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REGIONAL QUALITY OF LIVING IN EUROPE

PBL report 1271

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Contents

ABSTRACT

This report sets out the conceptual framework and results of the Regional Quality of Living. As part of this project, a Regional Quality of Living Index (RQI) was developed for benchmarking European regions. This RQI for non-business-related indicators may help to improve the attractiveness of regions, thus attracting people or companies to settle in those regions. Data from reliable sources were collected and aggregated to NUTS2 level to match data from other studies on European regions. Finally, 25 indicators in 9 categories were calculated to determine the RQI score and ranking of European NUTS2 regions.

The highest RQI scores were found for regions in Switzerland, Sweden, Norway and the Netherlands. A wide divergence in regional scores could be observed for some countries, such as Italy and Spain, with more southerly regions ranking lower than those in the north. Another conclusion is that the regions where the capital city was found offered a better Quality of Living. Exceptions to this were seen in Germany, Belgium and Rumania.

A benchmark comparison of Dutch regions and the average scores of the best 25 European regions (Best in Europe; in terms of GDP per capita) revealed the strengths and weaknesses of Dutch regions with regard to the Quality of Living. Most of the Dutch regions have remarkably better scores than the Best in Europe for *Public services*, *Recreation* and *Education* and similar scores for *Social environment*, *Health* and, *Purchasing power and employment*. The scores for *Housing* and *Natural Environment* for almost all Dutch regions were lower than for the Best in Europe.

The northern Dutch regions compared with the Randstad regions showed better scores for *Governance*, *Social environment* and *Housing* but worse scores for *Education*, *Recreation and Public services*.

The RQI can be used to benchmark the Quality of Living in European regions, and could play a role in achieving Dutch policy ambitions to elevate Dutch regions to the top 10 most competitive economic regions in the world.

SAMENVATTING

Dit rapport beschrijft het conceptuele kader en de resultaten van het project Regional Quality of Living in Europe. Als onderdeel van dit project, is een Regionale Quality of Living Index (RQI) ontwikkeld. Deze index die is samengesteld uit niet-bedrijfs-gerelateerde indicatoren kan een bijdrage leveren aan het verbeteren van de aantrekkelijkheid van regio's als vestigingsplaats voor mensen en bedrijven.

Gegevens uit betrouwbare bronnen werden verzameld en samengevoegd tot NUTS 2 ofwel provincie-niveau om aan te kunnen sluiten op andere studies over de Europese regio's. Met behulp van 25 indicatoren in 9 categorieën werden scores berekend voor de Europese NUTS 2 regio's om een ranking te kunnen bepalen en om sterke en zwakke punten van regio's te identificeren.

De hoogste RQI scores werden gevonden voor regio's in Zwitserland, Zweden, Noorwegen en Nederland. Grote verschillen in regionale scores binnen landen konden worden waargenomen voor onder meer Italië en Spanje, met lagere scores voor de zuidelijke regio's vergeleken met het noorden. Een andere conclusie is dat de Quality of Living in regio's met een hoofdstad beter scoort. Uitzonderingen op deze werden gezien in Duitsland, België en Roemenië.

Een vergelijking van Nederlandse regio's en de gemiddelde scores van de beste 25 Europese regio's (Best in Europa, in termen van het BBP per hoofd van de bevolking) geeft inzicht in de sterke en zwakke punten van de Nederlandse regio's met betrekking tot Quality of Living. De Nederlandse regio's scoren beter dan Best in Europa voor *Publieke voorzieningen, Recreatie* en *Onderwijs* en hebben vergelijkbare scores voor de *Sociale omgeving*, *Governance, Gezondheid* en *Koopkracht en werkgelegenheid*. De scores voor *Wonen* en *Natuurlijke omgeving* waren voor bijna alle Nederlandse regio's lager dan bij de benchmark Best in Europa. De Noordelijke provincies lieten vergeleken met de Randstad regio's betere scores zien voor *Governance*, *Sociale omgeving* en *Wonen* maar scoorden slechter voor *Onderwijs, Recreatie en Publieke voorzieningen*.

De RQI kan een bijdrage leveren aan het realiseren van de Nederlandse beleidsambitie om Nederlandse regio's te laten stijgen tot de top 10 van meest concurrerende economische regio's in de wereld.

Credits

PBL report 1271 – Regional Quality of Living in Europe

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1 INTRODUCTION

The Dutch policy document on infrastructure and spatial planning (SVIR; IenM 212a) sets out the Netherlands' ambition to be among the top 10 most competitive economies in the world. High standards for the business climate for internationally operating companies are important. SVIR emphasises the importance of powerful regions with a good 'Quality of Living'', optimum accessibility and good connections to the rest of Europe and the world. In 2012, the realisation of these objectives was evaluated by PBL Netherlands Environmental Assessment Agency (Kuiper and Van der Schuit, 2012).

Results from several studies have been published about the attractiveness of the Dutch regions to companies in terms of the economic environment (Raspe et al., 2010; Weterings et al., 2011). The Regional Competitiveness Index (Dijkstra et al., 2011; Annoni and Dijkstra, 2013) shows the competitiveness of European regions. These studies mainly took economic factors into account, without including the characteristics of a good Quality of Living for residents and employees. Although economic factors are important in relation to the attractiveness of regions to companies, the quality of the living environment also plays a role and therefore deserves attention. The Quality of Living, currently is not being measured systematically.

The Regional Quality of Living Index (RQI) aims to fill this gap with a set of 25 indicators in 9 categories. The RQI provides an international benchmark of non-business-related indicators that are important to living standards and the quality of the human environment. The results can be used for other purposes, too. For example, to improve the attractiveness of specific regions to students, or in the context of population decline.

Besides the economic arguments, foreign investors will have more reasons for starting a business in the Netherlands. According to a recently published survey (*Barometer Nederlands vestigingsklimaat*; EY, 2013) in which foreign investors were asked about the most important non-economic factors that make the Netherlands an attractive place to do business, the factors most highly rated were: *Quality of Life* (86% answered that this factor makes The Netherlands moderately or very attractive) along with I*nternet (telecoms) (*81%*)*, *Stable Political Environment* (78%) and *Connectivity (*71%*).* It is important that the Netherlands maintains or improves on the scores for these *Quality of Living* factors.

2 METHODS

2.1 Theory

A review of the scientific literature on the Quality of Living leads to the conclusion that, at present, there is no consensus on either the definition of the concept or specification of the underlying dimensions (Morais et al., 2011; Van Kamp et al., 2003). Several terms and definitions have been presented in the literature for concepts such as *Quality of Living, quality of life, liveability,* and *standards of living*. *Quality of Living*, as a concept, is attracting growing interest in the scientific literature. The subject has been picked up from different points of view by various institutes and researchers.

Regional Quality of Living (life) in the European Commission

In the European Union this topic has gained more attention as it has become an essential element in the development of cities and regions. A European Parliament resolution (2005) on regional expansion indicates that these places are not only locations where problems are concentrated, but also where the future lies.

In 2008 the Commission on the Measurement of Economic Performance and Social Progress (CMEPSP) was created at the instigation of President Sarkozy of France because he was dissatisfied with the current level of statistical information about the state of the economy and society. The Commission's aim was to identify the limits of GDP as an indicator of economic performance and social progress. It was suggested that more attention should be given to Quality of Life as well as Sustainable Development and the Environment (Stiglitz, et al., 2009). Eurostat recently published new Quality of Life indicators for various countries in Europe (Eurostat, 2014).

Internationally, there are several indices that reflect *Quality of Living* or *liveability*. Several institutes or companies have considered this concept from various angles and at different levels of aggregation.

The Mercer Quality of Living index (Mercer, 2010) and the Liveability index (EIU, 2012a) have been used for determining the amount of compensation awarded to workers who temporarily have had to accept a lower standard of living. These indices are intended for people working for companies in foreign countries. Other indices (International Living, 2012; Numbeo, 2012) focus on holiday or retirement situations. However there is no benchmark for European regions based on the Quality of Living compiled from public data.

Another difference between indices is the level of analysis. Some international indices have been published with a benchmark for countries (International Living, 2012; OECD Better Life Index, 2012; EIU, 2012a). Country data, however, are not generally representative of regions because of the inhomogeneity of countries. City indices are published by a number of institutions, such as in the Quality of Living Index (Mercer, 2010), the Economist Intelligence Unit's Liveability Index (EIU, 2012) and Monocle's Most Liveable Cities index (Monocle, 2012).

Table 1 Index categories used by Morais, Mercer, Liveability Index, OECD Better Life Index and International Living.

Index	Morais et al. (2011) Mercer Quality of Living Index (2010) * categories only used by Mercer	Liveability Index of the Economist Intelligence Unit (2012a) ; 5 categories and 23 indicators	OECD Better Life Index	International Living (2010)
Aggregation level	regions	countries	countries	countries
Factors/ categories	• Political and social environment • Economic environment • Socio cultural environment * • Health issues • Schools and education • Public services and transport • Consumer goods * • Recreation • Housing • Natural environment	• Stability • Health care • Culture & environment • Education • Infrastructure	• Housing • Income • Jobs • Community • Education environment • Civic engagement Health • Life satisfaction • Safety • Work–life balance	• Cost of living • Culture and leisure • Economic environment • Freedom • Health • Infrastructure • Safety and risk

Several categories have been chosen to characterise Quality of Living or liveability (Table 1). The study by Morais et al. grouped the indicators into eight categories, similar to those used in the Mercer index. Mercer's categories *socio-cultural environment* and *consumer goods* were not included in the study of Morais et al. because they are not sufficiently differentiated for Europe. The EIU Liveability Index has 23 indicators in 5 categories.

Quality of Living vs quality of life

Quality of life is specific to people

Quality of Living should not be confused with *quality of life* which is a broadly used term (Investipedia, 2011). Quality of life is about a person's emotional state and personal life. As Veenhoven (1996) stated: 'Quality of life is happy life expectancy = product score of life expectancy (in years) and the mean 'happiness'. Many studies have been carried out on people's life situation. The *'Life Situation Index'* in the four largest cities in the Netherlands, for example, was reported for several decades (Boelhouwer and Gilsing, 2012). Eurostat recently published new Quality of Life indicators for various countries in Europe (Eurostat, 2014). The document presents a detailed analysis of many different dimensions of quality of life, complementing the indicator traditionally used as the measure of economic and social development, GDP. This concept relates to the '8+1 quality of life indicators, where 1 is the indicator '*overall experience of life*'.

Quality of Living is specific to a region or country

Quality of Living deals with the standards required for such a quality; for example, personal safety and security, health, transport infrastructure, the availability of consumer goods, along with adequate housing, schooling and recreational facilities. In several publications, however, the term *quality of life* is used when describing the characteristics of a region or city. Morais et al. (2011), for instance, described their study as a *quality of life* study, although they applied Mercer's '*Quality of Living'* concept when conducting a benchmark study of European cities.

2.2 Concept for composition of the Regional Quality of Living Index (RQI)

2.2.1 Index based on 9 categories and 25 indicators

The approach to *Quality of Living* of Mercer (2010) and Morais et al. (2011) was to some extent applied in this study. This means that indicators and categories were chosen which are important for people individually or people with their families related to foreign companies when they want to settle in a specific region, either for some time or permanently.

Some indicators in the Mercer index were changed or omitted because they were not relevant for benchmarking European regions (e.g. 'infectious diseases' and 'troublesome and destructive animals and insects' in the category *Health Care*). For the same reason, we left out the *Consumer Goods* category because consumer goods can be bought in all European regions. In the *Economic Environment* category, we added *Employment*, *Cost of Living and Housing Affordability* and introduced the heading *Purchasing power and employment* to emphasise this. In the category *Housing,* factors such as *furniture* and *maintenance services* were omitted and replaced by *Housing environment*.

After collecting data from several databases (Appendix 7.2) and selecting relevant sub-indicators, we subsequently selected 25 indicators, representing people's Quality of Living (Figure 1). Most indicators were calculated as averages of several sub-indicators (Appendix 7.2). The indicators focus on the quality, availability and affordability of certain services. Some statistical methods were then applied to create a database for NUTS2 regions. The condition applying to the data was that these should be publicly available from recognised institutes, such as Eurostat, World Bank and OECD.

2.2.2 NUTS2 regions as level of analysis

International comparisons can be made for NUTS0 regions (countries), NUTS1 regions (certain parts of countries), NUTS2 regions (provinces), NUTS3 regions (city regions) or metropolitan areas (cities and their surrounding countryside, as well as smaller cities). The disadvantage of data at national level is that these data are not representative of important regions within a country, as some countries are very heterogeneous. Italy, for example, where there is a wide divergence between the less developed south and the more developed north. The same applies to Turkey, Flemish and Walloon Belgium, former East and West Germany, and the southern and northern parts of Sweden, Finland and Norway.

According to Daniel Hyslop (personal communication, 2013), metropolitan regions would be the preferred choice but there are insufficient data available on these types of regions. NUTS3 regions (cities) are too small because, although the built environment is important, these regions do not include the categories for outdoor activities.

Therefore, data were collected for the European NUTS2 regions (NUTS2 codes 2010), as was done for research carried out on Dutch top sectors and their European competitors (Raspe et al., 2012). This is consistent with the approach adopted for the EU Regional Competitiveness Index (Dijkstra et al., 2011, and Morais et al., 2011). Europe has 316 NUTS2 regions, with 270 of these in the EU27 and 46 in Turkey, Switzerland, Croatia, Liechtenstein and Macedonia (Appendix 7.1).

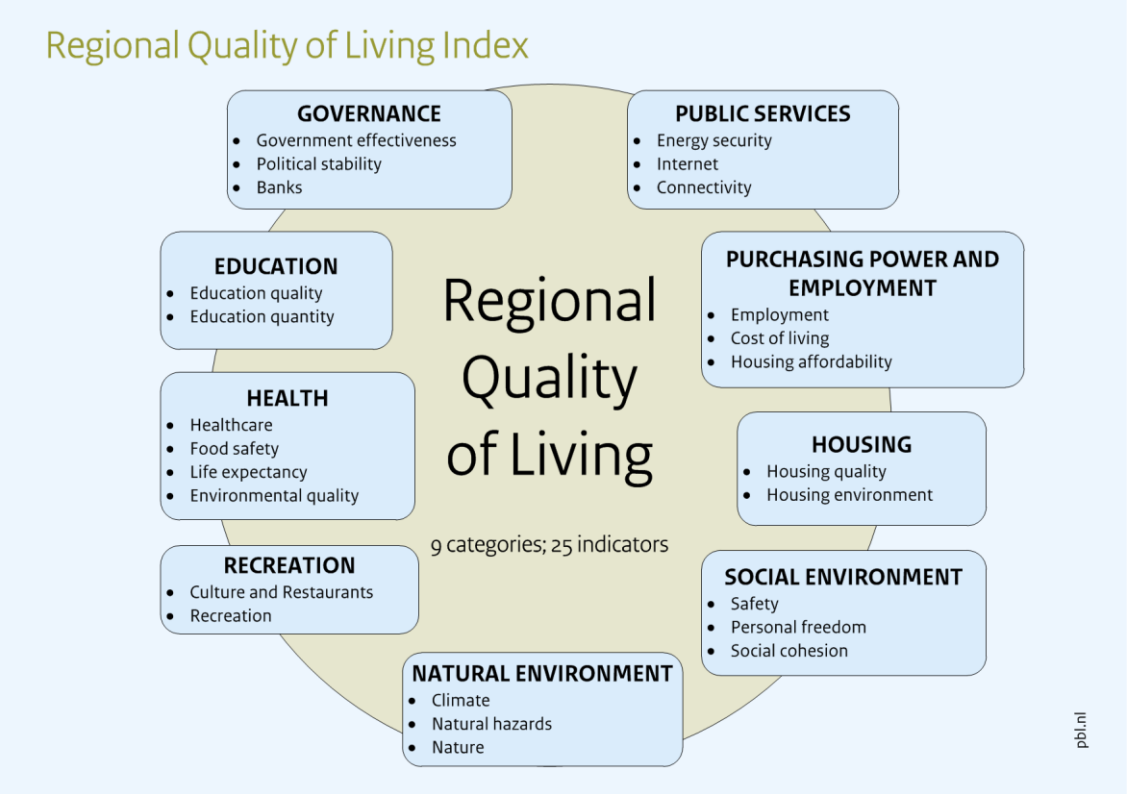


Figure 1 Indicators in the Regional Quality of Living Index, representing Governance and the Socioeconomic and Physical Environment.

Although our results on the Quality of Living mostly was based on objective data, we also used subjective data when objective regional data were unavailable. We took advantage of data acquired for a large, EC-funded project on measuring the Quality of Governance in the EU (DG Regional Policy, 2010). This involved a survey of approximately 34,000 EU citizens from 172 NUTS1 and NUTS2 regions in 18 EU member states based on survey questions concerning people's perceptions of the Quality of Governance. Data from the European Perception Survey (Eurostat, 2010) were also used.

2.2.3 Weighting factors

Weighting factors generally depend on the objective of the index in question. Indicators are often equally weighted in the literature. Category scores and the RQI were calculated using the 'equal weighting' method. The results of a robustness analysis with different weighting schemes are given in Section 2.3

2.3 Data calculation methods

The process of creating the RQI is shown in Figure 2. The databases used are given in Appendix 7.1 provides further details about which sub-indicators were used in the calculation of the 25 indicators. The indicators and categories data were converted to a scale of 1 to 10. The methods of data handling were performed according to an OECD handbook on constructing composite indicators (Nardo, Saisana, 2008).

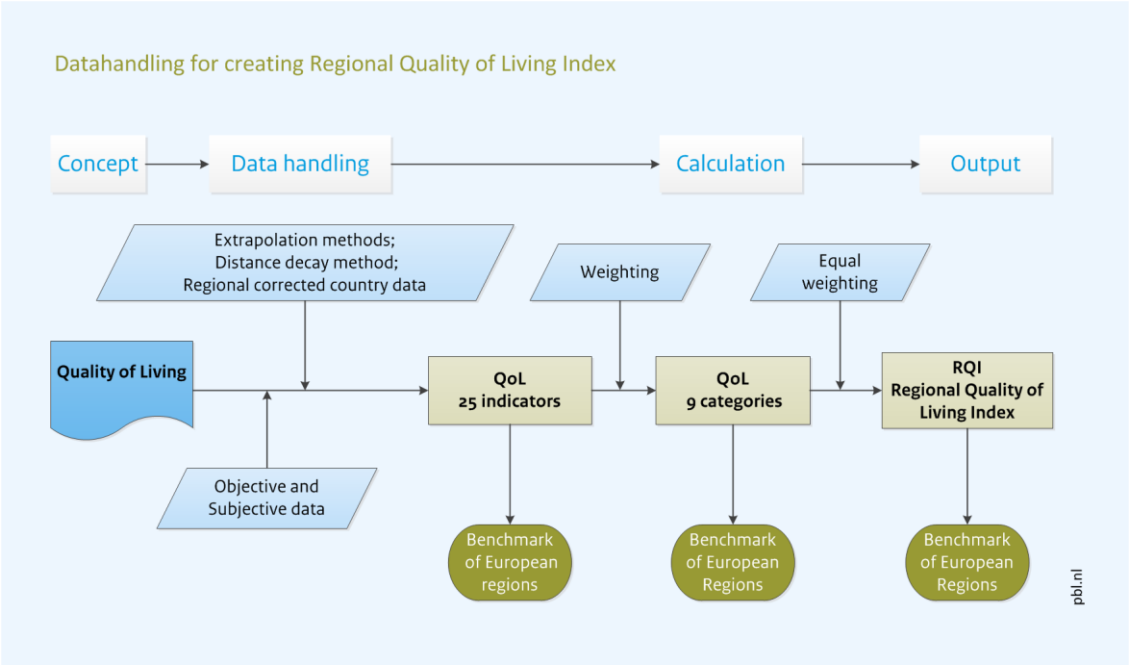


Figure 2 Diagram of the process of creating the Regional Quality of Living Index

Assumptions with regard to extrapolation of city data

City data from several databases (EEA - 500 cities; Urban Audit - 418 key cites; Perception Survey – 75 cities) were used for the calculation of the regional indicators. We assumed that most of the people living in a particular region live in the largest cities in that region. When a region contained two or more cities a population weighted average value was calculated and considered as representative for the region. For regions were no data were available, the average value of the NUTS1 level (or NUTS0) was sometimes used when – on the basis of expert judgement – it was assumed that this would be acceptable.

Calculation of indicators and sub-indicators

As shown in Appendix 7.2, most of the indicators were calculated with at least 2 and up to 7 sub-indicators. All indicators and sub-indicators were scored using the Max–Min method (Box 1). The score was normalised/scaled on the basis of the minimum and maximum score, resulting in a scoring from 1 to 10. For all indicators, a score of 10 represents the best and 1 the worst. Equation 2 was applied when a high negative value was scored for Quality of Living.

Disclaimer: Consequently a low index/category/indicator score does not automatically mean that the situation is bad or unacceptable, because only relative scores were calculated. Similarly, a high score does not mean that it is good or acceptable.

In some situations, outliers were responsible for very high or very low average values of the data set or a skewed distribution. When the average of the scaled data was lower than 4 or higher than 7, winsorisation of the data was applied by taking the 95 percentile value as the maximum and/or the 5 percentile value as the minimum (Nardo and Saisana, 2008).

When data were unreliable or unexplainable 'no data' (nd) were used. Expert judgement was applied to decide whether data were acceptable or not. For example, *nd* was entered for the Spanish, Portuguese and French islands off the European continent and for some data sets for Iceland and non-EU countries, such as Turkey, Switzerland, Norway, Croatia, Liechtenstein and Macedonia.

Box 1 Equation used to determine score of categories and indicators

Equation 1 $$\text{Value Y} = \frac{\text{X} - \text{Min}}{\text{Max} - \text{Min}} \times 9 + 1$$

Equation 2 $$\text{Value Y} = 10 - \frac{\text{X} - \text{Min}}{\text{Max} - \text{Min}} \times 9$$

- Value Y = score between 1 and 10 for a sub-indicator, indicator, category or RQI where 10 is the best score
- X = value original data set
- Min = minimum value original data set
- Max = maximum value original data set

Merging national data and perception data

When objective data only were available at national scale and subjective perception data were available on the regional scale, we used these data for regional differentiation. The national average of the perception data of the different regions inside a country was calculated. The deviation of this national average for a region was used to calculate regional values for the 'objective' national scale data. (*See Appendix 7.2.2 Merging national data and perception data*).

Distance decay method

A log-logistic 'distance decay method' (Appendix 7.2.1) was used for neighbourhood effects. For example, to which degree regions benefit when a nearby region has a university (see also Iacono et al., 2008). A matrix was developed for this purpose, containing the distances between all NUTS2 regions. See also *Appendix 7.2.1: Regional potential score calculated with Distance decay function*.

Robustness analysis

Calculations to determine the sensitivity of different weighting factors were carried out by applying the Ordered Weighted Averaging Method (Yager, 1996). This resulted in a high value for RQI (RQI OWA $_{max)}$ when the best scoring categories are given high weighting factors and low for the worst scoring categories; for this situation the focus is given to the best characteristics of a region. The RQI low value (RQI OWA $_{min}$) was calculated by applying highest weighting to the lowest scoring categories (Appendix 7.2.3, Equation 4). It was concluded that the weighting factors have little influence on the results because the difference in results between the two methods of weighting were relative small. The method and the results are described in *Appendix 7.2.3 Robustness analysis*.

3 RESULTS

3.1 Maps and information for 9 RQI categories

The maps of Europe for the 9 RQI categories are presented here. The legend of the maps shows values ranging from 1 to 10, where 10 is the highest score and 1, the lowest. The scores for these categories were calculated after averaging 2, 3 or 4 indicators in these categories.

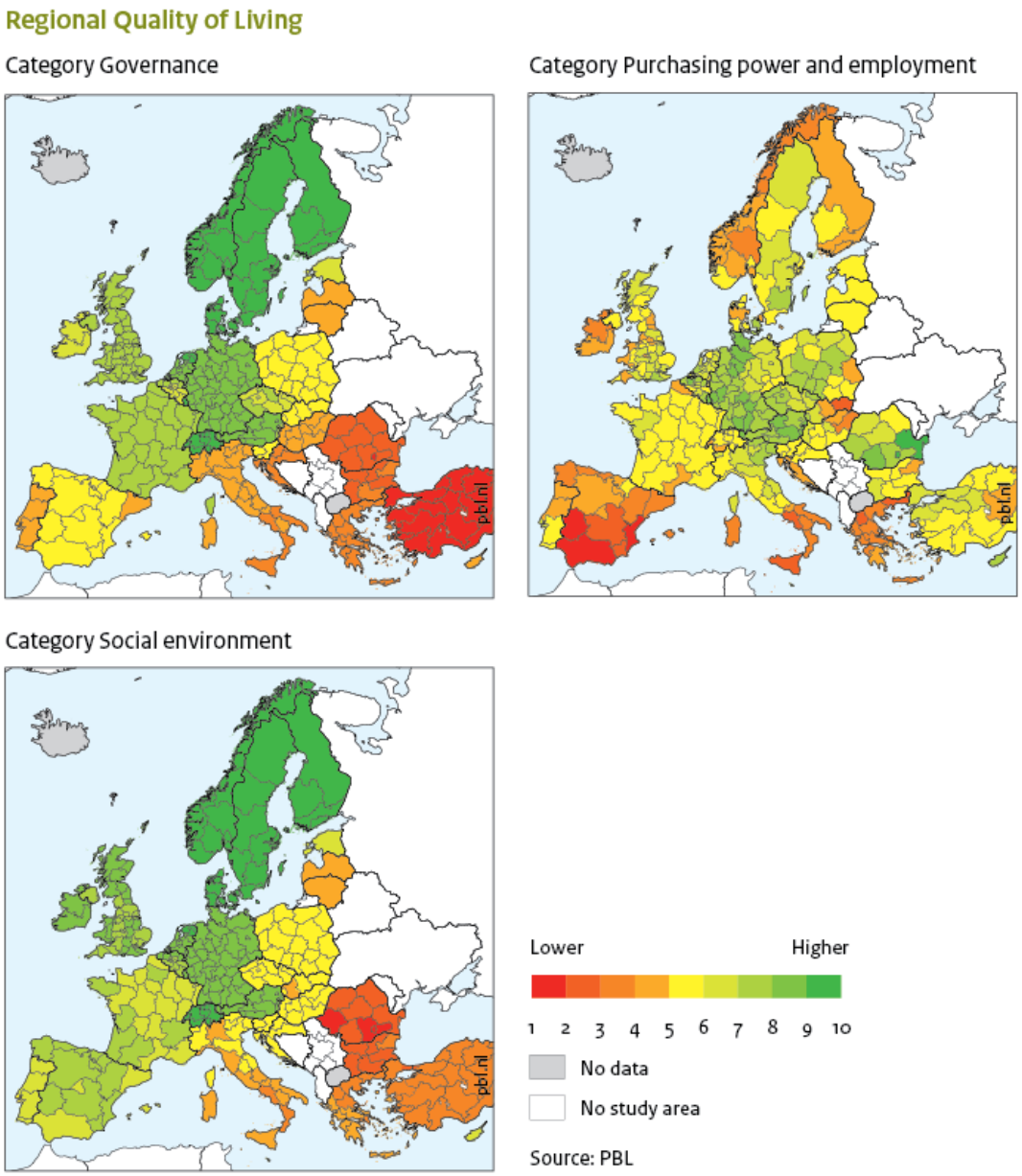


Figure 3 Maps of Europe for RQI categories *Governance*, *Purchasing power and employment,* and *Social environment*

RQI 1. Governance

Governance is an important factor for people when deciding to settle in a region. This was taken into account in all 'Quality of Living' indices. The category *Governance* was calculated with the indicators *RQI 1.1 Government Effectiveness, RQI 1.2 Political Stability and Terror* and *RQI 1.3 Banks.* Governance data were derived from the World Bank (World Governance Indicators, 2012), a recent study on regional variation in quality of government within the EU (DG Regional Policy, 2010) and from the World Bank (2012). Data on corruption were also taken into account, as well as EU regional statistics and perception data from the EU Urban Audit (Perception Survey, Eurostat, 2010). Data from the Global Peace Index were used (Vision of Humanity, 2012) for *Political Stability and Terror*. The scores for *Banks* resulted from a benchmark using OECD data on the soundness of banks taken from Sustainable Governance Indicators (OECD, 2011) and the Standard and Poor's credit rating per country. The northern countries of Europe showed the highest scores. The lowest scores were found in south-east Europe, including southern Italy.

RQI 2. Purchasing power and employment

Only non-business-related data important to people's Quality of Living were taken into account for each region. These indicators were used for several indices that rank the Quality of Living. The category RQI 2 *Purchasing power and employment* is the result of the average of three indicators: *RQI 2.1 Housing Affordability, RQI 2.2 Employment and RQI 2.3 Cost of Living.* For the *RQI 2.2 Employment* data for unemployment of people aged from 15 to 24, and 20 to 65, were derived from Eurostat's regional labour market statistics. Price level indices with a correction for income per capita were used for the *RQI 2.3 Cost of Living*. The indicator *RQI 2.1 Housing Affordability* refers to the property price per square metre, divided by income per capita. The highest scores were found in the centre of Europe with low values in Greece and Turkey, as well as the southern regions of Spain and Italy as a consequence of the poor economic situation in those areas.

RQI 3. Social environment

When people decide whether or not they intend to settle in a certain region, *Freedom*, *Safety* in the personal environment and *Social cohesion* are important factors, representing the *Social environment*. *RQI 3.1 Safety* was calculated with the indicators *RQI 3.1 Safety, RQI 3.2 Personal freedom and RQI 3.3 Social cohesion.* Data for *Safety* were obtained from DG Regional Policy research (Charron et al., 2012) and the EU perception survey. The indicator *RQI 3.2 Personal freedom* was constructed with country data from Sustainable Governance Indicators (OECD, 2012) with a regional correction. Regional data on *Voice and Accountability* were derived from a recent study on regional variation in the quality of government in EU member states (DG Regional Policy, 2010). The data for *Social cohesion* were derived from the European Social Survey (ESS, 2014) and Eurofound (2014). The northern countries show high scores, with good scores also for central Europe.

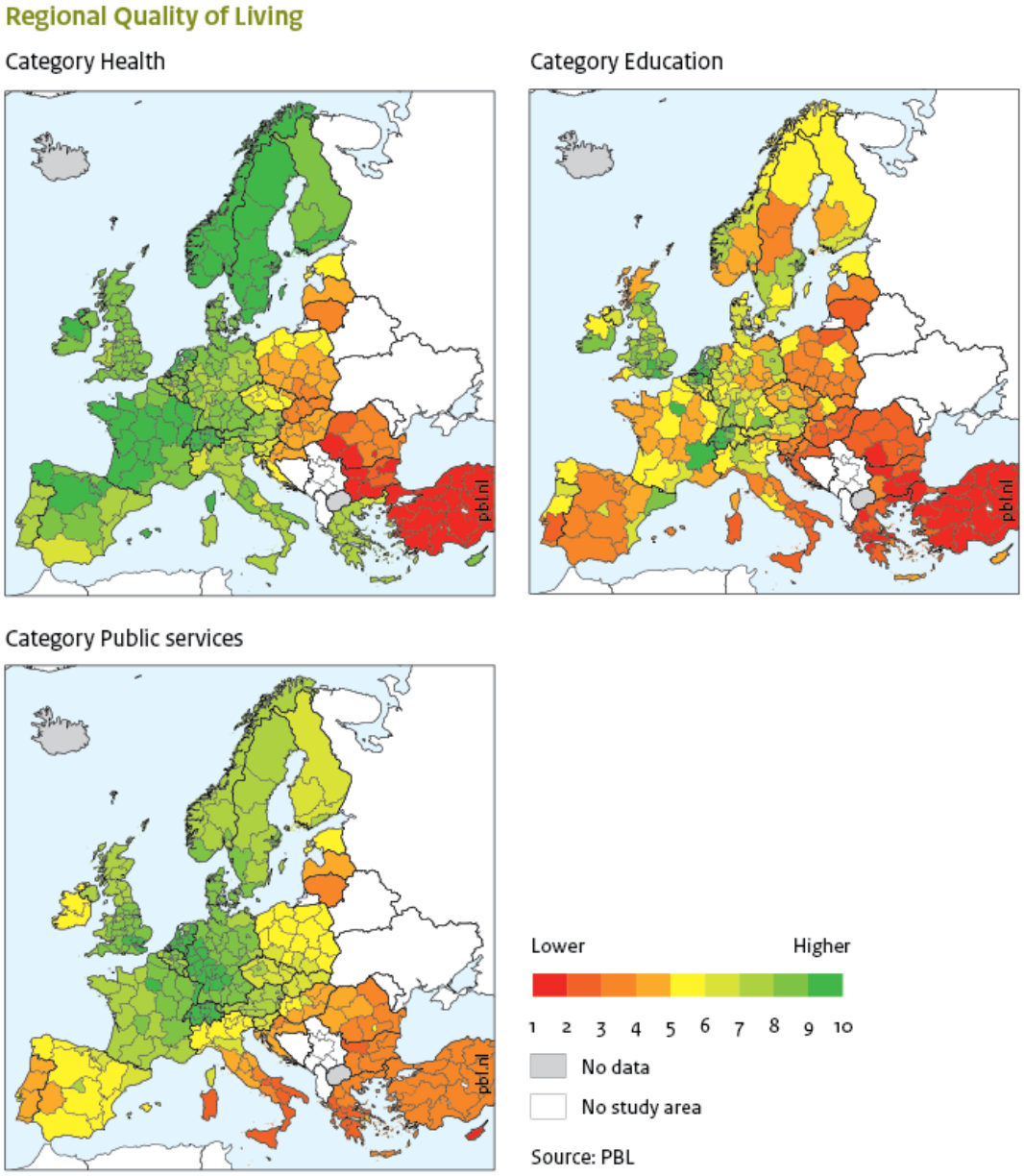


Figure 4 Maps of Europe for the RQI categories *Health*, *Education* and *Public services*.

RQI 4. Health

The category *Health* was calculated with four indicators. *RQI 4.1 Healthcare* represents the average of 7 sub-indicators of qualitative and quantitative aspects of healthcare. *RQI 4.3 Life Expectancy* includes life expectancy at birth and at the age of 65, and healthy years at the age of 50. *RQI 4.4 Environmental quality* was focussed on health effects as a consequence of environmental pollution. Objective data on air quality (particulate matter and ozone) and noise, as well as perception data were used for calculation of the score for *Environmental quality*. Most of these data were derived from the urban audit data 'Key Cities', a database on 416 cities (Eurostat, 2012) and European Environmental Agency (EEA, 2009). *RQI 4.2 Food Quality and Safety* is a country indicator that was derived from the Global Food Security

Index (EIU, 2012b). The map shows gradients from east to west and from south to north because there is a fairly strong correlation between health and GDP.

RQI 5. Education

Education is an important settlement factor for both companies and potential residents. The qualitative aspects (RQI 5.1) as well as the quantitative aspects (RQI 5.2) were considered. Quality standards and education opportunities (including higher education) are among the factors that people take into account when choosing to settle in a specific region. The data used for the indicator *RQI 5.1 Education quality* were derived from PISA (2012), university rankings and the EU Urban Audit (perception surveys). The 'Distance decay method' was applied for the indicator *RQI 5.2 Education quantity*. Regions near to those with universities benefit from this. The best scores were found in regions with a high population density, universities and foreign schools, as well as a positive correlation with regional GDP.

RQI 6. Public services

Public services are important to potential residents when deciding where to settle. This category includes information from the indicator *RQI 6.1 Energy security*, *RQI 6.2 Internet* and *RQI 6.3 Connectivity*. Data for *Energy security* were derived from the World Economic Forum where the use of renewable energy sources produces high scores. The data used for the *RQI 6.2 Internet* (availability and quality) indicator were derived from the EU Urban Audit. The indicator *RQI 6.3 Connectivity* refers to potential accessibility of the region by road, rail, and air (ESPON, 2011). In terms of connectivity inside the region, only data from the EU perception surveys (Eurostat, 2010) were available. The map shows high values for the central European regions with the highest population and GDP.

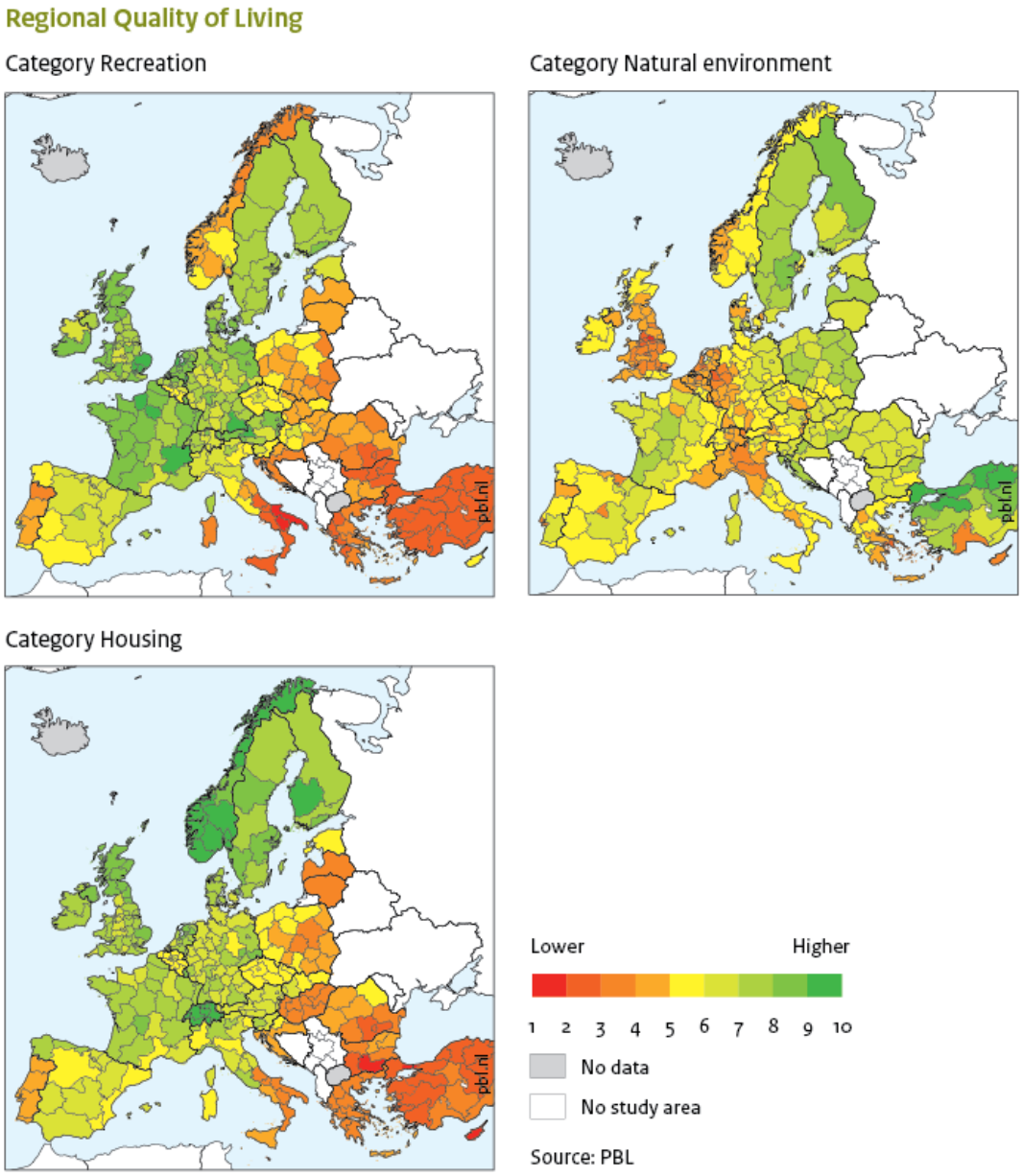


Figure 5 Maps of Europe for the RQI categories *Recreation*, *Natural Environment* and *Housing*.

RQI 7. Recreation

The presence of restaurants or cultural possibilities and recreational opportunities are factors that also determine the quality of the living environment. This category was calculated with data from the indicators RQI 7.1 *Culture and Restaurants* and RQI 7.2 *Recreation possibilities*. Regions near those with high ranking restaurants (e.g. with Michelin stars) benefit from this factor based on the Distance decay method. RQI 7.2 *Recreation* was calculated with data from Urban Audit – Key cities, LUCAS and the Perception survey. The highest values for *Recreation* were found in countries and regions with relative high GDP.

RQI 8. Natural environment

Although the natural environment and in particular climate cannot directly be influenced by policy measures, it is a factor that is taken into account when people choose to settle in a certain region. Three indicators were used for this: *RQI 8.1 Climate*, *RQI 8.2 Natural hazards* and *RQI 8.3 Nature*. Climate data on temperature and precipitation were taken from the EU Urban Audit. Regions with medium temperatures and precipitation levels generally scored best, as high and low levels are not comfortable to most people (KNMI, 2013). The indicator *RQI 8.2 Natural hazards* refers to the aggregated exposure potential for 11 Natural hazards, including floods, forest fires, droughts, earthquakes and tropical storms. The regions' integrated sensitivity and response capacity (ESPON, 2013) were also taken into account for this indicator. RQI 8.3 included *Land Use* (LUCAS-Eurostat, 2009) and biodiversity data. The map shows the reverse to the other categories as a consequence of high scores for regions with low risks for Natural hazards, a good climate and plenty of space for nature. These regions are mostly characterised by a low population density and a relatively low GDP.

RQI 9. Housing

Housing covers *RQI 9.1 Housing quality* which refers to the quality of both privately owned and rented housing and *RQI 9.2 Housing environment* which is made up of several sub-indicators, such as the amount of green space and green/blue urban areas, as well as data from the EU perception survey (Eurostat, 2010) with respect to satisfaction with the Housing environment, such as public spaces and greenery. The map shows a gradient from south to north, and from east to west further to a correlation between regional GDP.

3.2 Regional Quality of Living Index for European regions

3.2.1 Ranking of European regions for RQI

On a map of the European regions (Figure 6) the highest values for the Regional Quality of Living Index can be seen in western Europe. The average values for 9 categories were calculated. A gradient from south to north and from east to west can be observed ranging from values of 2 to 3 in Turkey, and 3 to 6 in eastern Europe, southern Spain and northern Italy, to values of 6 to 8.5 in northern and western Europe.

Figure 7 shows the highest scoring regions with more than 1 million inhabitants. The highest scores are seen in Swiss, Swedish, Norwegian and Dutch regions. The Dutch regions with more than 1 million inhabitants are all among the best 30 on the list. Relative high scores were also found for some Danish, German and British regions and the regions of Iles de France and Wien.

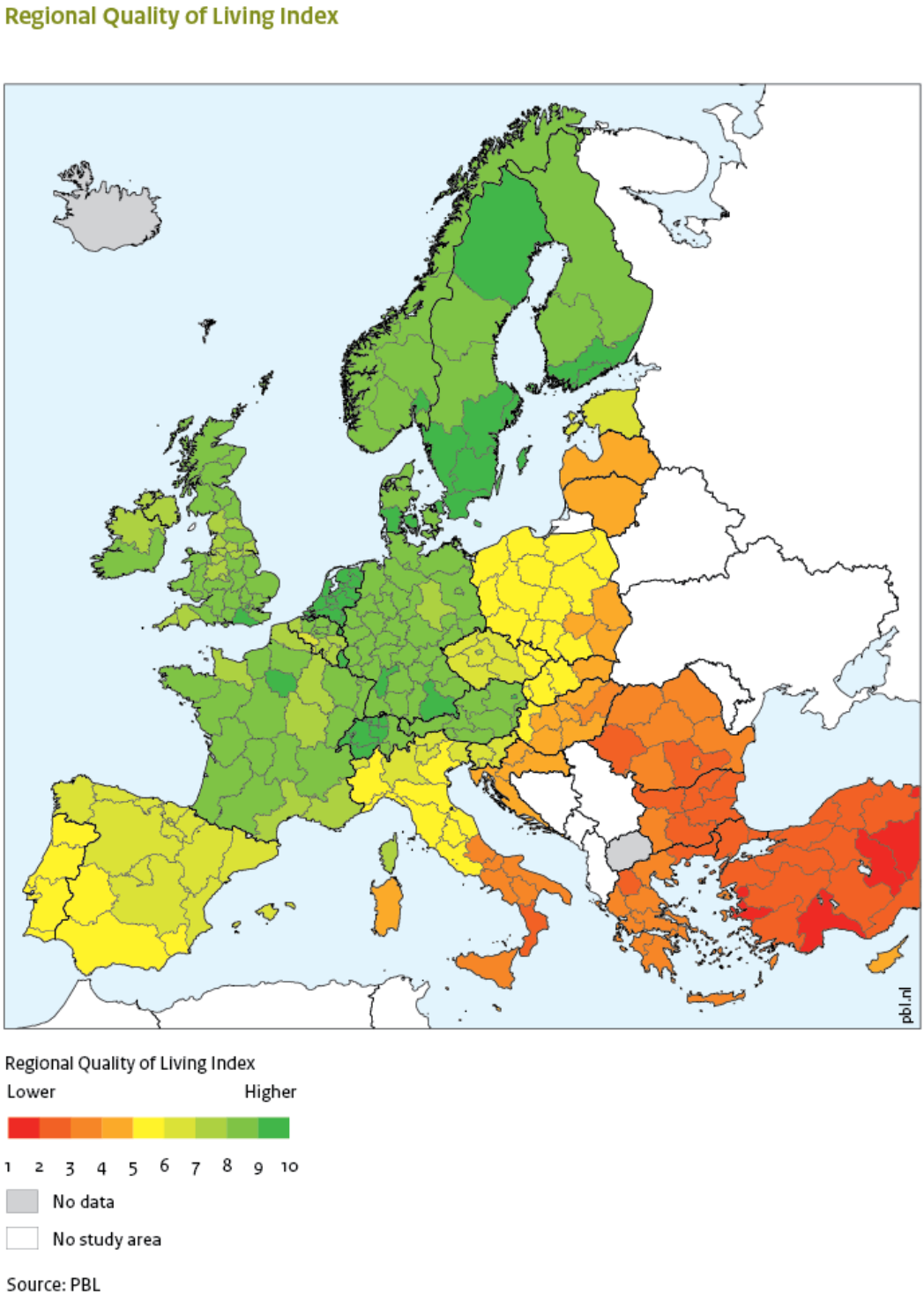


Figure 6 The Regional Quality of Living Index for European regions ranked on a scale of 1 to 10 (in which 10 is the best score).

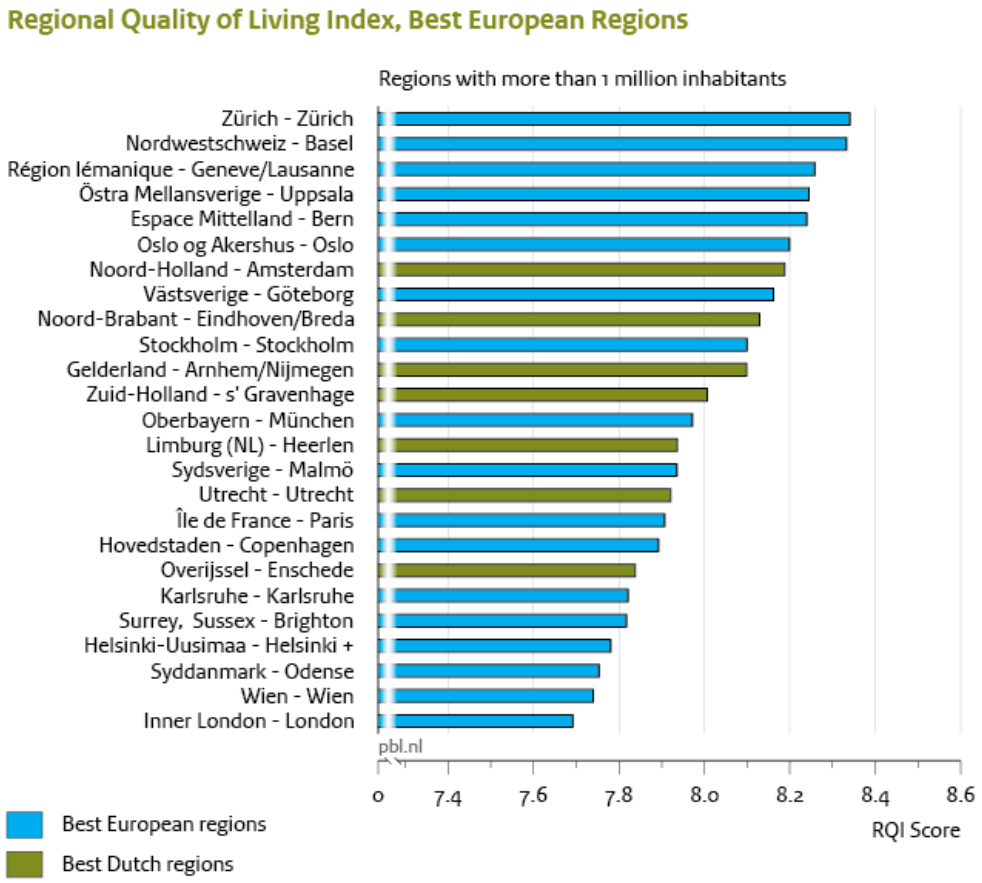


Figure 7 The highest scoring regions in Europe with more than 1 million inhabitants, according to the Regional Quality of Living Index with equal weighting for all the 9 categories. The figure shows the average value for 9 Quality of Living categories.

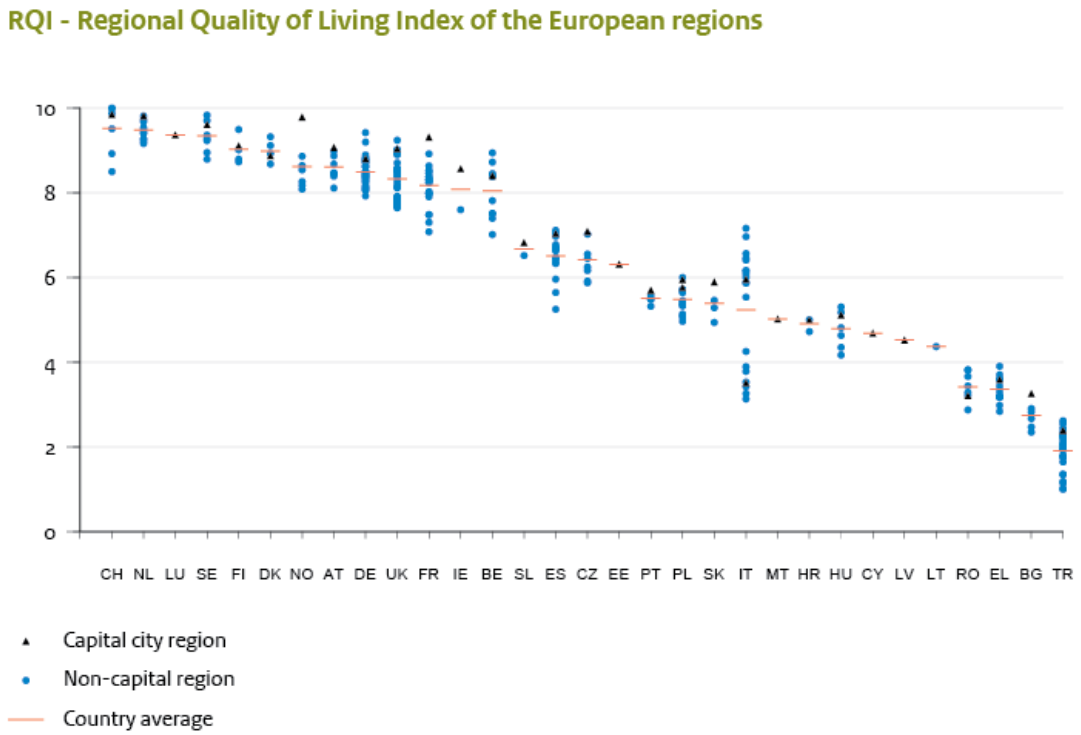


Figure 8 RQI values for the European NUTS2 regions, showing the average RQI value per country and its capital city

3.2.2 Regional differences in the Quality of Living in European countries

For 11 countries, the capital city region scored relatively higher than other regions in that country. Extremely high scores for RQI regions that included a capital city were found for Norway (Oslo region), Ireland (Dublin region), Czech (Prague region) and Slovakia (Bratislava region).

This was not the case, however, with Belgium (BE), Germany (DE), Greece (EL), Romania (RU) and Denmark (DK). In these countries, the regions that include the capital city are large with high population densities, and the Quality of Living scored relatively low compared to other regions in these countries. A large spread within countries was found for Italy (IT) and Spain (ES). The northern regions of both these countries scored better in terms of the Quality of Living.

3.2.3 Correlation of the RQI index with regional characteristics

The Quality of Living is significantly correlated with regional GDP/cap (Gross Domestic Product per capita), FDI/cap (Foreign Direct Investments per capita) and population density in the European regions (Figure 9). Foreign Direct Investment is a measure of the presence of foreign companies in a specific region. One of the aims of Dutch policy is to attract foreign companies to improve the Dutch economy. To account for potential outlier effects in the calculated correlations due to a skewed wide data range in some regional variables, the correlation has also been calculated for log-transformed data. Some correlations then became more prominent. Negative correlations are found for number of inhabitants and the area of the regions.

Low or even negative correlation for area and number of inhabitants is most likely the result of the underlying choice in which NUTS regions are composed. The number of inhabitants is the major factor and thereby determines the size of the area of a region.
The negative correlation for area can be explained by relative low population density and less economic activity with consequently fewer Public services, education and some other Quality of Living elements.

The correlation between the 9 RQI categories and GDP/cap showed positive correlations for all categories except Natural Environment (Table 2). This is the logical result of the negative correlation between *Nature* (forests, areas of protected nature) and *Natural hazards (*mostly rural areas with a low population density*)* and economic activity.

Improving the Quality of Living may contribute to increased economic activity resulting in a higher GDP/cap. Conversely, a high GDP/cap could lead to a better Quality of Living because there will be more money available for investment in better *Public services*, *Recreation*, *Health* and *Education*. Table 2 shows the strong correlation between these variables.

The strongest correlation between RQI and FDI/cap was found for the categories *Education*, and *Public services*. Foreign investment takes place in regions with high *Education* scores and good *Public services* such as *Connectivity* and *Internet* facilities. The weaker correlations between GDP and FDI for the category *Natural Environment* can be explained by the fact that these regions have a low population density.

The difference between GDP/cap and FDI/cap with respect to the RQI category *Health* is noteworthy. The score for *Health* seems not to be relevant for decisions concerning foreign investment, while the strongest correlations were calculated for GDP.

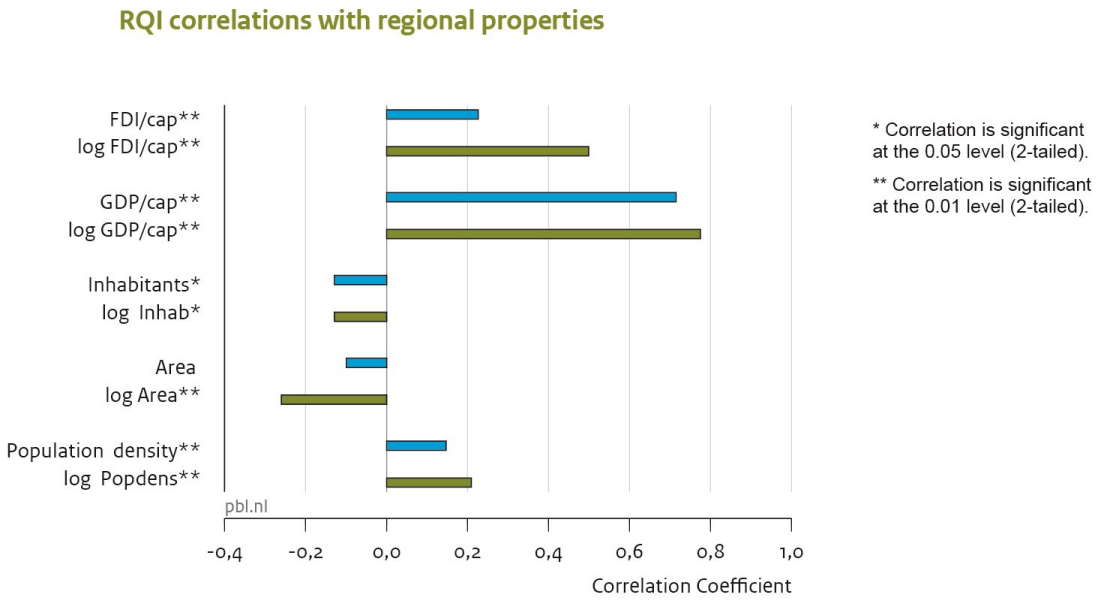


Figure 9 Correlation between RQI and some general regional variables

Table 2. Correlation between RQI categories and some general regional variables

	log GDP /cap	log FDI /cap	log population density
RQI 1 Governance	0.70	0.41	0.15
RQI 2 Purchasing power and employment	0.46	0.37	0.21
RQI 3 Social environment	0.75	0.34	0.12
RQI 4 Health	0.84	0.10	0.06
RQI 5 Education	0.68	0.65	0.48
RQI 6 Public services	0.64	0.56	0.39
RQI 7 Recreation	0.64	0.51	0.23
RQI 8 Natural Environment	-0.42	-0.26	-0.60
RQI 9 Housing	0.72	0.38	0.08

3.3 Comparison of Dutch regions with a benchmark for the best regions in Europe

A benchmark with the best 25 European regions (with respect to GDP per capita) will provide insight into the strengths and weaknesses of the Dutch regions. A benchmark with the Best in Europe will offer more information than a comparison with the average in Europe because the stages of development differ. Besides which, the aim of the Dutch policy is to be among the world's top ten countries.

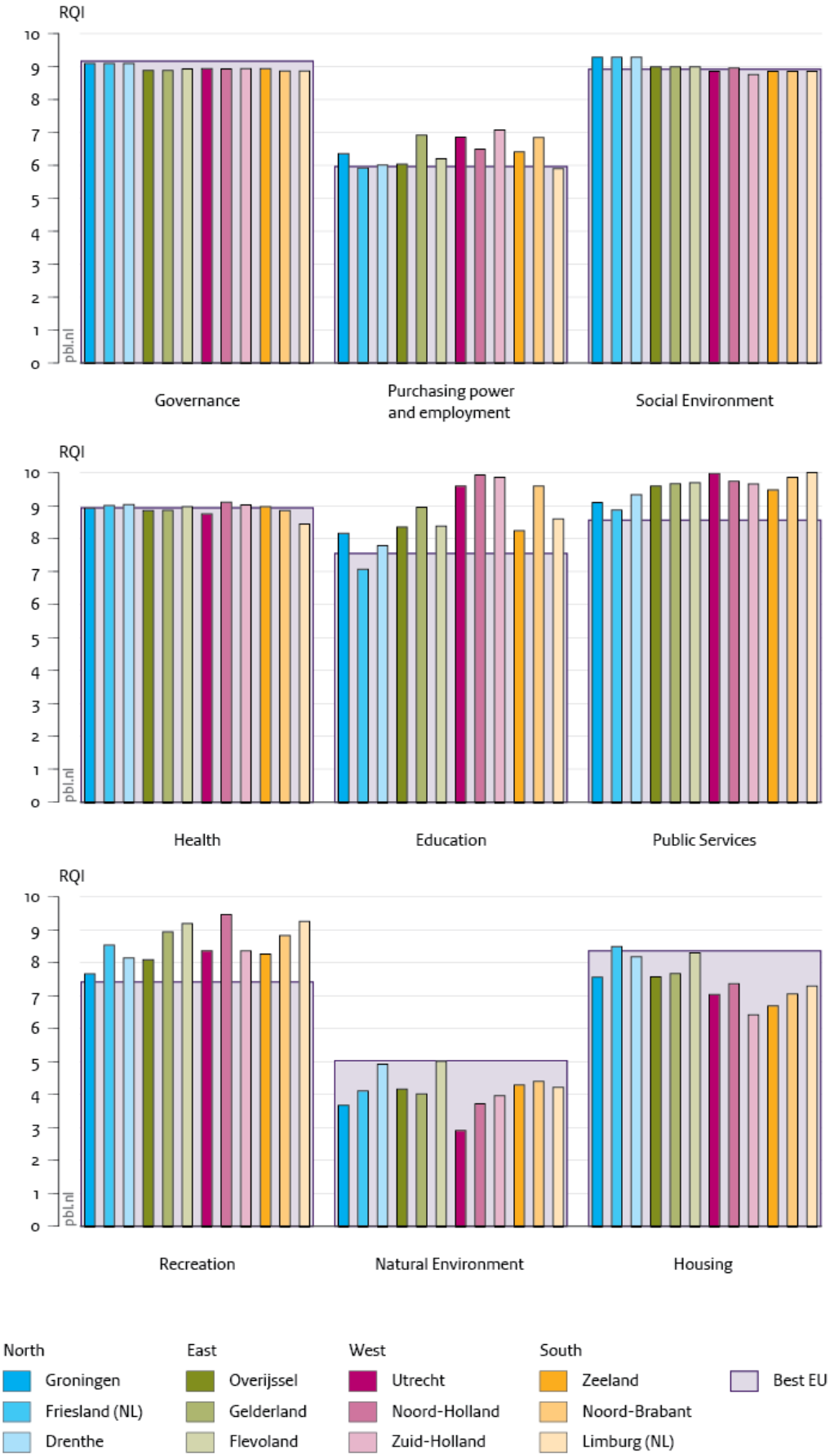
Dutch regions have better scores than the Best in Europe for categories *Education, Public services and Recreation*. Slightly higher values where found for the northern regions of the Netherlands for *Governance* and *Social environment* because there perceptions about the reliability of government, the incidence of corruption and personal safety differ from those in other parts of the country. The differences between regions for the category *Health* are very small and the scores are approximately the same as the average of Best in Europe. Better air quality, especially with regard to particulate matter, would improve the scores of the Dutch regions (see Appendix 7.3 and 7.4 Dutch regions vs Best in Europe; 25 indicators). The scores for *Education* are high as a result of several good universities in the vicinity. These universities are situated in the Randstad (western conurbation) so higher scores for Education are found there as a result.

The scores for *Purchasing power and employment* are sometimes better than or equal to the Best in Europe. Better scores can be achieved by realising low unemployment and improving the affordability of housing. The scores for *Public services* too, are higher than in the Best in Europe because connectivity by road, rail, and air and the internet are all very good. Scores for the indicator *Energy* are relatively low for the Netherlands because of the dependence on non-renewable energy sources. Several other European countries have higher percentages for renewable energy (see also Appendix 7.3). The score for *Housing* is better for the northern regions, where the quality of the *Housing environment* is more highly appreciated.

Next page -->

Figure 10 Benchmark for the 9 RQI categories comparing Dutch regions and Best in Europe.

Regional Quality of Living Dutch regions vs best 25 European regions



The scores for *Recreation* are slightly better than the Best in Europe. The relatively high scores for Flevoland, Noord-Holland and Limburg are due to the relatively large area available for recreational facilities, such as cycle paths, golf courses and tennis courts.

The Best in Europe regions and the Dutch regions have remarkably low scores than the other European regions for the *Natural Environment.* The average score for Best in Europe is 5. This is a result of the low values for all indicators in this category, *Nature, Natural hazards* and *Climate* (Appendix 7.3) . Flevoland scores best because *vulnerability to hazards* is low while the Randstad regions (western conurbation covering the provinces Noord-Holland, Utrecht, and Zuid-Holland) with the greatest population density, has the worst score.

3.3.1 Indicators that can be influenced by policy measures

With regard to the indicators for Quality of Living, which that can be influenced by policy measures it may be concluded that all the Dutch provinces scores better for *Governance Effectiveness* and *Internet* (Table 3). Almost all Dutch provinces scored better on *Employment (*low unemployment*), Connectivity, Culture and Restaurants, Recreation, Education quality and Education quantity*. The northern Dutch provinces sometimes showed lower scores as a result of their less central position compared to the Randstad regions. Population density in the Randstad regions is greater which results in a better score for *Education quantity and Connectivity* but worse scores for *Housing environment, Nature and Natural hazards.*

It should be noted that a red or yellow symbol does not mean that the standard for a specific indicator is unacceptable or insufficient. The standard of *Health Care* in the Netherlands (average score 8.1) is very good, for example, but compared to the best European regions (score 8.6) the symbol is yellow or red. *Housing quality* is also good in the Netherlands but it is also very good in the best European regions.

There are several possible measures which could improve the scores of the Dutch regions after benchmarking with the best European regions. Measures need to be focused not only on indicators with a relatively low score, but also on indicators with a high score, in order to maintain top positions. Some possible measures for environmental and spatial policy include:

- Creating a larger area for recreation with suitable facilities, for example, cycle paths, tennis courts or golf courses, and more green parks, especially in the Randstad regions. This will raise the scores for *Recreation possibilities* and *Housing environment.*
- Improving *Connectivity* by road, rail and air, particularly for the northern regions of the Netherlands.
- Creating larger areas for nature (*Natural Environment*) or green or blue (water) spaces in the cities of the region, which will result in better appreciation of *the Housing environment.*
- Making *Safety* improvements which will lead to a higher level of safety perception, especially in the big cities (*Social environment*).
- Improving air quality, especially with regard to particulate matter, and reducing noise will lead to better quality health and less noise nuisance in larger cities (*Environmental quality - Health*).

Table 3 The relative score of the Dutch regions compared to the benchmark of Best in Europe for a selection of 17 Quality of Living indicators that can be influenced policy measures

	Dutch regions											
Selection of RQI indicators which can be influenced with policy measures	Groningen	Friesland (NL)	Drenthe	Overijssel	Gelderland	Flevoland	Utrecht	Noord-Holland	Zuid-Holland	Zeeland	Noord-Brabant	Limburg (NL)
Government effectiveness	●	●	●	●	●	●	●	●	●	●	●	●
Unemployment	▲	●	▲	●	●	●	●	▲	▲	●	●	●
Housing affordability	●	◆	▲	◆	●	◆	▲	▲	●	◆	▲	◆
Safety	●	●	●	▲	▲	▲	▲	▲	◆	▲	▲	▲
Social cohesion	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Health care	▲	▲	▲	◆	◆	▲	▲	▲	◆	▲	▲	◆
Environmental quality	●	●	●	◆	◆	◆	◆	◆	◆	◆	▲	◆
Education quality	●	●	▲	●	●	▲	●	●	●	▲	●	●
Education quantity	▲	◆	▲	●	●	●	●	●	●	●	●	●
Internet	●	●	●	●	●	●	●	●	●	●	●	●
Connectivity	▲	▲	●	●	●	●	●	●	●	●	●	●
Culture and Restaurants	▲	●	●	●	●	●	●	●	●	●	●	●
Recreation possibilities	▲	●	●	●	●	●	●	●	●	▲	●	●
Natural hazards	▲	▲	●	◆	◆	●	◆	◆	◆	▲	▲	▲
Nature	◆	◆	●	▲	◆	▲	◆	◆	◆	◆	◆	◆
Housing quality	◆	◆	◆	◆	◆	▲	▲	▲	◆	◆	◆	◆
Housing environment	●	●	●	▲	●	●	◆	◆	◆	◆	◆	▲

● Score above the average of the 25 best European regions (> 0,5 score unit above)

▲ Score comparable to the average of the 25 best European regions

◆ Score below the average of the 25 best European regions (> 0,5 score unit below)

Disclaimer: a lower or average score does not mean that level or score is insufficient.

4 CONCLUSIONS

The Regional Quality of Living Index, using non-business-related indicators, could help to improve the attractiveness of regions, thereby encouraging people and companies to settle in these regions. The highest scores in the RQI were found for regions in Switzerland, Sweden, Norway and the Netherlands.

European regions

Some countries showed a wide divergence between regional scores. The southern regions of Italy and Spain, for example, had significantly lower scores than those in the north. In addition, regions in which the capital city is situated were found to have a better Quality of Living. with Germany, Belgium, Romania and Denmark being the exceptions.

Significant correlations were found between RQI and Gross Domestic Product (GDP) and Foreign Direct Investment (FDI) for European regions. Quality of Living is one of the factors that can to some extent be influenced by policy measures which could lead to an improvement in GDP and FDI.

Benchmark for Dutch provinces

Benchmarking Dutch regions alongside the best 25 European regions (Best in Europe in terms of GDP per capita) provides insight into the strengths and weaknesses of the regions in terms of the Quality of Living. The Dutch regions have remarkably higher scores than the Best in Europe regions for *Public services* and *Recreation* and often better scores for *Education*. The scores for *Purchasing power and employment* are higher for some regions and lower for others. The scores for *Governance* and *Social environment* are at the same level. The scores in the category *Natural environment* and *Housing* were lower than for the Best in Europe for almost all Dutch regions.

The regions in the Randstad (western conurbation of the Netherlands) showed higher scores for *Public services* (*Connectivity*; distance to Schiphol airport) and *Education (*several universities in the vicinity), but lower scores for *Social environment* as well as *Natural Environment* as a result of the greater population density than in other Dutch regions. The provinces of Flevoland and Noord-Holland had the highest RQI score of the Dutch regions. Although the province of Zeeland had the lowest score, this region is still one of the better regions of Europe.

The northern regions of the Netherlands showed lower scores because of lower scores for *Public services* (*Connectivity*; distance to Schiphol airport), *Education* and *Recreation*. Conversely, *Governance* and *Social environment* did better due to scoring better in perception surveys.

Opportunities for improving the Quality of Living in the Netherlands

The RQI score could be influenced with policy measures at national, regional and municipal levels. There is not much room to exercise influence over categories such as *Governance* and *Education* at regional level. However, regional environmental and spatial policy could be applied to improve the Quality of Living with measures such as:

- Creating a larger area for recreation with suitable facilities, for example, cycle paths, tennis courts or golf courses and more green parks, especially in the Randstad regions (*Recreation* and *Housing environment).*
- Improving *Connectivity* by road, rail and air, particularly for the northern regions of the Netherlands (see Appendix 7.3).

- Creating larger areas for nature (*Natural Environment*) or green or blue (water) spaces in the cities of the region (*Housing environment*).
- Making *Safety* improvements which will lead to a higher level of safety perception, especially in the big cities (*Social environment*).
- Improving air quality, especially with regard to particulate matter, and reducing noise nuisance in larger cities (*Environmental quality - Health*).

Improving the Quality of Living can help to make the Dutch regions more attractive for local residents and businesses as well as attract the personnel that companies need.

The RQI can be used to benchmark the Quality of Living in European regions. Improving the quality of the living environment could well help to achieve the policy ambitions of the Dutch government in elevating the Dutch regions into the top 10 most competitive economies in the world.

5 RECOMMENDATIONS

The design of a Regional Quality of Living Index which is presented in this report should be seen as an initial concept. Some suggestions for further improvements and potential applications will be given here.

- In order to monitor changes in the Quality of Living over time, consideration should be given to the methods of determining the scores for the various indicators. The methods applied resulted in relative scores and not absolute scores. This method will make it possible to show whether one region has improved more than another region. In terms of the primary purpose of the RQI, however, it is important not only to improve several aspects but also to achieve a higher ranking.
- Investigations should be carried out using functional units instead of NUTS2 regions. One option would be to combine regions as in the Regional Competitiveness Index (Dijkstra et al., 2012). In that study regions with high population density (Inner London, for instance) were combined with the surrounding region.
- Another option would be to investigate whether it would be possible to calculate the RQI at NUTS3 level or city regions for the Dutch situation. There is more data available for the Netherlands than for Europe.
- An investigation could be carried out for the Dutch regions to compare them with their specific equivalent regions. For each Dutch region and several economic activities equivalents would be identified and a benchmark created based on Quality of Living characteristics.
- The results of the RQI could then be used for comparison with the Quality of Life index (Boelhouwer, 2012) or a happiness index.
- Cluster analysis could be carried out to identify regions with similar characteristics in relation to the various categories. The problem with the European regions is that there are wide differences in economic development between the regions. This would allow regions to find, peers thereby creating a more useful benchmark for comparing regions.
- Assess the robustness of the ranking of the RQI outcomes with respect to the uncertainty in the data that are used for the (sub)indicators which constitute the RQI.

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7 APPENDIX

7.1 RQI indicators; databases, maps and sub-indicators

Choice of NUTS2 European regions

Data were collected for the European NUTS2 regions (NUTS2 codes 2010), in the same way as in the approach used for the EU Regional Competitiveness Index (Dijkstra et al., 2011 and Morais et al., 2011). This was consistent with research that has already been carried out for Dutch prime sectors and their European competitors (Raspe et al., 2012). Europe has 316 NUTS2 regions, 270 of which are in the EU27 and 46 in Turkey, Switzerland, Croatia, Northern Liechtenstein and Macedonia.

Data were collected for 463 European regions. Data on French, Portuguese and Spanish NUTS2 regions that are not on the European continent were not taken into account. Macedonia, Liechtenstein and Iceland were also missing from most data sets. Most of the analyses were therefore performed for 305 NUTS2 regions.

Table 4 NUTS 0, 1, 2 and 3 regions in Europe

	NUTS0 countries	NUTS1	NUTS2	Total
EU 27	27	97	270	394
Turkey	1	12	26	39
Norway	1	1	7	9
Switzerland	1	1	7	9
Croatia	1	1	3	5
Northern Ireland	1	1	1	3
Liechtenstein	0	1	1	2
Macedonia	0	1	1	2
Total	32	115	316	463

The databases that were used for the calculation of indicators are presented in Table 5. The sub-indicators that were used to calculate the indicator scores are given in Table 6 to 14. The maps of the indicator scores are presented in figure 11 to 19.

Table 5 Databases from which data were derived to calculate Regional Quality of Living scores.

Code	Database	Content
DG/RP	EU/ DG regional policy on Regional Governance Matters	NUTS2 regions
Eurofound	European Quality of Life Survey, 2011–2012	33 countries
EEA	European Environment Agency (EEA)	c. 500 European cities
ESS	European Social Survey	Countries -NUTS2- regions
ESPON TRACC	Potential Accessibility Travel Indicators	NUTS3 regions
ESPON	Hazard data	NUTS3 regions
GCB	Global Corruption Barometer (Transparency International)	32 countries
GFI	Global Food Security Index (Economic Intelligence Unit)	31 countries
GPI	Global Peace Index	32 EU countries
HRI	Human Rights Index / Cingranelli-Richards (CIRI)	31 countries
LUCAS	LUCAS - Land use and land cover statistics (Eurostat)	379 NUTS2 regions
OECD	Several databases	EU countries
Pisa	National Center for *Education* Statistics - Program for International Student Assessment	Countries
PPP	Eurostat / purchasing power parities	31 countries
RDS	Eurostat / Regional demographic statistics	NUTS2 regions
RegStat	Regional statistics (Eurostat)	379 NUTS2 regions
RHS	Eurostat / Regional health statistics	NUTS2 regions
RISS	Eurostat / Regional information society statistics	NUTS2 regions
RLMS	Eurostat / Regional labour market statistics	NUTS2 regions
SGI	Sustainable Governance Indicators (OECD)	24 EU countries
UA-Key	Key cities (Urban Audit; Eurostat)	418 Key cities
UA-PS	Perception survey (Urban Audit; Eurostat)	75 European cities
WDI	World Development Indicators (World Bank)	32 EU countries
WEF	World Economic Forum	32 EU countries
WIKI	Wikipedia various data	Cities/countries
WGI	World Governance Indicators (World Bank)	32 EU countries

RQI 1. Governance

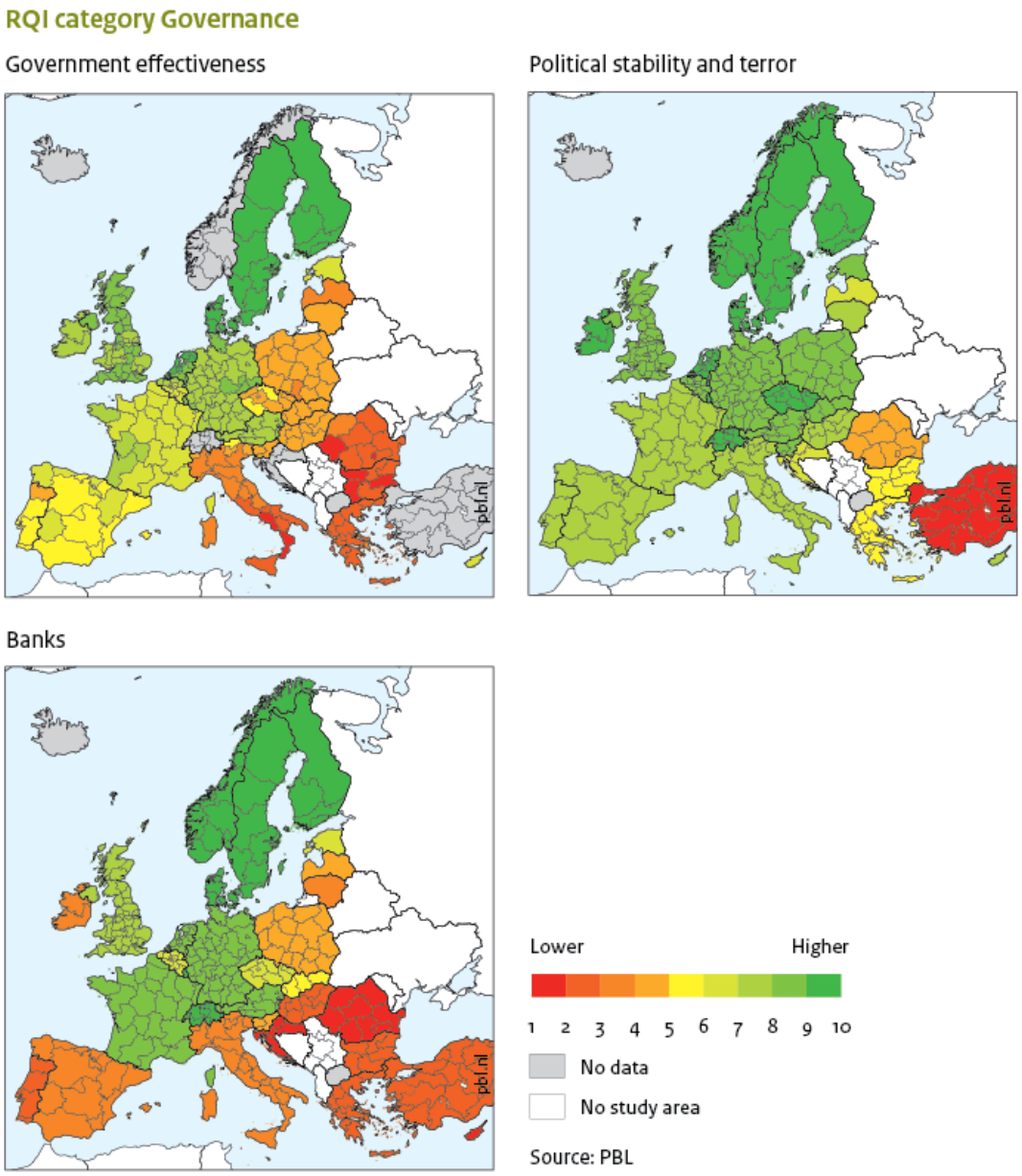

Figure 11 Maps of Regional Quality of Living indicators of the RQI category *Governance*

Table 6 Sub-indicators used to calculate indicators of the Regional Quality of Living category *Governance*

Name Indicator/ Sub-indicator	Data source (Table 5)	Year
RQI 1.1 Governance Effectiveness		
Government Effectiveness	WGI	2011
Regulatory Quality	WGI	2011
Rule of Law:	DG/regio	2009
Control of Corruption	DG/regio	2009
Corruption	GCB	2012
RQI 1.2 Political Stability and terror		
Political Terror Scale	GPI	2011
Political Stability and Absence of Violence/Terrorism:	WGI	2011
Physical Integrity Rights Index	GPI	2011
Political stability	HRI	2011
RQI 1.3 Banks (country indicator)		
Standard & Poor country ratings	WIKI	2013
Soundness of banks	SGI	2011

RQI 2. Purchasing power and employment

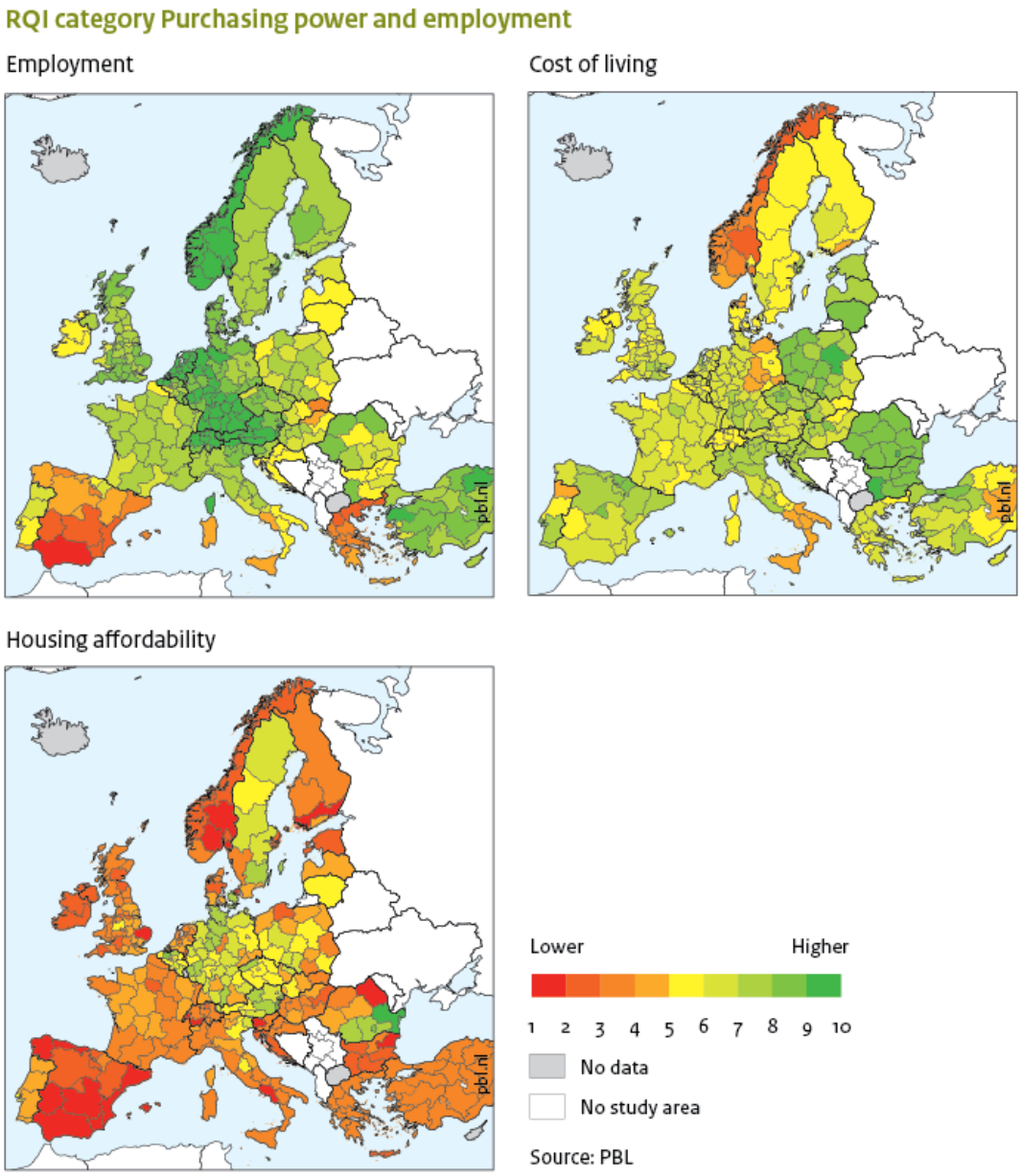

Figure 12 Maps of Regional Quality of Living indicators of the RQI category *Purchasing power and employment*

Table 7 Sub-indicators used to calculate indicators of the Regional Quality of Living category *Purchasing power and employment*

Name Indicator/ Sub-indicator	Data source (Table 5)	Year
RQI 2.1 Housing Affordability		
Price owner-occupied housing (relative)	UA-Key	2009
Price rented housing (relative)	UA-Key	2009
RQI 2.2 Employment		
Unemployment 15–24 year age group)	RLMS	2012
Unemployment 20–65 year age group)	RLMS	2012
RQI 2.3 Cost of living		
Price goods	PPP	2010
Price fuel/alcohol	PPP	2010

RQI 3. Social environment

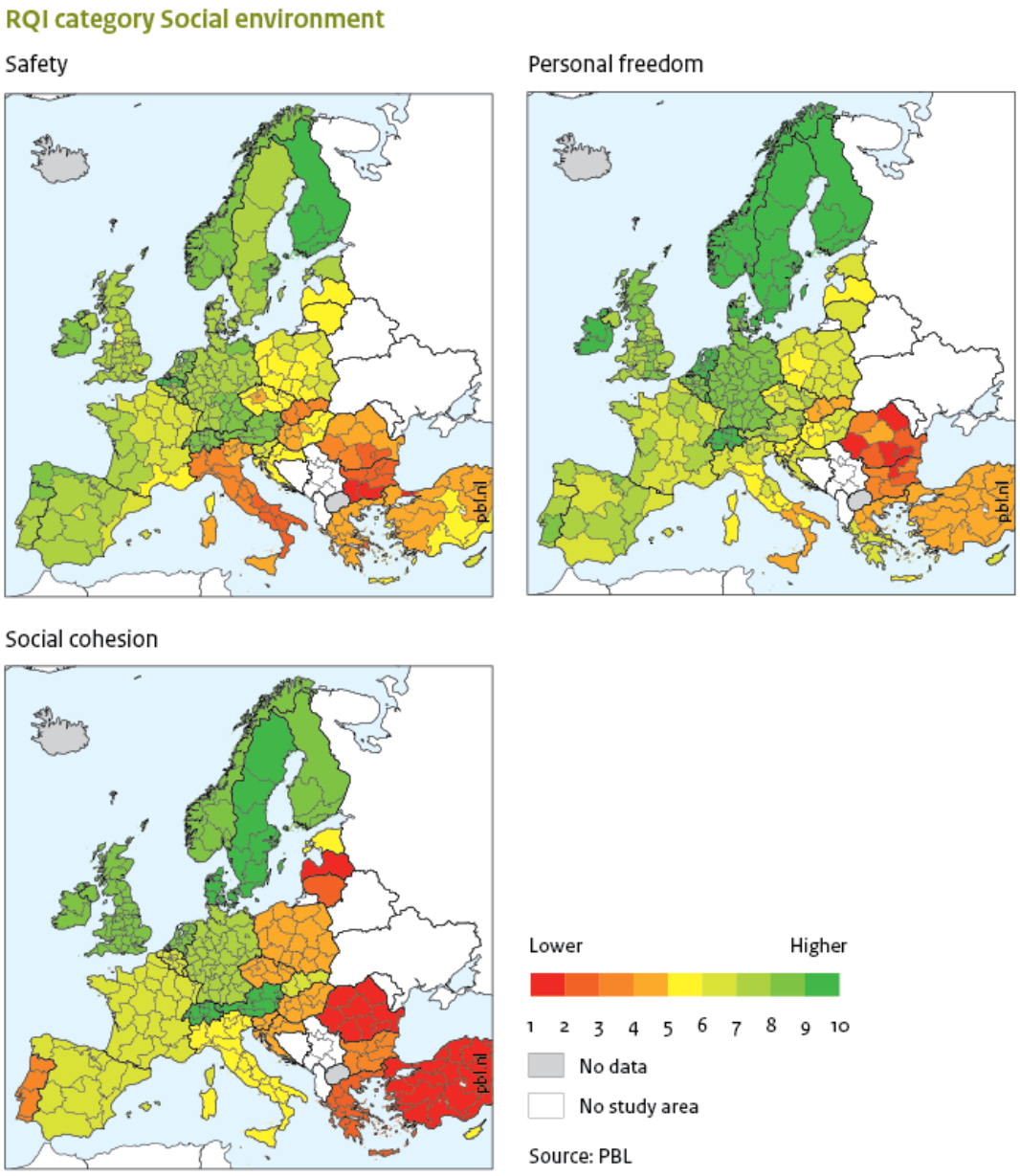

Figure 13 Maps of Regional Quality of Living indicators of the category *Social environment*

Table 8 Sub-indicators used to calculate indicators of the Regional Quality of Living category *Social environment*

Name Indicator/ Sub-indicator	Data source (Table 5)	Year
RQI 3.1 Safety		
Feel safe in this city	UA-PS	2009
Most people can be trusted	UA-PS	2009
Feel safe in this neighbourhood	UA-PS	2009
Business costs of crime and violence (Country data)	DG-RP	2011
Reliability of police services (Country data)	DG-RP	2011
Organised crime (Country data)	DG-RP	2011
RQI 3.2 Freedom (Country Indicator)		
Civil Rights	SGI	2011
Access to Information	SGI	2011
Voice and accountability	WGI	2011
RQI 3.3 Social cohesion (country indicator)		
Most of the time: people helpful or mostly looking out for themselves	ESS	2011
Important to help people and care for others well-being	ESS	2011
Important to be loyal to friends and devote to people close	ESS	2011
Participating in social activities of a club, society or association	Eurofound	2011
How often did you do unpaid voluntary work in the last 12 months?	Eurofound	2011

RQI 4. Health

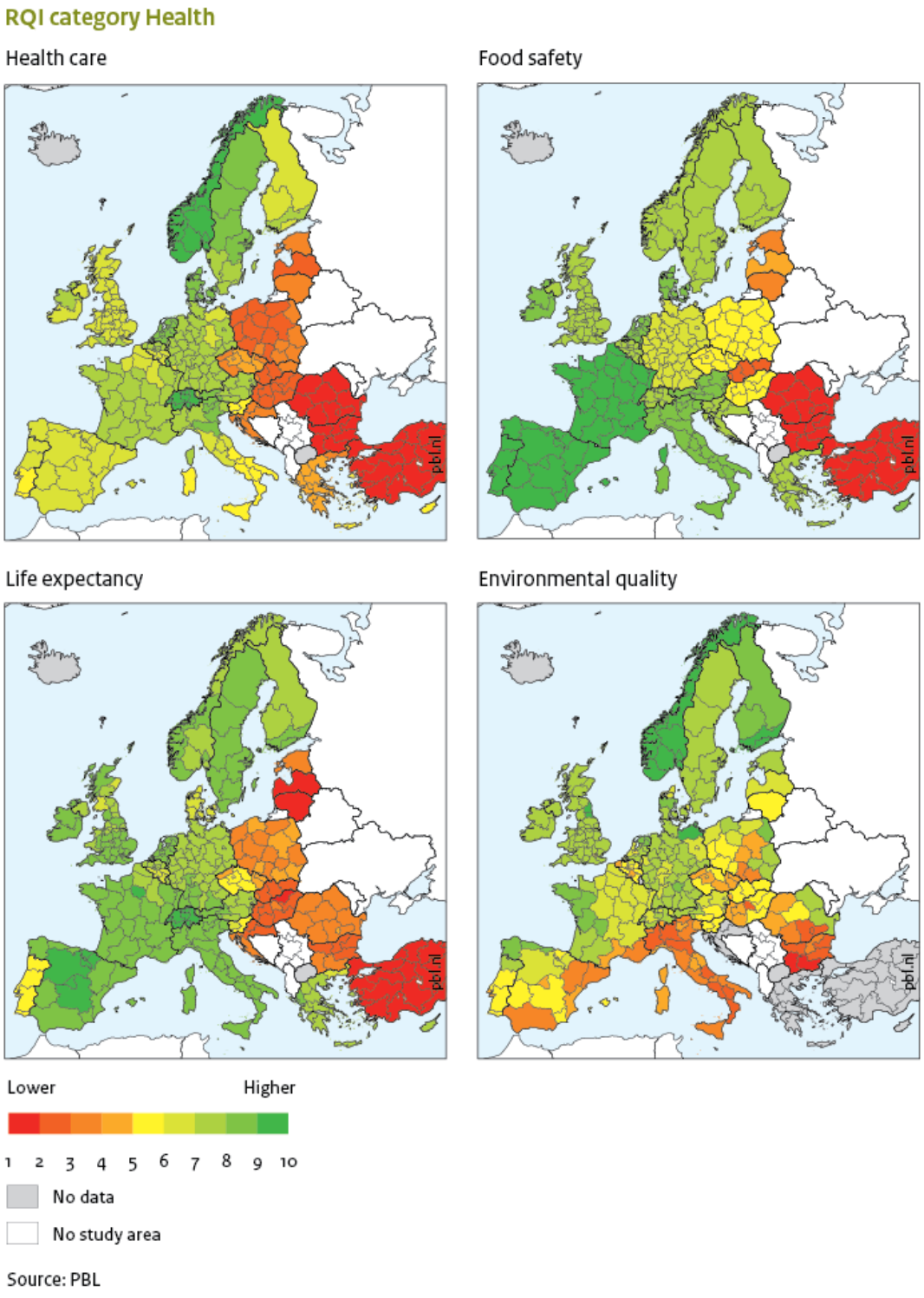

Figure 14 Maps of Regional Quality of Living indicators of the category *Health*

Table 9 Sub-indicators used to calculate indicators of the Regional Quality of Living category *Health*

Name Indicator/ Sub-indicator	Data source (Table 5)	Year
RQI 4.1 Healthcare		
Infant mortality rate	RDS	2009
Satisfied with hospitals	UA-PS	2009
Cancer death rate	DG/RP	2010
Per capita government expenditure on health	WHO	2011
Satisfied with healthcare	UA-PS	2009
Satisfied with doctors	UA-PS	2009
Heart disease death rate	DG/RP	2010
Per capita total expenditure on health at average exchange rate (USD)	WHO	2011
RQI 4.2 Food quality and safety		
Food quality and safety	GFI	2012
RQI 4.3 Life expectancy		
Life expectancy at given exact age	DG/regio	2010
Life expectancy at birth	OECD	2012
Life expectancy, Females at age 65	OECD	2012
Life expectancy, Males at age 65	OECD	2012
Number of years of healthy life expected	RDS	2010
RQI 4.4 Environmental quality		
Air pollution is a big problem here	UA-PS	2009
Noise is a big problem here	UA-PS	2009
This is a clean city	UA-PS	2009
Number of days ozone concentration exceeds 120 µg/m³	UA-Key	2011
Number of days particulate matter concentration (PM_{10}) exceeds 50 µg/m³	UA-Key	2011
Accumulated ozone concentration in excess 70 microgram/m^3	UA-Key	2011
Annual average concentration of PM_{10}	UA-Key	2011

RQI 5. Education

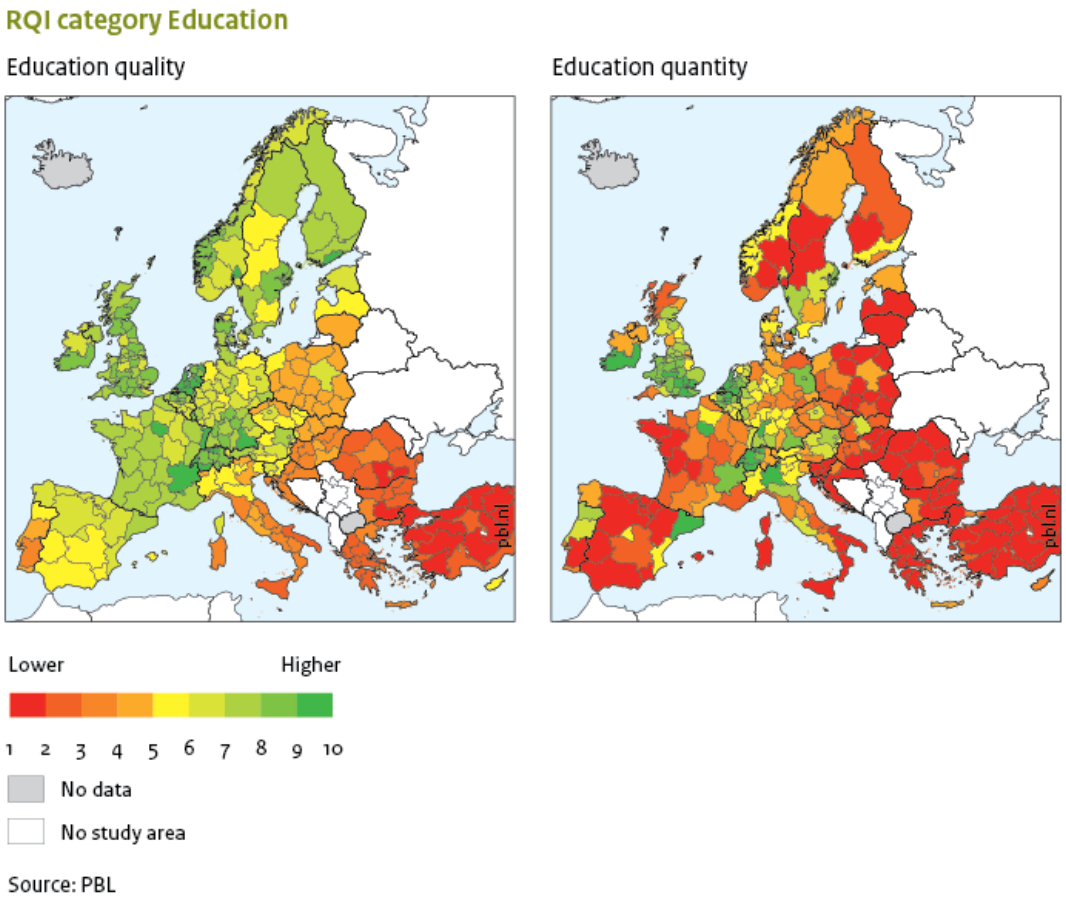

Figure 15 Maps of Regional Quality of Living indicators of the category *Education*

Table 10 Sub-indicators used to calculate indicators of the Regional Quality of Living category *Education*

Name Indicator/ Sub-indicator	Data source (Table 5)	year
RQI 5.1 Education quality		
Satisfied with schools	UA-PS	2009
Quality of University – best 20% in world = 5 etc.	WIKI	2012
PISA score	Pisa	2012
Aged 15 to 64 qualified at tertiary level (ISCED 5–6)	RegStat	2008
Number of foreign languages	OECD	2009
RQI 5.2 Education Availability		
Number of universities per region (Distance decay calculation)	WIKI	2012
N-international schools per region (Distance decay calculation)	WIKI	2012

RQI 6. Public services

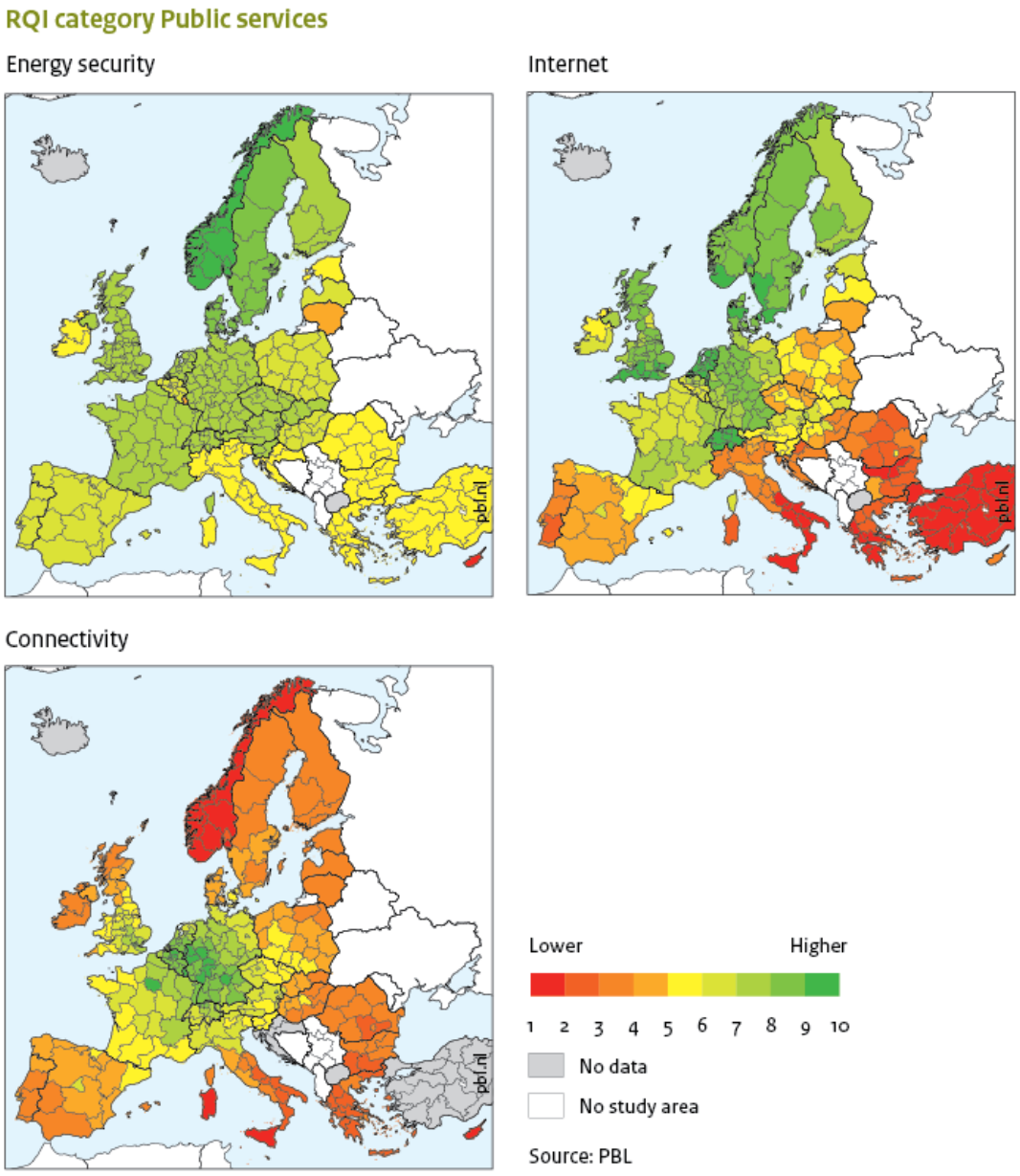

Figure 16 Maps of Regional Quality of Living indicators of the category *Public services*

Table 11 Sub-indicators used to calculate indicators of the Regional Quality of Living category *Public services*

Name Indicator/ Sub-indicator	Data source (Table 5)	Year
RQI 6.1 Energy security		
Energy security and access	WEF	2012
RQI 6.2 Internet		
Satisfied with public internet access	UA-PS	2009
Households with access to the Internet	RISS	2009
Households with broadband access	RISS	2009
Individuals who ordered goods or services over the Internet	RISS	2009
RQI 6.3 Connectivity		
Satisfied with public transport	UA-PS	2009
Rail accessibility	Espon – TRACC	2011
Road accessibility	Espon – TRACC	2011
Air accessibility	Espon – TRACC	2011

RQI 7. Recreation

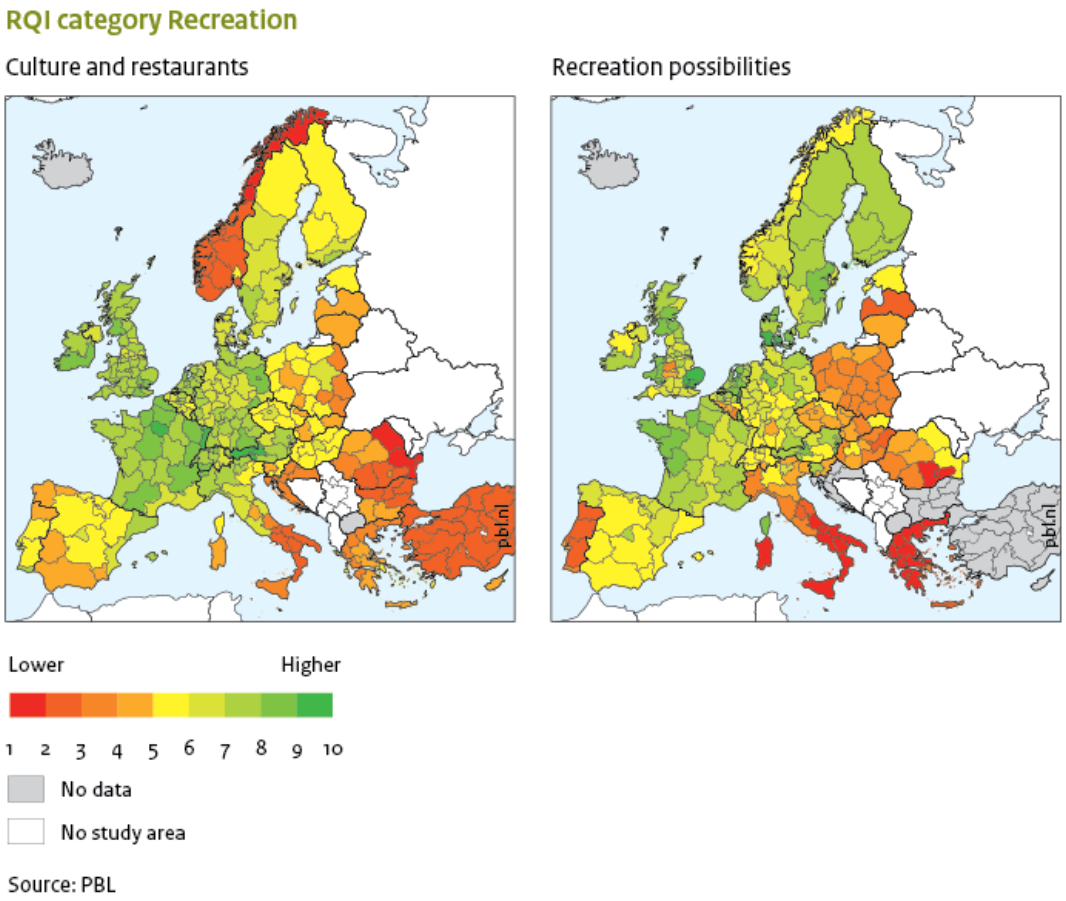

Figure 17 Maps of Regional Quality of Living indicators of the category *Recreation*

Table 12 Sub-indicators used to calculate indicators of the Regional Quality of Living category *Recreation*

Name Indicator/ Sub-indicator	Data source (Table 5)	year
RQI 7.1 Culture and Restaurants		
Michelin star restaurants (Distance decay calculation)	WIKI	2012
Satisfied with cultural facilities	UA-PS	2009
Satisfied with cinemas	UA-PS	2009
RQI 7.2 Recreation possibilities		
Satisfied with sports facilities	UA-PS	2009
Area for recreational sports and leisure use	UA-Key	2011
Land area for recreational sports and leisure use/cap	UA-Key	2011
Length of bicycle network	UA-Key	2011
Satisfied with outdoor recreation	UA-PS	2009
Recreation, leisure and sport	LUCAS	2009

RQI 8. Natural environment

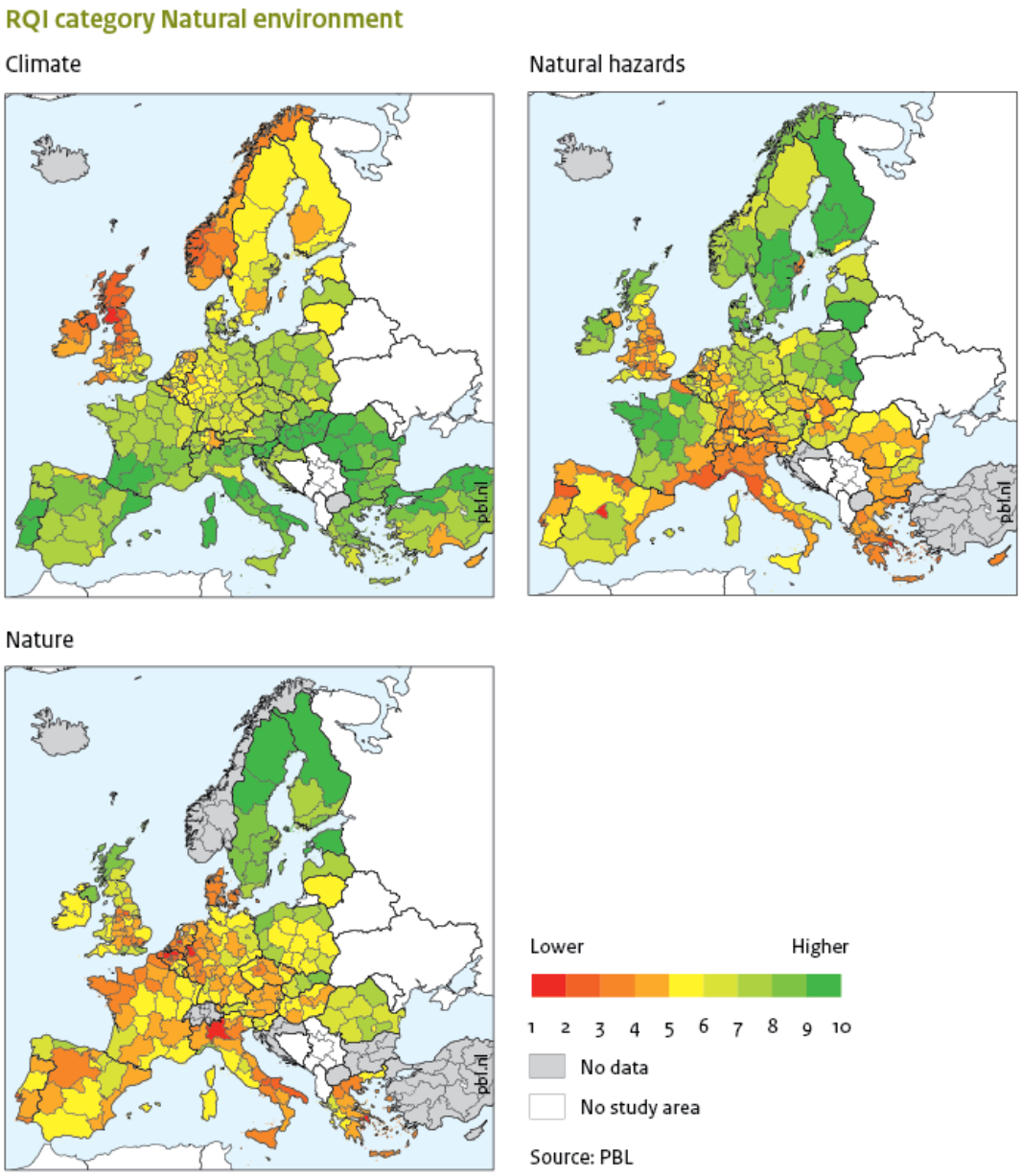

Figure 18 Maps of Regional Quality of Living indicators of the category *Natural environment*

Table 13 Sub-indicators used to calculate indicators of the Regional Quality of Living category *Natural environment*

Name Category Indicator/ sub-indicator	Data source (Table 5)	Year
RQI 8.1 Climate		
Number of days of rain per year	UA-Key	2011
Average number of hours of sunshine per day	UA-Key	2011
Average temperature of warmest month	UA-Key	2011
Average temperature of coldest month	UA-Key	2011
Rainfall	UA-Key	2011
RQI 8.2 Natural hazards		
Aggregated hazard exposure potential	ESPON	2010
Sensitivity and response	ESPON	2010
RQI 8.3 Nature		
Satisfied with outdoor recreation	UA-PS	2009
Recreation, leisure and sport	LUCAS	2009
Nature reserves	LUCAS	2009
Forestry	LUCAS	2009
Landscape Shannon Evenness Index	WIKI	2009

RQI 9. Housing

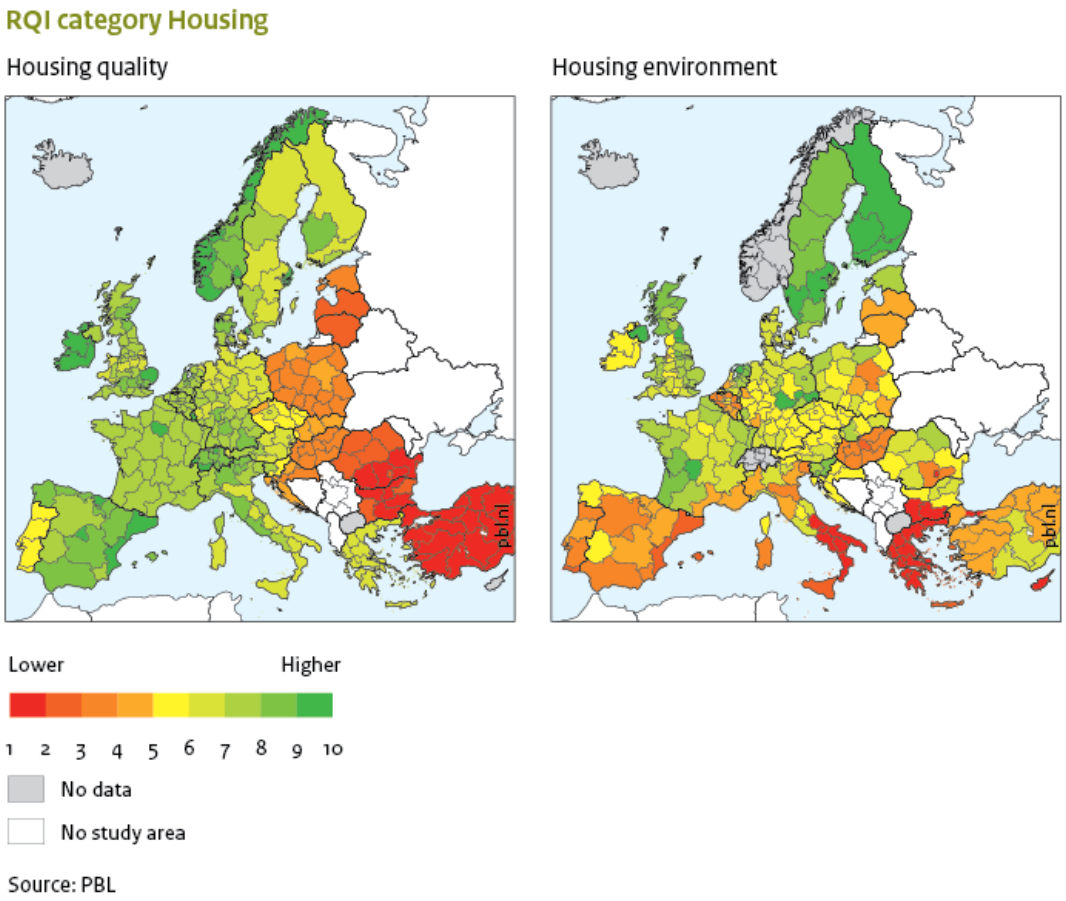

Figure 19 Maps of Regional Quality of Living indicators of the category *Housing*

Table 14 Sub-indicators used to calculate indicators of the Regional Quality of Living category *Housing*

Name Indicator/ Sub-indicator	Data source (Table 5)	Year
RQI 9.1 Housing quality		
Average price per m^2 – apartment	UA-Key	2009
Average price per m^2 – house	UA-Key	2009
Rooms per person	YBLI	2009
Dwellings with basic facilities	YBLI	2009
RQI 9.2 Housing environment		
Satisfied with green space	UA-PS	2009
Satisfied to live in this city	UA-PS	2009
In 5 years, it will be more pleasant to live here	UA-PS	2009
Satisfied with public spaces	UA-PS	2009
Green space (in m^2) to which the public has access, per capita	UA-Key	2009
Proportion of the area in green space	UA-Key	2009

7.2 Methods of data calculation (more details)

7.2.1 Distance decay method

Equation 3 (see Box 2) was used for the Distance decay method. The relationship between distance (d) and weighting (w_j) can be modelled using the Distance decay function. The parameters a and b determine the steepness and throughput of the curve.
These parameters can be estimated with empirical data. The result is an S-curve starting with a plateau, followed by a fast decline and ending with a tail (Figure 20). A matrix was developed for this purpose, containing the distances between all NUTS2 regions (matrix of 316 x 316). We assumed that having a university within a distance of 25 kilometres gave a benefit of 50% and within a distance of 100 km a benefit of 20%. The maps for the sub-indicator *Restaurants* (Figure 21) show the difference between when the Distance decay function is applied and when not.

Box 2. Equation used to calculate distance decay correction

Equation 3

$$P_i = \sum_{j=1}^{N} \frac{x_j}{1 + e^{(a+b*\ln(d_{i,j}))}}$$

P_i = potential score of region i
x_j = number of universities in region j
$d_{i,j}$ = distance between region i and region j
a = variable for start distance for decay of the curve
b = variable for steepness of the curve

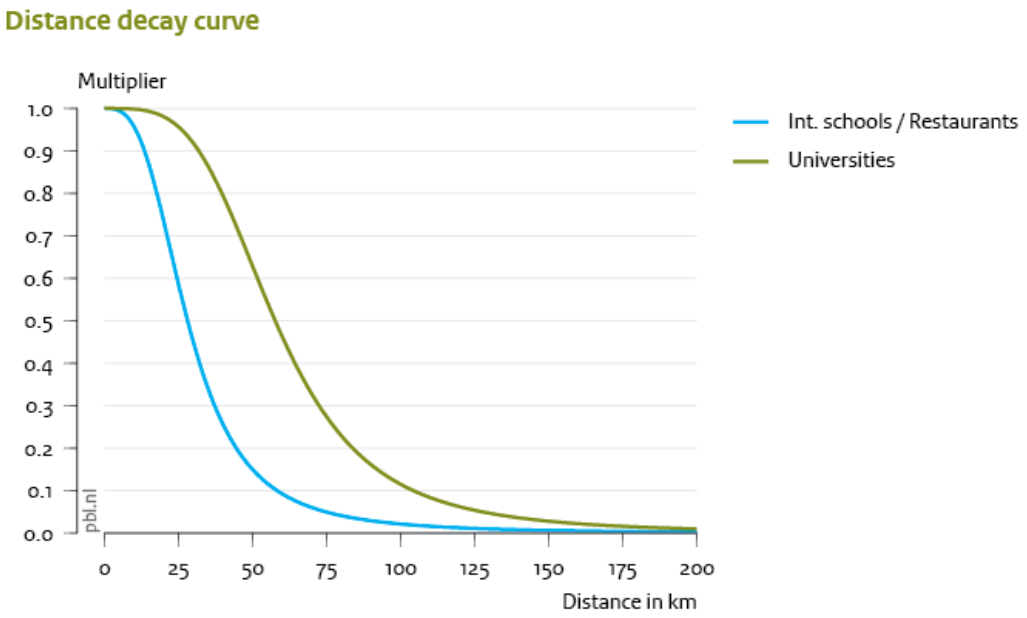

Figure 20 Distance decay functions for universities, international schools and Michelin star restaurants

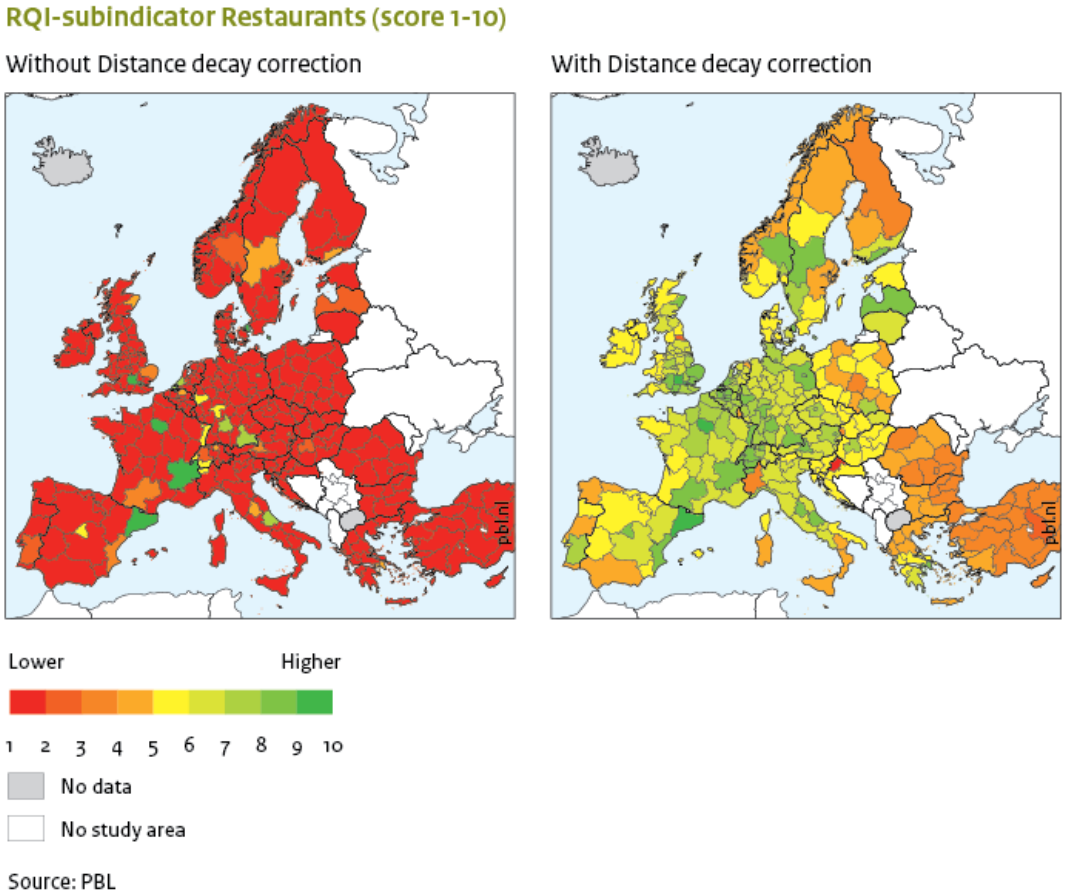

Figure 21 Map of European regions for sub-indicator Restaurants from Regional Quality of Living Index calculated without and with Distance Decay Correction.

7.2.2 Merging national data and perception data

When objective data only were available at national scale and perception data were available on the regional scale, we used these data for regional differentiation. The national average of the perception data for different regions inside a country was calculated. The deviation of this national average for a region was then used to calculate a regional value (Charron et al., 2012). (see Box 3).
For example when a country indicator A tells that Italy scores 7 and for region indicator B for South Italian region scores 5 and a North Italian region scores 8 while the country average of all regions is 7,4. Than the result after considering two indicators is that the North Italian region scores 7*(8/7,4)=7,57 and the South Italian region scores 7*(5/7,4)= 4,72.

Box 3 Equation used to calculate regional correction of national data

Equation 4

$$\text{RI (reg. X in country Y)} = \text{CSI (country Y)} \times \frac{\text{RSI (region X)}}{\text{avg RSI regions in country Y}}$$

- RI (reg. X in Country Y) = regional score for indicator (I) in region X in Country Y
- CSI (country Y) = Country sub-indicator value for Country Y which was used for calculation of one of the *25 indicators* of RQI
- RSI (region X) = Region sub-indicator value for Region X was used for calculation of one of the *25 indicators* of RQI
- Avg RSI regions in country Y = average value of region indicator RI of regions in Country Y
- Remark: the formula only could be used when sd (Europe countries) > or = sd (regions within country)

7.2.3 Robustness analysis

Calculations to determine the sensitivity of different weighting factors for the categories were carried out using the Ordered Weighted Averaging method (Yager, 1996; Box 4). Random weighting factors were generated for 5000 calculations. The RQI $_{\mathbf{OWA\ max}}$ and a RQI $_{\mathbf{OWA\ min}}$ were calculated. RQI $_{\mathbf{OWA\ max}}$ is the result of a calculation when the best characteristics of a region are focused on by applying higher weighting factors to these indicators. A Weighting of 9 for best scoring category; 8 for the second best ……and 1 for the worst scoring category. RQI $_{\mathbf{OWA\ min}}$, by analogy, is the same calculation when the worst indicator scores for a region are given a higher weighting than the best. These values help to show the robustness of the calculated value for RQI. Figures 22 and 23 show that the scores of NUTS 2 regions will change when either the best characteristics of a region or its worst characteristics are made the focus.
Figure 24 shows the different scores for the Dutch regions. Utrecht has the lowest score for RQI OWA min because it had the lowest extreme value.

Box 4 Equation used to calculate Regional Quality of Living Index (RQI) with different weighting factors

Equation 5

$$\text{RQI}_{\text{OWA}}\ (c_1, c_2, \ldots c_9) = \sum_{i=1}^{9} c_{(i)} w_i \ / \sum_{i=1}^{9} w_i$$

- C_i = score for category i
- W_i = Weighting factor; ranked from high to low
- RQI owa = Ordered Weighted Averaging value for RQI
- Calculation RQI $_{\mathbf{OWA\ max}}$: c_i ordered $c_{i,\ max}, \ldots, c_{i\ min}$ Aim is to obtain an RQI score for the best characteristics of a specific region
- Calculation RQI $_{\mathbf{OWA\ min}}$: c_i ordered $c_{i,\ min}, \ldots, c_{i\ max}$ Aim is to obtain an RQI score for the worst characteristics of a region

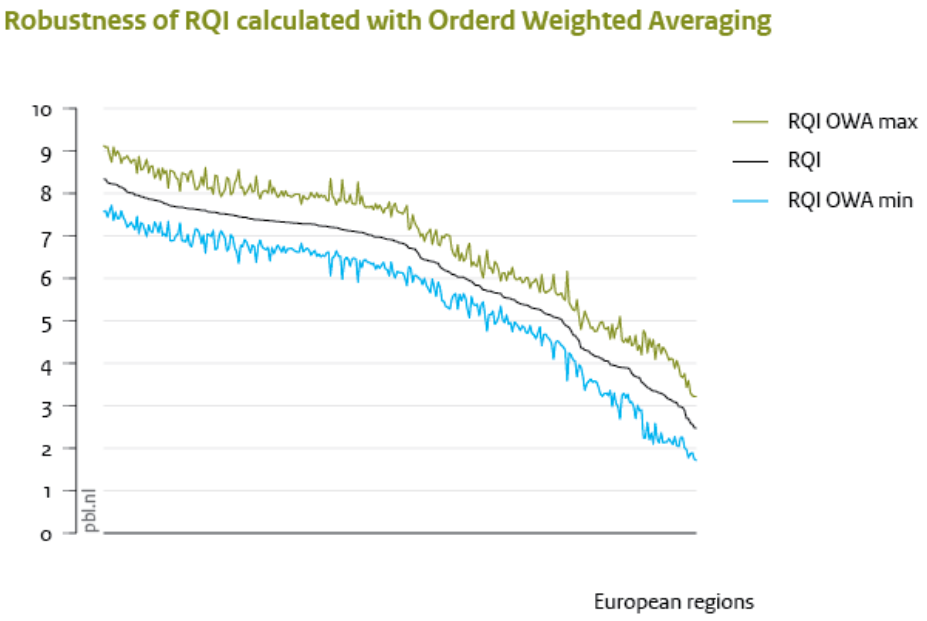

Figure 22 Robustness analyses for Regional Quality of Living Index (RQI) scores after applying Ordered Weighted Averaging for different weightings of 9 Quality of Living categories

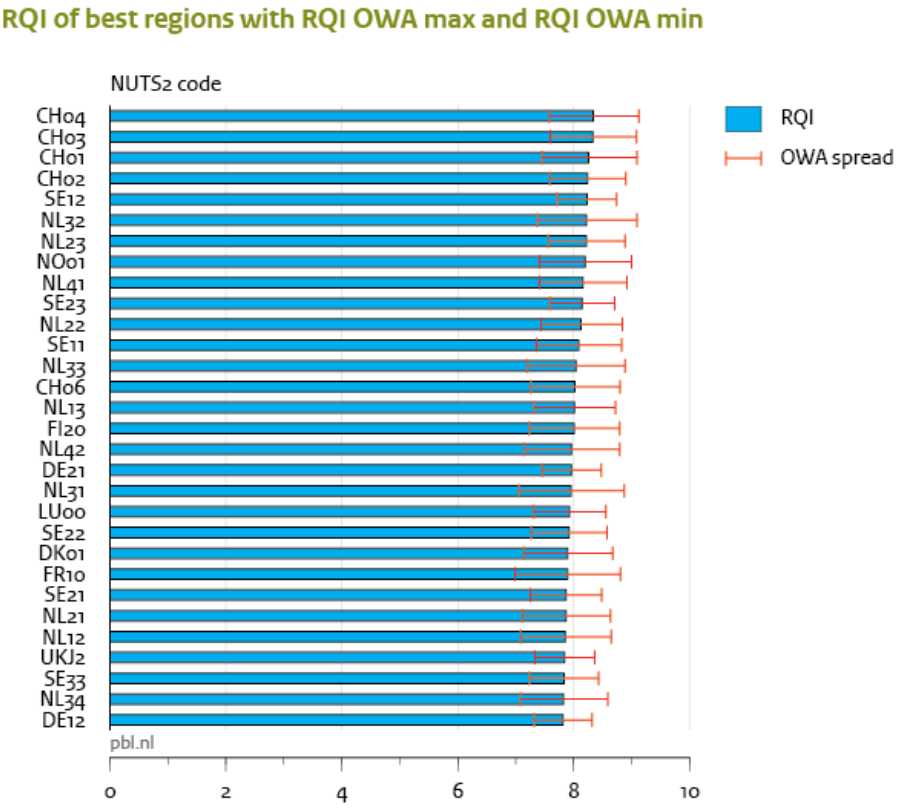

Figure 23 Ranking of the best 30 NUTS 2 regions using different Ordered Weighted Averaging Methods; showing RQI OWA max and RQI OWA min

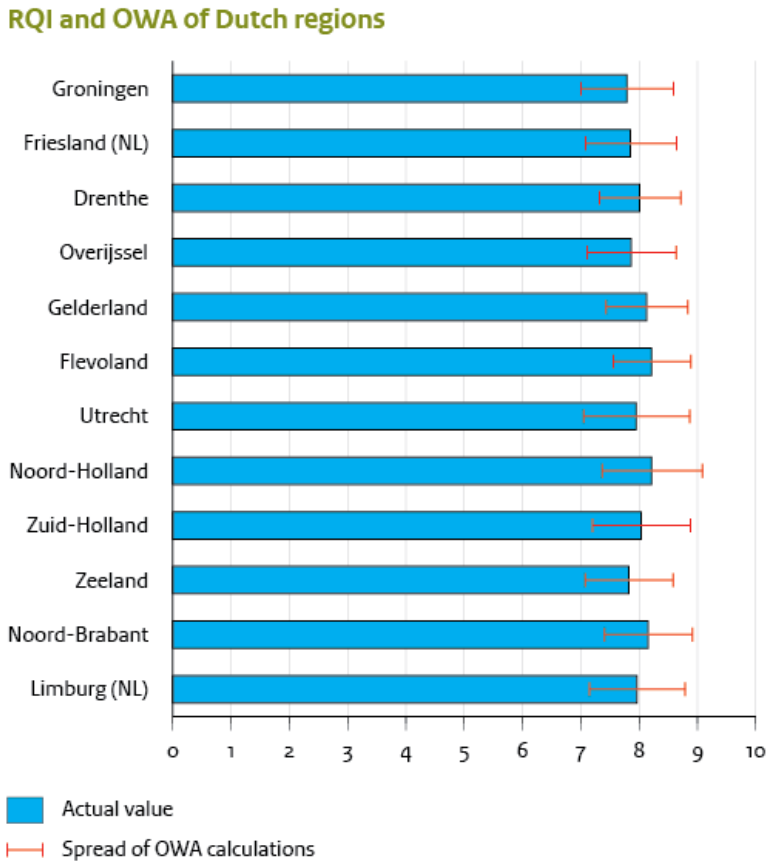

Figure 24 RQI scores of Dutch regions in Europe with different Ordered Weighted Averaging Methods; RQI OWA max and RQI OWA min

7.3 Dutch regions vs. Best in Europe; *25 indicators*

A benchmark with the best 25 European regions (with respect to GDP per capita; Figure 25 and Table 15) will provide insight into the strengths and weaknesses of Dutch regions. A benchmark with the Best in Europe will yield more information than a comparison with the average in Europe because the stages of development differ. Besides which, the aim of the Dutch policy is to be among the world's top ten countries.

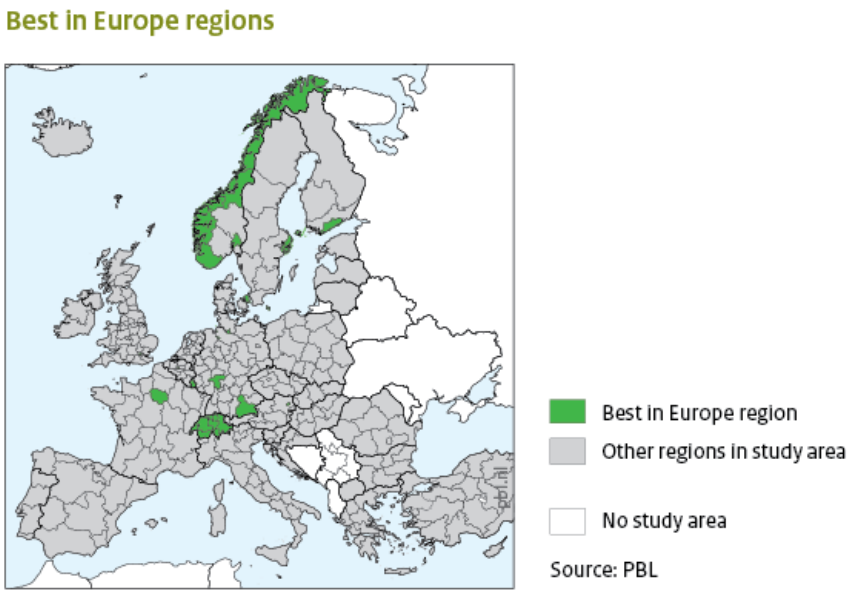

Figure 25 The Best in Europe regions; the best 25 regions in Europe based on their GDP/cap

When the Dutch regions are compared with the Best in Europe, the Netherlands shows better scores for half of the indicators (Figure 26). The largest difference is seen for *Nature* as a consequence of the high population density in the Dutch regions. The scores for *Climate* and *Natural hazards* are also relatively low. The low score for *Banks* does not mean that the situation in the Netherlands is worse but it is slightly lower than the extremely high scores for the Best in Europe. The Dutch regions score much better for *Connectivity, Education quantity, Recreation* and *Education quality* as a consequence of the relatively high population density and therefore high density of roads, rail links and airports, numerous universities and ample recreation facilities.

Table 15 The best 25 regions in Europe based on their GDP/cap

Code	Name
AT13	Wien
BE10	Région de Bruxelles-Capitale
CH01	Région lémanique
CH02	Espace Mittelland
CH03	Nordwestschweiz
CH04	Zürich
CH05	Ostschweiz
CH06	Zentralschweiz
CH07	Ticino
DE21	Oberbayern
DE50	Bremen
DE60	Hamburg
DE71	Darmstadt

Code	Name
DK01	Hovedstaden
FI1B	Helsinki-Uusimaa
FI20	Åland
FR10	Île de France
LU00	Luxembourg
NO01	Oslo og Akershus
NO04	Agder og Rogaland
NO05	Vestlandet
NO06	Trøndelag
NO07	Nord-Norge
SE11	Stockholm
UKI1	Inner London

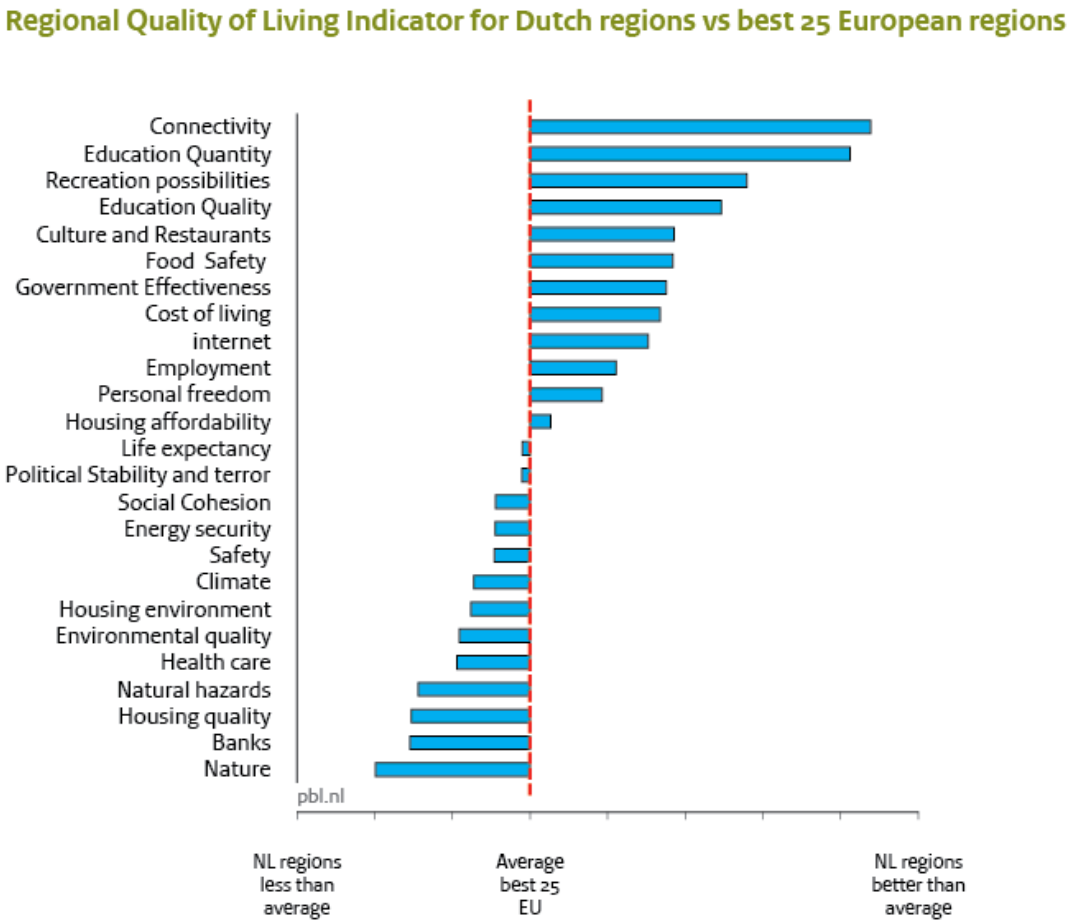

Figure 26 Difference between the average value for the Dutch regions and the Best in Europe regions

With respect to *Governance*, the Dutch regions showed higher scores than the best European regions (Figure 27) and this was also true for *Employment*. For *Cost of Living,* Groningen scored lower than the average of the best European regions. The Dutch regions scored high in *Political Stability*. Although the score for *Banks* was good, other countries scored relatively better in the OECD indicator of *Soundness of Banks*. Housing prices per square metre are relatively high in the Netherlands, which resulted in low scores for *Housing Affordability*.

The northern regions of the Netherlands scored relatively high for *Safety,* whereas in regions with a high population density this score was relatively low. A negative score for *Safety* was found for the province of Zuid-Holland. *Personal freedom* scored relatively high while *Quality and Quantity of Education* was found to be much better than in the best European regions. Highest scores in this category were found for Zuid-Holland due to the presence of some high ranking universities (e.g. Leiden and Delft, WIKI, 2012).

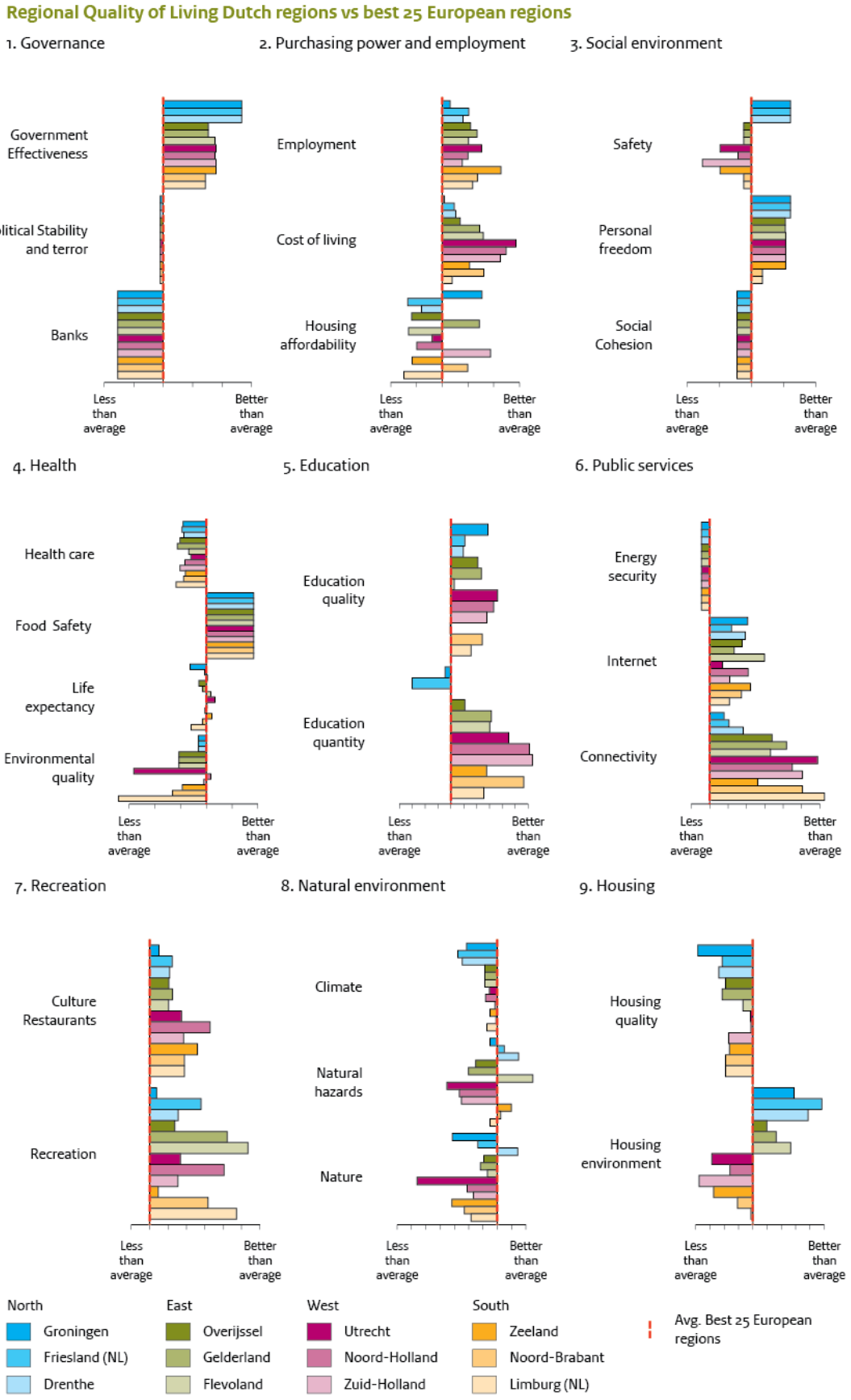

Figure 27 Benchmark for the RQI indicators comparing the Dutch regions and the 25 best European regions (with respect to GDP per capita).

Figure 27 shows good scores for the Netherlands in *Health Care*. It is interesting to note that *Life Expectancy* scored lower in the Netherlands for some regions. With respect to *Environmental Quality,* the northern Dutch regions scored higher than the best European regions, while other Dutch regions had relatively low scores. Utrecht especially, scored low as a consequence of relatively high levels of particulate matter and noise pollution. Scores for *Food Quality* in the Netherlands were high.

The Dutch score was slightly better for Energy security than the Best in Europe regions, despite of the low percentage of renewable energy consumption in the Netherlands. The standard of *Internet* facilities was very good in most regions, as was the level of *Connectivity* for road, rail and air travel. *Connectivity* had a relatively low score in the northern regions.

The Dutch scores for *Culture* and *Restaurants* were comparable to the Best in Europe regions. Despite the high population density in the Netherlands, the score for *Recreation* was relatively high.

7.4 Additional figures of Dutch regions vs Best in Europe

For each Dutch region a comparison is made with the benchmark Best in Europe to identify strong and weak points. The analysis has been carried out for:

- the nine categories of Regional Quality of Living index
- the 25 indicators of the Regional Quality of Living Index

The results are presented in figure 28 to 51.

Groningen

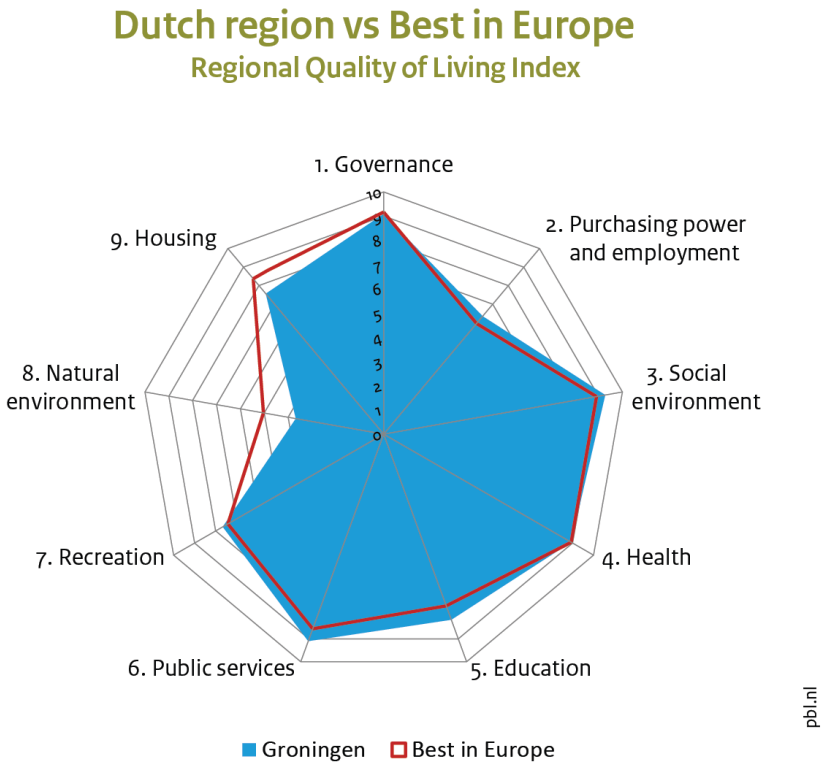

Figure 28 Regional Quality of Living for 9 categories. Groningen compared with benchmark Best in Europe

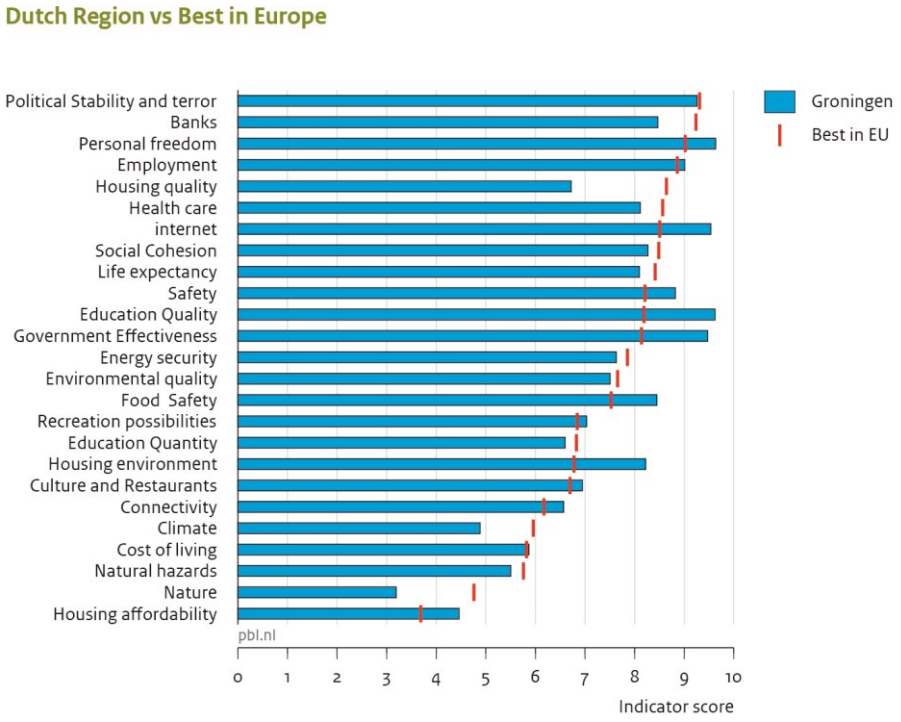

Figure 29 Regional Quality of Living for 25 indicators. Groningen compared with benchmark Best in Europe

Friesland

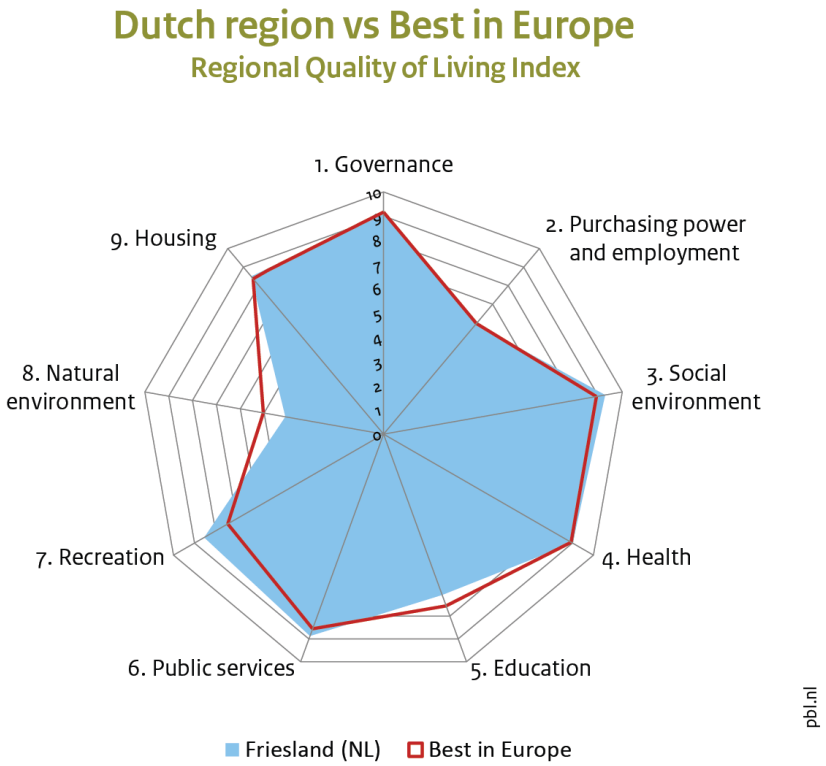

Figure 30 Regional Quality of Living for 9 categories. Friesland compared with benchmark Best in Europe

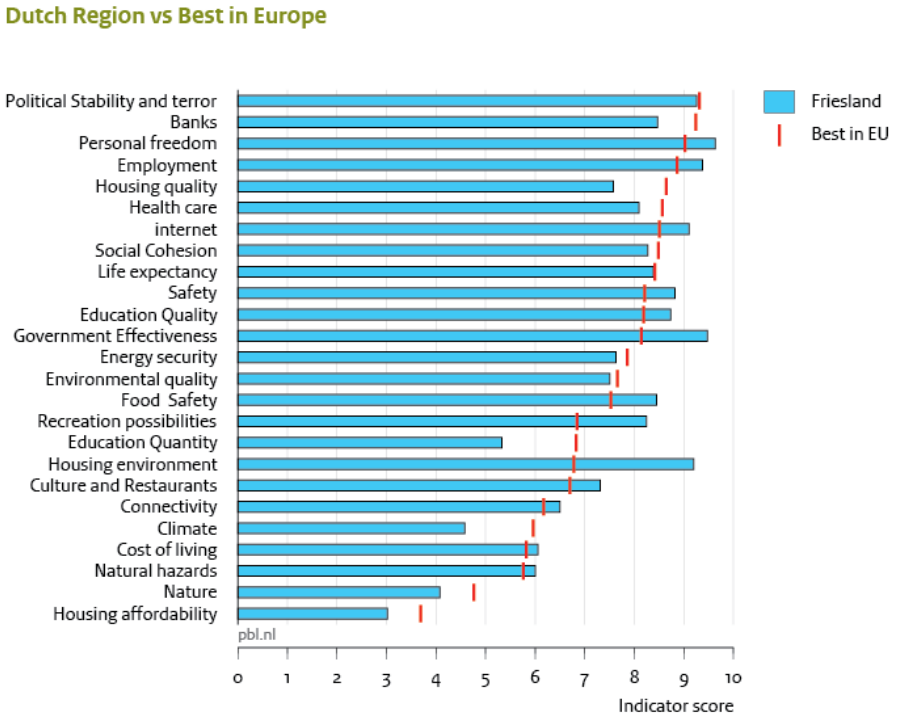

Figure 31 Regional Quality of Living for 25 indicators. Friesland compared with benchmark Best in Europe

Drenthe

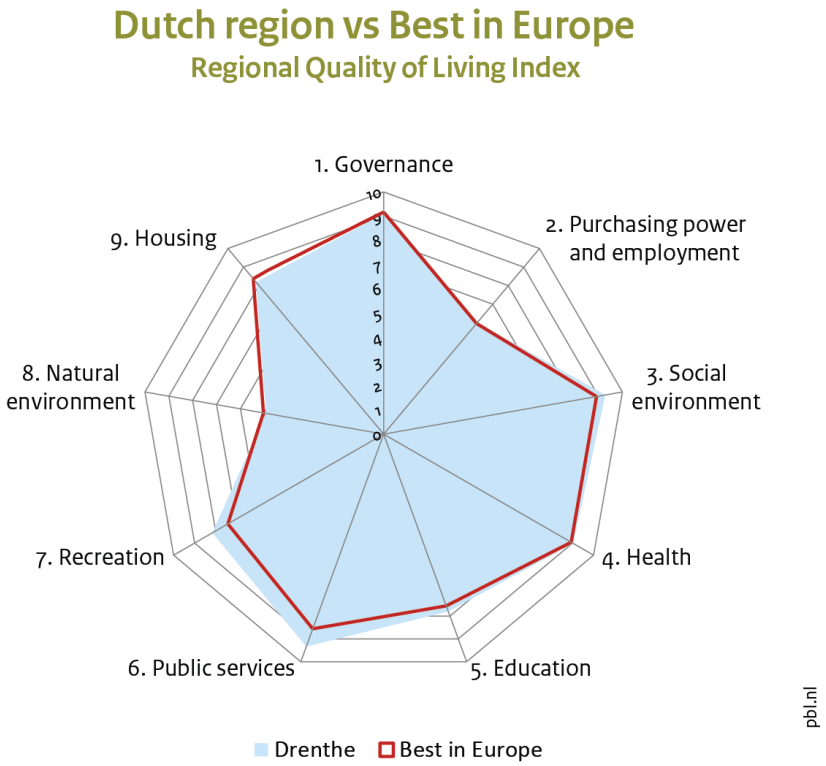

Figure 32 Regional Quality of Living for 9 categories. Drenthe compared with benchmark Best in Europe

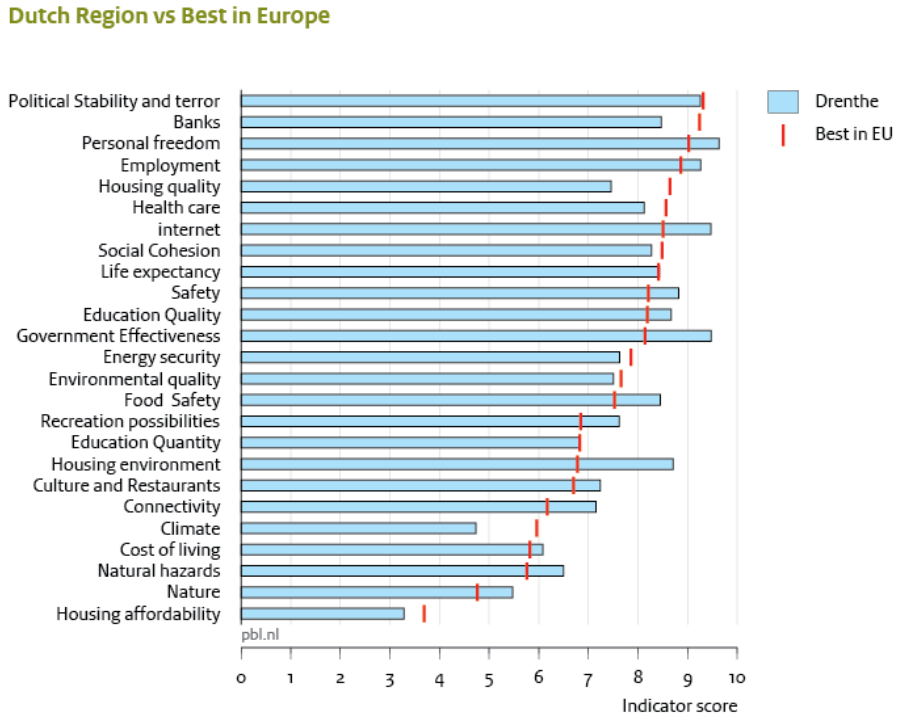

Figure 33 Regional Quality of Living for 25 indicators. Drenthe compared with benchmark Best in Europe

Overijssel

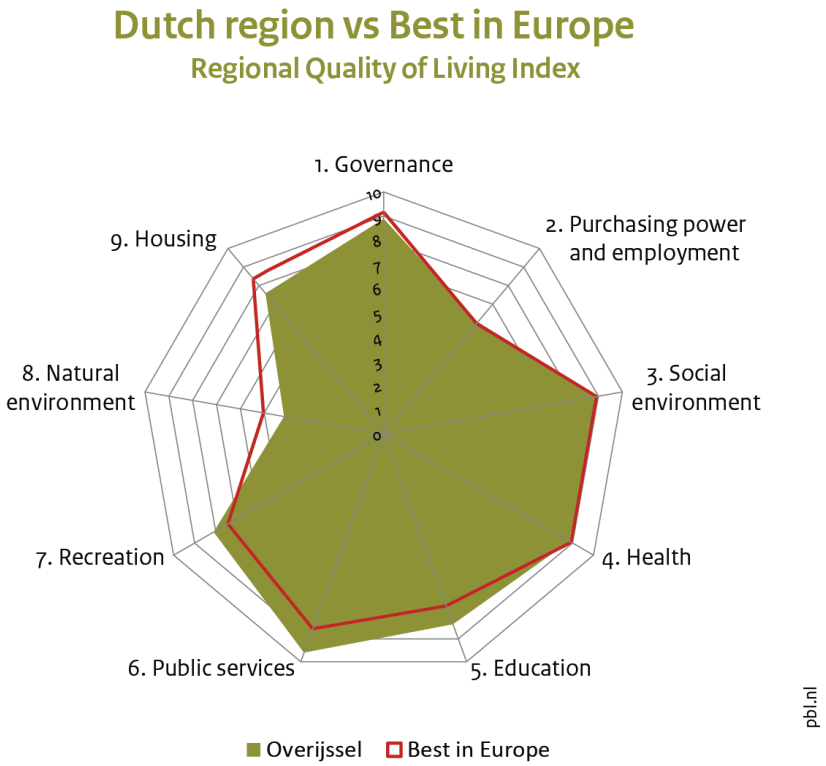

Figure 34 Regional Quality of Living for 9 categories. Overijssel compared with benchmark Best in Europe

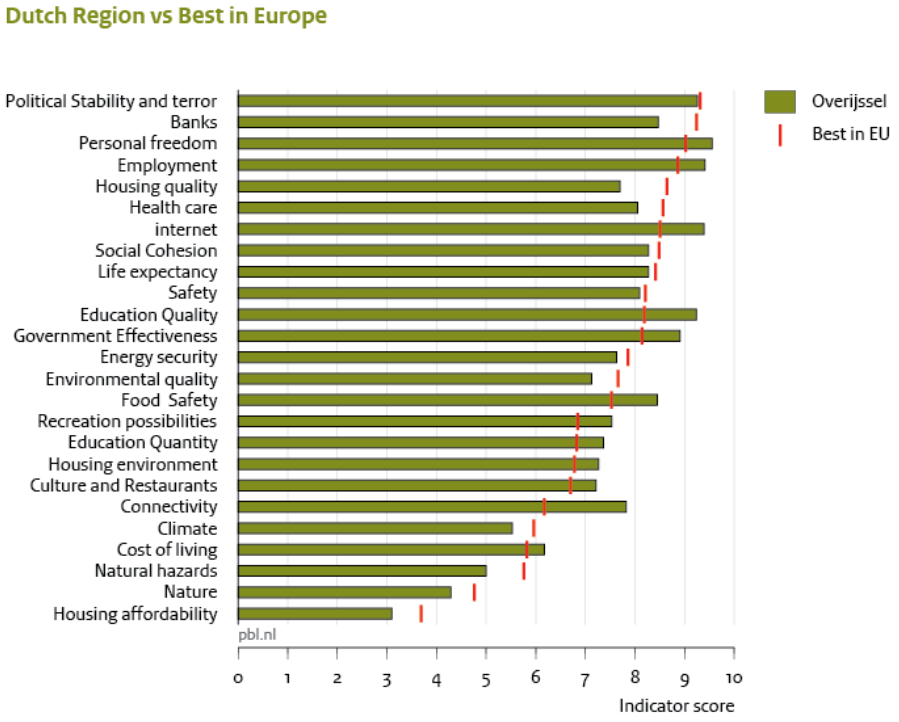

Figure 35 Regional Quality of Living for 25 indicators. Overijssel compared with benchmark Best in Europe

Gelderland

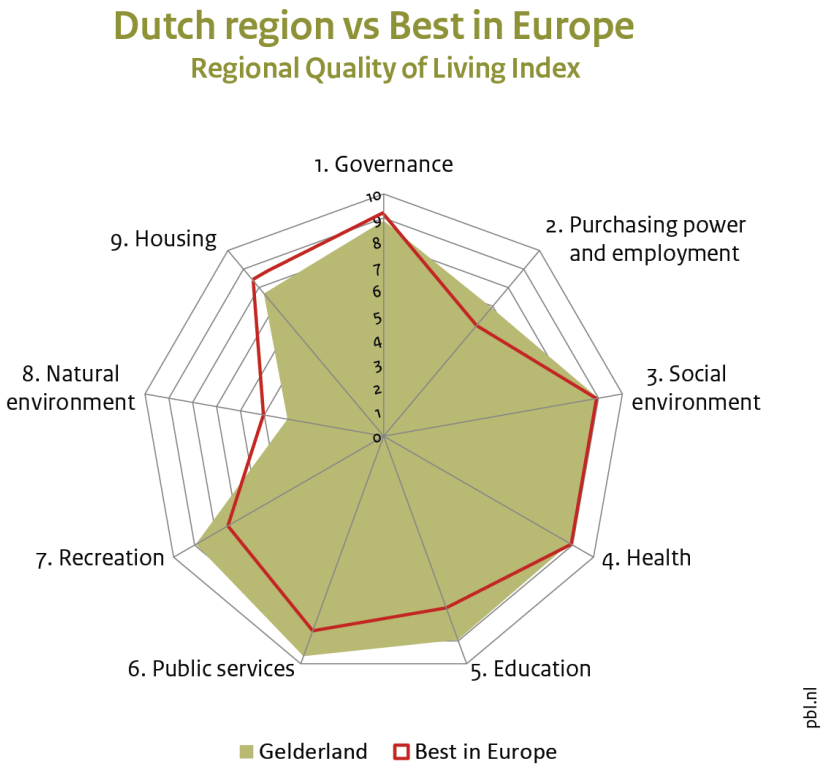

Figure 36 Regional Quality of Living for 9 categories. Gelderland compared with benchmark Best in Europe

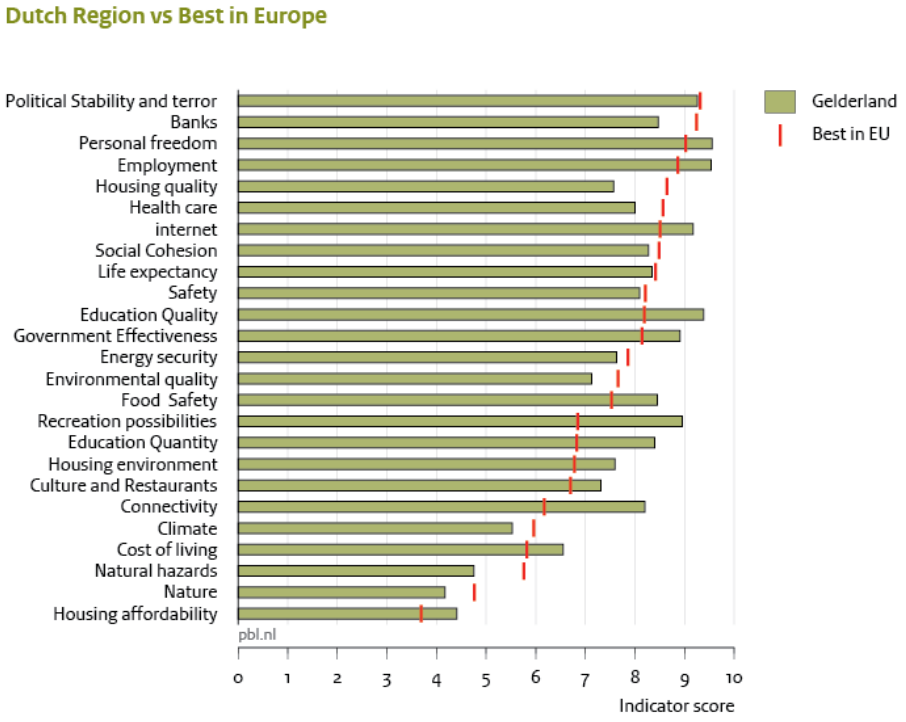

Figure 37 Regional Quality of Living for 25 indicators. Gelderland compared with benchmark Best in Europe

Flevoland

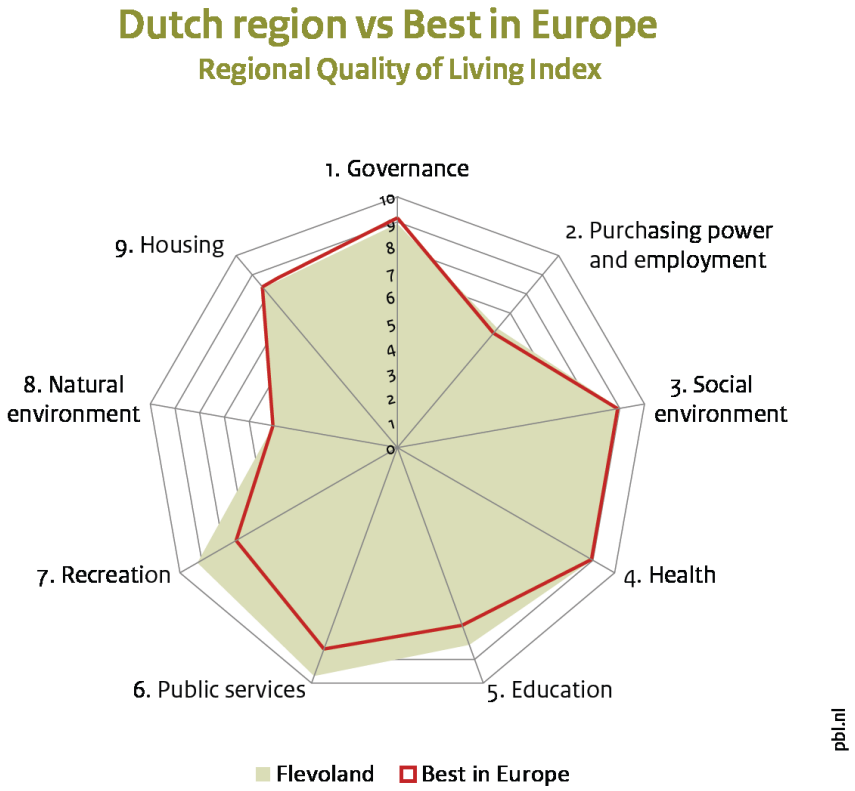

Figure 38 Regional Quality of Living for 9 categories. Flevoland compared with benchmark Best in Europe

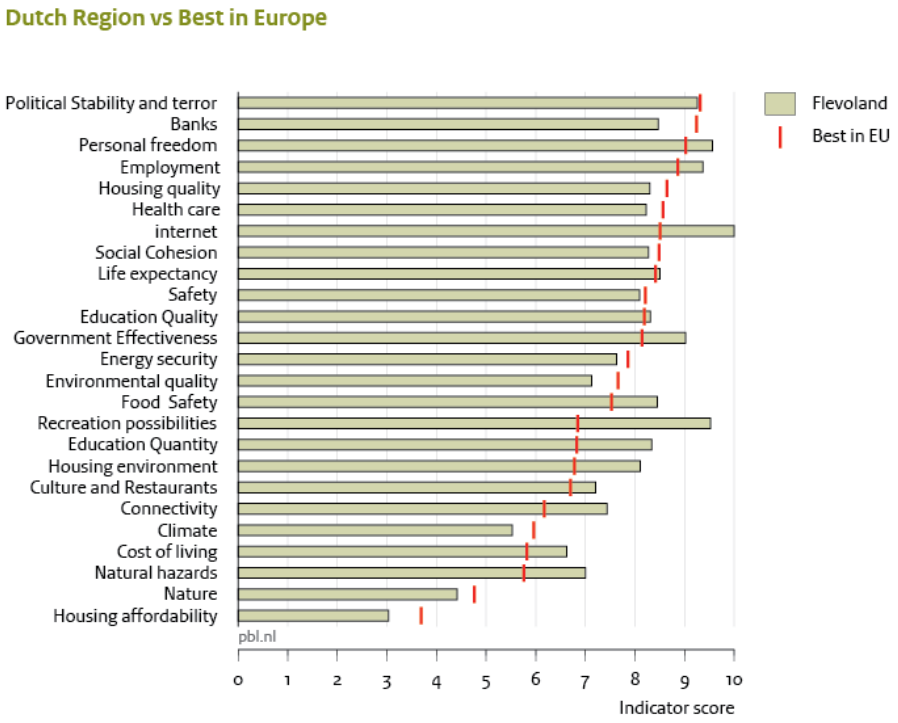

Figure 39 Regional Quality of Living for 25 indicators. Flevoland compared with benchmark Best in Europe

Utrecht

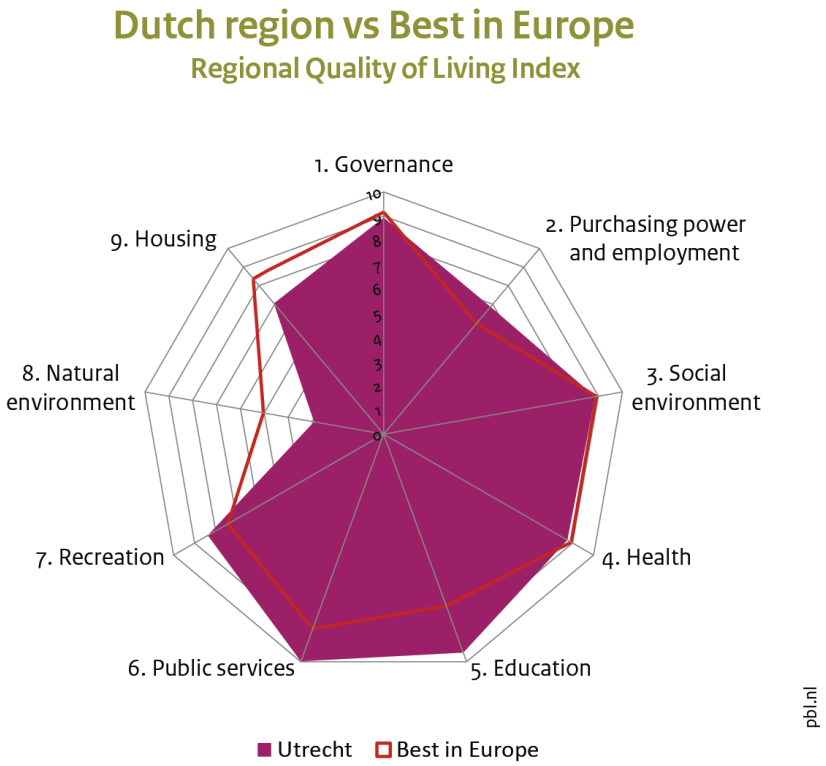

Figure 40 Regional Quality of Living for 9 categories. Utrecht compared with benchmark Best in Europe

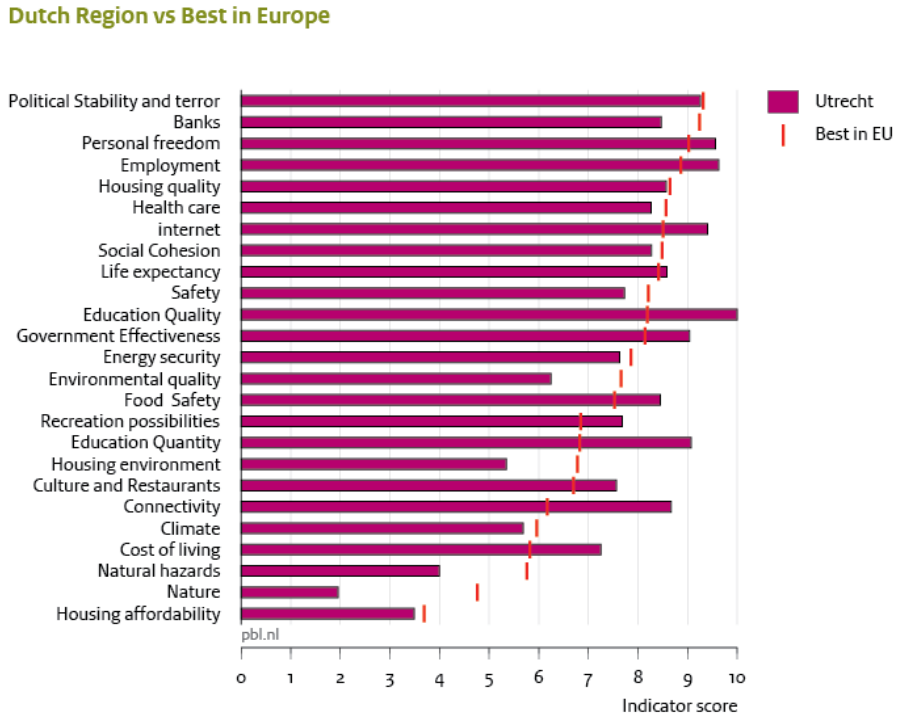

Figure 41 Regional Quality of Living for 25 indicators. Utrecht compared with benchmark Best in Europe

Noord-Holland

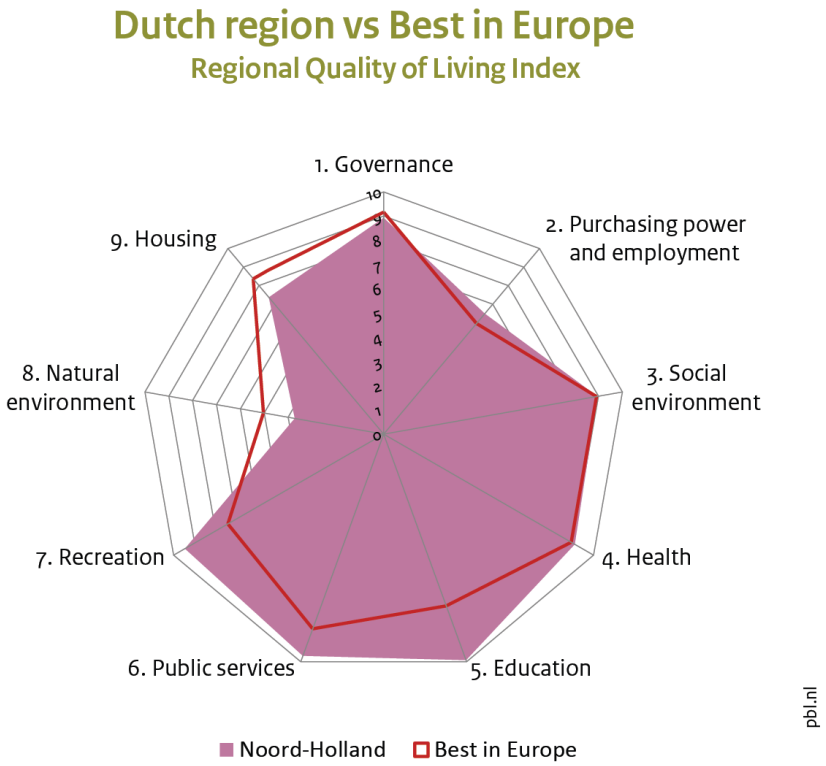

Figure 42 Regional Quality of Living for 9 categories. Noord-Holland compared with benchmark Best in Europe

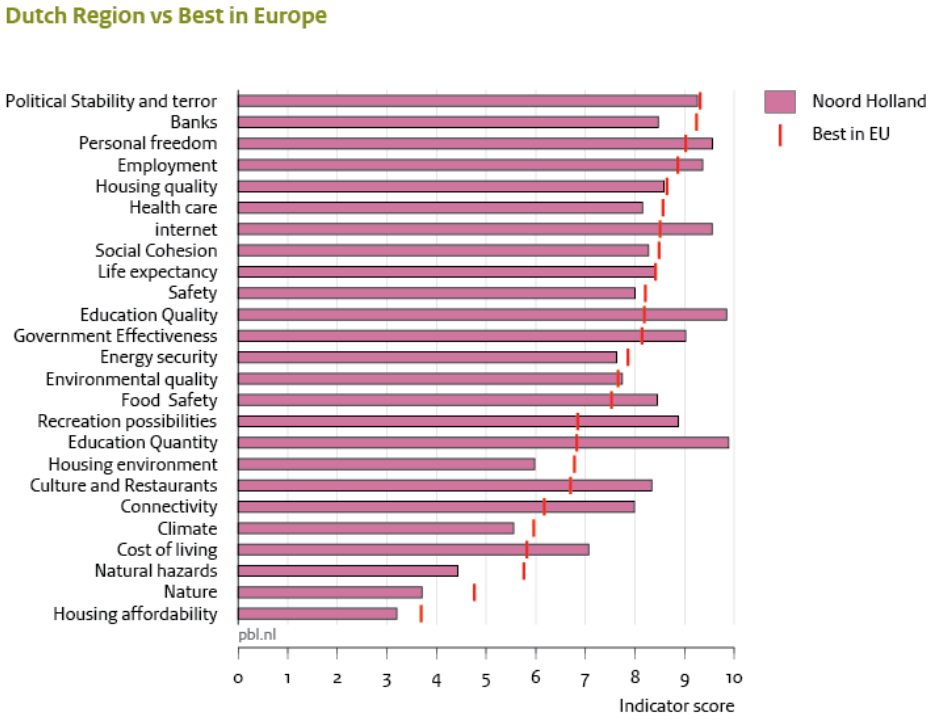

Figure 43 Regional Quality of Living for 25 indicators. Noord-Holland compared with benchmark Best in Europe

Zuid-Holland

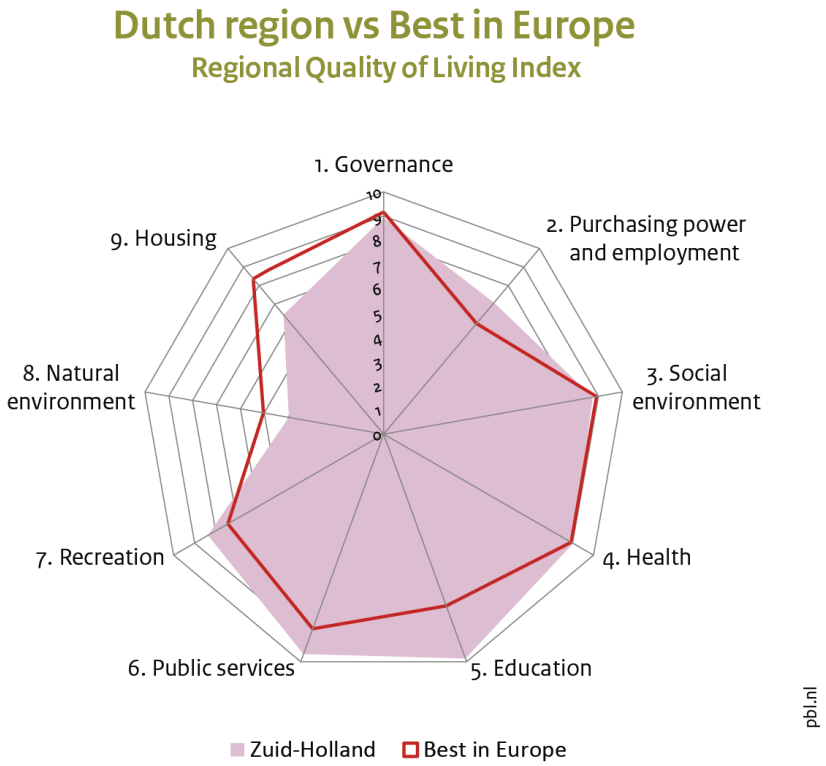

Figure 44 Regional Quality of Living for 9 categories. Zuid-Holland compared with benchmark Best in Europe

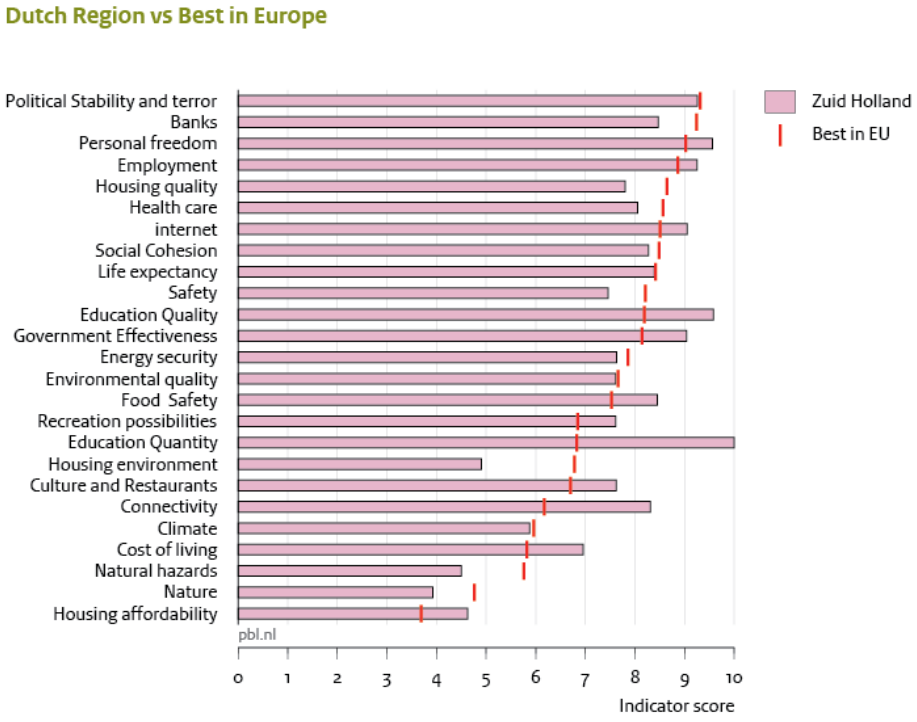

Figure 45 Regional Quality of Living for 25 indicators. Zuid-Holland compared with benchmark Best in Europe

Zeeland

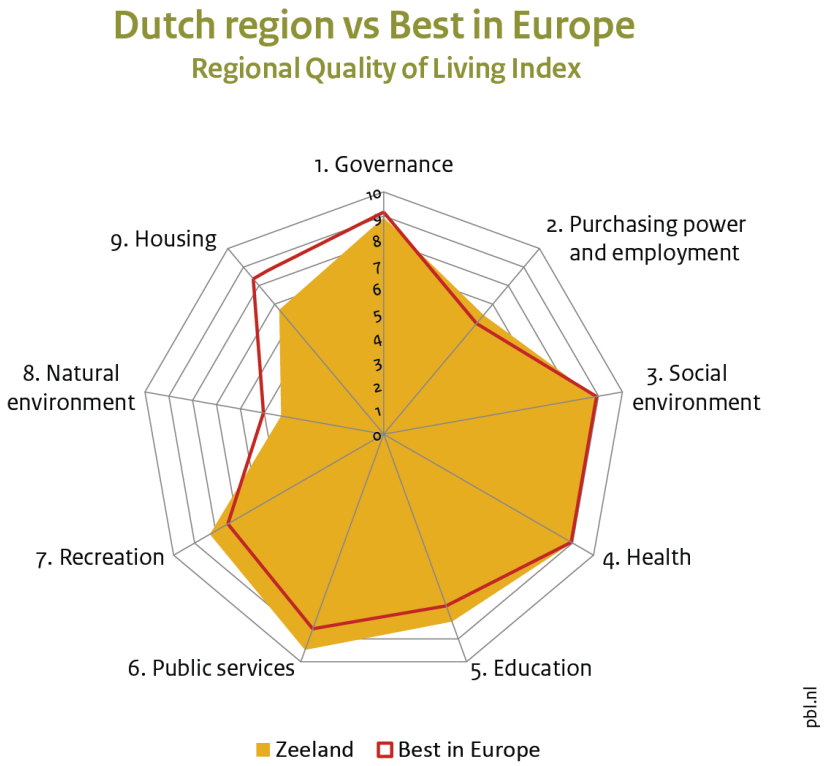

Figure 46 Regional Quality of Living for 9 categories. Zeeland compared with benchmark Best in Europe

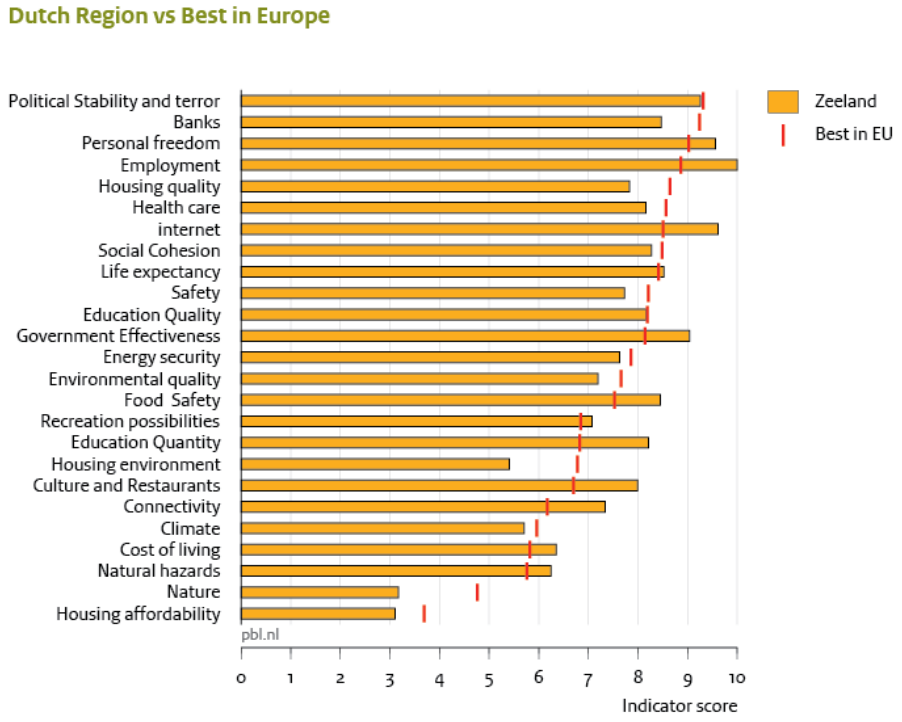

Figure 47 Regional Quality of Living for 25 indicators. Zeeland compared with benchmark Best in Europe

Noord-Brabant

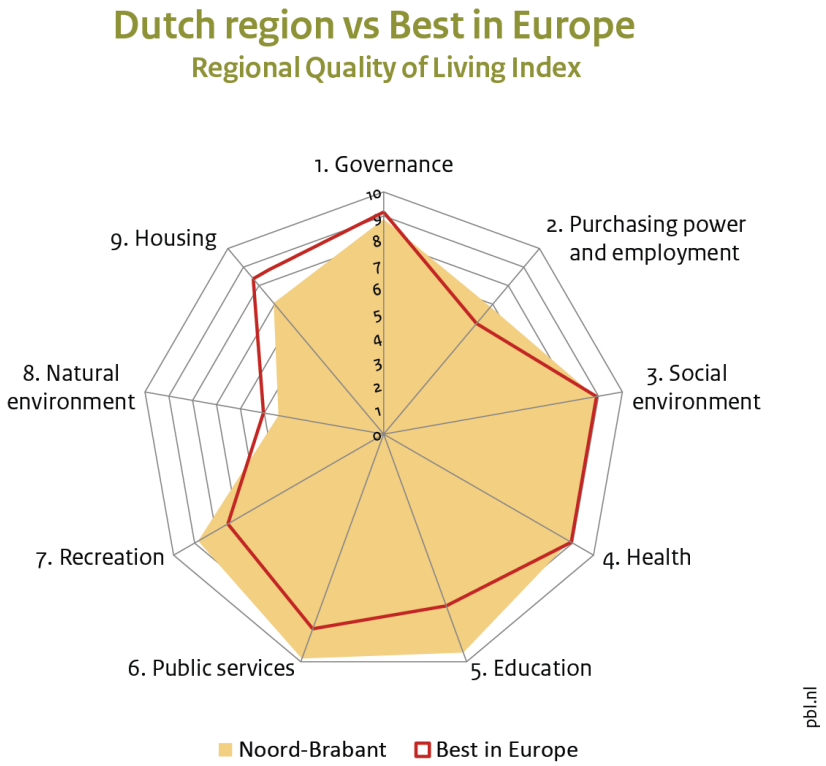

Figure 48 Regional Quality of Living for 9 categories. Noord-Brabant compared with benchmark Best in Europe

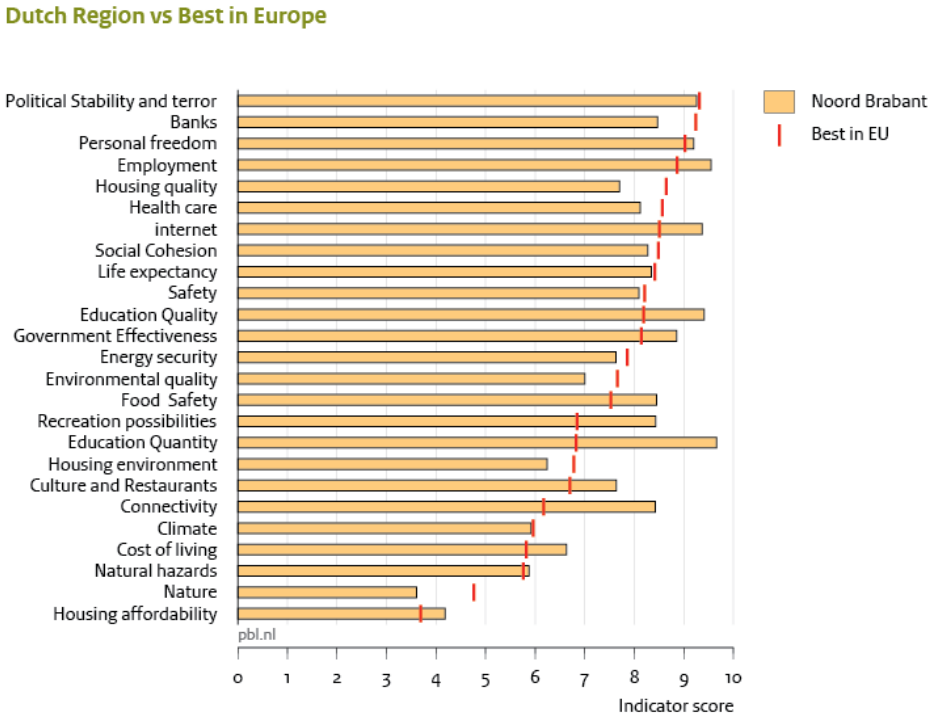

Figure 49 Regional Quality of Living for 25 indicators. Noord-Brabant compared with benchmark Best in Europe

Limburg

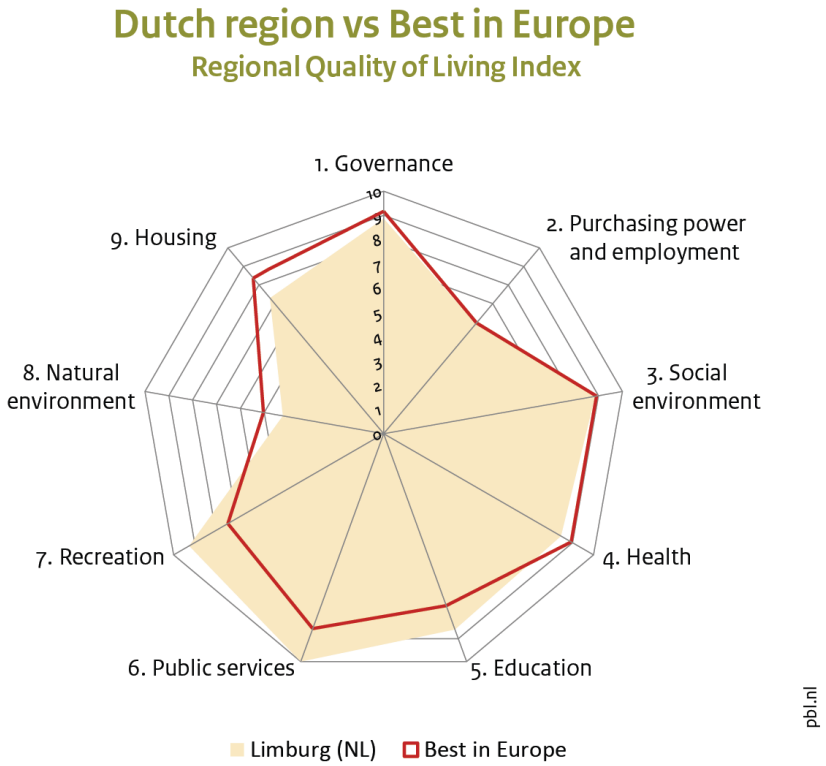

Figure 50 Regional Quality of Living for 9 categories. Limburg compared with benchmark Best in Europe

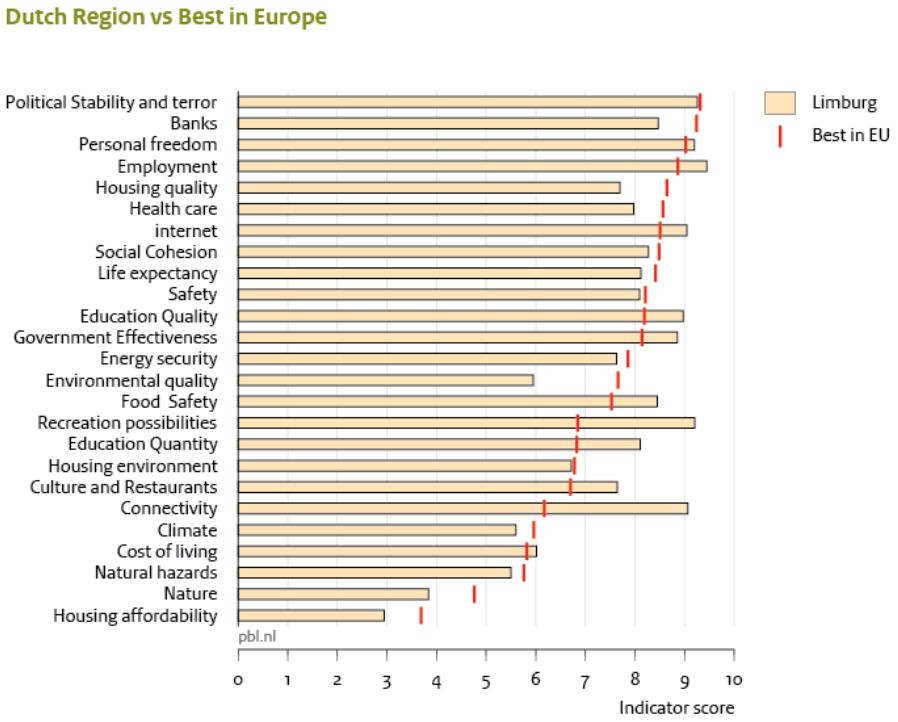

Figure 51 Regional Quality of Living for 25 indicators. Limburg compared with benchmark Best in Europe