG considered as an auxiliary indicator in the sub domain "Health" but consequently discarded since it correlates very strongly with life expectancy. Data for the three year average 2008-2010 for 254 NUTS 2 regions within the ESPON space indicate that 77 % of the regional variation in standardised death rates can be explained by life expectancy at birth. When both data sets are ranked, the amount of variation explained reaches 97 %, indicating that the variables are nearly identical.

Domain 5: Environmental qualities

Wish list indicators under this domain include the state and development of biodiversity as well as indicators associated with renewable energy production. Also, the concept of climate change and vulnerability thereof is a multi-faceted concept and it is on the list right now to indicate that this would be an interesting concept to pursue in territorial cohesion in the future. The aspect of climate change differs greatly across regions and will have an impact on such regional aspects as agricultural production, renewable energy production and building and construction. However, we recognise that this also implies that the monitoring of such a concept would have to be as multi-faceted and that this would be almost an entire monitoring system in itself. Also, any measures in the same categories as those developed in Europe on vulnerability to climate will be difficult to obtain (define and measure) in Russia and Belarus. As such, the following indicators or concepts were at this stage discarded from further development:

- Energy efficiency
- Renewable energy production
- CO2 emissions
- Fresh water resources
- Wind power potential
- Photovoltaic potential
- Biodiversity
- Natural resources
- Vulnerability to climate change
- Aggregated natural hazards

The TPG has also omitted an indicator on access to Natura 2000 areas, partly because this indicator does not change much over time, partly because it does not say so much about the value of landscapes from a territorial cohesion

perspective. Instead, the TPG selected the indicator on fragmentation index which much better reflect the size of un-fragmented habitats.

Finally, the TPG decided to discard the indicator on land consumption by transport in that it was concluded that it did not add to the environmental domain in a complementary manner to the other indicators within that domain.

Domain 6: Territorial cooperation and governance

The TPG considered methods of obtaining regional data on institutional decentralisation, inter municipal cooperation, the use of integrated place based strategies, and the use of territorial impact assessments. In all these cases, such concepts do not for the time being lend themselves to quantitative measurements comparative across countries. Furthermore, when examining whether the ESPON TANGO project were developing governance indicators that would be relevant to include in the monitoring system, it was found that the findings of the TANGO indicate that governance is context sensitive and thus cannot point to quantitative measures. Such information is therefore put on the general "wish list" of the monitoring system.

5. Data collection

This section function both as a documentation of the data collection principles of the TPG, including explanations on the gaps in the collected data, and as a text to use for evaluating the policy relevance of the BSR TeMo system.

5.1. Principles behind data collection

As with statistical systems in general, a leading principle of the data collection for the BSR TeMo project has been to distinguish between variables and indicators. The *indicator* most often is the calculated result of two or more *variables*. Since the variables form the basis of the indicator, it was clearly pointed out within the TPG, before the data collection started, exactly which variables should be collected. Practically speaking, the TPG members that collected data used the "Collected variables" information in the Frequency table below (Table 7), to see which variables, with precise definitions they should collect for a specific indicator (i.e. in the case of the GDP per capita *indicator*, the three *variables* "GDP in mill. PPS", "GDP in mill. Euros" and "Total population at end of year" were collected). Most commonly, the data of several indicators for one indicator was added to a specific Excel sheet named by the indicator and stored on a server. From there on, further steps, such as calculations of variables in order to create the final indicator, could start.

Thus, an indicator is not final and usable until several steps have been processed. A model of these steps are presented in Figure 3 below. While the end result is the Indicator, the process have passed the steps of Data collection of variables; editing of the collected data of the variables (data editing); harmonisation (making sure data for certain countries and regions are interchangeable, e.g. the same methodology is used, coverage of the same geographical entities, etc), and calculation (combining different variables through calculations, for example in the case of the indicator GDP/capita, data of the variable GDP (for example GDP in PPS) is divided by data of the variable Total population).

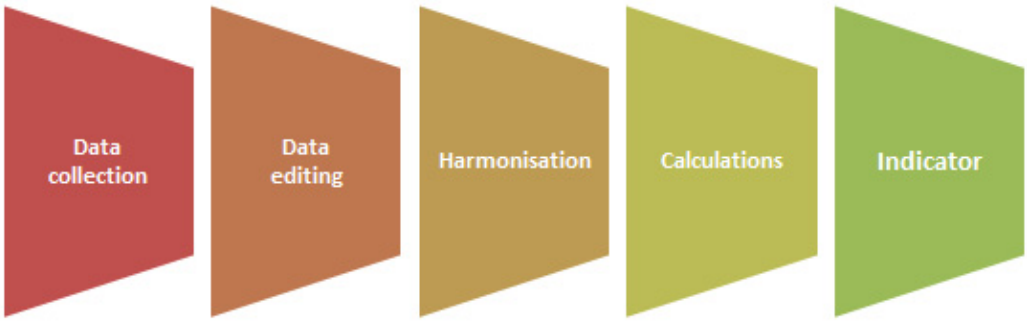


Figure 3 Model of the steps included in the process of construction of an indicator

The choice of precise definitions of which variables to collect were based on common statistical principles and aimed at showing an as correct picture as possible of the differences between countries. As an example, in the case of GDP, it was considered important to collect data adjusted to Purchasing Power Parity (PPP), which better shows comparisons of GDP between different countries since

the difference otherwise easily could be biased due to political and financial factors unique for a country, among others.

To ensure that the knowledge within the TPG regarding both national data and specific statistical domains was used in the most efficient way, data collection tasks for the TPG members were allocated according to the individual's expertise. A clear advantage with this division of labour was that in cases when data had to be compiled from national sources, each "country expert" of the TPG contributed with data from his or her specific country.

5.2. Time frame(s)

Before collection of data started in winter 2012-2013, a time frame for which years the collected data should cover was decided.

Starting year for the time frame was set to 2005. That would ideally give at least five years of data in the form of time series even for variables which releases usually lag behind approximately three years, such as GDP data, i.e. only GDP data for the periods 2005-2009 (or maybe 2005-2010, depending on release month) would be available in 2012.

An end year of the time frame was not set at first, but the basic rule was that the freshest data possible should be collected, i.e. if data for a certain variable for 2012 would be available already at the time of collection in the winter 2012-2013 (possible for population data, which for some countries are released within a few months after the start of a new year), the end year of the collected time series should be 2012. However, during the course of the data collection it became clear that in most cases the freshest collected data stemmed from year 2011, while 2012 is only partly covered. Thus for this chapter, and in Table 7 which shows the coverage of the collected data per year, the time frame is referred to as covering the years 2005-2011.

However, already when setting the starting year of the time frame to 2005, it was clear that some data would only be available for single years in 5-years cycles. This is especially the case with data for most indicators of the two domains Access to services, markets & jobs and Environmental qualities. In order to cover at least two 5-years cycles for such data, it was decided to also work parallel with a so called "extended time frame" that would go back more than ten years. The year 2000 was set as starting year for the extended time frame. In practical terms that meant that TPG members collecting data generally had the year 2005 as their outset, but in case they encountered data with longer update cycles, for example accessibility and environmental data, they switched to the extended time frame and collected available data from year 2000 and onwards.

5.3. Spatial distribution

As presented in Volume 4, NUTS-3 and NUTS-2 regions were identified as the main geographical scales for the EU/Eurostat countries of the BSR TeMo project, with the addition of attempting to find additional data on LAU-2 or raster level. Rayon (SNUTS4) and oblast (SNUTS2) levels are the main geographical scales intended for Russia and Belarus. From the data collection point of view, the aim has been to collect data on the most detailed regional level possible.

However, considering the availability of data, it proved difficult with the data collection conducted so far to go below NUTS-3 regions for most indicators within the EU/Eurostat space (also see chapter 7.). While NUTS-3 data was been

available for many indicators, especially within the Economic performance & competitiveness domain, data for several other indicators were only available at Eurostat on NUTS-2 level.

For Russia and Belarus, much of the collected data was available at oblast (SNUTS2) level. However, going beyond oblast (SNUTS2) level to rayon (SNUTS4) level proved difficult at this stage of the project. As pointed out in chapter 6 there are several technical issues connected to data collection for rayons, including lack of coherent statistical system (database), no thematic key but only a territorial key, and the variables differ between different rayons.

Regarding the geographical scope, naturally data for all BSR countries was collected. However, whenever possible, data was also collected for the entire ESPON space. Reasons behind this are that for the testing phase (see Volume 3) data of parts of Europe outside the BSR would be interesting for benchmarking purposes, and also, data collected within the BSR TeMo project will eventually be delivered to EPSON's database and for that coverage of the entire ESPON space was considered important.

5.4. General data coverage

The availability for data used within the BSR-TeMo project is shown in table 6 below. Table 6 shows the availability of data (for the indicators) for each BSR country. This table shows the possibility to collect data for one recent year and to produce an analytical map including this region in the BSR analysis. It does not show the occurrence of time series. The frequency table (7) shows this latter aspect, but due to the large about of information in such a table we have to show this for the EU BSR, Russian BRS and Belarusian regions aggregated. This means that if there are some regions within these aggregated with poorer data this gives the note that data is only partially available. Furthermore in table 7, for the indicators for which data are only available for specific years (like accessibility) there are lots of red cells of "data not available". Table 6 instead gives another kind of overview as it shows for which countries specific indicators are difficult to collect.

Table 6 Coverage of TeMo indicators by BSR country (based upon latest available year)

Indicator	BY	DE	DK	EE	FI	LT	LV	NO	PL	RU	SE
GDP per capita	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GDP per person employed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Unemployment rate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Employment rate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Net migration rate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total population change	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Economic dependency ratio	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Accessibility potential by road	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓
Accessibility potential by rail	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓
Accessibility potential by air	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓
Multimodal accessibility potential	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓
Functional areas: access to cities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Population potential within 50 km	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓
Border crossings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Households with internet access at home	X	X	✓	✓	(✓)	✓	✓	✓	X	✓	✓
Population with tertiary education	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Employment in technology & knowledge sectors	X	✓	✓	✓	✓	✓	✓	✓	X	X	X
Gross-domestic expenditures in R&D, business	X	✓	✓	✓	✓	✓	✓	X	✓	X	✓
Gross-domestic expenditures in R&D, total	X	✓	✓	✓	✓	✓	✓	X	✓	✓	✓
At-risk-of-poverty rate	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓
Severe material deprivation rate	X	X	✓	✓	✓	✓	✓	✓	✓	X	✓
Youth unemployment rate	X	✓	✓	✓	✓	✓	✓	✓	✓	(✓)	✓
Gender imbalances	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Life expectancy at birth	✓	(✓)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Self-assessed health status	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New soil sealing per capita	X	✓	✓	✓	✓	✓	✓	X	✓	X	✓
Air pollution (PM10)	X	✓	✓	✓	✓	✓	✓	X	✓	X	✓
Eutrophication	*Not applicable*										
Fragmentation index	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓
Number of indicators covered (Total number of indicators=29)	***13***	***27***	***29***	***29***	***29***	***29***	***29***	***25***	***27***	17	***28***

Note: Assessment based upon latest available year, i.e. reflecting the standard BSR maps as presented in the Presentation Tool.

5.5. Gaps explanation

The indicators in Table 7 below – which shows the coverage of the collected data per year – have been divided into three territories: the EU/Eurostat space, Russia and Belarus. Russia and Belarus are shown as individual countries in the table since the data of these two countries to a certain extent differ in methodology compared to the nine EU/Eurostat countries[9].

A look at the Frequency table reveals that the collected data for literally every indicator contains gaps during the time frame for collection, 2005-2011. A "gap" in this context is defined as incomplete data for a certain year. For example, there could be no data at all available from statistical sources (marked as red cells in the frequency table), or data for a certain country may be only partly available, i.e. data exist for only one or several regions (marked as blue cells in the frequency table).

As a minimum, data for at least three years are missing per indicator. However, only within the Economic performance & competitiveness domain such a low number as three years missing per indicator can be found, namely for the common statistical indicators on labour force and demography: *Unemployment rate, total*, *Employment rate*, *Population change* and *Economic dependency ratio(s)*. Worth noting regarding this domain is that Russia and Belarus generally has better data coverage than the EU/Eurostat space. For other domains, which cover less "traditional" statistical indicators, such as accessibility and environmental indicators, the picture is reversed; data for Russia and Belarus is generally missing to a larger extent than data for EU/Eurostat countries.

Although the existence of a gap might have specific reasons, some general explanations can be given.

Regarding data for the so-called "EU/Eurostat" territory in the Frequency table, many of the gaps are pointed out as "partly available" (blue colour). To a large extent such gaps are explained by the fact that this territory contains nine different BSR countries, of which several have undergone administrative reform changes during the 2005-2011 time-frame. In the case of Denmark a new NUTS3 regional division was implemented in 2007. Even municipalities (LAU2 level) were divided between the new NUTS3 regions, which made it difficult to combined pre-2007 data with data from 2008 or later. The Denmark case explains parts of the 2005-2006 data gaps in the collected EU/Eurostat data. For Germany the case is similar. There are gaps for the whole period 2005-2011 due to on-going administrative reforms on NUTS3 level, of which changes in Sachsen-Anhalt (2007), and Sachsen (2008) are the most notable. Also in Finland several NUTS3 administrative structural changes have occurred after 2005. Thus the gaps in these cases depend on missing (blank) data entries in the statistical tables.

Gaps may also exist for purely geographical reasons. In the case of the indicator *Eutrophication* (of the Baltic Sea), data for Belarus and Norway is missing entirely since neither country physically borders the Baltic Sea.

Data for several of the indicators of the *Access to services, markets & jobs* domain (especially the accessibility indicators) as well as the *Environmental qualities* domain stems from EU specific projects, which generally so far has not included Russia and Belarus (and, in some cases, neither is Norway included).

[9] Denmark, Estonia, Germany, Finland, Norway (not EU member, but included in the "EU/Eurostat" territory in the Frequency table since data for Norway is included in Eurostat data), Latvia, Lithuania, Poland and Sweden.

Examples of such projects are different ESPON and EEA projects. Data for these indicators generally require advanced calculations and as usually no drastic changes occur from one year to another for such data, a 5-years update cycles is often considered sufficient. Therefore, usually a maximum of only three updates have been made during the extended time frame 2000-2011 for accessibility and environmental data.

As mentioned above, data for Russia and Belarus in some cases is built on different methodology compared to the EU/Eurostat data. As presented in chapter 6., the methodologies behind Russian and Belarusian data is generally similar, and the BSR TeMo TPG has received comments from Russian statistical experts on which existing data for Russia and Belarus can possibly be integrated with the EU/Eurostat data. Within the Economic performance & competitiveness domain, methodological differences exist between Russian and Belarusian data on the one hand, and EU/Eurostat data on the other, however much of this data is still comparable. Within other domain the situation is quite different. Regarding the domains Access to services, markets & jobs, Innovative territories and Environmental qualities the Russian statistical experts concluded that for many of the indicators Russian and Belarusian data differ in methodology compared to EU/Eurostat data, some data comparable to EU/Eurostat data doesn't exist, or there are issues concerning territorial aggregation. One example is the *Air pollution (PM10)* indicator within the Environmental qualities domain. In this case data exist for Russia and Belarus, and is expressed as cumulative air emissions of harmful chemical compounds, e.g. SO2, NO, CO, while the EU/Eurostat data shows measurements on number of days PM10 exceeds norm value, i.e. the average number of days in the year where "particular matter" (PM, particulates) exceeds the norm value. Because of the different approaches to measure Air pollution, the Russian and Belarusian data could not be combined with EU/Eurostat data for the moment. It is beyond the objective of the TeMo project to develop a methodology that makes it possible to compare EU and Russian air pollution indicators but by including the EU indicator and explicitly making the methodological problem clear, the monitoring system could be altered to take this in if such a comparability of EU and Russian air pollution indicator becomes possible. Another example is the *Gender imbalances (ratio of male-female aged 25-39)* indicator (included in Social inclusion & quality of life domain; the indicator is built on population age cohorts), for which Russian data on regional level (Oblast) only is available for two years during the extended timeframe, 2000-2011, namely from censuses performed in October 2002 and October 2010. While many of the EU countries uses register data for such population statistics, covering every year, for Russia in this case only survey (census) data is available.

For some cases of Russian and Belarusian data, the data is not publically available in digital form. For example, in the case of data for the *Gender imbalances (ratio of male-female aged 25-39)* indicator for Belarus, data for three years, 2010, 2011 and 2012, is publically accessible in BELSTAT's The Demographic Yearbook in on-line access. Earlier years are however not available in digital form, therefore this data has not been collected for the TeMo project. Hence, the gaps noted 2005-2009 in the Frequency table. The TPG considered that the three latest years would suffice to show recent development trends and thus be available for future monitoring.

Table 7 Frequency table with data gaps explanation

Indicator	Collected variables	Territory	Spatial level	1 Data available	0 Data not available	999 Data available but not collected	0.5 Data partly available							Main reason(s) behind data gaps
				Data availability										
				2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
Economic performance & competitiveness																
GDP per capita	1) GDP in mill. PPS 2) GDP in mill. euros 3) Total population at end of year	EU/Eurostat	NUTS-3						0.5	0.5	0.5	0.5	0.5	0.5	0.5	Total Population: Gaps 2005-2006 for DK, DE, FI due to administrative reforms. GDP: Data for 2011 not released at the time of collection. Gaps 2005-2009 for NO.
		Russia	Oblast						1	1	1	1	1	1	0	Data for 2011 not released at the time of collection.
		Belarus	Oblast						0.5	0.5	0.5	1	1	1	1	No GRP (Gross Regional Product) data available for 2005-2007, since such data was not calculated by BELSTAT before 2008.

GDP per person employed	1) GDP in mill. PPS 2) GDP in mill. Euros 3) Persons employed (all age groups)	EU/Eurostat	NUTS-3						0.5	0.5	0.5	0.5	0.5	0	0	Data for 2010-2011 not released at the time of collection. GDP: Gaps 2005-2009 for NO.
		Russia	Oblast						1	1	1	1	1	1	0	Data for 2011 not released at the time of collection.
		Belarus	Oblast						0.5	0.5	0.5	1	1	1	1	No GRP (Gross Regional Product) data available for 2005-2007, since such data was not calculated by BELSTAT before 2008.
Unemployment rate, total (Ratio of unemployed people in relation to overall work force)	1) Nr of unemployed persons aged 20-64 years (annual average, or month of April) 2) Nr of persons in labour force aged 20-64 years, aa (=employed + unemployed)	EU/Eurostat	NUTS-3						0.5	0.5	1	1	1	0	0	Unemployment: Gaps 2005-2006 for DK, DE, SE due to administrative reforms. Unemployment rate from INTERCO used as a substitute – Eurostat data for number of unemployed persons is not available. Labour force aged 20-64:

										1	1	1	1	1	1	0.5	Gaps 2005-2006 for DK due to administrative reforms. Labour force aged 20-64: Data for 2011 not released at the time of collection.
		Russia	Oblast						1	1	1	1	1	1	1	No gaps.
		Belarus	Oblast													
Employment rate (20-64 years)	Nr of persons aged 20-64 years,	EU/Eurostat	NUTS-2						0.5	0.5	1	1	1	1	1	Gaps 2005-2006 for DK due to administrative reforms. Data for 2011 not released at the time of collection.
		Russia	Oblast						1	1	1	1	1	1	0	No gaps.
		Belarus	Oblast						1	1	1	1	1	1	1	
Net migration rate	Net migration in persons per year	EU/Eurostat	NUTS-3						0.5	0.5	0.5	0.5	1	1	0	Gaps 2005-2006 for DK, FI, DE and also 2007-2008 for DE, due to administrative reforms. Data for 2011 not released at the time of collection.
		Russia	Oblast						1	1	1	1	1	0	0	Data for 2010-2011 not released at the time of collection.

		Belarus	Oblast						1	1	1	1	1	1	1	No gaps.
Total population change	Total population at end of year	EU/Eurostat	NUTS-3						0.5	0.5	1	1	1	1	1	Gaps 2005-2006 for DK, DE, FI due to administrative reforms.
		Russia	Oblast						1	1	1	1	1	1	0	Data for 2010-2011 not released at the time of collection.
		Belarus	Oblast						1	1	1	1	1	1	1	No gaps.
Economic dependency ratio	1) Total population at end of year 2) Persons employed (all age groups)	EU/Eurostat	NUTS-2						0.5	0.5	1	1	1	1	1	Gaps 2005-2006 for DK, DE, FI due to administrative reforms.
		Russia	Oblast						1	1	1	1	1	1	0	Data for 2011 not released at the time of collection.
		Belarus	Oblast						1	1	1	1	1	1	1	No gaps.
Access to services, markets & jobs																
Accessibility potential by road (Reachable population weighted by time distance by using cars)	GIS layer road network, GIS layer NUTS-3 regions, total population at NUTS-3 level	EU/Eurostat	NUTS-3		1				0	1	0	0	0	0	1	Data from ESPON Accessibility Update and ESPON TRACC. Indicator requires advanced calculations and no drastic changes occur from one year to

																	another (for the future, thereby the 5-years update cycles). 2011 data to be calculated.
		Russia	N/A						0	0	0	0	0	0	0		RU not part of study area of ESPON TRACC.
		Belarus	N/A						0	0	0	0	0	0	0		BY not part of study area of ESPON TRACC.
Accessibility potential by rail (Reachable population weighted by time distance by using rail)	GIS layer rail network, GIS layer NUTS-3 regions, total population at NUTS-3 level	EU/Eurostat	NUTS-3		1				0	1	0	0	0	0	1		Data from ESPON Accessibility Update and ESPON TRACC. Indicator requires advanced calculations and no drastic changes occur from one year to another (for the future, thereby the 5-years update cycles). 2011 data to be calculated.
		Russia	N/A						0	0	0	0	0	0	0		RU not part of study area of ESPON TRACC.
		Belarus	N/A						0	0	0	0	0	0	0		BY not part of study area of

																ESPON TRACC.
Accessibility potential by air (Reachable population weighted by time distance by using planes)	GIS layer flight network, GIS layer NUTS-3 regions, total population at NUTS-3 level	EU/Eurostat	NUTS-3		1				0	1	0	0	0	0	1	Data from ESPON Accessibility Update and ESPON TRACC. Indicator requires advanced calculations and no drastic changes occur from one year to another (for the future, thereby the 5-years update cycles). 2011 data to be calculated.
		Russia	N/A						0	0	0	0	0	0	0	RU not part of study area of ESPON TRACC.
		Belarus	N/A						0	0	0	0	0	0	0	BY not part of study area of ESPON TRACC.
Multimodal accessibility potential (Aggregated reachable population by logsum over road, rail and air indicators)	GIS layers for road, rail and flight networks, GIS layer NUTS-3 regions, total population at NUTS-3 level	EU/Eurostat	NUTS-3		1				0	1	0	0	0	0	1	Data from ESPON Accessibility Update and ESPON TRACC. Indicator requires advanced calculations and no drastic changes occur from one year to

																another (for the future, thereby the 5-years update cycles). 2011 data to be calculated.
		Russia	N/A					0	0	0	0	0	0	0		RU not part of study area of ESPON TRACC.
		Belarus	N/A					0	0	0	0	0	0	0		BY not part of study area of ESPON TRACC.
Functional areas: access to cities (Number of cities that can be reached by car within 45 min travel time from each LAU-2 unit)	GIS layer road network, GIS layer cities in Europe	EU/Eurostat	Grid, NUTS-3					0	0	0	0	0	0	1		Data exist from ESPON TRACC project (2011). Indicator requires advanced calculations and no drastic changes occur from one year to another (for the future, 5-years update cycle is recommended).
		Russia	Grid, NUTS-3					0	0	0	0	0	0	1		Data exist from ESPON TRACC project (2011). Indicator requires advanced calculations and no drastic changes occur

																	from one year to another (for the future, 5-years update cycle is recommended).
		Belarus	Grid, NUTS-3						0	0	0	0	0	0	1		Data exist from ESPON TRACC project (2011). Indicator requires advanced calculations and no drastic changes occur from one year to another (for the future, 5-years update cycle is recommended).
Population potential within 50km (Number of resident population within 50 km airline distance for each raster cell)	GIS layer of grid cells for ESPON space, GIS layer on city centres with population figures	EU/Eurostat	Grid, NUTS-3						0	0	0	1	0	0	0		Data from ESPON INTERCO; Study for European Parliament. Indicator requires advanced calculations and no drastic changes occur from one year to another (for the future, thereby the 5-years update cycles).

Border crossings (Estimated average nr of vehicles crossing a boarder point at peak time)	UN ECE E-road census and inventory	Russia	N/A						0	0	0	0	0	0	0	RU not part of study area (originating study for EU Parliament covered EU countries only).
		Belarus	N/A						0	0	0	0	0	0	0	RU not part of study area (originating study for EU Parliament covered EU countries only).
		EU/Eurostat	Border crossings	1					1	0	0	0	0	0	0	Data in GIS format for 2010 not yet (January 2014) available.
		Russia	Border crossings	1					1	0	0	0	0	0	0	Data in GIS format for 2010 not yet (January 2014) available.
		Belarus	Border crossings	1					1	0	0	0	0	0	0	Data in GIS format for 2010 not yet (January 2014) available.
Households with internet access at home (% of households with access to the Internet at home by NUTS 2 regions)	Households with access to the Internet at home by NUTS 2 regions	EU/Eurostat	NUTS-2						0	0.5	0.5	0.5	0.5	0.5	0.5	Data for 2005 not available. Gaps 2006-2007 for DE, DK, FI, EE, LV, LT, NO, SE; 2008 DE, FI, LT, LV, NO, SE; 2009 DE, LV, FI; 2010-2011 DE, FI.

		Russia	Oblast						0	0	0	1	1	1	1	Data gaps for 2005-2007.
		Belarus	NUTS-0						0	0	0	0.5	0.5	0.5	0.5	Data on a number of Internet subscribers (individuals and/or enterprises) is available at national level and is in absolute numbers (not as a share of a total number of households)
Innovative territories																
Population with tertiary education (25-64 years)	As a share of total age group 25-64 years	EU/Eurostat	NUTS-2						0.5	0.5	1	1	1	1	1	Gaps 2005-2006 for DK due to administrative reforms.
		Russia	Oblast			1			0	0	0	0	0	1	0	Data is available from the Population Census 2010 (and 2002). Data for some oblasts was not collected although it is available.
		Belarus	Oblast						0	0	0	0	1	0	0	Data available from the Population Census 2009

Employment in technology & knowledge sectors	1) Persons 2) as a share of all employed	EU/Eurostat	NUTS-2						0.5	0.5	1	0.5	0	0	0	Gaps 2005-2006 for DK due to administrative reforms. Gaps 2008 for PL, SE. No data available 2009-2011.
		Russia	Oblast						0	0	0	0	0.5	0.5	0.5	Data available for 2009-2011 but the definition is only partly comparable with EUROSTAT. Available: number of persons employed in organizations in the field of R&D. Not used in testing or visualisations, since coherence with Eurostat data has not been possible to certify.
		Belarus	N/A						0	0	0	0	0	0	0	No data available.
Gross-domestic expenditures on R&D, business	1) mill. PPS 2) % of GDP	EU/Eurostat	NUTS-2						0.5	0.5	1	1	1	0.5	0.5	Gaps 2005-2006 for DK due to administrative reforms. Gaps 2010-2011 for

																DK, DE, SE.
		Russia	N/A					0	0	0	0	0	0	0		Inquiries made regarding data from Ministry of Education and Sciences of the Russian Federation but data cannot be combined with EU/Eurostat data due to territorial aggregation and methodology issues.
		Belarus	N/A					0	0	0	0	0	0	0		See information for Russia above.
Gross-domestic expenditures on R&D, total	1) mill. PPS 2) % of GDP	EU/Eurostat	NUTS-2					0.5	0.5	0.5	0.5	0.5	0.5	0.5		Gaps 2005 for DE, DK; 2006 & 2008 DE, DK, NO, SE; 2007 & 2009 DE; 2010 DE, DK, SE; 2011 DE, DK, FI, NO, PL, SE.
		Russia	Oblast					0.5	0.5	0.5	0.5	0.5	0.5	0.5		Gross-domestic expenditures on R&D, total: calculated as percentage of GRP in current prices. Gaps 2005-2008 for

																some oblasts. For some oblasts data is available on gross-domestic expenditures on R&D, total: in mill. RU Roubles (2006, 2010)
																Data available on gross-domestic expenditures on R&D, total: in mill. BY Roubles
		Belarus	Oblast						0	0	0	0.5	0.5	0.5	0.5	
Social inclusion & quality of life																
At-risk-of-poverty rate	% of total population	EU/Eurostat	NUTS-2						0.5	0.5	0.5	0.5	0.5	0.5	0.5	Gaps 2005-2006 for DE, DK, FI, SE; 2007 FI, SE; 2008-2010 FI; 2011 DE, FI.
		Russia	Oblast						1	1	1	1	1	1	0	Data for 2011 not released at the time of collection.
		Belarus	Oblast						1	1	1	1	1	1	1	No gaps.
Severe material deprivation rate	% of total population	EU/Eurostat	NUTS-2						0.5	0.5	0.5	0.5	0.5	0.5	0.5	Gaps 2005-2006 for DE, DK, FI, SE; 2007 DE, FI, SE; 2008-2010 DE, FI; DE 2011.
		Russia	N/A						0	0	0	0	0	0	0	No data available.
		Belarus	N/A						0	0	0	0	0	0	0	No data

																available.
Youth unemployment rate (15-24 years)	1) Nr of unemployed persons aged 15-24 years 2) nr of persons in labour force aged 15-24 years (i.e. unemployed+employed)	EU/Eurostat	NUTS-3						0	0.5	1	1	0.5	0.5	0.5	Gaps 2006 for DE, DK; 2009-2011 DE, DK, EE, FI, LT, LV, NO, PL, SE.
		Russia	Oblast						0.5	0.5	0.5	0.5	0.5	0,5	0.5	Data gaps for some years. Data for Leningradskaya oblast and St. Petersburg is available but was not provided. Moreover, two oblasts provided data for age group 15-29.
		Belarus	NUTS 0						0	0	0	0	0.5	0	0	At national level from Census 2009
Gender imbalances (ratio of male-female aged 25-39)	nr of 1) males and nr of 2) females aged 25-39 years, at end of year	EU/Eurostat	NUTS-3						0.5	0.5	0.5	0.5	0.5	0.5	0.5	Data only available through national statistical bureaus at NUTS-3 level (available at NUTS-2 level at Eurostat). Gaps 2005-2006 for DE, DK due to administrative changes; DE also

																2007-2011.
		Russia	Oblast				1		0	0	0	0	0	0	1	Only available from census data from October 2010, transferred to 2011 in order to harmonize with other countries (January 1st used as default population dat for each year).
		Belarus	Oblast						0	0	0	0	0	1	1	No data available before 2010: There are issues of The Demographic Yearbook in on-line access only from 2010 and onwards.
Life expectancy at birth, in years	In years	EU/Eurostat	NUTS-2						0.5	0.5	1	1	1	0.5	0	Gaps for DK 2005-2006; DE 2005-2010.
		Russia	Oblast						1	1	1	1	1	0	0	Data for 2010-2011 not released at the time of collection.
		Belarus	Oblast						1	1	1	1	1	1	1	No gaps.

Self-assessed general health status		EU/Eurostat	NUTS-2 (DE, DK, FI, NO, PL, SE) & NUTS-3 (EE, LT, LV)	0	0	0	0	0	0	0.5	0	0.5	0	1	0	Gaps 2006 & 2008 for LT, LV. Survey data only from every second year.
		Russia	Oblast	0	0	0	0	0	0	1	0	1	0	1	0	No gaps. Survey data only from every second year.
		Belarus	N/A	0	0	0	0	0	0	0	0	0	0	0	0	BY not included in survey.
Environmental qualities																		
New soil sealing per capita (New soil sealing per year per capita (in ha, sqkm or sqm))		EU/Eurostat	NUTS-3						0	0.5	0	0	0	0	0	Data from EEA, Eurostat, REGIO-GIS (published in Fifth Report on Economic, Social and Territorial Cohesion). Indicator requires advanced calculations and has been calculated only using 2006 data. Gaps for NO (NO not included in data).

		Russia	N/A						0	0	0	0	0	0	0	Inquiries made regarding data from Ministry of Natural Resources, but data cannot be combined with EU/Eurostat data due to territorial aggregation and methodology issues.
		Belarus	N/A						0	0	0	0	0	0	0	See information for Russia above.
Air pollution (nr of days PM10 exceeds norm value)		EU/Eurostat	NUTS-3						0	0	0	0	0.5	0	0	Data from GMES Promote project, JRC, EFGS, REGIO-GIS (published in Fifth Report on Economic, Social and Territorial Cohesion). Indicator requires advanced calculations and has been calculated using 2009 data. Gaps for NO (NO not included in data).

		Russia	Oblast						999	999	999	999	999	999	999	Inquiries made regarding data from Ministry of Natural Resources, but data cannot be combined with EU/Eurostat data due to territorial aggregation and methodology issues. There is data on air pollution, but it is expressed as cumulative air emissions of harmful chemical compounds, e.g. SO2, NO, CO.
		Belarus	Oblast						999	999	999	999	999	999	999	See information for Russia above.
Eutrophication (Helcom HEAT index)		EU/Eurostat	Per sea area						0	0	0	0	0.5	0.5	0	Index produced only 2009 and 2010 so far, but cover interpolated eutrophication status of the Baltic Sea based on average data for 2001-2006 and 2003-2007, respectively. NO

																	missing (not covered by data/not bordering the Baltic Sea).
		Russia	Per sea area						0	0	0	0	0.5	0.5	0	Index produced only 2009 and 2010 so far, but cover interpolated eutrophication status of the Baltic Sea based on average data for 2001-2006 and 2003-2007, respectively.
		Belarus	N/A						0	0	0	0	0	0	0	BY missing (not covered by data/not bordering the Baltic Sea).
Fragmentation index (landscape metrics: lenght of all border between settlement areas and open space / length of all borders * 100)	Corine GIS layers (from EEA), GIS layer on NUTS-3 regions	EU/Eurostat	NUTS-3			0.5			0	0	0	0	1	0	0	2002: FI (parts), EE, LV, LT, PL: No data.
		Russia	N/A						0	0	0	0	0	0	0	No data.
		Belarus	N/A						0	0	0	0	0	0	0	No data.

5.6. Strategies to overcome missing data entries

As explained above, there exist gaps in the collected data for literary all indicators within the 2005-2011 timeframe. A major part of these gaps, at least for the EU/Eurostat data, consist of missing data entries because of administrative reforms. The strategy to tackle the issues with missing data entries consists of several steps. Recommended steps are extrapolation or interpolation of trends, disaggregation of national figures or figures from a higher nomenclature hierarchy, construction of new averages based on the true data years, among others. Such standard data processing is a part of the common analysis and has been applied to the testing of the collected BSR TeMo data.

Should there be no data available from statistical sources (e.g. Eurostat) for the requested level one might turn to national sources. As an example, in the case of the indicator *Gender imbalances (ratio of male-female aged 25-39)*, data on NUTS3 level was not available at Eurostat, but only NUTS2 level data. In this case the data was constructed using data from national sources. Persons within the TPG responsible for certain BSR countries collected the data on NUTS3 level from national statistical bureaus. The data was then compiled and harmonized. However, naturally the challenges differ for data of different indicators. While population data is released every year and is generally publically available at national statistical bureaus, there's a different matter with other kinds of data. The indicator *Self-assessed general health status*, for example, consists of survey data from the Norwegian Social Science Data Services institute, and will not be publically available at national statistical bureaus, nor updated annually.

6. Russian and Belarus data

6.1. Data sources and data exchange

The statistical data for the administrative units (*oblasts*, republic – regional level) analysed (the so-called "SNUTS 2 regions", regions equivalent to NUTS 2 regions within the EU space) in Russia and Belarus originate from the two official sources: the Federal State Statistics Service of the Russian Federation (ROSSTAT) and the National Statistical Committee of the Republic of Belarus (BELSTAT). Publically available data (on-going statistics and census data) published on websites of the statistical offices were exclusively used. Data for some indicators were only available for census years.

Methodological problems linked to differences in methods of collection of statistical data between ROSSTAT and BELSTAT, on the one hand, and EUROSTAT, on the other, remain a major issue. The problems were discussed at several occasions:

- At a meeting in St. Petersburg between Russian experts, including researchers of the Leontief Centre and experts of the Petrostat, and ministerial representatives and representatives of the BSR TeMo team which was held on 17 January 2013. The meeting in St. Petersburg was organised in order to discuss the methodological problems and possible solutions to overcome them with Russian experts. As a result of an exchange of e-mails that followed the meeting, the BSR TeMo team obtained information about the various indicators. Furthermore, Russian scientists confirm the VASAB comment about the difficulties in comparability between national and regional calculations of particular variables. This mainly concerned economic indicators. At the St. Petersburg meeting, a range of additional sources of statistical data were indicated that should be verified in terms of their usefulness to the project (e.g. data on the number of Internet users – Yandex data, environmental indicators – data of the Ministry of Natural Resources and Environment of the Russian Federation, R&D spending – data of the Ministry of Education and Science of the Russian Federation, waiting time at borders – data of customs services). The territorial aggregation of such data (national level and federal districts) did not allow it to be used in the project. Moreover there were methodological differences in the structure of the indicators, which limited their comparability.
- At a Session on statistics conference in St. Petersburg on 29 January 2014, organized by ROSSTAT, PETROSTAT, VASAB and Leontief Centre: "Statistics as a tool for international communications". During the conference the TeMo project was presented and the main challenges associated with collection and use of Russian data was brought up. The issues of incompatibility and methodological differences between ROSSTAT and EUROSTAT were addressed. Large gaps with regard to the environmental data which is incompatible with EU data, as well as practical difficulties when it comes to payment to the Regional Statistics offices for provided data were emphasized. Among the recommendations from TeMo project were a greater use of variables rather than indicators, widening age groups in calculation of variables, but also improving compliance in data collection across the Russian oblasts and republics (e.g. using the same age groups in calculating youth unemployment rate). The Russian experts showed a great interest in the project and stressed the need to continue a constructive dialogue between ROSSTAT and EUROSTAT on data harmonization.

A good contact was established at the meeting with the experts from PETROSTAT (Federal Statistics Office for St. Petersburg and Leningradskaya oblast). Unfortunately due to time constraints some data requested from PETROSTAT was not received by project partners (e.g. youth unemployment, expenditures on R&D), although it is available.

PETROSTAT pointed out during the meeting that UniSIS database could be helpful in finding additional statistical data for Russia (Unified Interdepartmental Statistical Information System)[10]. It contains information provided by the Federal State Statistics Service (ROSSTAT) and the governmental departments (Ministries and Federal Agencies). Some of the indicators in the database are available at oblast level.

The statistical data published on the ROSSTAT and BELSTAT websites are publically available and may be used for one's own purposes.[11] Some information is not provided on the official websites of the statistical offices, but is published in individual thematic publications[12].

Overall, it is important to note that receiving of data from the Russian regional statistic offices had been delayed due to difficulties in payment for the data requests. None of the regional statistic offices has a foreign bank account, which means that money transfer can only be made in roubles from a bank account in Russia.

A general overview of methodological considerations for Russian and Belarusian data regarding coherence with data from the BSR EU countries, availability and reasons behind possible gaps is shown below in Table 8.

[10] http://www.fedstat.ru/indicators/start.do

[11] The free usage of this data for databases such as for ESPON BSR TeMo was confirmed by telephone call from ESPON BSR TeMo Lead Partner to PETROSTAT on June 7 2013 and BELSTAT on June 10 2013.

[12] Example from the Demographic Yearbook of Russia 2010: „The Handbook may be used by chief executives, senior management officials, corporate planners, marketing directors and sales executives, academic scholars, entrepreneurial and banking institutions, professors, post-graduates and students of higher schools of economics and other users". *The Demographic Yearbook of Russia. Statistical Handbook*, p. 3.

Table 8 Methodological considerations and data gaps for Russian and Belarusian data

Indicator	Availability at which Russian/Belarus Spatial level	Methodological considerations	Availability / Main reasons gaps (refer to Table 7 for full overview)
Economic performance & competitiveness			
GDP per capita	Oblast	The amount of gross regional product in Belarus and Russia is different from GDP because it does not include the value added by the collective non-market services (defence, public administration, etc.) provided by State institutions to society. Currency translations: and the resultant need to use other data sources than EUROSTAT (e.g. World Bank, which collects comparative GDP data for most countries of the world, including Russia and Belarus). Russian experts pointed out that Belorussian economic data (e.g. Gross Regional Product) must be analysed with great care, as it may be distorted by the economic policy of the state (due to the systemic differences between a centrally planned economy and a market economy, i.e. Belarus compared to Russia and EU).	No major gaps in data, but data was collected only as gross regional product at regional level in Russia and Belarus, due to the methodological difference between GDP and GRP (see "Methodological considerations" column). Furthermore, no GRP (Gross Regional Product) data for Belarus is available for 2005-2007, since such data was not calculated by BELSTAT before 2008.
GDP per person	Oblast	See "GDP per capita" above.	See "GDP per capita" above.
Unemployment rate, total	Oblast	ROSSTAT (Russia) data for unemployment include persons aged 15-72, while Eurostat include persons aged 15-74 years (16-74 years for Norway data). There are differences in "unemployed" definition between ROSSTAT and EU/Eurostat. Regarding Belarus, official unemployment rates have been collected. Russian experts pointed out this data has a different methodology compared to Russia and EU (ILO methodology is not used for Belarus unemployment statistics); job-seekers are not registered as unemployed, only those registered as unemployed are registered as unemployed; all registered unemployed are obliged to perform community work. However, as with Eurostat data, data is divided by five years age groups and sex.	
Employment rate (20-64 years)	Oblast	Difference in methodology compared to EU/Eurostat data: For Russia, data available only 16-59 years for men and 16-54 years for women (total). For Belarus, only available for total population.	

Net migration rate	Not available	For Russia, the data is based on processing of primary forms of arrival and departure, which are not filled in by migrants that are registered at the place of stay.	
Total population change	NUTS-3/Oblast	OK regarding comparability according to Russian experts.	
Economic dependency ratio	NUTS-3/Oblast	OK regarding comparability according to Russian experts.	
Access to services, markets & jobs			
Accessibility potential by road	NUTS-3	Confirmed by Russian experts that no data comparable to EU/ESPON data is available.	Russia and Belarus not part of study area of ESPON TRACC.
Accessibility potential by rail	NUTS-3	Confirmed by Russian experts that no data comparable to EU/ESPON data is available.	Russia and Belarus not part of study area of ESPON TRACC.
Accessibility potential by air	NUTS-3	Confirmed by Russian experts that no data comparable to EU/ESPON data is available.	Russia and Belarus not part of study area of ESPON TRACC.
Multimodal accessibility potential		Confirmed by Russian experts that no data comparable to EU/ESPON data is available.	Russia and Belarus not part of study area of ESPON TRACC.
Functional areas: access to cities	Grid, NUTS-3 LAU-2	Data exist from ESPON TRACC project (2011).	5-day update cycle planned
Population potential within 50km	Grid, NUTS-3	Confirmed by Russian experts that no data comparable to EU/ESPON data is available.	Russia and Belarus not part of study area (originating study for EU Parliament covered EU countries only).
Border crossings		Data exists.	Data exists.
Households with internet access at home	Oblast (Russia)/ NUTS 0 (Belarus)	For Russia, OK regarding comparability .	In Belarus, only data at national level is available and only regarding number of Internet subscribers (individuals and enterprises)
Innovative territories			
Population with tertiary education (25-64 years)	Oblast	OK regarding comparability for Russia and Belarus. For Belarus, data is available only from the Population Census in 2009.	
Employment in technology & knowledge sectors	Oblast	Difference in definition compared to Eurostat. In Russia, data on employment in technology and knowledge-intensive sectors is available in the framework of enterprise statistics by economic activity "Research and development". More specifically, number of employees in the organizations in the field of R&D. Not used in testing or visualisations, since coherence with Eurostat data has not been possible to certify.	

Gross-domestic expenditures on R&D 1) business, 2) total	Oblast	Russian experts confirmed that due to territorial aggregation and methodology issues data for Russia (data of the Ministry of Education and Science of the Russian Federation) could not be used for the ESPON TeMo project. In Russia and Belarus, gross domestic expenditure on R&D (total) is calculated across the subjects of the Russian Federation as a percentage of the gross regional product (GRP) in current prices.	Russian and Belorussian statistics as regards R&D expenditure on regional level do not cover the assumptions adopted in the project or they capture them in a different manner.
Social inclusion & quality of life			
At-risk-of-poverty rate	Oblast	Difference in definition compared to Eurostat: In Russia and Belarus the term “Population with a money income below the minimum level for subsistence (at a regional level)” is used, defined by the minimum level for subsistence is an estimate of the cost of a basket of consumer products (approved by the Federal Decree) and compulsory payments and dues, while Eurostat uses the “at-risk-of-poverty rate”, defined as the share of people with a disposable income (after social transfer and measured on an equivalent basis) below the at-risk-of-poverty threshold, which is set at 60 % of the national median disposable income (measured on an equivalent basis) after social transfers.	
Severe material deprivation rate	N/A	Confirmed by Russian experts that no data comparable to EU/Eurostat data is available.	
Youth unemployment rate (15-24 years)	Oblast	Partly OK regarding comparability for Russia and Belarus. In Northwest Russia, two regions (Novgorod and Pskov) provided data for age group 15-29. In the Republic of Karelia data is collected every second year. For Belarus, data is available only from the Population Census in 2009.	

Gender imbalances	Oblast	ROSSTAT (Russia) collects data for 5-year groups at a national level (current statistics), but at the regional level (oblasts, republics, krais), the number of men and women is available by other age groups, i.e. by economic age groups (0-15; 16-59 for men and 16-54 for women; 60 and above for men and 55 and above for women). The only statistical data for 5-year age groups at regional level comes from survey data (censuses in 2002 and 2010), while in EU BSR a majority of the countries use register data. Belarus, however, is covered by yearly data, but only 2010-2012 is publically available.	Belarus: No data available before 2010: There are issues of The Demographic Yearbook in on-line access only from 2010 and onwards.
Life expectancy at birth,	Oblast	Data for Russia and Belarus exist.	
Self-assessed general health status	Oblast (Russia) / N/A (Belarus)	Data for Russia exist, same methodology used as for BSR EU countries. No data for Belarus available.	Survey data, Belarus not included in survey.
Environmental qualities			
New soil sealing per capita	NUTS-3	Russian experts confirmed that due to territorial aggregation and methodology issues data for Russia (data of the Ministry of Natural Resources) and Belarus could not be used for the ESPON TeMo project.	The existing detailed Russian and Belorussian statistics as regards environmental indicators do not cover the assumptions adopted in the project or they capture them in a different manner.
Air pollution (PM10)	Oblast (N/A)	Russian experts confirmed that due to territorial aggregation and methodology issues data for Russia (data of the Ministry of Natural Resources) and Belarus could not be used for the ESPON TeMo project.	Russian and Belorussian statistics as regards environmental indicators do not cover the assumptions adopted in the project or they capture them in a different manner. E.g. there is data on air pollution in Russia and Belarus, but it is expressed as cumulative air emissions of harmful chemical compounds, e.g. SO2, NO, CO, which is different from the data for BSR EU countries (data from GMES Promote project, JRC, EFGS, REGIO-GIS).
Eutrophication	Per sea area (Russia) / N/A (Belarus)	Data for Russia exist, same methodology used as for BSR EU countries. No data for Belarus available.	Data gap for Belarus purely of geographical reasons, since Belarus does not border the Baltic Sea.
Fragmentation index	N/A	Russian experts confirmed that due to territorial aggregation and methodology issues data for Russia (data of the Ministry of Natural Resources) could not be used for the ESPON TeMo project.	The existing detailed Russian and Belorussian statistics as regards environmental indicators do not cover the assumptions adopted in the project or they capture them in a different manner.

6.2. Reliability of data and important gaps

In 2009, the Joint Statistical Council of the Federal State Statistics Service of the Russian Federation and the National Statistical Committee of the Republic of Belarus was appointed. It deals, among other things, with the preparation of a common system of statistical indicators and their comparability between the two countries. Therefore the methodological bases for data collection are similar (they may differ only in detail).

Despite the generally uniform methodology, the Russian and Belorussian data for some variables show surprisingly large disparities. These cannot be explained in any way by differences in economic development. The most glaring example of the huge differences is the data for unemployment rate, which in 2011 was assessed as 0.6% in Belarus (official BELSTAT data) and 6.5% in Russia (official ROSSTAT data). This can be attributed in part to the fact that Belarus does not use the methodology of the International Labour Organization (ILO), and does not classify job-seekers as unemployed persons, but only those people who are officially registered as unemployed. Furthermore, the officially low unemployment rate results from the very low level of benefits (ca. USD 10 monthly) and systemic solutions, i.e. each registered unemployed person is obliged to perform community work[13]. There is no official data on unemployment in Belarus collected by ILO methods. However, according to estimates made by the Gallup Organization, the actual unemployment rate in 2011 amounted to ca. 24% (30% among women and 19% among men)[14].

Furthermore, the Russian experts present at the VASAB meeting in St. Petersburg pointed out that the discrepancies between the official data on unemployment in Russia and Belarus may be attributed to the systemic differences between a centrally planned economy and a market economy. Consequently, Belorussian data must be analysed with great care, not only that on unemployment, but also other economic data (e.g. Gross Regional Product), as it may be distorted by the economic policy of the state.

The lack of comparability between certain ROSSTAT/BELSTAT and EUROSTAT indicators is caused by two factors:

- methodological differences in data collection;
- differences in the territorial aggregation of data.

For these reasons, only partial data was collected on gender imbalances for ages 25-39 for Russia (due to different aggregation of population by age groups or different territorial levels), while the unemployment levels among youths aged 15-24 (youth unemployment rate) was collected but difficult to compare with Eurostat data, as Russian data covered different age groups (<20 years, 20-29 years…), making aggregation of data for the desired 15-24 age group impossible.

A serious problem is that linked to some of the environmental indicators adopted (New soil sealing per capita; Air pollution (PM10); Fragmentation index) – their collection for Russia and Belarus proved impossible. The existing detailed Russian and Belorussian statistics as regards environmental indicators do not cover the assumptions adopted in the project or they capture them in a different manner (e.g. there is data on air pollution in Russia and Belarus, but it is expressed as cumulative air emissions of harmful chemical compounds, e.g. SO_2, NO, CO). The

[13] http://naviny.by/rubrics/society/2011/02/23/ic_articles_116_172587/ (Russian).
[14] http://www.ilo.org/public/english/region/eurpro/moscow/news/2012/0709.htm (English).

same problem concerned R&D expenditure. For Russia and Belarus such data are only available at the national level.

6.3. Comparability

The official statistical data published on the websites of the statistical offices (ROSSTAT and BELSTAT) come from several sources: censuses, current statistics and representative surveys (e.g. employment rate[15], at-risk-of-poverty rate).

A review of the data collection methodology (Table 9) showed certain differences in the design of some indicators adopted in the project.

6.4. Comparability of ROSSTAT/BELSTAT data between levels

Disparities in the methodology of data collection were identified not only between ROSSTAT/BELSTAT and EUROSTAT, but also within the same statistical office. They result from the adoption of different data collection methods for various territorial levels (national and regional). For the gender imbalances indicator, ROSSTAT collects data for 5-year groups at a national level (current statistics), but at the regional level (*oblasts*, republics, *krais*), the number of men and women is available by other age groups, i.e. by economic age groups (0-15; 16-59 for men and 16-54 for women; 60 and above for men and 55 and above for women). The only statistical data for 5-year age groups at regional level comes from censuses (in 2002 and 2010).

Serious methodological differences were seen for the GDP indicator in Russia and Belarus at the regional and national level. The amount of gross regional product in Belarus and Russia is different from GDP because it does not include the value added by the collective non-market services (defence, public administration, etc.) provided by State institutions to society. Therefore data was collected on gross regional product at regional level in Russia and Belarus for the needs of BSR TeMo. A methodology problem was also encountered with respect to currency translations and the resultant need to use other data sources than EUROSTAT (e.g. World Bank, which collects comparative GDP data for most countries of the world, including Russia and Belarus).

[15] The data on the economically active population, employment in the economy and unemployment are obtained on the basis of sample surveys on employment, conducted by the statistical authorities of the Russian Federation, followed by the extrapolation of the results to the entire population of the age of the subject. In 1992 to 1994, 1996, 1997, 1998 it was carried out once a year. In 1995 two surveys were conducted. From 1999 to 2009 surveys were conducted on a quarterly basis; since September 2009 they were conducted on a monthly basis. Observation units are households and persons aged 15-72 years - the members of these households. During each survey more than 69 thousand people aged 15 to 72 years were questioned (0.06% of the population of that age).

Table 9 Methodological disparities between ROSSTAT/BELSTAT and EUROSTAT – examples

1. At-risk-of-poverty rate/Population with a money income below the minimum level for subsistence (at a regional level)	
ROSSTAT/BELSTAT	**EUROSTAT**
The minimum level for subsistence is an estimate of the cost of a basket of consumer products (approved by the Federal Decree) and compulsory payments and dues. The basket of consumer products includes a minimum range of food and non-food goods and services which are necessary in securing people's health and ensuring their life activities. In the regions of the Russian Federation, the market basket is set by the legislative (representative) bodies of the Russian Federation with regard to the climatic conditions, national traditions and local characteristics of food consumption, non-food goods and services of basic socio-demographic groups.	The at-risk-of-poverty rate is the share of people with a disposable income (after social transfer and measured on an equivalent basis) below the at-risk-of-poverty threshold, which is set at 60 % of the national median disposable income (measured on an equivalent basis) after social transfers.
2. Unemployment	
ROSSTAT Unemployed persons: • aged 15 to 72; • had no job (profitable occupation); • were seeking a job, i.e. had applied to the State or a commercial employment service, used or placed announcements in mass media, appealed directly to enterprise administrations (to employers), used personal contacts, etc. or tried to organise their own business; • were ready to start working during the reference week. Pupils, students, pensioners and invalids are referred to the category of unemployed if they didn't have a job, have been seeking a job and were ready to start working.	An unemployed person: • someone aged 15 to 74 (in Italy, Spain, the United Kingdom, Iceland, Norway: 16 to 74 years); • without work during the reference week; • available to start work within the next two weeks (or has already found a job to start within the next three months); • actively having sought employment at some time during the last four weeks.
3. Youth unemployment rate (regional level)	
ROSSTAT -Regional Statistics Offices Unemployment in some regions is calculated in the age group 15-29 (e.g. Novgorodskaya and Pskovskaya oblasts), whereas in others in the age group 15 to 24,	Youth unemployment rate is the percentage of the unemployed in the age group 15 to 24 years old compared to the total labour force (both employed and unemployed) in that age group.

Source: EUROSTAT, ROSSTAT.

6.5. *Oblasts* and *rayons* – why *rayons* are not used in BSR TeMo

A key problem is posed by the large differences between the size of *rayons* (equivalent to LAU 1) in Russia and Belarus, not only compared to NUTS 3 units in other countries of the European Union (especially Germany), but also the mutual differences. Within the Russian territory under study, the smallest *rayon* has an area of 33 km^2, and the largest, 52 978 km^2, which basically corresponds in size terms to a large NUTS 2 region.

It is worth noting yet another issue. In the countries of Western Europe, NUTS 3 units of most countries have an administrative nature, while in some countries of Eastern Europe, NUTS 3 units have a purely statistical character (e.g. Poland).

Data collection at local level (*rayons*) in Russia and Belarus involves a range of technical problems. There is no single coherent system (data base) to allow for the desired data comparisons to be generated for all *rayons*. There is no thematic key (according to different types of characteristics), but only a territorial key, which allows comparisons to be generated for one or several characteristics of a single *rayon*. The completeness of data by *rayons* is another serious issue. There are different sets of variables for different *rayons*. This leads to serious gaps in the data sets. Furthermore, data by *rayons* cover only the last few years (with a different number of years for different indicators).

7. Indicators at LAU-2/raster level

Even though the NUTS-3 level has been identified as the main spatial level to set up the monitoring system at, finer spatial levels such as LAU-2 (or municipality) level or grid levels were investigated, acknowledging that due to the size of NUTS-3 entities in the BSR many spatial developments materialize only at detailed spatial scales. The results of these investigations are presented below, including a brief overview on data availability and requirements for handling and presenting data below NUTS level.

Having said this, a complete data collection for NUTS-3 level is already challenging, given the current data availability in Europe where many of the regional statistics are only available at NUTS-2 level. All the more, data collection below NUTS-3 level or for alternative spatial entities will be even more challenging. Nevertheless, there are some data already available at LAU-2 and raster levels, or for alternative entities for the BSR, though some of them cover only parts of the BSR. LAU-2 data often stem from national statistical institutes (NSI's), while raster data often represent output of environmental or accessibility model applications, of which several have been used in previous ESPON projects.

Alternative spatial entities in addition to LAU-2 and raster level that are of interest for TeMo represent water bodies (i.e. the Baltic Sea as such), main cities, labour market areas or functional area, and border crossings (as point locations). None of these represent the "classical" ESPON spatial units. Regarding labour market areas and functional areas, several previous projects and maps from Nordregio contain data on this spatial level. Nordregio has defined 197 labour market areas for the five Nordic countries, of which four are included in the BSR-TeMo project (Denmark, Finland, Norway and Sweden). These labour market areas in most cases do not exactly correspond to the LAU region boundaries, as they are designed primarily for the purpose of showing commuting patterns and, as the name implies, are centred around certain locations that form the centre of the local labour market. For an example map with the Nordic labour market areas, see Figure 4. The Nordic labour market areas can be applied to demographic and labour market data provided by NSI's. However, as stated above, they only cover four out of the ten BSR TeMo countries.

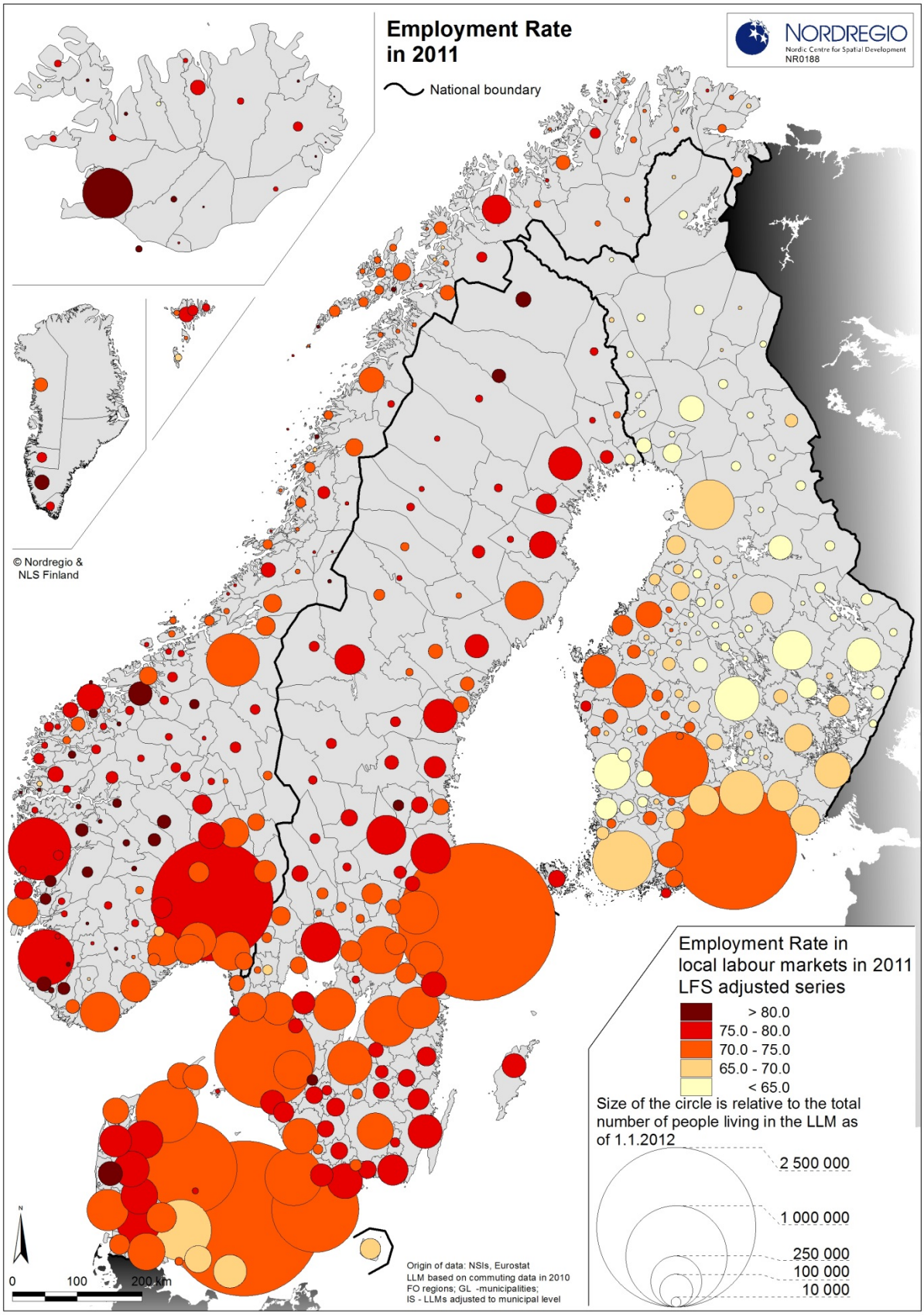


Figure 4 Employment Rate in 2011, according to Nordic labour market areas divisions.

Example map (© Nordregio & NLS Finland).

With the introduction of the notion of so-called 'functional urban areas' by the ESPON 1.1.1 project, a long debate among researchers, geographers, planners and politicians were triggered about the role of such areas and how they could be best delineated. While many experts appreciated the hidden concept as such, criticism was raised about the criteria and the way how the areas were generated. Similar to the concept of labour market areas, functional urban areas do not follow LAU or region boundaries, but by intention they cross such borders. Thus, statistical data for such entities are not available, and aggregation of statistics to the level of functional urban areas appears to be non-trivial. The delimitation of 'functional urban areas' according to ESPON 1.1.1 is presented in figure 5.

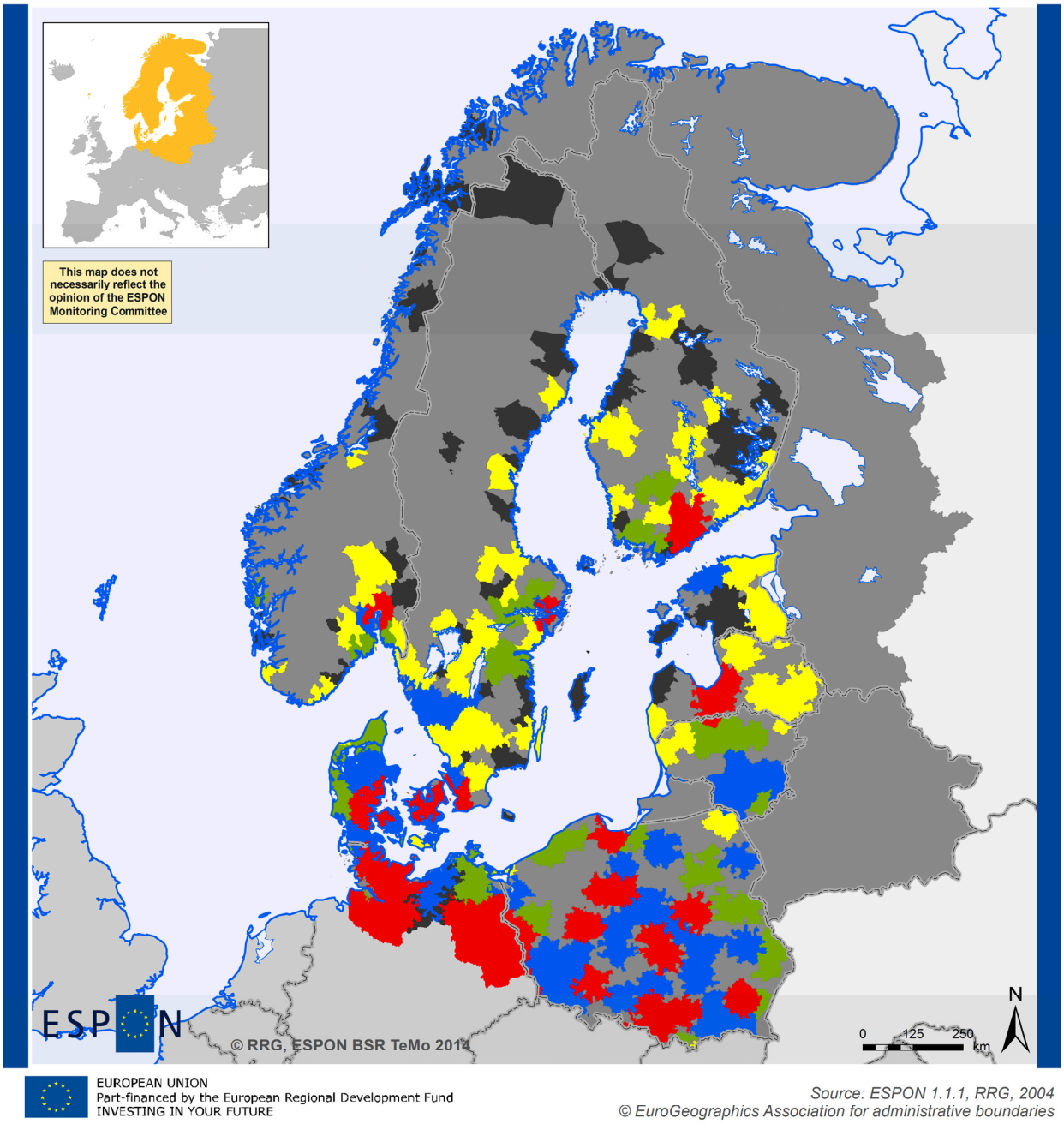


Figure 5 Delimitation of Functional Urban Areas (FUAs): Number of inhabitants per FUA (2004).

The following Table 10 is summarising alternative spatial entities that might be of future interest for the BSR territorial monitoring system. The table not only provides hints as how to apply selected TeMo Indicators to alternative spatial units, but also give hints for new indicators that might become of interest in the future for the further development of the TeMo system.

Table 10 Alternative spatial units and potential indicator applications

Type of entity	Example	Potential indicators
Regular squares	Raster / grid	Accessibility or environmental indicators (i.e. population potential, travel time, fragmentation, land take, air pollution)
Municipalities	LAU-1/2	Demographic, labour market or economic indicators (i.e. population, education, jobs and work places, employment or unemployment rates)
Discrete points	Cities / Urban audit	Demographic indicators (i.e. population, education, poverty)
	Border crossings	Flow or interaction indicators (i.e. waiting times, traffic flows)
	Airports	Facilities or traffic indicators (number of runways, number of gates, passenger or cargo turnover, number of flights)
	Ports	Facilities or traffic indicators (number of harbour basins, length of wharfs, cargo turnover, number of vessels)
Lines	Roads	Traffic indicators (i.e. AADT, link loads, average or maximum speeds)
	Railway sections	Traffic indicators (i.e. speeds, number of IC trains)
	Shipping routes	Traffic indicators such as frequency of services, number of vessels, density of vessels)
Alternative polygon units	Sea or lakes	Environmental indicators such as eutrophication
	Labour market areas	Labour market statistics (total employment, employment by branch, commuting, GDP)
	Functional urban areas	Demographic, land use, labour market and economic statistics (i.e. population, land use by type, employment, unemployment, commuting, GDP)
Tabular data	Matrices	Travel time or commuting matrices

7.1 Status of indicators at or below LAU-2 / raster level

Table 11 gives an indication about the status of indicators at or below LAU-2 / raster level, or for alternative spatial units, by listing the indicators, the potential data availability (including main spatial level; in general LAU-2 or grid, depending on which level covers most of the BSR), data sources and reference years. Also, the last column provides information on alternative spatial coverage. For example, while grid is the main level for the indicator "Functional areas: access to cities" and cover the whole BSR with data from 2011, this column states that

there is also data available on LAU-2 level but limited to the ESPON space (thus not including Russia and Belarus) and only from 2004.

Regarding Russia and Belarus, the possible spatial level for data below *oblast* level (SNUTS-2) is *rayon* level (SNUTS-4), equivalent to LAU-1 within the EU/Eurostat zone. Only LAU-2 or lower levels are in the scope of investigation in this case, however *rayons* are still discussed in general terms in this chapter. Denmark, however, has been included on LAU-1 level rather than LAU-2 level for practical purposes (e.g. availability of data) and coherence with other BSR countries on municipality level (both regarding population and size), since Denmark's LAU-2 regions consist of parishes (sogne), relatively small in size, with a total number of as much as 2148.

It should be noted that Table 11 only provide an indication on *potential* data availability, based on a desk based review on available sources at or below LAU-2 / raster level. I.e. as the scope of the TeMo project cover the establishment of a territorial monitoring system at NUTS level, including a thorough review of data availability on primarily NUTS2 and NUTS3 levels (and corresponding SNUTS levels), the aim of this section is only to briefly explore the possibilities for the future to go beyond NUTS level.

Furthermore, when discussing potentials and data availability at LAU-2 / raster level, we believe that this is not just purely a technical data question, but one must also discuss the rationale behind it. Applying some of our indicators at LAU-2 level or below is simply misleading, due to the way the indicators are defined or the input data are collected. For example, indicators like GDP per capita, gross-domestic expenditures on R&D or accessibility potential to airports should or cannot be applied at LAU-2 or raster level. Although some such data does exist on LAU level for some countries (i.e. Sweden) for, for example, GDP, it's only available for relatively high fees from the National Statistical Institutes; there are issues with GDP values "spilling" over the LAU border (due to commuting and "non-functional" LAU regions); and since the data is only accessible from few BSR countries it makes no sense to apply an indicator on LAU level when it only covers part of the BSR territory.

Table 11 Indicator availability at alternative spatial levels (indication).

Green cells reflect cases for which data below NUTS level is available, and level (i.e. LAU-2, etc.). Grey cells, "N/A": Data below NUTS level not available (confirmed). Blank cells: Data availability not confirmed, further inquiries needed.

Indicator	*Possible data availability below NUTS/LAU1 level (i.e. LAU-2/SNUTS5, GRID, Baltic Sea, Border control stations; with possibilities for harmonization)**											Source	Year	Alternative source/coverage and comments
	Denmark	Belarus	Estonia	Finland	Germany	Latvia	Lithuania	Norway	Poland	Russia	Sweden			
1. Economic performance and competitiveness														
GDP per capita	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NSI	-2012	GDP LAU data available upon payment only to NSI's for some Nordic countries, and also methodological problem exist, so not recommended.
GDP per person employed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NSI	-2012	GDP LAU data available upon payment only to NSI's for some Nordic countries, and also methodological problem exist, so not recommended.
Unemployment rate, total	LAU-1	SNUTS-4 2005-'12	LAU-2	LAU-2	LAU-2			LAU-2	LAU-1 LAU-2	N/A	LAU-2	NSI	-2012	NSI/Nordregio: Labour market areas (DK, FI, NO, SE), -2012. ESPON INTERCO: LAU-2 (Copenhagen (DK) /Skåne (SE)), 2011
Employment rate (20-64 years)	LAU-1	N/A	LAU-2	LAU-2				LAU-2	N/A	N/A	LAU-2	NSI	-2012	NSI/Nordregio: Labour market areas (DK, FI, NO, SE), -2012. ESPON INTERCO: LAU-2

														(Copenhagen (DK) /Skåne (SE)), 2011
Net migration rate	LAU-1	N/A	LAU-2 (census)	LAU-2				LAU-2	LAU-2 1995-'12	SNUTS-4 2010-'12	LAU-2	NSI	-2012	NSI/Nordregio: Labour market areas (DK, FI, NO, SE), -2012.
Population change	LAU-1	SNUTS-4 2005-'12	LAU-2 (census)	LAU-2	LAU-2			LAU-2	LAU-2 2005-'12	SNUTS-4 2009-2013	LAU-2	NSI	-2012	NSI/Nordregio: Labour market areas (DK, FI, NO, SE), -2012.
Economic dependency ratio	LAU-1	SNUTS-4 2007-'12	LAU-2 (census)	LAU-2	LAU-2			LAU-2	LAU-2 1995-'12	SNUTS-4 2002, 2010	LAU-2	NSI	-2012	NSI/ Nordregio: L.M.A.'s (DK FI NO SE) -2012.
2. Access to services, markets and jobs														
Accessibility potential road			LAU-2			LAU-2	LAU-2		LAU-2			ESPON TRACC	2012	ESPON TRACC demonstrated that these indicators (except Air) can be produced at raster and LAU-2 level; however, it was only generated for seven case studies, incl. one case study for Poland and one for the three Baltic States. The other five case studies did not cover the BSR. Future projects, however, may use the ESPON TRACC approach to calculate these indicators at LAU-2/raster level for the entire BSR.
Accessibility potential rail			LAU-2			LAU-2	LAU-2		LAU-2			ESPON TRACC	2012	
Accessibility potential air	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Multi-modal accessibility potential			LAU-2			LAU-2	LAU-2		LAU-2					
Functional areas: access to cities	GRID	GRID	GRID	GRID	GRID	GRID	GRID	GRID	GRID	GRID	GRID	ESPON TRACC	2011	ESPON 1.1.1: LAU-2 (ESPON space), 2004

Population potential within 50km	LAU-1		LAU-2	LAU-2	LAU-2	LAU-2	LAU-2	LAU-2	LAU-2		LAU-2	RRG	2008	RRG: grid (ESPON space), 2008
Border crossings	Border control stations	Border control stations	Border control stations	Border control stations	Border control stations	Border control stations	Border control stations	Border control stations	Border control stations	Border control stations	Border control stations	UN-ECE, IRU	2005	
Households with internet access at home	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Data exist for Nordic countries on LAU level, but is not comparable (i.e. SE-NO).
3. Innovative territories														
Population with tertiary education (25-64 years)	LAU-1	N/A	LAU-2 (census)	LAU-2				LAU-2	N/A	N/A	LAU-2	NSI	-2012	PL, RU: only tot. value avail.; PL LAU-2 2002, LAU-1 2011. RU SNUTS-4, 2002, 2010.
Empl. in technology and knowledge-intensive sectors	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Gross-domestic expenditures on R&D, business	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Gross-domestic expenditures on R&D, total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4. Social inclusion & quality of life														
At-risk-of-poverty rate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Severe material deprivation rate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Youth unemployment rate (15-24 years)	LAU-1	N/A		LAU-2	LAU-2			LAU-2	N/A	N/A	LAU-2	NSI	-2012	

Gender imbalances	LAU-1	SNUTS-4 (2010-2012)	LAU-2	LAU-2		LAU-2		LAU-2	LAU-2 (1995-2012)	SNUTS-4 (2002, 2010)	LAU-2	NSI	-2012	NSI/Nordregio: Labour market areas (SE), -2012
Life expectancy at birth, in years	LAU-1	N/A	N/A	LAU-2				LAU-2	N/A	N/A	LAU-1	NSI		ESPON INTERCO: LAU-2 (Sjælland and Hovedstaden Regionen (DK)), 1998-2007; LAU-2 (SydSverige (SE)), 2003-2007
Self-assessed general health status	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5. Environmental qualities														
New soil sealing per capita	GRID	N/A	GRID	GRID	GRID	GRID	GRID	GRID	GRID	N/A	GRID	EEA et al.		Grid/raster data, usage maybe possible
Air pollution (PM10)	CITY	N/A	CITY	CITY	CITY	CITY	CITY	N/A	CITY	N/A	CITY	JRG et al.		Data on city level available for EU countries, usage maybe possible
Eutrophication	Baltic Sea	N/A	Baltic Sea	Baltic Sea	Baltic Sea	Baltic Sea	Baltic Sea	N/A	N/A	Baltic Sea	Baltic Sea	HELCOM		Raster data, interpolated
Fragmentation index	GRID	N/A	GRID	GRID	GRID	GRID	GRID	GRID	GRID	N/A	GRID	EEA et al.	2006, '10	Grid/raster data, usage maybe possible

7.2 TeMo BSR example maps on LAU-2 level

Despite the limitations in scope, the TPG has made an effort to exemplify how a territorial monitoring system below NUTS level could be visualized, by producing maps on LAU-2 and grid level that cover at least more than half of the BSR. Some of these maps are shown below. They cover Denmark, Finland, Norway, Sweden, Estonia and Latvia on LAU-2 level and concern the indicators Total population change and Gender imbalances (figures 6, 7). Other maps, also on LAU-2 level, covering Denmark, Finland, Norway and Sweden, are presented in Chapter C.3. They cover the indicators Total Unemployment rate, Employment rate, and Population with tertiary education and, as with the aforementioned two maps, have been produced specifically for the BSR TeMo project. Furthermore, apart from the mentioned maps, also other example maps for the alternative spatial units listed in Table 10 above are included in the *Presentation Tool* under each indicator in the so-called indicator map gallery (for more information see Volume 5).

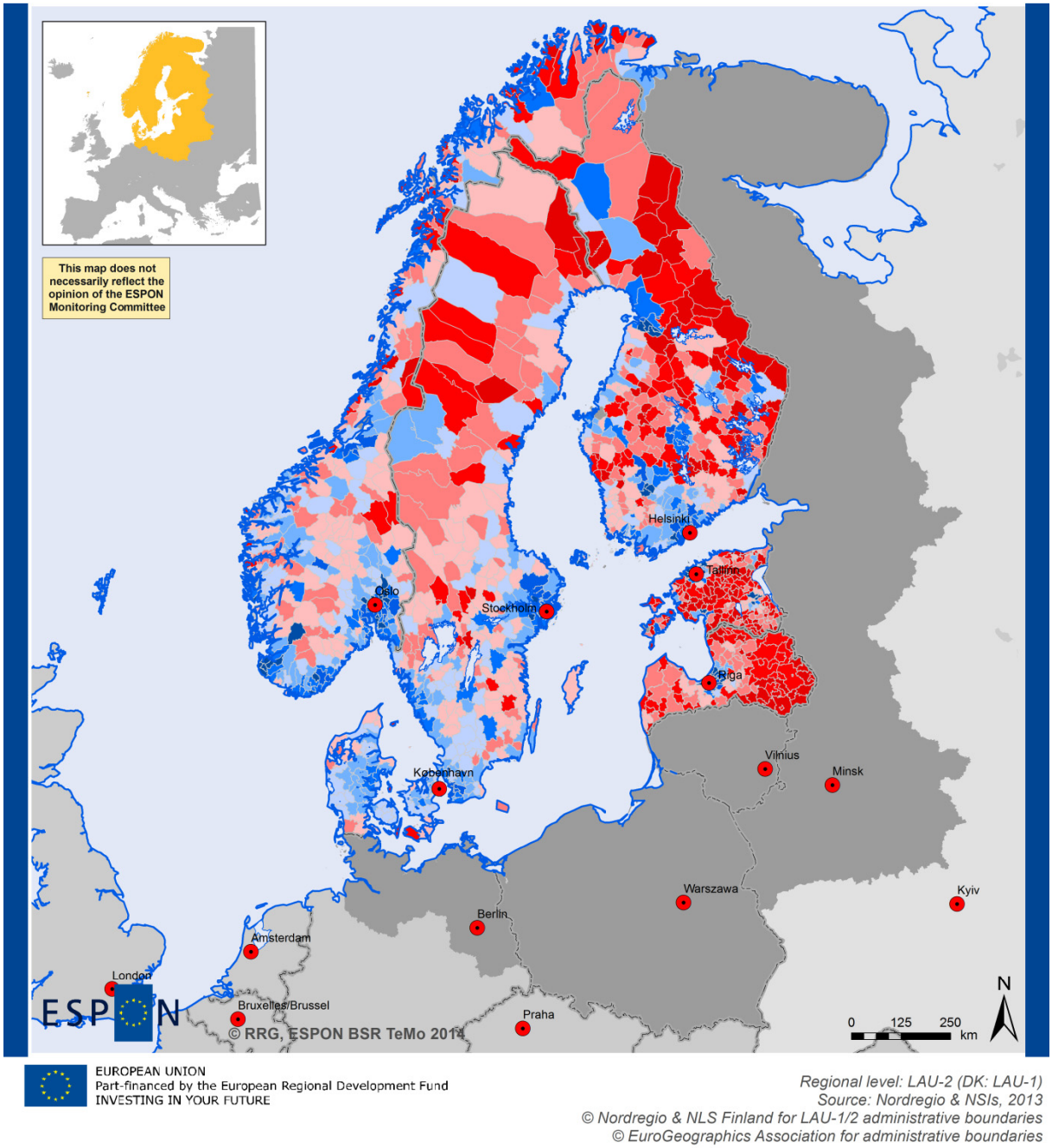


Figure 6 Total population change 2006-2011 on municipality level (Nordic countries, Estonia, Latvia).

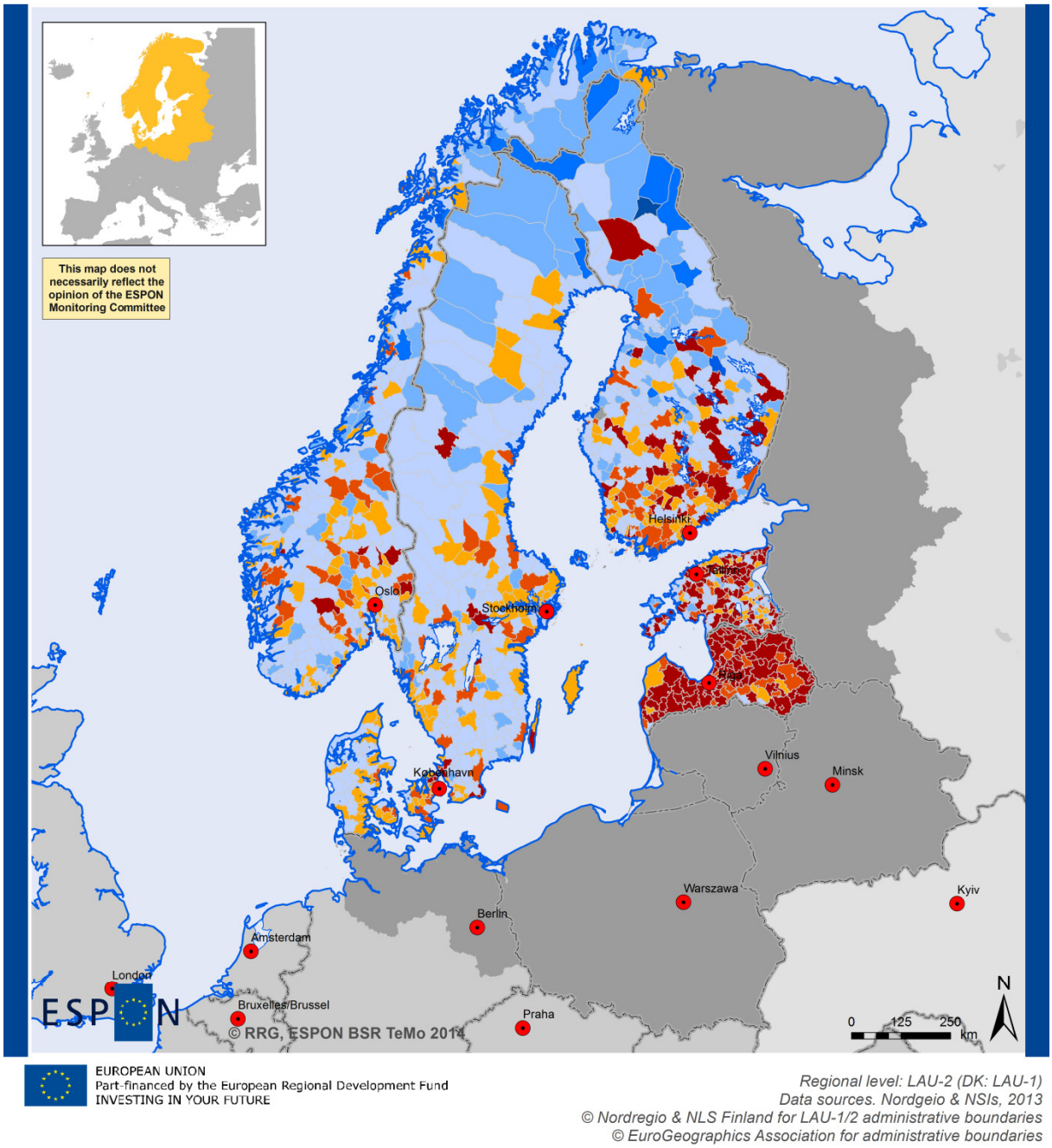


Figure 7 Gender imbalances 2011 on municipality level (Nordic countries, Estonia, Latvia).

It might be argued that these example maps should cover all LAU-2 regions of the BSR. However, availability, collection, harmonization and the technical requirements of handling the LAU-2 data is in parts a different process compared to working with NUTS-3 or NUTS-2 data. It's generally a much more time-consuming process, and as already mentioned is not part of the project scope. That is also the reason why only a limited number of countries are covered in the example maps. The specific issues with LAU-2 data handling are mainly a matter of the fine scale of these territorial units. These obstacles are further explained in the next section.

7.3 Specificities in data handling below NUTS level for the BSR

Regional structure at local level and comparability

Table 12 gives an overview of the number of main territorial units below NUTS level (LAU-2, with some exceptions) in respective country within the BSR. The detailed scale of these units means that the total number is big – more than 7000. This number can be compared to the total number of NUTS-2 regions in the BSR, 66, and NUTS-3 regions, 465. With such difference in number of entities between NUTS and LAU level, the implications regarding data handling (collection, harmonisation, etc.) for LAU regions are easily understandable. Naturally, the large number of local territorial units also means that maintenance needs (for example on a yearly basis) of the monitoring system on this scale increases drastically. The main problem statistically working with the LAU-2 level is not so much the number of units as such, but the fact that every year numerous changes to these units are being made in all member states by merging or splitting units, by renaming them and/or changing the unit codes, or by changing the boundaries between two or more units. Of course, this also happens to the NUTS system, however, less often compared to the LAU level.

By way of consequence, building a territorial monitoring system around LAU-2 level would require many efforts keeping track of all these changes, not only in terms of geometrical correctness but also in terms of updating the statistical data for each unit.

Table 12 Main territorial units below NUTS level in the BSR as of 2013.

Note: The number of units fluctuates more or less yearly for many countries, especially in the case of Germany.

Country	Unit name in English	Unit name in national language(s)	Spatial level	Number of units
Belarus	Rayon	Район	SNUTS-4	118 (130)**
Denmark	Municipality	Kommune	LAU-1	98 (99)***
Estonia	Municipality	Omavalitsus	LAU-2	215
Finland	Municipality	Kunta ; Kommun	LAU-2	320
Germany*	Municipality	Gemeinde	LAU-2	2712
Latvia	Cities under state jurisdiction / counties	Republikas pilsētas / novadi	LAU-2	119
Lithuania	Eldership	Seniūnija	LAU-2	550
Norway	Municipality	Kommune	LAU-2	428
Poland	Municipality	Gmina	LAU-2	2479
Russia*	Rayon	Район	SNUTS-4	123****
Sweden	Municipality	Kommun	LAU-2	290
Total				***7448***

** Only those entities located in the BSR.*

*** Including towns of oblast subordinance (urban locality with the population of not less than 50,000 people; it has its own body of self-government). Belarus officially has 118 rayons, but there are separate statistics for towns of oblast subordinance. Belarus is here represented at SNUTS-4 level (equivalent to LAU-1) since there are no corresponding LAU-2 units in Belarus.*

**** For practical purposes (e.g. availability of data) and coherence with other BSR countries on municipality level (both regarding population and size), Denmark is here represented on LAU-1 level rather than LAU-2 level. Denmark's LAU-2 regions consist of parishes (sogne), with a total number of 2148, while Denmark's LAU-1 regions number 99 in total, e.g. 98 municipalities (kommune) and, in addition, Christiansø, which formally does not belong to the municipalities of Denmark.*

***** On the level sNUTS4 Russian statistic includes rayons and municipality districts. Russia is here represented at SNUTS-4 level (equivalent to LAU-1) since there are no corresponding LAU-2 units in Russia.*

In addition, there are notable variations in the structure of the local administrative regions simply by the number of LAU-2 regions between countries, e.g. in relation to the countries' sizes both in terms of population and area. One of many examples are Sweden and Estonia, where the difference in number of municipalities are quite small (290 versus 215), while Sweden covers a much bigger area and has almost eight times Estonia's population. Similar variations between the regional structures in different countries also exist on NUTS levels, but they are much more pronounced on LAU-2 level. One prominent example is Germany: the bigger cities ("kreisfreie Städte") are LAU-2 and NUTS-3 units at the same time, while on the other hand usual NUTS-3 entities of Germany are "Kreise", which by definition cover several LAU-2 units.

Furthermore, there's also a question on at which level a territorial monitoring system of an entire macro region such as the BSR makes sense. Municipal level (LAU) data might be better for presenting differences within a country, rather than between various countries. In the latter case, NUTS-3 or NUTS-2 regions probably make up a better overview on Macro region level. Sometimes the geographical extent (area) of LAU-2 units is so small that they simply will not be visible upon maps, even at BSR level, which – based upon practical experiences – poses lots of 'imagination' tasks on the reader. On the other hand, applying certain indicators at NUTS-3 or NUTS-2 lead to averaged values which hides interesting spatial patterns – for instance, accessibility indicators benefit significantly when being calculated at lower spatial level since 'peaks' of high accessibilities appear close to 'valleys' of low accessibilities. Such small-scale differences are hidden when aggregated NUTS levels are analysed. This clearly is a pro-argument for promoting LAU-2 or raster based approaches.

The refined territorial scales also bring other consequences that are influenced by people's movements across local administrative boundaries. Such consequences can also be seen across national boundaries (NUTS-0 level boundaries), in cases where persons might live in one country but commute on a daily basis to the neighbouring country for work. In the national labour market statistics, those persons most probably will not be recorded as employed in their country of living. Therefore, some densely populated national border areas, with an easily crossed border, in many cases in the national statistics on one side of the border might show up incorrectly as an area with many non-employed. Still, in national level data such inconsistencies in most cases are not very apparent. However, in regional context, on NUTS-1, NUTS-2 and NUTS-3 levels, cross border commuting will distort the figures more, since the population is smaller than on national level. The issue then become even more apparent on the local scale, for example between suburban municipalities and urban centre municipalities, where most people might live in the former but work in the latter.

Estonia, as mentioned above, has 215 LAU-2 units that are relatively small in size, especially so in a BSR context. The consequence then is that although LAU-2 data might exist for several indicators (as outlined in Table 11 above), in many cases the figures for those units will be too small for reliability. Thus, the finer scale, there's greater need to be aware of that statistical data might be misleading.

As mentioned above, the variation in territorial levels between Belarus and Russia (SNUTS-2) on the one hand, and the other BSR countries on the other (NUTS-3), is not only apparent on NUTS level, but also on LAU level. Thus the finest territorial level below NUTS is SNUTS-4 (*rayons*, equivalent to LAU-1) for Belarus and Russia, but LAU-2 for the other BSR countries (with the exception of Denmark, for which a LAU-2 division exist, but the LAU-1 level has been applied in this context for practical reasons). As mentioned previously in this chapter (see C.2.6), the size of *rayons* can vary greatly, both when compared to countries of the European Union (especially Germany), and regarding mutual differences. Thus, within the Russian territory under study, the smallest *rayon* has an area of 33 km^2, and the largest 52 978 km^2, which basically corresponds in size terms to a large NUTS-2 region.

"Cities" as local units

Many LAU units consist of a city or town, and probably even more often the case is that several agglomerated LAU units that border each other make up one single agglomeration. However, the official LAU-2 units might not always correspond to a functional city region, e.g. "cities" as local units in the sense of "point entities". Although such functional city regions lack the formal administrative structures, which also in most cases limits the availability of statistical data, there are possibilities of analysing functional city regions. For example, there are approximately 250 cities with more than 50,000 inhabitants within the BSR, and a share of these cities is covered by the Urban Audit database (Figure 8 below)[16]. Therefore, some data would be available for further analysis on a functional city level. One argument against this approach is that a selected set of cities only represents one part of the BSR, while rural and peripheral areas are not covered. All results from such analyses thus have bias.

[16] Altogether 63 cities of the BSR currently participate in Urban Audit: Denmark (4), Estonia (2), Finland (4), BSR Germany (7), Latvia (2), Lithuania (3), Norway (6), Poland (27), Sweden (8). Belarus and Russia are currently not participating in the UA initiative.

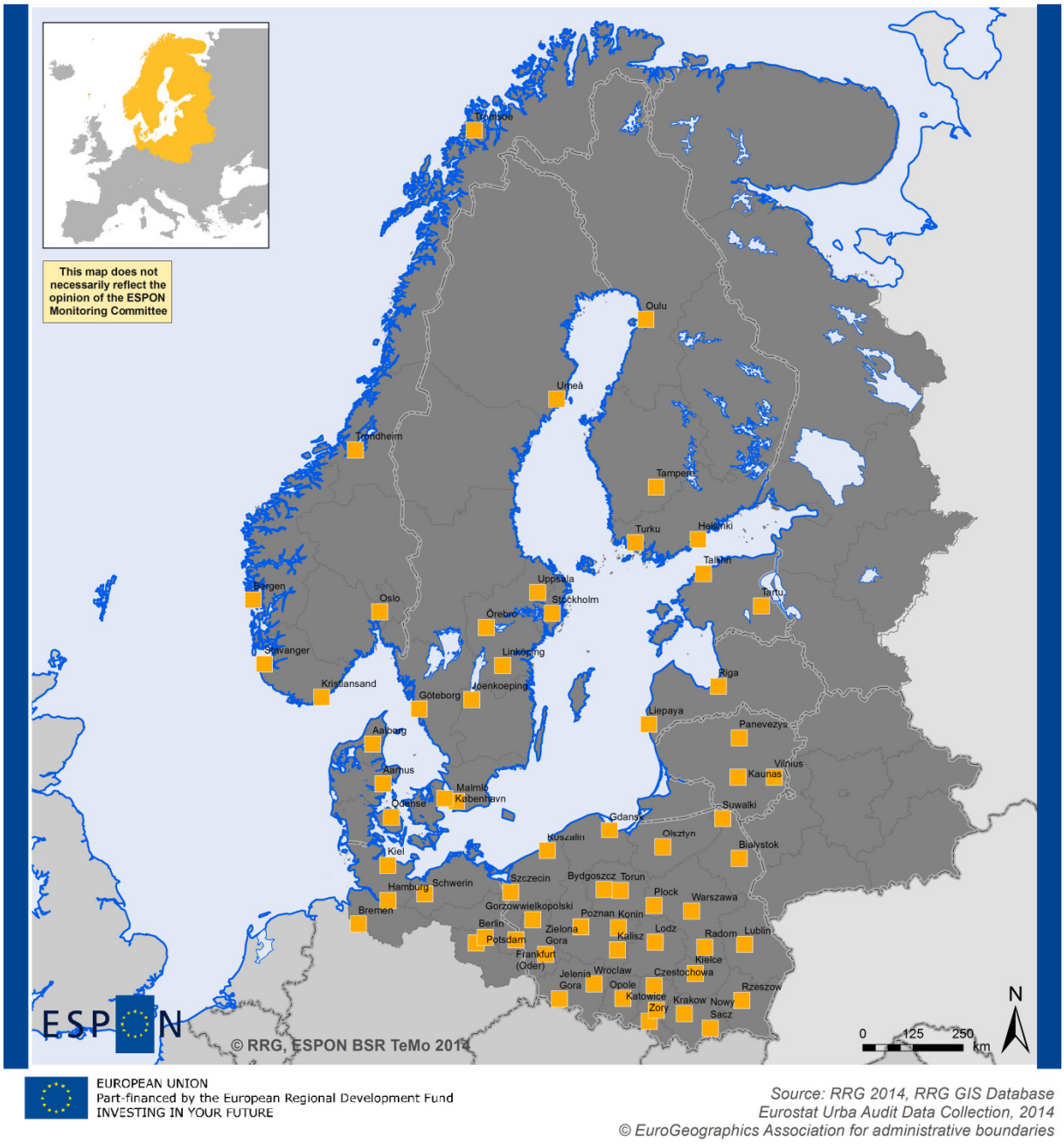


Figure 8 BSR Cities participating in Urban Audit Programme.

Still, it might be possible to analyse a few indicators for a selected set of cities using the Urban Audit data.

Table 13 contrasts the list of TeMo indicators by domain, with the available variables of the Urban Audit data collection (Eurostat, 2004). The table shows, that 16 TeMo indicators would also be available in Urban Audit (also sometimes with slightly different definition). Ten indicators are not available in Urban Audit, however, some of them could potentially been generated rather easily from the

available Urban Audit input data. Three TeMo indicators are conceptionally not applicanle for Urban Audit cities.
In case of the indicators of potential accessibility, Urban Audit already uses the ESPON NUTS-3 indicators.

In brief, most of the TeMo indicators could potentially be replicated for city assessment by using Urban Audit city data. Still, not all Urban Audit indicators may be avaiulable for all cities (which was not tested here), so some data gaps must be anticipated.

Table 13 Availability of TeMo indicators in Urban Audit data collection programme.

Temo Indicator	Urban Audit	
	Availablility (yes/no)	Comment
Economic performance and competitiveness		
GDP per capita	✓	GDP per head of resident population
GDP per person employed	✓	
Unemployment rate, total	✓	
Employment rate (20-64 years)	X	
Net migration rate	X	
Total population change	✓	Total annual population change over 5 years
Economic dependency ratio	X	
Access to services, markets and jobs		
Accesibility potential by road	✓	*These indicators actually are the ESPON NUTS-3 indicators; for each city, the respective NUTS-3 value was used*
Accesibility potential by rail	✓	
Accesibility potential by air	✓	
Multimodal accessibility potential	✓	
Functional areas: access to cities	n/a	
Population potential within 50 km	X	
Border crossings	n/a	
Households with internet access at home	✓	
Innovative territories		
Population with tertiary education (25-64 years)	✓	Proportion of population qualified at different ISCED levels
Employment in technology & knowledge intensive sectors	✓	Proportion of employment in different sectors (NACE Rev.1)
Gross-domestic expenditures on R&D, business	X	
Gross-domestic expenditures on R&D, total	X	
Social inclusion and quality of life		
At-risk of poverty rate	✓	% of households with less than half national average income

Severe material deprivation rate	X	
Youth unemployment rate (15-24 years)	✓	Proportion of residents unemployed in age group 15-24
Gender imbalances	X	
Life expectancy at birth (in years)	✓	
Self-assessed general health status	(✓)	Perception of health services
Environmental quality		
New soil sealing per capita	X	
Air pollution (PM10)	✓	Number of days particulate matter PM10 concentration exceed 50 µg/m3
Eutrophication	n/a	
Fragmentation index	X	

Reference: Eurostat (2004): *Urban Audit. Methodological Handbook*. Luxembourg: Eurostat

Collection and harmonisation of local level data

As with the data handling on NUTS-2 and NUTS-3 levels, data identification, comparison checks and harmonisation are important parts also for LAU level data.

However, in many aspects data handling for LAU data is more demanding than it is for NUTS data. The increased amount of territorial units to handle has already been outlined above. Furthermore, local level data in most cases will at best only be available from NSI's, and concern only the specific country of the NSI, its' regions and municipalities. Therefore, the identification of suitable NSI data country by country requires a certain effort. This task becomes even more cumbersome for countries where data below national level is not available from the NSI's, but only from Regional Statistical Offices. In the TeMo BSR case, this applies to Russia and Germany, where the regional offices are responsible for *rayon* and LAU-2 level data, respectively. Each Regional Statistical Office must then be contacted one by one and local level data for all regions can be compiled only after that. This regional distribution of responsibilities for statistical data within a country also increases the risk that regional offices, even in the same country, use different methodologies or statistical keys, or they use different reference years, or that there are gaps in the data coverage for certain regions. For a more detailed description of these matters regarding *rayon* level data in Russia, see section C.2.6.

Population data for Estonia provides an example on the carefulness needed when collecting the data, since there are two possible sources of Estonian demographic data: Statistics Estonia's population census data (from 2011) on the one hand, and, on the other hand, the population register data. Data from these two sources don't match. The reason is that for the register, people have signed in a certain local government, but do not necessarily live there. This causes problems for the truthfulness of the register data and its reliability varies on the local government level to a rather large extent. This was proven in 2011 when data was compared. Therefore, when collecting population data for Estonia, the official data from Statistics Estonia should be chosen.

Once suitable data has been identified and compiled, an evaluation of the combined dataset is needed in order to identify possible needs of harmonisation, similar to what is needed for data on NUTS level (see "5.6. Strategies to overcome missing data entries"). Supra national statistical institutions, such as Eurostat, which provided the main bulk of social and economic data for the TeMo project, has the advantage that although their datasets cover several countries, the same methodology has been used when producing the data. With local level data collected from different NSI's, chances are high that the methodology will differ between countries and NSI's.

The work needed for harmonising NSI data for different countries usually depend on the character of the data.

For most demographic data – TeMo indicators such as Net migration rate, Total population change, Economic dependency ratio, Gender imbalances – the one important harmonisation task might be to adjust the datasets according to reference date. I.e. some countries use December 31st as reference date, while other countries use January 1st the following year as reference date. This is basically the same date, but the data is labelled different reference years. In cases like that, data for the countries that use the December 31st reference date, needs to be merged with next year's data for countries that use January 1st as reference date.

Labour market data – including TeMo indicators as Unemployment rate, total, Employment rate (20-64 years), Youth unemployment rate (15-24 years) – probably require more thorough harmonization work, due to the national specific methodologies applied within each country's NSI. One solution to this problem is to produce harmonized estimates by disaggregation of national figures. I.e. each NSI's' labour market figures are related to Eurostat's national totals (NUTS-0) by distributing those figures proportionally to the LAU-2 units according to the shares of the NSI's municipality (LAU-2) data. As its' a question of estimates, the quality level is lower than data that originally was produced using the same methodology. It's also worth mentioning that estimates require more careful usage, as potential users might question why these estimates, although comparable across countries, do not fully have the same values as the NSI's' data.

Another important issue regarding harmonisation of LAU-2 data is the adjustment of data according to changes in the territorial structure (see discussion above). Naturally, simply because of the huge number of municipalities, there's a great chance that a certain amount of the municipalities in the BSR will receive new spatial formations in the coming years. This is already the case in several BSR countries. For example, in Finland municipalities have been split or merged regularly during the last few years. These new administrative divisions on local level might not always correspond to the available data, or only data of the most recent reference year has been updated according to the new administrative local borders. The latter case creates a leap in time series between on the one hand data that follows the old administrative division, and on the other hand the latest data that follow the new administrative structure. This issue of time series is usually possible to overcome by recalculation of "old" data according the administrative division, but again, requires more work than on NUTS level, where border changes are much fewer in absolute numbers.

Technical requirements

Finally, there are some technical considerations to be aware of when working with local level data, as compared to NUTS level data.

In order to properly structure data in the same dataset and also for the production of maps (and ability to load a dataset into GIS software) geographic unit codes are crucial. These are codes that are tied to specific regions and often consist of a combination of one or two letters from a country's name and a digit unique for the specific region. Above local level, such codes are available within European wide territorial nomenclatures, i.e. that of NUTS and SNUTS territorial units. The NUTS nomenclature is updated every four years. For LAU units, unit codes do exist for the ESPON space, from database projects. However, codes provided through the database project sometimes do not correspond to the official codes from National Statistical Institutes, and therefore it might be a cumbersome task to combine national statistical LAU data into one single dataset covering the entire, or large parts of Europe.

Furthermore, due to the annual changes in municipal structures in many countries (see previous section), there is a greater need for more regularly updated LAU-1 and LAU-2 nomenclature than for the NUTS nomenclature, at least if annual data time series should be used in the territorial monitoring system also for local level.

For mapping, so called shapefiles, a geospatial vector data format, is often used in the GIS software to represent the territorial national, regional and local entities and also for connecting these entities with the data through unit codes. Since shapefiles include territorial entities and their borders, the shapefiles must be updated in the same fashion as the unit codes according to new administrative borders. Again, considering that there are more than 7,000 territorial units below NUTS level in the BSR, there's a greater need for updating the shapefiles on local level than on NUTS level.

Raster datasets

The acceleration of computer hardware and software over the last decade enabled storage, calculation, processing and analyses of large scale raster data sets. Raster datasets are either 'real' raster data or are vector datasets using regular grids as their units. In either case, raster datasets subdivide a territory into regular squares of same size, by that overcoming the MAUP issues. Indicators or data are then stored for each raster cell or grid unit. Even though raster datasets by nature are independent from administrative or statistical units such as LAU or NUTS classifications, they can easily aggregated to LAU or NUTS levels, as required. By that, raster datasets provide high levels of flexibility.

Usually, raster datasets own a high resolution, i.e. their cell / grid size is rather small (prominent examples are squares with 250x250 meters, 500x500 meters, or 1x1 km edge length). This is no problem when the study area is quite small, such as a capital city region like Stockholm with its surroundings. It might, however, become a challenge when applying the same resolution to an area like the BSR, resulting in millions of raster cells. Obviously, data for raster datasets with hundreds of thousands of cells cannot be validated manually.

Actually, there are three main options for generating raster datasets:

1. *Modelling approaches*: Raster datasets may be the output of spatial models. Such models require usual vector data as inputs, and through processing of these input data they generate raster data as output. Examples of such models are accessibility models or many environmental models, such as dispersion models or climate models.

2. *Detectors*: Different types of detectors at different measurement stations continuously record real-world data (for instance, air pollution data, noise data, etc.). By combining the measurement data from different stations, and by applying some smoothing algorithms continuously raster datasets are being produced. This is often the case for environmental data. Also satellite images can be attributes here.
3. *Small-scale grid statistics*: Some countries (for example, Finland, Austria) already re-organized their official statistics in a way to use regular grids as the basic statistical unit. Each resident, household, firm, work place etc. is then assigned to one grid cell by geocoding the addresses to co-ordinates. Consequently, such statistics entail a number of attributes for each grid cell. Because of the high resolution of the grid cells, often privacy issues arise with such datasets as numbers attached to each cell are quite small (for example, one grid cell might entail one work place, one resident, etc.).

Using such raster datasets in territorial monitoring is quite a new, still challenging field of application. Only little experiences have been made so far, in particular when it comes to the comprehensive analyses of such datasets under different political objectives. However, when using models or detector approaches to generate such raster datasets, such datasets are often generated with less effort compared to LAU-2 datasets; Acknowledging their utmost flexibility for aggregations to various LAU or NUTs levels, raster datasets are often favourable over LAU-2 datasets. Thus, in future ESPON should assess potentials for using raster datasets thoroughly.

8. Data handling, M4D requirements and data deliveries

8.1. The TeMo data delivery template

In order to structure and store the collected data in a coherent way a TeMo specific Excel data delivery template file was produced. This TeMo data delivery template file has been used by the data collectors for describing and adding the data of a given indicator, forming a dataset (generally, one file per indicator and country was used). Having populated the file, it was stored together with all other TeMo datasets within a tree structure on one of Nordregio's (lead partner) servers.

The TeMo data delivery template consists of five tabs with a predefined structure of fields for the data collector to fill in, both metadata (such as origin of data, explanation of abbreviations used for raw data, quality of data) and the raw data of different variables. The TeMo data delivery template is based on two official ESPON data Excel data templates, the ESPON "Metadata model" template (for metadata) and the ESPON "Data model" template (for raw data). By merging these two templates into one sheet data collection and data handling within the TeMo project was simplified since both metadata and raw data was stored in one single file. However, the intention has been to keep the general structure of the official ESPON templates, so that data collected within the TeMo project will be easily transferable to the ESPON database in the future. To ensure this future transferability to the ESPON database, the need to collect and structure metadata as a part of the collection process has been emphasized, as is shown below.

In addition to merging the two original ESPON templates, two additional adjustments were made to the TeMo data delivery template in order to fit the specific needs of the TeMo project.

The first adjustment is that instructions on how to use and fill in the data delivery template were added to column and row headlines (Figure 9; text in red color). For the original ESPON templates, such instructions are available only in separate documents (the ESPON Metadata guidelines documents), but the idea here was that by providing instructions within the actual template the data collector won't have to access additional documents and data collection will hopefully run more smoothly. The instructions are easily erased from the data delivery template by the data collector before it is sent to Nordregio for storage.

The other additional adjustment consists of two new columns to the raw data section (within the tab "DATA", further described below) of the data delivery template, "region name" and "region name other" (Figure 9).The reason behind adding these two columns is that the original ESPON templates were made specifically to fit data of EU and EFTA countries. These are countries with a clearly defined and coherent NUTS classification where each NUTS code correspondents with a certain region. These NUTS codes are used for the ESPON data templates for the identification of regions. However, during the first phase of the TeMo project, there were no coherent administrative codes for regions outside the EU and EFTA space that corresponded to the NUTS classification. Since several regions outside the EU and EFTA space are an integral part of the TeMo project's geographical coverage – namely regions in Belarus and Russia on *oblast*[17] and *rayon levels* – it was considered important to make it possible to add these

[17] The Russian Federation consists of 86 so called Federal Subjects, which include 46 oblasts, 21 republics, 9 krais, 2 federal cities, 4 autonomous okrugs and 1 autonomous oblast. For simplicity reasons, these Federal Subjetcs are in this appendix referred to as regions on "oblast level".

region's names in the TeMo template in order to avoid any confusion and clearly identify the regions by their names, both in Latin characters and in Cyrillic script.

	A	B	C
1	*id [NUTS code]*	*region name (with Latin characters)*	*region name other (in original language/script, e.g. with special charachters, Cyrillic alphabet)*
579	RU26	Leningrad Oblast	Ленинградская область
580	RU2A	Pskov Oblast	Псковская область
581	BY11	Minsk Oblast	Минская область

Figure 9 Russian name structure in TeMo data template

TeMo specific columns "region name" (Column B) and "region name other" (Column C) were added in addition to the "id" column (Column A, for NUTS and equivalent region codes) in order to clearly name regional entities outside the EU and EFTA space.

8.2. Adjustment to the ESPON M4D project and ESPON Database requirements, and the usage of SNUTS codes

During the course of the TeMo project, the ESPON M4D project, responsible for the ESPON Database, developed codes similar to NUTS codes (abbreviated as "SNUTS") to use for data from countries of EU's neighboring regions, including Russia and Belarus. The TeMo TPG communicated with the M4D project regarding these codes, and once the M4D project decided which codes to use, the codes were also implemented by the TeMo TPG to the TeMo data delivery template, and have been added to all collected datasets that include data for Russia and Belarus (in most cases *oblast* level, i.e. SNUTS2). Besides the ESPON M4D and TeMo projects, these SNUTS codes are also used within the ESPON Itan project. Thus, regarding data deliveries to the ESPON database, coherence with the M4D and Itan projects in relation to classifications for regions outside the EU was assured.

The SNUTS codes are limited to the levels SNUTS0, SNUTS1 and SNUTS2 (i.e. o*blast*) levels. Concerning other levels, for example rayons (SNUTS4, corresponding to LAU1), after discussion with the M4D project the advice was that these codes were created when needed within the TeMo project (i.e. when data on rayon/SNUTS4 level is collected), however keeping the NUTS logic. I.e., in the example of Kareliya (which carries the "*oblast* code" RU20 on SNUTS2 level) in Table 14, a third figure is added to create the SNUTS3 code (RU200), and for SNUTS4 (corresponding to LAU1) the third figure is changed to 1-9 or (in case 9 digits are not enough) letters A-Z (RU201, RU202, RU203 … RU209, RU20A, RU20B …). Also, if possible, the SNUTS4 regions should be numbered according to the order used by the official statistics agency. These principles on the creation of SNUTS codes for *rayons* have also been discussed between the TeMo and Itan projects, to ensure that both projects follow the same procedure.

Table 14 Example of unit codes used for Belarus and Russia for levels SNUTS0-SNUTS4

Unit code	Object Type (SNUTS)	Name (Latin script)	Name (Cyrillic script)	Level	Eqvivalent Object Type (NUTS)
RU	SNUTS0	Russian Federation	Российская Федерация	country	NUTS0
RU2	SNUTS1	Severo-Zapadniy Federalniy Okrug	Северо-Западный федеральный округ	federal okrug	NUTS1
RU20	SNUTS2	Respublika Kareliya	Республика Карелия	oblast (i.e. oblast, respublica, federal citiy, etc)	NUTS2
RU200	SNUTS3	-	-	-	NUTS3
RU201	SNUTS4	Xxxxx	Xxxxx	rayon	LAU1

8.3. TeMo data delivery template structure

Within the TeMo data delivery template there are five tabs. The first three tabs were added from the ESPON "Metadata model" template, while the fourth tab derives from the ESPON "Data model" template. The fifth tab, "Instructions", consists of general instructions on how to use and fill in the template and also instructions on data delivery.

The intention of the first tab, the **dataset_metadata** tab, is to give an overview of the dataset. Name and date of latest upload of the dataset are added here, as well as contact details for the data collector (Figure 10).

Dataset information		**Explanation**
name	Total Population	*Name of dataset*
date of latest update	2012-10-15	*Date of latest update of dataset by year-month-day*
Metadata point of contact		
name	Linus Rispling	*Name of person uploading dataset*
email	linus.rispling@nordregio.se	*E-mail of person uploading dataset*
organization/institute	Nordregio	*Organization of person uploading dataset*

Figure 10 Tab 1, dataset_metadata tab excerpt

In the second tab, **indicator_metadata tab**, information to identify each variable that is part of the dataset, such as name of variable and start and end of time series, is listed. As each indicator often consist of several variables, it is possible to list information on each variable here, with one variable per "Identification" box (Figure 11).

Identification				**Explanation**
code	pop_t			*Code of variable*
name	Total population			*Name of variable (quick description)*
units	Thousands inhabitants			*Unit used to measure variable. More population": Annual average, Popula Population December 31st*
abstract	Annual average population (both sex)			*Name of variable in detail (e.g. desc*
methodology				*To be used if the variable is more c i.e. data is based on mathematical f*
temporal extent	**start**	2000		*Time series start*
	end	2006		*Time series end*
Identification				
code				
name				

Figure 11 Tab 2, indicator_metadata tab excerpt

The third tab, **value_metadata tab**, contains information on origin and quality of the dataset. In case several sources have been used, the source information is listed repeatedly, with one source under each "scope" row (Figure 12).

scope				**Explanation**
	label	1		*Each source is indicated by a specific label in number format (*
	lineage			
		provider	EUROSTAT	*Owner of origin data: Eurostat, a National Statistical Institute*
		date	2012-10-15	*Date of download of data by year-month-day*
		URL	http://epp.eu	*URL the database from where data has been downloaded*
		methodology		*No need to add information here in case the data is unmodifie*
		methodology URI		
	reliability			
		estimation	FALSE	*Has the data been estimated by the original source provider (*
		quality	high	*Using your knowledge on the quality of data, define the quality*
	constraints			
		public data access	TRUE	*Is it the data publicly available? Type TRUE or FALSE*
		public metadata access	TRUE	*Is it the metadata publicly available? Type TRUE or FALSE*
		copyrights	EUROSTAT	*Copyright owner of data - add name*
scope				
	label			
	lineage			

Figure 12 Tab 3, value_metadata tab excerpt

As mentioned above, the first three tabs derive from the ESPON "Metadata model" template. It was deemed important to keep these detailed metadata tabs also in the TeMo data delivery template since the TeMo project covers regional data from eleven different countries, of which two are not part of EU and EFTA, with possible differences in data availability and classification methods. Considering this background it was crucial to have a comprehensive metadata section in order to clarify all aspects of the metadata, such as lineage of the data, and having the possibility to distinguish quality and classification methods, etc., between different collected data.

The fourth tab, **DATA**, is the tab where raw data is added. Region codes (NUTS or similar codes, e.g. SNUTS) and region names are added vertically, while variable data is added horizontally (Figure 13).

id [NUTS code]	*region name (with Latin characters)*	*region name other (in original language/script, e.g. with special charachters, Cyrillic alphabet)*	*level [NUTS3/NUTS2/etc.]*	pop_t [name of variable	*scope*	pop_t
validity_start [Temporal start]				2000		20
validity_end [Temporal end]				2000		20
de300	Berlin		NUTS3	3384,1	1	3385
de411	Frankfurt (Oder), Kreisfreie Stadt		NUTS3	73,1	1	71
de412	Barnim		NUTS3	168,7	1	170
de413	Märkisch-Oderland		NUTS3	187,3	1	188
de414	Oberhavel		NUTS3	190,5	1	192
de415	Oder-Spree		NUTS3	196,5	1	195
de416	Ostprignitz-Ruppin		NUTS3	113,5	1	112

Figure 13 Tab 4, value_metadata tab excerpt

Finally, in the fifth tab, **Instructions**, an explanation overview is given on how to use and fill in the template (including naming of the file according to the specific indicator that is collected) and also instructions for the data collectors on delivery of data (Figure 14).

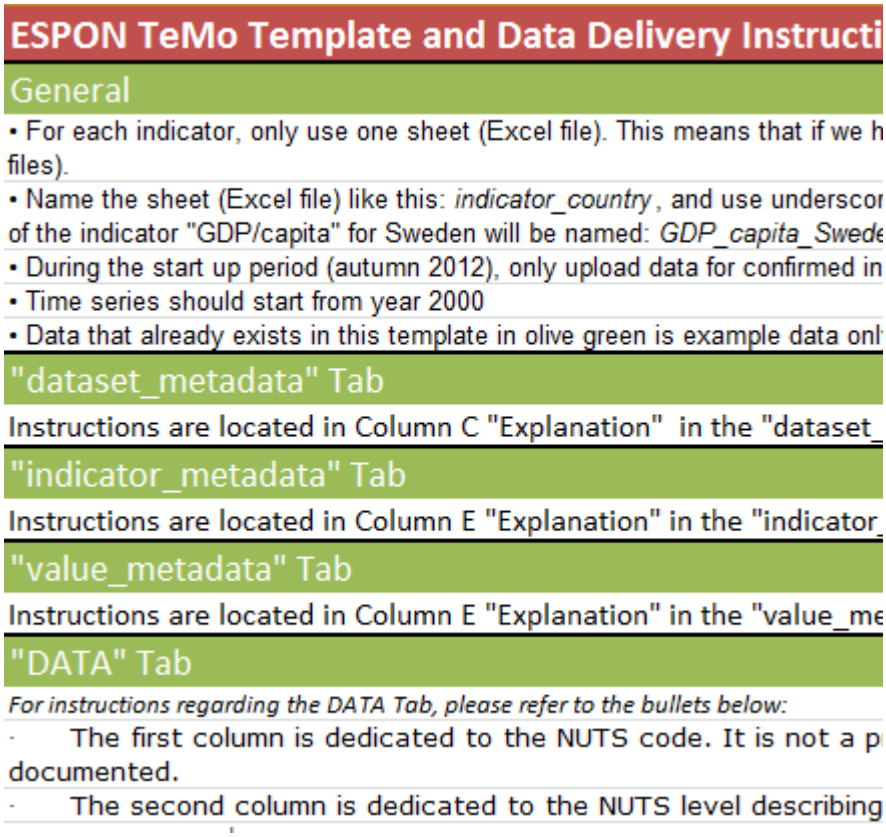


Figure 14 Tab 5, Instructions tab excerpt

8.4. Data delivery within the TeMo project

Excel files with datasets collected within the TeMo project (i.e. the TeMo data delivery templates populated with data) were delivered to Nordregio for storage. To simplify the delivery process and avoiding a large amount of Excel files containing TeMo datasets being sent by e-mail which then has to be sorted, a password protected share point to which the collected data was uploaded (Figure 9) was used.

Once the data collector collected all available data for a given indicator and populated the TeMo template (tabs 1-4), he or she navigated to http://sharepoint.nordregio.se/temo, logged in and then, in the tree structure within the folder "Uploaded TeMo data", accessed the country/indicator folders in question and uploaded the data file. The data collector also notified the Nordregio staff that a dataset has been uploaded. Nordregio's staff was then able to download data from the share point and store the data on Nordregio's server.

The share point was also the location of the latest updated version of the TeMo Data Delivery Template. Thus, in case any changes were made to the template, the new version of the template was made available at the share point (within the folder "TeMo Template and Metadata Guidelines") for data collectors to download. For reference also the ESPON Metadata guidelines documents were to be found here.

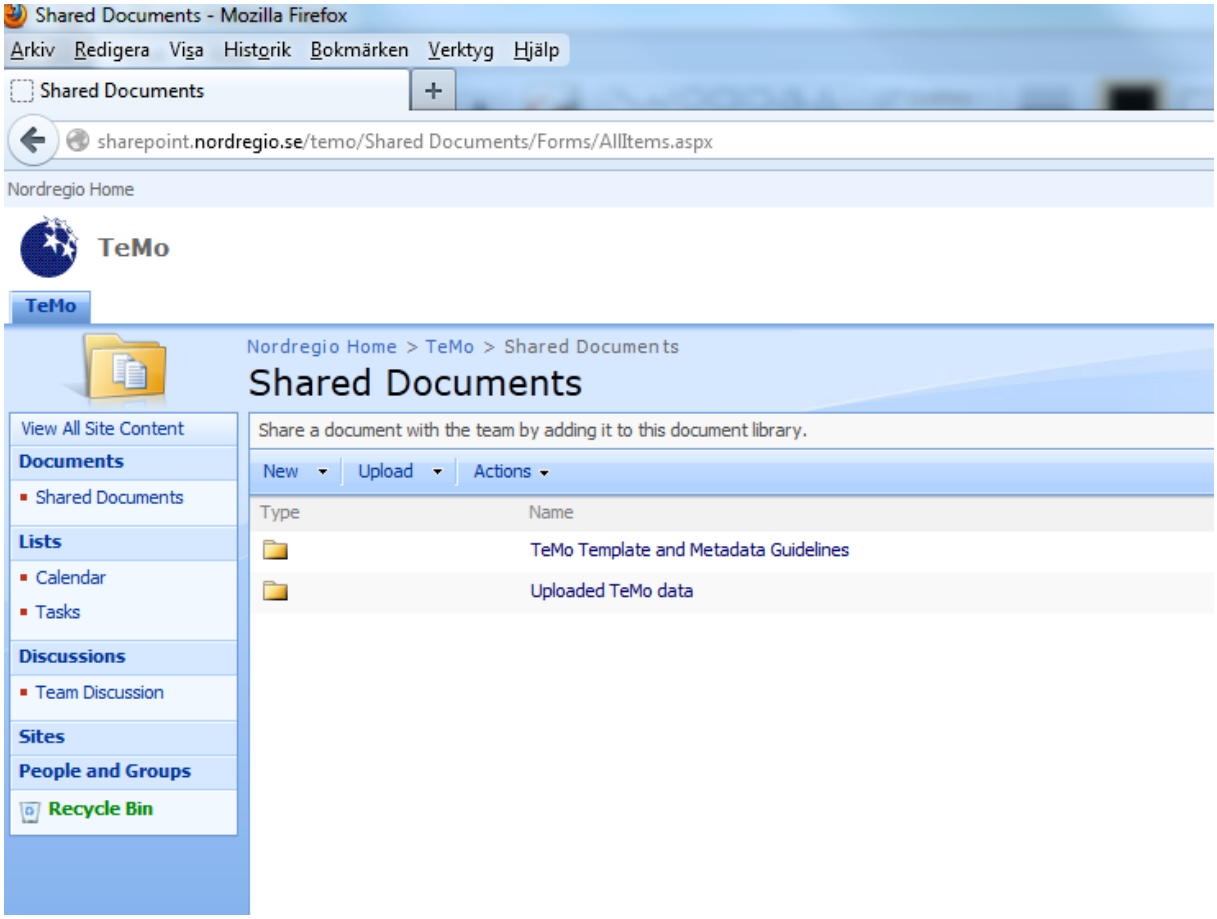


Figure 15 The TeMo folder on Nordregio's share point

8.5. Data delivery to the ESPON M4D project and ESPON Database

During the final months of the TeMo project, preparations were initiated for delivery of the data used within the project to the ESPON Database.

The first step was to transfer data from the TeMo data delivery templates to the latest available versions of the ESPON Database templates. Through contact with the M4D project, which is responsible for the ESPON Database, the TeMo TPG received the latest ESPON Database templates. Depending on the nature of the TeMo data, and in accordance with M4D's requirements, the data was transferred to three different ESPON Database templates, corresponding to three different data delivery categories:

- Key indicators, data for some indicators with broad ESPON area coverage and high expectations on metadata quality

- Case-studies, data for case-studies or data with limited geographical coverage, (in the TeMo case, data that only covers the BSR region)

- Background data, data for indicators in different formats than those mentioned above (Key indicators, Case-studies)

During the process of choosing data delivery category for the different data used within the TeMo project, the TeMo TPG had an e-mail exchange with the M4D project in order to clarify different considerations. Also the final delivery process

of the data was discussed in the e-mail exchange. Furthermore, the TeMo TPG made use of the different manuals developed by the ESPON M4D project, such as "How to deliver my data?" (2013) and "ESPON Data and Metadata Specifications" (2013).

Finally, by the final phase of the project, the data was delivered to the ESPON Database according to M4D's requirements.

9. Database structure

All inputs and outputs of the BSR territorial monitoring system will be compiled on a comprehensive CD-ROM / DVD as a simple mean for dissemination. This CD-ROM / DVD will have a dedicated structure of directories and subdirectories. The root level of the CD-ROM /DVD has the following structure:

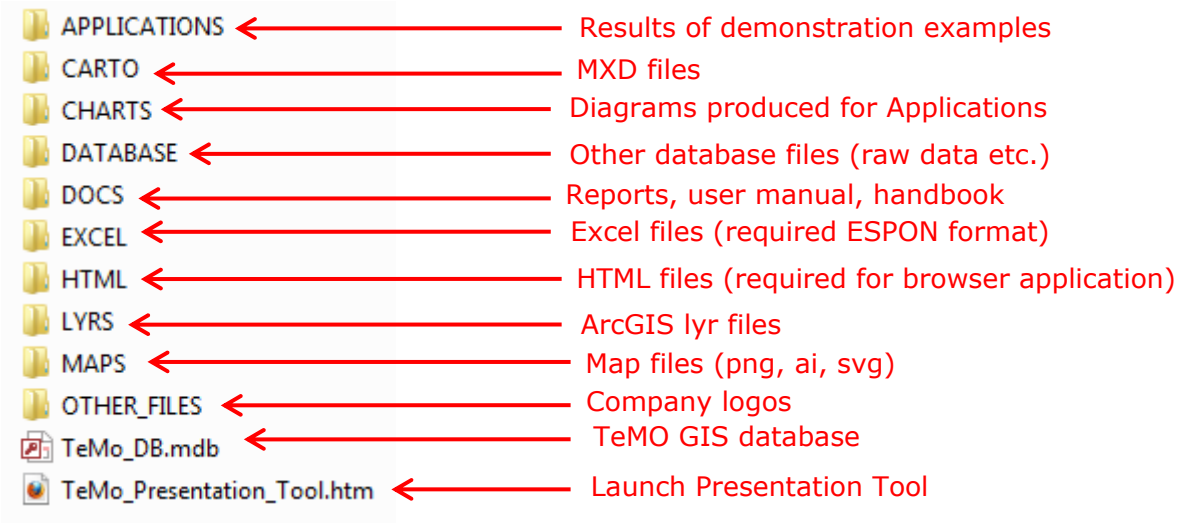


Figure 16 Directory structure of the TeMo CD-ROM.

This structure represents a simple file-based organization, including GIS database (ArcGIS personal geodatabase), map files (**MXD**), lyr files, exported maps (**png, ai, svg**), charts, Excel files, and the required reports and documentations (pdf files). The Presentation Tool will then act as the gateway to access this wealth of information.

The directories store different kind of files

APPLICATION	collection of materials / results of demonstration examples
CARTO	comprises all generated **MXD** files (ArcGIS version 10.1) for indicator mapping
CHARTS	collection of diagrams for indicator benchmarking and comparisons
DATABASE	other data files, such as raw data
DOCS	reports, handbook, metadata documentation and user manuals
EXCEL	collection of Excel files in ESPON file format (input/output of indicator calculation)
HTML	html files required to run the browser application
LYRS	collection of layer files for mapping (referenced in **MXD** files)
MAPS	collection of maps in **PNG** & **AI** file format, exported from ArcGIS
OTHER FILES	collection of company logos

The actual **TeMo_DB** PGDB as well as the browser application start file are stored in parallel to these sub-directories.

Each of the directories **APPLICATION**, **CARTO**, **EXCEL**, **LYRS** and **MAPS** have several sub-directories which are named after the selected domains (Tables 15 and 16) to store the respective application results (**APPLICATION**), map templates (**CARTO**), diagrams (**CHARTS**), indicator files (**EXCEL**), layer files (**LYRS**) or exported raster **PNG**, **AI** and **SVG** map files (**MAPS**).

Table 15 Available sub-directories under CARTO, CHARTS, EXCEL, LYRS and MAPS folders.[18]

Name of subdirectory	Domain
ACCESSIBILTIY	Access to services, markets and jobs
ECONOMY	Economic performance and competitiveness
ENVIRONMENT	Environmental quality
INCLUSION	Social inclusion and quality of life
INNOVATION	Innovative territories

Table 16 Available sub-directories under APPLICATION folder.[19]

Name of subdirectory	Demonstration example
BENCHMARKING	Results of overall benchmarking case study
COHESION	Results of territorial cohesion case study
CROSS_BORDER	Results of cross-border geographic case study
MIGRATION	Results of thematic migration case study

9.1. Map template files

The **CARTO** directory and its subdirectories provide a full collection of ArcGIS map files in **MXD** file format. For each indicator, there will be at least one map file, showing the indicator performance for the Baltic Sea Region. The file name conventions are as follows:

xxx_Nz_YYYY_BSR.MXD

where **xxx** represents the indicator name, **z** represents the NUTS level (0, 1, 2 or 3), and **YYYY** represents the year. The suffix **BSR** or **ESPON** indicates that the indicator is illustrated for the Baltic Sea Region or for entire ESPON space, respectively.

9.2. Charts and diagrams

In addition to the map output, charts and specific diagrams such as time series illustrations or change graphs will be generated to provide further analyses on specific indicators. All these materials are stored in **PNG** file format in the **CHARTS** directory. The naming conventions for the charts follow those for maps, as described above.

Individual charts may be directly opened from the file repository by clicking on the file name in the Windows Explorer; however, the charts will also be accessible through the browser application.

9.3. Documentations

This folder provides access to all documents produced in TeMo. Documents will be provided in **PDF** file format. Documents available here include the Inception Report, the Interim Report as well as the Final Report of TeMo, including all Annexes. Moreover, the handbook and user manual, as well as the technical specification and the metadata description will also be available here.

[18] In alphabetical order as they appear in the Windows Explorer.

[19] In alphabetical order as they appear in the Windows Explorer.

Individual documents may be directly opened from this repository by clicking on the file name in the Windows Explorer; however, all documents will also be accessible from the browser application (Figure 17).

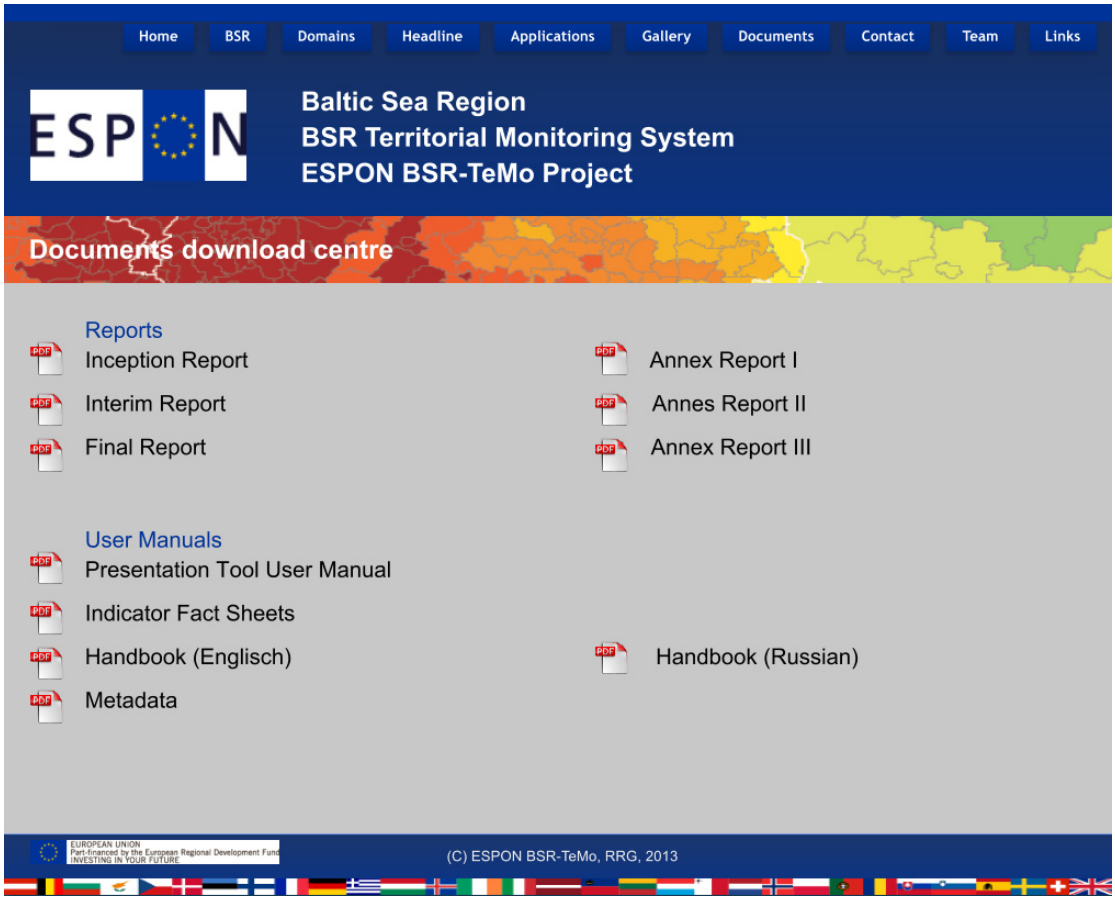


Figure 17 Browser application – document download section.

9.4. Excel files

For those people who do not have ArcGIS available, or are non-GIS specialists, or for those who just want to work with the statistical data outside a GIS, TeMo offers all indicators in Excel file format.

The structure of the Excel files is easy to understand and straightforward, following the ESPON guidelines. There will be one Excel file per indicator. Each file stores the indicator numbers (or input data) for all available years, where one column represents one year. The structure of these Excel file follows the instructions as given by the ESPON Database project, i.e. these Excel files can also be used to import the indicators into the overall ESPON database.

The column headers, contents and units of the indicators are described in the metadata documentation and in the user manual.

9.5. HTML files

This directory comprises all technical background files necessary for the functioning of the *Presentation Tool*. These files are not intended to be directly opened by the user, but are needed by the application. They are stored in different file formats, such as **`PNG`**, **`GIF`**, **`CSS`**, **`JS`**, and **`TXT`**.

9.6. LYRS files

LYR files are specific files produced by ArcGIS storing layer symbology (colours, symbols, line type and line width, line and polygon markers, etc.) for later use in other maps, without the need to re-establish the overall layer symbology at a later stage again. **LYR** files can only be used with ArcGIS, not as stand-alone files.

9.7. PNG, AI and SVG files

All indicator maps are exported from ArcGIS into **PNG**, Adobe Illustrator (**AI**) and Scalable Vector Graphics (**SVG**) file format, i.e. raster format and vector graphics format, respectively. All the **PNG**, **AI** and **SVG** files are provided through a subdirectory on the CD-ROM/DVD. From there they can directly be viewed, retrieved and imported into reports, presentations or other documents; even for those users who do not have a GIS system at hand. The **AI** and **SVG** files can even more be further processed in any drawing software. The browser application will load the **PNG** files when illustrating the indicator maps.

9.8. The TeMo GIS database

In order to allow for GIS analyses and mapping, a comprehensive TeMO GIS database in ESRI´s Personal Geodatabase format (PGDB, ArcGIS Version 10.1) will be developed, named **TeMo_DB**. The overall geodatabase will be structured by so-called feature datasets, feature classes and tables.

A ***feature dataset*** is a collection of related feature classes that share a common coordinate system. Feature datasets within a geodatabase are used to spatially or thematically organize and integrate related feature classes. ***Feature classes*** are homogeneous collections of common features, each having the same spatial representation, such as points, lines or polygons, and a common set of attribute columns (fields). The four most commonly used feature classes in a geodatabase are points, lines, polygons and annotations.

The third building block of a geodatabase is tables. Tables store statistical data. Tables are not permanently linked to any feature class, but if a common field exist both a table and a feature class may be joined to each other. The join may be furthermore permanently saved in a so-called relationship class.

The **TeMo_DB PGDB** comprises feature datasets, feature classes and standalone tables, as shown in Figure 18:

- the feature dataset called **ADMINISTRATIVE_BOUNDARIES** stores line and polygon layers representing administrative units. Most of these layers were imported from the overall ESPON Database, however, the layers called **ZONES_TEMO*** represent newly created NUTS region layers.

- the feature dataset called **LANDCOVER** provides land cover and land use layers. Currently two layers are available, which are the **LAKES** layer, i.e. a layer representing water bodies derived from the seamless ESPON NUTS 5 municipality layer, and the **UMZ_PROJECT** layer, which represents settlements/urban areas, taken from the overall ESPON Database.

- The feature dataset called **OTHER_LAYERS** comprises various other layers that are needed for drawing maps or for GIS processing. All layers

subsumed under this feature datasets were taken from the ESPON Database.

- Apart from these feature datasets, the **TeMo_DB PDGB** provides a number of different standalone tables, which can be combined into three groups: First, the template tables **ZONE_TEMPLATE_TABLE_NUTS3**, **ZONE_TEMPLATE_TABLE_NUTS2**, **ZONE_TEMPLATE_TABLE_NUTS1**, and **ZONE_TEMPLATE_TABLE_NUTS0** are template tables providing lists of all NUTS 3, 2, 1, and 0 regions that are used in ESPON TeMo. These templates can be used to create new tables. Tables starting with **RD*** and followed by numeric numbers represent "raw data" tables, i.e. tables to provide raw data that are needed to calculate certain indicators but that are not indicators itself. Finally all standalone tables starting with **DOM_*** store the actual indicators, where one table is supposed to store all indicators belonging to a particular domain (DOM) for a specific spatial level. The actual spatial level is provided as suffix to the table name (***_NUTS0**, ***_NUTS1**, ***_NUTS2**, or ***_NUTS3**). The following domains were identified:
    - Economic performance and competitiveness (**DOM_ECONOMY_***)
    - Access to services, markets and jobs (**DOM_ACCESSIBILITY_***)
    - Innovative territories (**DOM_INNOVATION_***)
    - Social inclusion and quality of life (**DOM_SOCIAL_INCLUSION_***)
    - Environmental quality (**DOM_ENVIRONMENT_***)

A full description of this geodatabase, including detailed descriptions of database structures, fields and formats, will be given in the metadata document that will be provided through the database CD-ROM/DV and which will be accessible through the browser application.

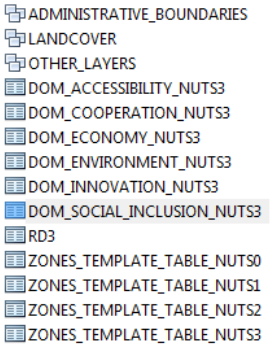


Figure 18 TeMo GIS Database Structure

10. Data sources and future updates

10.1. Data sources

The sources for the data used within the BSR TeMo project can be divided into two main groups: *Statistical Bureaus* and *Institutes/Projects* (see Table 17 below).

Table 17 Main data sources.

Statistical Bureaus
BELARUS: BELSTAT: http://belstat.gov.by DENMARK: Statistics Denmark: http://www.dst.dk/en ESTONIA: Statistics Estonia: http://pub.stat.ee EU/EFTA: EUROSTAT: http://ec.europa.eu/eurostat FINLAND: Statistics Finland: http://www.stat.fi/ SWEDEN: Statistics Sweden: www.scb.se GERMANY: Statistisches Bundesamt: https://www.destatis.de LATVIA: Latvijas Statistika: http://data.csb.gov.lv LITHUANIA: Statistcis Lithuania: http://db1.stat.gov.lt NORWAY: Statistics Norway: http://www.ssb.no/en POLAND: GUS (Central Statistical Office): http://www.stat.gov.pl RUSSIA: ROSSTAT: http://www.gks.ru
Institutes/Projects
EEA: http://www.eea.europa.eu/ ESPON: http://www.espon.eu Fifth Report on Economic, Social and Territorial Cohesion: http://ec.europa.eu/regional_policy/sources/docoffic/official/reports/cohesion5/index_en.cfm HELCOM: http://www.helcom.fi/ Norwegian Social Science Data Services: www.nsd.uib.no/nsd/english/ UNECE: http://www.unece.org/

10.2. Statistical bureaus

The Statistical Bureaus provide the major part of the social and economic data used within the BSR TeMo project.

For the EU/Eurostat space Eurostat is the major contributor. Eurostat provides data for all BSR TeMo countries except for Russia and Belarus. Eurostat aims at providing national and regional data according to the same methodology for all covered countries. Therefore Eurostat has been the natural starting point as data source for social and economic data of the BSR region (except for Russia and Belarus).

Regarding Russia, the national statistics bureau ROSSTAT is the primary provider of data. Also regional statistical offices (on Oblast/SNUTS-2 level) have contributed with data for Russia. The TeMo TPG has also been assisted by Russian statistical experts from Petrostat, a regional filial to ROSSTAT, located in St. Petersburg, regarding methodological issues on coherence between EU/Eurostat data and Russian and Belarusian data (see chapter 6.)

Concerning Belarus, the national statistics bureau BELSTAT is the major contributor of data. The TPG has also received information on future updates from BELSTAT.

10.3. Institutes/projects

Data providers of the group of Institutes/Projects consist of a rather diverse combination of international and regional organisations, agencies and institutes on the one hand and project based sources such as ESPON projects and the EU report "Fifth Report on Economic, Social and Territorial Cohesion" on the other.

EEA, the European Environment Agency, located in Denmark, provides data for the environmental indicators *Fragmentation index*, and, as a part supplier, to *New soil sealing per capita*. HELCOM, the Helsinki Commission (also known as the Baltic Marine Environment Protection Commission), located in Finland, is an intergovernmental organization that provides data for the environmental *Eutrophication* indicator (based on the so-called HELCOM HEAT index). The Norwegian Social Science Data Services, located in Norway, contributes with data of the social indicator *Self-assessed general health status*. UNECE, United Nations regional economic commission for Europe, supply with data of the indicator *Border crossings*.

ESPON projects used as sources include projects such as ESPON TRACC (for accessibility indicators) and ESPON INTERCO (for supplementing missing Eurostat data, e.g. indicator *Unemployment rate*; in cases where the Statistical Bureaus lack data it's been natural to make use of previously collected, harmonized ESPON data). EU's "Fifth Report on Economic, Social and Territorial Cohesion" has been used as a source for the environmental indicators *New soil sealing per capita* and *Air Pollution (PM10)*, which are in turn based on a range of data providers/projects (EEA, Eurostat, REGIO-GIS, GMES Promote project, JRC, EFGS).

10.4. Future updates

As has been shown in Table 4, previous releases were in general *yearly*, *every 2 years* or *every 5 years*, with a few exceptions of *irregular* releases. Using that table as a setoff, this section goes deeper into the previous release cycles, and, based on those, in combination with information on the planned release dates provided by the source institutions, aims at giving a more detailed picture on the future releases as well as recommendations from the TPG on possible future release cycles.

As shown in Table 18 (columns "Next update" and "Data source") below, data for most of the social and economic indicators have so far been released yearly, with the notable exception of *Self-assessed general health status*, which is based on survey data collected every 2 years. Information from Eurostat, PETROSTAT and BELSTAT indicates that most of data for their social and economic indicators also for the future will be updated yearly, e.g. next updates are expected in 2013 (or, in some cases, 2014).[20] As mentioned, data for the indicator *Self-assessed*

[20] Update information from Eurostat accessed from http://ec.europa.eu/eurostat on June 28, 2013. Update information from PETROSTAT received by phone call with the TPG on July 2, 2013, and by e-mail to the TPG on July 3, 2013. Update information from BELSTAT received by e-mail to the TPG on June 27, 2013.

general health status has so far been released every second year, and this is also the case for the future (next release is expected 2012/2013[21]).

Data of several of the indicators of the Access to services, markets & jobs domain have so far be released every 5 years: *Accessibility potential road*, *Accessibility potential rail*, *Accessibility potential air*, *Multimodal accessibility*. Although this data so far has been project specific and produced (calculated) upon project needs, the recommendation from the TPG is that these indicators also for the future should be updated every 5 years, e.g. since last update was made 2011, next update is suggested for 2016. In the same domain, there are two indicators for which data has been produced for one year so far (*Functional areas: access to cities*: 2011; *Population potential within 50 km*: 2008), but as with the other four indicators mentioned above, the TPG suggests that data for these indicators also should be updated every 5 years.

As with the indicators *Functional areas: access to cities* and *Population potential*, data of two of the indicators within the Environmental qualities domain have been released for only one year each so far, namely *New soil sealing per capita* (2006) and *Air pollution (nr of days PM10 exceeds norm value)* (2009). According to EEA, data on *New soil sealing/capita* will be released in 2014-2015[22], while there's so far no information regarding the update of data for *Air pollution (PM10)* on NUTS-3 level (although yearly updates exist for stations level, city level and aggregated EU level)[23]. As mentioned in chapter 6., existing data on Air Pollution for Belarus and Russia is not coherent with the data for the EU zone, and although it is beyond the objective of the TeMo project to develop a methodology that makes it possible to compare EU and Russian air pollution data, the monitoring system could be altered to take in a combined EU and Russian/Belarusian air pollution indicator, based on a common methodology.

Data of the *Fragmentation index* indicator, also within the Environmental qualities domain, have been released in 2002 and 2009. Next update could be available in 2014 (based on 2012 data).[24] Data of the fourth Environmental qualities indicator, *Eutrophication (Helcom HEAT index)*, has so far been released for two years, 2009 and 2010. Helcom aims at updating data of this index yearly, but no newer data has yet been released and according to Helcom it seems the next update is due either in 2014 or 2015.[25]

To conclude, indicators of the Environmental qualities domain show the largest disparities regarding release years so far and it's also difficult to predict future release cycles of the four environmental indicators. However, based on previous release years and the character of the indicators, the TPG consider an update cycle of every 5 years would be feasible for *New soil sealing per capita*, *Air pollution (PM10)* and *Fragmentation index*, and of every year for the *Eutrophication (Helcom HEAT index)* indicator.

[21] Update information received from Norwegian Social Science Data Services.

[22] Update information from EEA received by e-mail to the TPG on April 29, 2013.

[23] Update information from EEA received by e-mail to the TPG on March 21, 2013.

[24] Update information from EEA et al. received by e-mail to the TPG on January 1, 2014.

[25] Update information from HELCOM received by e-mail to the TPG on June 5, 2013.

Table 18 Data sources and future updates

Indicator	Territory	1 Data avail-able	0 Data not available	999 Data available but not collected	0.5 Data partly available	Next update *	Data source
		2000 2001 2002 2003 2004	2005	2006	2007	2008	2009	2010	2011		
GDP per capita	BSR except RU/BY		0.5	0.5	0.5	0.5	0.5	0.5	0.5	2013	EUROSTAT
	Russia		1	1	1	1	1	1	0	March 2014	ROSSTAT
	Belarus		0.5	0.5	0.5	1	1	1	1	Apr/Dec 2013 -14**	BELSTAT
GDP per person employed	BSR except RU/BY		0.5	0.5	0.5	0.5	0.5	0	0	2013	EUROSTAT
	Russia		1	1	1	1	1	1	0	March 2014	ROSSTAT
	Belarus		0.5	0.5	0.5	1	1	1	1	June 2013-14	BELSTAT
Unemployment rate, total	BSR except RU/BY		0.5	0.5	1	1	1	0	0	Un-known	ESPON
	Russia		1	1	1	1	1	1	0.5	June 2014	ROSSTAT
	Belarus		1	1	1	1	1	1	1	June 2013-14	BELSTAT
Employment rate (20-64 years)	BSR except RU/BY		0.5	0.5	1	1	1	1	1	2013	EUROSTAT
	Russia		1	1	1	1	1	1	0	June 2014	ROSSTAT
	Belarus		1	1	1	1	1	1	1	July 2013	BELSTAT
Net migration rate	BSR except RU/BY		0.5	0.5	0.5	0.5	1	1	0	2013	EUROSTAT
	Russia		1	1	1	1	1	0	0	Un-known	ROSSTAT
	Belarus		1	1	1	1	1	1	1	March 2014	BELSTAT
Total population change	BSR except RU/BY		0.5	0.5	1	1	1	1	1	2013	EUROSTAT
	Russia		1	1	1	1	1	1	0	October 2013	ROSSTAT
	Belarus		1	1	1	1	1	1	1	Un-known	BELSTAT
Economic dependency	BSR except		0.5	0.5	1	1	1	1	1	2013	EUROSTAT

ratio	RU/BY														
	Russia						1	1	1	1	1	1	0	Un-known	ROSSTAT
	Belarus						1	1	1	1	1	1	1	Un-known	BELSTAT
Accessibility potential by road	BSR except RU/BY		1				0	1	0	0	0	0	999	2016	ESPON
	Russia						0	0	0	0	0	0	0	N/A	N/A
	Belarus						0	0	0	0	0	0	0	N/A	N/A
Accessibility potential by rail	BSR except RU/BY		1				0	1	0	0	0	0	999	2016	ESPON
	Russia						0	0	0	0	0	0	0	N/A	N/A
	Belarus						0	0	0	0	0	0	0	N/A	N/A
Accessibility potential by air	BSR except RU/BY		1				0	1	0	0	0	0	999	2016	ESPON
	Russia						0	0	0	0	0	0	0	N/A	N/A
	Belarus						0	0	0	0	0	0	0	N/A	N/A
Multimodal accessibility potential	BSR except RU/BY		1				0	1	0	0	0	0	999	2016	ESPON
	Russia						0	0	0	0	0	0	0	N/A	N/A
	Belarus						0	0	0	0	0	0	0	N/A	N/A
Functional areas: access to cities	BSR except RU/BY						0	0	0	0	0	0	1	2016	ESPON
	Russia						0	0	0	0	0	0	1	2016	ESPON
	Belarus						0	0	0	0	0	0	1	2016	ESPON
Population potential within 50km	BSR except RU/BY						0	0	0	1	0	0	0	2013	ESPON
	Russia						0	0	0	0	0	0	0	N/A	N/A
	Belarus						0	0	0	0	0	0	0	N/A	N/A
Border crossings	BSR except RU/BY	1					1	0	0	0	0	0	0	(2010 data)	UNECE
	Russia	1					1	0	0	0	0	0	0	(2010 data)	UNECE
	Belarus	1					1	0	0	0	0	0	0	(2010 data)	UNECE
Households with internet access at home	BSR except RU/BY						0	0.5	0.5	0.5	0.5	0.5	0.5	2013	EUROSTAT
	Russia						0	0	0	1	1	1	1	2013	ROSSTAT
	Belarus						0	0	0	0.5	0.5	0.5	0.5	2013	BELSTAT
Population with tertiary education (25-64 years)	BSR except RU/BY						0.5	0.5	1	1	1	1	1	2013	EUROSTAT
	Russia			1			0	0	0	0	0	1	0	N/A	ROSSTAT

	Belarus						0	0	0	0	1	0	0	N/A	BELSTAT
Employment in technology & knowledge sectors	BSR except RU/BY						0.5	0.5	1	0.5	0	0	0	2013	EUROSTAT
	Russia						0	0	0	0	0.5	0.5	0.5	N/A	ROSSTAT
	Belarus						0	0	0	0	0	0	0	N/A	N/A
Gross-domestic expenditures on R&D, business	BSR except RU/BY						0.5	0.5	1	1	1	0.5	0.5	2013	EUROSTAT
	Russia						0	0	0	0	0	0	0	N/A	N/A
	Belarus						0	0	0	0	0	0	0	N/A	N/A
Gross-domestic expenditures on R&D, total	BSR except RU/BY						0.5	0.5	0.5	0.5	0.5	0.5	0.5	2013	EUROSTAT
	Russia						0.5	0.5	0.5	0.5	0.5	0.5	0.5	2013	ROSSTAT
	Belarus						0	0	0	0.5	0.5	0.5	0.5	2013	BELSTAT
At-risk-of-poverty rate	BSR except RU/BY						0.5	0.5	0.5	0.5	0.5	0.5	0.5	2013	EUROSTAT
	Russia						1	1	1	1	1	1	0	April 2014	ROSSTAT
	Belarus						1	1	1	1	1	1	1	July 2013	BELSTAT
Severe material deprivation rate	BSR except RU/BY						0.5	0.5	0.5	0.5	0.5	0.5	0.5	2013	EUROSTAT
	Russia						0	0	0	0	0	0	0	N/A	ROSSTAT
	Belarus						0	0	0	0	0	0	0	N/A	BELSTAT
Youth unemployment rate (15-24 years)	BSR except RU/BY						0	0.5	1	1	0.5	0.5	0.5	2013	EUROSTAT
	Russia						0.5	0.5	0.5	0.5	0.5	0.5	0.5	June 2014	ROSSTAT
	Belarus						0	0	0	0	0.5	0	0	July 2013	BELSTAT
Gender imbalances	BSR except RU/BY						0.5	0.5	0.5	0.5	0.5	0.5	0.5	2013	*National Statistical Bureaus*
	Russia				1		0	0	0	0	0	0	1	October 2013	ROSSTAT
	Belarus						0	0	0	0	0	1	1	April 2013-14	BELSTAT
Life expectancy at birth in years	BSR except RU/BY						0.5	0.5	1	1	1	0.5	0	2013	EUROSTAT
	Russia						1	1	1	1	1	0	0	March 2014	ROSSTAT
	Belarus						1	1	1	1	1	1	1	May 2013-14	BELSTAT
Self-assessed general health status	BSR except RU/BY						0	0.5	0	0.5	0	1	0	2012-2013	Norwegian Social Science Data Services,

															Norway
	Russia						0	1	0	1	0	1	0	2012-2013	Norwegian Social Science Data Services, Norway
	Belarus						0	0	0	0	0	0	0	N/A	N/A
New soil sealing per capita	BSR except RU/BY						0	0.5	0	0	0	0	0	2014-2015	Fifth Report on Economic, Social and Territorial Cohesion (EEA, Eurostat, REGIO-GIS)
	Russia						0	0	0	0	0	0	0	N/A	N/A
	Belarus						0	0	0	0	0	0	0	N/A	N/A
Air pollution (PM 10)	BSR except RU/BY						0	0	0	0	0.5	0	0	Un-known	Fifth Report on Economic, Social and Territorial Cohesion (GMES Promote project, JRC, EFGS, REGIO-GIS)
	Russia						999	999	999	999	999	999	999	Un-known	ROSSTAT
	Belarus						999	999	999	999	999	999	999	Un-known	BELSTAT
Eutrophi-cation	BSR except RU/BY						0	0	0	0	0.5	0.5	0	2014-2015	HELCOM
	Russia						0	0	0	0	0.5	0.5	0	2014-2015	HELCOM
	Belarus						0	0	0	0	0	0	0	N/A	N/A
Fragmen-tation index	BSR except RU/BY			0.5			0	0	0	0	1	0	0	2014 (2012 data)	EEA et al.
	Russia						0	0	0	0	0	0	0	N/A	N/A
	Belarus						0	0	0	0	0	0	0	N/A	N/A

* The column "Next update" refers to the next update after spring 2013 (when data collection for the ESPON BSR TeMo Final Report was performed). Thus this column refers to data publically accessible later than spring 2013 and might include data of either next year after the already collected data, or next year after the already collected data *and* even later updates.

** April 2014 - GDP in mill. PPS in U.S. dollars at national level; December 2014 - GDP in national currency at oblast level; March 2014 - total population at end of the year

11. Suggestion for further work after project end

11.1. Structural data gaps from 2012-2013 (and previously)

As already pointed out, the data collected so far generally derives only from 2011. That means there are structural gaps of data from 2012 or later. Much of the 2012 data has not been collected since it was not yet published by the statistical bureaus when data collection in the TeMo project started early during the winter 2012-2013. Furthermore, very little data produced for 2013 has been collected since most of this is not yet available. Furthermore, there is data from 2011 or earlier that has not yet been released, depending on the character of the data: data covering several years is delivered as one load only after several years; the complexity of the data makes the data production time consuming; or other reasons might cause delays in the data compilation from the side of the source provider. One example in this respect is the GDP data: no newer GDP figures than 2009 were released by Eurostat at the time of collection, as GDP data on regional level always lags a few years behind national data. To name another example, the latest year available for population data from Russia for the indicator Net migration rate also derived from 2009 only. Thus for the next update of the BSR Monitoring System, data generally has to be collected starting with data of year 2012, but sometimes even earlier than that, in order to cover the existing gaps. A third example is the Eutrophication data: When a new dataset for this indicator is released, it is based on data that is already 3-7 years old. E.g. the Eutrophication dataset of 2010 consists of average values of data for years 2003-2007. Following this logic, is a new dataset will be released in 2014, it will build on data for years 2007-2011.[26]

11.2. Possible update of the Territorial Monitoring System

Considering the structural gaps of data from 2012-2013 due to the ongoing project phase of the BSR TeMo project outlined above, as well as supplementing the missing data from 2011 or earlier (such as GDP data, population data for Russia, etc.), the TPG suggests a general update of the monitoring system's data after the end of the project, e.g. as soon as 2014. Such an update would not only fill the mentioned data gaps for recent years but also improve the possibilities for further testing, since more recent and longer time series would then become available.

In Table 19, suggestions for the next updates of the Territorial Monitoring system are presented indicator by indicator. As most of the data of social and economic indicators are released on a yearly basis most such data should by the spring of 2014 be readily available up to year 2013. For other indicators – especially within the Access to services, markets & jobs and Environmental qualities domains – the release dates are more irregular or even difficult to predict and not all of the data for these indicators might be available. In case an update of the Territorial Monitoring System will take place in 2014, one will therefore have to make use of what data actually has become available by that time regarding these specific indicators. Nevertheless, in the column "Suggested general update cycle" in Table 15, the "ideal" update cycles have been listed. This may be of interest in case there would be any possibilities to streamline the future releases of these indicators according to the needs of the BSR or other monitoring systems.

[26] Update information from HELCOM received by e-mail to the TPG on June 5, 2013.

Another possibility regarding updating of the monitoring system would be to further explore the possibilities to cover spatial levels beyond NUTS-3 and *Oblast* (SNUTS-2) levels, e.g. LAU (municipality) and *rayon* levels, respectively (section C.2.7 above).

Table 19 Suggested future updates

Indicator	**Over all data availability*, based on previous data releases** *) Gaps may exist for certain regions	**Next suggested update of TeMo**	**Suggested general update cycle**
Economic performance & competitiveness			
GDP per capita	Yearly	After project end	Yearly
GDP per person employed	Yearly	After project end	Yearly
Unemployment rate, total	Yearly	After project end	Yearly
Employment rate (20-64 years)	Yearly	After project end	Yearly
Net migration rate	Yearly	After project end	Yearly
Total population change	Yearly	After project end	Yearly
Economic dependency ratio	Yearly	After project end	Yearly
Access to services, markets & jobs			
Accessibility potential by road	Every 5 years (2001, 2006, 2011 …)	As soon as available	Every 5 years
Accessibility potential by rail	Every 5 years (2001, 2006, 2011 …)	As soon as available	Every 5 years
Accessibility potential by air	Every 5 years (2001, 2006, 2011 …)	As soon as available	Every 5 years
Multimodal accessibility potential	Every 5 years (2001, 2006, 2011 …)	As soon as available	Every 5 years
Functional areas: access to cities	Irregular (2011 …)	As soon as available	Every 5 years
Population potential within 50 km	Irregular (2008 …)	As soon as available	Every 5 years
Border crossings	Every 5 years (2000, 2005 …)	As soon as available	Every 5 years
Households with internet access at home	Yearly	After project end	Yearly
Innovative territories			
Population with tertiary education (25-64 years)	Yearly	After project end	Yearly
Employment in technology & knowledge sectors	Yearly	After project end	Yearly
Gross-domestic expenditures on R&D, business	Yearly	After project end	Yearly
Gross-domestic expenditures on R&D, total	Yearly	After project end	Yearly

Social inclusion & quality of life			
At-risk-of-poverty rate	Yearly	After project end	Yearly
Severe material deprivation rate	Yearly	After project end	Yearly
Youth unempl. rate (15-24 years)	Yearly	After project end	Yearly
Gender imbalances	Yearly	After project end	Yearly
Life expectancy at birth, in years	Yearly	After project end	Yearly
Self-assessed general health status	Every 2 years (2006, 2008, 2010 …)	As soon as available	Every 2 years
Environmental qualities			
New soil sealing per capita	Irregular (2006 …)	As soon as available	Every 5 years
Air pollution (PM10)	Irregular (2009 …)	As soon as available	Every 5 years
Eutrophication	Yearly/Irregular (2009, 2010 …)	As soon as available	Yearly
Fragmentation index	Every 7 years/Irregular (2002, 2009 …)	As soon as available	Every 5 years

11.3. Headline indicators updates

The TeMo project's suggested five to six headline indicators were presented in chapter 3.2. They are also shown in grey scale in Table 19 above. In case updating of all indicators might be too cumbersome or become too expensive, one possibility would be to focus on the headline indicators only. The suggested option would then be to keep the headline indicators as updated as possible at all times.

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