D.T4.1.2

Benchmarking Tool – Methodology Report

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Main author	Christopher Meyer (Wismar University of Applied Sciences)
Contributors	FWW / EPC
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Acknowledgement

1. Introduction

In this report, the author provides a detailed description of the Benchmarking Tool as Deliverable D.T4.1.2 in the collaborative project SMART_watch funded by the INTERREG Central Europe Program. The author and his team is responsible for the implementation of the Technical Working Package No. 4 "Boosting SMART_watch – Policy Recommendations". The provided Deliverable is a crucial part of the first Activity in WPT4 which is illustrated in the Figure No.1. It builds up directly on the report and methodology of D.T4.1.1 "Common Set of Indicators" conducted by the author too.

The developed Benchmarking Tool uses the common set of indicators as database for the comparison of eight NUTS 2 regions in the programme area. It tries to provide an approach to benchmark the performance of the regions in the frame of Smart Specialisation implementation by using one common set of indicators instead of following the respective national / regional monitoring systems. This ensures a better comparison since the same data is used and allows to analyse the regional implementation in detail.

Basically, a benchmarking is build up on four stages (Matson & Piete, 2005). The first step is a development of the database, what was already provided by the author in the Common Set of Indicators. The second stage is the collection of needed data to measure performances, followed by the next stage: comparison analysis. The fourth and final stage is the development of recommendations for performance improvement. All four stages are covered in the project Activiy A.T4.1.

Deliverables

D.T4.1.4 – Final Report

D.T4.1.3 – Regional Reports

D.T4.1.2 – Benchmarking Tool

D.T4.1.1 – Common Set of Indicators

Figure 1 - Logic of A.T4.1

The implemented benchmarking can be seen as a combination of a competitive benchmarking that involves a comparison of processes with the participating competitors. Furthermore, in combination with other tools provided in the SMART_watch project, the tool supports the idea of benchlearning following the idea to learn from external actors (Kyrö, 2013).

The conducted report should be seen as an assistance to work with the interactive tool. The report will provide the methodology as well as the used data sources and normalisation methods. The actual benchmarking is provided by an online tool, accessible via the following link:

http://smartwatchepc.s3-website.eu-central-1.amazonaws.com

Within the methodology the author will explain the used equations for the final benchmarking score, indicator multiplier, normalised values and structure. The provided report will close with an user-guide to understand how the shown values should be analysed.

Due to the development of the Benchmarking Tool and the previous Set of Indicators as well as their respective methodology approaches, the author provides a new proceeding to analyse the implementation of Smart Specialisation Strategies with the European Funding Period 2014 – 2020. Depending on its feasibility, we will evaluate their usage in the analyses for the policy recommendations and strategy in the following activities of WPT4.
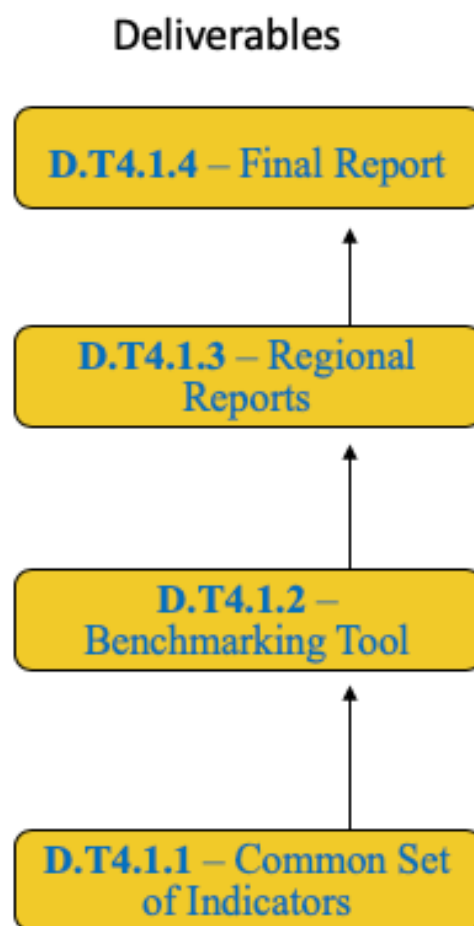
2. Methodology of Benchmarking Index

The used methodology for the Benchmarking is based on the previous Deliverable D.T4.1.1 Common Set of Indicators. The set is used as required database for the benchmarking. For all participating regions, the necessary (and available) data was collected and standardised to create one final index for comparison of the implementation of regional Smart Specialisation Strategies.

Additionally, we estimated a structure index covering the regional starting points in 2013 and 2014. This allows a better assessment of the final benchmarking index and comparison between relatively different regions.

Since the indicators are not available via one well-known dataset, scoreboard or scientific paper, different sources were taken into consideration for gaining necessary values. This also leads to different approaches to standardise the data as written in the following subchapters.

Following the idea of the methodology that yields to create a Common Set of Indicators, all indicators will be weighted depending on their frequency of use in the regions. Together with the normalised value, we receive a score for each indicator in all participating regions (ref. to Rickman & Schwer, 1995). However, the final benchmarking index will be estimated by the mean of all scores, as shown in the equation:

$$b_r = \frac{\sum_{i=0}^{n} m_i * x_{ri}}{n}$$

where b_r is the benchmarking index for the region r, m_i describes the multiplier for the indicator i and x_{ri} the normalised value for indicator i for the region r. The sum in the counter will be divided by the number of indicators n to achieve the final benchmarking index for the region.

In the following subchapters, the methodology for the multiplier , the normalised values and the structure index will be explained in detail.

2.1. Indicator Multiplier

Following the presented idea of collecting a common set for indicators to measure the implementation of Smart Specialisation Strategies, we can differ between different classes of indicators due to their frequency of appearance in the different regional monitoring systems. As an example, we want to take out the indicators "private sector spending on R&D in percent of GDP" and "share of R&D employees". While the first one is used as indicator for RIS3 implementation in all regions or is at least adoptable to one used indicator, the second one is only used in around 60%. Therefore, the value of the first indicator will have a higher influence on the final benchmarking score due to the mentioned multiplier m_i. The following table 1 shows the multiplier for every indicator of the common set:

Table 1 - Multiplier of Common Set of Indicators

The private sector spending on R&D as a percentage of GDP	1,2
Share of funds in public sector expenditure on R&D funded by the business sector	1,2
Incidence of R&D expenditure on regional in GDP	1,2
Incidence of total R&D expenditure on GDP	1,2

Expenditures on R&D in private sector referring to GDP	1,2
Expenditures on R&D in public sector referring to GDP	1,2
Expenditures on R&D at universities referring to GDP	1,2
Scientific employees	1,2
Expenditures on R&D in public sector and universities per employee	1,2
Number of patents and utility models protection rights granted to national entities per inhabitant	1
Number of businesses introducing product and service innovations in % of total SME number	1,2
Number of companies supported that cooperate with research institutes	1,2
Industrial SMEs (excluding micro-enterprises) introducing innovations as a percentage of SMEs	1
Share of innovation-active companies	1
Private investments to facilitate public support for innovation or R&D	1
Spending on innovation activities in companies operating in the industry and service sectors other than R&D	0,8
Share of R&D employees in private sector	0,6
Number of companies supported to introduce a new business product	0,6
Number of companies supported to introduce new products that are new to the market	0,6
Increase in business innovation activities	0,6

Basically, indicators that are taken into consideration in all regional monitoring system receive a multiplier of 1,2. The weights are fixed according to the amount of appearances (Berger & Bristow, 2009). Whenever a region is missing, we subtract 0,2, which means that a multiplier of 0,6 is given to an indicator, that is not used by three regions.

Introducing a multiplier helps to generate a more feasible final benchmarking score, since a good performance in an often used indicator in monitoring systems is appreciated in the final score as well. On the opposite a low used indicator doesn't prosecute bad performance that much.

2.2. Normalised Values for Indicators

To yield comprehensible values for all indicators across the respective regions, the author collected the necessary data through four different methods by using different data sources. All four ways of data gaining are presented in the following subchapters. However, the author preferred the first option that follows directly the regional monitoring system of each region. Nevertheless, only a few normalised values could be taken out from this option. This results in a lack of information out of the regional strategy papers, which do not provide all necessary information to trace the idea of the respective region on how to get the data / values.

2.2.1. Values from regional Smart Specialisation Strategy Documents

By analysing the regional strategy documents in the frame of the development of a Common Set of Indicators as Deliverable D.T4.1.1, a collection of the used values for all regions was developed. In some regions, the responsible institutions for implementing the Smart Specialisation Strategy defined start and target value of the indicators used in the monitoring system for the current funding period. This allows an easy measurement of the implementation by comparing the defined target value for 2020 with the latest value, that is provided for the respective indicator.

Having this in mind, the value x_{ir} can be obtained as follows:

$$x_{ir} = \frac{t_{ir} - s_{ir}}{y_{ir} - s_{ir}}$$

where t_{ir} and s_{ir} are the target (2020) and starting value (2014) defined by the regions. y_{ir} is the latest value the author was able to collect for the respective indicator. Therefore, equation (2) describes the resulting value as rate of the difference between planned performance and actual performance. If the region is able to achieve the planned target value, the value for the indicator would be $x_{ir} = 1$, while underperformance yields in $x_{ir} < 1$. However, $x_{ir} > 1$ is also a possible value, but it should be reminded, that the target values are defined for 2020 and the latest values are mostly accessible for 2018, which means that the data demands a two years gap.

2.2.2. Normalised Data via Regional Innovation Scoreboard 2019

Since not all regions provide the necessary information to follow option 2.2.1 and / or the strategy paper do not present the methodology how the data was normalised or from which sources it was taken, another option has to be considered to get the necessary data for a useful benchmarking.

As it is shown in the Annex I, some indicators of the common set can be represented via indicators that are used in the Regional Innovation Scoreboard. The scoreboard is provided by the European Commission on a yearly basis, by analysing the NUTS2 regions. This allows us, to use the latest available data from a validated data source (EC, 2019a).

The Scoreboard provides three information to create the normalised values for the respective indicators. Therefore, we can use different approaches to obtain the demanded normalised value. The first option is used, whenever the Scoreboard provides the data in relation to the European and national level of the respective indicator:

$$x_{ir} = \frac{(e_{ir} * 0,007 + l_{ir} * 0,007)}{2}$$

where e_{ir} is the score taken out from the Regional Innovation Scoreboard for the respective region in relation to the European level and l_{ir} the score in relation to national level. The values are multiplied with 0,007, since an assumption has to derived that 0,7 is a value providing the mean of performances. The assumption follows grading systems for performances from education sector (rf. Ministry of Education and Science, 2010). By dividing the score in the counter with 2, we obtain the normalised value for the indicator of the respective region.

As second option, we use the provided value for some indicators, which are not related to European and National level. In this case, the mean of all European NUTS2 regions was calculated by the author from the Regional Innovation Scoreboard. Having the European mean value and the regional value, we can obtain the normalised value for the benchmarking by using:

$$x_{ir} = 0,7 * \frac{z_{ir}}{m_i}$$

where z_{ir} is the value taken out from the Scoreboard and m_i the calculated European mean for the respective indicator i. Again, we are multiplying 0,7 since we assume that this is the value for mean performance.

2.2.3. Normalised Data via Regional Competitiveness Index

Additionally to the Regional Innovation Scoreboard 2019, data from the Regional Competitiveness Index were used to fulfil the database for the benchmarking tool as shown in the Annex I. The Competitiveness Index is also a yearly provided source for NUTS regions to measure the competitiveness performance and readiness in business sectors (EC, 2019b).

The Index provides a value for every European NUTS2 region, therefore we can use the same method as earlier in option two for the Regional Innovation Scoreboard. Therefore, we use again

$$x_{ir} = 0,7 * \frac{y_{ir}}{m_i}$$

where y_{ir} is the value taken out from Competitiveness Index and m_i the calculated European mean of all regions for the respective indicator i. As mentioned before, we are multiplying 0,7 as value for mean performance.

2.2.4. Normalised Data via EuroStat

As third validated data source, EuroStat as official statistical institution of the European Commission located in Luxembourg was used to obtain the remaining data (EC, 2019c). Once again, for every region and the respective indicator, a value could be taken out from the database. Therefore, the equation is nearly the same as before:

$$x_{ir} = 0.7 * \frac{a_{ir}}{m_i}$$

where a_{ir} is the value taken out from EuroStat and m_i the calculated European mean of all regions for the respective indicator i. The fraction is multiplied with 0,7 due to the mentioned assumption of mean performance.

2.2.5. Normalised Data using a combination of data sources

For some indicators, none of the shown methods were feasible. This results in a lack of information / data or in the understanding of the indicators content. Therefore, the author conduct for the following indicators an individual approach to obtain normalised data:

Incidence of total R&D expenditures on GDP

To achieve a normalised value for this indicator, we use a combination of the previous shown methods. This includes data from the Regional Innovation Scoreboard and Eurostat. The equation is built as follows:

$$x_{4r} = \frac{(0,007 * l_{5r} + 0,007 * l_{6r} + x_{7r})}{3}$$

where l_{5r} is the value from the Scoreboard in relation to national level for the indicator "expenditures on R&D in private sector referring to GDP", l_{6r} the value from the Scoreboard in relation to national level for the indicator "expenditures on R&D in public sector referring to GDP" and x_{7r} the value for "expenditures on R&D at universities referring to GDP" taken from EuroStat by using the method presented in 2.2.4.

Incidence of R&D expenditures on regional GDP

The normalised value for this indicators follows directly from the presented above. To obtain the normalised value additional data from the Regional Innovation Scoreboard is used.

$$x_{3r} = x_{4r} * \frac{GDP_n}{GDP_r}$$

where GDP_n is the national and GDP_r is the regional Gross Domestic Product taken out from the Regional Innovation Scoreboard. That means, we multiply the value for indicator No. 4 with the relation between national and regional GDP to obtain a normalised value for this indicator.

2.3. Structure Index

The Structure Index is based on an idea and tool published on the S3-platform by the European Commission. It tries to identify the characteristics in terms of structural conditions for the participating regions at the beginning of the Smart Specialisation funding period 2014 – 2020 (EC, 2014). Those characteristics are seen as fixed in the short term and reflect the way innovation and economic evolution happen in the region. However, for the developed benchmarking tool described in this report, the provided structure benchmarking tool is not sufficient, since it shows the 35 nearest regions from all European NUTS2 regions to the selected one. This doesn't allow a comparison between the participating regions which are highly different what excludes them in the provided tool.

To solve this problem, we access the data from Regional Innovation Scoreboard and Regional Competitiveness Index. The database described for the European structure tool can be covered in a sufficient way by the two mentioned data sources. To obtain a structure index, we use the final scores from 2013 and 2014 from the data sources. Therefore, the structure index u_r can be written as

$$u_r = \frac{(RIS_r^{2013} + RCI_r^{2014})}{2}$$

where, RIS_r^{2013} is the total index score for the region from the Regional Innovation Scoreboard in 2013 and RCI_r^{2014} is the total score for the region taken from the Regional Competitiveness Index.

3. How to use the tool

The tool provides a detailed comparison for the Smart Specialisation performance of NUTS regions, that are represented in the SMART_watch project, part-funded by the INTERREG Central Europe Programme. It is based on a Common Set of Indicators, that results from the regional monitoring system of the regions. This allows a new approach of a benchmarking in the field of Smart Specialisation, that tries to eliminate the differences between the individual monitoring systems.

Via the Drop-Down selection, three regions can be displayed at the same time. After choosing the regions to be compared, the tool shows a multiplicity of data. At first, the structure index is shown next to the name of the region. This index is not a direct part of the benchmarking in the frame of Smart Specialisation. However, it helps to analyse the individual performance since the structure index tries to elaborate the starting conditions at the beginning of the funding period and Smart Specialisation approach.

After choosing the regions a table with normalised values for every indicator of the Common Set of Indicators, which is displayed as list on the left side, will be created. To trace the values in detailed, have a look on the Benchmarking Report. We used an assumption, that a mean performance is measured with the value of 0,700. At the end of the table, the final benchmarking score is displayed to be used as key value for a benchmark in the frame of the Smart Specialisation implementation.

The user is allowed to ex-/include indicators from the list to modify the resulting benchmarking score. By (un-)clicking the box next to the respective indicator, the values will be ex-/included to the final score. This interactive function erases the values from all chosen regions. This allows an additional benchmarking analysis of regions, e.g. by excluding GDP-related indicators for a different kind of benchmarking.

Please note: an interpretation of a value as percentage is not valid (value 0,5432 ≠ 0,5432%).

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Annex

Annex I

Table 2 - Overview of indicators and data sources

Indicator:	Data source:	Name in data source:
The private sector spending on R&D as a percentage of GDP	Regional Innovation Scoreboard	R&D Expenditures in business sector
Share of funds in public sector expenditure on R&D funded by the business sector	EuroStat	Businees expenditures on R&D by NACE Rev. 2 activity
Incidence of R&D expenditure on regional in GDP	Regional Innovation Scoreboard	See Chapter 2.2.5
Incidience of total R&D expenditures on GDP	Regional Innovation Scoreboard + EuroStat	See Chapter 2.2.5
Expenditures on R&D in private sector referring to BIP	Regional Innovation Scoreboard	R&D Expenditures in business sector
Expenditures on R&D in public sector referring to BIP	Regional Innovation Scoreboard	R&D Expenditures in public sector
Expenditures on R&D at universitites referring to BIP	EuroStat	(re_e_gerdreg)
Scientific employees	EuroStat	Regional Science and Technology Statistics – HRST
Expenditures on R&D in public sector and universities per employee	EuroStat	Regional Science and Technology Statistics – HRST
The number of patents and utility models protection rights granted to national entities per inhabitant	Regional Innovation Scoreboard	PCT patent applications
Number of businesses introducing product and service innovations in % of total SME number	Regional Innovation Scoreboard	SMEs innovating in-house
Number of companies supported that cooperate with research institutes	Regional Innovation Scoreboard	Public-private co-publications

Industrial SMEs (excluding micro-enterprises) introducing innovations as a percentage of SMEs	Regional Competitiveness Index	Exports in medium high/high-tech manufacturing
Share of innovation-active companies	Regional Competitiveness Index	Innovative SMEs
Private investments to facilitate public support for innovation or R&D		
Spending on innovation activities in companies operating in the industry and service sectors other than R&D	Regional Innovation Scoreboard	Non R&D innovation expenditures
Share of R&D employees in private sector	Regional Competitiveness Index	Human Resources in Science and Technology
Number of companies supported to introduce a new business product	Regional Competitiveness Index	Sales of new market and new to firm innovation
Number of companies supported to introduce new products that are new to the market	Regional Competitiveness Index	Sales of new market and new to firm innovation
Increase in business innovation activities	Regional Innovation Scoreboard	Increase of Score related to 2011

Source: compiled by the author