

2018 COMPETITIVENESS REPORT

Holding up in a turbulent time



LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Économie

Observatoire de la compétitivité

2018 COMPETITIVENESS REPORT

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2018 Competitiveness Report

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Summary

Chapter 2

The discussion on territorial competitiveness is regularly revived at the time of publication of **benchmarks and international rankings**. The most closely monitored annual reports include those issued by the World Economic Forum, the International Institute for Management Development (IMD), the Heritage Foundation and the European Commission. A strong correlation may be observed between these four international rankings and the national system of indicators among the Member States of the European Union (see Chapter 3). Apart from these major benchmarks released annually, a multitude of others are also published regularly or occasionally. For the large majority of rankings selected as examples in the present 2018 Report, Luxembourg ranks among the Top 10 countries in the EU. Although the final ranking often constitutes the most widely publicised element, these analyses tell a more complex story which belies the simplicity of the ranking. We must not lose sight of the limitations of such an exercise, such as the relativity of the rankings, the quality of the sources, the 'one size fits all' approach, etc. Despite the numerous reservations one may have in the face of territorial benchmarking, these reports deserve to be monitored, because they represent powerful communication tools.

Chapter 3

Chapter 3 is dedicated to the **national competitiveness scoreboard**, which constitutes a central component of competitiveness analysis. Indeed, in 2003, the Tripartite Coordinating Committee of Luxembourg recognised the need for a table of indicators to take account of the national specificities of the country, so as to gain a better understanding of the competitiveness of the country, which is not possible through the simple use of international benchmarks. This scoreboard, which was drawn up by Prof. Fontagné at that time, was revised by the Economic and Social Council in 2016. The present Report contains the first annual update of this new national system of competitiveness indicators.

The updated results show that the Luxembourgish performance is usually mixed in the three dimensions. More specifically, the result for the Economy dimension reveals that a slight deterioration occurred between 2016 and 2017. Nevertheless, the analysis of the Luxembourgish performance in the Social and Environmental dimensions indicates a slight improvement or stable situation compared to the 2016 results. After a detailed analysis of the indicators on the scoreboard, the ODC has calculated its traditional composite indicator based on 68 indicators. In the general ranking, Luxembourg scores in the group of high-performance countries. In the ranking by dimension, Luxembourg positions itself among the high-performance countries for the Economy and Environment dimensions, while it is placed among the top performers in the Social dimension. While Luxembourg ranks rather highly compared to the other countries of the EU in 2017, it is equally important to analyse the variations from 2016 to 2017 to determine the performance trend. These analyses show that some changes are less favourable.

Chapter 4

The **Europe 2020 strategy** constitutes a central element of the EU response to the economic crisis, now a decade old. Overcoming the crisis was considered a shift towards a social, greener and more intelligent market economy. Five broad objectives were confirmed on the level of the European Union with regards to promoting employment, improving the conditions for innovation and R&D, fulfilling the objectives relating to climate change and energy issues while improving levels of education and encouraging social inclusion. Each Member State later fixed its own national targets. For some of the targets established by Luxembourg (2010), the indicators have evolved in the right direction, while for others, the situation is less favourable. In early 2018, the European Commission considered that Luxembourg was on the right track in the realm of renewables and energy efficiency, but that it would fail to meet its target for greenhouse gas emissions. The Commission has also considered that little progress had been made in terms of R&D, poverty risk reduction and employment rates.

The years preceding the crisis were also characterised by macroeconomic developments creating imbalances between Member States of the EU. The Commission therefore developed a **macroeconomic imbalance procedure**. The Commission publishes an annual scoreboard analysing each Member State in relation to certain alert thresholds. Since 2015, the procedure has consisted of 14 main indicators. In the most recent edition (2017), the Commission noted that Luxembourg faced no imbalances, although the country did exceed certain thresholds. In the present Report, data were updated in July 2018. We may note that Luxembourg exceeded two thresholds: the consolidated private sector debt and the variation in the activity rate. The private debt indicator for Luxembourg must be interpreted with care, since most of the debt is contracted by non-financial companies. However, many businesses choose to be financed through Luxembourg not because of any direct need, but for the benefit of other associated entities located abroad (e.g. intra-group loans). The Commission considers that the reason the country surpasses the threshold so obviously is therefore related to the structure of the country, and thus constitutes no risk at this stage.

Chapter 5

With a view to reducing Luxembourg's pronounced dependence on the financial sector (26.5% of GDP), the Government actively promotes the **development of new priority sectors** according to a strategy of sectoral multi-specialisation: ICT, logistics, health sciences and technologies, eco-technologies and space technologies. Based on calculations derived from STATEC and the Trade and Companies Register (RCS) data, and bearing in mind the major methodological limitations of such an exercise, private business undertakings in these sectors represented 9.6% of the gross value added of the country in 2016, or nearly 31,000 jobs in 3,047 businesses. By far the greatest share in terms of value added (6.8%) and jobs (4.1%) was attributed to ICT, 1.7% and 0.2% of which were respectively created by the space technologies sector, and 2.4% and 3.2% by logistics. Health sciences and technologies have grown strongly, mainly where public research is concerned, while eco-technology businesses remain very limited in Luxembourg, despite the fact that the number of eco-technology user businesses has been constantly on the increase for several years. Overall, we have been seeing a positive trend, in absolute terms, in the performance of the five new priority sectors for some years now.

Chapter 6

From the late 19th century on, Luxembourg was dominated by the steel industry, which still represented 30% of its economy in the 1970s. This was followed by a dramatic expansion in financial activities, representing approximately 25% of the economy today. This boom occurred at practically the same time as the decline in the steel industry. Luxembourg thus made the transition from one monolithic structure to another. Since pronounced dependence on a single activity sector is always hazardous, we need to follow Luxembourg's **level of economic diversification**.

Based on a consolidation of the activities into 45 branches, the economic diversification of Luxembourg in terms of value added is calculated with the help of a concentration index for the last two decades. Compared with other countries, the economy of Luxembourg is poorly diversified. While diversification was already relatively weak at the start of the period under observation, it dropped considerably by 2008, but rose slightly starting in 2009. The domination of the financial sector partly explains the situation, but the analysis reveals that the important weight of this sector cannot be the only explanation. In fact, diversification is also dropping for the rest of the economy. Two tentative explanations are offered. First, the small size of the country implies a limitation of the factors of production, resulting in weak diversification. Second, the level of diversification drops whenever a country exceeds a certain level of economic development.

In addition to the analysis of the economy as a whole, three branches are studied in more detail. The analysis confirms that the impact of the financial sector on the overall diversification of the economy is negative. An analysis of the commercial exchanges of financial services reveals that Luxembourgish players have broadened their client base. In the manufacturing industry, the decline of the steel industry, in combination with the development of other industrial activities, has led to an increase in intra-sectoral diversification. With regards to knowledge-intensive services, the development of a few specific branches, such as legal activities, company headquarter activities, management consultancy and telecommunications has had a positive impact on the overall diversification of the economy of the country.

Chapter 7

An international conference entitled '**Competitiveness strategies for the small EU States: economic and social perspectives**' was held in April 2018 in Luxembourg by the Observatoire de la compétitivité in collaboration with the Islands and Small States Institute of the University of Malta and STATEC. This conference hosted researchers and the public for a discussion on matters related to competitiveness and in particular the specificities of small States. The participating countries included Luxembourg, Ireland, Montenegro, Macedonia, Malta, Cyprus, Lithuania, Albania and Slovenia. In addition to the three plenary sessions, the conference agenda included parallel sessions organised around the six following themes: strategies, entrepreneurship, economic development, global indicators, policy framework and social aspects. This chapter summarises the main topics discussed.

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1 The Observatoire de la compétitivité

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1.1 The Observatoire de la compétitivité: Role and missions

The role of the Observatoire de la compétitivité is to assist the Government and the social partners in providing guidelines and formulating policies that promote and/or are suited to the concept of long-term competitiveness, which is the source of growth and well-being.

As such, it is a tool for documenting, observing and analysing evolution in the country's competitive position. It is a monitoring unit, responsible for leading a constructive debate between the social partners.

The main tasks of the Observatoire de la compétitivité are as follows:

- ▼ Collect, analyse and compare existing data on the national, regional and international levels that relate to economic competitiveness;
- ▼ Accurately target the dissemination of selected and processed information, which is useful for strategic decision-making;
- ▼ Undertake or commission studies and research on competitiveness, its factors, etc.;
- ▼ Contribute to the works and to the analyses of international organizations dealing with competitiveness (EU Council, OECD, etc.);
- ▼ Coordinate the work and the drafting of the Luxembourg's National Reform Programme (NRP) within the framework of the European Strategy for Growth and Jobs (Europe 2020 strategy).

1.2 From the Lisbon strategy to the Europe 2020 strategy

Within the Government, the Minister of the Economy is responsible for coordinating the implementation of the European strategy for growth and jobs on the national level. The Observatoire de la compétitivité was commissioned in the autumn of 2005 to prepare the National Plan for Innovation and Full employment, which was submitted to the European Commission within the framework of the Lisbon strategy. In order to optimize government coordination, to ensure consultation procedures and to guarantee assimilation of reforms nationally, an ad hoc structure was set up at the inter-ministerial level in 2005, whose structure is coordinated by the Observatoire de la compétitivité. This network brings together Lisbon strategy coordinators within each of the relevant ministerial departments and administrations concerned. The Government then submitted annual implementation reports to the Commission, until the Lisbon strategy expired in 2010.

At the end of 2009, the European Commission began the works to define a strategy for the next decade: the Europe 2020 strategy¹. Based on European Commission proposals, the June 2010 European Council decided upon the development of this new strategy, the governance of which will take place at three integrated levels:

- ▼ A level of macroeconomic monitoring to focus on macroeconomic and structural policies;
- ▼ A thematic coordination level, covering the five major European objectives and their national implementation;
- ▼ A simultaneous monitoring level, taking place within the framework of the Stability and Growth Pact (SGP).

In November 2010 each Member State had to submit to the European Commission a first draft of the National Reform Programme (NRP), developed in the framework of the Europe 2020 strategy. In November 2010 Luxembourg submitted its interim NRP draft to the Commission, and the Government finally decided on the finalized NRP for Luxembourg in April 2011 which was then submitted to the European Commission, along with the SGP. The eighth update of Luxembourg's finalized NRP was sent to the European Commission in April 2018, along with the SGP 2018-2021². Based on the NRP and the SGP, the Council issued in July 2018 new country-specific recommendations for Luxembourg, for consideration during the national discussions to be conducted about the 2019 draft budget.

¹ For additional details:
https://ec.europa.eu/info/strategy/european-semester_en

² For additional details:
<http://www.mf.public.lu>

1.3 STATEC Research ASBL

Since 2011, due to difficulties encountered in recruiting top-level researchers, the Ministry of the Economy gave STATEC and the Observatoire de la compétitivité its assent to organise their research within the GIE ANEC (Agency for Standardisation and the Knowledge Economy).

The research is conducted within the framework of a collaboration agreement with STATEC, the Observatoire de la compétitivité and ANEC. The Observatoire de la compétitivité and STATEC co-finance the research programme carried out by the ANEC GIE via budget articles 05.0.41.010 and 05.1.41.010.

The researchers recruited work mainly on microdata from businesses at the STATEC facilities, so as to ensure the confidentiality of these sensitive data. The research unit consists of a team of economists and econometricians specialising in the fields of innovation, productivity and well-being. Nine Ph.D.-level researchers and one research assistant are currently working under the aegis of the ANEC. The facility regularly hosts students working on their Master's Degree or Ph.D. theses, as well as other visiting researchers. The papers are supervised by the Scientific Committee, as provided for under the 2011 STATEC framework law.

Since the entry into effect of the Law of 27 August 2014 amending the amended Law of 31 May 1999 on the creation of a National Research Fund in the public sector (FNR), followed, shortly thereafter, by the Grand-Ducal Regulation of 29 October 2014 amending the Grand-Ducal Regulation of 27 July 2000 establishing the presentation, selection and realisation of research activities benefiting from intervention by the FNR, the ANEC GIE is no longer eligible to request the financial assistance of the FNR; it is therefore excluded from national academic collaboration. Only co-financing from the FNR for research training assistance (AFR) may still be considered. Upon the recommendation of the FNR management, the STATEC then created a non-profit organisation ("asbl") named "STATEC Research" registered in the Trade and Companies Register under no. F10898.

STATEC Research is taking over the research activity of STATEC and the Observatoire de la compétitivité organised since 2011 within ANEC GIE. More specifically, it focuses on the current pillars of research, that is, growth and productivity, innovation and entrepreneurship, business performance, and well-being. STATEC Research (asbl) received the approval to act as a research body on 15.11.2016 from the Ministry for Higher Education and Research. For 2018, the working programme aims to pursue the activities undertaken in greater depth so as to meet the objectives of the primary mission of STATEC Research, i.e. make use of the statistical data available from STATEC, within the framework of applied research work.

1.4 Events and publications in 2017-2018

The Observatoire de la compétitivité aims to inform both the economic agents and the general public on competitiveness issues. To achieve this, multiple communication channels are used, such as organising public events (seminars, conferences, etc.) and publishing analytical documents on competitiveness. All information concerning events organized by the Observatoire de la compétitivité and its publications can be downloaded.

1.4.1 Seminars and conferences

The communication strategy of the Observatoire de la compétitivité is consistent with its 'competitiveness monitoring' mission and is in particular useful for initiating public debate on the major axes that define the competitiveness of the Luxembourg economy and the Europe 2020 strategy. The organization of public events is a part of this mission.

Economy Day 2018³

The Ministry for the Economy, the Chamber of Commerce and Fedil, in collaboration with pwc, organised the Economy Day entitled *"Innovation, growth and prosperity. What will drive economic growth in Luxembourg and worldwide?"* held on 22 March 2018.

The focal points of the conference were its two main speakers, Marcel Fratzscher and Mariana Mazzucato. Marcel Fratzscher (Chairman of "DIW Berlin") presented his views relating to economic prospects in a talk entitled *"Quo vadis Europe? Economic outlook in a divided world"*. Mariana Mazzucato (Director of the "Institute for Innovation and Public Purpose"), on the other hand, stressed the need to establish new frameworks to help understand the role of the State in economic growth, in a speech entitled *"Rethinking the public sector: a mission-oriented lens"*. She reviewed the role of the State as a first-resort investor and discussed how this role should change in the future so as to encourage more public-private partnerships relating to innovation.

³ For additional details:
<http://www.jecolux.lu/events/economyday/index.html>

Conference: “International Conference on Competitiveness Strategies for the Small States of the EU”⁴

On 19 and 20 April 2018, an international conference was organised and held by the Observatoire de la compétitivité in collaboration with the “*Islands and Small States Institute*” of the University of Malta and STATEC.

The conference featured national and international researchers, as well as interested members of the public, in a discussion of various issues relating to competitiveness, particularly as regards the specificities of small States. Besides the three talks by Enrico Spolaore, Patrice Pieretti and Stéphane Pallage, the conference agenda was divided into 6 parallel sessions organised around 6 different themes over two half-days. The themes were: strategies, entrepreneurship, economic development, global indicators, institutional framework and social aspects. Among the countries represented at the conference were Luxembourg, Montenegro, Macedonia, Malta, Cyprus, Lithuania, Poland, Albania and Slovenia.

Conference: “Inequality and globalization, a brief review of facts and arguments”⁵

In July 2018, the Observatoire de la compétitivité and the LIS Cross-National Data Center organized the conference “*Inequality and globalization, a brief review of facts and arguments*” by Professor François Bourguignon.

1.4.2 Perspectives de Politique économique

Through the publication ‘*Perspectives de Politique économique*’, the Observatoire de la compétitivité disseminates the findings of studies and/or commissioned research from academics or consultants, as well as papers written by members of the Observatoire de la compétitivité. This publication is also intended to publicize the reports of lectures, seminars or conferences that the Ministry of the Economy organizes on issues of economic policy. Finally, its goal is also to clarify the possible policy options, to assess the effectiveness of certain measures, and so to foster the public debate on economic policy.

1.4.3 The Observatoire de la compétitivité website

The Observatoire de la compétitivité has a website that gathers all the information and publications regarding the competitiveness of the national economy: <https://odc.gouvernement.lu>. In particular this site provides information on Luxembourg’s competitiveness in international publications. It acts as a communication platform for all those involved in the implementation of the Europe 2020 strategy in Luxembourg and enables to make the national competitiveness scoreboard data available. The website announces upcoming events and publications. Documents relating to conferences and seminars, as well as the publications, can be downloaded for free from this site.

⁴ For additional details: https://odc.gouvernement.lu/fr/actualites.gouv_odc%2Ben%2Bactualites%2Bmes-actualites%2B2018%2BConference-Small-States.html

⁵ For additional details: <http://www.lisdatacenter.org/news-and-events/events/lecture-series/>

1.5 An overview of the 2018 Competitiveness Report

Chapter 2 presents the performance of Luxembourg according to major international composite indicators (IMD, WEF, etc.) and also looks at various rankings less known by the general public.

Chapter 3 analyses how Luxembourg's competitiveness has developed over the course of the past year in comparison with other EU Member States based on the national Competitiveness Scoreboard indicators. This scoreboard was initially introduced at the request of the Tripartite Coordination Committee in 2003 to provide a clearer overview of the specific information pertaining to Luxembourg. It has since been revised by the Economic and Social Council which unanimously adopted an opinion in 2016 on the national indicator system, which constitutes from 2017 on the new updated and restructured scoreboard.

Chapter 4 aims to present the priorities as well as the European and national objectives of the Europe 2020 strategy in the context of the European Semester and makes an intermediate appraisal of Luxembourg's position for the indicators in the macroeconomic surveillance scoreboard, before the publication of the new edition by the end of 2018 by the European Commission.

Chapter 5 aims to provide an overview and monitoring of the five priority economic sectors in Luxembourg, whose development is being promoted actively by the Ministry for the Economy: ICT, logistics, health technologies, eco-technologies and space technologies.

Chapter 6 analyses the degree of diversification of the Luxembourgish economy over the past two decades.

Finally, **Chapter 7** presents a summary of a European conference held in Luxembourg in April 2018 by the Observatoire de la compétitivité, which served as an opportunity to appraise the current situation of knowledge relating to the competitiveness of small countries, entitled: *"Competitiveness Strategies for Small EU States: Economic and Social Perspectives"*.

2 Benchmarks and comparative competitiveness analysis

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2.1 Introduction

The debate on 'territorial competitiveness' is regularly re-launched in Luxembourg when international benchmarks and territory rankings are published. Composite indices are increasingly used to make international comparisons as they draw together multiple sets of information under a single numerical value¹. These indices sum up a variety of characteristics and provide an approximate summary of complex issues such as competitiveness, attractiveness. At the same time, although omnipresent, the concept provides no clue as to its precise meaning.

This chapter seeks on one hand to provide an overview of a raft of international benchmarks which have been published since the last edition of this Report. On the other hand its aim is above all to analyse Luxembourg's position in those benchmarks and rankings².

2.2 Luxembourg's rankings

In the debate about the determinant factors of regional competitiveness, the best-known annual benchmarks and rankings are those of the World Economic Forum (WEF), the International Institute for Management Development (IMD), the Heritage Foundation and the European Commission. In addition to these four rankings, there are a multitude of other ones, some of which we will look at in this chapter.

2.2.1 WEF, IMD, Heritage Foundation and European Commission

a. Growth Competitiveness Index³

In mid-October, the World Economic Forum (WEF) published a new edition of its annual study of competitiveness in 140 countries across the world: the *Global Competitiveness Report*. This report aims to evaluate the potential of world economies to achieve sustained medium and long-term growth.

¹ For more information on composite indicators, see the European Commission's Joint Research Centre website: <http://composite-indicators.jrc.ec.europa.eu/>

² A list of more benchmarks may also be found on the website of the Observatoire de la compétitivité: <https://odc.gouvernement.lu/fr/statistiques/benchmarks-internationaux.html>

³ For additional details: <http://reports.weforum.org/global-competitiveness-report-2018/>

The changing nature of economic competitiveness in a world increasingly transformed by new digital technologies is resulting in a series of new challenges for governments and businesses. This is the reason why the WEF has used a new methodology for this 2018 edition, designed to understand the dynamics of the world economy in these times of the fourth industrial revolution. In fact, according to the authors of the report, a large proportion of the factors which will have the greatest impact on competitiveness in the future have never been at the centre of major political decisions in the past. These include the creation of new ideas, entrepreneurial culture, openness and agility.

The Global Competitiveness Index (GCI) evaluates the set of factors determining the level of productivity of an economy – considered as the most decisive factor in long-term growth. The framework is built around 12 main factors of productivity. These pillars are the following: institutions, infrastructure, ability to integrate technology, macroeconomic stability, health, education and skills, property market, labour market, financial system, size of the market, dynamism of businesses and innovation. They include 98 individual indicators in all, based on a combination of statistical data and information derived from an annual opinion poll of economic decision-makers and business owners, carried out in collaboration with a network of partner institutes, including the Chamber of Commerce for Luxembourg. Each indicator, on a scale from 0 (poor performance) to 100 (best performance), indicates the ranking of an economy compared to the ideal situation.

The 2018 world ranking was headed by the United States (85.6), Singapore (83.5) and Germany (82.8). Luxembourg stood in 19th place worldwide (76.6). The Netherlands ranked 6th (82.4), while France was 17th (78.0) and Belgium 21st (76.6).

The ranking of the Member States of the EU was headed by Germany, the Netherlands and the United Kingdom, while Luxembourg stood in 8th place within the EU.

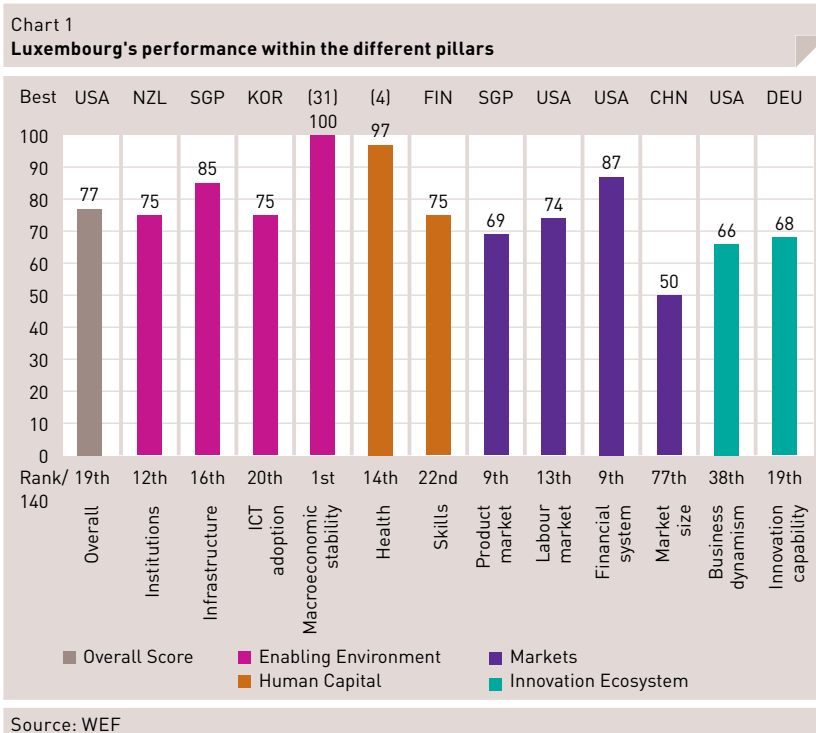
Table 1
Luxembourg's position according to the GCI

	Economy	Diff. from 2017 ²				Economy	Diff. from 2017 ²				Economy	Diff. from 2017 ²		
		Score	Rank	Score			Score	Rank	Score			Score	Rank	Score
1	United States	85.6	—	+0.8	48	Hungary	64.3	—	+0.9	95	Paraguay	53.4	+1	+0.5
2	Singapore	5.85	—	+0.5	49	Mauritius	63.7	—	+0.8	96	Guatemala	53.4	-5	-0.1
3	Germany	5.71	—	+0.2	50	Bahrain	63.6	-4	-0.2	97	Kyrgyz Republic	53.0	+3	+1.1
4	Switzerland	82.6	—	+0.2	51	Bulgaria	63.6	—	+1.2	98	El Salvador	52.8	—	+0.4
5	Japan	82.5	+3	+0.9	52	Romania	63.5	—	+1.3	99	Mongolia	52.7	-4	-0.2
6	Netherlands	82.4	-1	+0.2	53	Uruguay	62.7	-3	—	100	Namibia	52.7	-1	+0.3
7	Hong Kong SAR	82.3	—	+0.3	54	Kuwait	62.1	+2	+0.5	101	Honduras	52.5	+2	+1.2
8	United Kingdom	82.0	-2	-0.1	55	Costa Rica	62.1	-1	+0.4	102	Tajikistan	52.2	-5	-0.6
9	Sweden	81.7	—	+0.1	56	Philippines	62.1	+12	+2.3	103	Bangladesh	52.1	-1	+0.7
10	Denmark	80.6	+1	+0.7	57	Greece	62.1	-4	+0.3	104	Nicaragua	51.5	-3	—
11	Finland	80.3	+1	+0.5	58	India	62.0	+5	+1.2	105	Bolivia	51.4	n/a	n/a
12	Canada	79.9	-2	-0.1	59	Kazakhstan	61.8	—	+0.7	106	Ghana	51.3	-2	+1.4
13	Taiwan, China	79.3	—	+0.1	60	Colombia	61.6	-3	+0.1	107	Pakistan	51.1	-1	+1.3
14	Australia	78.9	+1	+0.7	61	Turkey	61.6	-3	+0.2	108	Rwanda	50.9	-1	+1.3
15	Korea, Rep.	78.8	+2	+0.8	62	Brunei Darussalam	61.4	+2	+1	109	Nepal	50.8	-1	+1.3
16	Norway	78.2	-2	-0.8	63	Peru	61.3	-3	+0.2	110	Cambodia	50.2	-1	+0.8
17	France	78.0	+1	+0.6	64	Panama	61.0	-9	-0.6	111	Cape Verde	50.2	-6	+0.4
18	New Zealand	77.5	-2	-0.6	65	Serbia	60.9	+5	+1.7	112	Lao PDR	49.3	-2	+0.7
19	Luxembourg	76.6	+3	+0.6	66	Georgia	60.9	+1	+1.0	113	Senegal	49.0	-2	+0.6
20	Israel	76.6	—	+0.4	67	South Africa	60.8	-5	-0.1	114	Côte d'Ivoire	47.6	n/a	n/a
21	Belgium	76.6	-2	—	68	Croatia	60.1	-2	—	115	Nigeria	47.5	-3	-0.5
22	Austria	76.3	-1	+0.2	69	Azerbaijan	60.0	-4	-0.2	116	Tanzania	47.2	-2	+0.8
23	Ireland	75.7	—	-0.3	70	Armenia	59.9	+2	+1.0	117	Uganda	46.8	-4	-0.2
24	Iceland	74.5	—	-0.1	71	Montenegro	59.6	+2	+1.4	118	Zambia	46.1	-3	+0.6
25	Malaysia	74.4	+1	+1.1	72	Brazil	59.5	-3	-0.2	119	Gambia, The	45.5	—	+0.8
26	Spain	74.2	-1	+0.4	73	Jordan	59.3	-2	+0.1	120	Eswatini	45.3	-4	+0.2
27	United Arab Emirates	73.4	—	+1.1	74	Seychelles	58.5	+10	+3.3	121	Cameroon	45.1	-3	+0.2
28	China	72.6	—	+0.9	75	Morocco	58.5	+2	+0.8	122	Ethiopia	44.5	-2	+0.6
29	Czech Republic	71.2	—	+0.3	76	Albania	58.1	+4	+0.8	123	Benin	44.4	-1	+0.8
30	Qatar	71.0	+2	+0.6	77	Viet Nam	58.1	-3	+0.1	124	Burkina Faso	43.9	n/a	n/a
31	Italy	70.8	—	+0.3	78	Trinidad and Tobago	57.9	-2	+0.1	125	Mali	43.6	-4	-0.1
32	Estonia	70.8	-2	—	79	Jamaica	57.9	-1	+0.5	126	Guinea	43.2	-3	+0.3
33	Chile	70.3	+1	+0.9	80	Lebanon	57.7	-5	-0.1	127	Venezuela	43.2	-10	-1.9
34	Portugal	70.2	-1	+0.5	81	Argentina	57.5	-2	+0.1	128	Zimbabwe	42.6	-4	+0.6
35	Slovenia	69.6	—	+1.1	82	Dominican Republic	57.4	—	+1.8	129	Malawi	42.4	—	+1.8
36	Malta	68.8	—	+0.3	83	Ukraine	57.0	+6	+3.1	130	Lesotho	42.3	-4	+0.9
37	Poland	68.2	—	+0.2	84	Macedonia, FYR	56.6	n/a	n/a	131	Mauritania	40.8	-3	+0.1
38	Thailand	67.5	+2	+1.3	85	Sri Lanka	56.0	-4	-0.4	132	Liberia	40.5	-2	+0.6
39	Saudi Arabia	67.5	+2	+1.6	86	Ecuador	55.8	-3	+0.4	133	Mozambique	39.8	-8	-2.1
40	Lithuania	67.1	-2	+0.7	87	Tunisia	55.6	-1	+1	134	Sierra Leone	38.8	-3	+0.1
41	Slovak Republic	66.8	-2	+0.6	88	Moldova	55.5	-1	+0.9	135	Congo, Democratic Rep.	38.2	-8	-2.6
42	Latvia	66.2	—	+1.4	89	Iran, Islamic Rep.	54.9	-1	+0.4	136	Burundi	37.5	-4	-1.0
43	Russian Federation	65.6	+2	+1.7	90	Botswana	54.5	-5	-0.5	137	Angola	37.1	n/a	n/a
44	Cyprus	65.6	-1	+0.9	91	Bosnia and Herzegovina	54.2	-1	+0.3	138	Haiti	36.5	-5	+0.7
45	Indonesia	64.9	+2	+1.4	92	Algeria	53.8	—	+0.3	139	Yemen	36.4	-4	+0.9
46	Mexico	64.6	-2	+0.5	93	Kenya	53.7	—	+0.4	140	Chad	35.5	-6	—
47	Oman	64.4	+14	+3.4	94	Egypt	53.6	—	+0.4					

■ East Asia and the Pacific
 ■ Eurasia
 ■ Europe and North America
 ■ Latin America and the Caribbean
■ Middle East and North Africa
 ■ South Asia
 ■ Sub-Saharan Africa
 Source: WEF

Luxembourg ranks as follows in the different pillars:

- ▼ Institutions: 12th (score of 75/100)
- ▼ Infrastructure: 16th (85)
- ▼ ICT adoption: 20th (75)
- ▼ Macroeconomic stability: 1st (100)
- ▼ Health: 14th (97)
- ▼ Skills: 22nd (75)
- ▼ Product market: 9th (69)
- ▼ Labour market: 13th (74)
- ▼ Financial system: 9th (87)
- ▼ Market size: 77th (50)
- ▼ Business dynamism: 38th (66)
- ▼ Innovation capability: 19th (68).



b. Global Competitiveness Index⁴

The Swiss Institute IMD published the 30th version of its annual report on competitiveness, the 'World Competitiveness Yearbook'. This report is published yearly since 1989. In this 2018 edition, 63 countries are analysed through 258 criteria. These criteria are both quantitative and qualitative (survey of business leaders), split into four subcategories: economic performance, government efficiency, business environment and infrastructure.

The 2018 world ranking is headed by the United States (score = 100 out of 100), Hong Kong (99.16) and Singapore (98.55). Luxembourg stands in 11th place worldwide (93.13). The Netherlands ranks 4th (97.53), Germany 15th (88.75), Belgium 26th (80.84) and France 28th (79.95).

Within the EU, the ranking is headed by the Netherlands, followed by Denmark (96.38) and Sweden (95.04). Luxembourg came 4th in the EU.

Table 2
IMD Top 20 global ranking

	0	10	20	30	40	50	60	70	80	90
100.00	(4) USA 1									
99.162	(1) Hong Kong SAR 2									
98.553	(3) Singapore 3									
97.534	(5) Netherlands 4									
97.143	(2) Switzerland 5									
96.385	(7) Denmark 6									
95.659	(10) UAE 7									
95.424	(11) Norway 8									
95.046	(9) Sweden 9									
94.337	(12) Canada 10									
93.135	(8) Luxembourg 11									
92.145	(6) Ireland 12									
89.028	(18) China Mainland 13									
88.888	(17) Qatar 14									
88.754	(13) Germany 15									
88.420	(15) Finland 16									
87.910	(14) Taiwan 17									
87.302	(25) Austria 18									
87.056	(21) Australia 19									
85.623	(19) United Kingdom 20									

Source: IMD

⁴ For additional details:
<http://www.imd.org/wcc/>

Luxembourg is ranked as follows under the four sub-categories of the global ranking:

- ▼ For the 'economic performance' category, Luxembourg places 4th, with strong results in international trade (4th) and international investment (2nd), but lower results in employment (15th), domestic economy (23rd) and prices (39th);
- ▼ For the 'government efficiency' category, Luxembourg places 17th, finishing 11th for public finances, 44th for tax policy, 8th for overall institutional framework, 12th for business legislation and 26th for societal framework;
- ▼ For the 'business environment' pillar Luxembourg placed 8th, with strong results for finance (3rd), productivity (8th) and management practices (10th), but lower results for attitudes and values (14th) and labour market (15th);
- ▼ The 'infrastructure' category is the area where Luxembourg records its poorest results, placing 24th. For example, Luxembourg finishes 14th for basic infrastructure, 32nd for technological infrastructure, 23rd for scientific infrastructure, 21st for environment and health, and 23rd for education.

c. Index of Economic Freedom⁵

The American Heritage Foundation published the 24th edition of its annual study 'Index of Economic Freedom', launched in 1995. Economic freedom, which is analysed in 186 countries around the world, is defined as the absence of any government coercion or constraint on production, supply or consumption of goods and services beyond the extent necessary to protect and maintain the liberty of citizens. Economic freedom is supposed to favour productivity and economic growth by supporting entrepreneurship and creation of value added. The more an economy is estimated to be free (composite index close to 100), the better a country ranks in the study. Economic freedom is measured through indicators spread among four categories, which are split into twelve equally-weighted sub-categories:

- ▼ Rule of law: property rights, judicial effectiveness, government integrity;
- ▼ Government size: tax burden, government spending, fiscal health;
- ▼ Regulatory efficiency: business freedom, labor freedom, monetary freedom;
- ▼ Market openness: trade freedom, investment freedom, financial freedom.

⁵ For additional details:
<http://www.heritage.org/index/>

The world ranking is headed by Hong Kong (90.2/100), followed by Singapore (88.8) and New Zealand (84.2). Luxembourg stands in 14th place worldwide (76.4) and forms part of the countries considered to be 'mostly free'. The Netherlands rank in 17th place (76.2), Germany 25th (74.2), Belgium 52th (67.5) and France 71st (63.9) in this worldwide classification. Within the EU, Luxembourg came 5th, after Ireland (80.4), Estonia (78.8), the United Kingdom (78.0) and Denmark (76.6).

Table 3
Top 20 of the European ranking

World Rank	Region Rank	Country Name	Overall Score	Change from 2017	Property Rights	Judicial Effectiveness	Government Integrity	Tax Burden	Gov't Spending	Fiscal Health	Business Freedom	Labor Freedom	Monetary Freedom	Trade Freedom	Investment Freedom	Financial Freedom
1	1	Hong Kong	90.2	0.4	92.5	84.3	82.8	93.1	90.2	100.0	96.3	89.4	84.3	90.0	90	90
2	2	Singapore	88.8	0.2	98.4	90.9	91.2	90.4	90.6	80.0	90.9	92.6	85.2	90.0	85	80
3	3	New Zealand	84.2	0.5	95.1	88.4	95.7	70.5	49.5	98.3	91.5	84.4	90.0	87.4	80	80
4	1	Switzerland	81.7	0.2	84.2	82.1	82.8	70.5	65.4	95.9	75.7	73.9	85.2	90.0	85	90
5	4	Australia	80.9	-0.1	78.7	93.4	77.4	63.0	61.2	84.3	89.1	79.7	87.4	86.2	80	90
6	2	Ireland	80.4	3.7	87.7	79.0	79.0	76.1	69.6	80.8	81.8	76.4	87.4	86.9	90	70
7	3	Estonia	78.8	-0.3	80.4	83.9	75.7	80.7	52.6	99.8	75.6	54.8	85.1	86.9	90	80
8	4	United Kingdom	78.0	1.6	92.2	93.8	79.0	65.2	44.4	53.5	91.1	74.4	85.2	86.9	90	80
9	1	Canada	77.7	-0.8	87.5	77.1	78.3	76.7	52.3	81.2	81.8	71.3	77.5	88.1	80	80
10	1	United Arab Emirates	77.6	0.7	76.3	83.4	77.3	98.4	70.9	99.0	79.9	81.1	80.2	84.3	40	60
11	5	Iceland	77.0	2.6	86.7	72.6	77.3	72.1	44.2	94.3	89.5	61.8	81.7	88.5	85	70
12	6	Denmark	76.6	1.5	84.8	83.6	84.1	41.4	10.6	96.7	92.5	82.8	86.4	86.9	90	80
13	5	Taiwan	76.6	0.1	84.3	69.2	70.9	76.1	90.4	90.8	93.2	54.9	83.3	86.2	60	60
14	7	Luxembourg	76.4	0.5	82.7	77.9	79.0	65.1	48.5	99.0	69.2	46.2	87.6	86.9	95	80
15	8	Sweden	76.3	1.4	92.6	88.2	92.9	43.9	23.2	96.1	89.3	53.7	83.8	86.9	85	80
16	9	Georgia	76.2	0.2	62.8	64.2	61.8	87.0	73.3	91.8	86.9	77.3	79.6	89.4	80	60
17	10	Netherlands	76.2	0.4	87.9	74.1	86.0	52.5	39.1	88.2	80.5	61.5	87.5	86.9	90	80
18	2	United States	75.7	0.6	79.3	76.9	71.9	65.1	56.5	54.8	82.7	91.4	78.6	86.7	85	80
19	11	Lithuania	75.3	-0.5	73.8	66.7	50.9	86.4	63.9	96.7	73.4	64.5	89.9	86.9	80	70
20	3	Chile	75.2	-1.3	67.9	63.4	61.2	78.0	81.3	91.7	72.4	60.4	82.4	88.7	85	70

Source: The Heritage Foundation

The report reveals Luxembourg's strong results in the domains of rule of law, tax burden, market openness and monetary stability. The country's scores for labour freedom, government spending and tax burden give more cause for concern. Luxembourg records the following results in the twelve sub-categories:

- ▼ Rule of law: property rights (82.7), judicial effectiveness (77.9), government integrity (79.0);
- ▼ Government size: tax burden (65.1), government spending (48.5), fiscal health (99.0);
- ▼ Regulatory efficiency: business freedom (69.2), labor freedom (46.2), monetary freedom (87.6);
- ▼ Market openness: trade freedom (86.9), investment freedom (95.0), financial freedom (80.0).

In conclusion, the authors of the study make the following observation with regard to Luxembourg: *'Luxembourg is one of the world's wealthiest countries. It has one of the eurozone's highest current account surpluses as a share of GDP, maintains a healthy budgetary position, and has the region's lowest level of public debt. Economic competitiveness is sustained by the solid institutional foundations of an open-market system. The judiciary, independent and free of corruption, protects property rights and upholds the rule of law. High levels of regulatory transparency and efficiency encourage entrepreneurial activity. (...) Growth is strong, and unemployment remains well below the EU average. During the 20th century, Luxembourg evolved into a mixed manufacturing and services economy with strong financial services. With its low energy costs, reliable electricity grid, and stable governance, the country is gaining interest as a hub for the new information economy of the 21st century.'*

d. European innovation scoreboard⁶

Each year, the European Commission publishes a comparative evaluation of the results of the Member States of the EU relating to innovation, measured against those in international competition. These data assist the Member States and the EU as a whole to evaluate the areas in which they should concentrate their efforts. According to the European Commission, approximately two thirds of the economic growth recorded by Europe over the past decades resulted from innovation. The European Commission published the 17th edition of its annual European Innovation Scoreboard (EIS), the first version of which was initially issued in 2001. This scoreboard enables the relative innovation performance of the different countries to be measured and compared and provides an analysis of the strengths and weaknesses of national research and innovation systems.

⁶ For additional details: http://ec.europa.eu/growth/industry/innovation/facts-Charts/scoreboards/index_en.htm

For last year's edition, the main framework of measurement was significantly modified, but for this year's edition no new modification was made in this respect. The measurement framework includes in total 27 indicators separated into 4 major types of indicators and 10 areas:

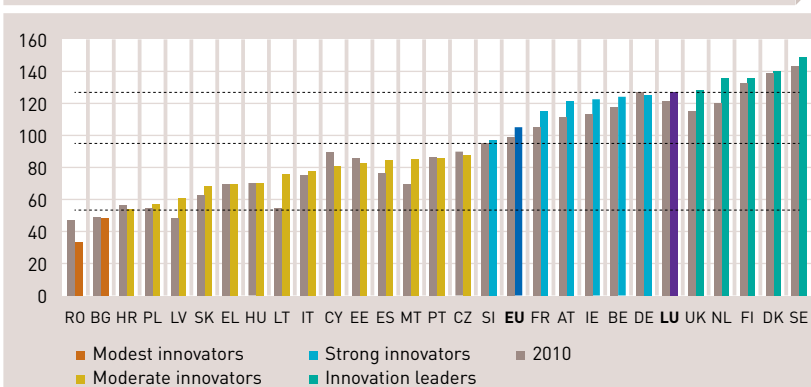
- ▼ 'Tools' covers the main drivers of innovation external to companies: human resources, attractive research systems, innovation-friendly environment;
- ▼ 'Investments' covers private and public investments in R&D: finance and support, firm investments;
- ▼ 'Innovation activities' includes the efforts made to innovate within companies: innovators, linkages and intellectual assets;
- ▼ 'Impacts' captures the effects of companies' innovation activities: employment impacts and sales impacts.

On the basis of the average innovation results, calculated using a composite indicator entitled 'Summary Innovation Index' (SII) and ranging from 0 (poorest performance) to 1 (best performance), countries are placed into four different performance groups:

- ▼ 'Innovation Leaders', whose 2017 results in terms of innovation are well above the EU average (score at least 20% above the EU average);
- ▼ 'Strong innovators', whose results are above or close to the EU average (score of between 90% and 120% of EU average);
- ▼ 'Moderate Innovators', whose results are below the EU average (score of between 50% and 90% of the EU average);
- ▼ 'Modest Innovators', whose results are well below the EU average (score of <50% of the EU average).

The new ranking is headed by Sweden (average score 0.710 out of 1), followed by Denmark (0.668) and Finland (0.649). This year, Luxembourg appeared in the top group – comprised of innovation champions – standing in 6th place (0.611). The Netherlands stand in 4th place (0.648), while Germany stands 7th (0.603), Belgium 8th (0.593) and France 11th (0.551).

Chart 2
EIS ranking of EU Member States



Finally, as regards the ten dimensions of innovation, Luxembourg ranks as follows in the indices compared to the 2017 EU average (base 100):

- ▼ 'Tools': human resources (126.0); attractive research systems (197.8); innovation-friendly environment (143.5);
- ▼ 'Investments': finance and support (124.7) ; firm investments (68.9);
- ▼ 'Innovation activities': innovators (142.2); linkages (62.2) ; intellectual assets (153.0);
- ▼ 'Impacts': employment impacts (138.6); sales impacts (84.8).

The European Commission is thus of the opinion that the environment favourable to innovation and the intellectual assets constitute the dimensions in which Luxembourg performs the best compared to the EU, while business collaboration and investments are areas in which Luxembourgish performance is the poorest.

Table 4
Performance of Luxembourg

Luxembourg	Performance relative to EU 2010 in		Relative to EU 2017 in
	2010	2017	2017
SUMMARY INNOVATION INDEX	121.2	128.1	121.1
Human resources	137.3	150.3	126.0
New doctorate graduates	46.2	83.1	59.6
Population with tertiary education	197.8	204.5	180.3
Lifelong learning	176.0	167.7	164.3
Attractive research systems	163.7	224.8	197.8
International scientific co-publications	282.4	576.0	354.1
Most cited publications	85.4	133.3	128.4
Foreign doctorate students	234.3	234.3	211.6
Innovation-friendly environment	186.1	192.0	143.5
Broadband penetration	144.4	277.8	156.3
Opportunity-driven entrepreneurship	210.7	141.1	131.0
Finance and support	114.4	134.3	124.7
R&D expenditure in the public sector	43.4	78.8	81.7
Venture capital expenditures	205.5	205.5	168.4
Firm investments	67.4	77.1	68.9
R&D expenditure in the business sector	57.2	51.9	46.6
Non-R&D innovation expenditures	24.5	4.9	4.5
Enterprises providing ICT training	114.3	164.3	143.8
Innovators	134.9	122.3	142.2
SMEs product/process innovations	127.3	107.8	131.8
SMEs marketing/organisational innovations	144.2	148.9	179.8
SMEs innovating in-house	132.6	109.1	117.0
Linkages	80.1	62.8	62.2
Innovative SMEs collaborating with others	111.7	80.0	79.6
Public-private co-publications	94.5	79.5	78.8
Private co-funding of public R&D exp.	32.4	27.1	26.7
Intellectual assets	145.1	154.4	153.0
PCT patent applications	44.2	47.5	49.6
Trademark applications	278.7	278.7	246.6
Design applications	139.3	161.1	166.9
Employment impacts	124.4	139.4	138.6
Employment in knowledge-intensive activities 191.8	223.4	211.7	191.8
Employment fast-growing enterprises	53.8	87.8	93.8
Sales impacts	100.6	88.2	84.8
Medium and high tech product exports	93.0	73.8	69.7
Knowledge-intensive services exports	146.1	149.8	142.8
Sales of new-to-market/firm innovations	56.6	33.6	33.2

Dark green: normalised performance above 120% of EU; light green: normalised performance between 90% and 120% of EU, yellow: normalised performance between 50% and 90% of EU; orange: normalised performance below 50% of EU. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.
Data in red show a decline in performance compared to 2010.
Source: European Commission

e. Ranking comparison and correlation analysis

The table below shows an extract of the rankings of the four major annual composite indicators that had been reviewed above, in which Luxembourg is appearing⁷.

Table 5
Top 25 of the four major rankings (reports published in 2018)

	N°	World Economic Forum	IMD	Heritage Foundation	European Commission
		<i>GCI</i>	<i>GCI</i>	<i>Economic Freedom</i>	<i>SII</i>
+	1	United States	United States	Hong Kong	Sweden
	2	Singapore	Hong Kong	Singapore	Denmark
	3	Germany	Singapore	New Zealand	Finland
	4	Switzerland	Netherlands	Switzerland	Netherlands
	5	Japan	Switzerland	Australia	United Kingdom
	6	Netherlands	Denmark	Ireland	Luxembourg
	7	Hong Kong	United Arab Emirates	Estonia	Germany
	8	United Kingdom	Norway	United Kingdom	Belgium
	9	Sweden	Sweden	Canada	Ireland
	10	Denmark	Canada	United Arab Emirates	Austria
	11	Finland	Luxembourg	Iceland	France
	12	Canada	Ireland	Denmark	Slovenia
	13	Taiwan	China	Taiwan	Czech Republic
	14	Australia	Qatar	Luxembourg	Portugal
	15	South Korea	Germany	Sweden	Malta
	16	Norway	Finland	Georgia	Spain
	17	France	Taiwan	Netherlands	Estonia
	18	New Zealand	Austria	United States	Cyprus
	19	Luxembourg	Australia	Lithuania	Italy
	20	Israel	United Kingdom	Chile	Lithuania
	21	Belgium	Israel	Mauritius	Hungary
	22	Austria	Malaysia	Malaysia	Greece
	23	Ireland	New Zealand	Norway	Slovakia
	24	Iceland	Iceland	Czech Republic	Latvia
-	25	Malaysia	Japan	Germany	Poland

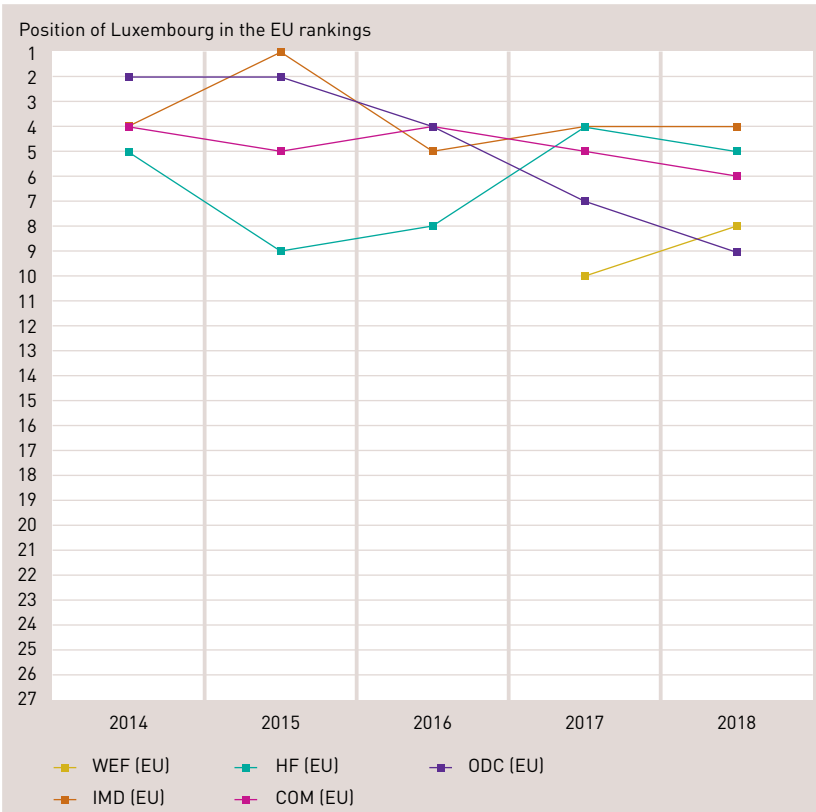
Note: Luxembourg's neighbouring countries (Germany, Belgium, France), and the Netherlands as a Member State of the Benelux, are highlighted in green when their ranking is better than Luxembourg's and otherwise in red.

We can observe that Luxembourg places between 4th (IMD) and 8th (WEF) position in the list of EU countries. Luxembourg places 9th in the EU in the ranking produced by the Observatoire de la compétitivité, based on the national competitiveness scoreboard.⁸

⁷ Annual changes in country rankings should be consulted with a certain caution, because over the years methodological changes in the calculation of the index may have occurred without a recalculation of the ranks for all the years.

⁸ Please refer to Chapter 3 of this Report for more information on the ODC ranking.

Chart 3
Evolution of Luxembourg in the EU rankings, 2014-2018



Notes: The time axis refers to the report's year of publication. Time series should be consulted with caution, because methodological changes might have occurred without the ranks for all prior years being recalculated.
For the WEF ranking, a new methodology was introduced in 2018 and a recalculation for the preceding years can only be performed for the year 2017.

In general, it is useful to analyse the correlation between these major benchmarks. Kendall's coefficient is suitable for this type of analysis as it measures the degree of agreement. This correlation has been calculated on the basis of the EU countries⁹. The coefficient takes a value between 0 (no relation) and 1 (a perfect agreement between rankings and judges). In each of the previous years' Competitiveness Reports, there has been a strong correlation between the rankings. On the basis of the four annual rankings previously described and the national scoreboard that is annually published by the Observatoire de la compétitivité, the Kendall's coefficient equates to 0.73 in 2018 and there is, as in previous years, a strong correlation between the different EU rankings.

⁹ EU excluding Malta. The list of countries used for making this calculation has changed over the years. Since the publication of the 2011 Report, only EU Member States are taken into account. Since the 2014 edition, Croatia has been added as new EU Member State. Since 2017 Cyprus could be added in the calculation.

Table 6
Adjustment of the EU rankings, 2018

Country	WEF	IMD	HF	EC	ODC
Germany	1	6	10	7	11
Austria	10	8	13	10	9
Belgium	9	10	18	8	12
Bulgaria	24	23	16	26	26
Cyprus	22	20	17	17	24
Croatia	27	27	26	25	15
Denmark	5	2	4	2	6
Spain	12	17	21	15	23
Estonia	15	13	2	16	13
Finland	6	7	11	3	4
France	7	11	23	11	14
Greece	26	26	27	21	27
Hungary	23	22	19	20	17
Ireland	11	5	1	9	1
Italy	14	21	25	18	21
Latvia	21	19	12	23	19
Lithuania	19	14	8	19	16
Luxembourg	8	4	5	6	8*
Netherlands	2	1	7	4	5
Poland	18	16	15	24	20
Portugal	16	15	24	14	22
Slovak Republic	20	25	20	22	7
Czech Republic	13	12	9	13	25
Romania	25	24	14	27	10
United Kingdom	3	9	3	5	18
Slovenia	17	18	22	12	2
Sweden	4	3	6	1	3

Note: Excluding Malta

* For reasons of comparability with the other four benchmarks considered here, Luxembourg is ranked in 8th position in the adjusted ODC ranking (EU-27, excluding Malta) and not 9th as in the general EU-28 ranking of ODC's National competitive scoreboard (including Malta).

Source: Observatoire de la compétitivité

2.2.2 Other international benchmarks

Besides the four composite indicators and rankings analysed in the previous section, a multitude of other ones can be found. Some of these will be considered below.

a. General indicators of competitiveness

a.1 Best countries for business¹⁰

Over the last decade the American economic and financial journal FORBES has been analyzing which countries in the world are most attractive for investors and capital. In the 'Best countries for business 2018' latest edition, 153 countries are analyzed according to fifteen (equally-weighted) criteria including intellectual property rights, innovation, taxation, technology, corruption, infrastructure, market size, political risk, quality of life, workforce, freedoms, administrative burden and finally investor protection. The writers drew information from several international source publications including the Global Economic Forum, World Bank etc.

The world ranking is headed by the United Kingdom, followed by New Zealand and the Netherlands. Luxembourg ranks 25th worldwide (13th in the EU). Germany ranks 13th (6th), Belgium 17th (8th) and France 22th (11th).

Table 7	
Top 10 of the ranking	
1	United Kingdom
2	New Zealand
3	Netherlands
4	Sweden
5	Canada
6	Hong Kong
7	Denmark
8	Ireland
9	Singapore
10	Switzerland
Source: Forbes	

¹¹ For additional details:
<https://www.forbes.com/best-countries-for-business/list/3/#tab:overall>

a.2 Growth promise indicators¹¹

KPMG published a new edition of its composite indicator on sustainable growth prospects, called 'Growth Promise Indicators' (GPI), released in 2014 for the first time. The present 2018 edition of the report covers 180 countries of the world. The present composite GPI index is based on fifteen indicator sub-categories, drawn up by international organisations, with an influence on potential growth and national productivity. Each sub-category may be assigned a score between 0 (very poor performance) and 10 (very good performance). These sub-categories are later combined into five large categories:

- ▼ Macroeconomic stability (public deficit, public debt);
- ▼ Openness (FDI stock, volume of international trade);
- ▼ Infrastructure (quality of infrastructure: transport, technology, availability of financial services);
- ▼ Human development (education, life expectancy);
- ▼ Institutions (quality of regulation, independence of the legal system, transparency of public authorities, effectiveness of public authorities, corruption, business law).

The weighting of the indicators, sub-categories and categories is determined by means of an econometric analysis and the results obtained from prior studies.

The global ranking is headed by the Netherlands (8.62/10), followed by Switzerland (8.62) and Luxembourg (8.29) in 3rd place worldwide. Germany ranked 14th (7.55), followed by Belgium in 16th place (7.42) and France in 24th place (7.04).

¹¹ For additional details:
<https://home.kpmg.com/lu/en/home/insights/2018/01/growth-promise-indicators.html>

Rank	12-month change	Country/ jurisdiction	Headline Index	Macroeconomic stability	Openness	Human development	Quality of infrastructure	Quality of institutions
1	-	The Netherlands	8.62	5.76	9.39	8.08	9.14	8.76
2	-	Switzerland	8.62	6.55	7.29	7.60	9.22	9.11
3	-	Luxembourg	8.29	7.96	10.00	6.98	8.42	8.68
4	-	Hong Kong (S.A.R)	8.25	9.14	10.00	8.26	7.40	8.55
5	-	Norway	8.11	7.41	3.11	8.18	8.11	8.79
6	-	Finland	8.07	5.28	3.47	8.35	7.73	9.11
7	↑ 1	Singapore	7.98	2.79	10.00	8.42	6.94	8.94
8	↑ 1	Denmark	7.98	6.74	5.18	7.98	7.94	8.51
9	↓ 2	Sweden	7.90	6.85	4.55	8.04	7.69	8.55
10	-	Iceland	7.82	6.70	4.93	7.86	8.16	8.05
11	-	New Zealand	7.77	7.51	2.44	8.15	6.78	9.02
12	↑ 2	Canada	7.58	3.74	3.35	8.24	7.22	8.53
13	-	United Kingdom	7.57	3.69	2.73	7.96	7.44	8.56
14	↓ 2	Germany	7.55	5.33	4.10	7.81	7.62	8.08
15	-	Ireland	7.43	5.00	10.00	8.02	6.05	8.14
16	-	Belgium	7.42	2.92	9.35	8.02	6.97	7.78
17	-	Australia	7.32	6.46	1.56	7.95	6.78	8.23
18	-	Estonia	7.31	8.50	9.12	7.69	6.41	7.41
19	↑ 1	Austria	7.20	4.36	5.38	7.29	6.91	7.95
20	↓ 1	Japan	7.16	0.72	0.73	8.49	6.83	8.35

■ Americas
 ■ APAC
 ■ Europe

Source: KPMG

Luxembourg's performance ratings are as follows in the GPI categories:

- ▼ Macroeconomic stability: score of 7.96/10;
- ▼ Openness: 10/10;
- ▼ Infrastructure: 6.98/10;
- ▼ Human development: 8.42/10;
- ▼ Institutions: 8.68/10.

b. Financial sector attractiveness and competitiveness indicators

b.1 Global Financial Centres Index¹²

In September 2018, the Z/Yen consultancy bureau published the latest edition of the bi-annual competitiveness index of about 100 financial centres around the world, the 'Global financial centres index' (GFCI). This composite indicator was first issued in 2007. In a world that is becoming increasingly globalised and interdependent through information and communication technologies (ICT), financial centres are facing a greater competition than other sectors. In fact, financial services are at the heart of the global economy, acting as facilitators of international trade and foreign investments.

The GFCI study is based on two types of sources to assess the competitiveness of financial centres (scale from 1 to 1,000). The study uses on the one hand 137 quantitative determinants and on the other hand a barometer of appreciation produced from online surveys among professionals of the sector. As defined in this study, competitiveness consists of five categories of indicators:

- ▼ Business environment (political stability, regulation, etc.);
- ▼ Human resources (training, flexibility, etc.);
- ▼ Infrastructure (cost and availability of offices, ICT, transports, etc.);
- ▼ Development of the financial sector (volumes, capital availability, etc.);
- ▼ Reputation (perception of cities as desirable places to live, degree of innovation, etc.).

In this new edition of the GFCI study, New York (788/1000), London (786) and Hong Kong (783) occupy the top three places worldwide, whereas Luxembourg ranks 21st (694). In the EU, Luxembourg comes 3rd, after London and Frankfurt (10th, 730). In the euro area, Luxembourg thus ranks 2nd, after Frankfurt. As an example, other European financial centres are appraised as follows: Zurich (9th place, 732), Paris (23rd; 691), Amsterdam (35th; 657), and Dublin (37th; 652).

¹¹ For additional details: <https://www.longfinance.net/publications/long-finance-reports/global-financial-centres-index-24/>

Table 9
Top 25 of the ranking

Centre	GFCI 24		GFCI 23		Change in		Change in	
	Rank	Rating	Rank	Rating	Rank		Rating	
New York	1	788	2	793	↑	1	↓	5
London	2	786	1	794	↓	1	↓	8
Hong Kong	3	783	3	781		0	↑	2
Singapore	4	769	4	765		0	↑	4
Shanghai	5	766	6	741	↑	1	↑	25
Tokyo	6	746	5	749	↓	1	↓	3
Sydney	7	734	9	724	↑	2	↑	10
Beijing	8	733	11	721	↑	3	↑	12
Zurich	9	732	16	713	↑	7	↑	19
Frankfurt	10	730	20	708	↑	10	↓	22
Toronto	11	728	7	728	↓	4		0
Shenzhen	12	726	18	710	↑	6	↑	16
Boston	13	725	10	722	↓	3	↑	3
San Francisco	14	724	8	726	↓	6	↓	2
Dubai	15	722	19	709	↑	4	↑	13
Los Angeles	16	721	17	712	↑	1	↑	9
Chicago	17	717	14	718	↓	3	↓	1
Vancouver	18	709	15	717	↓	3	↓	8
Guangzhou	19	708	28	678	↑	9	↑	30
Melbourne	20	699	12	720	↓	8	↓	21
Luxembourg	21	694	21	701	0	↓	7	
Osaka	22	693	23	692	↑	1	↑	1
Paris	23	691	24	687	↑	1	↑	4
Montreal	24	690	13	719	↓	11	↓	29
Tel Aviv	25	689	34	661	↑	9	↑	28

Source: Z/Yen

In the online assessment poll sent to professional operators, Luxembourg is among the top 15 financial centres perceived as having increasing significance in the next few years. This category is dominated by the Asian financial centres.

Finally, according to an analysis of the performance volatility of financial centres, in this new edition, Luxembourg is classified as an 'unpredictable' financial centre. This means that Luxembourg is considered to be one of the world's more volatile financial centres, due to changes in decisive factors, with the greatest number of contradictory appraisals, as indicated by online polls of professionals in the sector. This type of financial sector has the greatest potential for future movement. In prior editions of the study, Luxembourg appeared in the 'dynamic' category, between financial centres considered 'stable' and those considered 'unpredictable'.

c. Innovation and technology indicators

c.1 Global innovation index¹³

Bloomberg published the new edition of the composite index 'Global Innovation Index' (GII), which aims to gauge the innovation capacity of 80 countries worldwide. The statistical information for the GII index is sourced from several international organisations including the ILO, IMF, World Bank and OECD, to produce a report based on a range of 7 equally-weighted criteria, which are predominantly 'production oriented': it takes a value between 0 (worst performance) and 1 (best performance).

This ranking is led by South Korea (score 89.28/100), followed by Sweden (84.70) and Singapore (83.05). Luxembourg, the economic structure of which has been very strongly oriented towards services and, to a lesser extent, manufacturing or even the industry – for several decades now, ranks 32nd worldwide (60.65), standing in 18th place within the EU. Germany ranks 4th worldwide (2nd in the EU, 82.53), followed by France in 9th place (5th in the EU, 80.75), Belgium in 14th place (8th in the EU, 77.12) and the Netherlands in 16th place (9th place in the EU; 75.09).

Luxembourg performs as follows in the seven main criteria of the GII index (global rankings):

- ▼ R&D intensity: 27th;
- ▼ Manufacturing value-added: 38th;
- ▼ Productivity: 3rd;
- ▼ High-tech density: data not available;
- ▼ Higher education: 50th;
- ▼ Researcher concentration: 11th;
- ▼ Patent activity: 13th.

¹³ For additional details:
<https://www.bloomberg.com/news/articles/2018-01-22/south-korea-tops-global-innovation-ranking-again-as-u-s-falls>

Table 10
Top 50 of the ranking

2018 rank	2017 rank	YoY change	Economy	Total score	R&D intensity	Manufacturing value-added	Productivity	High-tech density	Tertiary efficiency	Researcher concentration	Patent activity
1	1	0	S. Korea	89.28	2	2	21	4	3	4	1
2	2	0	Sweden	84.70	4	11	5	7	18	5	8
3	6	+3	Singapore	83.05	15	5	12	21	1	7	12
4	3	-1	Germany	82.53	9	4	17	3	28	19	7
5	4	-1	Switzerland	82.34	7	7	8	9	11	17	17
6	7	+1	Japan	81.91	3	6	24	8	34	10	3
7	5	-2	Finland	81.46	8	16	10	13	19	6	4
8	8	0	Denmark	81.28	6	15	11	15	26	2	10
9	11	+2	France	80.75	12	35	14	2	10	21	9
10	10	0	Israel	80.64	1	27	9	5	41	1	19
11	9	-2	U.S.	80.42	10	23	6	1	42	20	2
12	12	0	Austria	79.12	5	8	15	26	12	12	5
13	16	+3	Ireland	77.87	22	1	1	18	20	14	33
14	13	-1	Belgium	77.12	11	22	13	10	37	13	21
15	14	-1	Norway	76.76	19	37	19	11	23	8	14
16	15	-1	Netherlands	75.09	17	26	20	6	47	15	18
17	17	0	U.K.	74.54	20	40	23	14	8	18	15
18	18	0	Australia	74.35	14	46	16	17	17	3	20
19	21	+2	China	73.36	16	19	40	12	4	42	6
20	24	+4	Italy	68.88	25	20	22	20	32	36	23
21	22	+1	Poland	68.74	35	13	37	16	14	34	24
22	20	-2	Canada	67.98	21	32	26	23	45	16	22
23	19	-4	New Zealand	67.40	31	36	18	25	43	22	11
24	25	+1	Iceland	67.11	13	28	2	-	27	9	26
25	26	+1	Russia	66.61	32	33	44	22	5	28	16
26	23	-3	Malaysia	64.79	26	17	36	24	36	33	34
27	27	0	Hungary	64.37	24	10	42	18	48	32	35
28	28	0	Czech Rep.	63.47	18	3	25	-	33	24	28
29	29	0	Spain	63.06	29	25	27	36	6	31	31
30	31	+1	Portugal	61.38	28	31	32	42	7	23	37
31	30	-1	Greece	61.37	36	45	34	28	15	26	39
32	34	+2	Luxembourg	60.65	27	38	3	-	50	11	13
33	37	+4	Turkey	60.26	34	21	30	34	13	43	30
34	32	-2	Lithuania	59.04	33	14	33	-	9	29	43
35	38	+3	Romania	58.94	48	12	31	27	24	47	38
36	33	-3	Estonia	58.76	23	24	29	-	22	27	42
37	35	-2	Hong Kong	57.05	41	50	4	29	31	25	29
38	36	-2	Slovakia	56.88	30	8	35	-	39	30	45
39	40	+1	Malta	54.27	40	43	7	37	29	38	47
40	39	-1	Latvia	53.65	46	39	28	40	30	39	32
41	NR	-	Bulgaria	51.54	37	34	41	39	38	37	48
42	41	-1	Croatia	51.24	39	30	39	44	35	41	41
43	45	+2	Tunisia	49.83	44	41	46	41	16	40	44
44	43	-1	Serbia	48.93	38	29	47	43	44	35	46
45	44	-1	Thailand	47.83	45	18	45	31	25	48	-
46	42	-4	Ukraine	47.28	47	48	50	32	21	46	27
47	47	0	Cyprus	47.01	49	49	38	30	40	45	40
48	-	-	S. Africa	46.98	42	47	43	35	49	50	25
49	-	-	Iran	46.09	50	42	49	38	2	49	36
50	50	0	Morocco	44.84	43	44	48	33	46	44	49

NOTES: **1. R&D intensity:** Research and development expenditure, as% GDP **2. Manufacturing value-added:** MVA, as% GDP and per capita (\$PPP) **3. Productivity:** GDP and GNI per employed person age 15+ an 3Y improvement **4. High-tech density:** Number of domestically domiciled high-tech public companies - such as aerospace and defense, biotechnology, hardware, software, semiconductors, Internet software and services, and renewable energy companies - as% domestic publicly listed companies and as a share of world's total public high-tech companies **5. Tertiary efficiency:** Total enrollment in tertiary education, regardless of age, as% the post-secondary cohort; share of labor force with advanced level of education; annual new science and engineering graduates as% total tertiary graduates and as% the labor force **6. Researcher concentration:** Professionals, including postgraduates PhD students, engaged in R&D, per million population **7. Patent activity:** Resident patent filings, total patent grants and patent in force, per million population; filings per \$100 billion GDP and total grants by country as a share of world total. All metrics are equally weighted. Metrics consisting of multiple factors were rescaled for countries void of some but not all data points. Most recent data available used. Of the more than 200 economies evaluated, 80 had data available for at least six of the seven factors and were ranked. The top 50 and the metric ranks among them are displayed.

Source: Bloomberg

c.2 Global innovation index¹⁴

Cornell University, INSEAD and the World Intellectual Property Organisation (WIPO) published the 11th edition of the Global Innovation Index (GII). The GI composite index has been published since 2007 and is a comparative tool enabling business leaders, decision makers and other interested parties to better understand the innovation state of play across the world. The report contains a ranking of countries' innovation capacities and performance. Given the vital role that innovation plays in economic growth and prosperity, the GI composite index features indicators which go beyond those traditionally used, such as R&D expenditure. This new edition assesses 126 countries and is based on 80 indicators. The GI composite index is based on two sub-indices:

- ▼ The 'Resources invested in innovation' sub-index ('Inputs') evaluates national economic measures in favour of innovative business activities on the basis of five pillars: 1) institutions, 2) human capital and research, 3) infrastructure, 4) market sophistication, 5) business sophistication;
- ▼ 'Outputs' sub-index assesses tangible evidence of innovation on the basis of two pillars: 6) knowledge and technology outputs, 7) creativity.

The GI composite index is calculated on the basis of the simple average of these two sub-indices, with scores ranging from 0 (poor) to 100 (excellent).

The worldwide ranking is headed by Switzerland (68.40/100), followed by the Netherlands (63.32) and Sweden (63.08). Luxembourg ranks 15th worldwide (54.53), while Germany ranks 9th (58.03), France comes 16th (54.36), and Belgium 25th (50.50). Within the EU-28, Luxembourg stands in 8th place.

¹⁴ For additional details:
<https://www.globalinnovation-index.org/home>

Table 11
Top 30 of the ranking

Country/Economy	Score (0–100)	Rank	Income	Rank	Region	Rank	Efficiency Ratio	Rank
Switzerland	68.40	1	HI	1	EUR	1	0.96	1
Netherlands	63.32	2	HI	2	EUR	2	0.91	4
Sweden	63.08	3	HI	3	EUR	3	0.82	10
United Kingdom	60.13	4	HI	4	EUR	4	0.77	21
Singapore	59.83	5	HI	5	SEAO	1	0.61	63
United States of America	59.81	6	HI	6	NAC	1	0.76	22
Finland	59.63	7	HI	7	EUR	5	0.76	24
Denmark	58.39	8	HI	8	EUR	6	0.73	29
Germany	58.03	9	HI	9	EUR	7	0.83	9
Ireland	57.19	10	HI	10	EUR	8	0.81	13
Israel	56.79	11	HI	11	NAWA	1	0.81	14
Korea, Republic of	56.63	12	HI	12	SEAO	2	0.79	20
Japan	54.95	13	HI	13	SEAO	3	0.68	44
Hong Kong (China)	54.62	14	HI	14	SEAO	4	0.64	54
Luxembourg	54.53	15	HI	15	EUR	9	0.94	2
France	54.36	16	HI	16	EUR	10	0.72	32
China	53.06	17	UM	1	SEAO	5	0.92	3
Canada	52.98	18	HI	17	NAC	2	0.61	61
Norway	52.63	19	HI	18	EUR	11	0.64	52
Australia	51.98	20	HI	19	SEAO	6	0.58	76
Austria	51.32	21	HI	20	EUR	12	0.64	53
New Zealand	51.29	22	HI	21	SEAO	7	0.62	59
Iceland	51.24	23	HI	22	EUR	13	0.76	23
Estonia	50.51	24	HI	23	EUR	14	0.82	12
Belgium	50.50	25	HI	24	EUR	15	0.70	38
Malta	50.29	26	HI	25	EUR	16	0.84	7
Czech Republic	48.75	27	HI	26	EUR	17	0.80	17
Spain	48.68	28	HI	27	EUR	18	0.70	36
Cyprus	47.83	29	HI	28	NAWA	2	0.79	18
Slovenia	46.87	30	HI	29	EUR	19	0.74	27

Source: INSEAD/Cornell/OMPI

Luxembourg scores as follows for the two sub-indices:

- ▼ With a score of 56.19, Luxembourg ranks 25th overall (12th in the EU) for the Inputs category (institutions: 24th place overall, human capital and research: 42nd, infrastructure: 23rd, market sophistication: 70th, business sophistication: 7th);
- ▼ With a score of 52.87, Luxembourg ranks 4th overall (3rd in the EU) for the Outputs category (knowledge and technology outputs: 14th, creativity: 2nd).

The authors also calculated an Outputs/Inputs index by cross-referencing these two sub-indices to assess the effectiveness of innovation systems and policies which have been implemented. Following Switzerland (0.96), Luxembourg comes 2nd place overall with a score of 0.94.

Finally, the authors note the following regarding Luxembourg: *'Luxembourg ranks 4th in the Innovation Output Sub-Index in 2018 and 15th in the overall GII. On the output side, Luxembourg gains one position in Knowledge and technology outputs (14th) and loses the 1st place in Creative outputs (2nd this year). At the indicator level, the country maintains its strengths in cultural and creative services exports, national feature films, and generic top-level domains (TLDs); it also gains strength in PCT patent applications by origin, FDI outflows, and ICTs and business model creation. The only weak indicator among Luxembourg's output indicators is creative goods exports.'*

c.3 Measuring information society¹⁵

The International Telecommunications Union (ITU) published the latest edition of its *Measuring Information Society report*, analysing the use of information and communication technologies (ICT) in 192 territories. It also gauges the development potential stemming from ICT use. Direct effects related to the development and diffusion of ICT can result in particular in productivity gains. The report uses a composite index entitled the 'ICT Development Index' (IDI), which assesses both the level and progress of ICT development over time. This composite index is made up of 11 base indicators split into three sub-categories:

- ▼ Access to ICTs (40% weighting): fixed-telephone subscriptions, mobile phone subscriptions, international Internet bandwidth per Internet user, households with a computer, and households with Internet access;
- ▼ ICT use (40%): individuals using the Internet, fixed broadband subscriptions, and mobile-broadband subscriptions;
- ▼ ICT skills (20%): mean years of schooling, gross secondary enrolment, and gross tertiary enrolment.

The worldwide ranking is headed by Iceland (index 8.98 out of 10), followed by South Korea (8.85) and Switzerland (8.74). Luxembourg stands in 9th place worldwide (8.47). The Netherlands are in 7th place (8.49), Germany stands 12th (8.39), France 15th (8.24) and Belgium in 25th place (7.81). Luxembourg stands 4th within the EU-28, after Denmark (8.71), the United Kingdom (8.65) and the Netherlands (8.49).

¹⁵ For additional details: <https://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2017.aspx>

For the three sub-categories of the general composite index:

- ▼ Luxembourg stands 1st for access to ICTs (9.54);
- ▼ Luxembourg stands 8th worldwide, and 4th in the EU, as regards ICT use (score of 8.30);
- ▼ Luxembourg stands 74th worldwide and 28th in the EU for ICT skills (score of 6.65). This rather poor third sub-classification is nevertheless explained by a specificity of Luxembourg of which the report takes no account. In fact, the report attributes Luxembourg's very poor performance on the basis of the number of Luxembourgish students in tertiary education: Luxembourg's share of students in tertiary education is calculated to be only 19.4% (under the 'tertiary gross enrolment ratio'), which places the country far behind its neighbours, all of which display rates in excess of 60%. The composite index, however, only accounts for students on the national territory, and takes no note of the fact that the majority of Luxembourgish residents do their tertiary studies in foreign countries. This heavily undervalues Luxembourgish performance for this third sub-category, which also has a negative impact on the country's position in the general classification. For the other two indicators in this sub-category, that is, the average number of years of education and the proportion of students in secondary education, Luxembourg displays much higher performance levels, close to those of neighbouring countries.

Finally, the authors note the following regarding Luxembourg: *'One of Europe's last state-owned operators dominates the telecommunication market in this small state with very high mobile and fixed penetration rates and affordable prices. Luxembourg stands out for being an international connectivity hub, taking advantage of its privileged position at the heart of Europe. (...) Luxembourg, one of the smallest European markets, has a very advanced ICT infrastructure and is on the way to becoming Europe's first fibred nation. ICT household penetration is very high and almost the entire population is online.'*

Table 12
Top 20 of the ranking

Economy	Rank 2017	IDI 2017
Iceland	1	8.98
Korea (Rep.)	2	8.85
Switzerland	3	8.74
Denmark	4	8.71
United Kingdom	5	8.65
Hong Kong, China	6	8.61
Netherlands	7	8.49
Norway	8	8.47
Luxembourg	9	8.47
Japan	10	8.43
Sweden	11	8.41
Germany	12	8.39
New Zealand	13	8.33
Australia	14	8.24
France	15	8.24
United States	16	8.18
Estonia	17	8.14
Singapore	18	8.05
Monaco	19	8.05
Ireland	20	8.02

Source: ITU

c.4 Digital economy and society index¹⁶

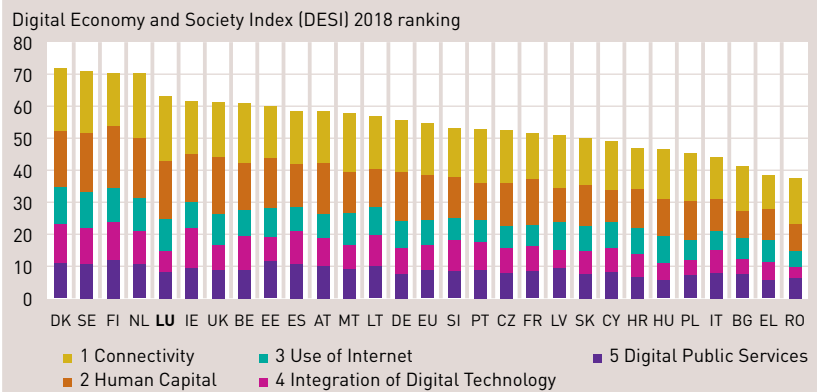
The European Commission has published a new edition of its 'Digital Economy & Society Index'. The DESI is a composite index which assesses the progress made by EU countries towards having a digital economy and society, with scores ranging from 0 (worst performance) to 1 (best performance). The index is made up of 30 indicators separated into five interlinked categories:

- ▼ Connectivity (fixed broadband, mobile broadband, connection speed and affordability): 25% weighting;
- ▼ Human capital (use of internet, advanced and basic digital skills): 25% weighting;
- ▼ Use of internet (content, communication and transactions): 15% weighting;
- ▼ Integration of digital technology (business digitisation, e-commerce): 20% weighting;
- ▼ Digital public services (e-government): 15% weighting.

¹⁶ For additional details:
<https://ec.europa.eu/digital-single-market/en/desi>

Denmark (73.7), Sweden (70.4) and Finland (70.1) occupy the top three positions in the ranking. Again, Luxembourg stands in 5th place (62.8), with a slightly better score than last year (60.4). The Netherlands stand 4th (69.9), followed by Belgium, in 8th place (60.7), Germany in 14th place (55.6), and France in 18th place (51.5). Luxembourg forms part of the nine top countries in the classification, which the European Commission considers to be one of the 'better performing countries'.

Chart 4
EU ranking and performance of Luxembourg



Source: European Commission

Luxembourg is one of the leading countries in terms of connectivity, digital skills and use of Internet, but fares less well in the integration of digital technology in the business sector and digital public services:

- ▼ Connectivity (2nd/80.1): Luxembourg is particularly competitive as regards the adoption of high-speed fixed broadband and mobile broadband;
- ▼ Human capital (5th/71.3): Luxembourg has a high level of digital skills;
- ▼ Internet utilisation (4th/65.9): use of the Internet by private citizens is clearly above the EU average in all areas;
- ▼ Integration of digital technologies (22nd/33.2): the level of integration of digital technologies by businesses in Luxembourg is well below the EU average;
- ▼ Digital public services (17th/56.2): Luxembourg is below the EU average, but has been making progress since last year.

c.5 Digital transformation scoreboard¹⁷

Digital technologies have created new markets and unprecedented business opportunities. The EU has a major challenge on its hands to ensure these opportunities are taken up by companies in the industrial and services sectors, so that digitalisation can drive growth and job creation. For this reason, the European Commission published a new edition of the European Digital Transformation Scoreboard. The main aim of this new scoreboard is to assess how much progress has been made towards the digitalisation of the economy in the EU. This scoreboard includes, in particular, three composite indices intended to measure the digitalisation of the economy from a macro-perspective. More particularly, these indices are a composite index measuring digitalisation enablers and two composite indices measuring digitalisation results:

- ▼ The Digital Transformation Enablers Index (DTEI) is composed of the 'enablers' category - digital infrastructures (20% weighting of the overall DTEI), Investment and access to finance (30%), Supply and demand of digital skills (30%), E-leadership (10%) and Entrepreneurial culture (10%);
- ▼ The Digital Technology Integration Index (DTII) is a part of the output category and is supposed to reflect changes in the digital transformation of the European companies;
- ▼ The ICT start-up evolution index is also a part of the output category and is supposed to reflect the creation of information and communication technology (ICT) start-ups.

This macro-analysis is based on a large quantity of data originating from national statistics offices and various international organisations. The scores of the composite indices vary from 0 (poorest performance) and 100 (best performance). Based on the indicators included in the first category of enablers (DTEI), the ranking is headed by the Netherlands (81.6/100), followed by Finland (79.0) and Sweden (77.7). Luxembourg ranks 5th in the EU (72.3), Belgium ranks 4th (73.7), France 9th (61.6) and Germany 10th (59.9).

¹⁷ For additional details:
[https://ec.europa.eu/growth/
tools-databases/dem/monitor/
scoreboard](https://ec.europa.eu/growth/tools-databases/dem/monitor/scoreboard)

More specifically, Luxembourg records the following results for the five dimensions of this first category:

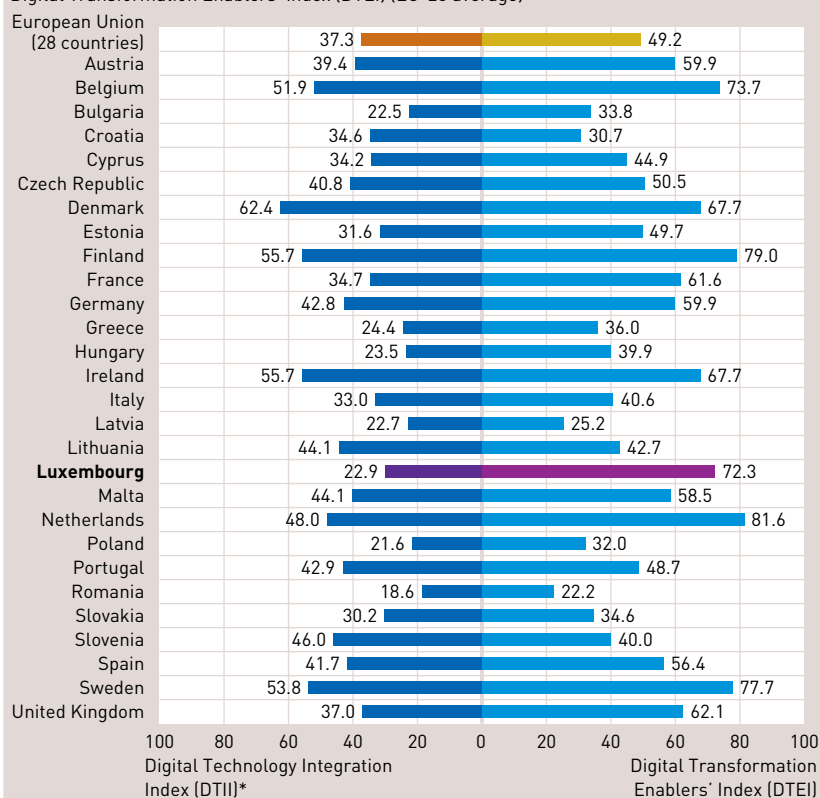
- ▼ Digital infrastructures: Luxembourg comes 2nd (80) with scores well above the EU average (48);
- ▼ Investment and access to finance: Luxembourg comes 4th (74) with scores well above the EU average (46);
- ▼ Supply and demand of digital skills: Luxembourg comes 7th (65) with scores above the EU average (45);
- ▼ E-leadership: Luxembourg comes 3rd (86) with scores well above the EU average (55);
- ▼ Entrepreneurial culture: Luxembourg comes 22nd (60) with scores below the EU average (68).

Based on the indicators included in the second category of DTII results, that is, the indicators thought to reflect the changes in the digital transformation of European businesses, the ranking is headed by Denmark (62.4), Ireland (55.7) and Finland (55.7). Luxembourg ranks 22nd in the EU (29.9). Belgium ranks 5th (51.9), the Netherlands 6th (48.0), Germany 10th (42.8) and France 16th (34.7).

Finally, for the third category, i.e. results relating to internal changes in the ICT start-up environment, the ranking is headed by Lithuania (79), followed by Sweden (76) and Malta (75). Luxembourg stands 9th (65) in the EU. France stands 22nd (34), the Netherlands 24th (32), Belgium 27th (24) and Germany 28th (22).

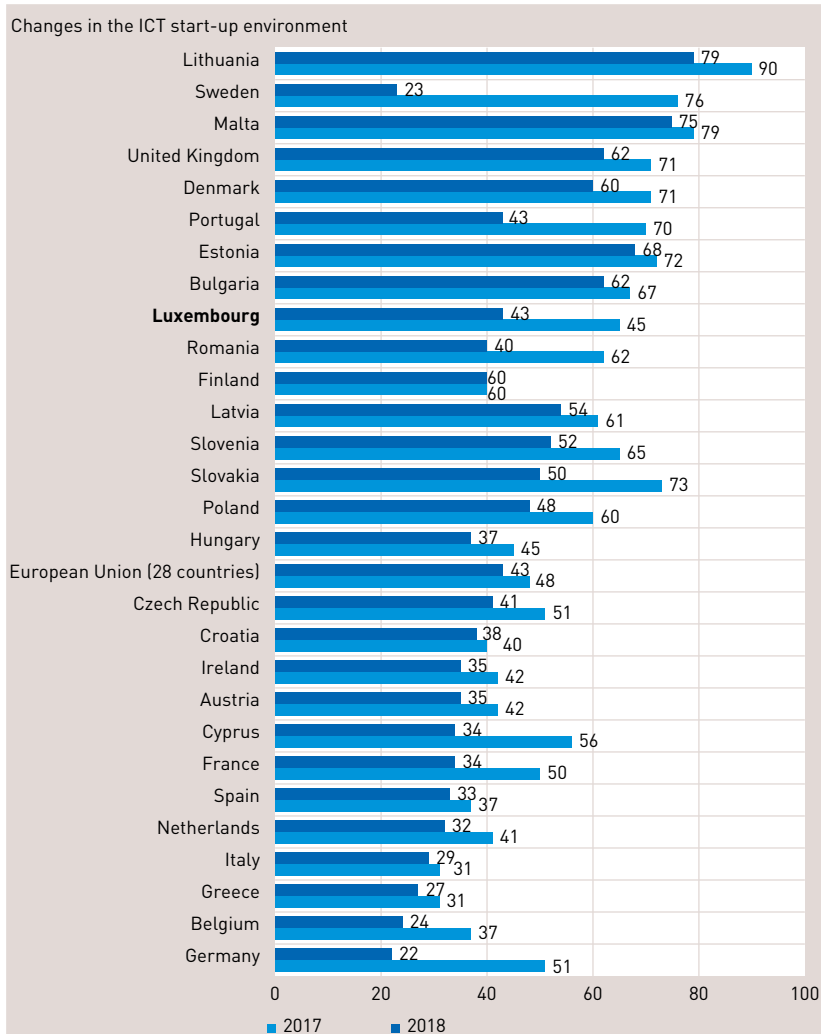
Chart 5
2018 DTEI and DTII rankings

Digital Technology Integration Index (DTII) and
Digital Transformation Enablers' Index (DTEI) (EU-28 average)



* Integration of Digital Technologies – Based on scores from section 4 of the DESI (Digital Economy and Society Index – 2017) on the Integration of Digital Technology. 2018 DESI will be published in May 2018.

Chart 6
2018 DTEI and DTII rankings



Source: European Commission

In conclusion, the report notes the following regarding Luxembourg: 'Luxembourg remains one of the EU leaders in digital transformation. Its high-quality digital infrastructure and e-leadership are the driving forces behind its strong performance. Luxembourg offers an all-round advantageous environment that incentivizes companies to engage in digital business and technology. Despite these excellent achievements, further effort should be made to increase access to finance and investments. A look at recent national policy efforts reveals that Luxembourg's focus is on stimulating digital skills and promoting the adoption of digital tools for business.' 'Luxembourg's performs above the EU average in five out of seven dimensions. Its strongest advantages are digital infrastructure and e-leadership. In both cases, Luxembourg scores approximately 30% above the EU average. In addition, the country is significantly more advanced than its European partners in the supply and demand of digital skills. The development of ICT start-ups has increased remarkably over the last 12 months. Luxembourg now scores more than 20% above the EU average. Moreover, in the field of finance for digital transformation, the country also performs almost 30% above the EU average. Despite these positive achievements, Luxembourg is not in line with other EU Member States in entrepreneurial culture and digital transformation, where its results are approximately 7% and 9% below the EU average.'

d. Globalisation and openness indicators

d.1 Index of Globalisation¹⁸

The Federal Institute of Technology in Zurich (ETH Zurich) published a new edition of its composite globalisation index (known as the KOF) which appeared for the first time in 2002. It assesses the level of globalisation of 185 countries around the world. From this year on, the KOF index is based on a new methodology, which includes 42 variables split into 3 sub-categories:

- ▼ Economic globalisation: it includes the strength of the international trade and financial flows and the effect of any restrictions on these flows;
- ▼ Social globalisation: it is measured based on three segments, namely personal international contacts, international information flows and cultural proximity to major global trends;
- ▼ Political globalisation: it is assessed based on the number of embassies, the number of UN peacekeeping missions, the number of international non-governmental organisations and the number of bilateral and multilateral agreements, etc.

The distinction is also made between 'de facto' globalisation (measurement of flow and activities) and 'de jure' globalisation (public policies with an impact on flow). Finally, the KOF index measures globalisation on a scale of 1 to 100 (most globalised).

Generally speaking, the Netherlands are the most highly globalised country in the world (90.24/100), followed by Switzerland (89.70) and Sweden (88.05). Luxembourg achieved an overall score of 79.3 and is less globalised than its neighbours, Belgium (87.8), France (87.3) and Germany (86.8).

Heading the economic globalisation ranking were Singapore (92.4), Hong Kong (90.0) and the Netherlands (89.3). Luxembourg ranks 7th worldwide (85.4). Luxembourg ranks 8th (87.6) for 'de facto' economic globalisation and 10th for 'de jure' economic globalisation (82.8). Norway (90.4) leads the classification for social globalisation, followed by Luxembourg, which ranks 2nd (89.8) worldwide. Luxembourg stands 5th worldwide (90.5) for 'de facto' social globalisation and 17th for 'de jure' social globalisation (89.2). With regards to political globalisation, Italy ranks 1st (99.2), France 2nd (99.1), and Germany 3rd (98.2). Luxembourg stands 82nd worldwide (70.9). Luxembourg ranks 130th (46.3) for 'de facto' political globalisation and 15th for 'de jure' political globalisation (95.6).

¹⁸ For additional details:
<http://globalization.kof.ethz.ch/>

e. Quality of life and cost of living indicators

e.1 Quality of living survey¹⁹

The consultancy firm MERCER published the 20th edition of its annual study on the quality of living for expatriates through their host cities around the world: the Quality of living survey. This survey is conducted to help multinational companies and governments to establish the amount of compensation for their staff abroad. In this edition, 231 cities were analysed. The survey is based on factors that expatriates consider as having a major impact on their quality of life abroad. Indicators used to assess the level of quality of living are grouped into ten categories: political and social environment, economic environment, sociocultural environment, health system, education system, public services and transport, leisure, consumer products, housing, and finally, the natural environment.

Vienna (1st), Zurich (2nd), Auckland and Munich (3rd) are ranked as the best cities in the world in terms of quality of living for expats. Luxembourg comes 18th in the global ranking. Luxembourg comes 8th at EU level. Vienna, Munich and Düsseldorf (6th) are the top three EU cities. Luxembourg outscores several neighbouring cities, including Brussels (27th), Stuttgart (28th) and Paris (39th), but is beaten by Düsseldorf (6th), Frankfurt (7th) and Amsterdam (12th). Dublin places 34e and London 41st.

Table 13

Top 25 of the ranking

Rank	City	Country
1	Vienna	Austria
2	Zürich	Switzerland
3	Auckland	New Zealand
3	Munich	Germany
5	Vancouver	Canada
6	Düsseldorf	Germany
7	Frankfurt	Germany
8	Geneva	Switzerland
9	Copenhagen	Denmark
10	Basel	Switzerland
10	Sydney	Australia
12	Amsterdam	Netherlands
13	Berlin	Germany
14	Bern	Switzerland
15	Wellington	New Zealand
16	Melbourne	Australia
16	Toronto	Canada
18	Luxembourg	Luxembourg
19	Ottawa	Canada
19	Hamburg	Germany
21	Perth	Australia
21	Montreal	Canada
23	Stockholm	Sweden
23	Nurnberg	Germany
25	Singapore	Singapore

Source: Mercer

¹⁹ For additional details:
<https://www.mercer.com/newsroom/2018-quality-of-living-survey.html>

e.2 Global liveability ranking²⁰

ECA International, a provider of solutions and information for professionals in the international human resources sector, published the latest edition of its *Global Liveability Ranking 2018* on the most liveable cities in the world for European expats. Using ratings provided by expats as well as other indicators, this survey assesses several factors to generate an estimate of quality of life in 480 cities around the world. Cities are rated on several criteria including weather conditions, availability of healthcare, accommodation, social networks and free time activities, infrastructures, personal safety, political tension, air quality, etc. These data are mainly used by human resources professionals to calculate living costs allowances for expats.

The global ranking is led by Copenhagen, followed by Bern and The Hague. The City of Luxembourg is in 9th position worldwide.

Table 14

Top 10 of the ranking

Top 10 most liveable locations for European expatriates

Location	2018 ranking
Copenhagen, Denmark	=1
Bern, Switzerland	=1
The Hague, Netherlands	3
Stavanger, Norway	=4
Geneva, Switzerland	=4
Amsterdam, Netherlands	=6
Eindhoven, Netherlands	=6
Basel, Switzerland	=6
Luxembourg City, Luxembourg	=9
Gothenburg, Sweden	=9

Source: ECA

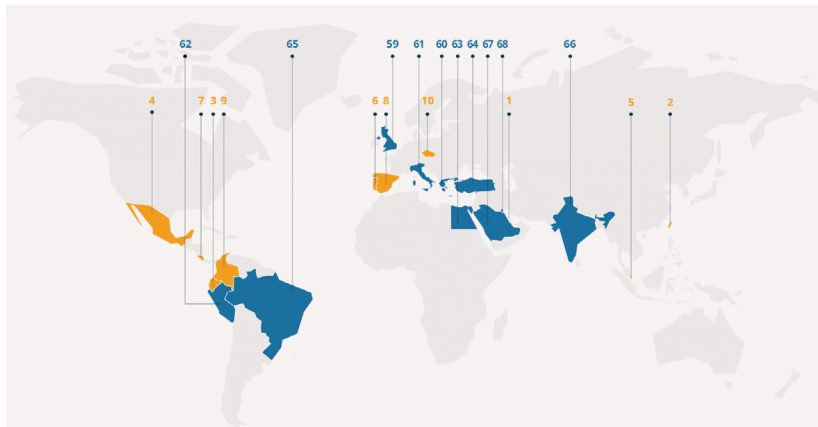
²⁰ For additional details:
<https://www.eca-international.com/news/march-2018/northern-european-cities-offer-best-living-conditions>

e.3 Expat insider²¹

InterNations, a worldwide expatriates network, published the 5th edition of its annual report on host countries for expatriates. The report is based on a (qualitative) survey of more than 18,000 expatriates. They scored different aspects of expatriate life in their host country: quality of life, easy insertion, work, family life, financial situation and cost of living abroad. The authors draw up a classification of the best destinations for expatriates across the world on the basis of the responses submitted.

The general ranking of the best destinations for expatriates is headed by Bahrain, Taiwan and Ecuador. Luxembourg stands 15th worldwide. The Netherlands rank 16th, Belgium 29th, France 34th and Germany 36th. As an example, Ireland ranks 43rd, Switzerland 44th and the United Kingdom 59th. Within the EU, Luxembourg therefore stands in 4th place, after Portugal (6th), Spain (8th) and the Czech Republic (10th).

Chart 7
Expat insider 2018 ranking



The Top Expat Destinations 2018

Top 10

1 Bahrain	3 Ecuador	5 Singapore	7 Costa Rica	9 Colombia
2 Taiwan	4 Mexico	6 Portugal	8 Spain	10 Czechia

Bottom 10

68 Kuwait	66 India	64 Turkey	62 Peru	60 Greece
67 Saudi Arabia	65 Brazil	63 Egypt	61 Italy	59 UK

11 New Zealand	21 Bulgaria	31 Oman	41 South Korea	51 Kenya
12 Australia	22 Israel	32 Morocco	42 Japan	52 South Africa
13 Panama	23 Finland	33 Chile	43 Ireland	53 Myanmar
14 Vietnam	24 Austria	34 France	44 Switzerland	54 Russia
15 Luxembourg	25 Norway	35 Denmark	45 Hungary	55 China
16 Netherlands	26 Uganda	36 Germany	46 Sweden	56 Hong Kong
17 Malaysia	27 Estonia	37 Romania	47 USA	57 Serbia
18 Thailand	28 Philippines	38 Qatar	48 Dominican Rep.	58 Argentina
19 Canada	29 Belgium	39 Poland	49 Kazakhstan	
20 Malta	30 Cyprus	40 UAE	50 Indonesia	

Source: InterNations

²² For additional details:
<https://www.internations.org/expat-insider/>

Luxembourg scores as follows in the 5 sub-categories on which the overall ranking is based:

- ▼ Quality of life: Luxembourg comes 17th, just behind the Netherlands (16th). France (19th), Germany (26th) and Belgium (39th) are further down the list. For the sub-indicators in this category, Luxembourg comes 62nd for Leisure Options, 25th for Personal happiness, 17th for Travel & Transport, 13th for Health & Well-being, 1st for Safety & Security and 16th for online digital life;
- ▼ Ease of settling in: Luxembourg comes 40th, ahead of Belgium (45th), France (50th) and Germany (66th). The Netherlands outperforms Luxembourg, coming in 37th place. For the sub-indicators in this category, Luxembourg comes 34th for Feeling Welcome, 45th for Friendliness, 52th for Making Friends and 31st for Language;
- ▼ Working Abroad: Luxembourg comes 9th, behind the Netherlands (5th) and Germany (8th). Belgium (18th) and France (34th) are further down the list. For the sub-indicators in this category, Luxembourg comes 26 for Job & Career, 37th for Work-Life Balance, and 1st for Job Security;
- ▼ Family Life: Luxembourg comes 16th and is outperformed by Belgium (8th) and the Netherlands (15th). Germany (18th) and France (21st) are behind Luxembourg. For the sub-indicators in this category, Luxembourg comes 17th for Availability of Childcare and Education, 12th for Costs of Childcare and Education, 22nd for Quality of Education and 15th for Family Well-being;
- ▼ Personal Finance and Cost of Living: Luxembourg comes 23rd for perceived personal finance, outstripping Belgium (25th), Germany (34th), the Netherlands (35th) and France (55th). Luxembourg comes 61st for cost of living and is beaten by Germany (32nd), France (41st), the Netherlands (43rd) and Belgium (48th).

e.4 Cost of living²²

MERCER published the 24th edition of its annual Cost of living survey for expatriates across the world. The survey measures the cost of living in 375 cities on five different continents and uses 200 products and services to estimate the cost of living (housing, transport, food, clothing, leisure, etc.). Among other things, human resources professionals use these data to calculate allowances for expatriates.

Hong Kong, Tokyo, Zurich and Singapore have the highest living costs for expats in the world. Luxembourg is ranked 71th worldwide. Other European cities rank as follows: Geneva (11th), London (19th), Paris (34th), Dublin (32nd), Amsterdam (50th), Brussels (67th) and Frankfurt (68th).

f. Human resources

f.1 Global talent competitiveness index²³

In a globalised world, human capital is a key factor for territorial competitiveness. Countries are competing in developing this human capital, but also in attracting and retaining it on the national territory. In this context, the business school INSEAD published with the Adecco Group and Tata communications the 5th edition of the 'Global Talent Competitiveness Index' (GTCI), first issued in 2013. In order to compare the performance of 119 countries around the world, the report uses a composite index based on an input-output model, which allows evaluating:

- ▼ The measures, policies and resources implemented to develop human capital (inputs), based on four sub-categories: enable, attract, grow and retain talents;
- ▼ The performance of the measures implemented (outputs), based on two categories of competence: mid-level/technical skills of labour force (LV skills) and high-level skills needed for innovation and entrepreneurship (GK skills).

The GTCI global composite index, calculated through a simple average of these six categories, is made up of 68 indicators. It uses a score between 0 (worst performance) and 100 (best performance).

The GTCI global ranking is led by Switzerland (79.90), followed by Singapore (78.42) and the United States (75.34). Luxembourg places 10th in the overall ranking (71.64). The Netherlands are in 9th place (72.56), Belgium 16th (69.56), Germany 19th (67.77) and France 21st (62.61). Luxembourg is the 6th EU country after Sweden, Finland, Denmark, the United Kingdom and the Netherlands.

²² For additional details: <https://mobilityexchange.mercer.com/Insights/cost-of-living-rankings>

²³ For additional details: <https://gtcistudy.com/#>

Table 15
Top 20 of the ranking

Country	Score	Overall rank
Switzerland	79.90	1
Singapore	78.42	2
United States of America	75.34	3
Norway	74.56	4
Sweden	74.32	5
Finland	73.95	6
Denmark	73.79	7
United Kingdom	73.11	8
Netherlands	72.56	9
Luxembourg	71.64	10
Australia	71.61	11
New Zealand	71.52	12
Ireland	71.38	13
Iceland	70.48	14
Canada	69.63	15
Belgium	69.56	16
United Arab Emirates	68.88	17
Austria	68.63	18
Germany	67.77	19
Japan	62.63	20

Source: INSEAD

In the inputs sub-category, Luxembourg comes 18th for Enable (77.79), 2nd for Attract (88.42), 19th for Grow (63.67) and 8th for Retain (84.81). In the outputs sub-category, Luxembourg comes 17th (64.39) for mid-level/technical skills (LV skills) and 18th (50.77) for high-level skills (GK skills).

The authors of the report note that Luxembourg: ‘Luxembourg (10th) owes a great part of its position within the top 10 of the GTCI to its excellent performance in Attract (2nd), the result of combining strong External Openness (3rd) with good Internal Openness (6th). The country attracts foreign businesses and also talent – it is 8th in Brain gain and also has a large stock of International students. Foreign talent is received in an environment of strong Social Inclusion (it is 2nd in Tolerance of immigrants and 1st in closing the Gender earnings gap). As a small country that has built an international reputation as a centre of finance and industry, Luxembourg also excels at retaining its domestic talent (8th in this pillar). There are many areas that need improvement, however. Formal Education (51st) does not figure at the top, particularly in terms of universities (as a small country, its universities do not appear in the global ranking of the best). The country has good Social protection (3rd) and Active labour market policies (3rd) but can still improve in ensuring the Employability (32nd) of domestic talent in the private sector.’

This year, the country-by-country analysis is once again accompanied by a second composite index specifically dedicated to the cities often constituting centres of attraction for talents: the 'Global Cities Talent Competitiveness Index' (GCTCI). This index is based on a limited list of only 17 variables, divided into five sub-categories. This second benchmark compares 90 cities. The four first sub-categories rather closely reflect the methodology utilised on the level of the countries. The fifth sub-category constitutes the principal change compared to the methodology applied to countries: it analyses the level of internationalisation of cities based on their share of the population and workforce with a tertiary education, the presence of international airports and the presence of intergovernmental organisations.

The classification for cities in 2018 was headed by Zurich (71.0), followed by Stockholm (68.2) and Oslo (68.1). Luxembourg stands 16th worldwide, and 10th within the EU (59.4). As regards the five sub-categories relating to cities, Luxembourg performs as follows:

- ▼ Enable (4th; 72.5);
- ▼ Attract (6th; 77.9);
- ▼ Grow (84th; 24.8);
- ▼ Retain (61st; 61.7);
- ▼ Internationalisation (4th; 59.9).

f.2 World talent report²⁴

The Swiss IMD institute published a new edition of its *World Talent Report*. The authors have analyzed how 63 countries are developing, attracting and retaining the talent needed by the economy and businesses to make progress and create lasting, long-term added value. The survey uses 30 indicators, both quantitative (weight of 2/3) and qualitative (weight of 1/3), which are split into three sub-categories:

- ▼ Investment in and development of home-grown talent (expenditure on education, quality of national education, apprenticeships, employee training etc.);
- ▼ Appeal to the overseas talent pool (quality of life, cost of living, brain drain etc.);
- ▼ Availability of skills and competencies (labour force growth, skills, student mobility, PISA test results etc.).

²⁴ For additional details:
<http://www.imd.org/wcc/world-competitiveness-center-rankings/talent-rankings/>

This information is then used to calculate a composite index which ranks the countries in order (with a value of between 1 and 100).

The ranking is headed by Switzerland (100), followed by Denmark (89.36) and Belgium (83.80). Luxembourg ranks 10th worldwide (78.46) and 8th within the EU. The Netherlands rank 6th (82.86), Germany 8th (79.87) and France 27th (65.76). Luxembourg performs as follows in the three sub-categories:

- ▼ Investment in and development of home-grown talent: Luxembourg ranks 16th worldwide, and 13th in the EU (score of 67.17);
- ▼ Appeal to the overseas talent pool: Luxembourg ranks 4th worldwide and 1st within the EU (74.63);
- ▼ Availability of skills and competencies: Luxembourg ranks 17th worldwide and 8th within the EU (69.65).

Table 16

Top 20 of the ranking

Rank	Country	1 yr +/-	
1	Switzerland	-	100
2	Denmark	-	89.36
3	Belgium	-	83.80
4	Austria	+1	83.63
5	Finland	+1	83.18
6	Netherlands	+2	82.86
7	Norway	-	82.41
8	Germany	+2	79.87
9	Sweden	-5	79.04
10	Luxembourg	+1	78.46
11	Canada	+1	77.99
12	Hong Kong SAR	-3	77.90
13	Singapore	+2	75.63
14	Ireland	+3	75.46
15	New Zealand	-1	75.40
16	USA	-3	74.52
17	Cyprus	-	74.47
18	Iceland	-	74.07
19	Australia	-3	71.09
20	Israel		69.58

Source: IMD

g. Miscellaneous indicators

A multitude of other factors play a role in the debate regarding competitiveness and territorial attractiveness: functioning and governance of public authorities, business environment, etc. There are regular publications on benchmarks focusing on a multitude of these topics, some of which are reviewed below.

g.1 Corruption perceptions index²⁵

The institutional and regulatory framework within which economic activities take place, impacts on the way resources are distributed, investment decisions are orientated and creativity and innovation are stimulated. Corruption weakens a country and harms the stability and security of the decisions economic agents make. The non-governmental organization Transparency International published an updated version of its composite index on the perception of corruption in the public sector, which is built on private and public sector experts' assessments: the 'Corruption Perceptions Index' (CPI). The latest version of this survey analyses 180 countries. The CPI, based on data from several sources which report on corruption perception (corruption perception polls and ratings compiled by various renowned institutions), ranges from 100 (lowest level of perceived corruption) to 0 (highest level of perceived corruption). Although no country is free of corruption, the countries at the top of the range often share the following features: a transparent government, freedom of the press, protection of civil liberties and independent legal systems.

New Zealand (89/100) showed the best results worldwide, followed closely by Denmark (88) and the Finland/Norway/Switzerland trio (85). Luxembourg ranks 8th worldwide, along with Canada, the Netherlands and the United Kingdom (82). Germany ranks 12th (81), Belgium 16th (75) and France 23rd (70) worldwide. As for the EU, Luxembourg ranks 4th, after Denmark, Finland and Sweden (84).

²⁵ For additional details: https://www.transparency.org/news/feature/corruption_perceptions_index_2017

Table 17
CPI ranking

Rank	Country	Score	Rank	Country	Score	Rank	Country/Territory	Score
1	New Zealand	89	23	Uruguay	70	46	Georgia	56
2	Denmark	88	25	Barbados	68	46	Malta	56
3	Finland	85	26	Bhutan	67	48	Cabo Verde	55
3	Norway	85	26	Chile	67	48	Rwanda	55
3	Switzerland	85	28	Bahamas	65	48	Saint Lucia	55
6	Singapore	84	29	Portugal	63	51	Korea, South	54
6	Sweden	84	29	Qatar	63	52	Grenada	52
8	Canada	82	29	Taiwan	63	53	Namibia	51
8	Luxembourg	82	32	Brunei Darussalam	62	54	Italy	50
8	Netherlands	82	32	Israel	62	54	Mauritius	50
8	United Kingdom	82	34	Botswana	61	54	Slovakia	50
12	Germany	81	34	Slovenia	61	57	Croatia	49
13	Australia	77	36	Poland	60	57	Saudi Arabia	49
13	Hong Kong	77	36	Seychelles	60	59	Greece	48
13	Iceland	77	38	Costa Rica	59	59	Jordan	48
16	Austria	75	38	Lithuania	59	59	Romania	48
16	Belgium	75	40	Latvia	58	62	Cuba	47
16	United States of America	75	40	Saint Vincent and the Grenadines	58	62	Malaysia	47
19	Ireland	74	42	Cyprus	57	64	Montenegro	46
20	Japan	73	42	Czech Republic	57	64	Sao Tome and Principe	46
21	Estonia	71	42	Dominica	57	66	Hungary	45
21	United Arab Emirates	71	42	Spain	57	66	Senegal	45
23	France	70						

Source: Transparency International

g.2 Global resilience index²⁶

FM Global, one of the world's largest commercial and industrial property insurance companies, published a new edition of its annual report analysing territorial resistance in the event of a disturbance in the business supply chain: the *Global Resilience Index*. This composite index thus constitutes a decision-making support tool for economic decision-makers to locate or expand their activities, select or evaluate suppliers, assess supply chains or identify vulnerable clients. The increased resistance of a territory permits businesses located there to protect themselves more effectively against a potential disturbance of their supply chain, as well as to bounce back more rapidly in such an event. This is particularly important for multinational corporations engaged in cross-border trade, since they face a multitude of risks: geopolitical tension, raw material price volatility, natural hazards, etc.

²⁶ For additional details: <https://www.fmglobal.com/research-and-resources/tools-and-resources/resilienceindex>

This edition analyses 130 countries and territories by means of twelve qualitative and quantitative criteria, divided into three sub-categories:

- ▼ Economy (productivity, political risk, oil intensity of the economy, urbanisation rate);
- ▼ Risk quality (exposure to natural hazards, potential risk management improvement rate, fire risk management, cyber risks);
- ▼ Supply chain (control of corruption, quality of infrastructure, local supplier quality, supply chain visibility).

These sub-categories and criteria are evaluated on a scale from 0 (territory with the poorest performance) to 100 (territory with the best performance).

The worldwide ranking is headed by Switzerland (100), which is considered the most resilient country. Luxembourg ranks 2nd worldwide (96.1), followed by Sweden (94.7). Germany ranks 5th (93.9), the Netherlands 11th (88.0), France 12th (85.5) and Belgium 16th (83.3).

Table 18
Top 20 of the ranking

Country	Country Rank	Country Score	Economic Score	Risk Quality Score	Supply Chain Score
Switzerland	1	100.0	86.3	78.3	100.0
Luxembourg	2	96.1	95.3	79.3	86.2
Sweden	3	94.7	73.8	88.5	93.1
Norway	4	94.0	82.1	94.2	83.5
Germany	5	93.9	69.3	95.5	91.1
Austria	6	92.1	70.7	83.7	92.6
Denmark	7	90.8	72.0	87.7	87.3
Finland	8	90.3	65.6	88.1	90.3
United States West	9	89.9	59.7	100.0	87.7
United States Central	10	88.3	59.7	95.0	87.7
Netherlands	11	88.0	57.7	82.5	94.1
France	12	85.5	56.6	92.2	85.2
Canada	13	84.5	56.7	88.6	85.1
Czechia	14	84.1	71.6	99.3	69.2
United States East	15	83.3	59.7	74.7	87.7
Belgium	16	83.3	52.6	93.8	82.9
Australia	17	83.2	66.1	89.2	76.2
United Kingdom	18	82.4	62.8	78.6	82.0
Hong Kong	19	81.8	72.3	52.8	87.3
Qatar	20	81.7	100.0	57.1	66.9

Source: FM Global

As regards the three sub-categories making up the general composite index most particularly, Luxembourg ranks as follows:

- ▼ Economy - Luxembourg ranks 2nd worldwide (95.3): productivity (87.3), political risk (97.0), oil intensity of the economy (68.3), urbanisation rate (71.0);
- ▼ Risk quality - Luxembourg ranks 19th worldwide (79.3): exposure to natural hazards (95.3), potential risk management improvement in the event of natural hazards (61.2), fire risk management (71.4), cyber risk (51.1);
- ▼ Supply chain - Luxembourg ranks 14th worldwide (86.2): control of corruption (94.2), infrastructure (78.6), local supplier quality (69.6), supply chain visibility (90.9).

In conclusion, the authors of the report note the following regarding Luxembourg: *'(...) Luxembourg also scores highly for its economic productivity, political stability, low corruption levels, and low exposure to natural hazards. The country is an attractive domicile for companies seeking a continental European base, following the United Kingdom's vote to leave the European Union (EU) and ensuring "Brexit". This is relevant especially for financial institutions keen to continue their "passporting" rights to offer services freely across the EU.'*

g.3 Logistics performance index²⁷

In late July 2018, the World Bank published the sixth biannual edition of its study 'Connecting to Compete'. This study constitutes an analysis of trade logistics, that is, the ability of a country to dispatch goods efficiently and establish links between manufacturers and clients on international markets. The underlying logic is that the most efficient countries on the logistical level will be able to boost their growth potential, become more competitive and invest more. Efficient logistical chains permit better access to markets and thus offer the greatest economic outlets. This study is based in particular on an in-depth study of express international forwarders and carriers in 160 countries throughout the world, as well as on quantitative data relating to the performance of a series of key components of the logistical chain (infrastructures, quality of services, reliability of shipping, efficiency of customs clearance procedures). Based on the information gathered, the World Bank constructed a composite index known as the *Logistics Performance Index* (LPI), which measures the performance of the countries on a scale from 1 (poor performance) to 5 (very good performance).

²⁷ For additional details:
<https://lpi.worldbank.org/>

So as to measure the performances of the various countries in logistical terms over the years, the report uses an average of the LPI scores from the last four biannual editions of the study (2012-2018) as its main composite index. According to the authors, this makes it possible to smooth out the fluctuations which may appear from one biannual edition to the other. In this composite index, the values of the editions are weighted so that the most recent data have more weight (6.7% for 2012, 13.3% for 2014, 26.7% for 2016 and 53.3% for 2018). The 2012-2018 world LPI ranking is headed by Germany (4.19; base 100), followed by the Netherlands (4.07), tied with Sweden (4.07). Luxembourg ranks 16th worldwide (3.84), with a performance score equal to 91.8% of the country in first place (Germany). Belgium ranks 4th (4.05), while France ranks 15th (3.86). With regards to the EU, Luxembourg ranks 10th in terms of average performance between 2012 and 2018.

Table 19
Top 20 of the ranking

Economy	Mean LPI rank	Mean LPI score	% of highest performer	Customs		Infrastructure		International shipments		Logistics quality and competence		Tracking and tracing		Timeliness	
				Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Germany	1	4.19	100.0	1	4.09	1	4.38	4	3.83	1	4.26	1	4.22	1	4.40
Netherlands	2	4.07	97.2	3	3.97	2	4.23	6	3.76	2	4.12	7	4.08	6	4.30
Sweden	3	4.07	97.2	4	3.95	3	4.22	2	3.88	5	4.04	11	4.02	4	4.32
Belgium	4	4.05	96.9	13	3.74	10	4.03	1	3.97	3	4.10	4	4.11	2	4.40
Singapore	5	4.05	96.6	2	4.00	5	4.14	8	3.72	4	4.08	8	4.05	3	4.34
United Kingdom	6	4.01	95.7	8	3.85	7	4.09	10	3.69	7	4.04	5	4.10	5	4.32
Japan	7	3.99	95.3	5	3.91	4	4.19	14	3.61	8	4.03	9	4.03	9	4.24
Austria	8	3.99	95.2	14	3.71	8	4.07	5	3.78	6	4.04	2	4.13	11	4.22
Hong Kong SAR, China	9	3.96	94.6	9	3.85	11	4.02	3	3.85	10	3.94	13	3.95	13	4.18
United States	10	3.92	93.7	11	3.76	6	4.10	23	3.54	11	3.93	3	4.13	16	4.14
Denmark	11	3.92	93.6	7	3.88	17	3.89	16	3.59	9	3.98	14	3.94	8	4.26
Finland	12	3.92	93.5	6	3.89	14	3.95	21	3.56	14	3.88	6	4.10	15	4.17
Switzerland	13	3.91	93.4	12	3.75	9	4.07	20	3.57	12	3.92	10	4.02	12	4.20
United Arab Emirates	14	3.89	92.8	17	3.66	13	3.98	7	3.76	16	3.83	16	3.89	10	4.23
France	15	3.86	92.2	18	3.63	12	4.00	15	3.60	17	3.82	12	3.99	14	4.17
Luxembourg	16	3.84	91.8	16	3.67	18	3.84	11	3.68	15	3.83	22	3.78	7	4.27
Canada	17	3.81	90.9	15	3.70	16	3.91	28	3.45	13	3.90	15	3.91	21	4.03
Spain	18	3.78	90.3	21	3.57	22	3.79	9	3.72	18	3.78	21	3.78	19	4.04
Australia	19	3.77	90.0	10	3.76	15	3.92	31	3.40	19	3.76	19	3.83	22	4.00
Norway	20	3.74	89.3	19	3.62	19	3.84	27	3.48	20	3.75	18	3.83	25	3.96

Source: World Bank

As regards the six sub-categories of the international module of the LPI ranking, based on data derived from a poll of international express forwarders and carriers, Luxembourg, on average, ranked as follows between 2012-2018:

- ▼ Efficiency of customs and border clearance: 16th (3.67);
- ▼ Quality of trade and transport infrastructure: 18th (3.84);
- ▼ Ease of arranging competitively priced shipments: 11th (3.68);
- ▼ Competence and quality of logistics services: 15th (3.83);
- ▼ Ability to track and trace consignments: 22th (3.78);
- ▼ Frequency with which shipments reach consignees within scheduled or expected delivery times: 7th (4.27).

g.4 International property rights index²⁸

In August 2018, the Property Rights Alliance, in collaboration with the Free Market Foundation, published the 12th annual edition of its composite International Property Rights Index (IPRI), launched in 2007. The object of this analysis is to measure the level of property rights constituting, according to the authors, a key indicator of economic success and political stability. The resulting composite IPRI index analyses the legal and political environment in particular, together with the protection of physical and intellectual property rights within the country. Three sub-categories consist of a total of ten indicators:

- ▼ Political and legal environment (LP): judicial independence, political stability, level of corruption, etc.;
- ▼ Physical property rights (PPR): property registration, access to loans, etc.;
- ▼ Intellectual property rights (IPR): protection of intellectual property rights, patent protection, etc.

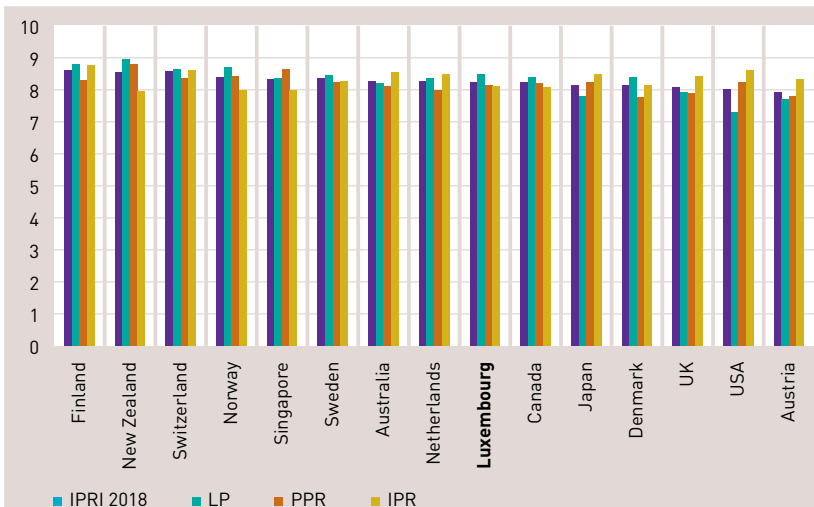
The indicators comprising these sub-categories are both qualitative and quantitative. The global composite IPRI index is constructed based on the average of these three sub-categories. It may be assigned a value between 0 (minimum) and 10 (maximum).

In the new 2018 edition, the global IPRI ranking is headed by Finland (8.692/10), followed by New Zealand (8.632) and Switzerland (8.619). Luxembourg ranks 9th worldwide, with a score of 8.298. The Netherlands rank 8th (8.325), Germany ranks 16th (7.909), Belgium 18th (7.679) and France 23rd (7.184).

The EU ranking is headed by Finland, Sweden (8.397) and the Netherlands. Luxembourg ranks 4th, Germany 8th, Belgium 9th and France 11th.

²⁸ For additional details:
<http://www.internationalpropertyrightsindex.org/>

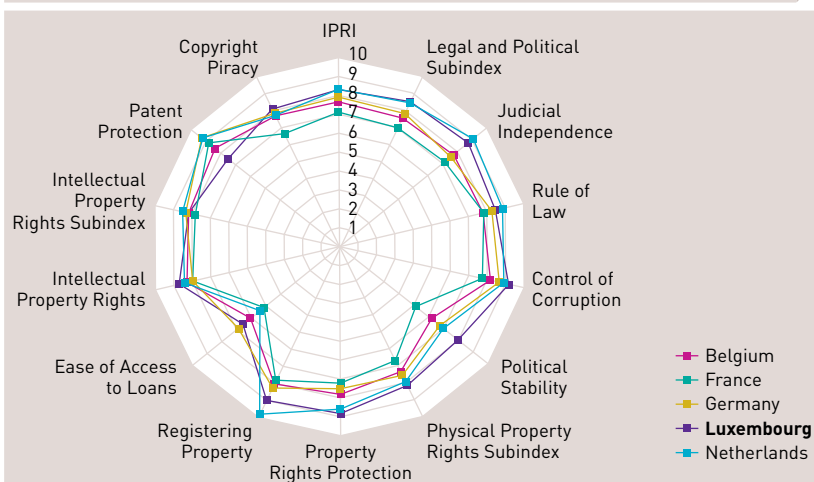
Chart 8
Top 15 of the ranking



Source: PRA

As regards the three sub-categories in particular, Luxembourg's most highly-performing component consists of its political and legal environment (8.539), followed by physical property rights (8.196) and intellectual property rights (8.158).

Chart 9
Comparison with neighbouring countries of Luxembourg



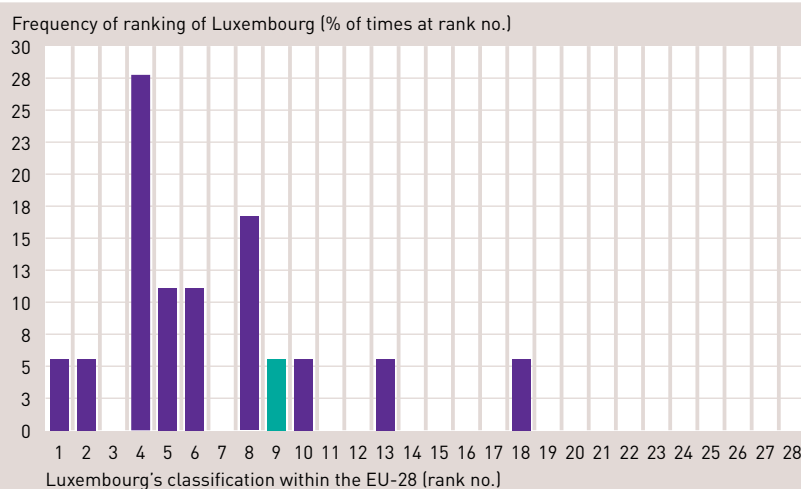
Source: PRA

2.3 Conclusions

Many benchmarks and classifications covering various facets of competitiveness and territorial attractiveness, with their determinant factors, are published annually. These include: the business environment, innovation, ICT, human resources, quality and cost of living, etc. The following chart provides an overview of the positions occupied by Luxembourg in the series of country rankings included in the present Report. For more than half (> 50%), Luxembourg ranks in the Top 5 within the EU, and it is in the Top 10 for nearly all of them (> 85%).

Chart 10

Ranking frequency of Luxembourg compared to EU Member States



Source: Observatoire de la compétitivité

Note: The above chart refers only to the (EU) country classification listed in the present 2018 Competitiveness Report. The city classifications are not taken into account here. The green bar represents the national scorecard (national system of indicators).

Rankings themselves are undoubtedly the most mediatized elements by far. However, those reports tell a more complex story which belies the apparent simplicity of the ranking. When analyzing those benchmarks, one should therefore not lose sight of the intrinsic limitations of such an exercise.

1. A rise or fall in the rankings does not mean that the performance of Luxembourg has improved or deteriorated. Such a development may also stem from the fact that other territories have experienced the effects of a shock more or less severely than Luxembourg. It is essential to take this relativity into account in international comparisons.
2. It is worth noting that there is a time lag between the time of publication of the rankings and many statistics used therein. Benchmarks analyzed in this 2018 edition of the Report still often use statistics and indicators dating back to 2015, 2016, 2017 and 2018. Therefore, these rankings should not be considered as short-term predicting tools.

3. Many rankings assume methodological differences. While for example the WEF attempts to measure the ability of countries to achieve sustainable economic growth, the IMD analyses the ability of countries to create and maintain a supporting environment for company competitiveness, as wealth creation is supposed to happen at the level of companies that operate within a national environment which either facilitates or hampers their competitiveness. Luxembourg's positions therefore can vary from one ranking to another, even if they try to measure 'territorial competitiveness'.
4. The different rankings are criticized over suffering from methodological weaknesses, especially in three areas: the quality of sources (primary and secondary data), the core indicators used and the method for calculating the composite index (formulas, weights, etc.). For example, some 'one size fits all' indicators used in the same way for all territories analyzed, often prove to be inadequate to the specificities of Luxembourg, which is a very small economy that is widely open.

The best-known example is the 'GDP per capita'²⁹ which, by its statistical construction, does not take into account the large flow of incoming cross-border workers in Luxembourg. Thus, this indicator strongly overestimates the country performance. The indicator concerning the number of Luxembourg students in higher education or associated is another typical example for which one should put Luxembourg's bad results into perspective. For instance, the science and technology graduates 'STEM' indicator³⁰, which is frequently used in this kind of analysis, ignores the fact that a majority of Luxembourg students are studying abroad. Hence it considerably underestimates Luxembourg's performance.

5. The detail of which countries are analysed has an impact on comparability. For example, the WEF compares 140 countries, the IMD only 63 and the Heritage Foundation 186. This affects the relative position of countries in the rankings. For example, a decision could be made to only compare the EU. Luxembourg would then climb from the 19th world position to the 8th position (WEF), from the 11th to the 4th position (IMD) and from the 14th to the 5th position (Heritage Foundation).
6. There are countries or groups of countries in these rankings for which the performance is often close, i.e. whose numerical values of the calculated composite indices are very close to each other. The mere country rankings can usually not show this situation. All things being equal, a slight increase (or decrease) in the value of the composite index could therefore lead to a significant rise (or fall) in the rankings. The ranking of a territory should therefore not be looked at separately from the value of its composite index. In fact, significant differences in the rankings of countries may be related to small differences in the index.

²⁹ *'[...] in some regions the GDP per capita figures can be significantly influenced by commuter flows. Net commuter inflows in these regions push up production to a level that could not be achieved by the resident active population on its own. There is a corresponding effect in regions with commuter outflows.'* Nearly 45% of the labour force in Luxembourg is currently border-workers. For additional details: <http://ec.europa.eu/eurostat/documents/2995521/8700651/1-28022018-BP-EN/15f5fd90-ce8b-4927-9a3b-07dc255dc42a>

³⁰ *'In 2014, the number of science and technology graduates ranged from about 24.7 per 1 000 inhabitants in Ireland to 9.2 per 1 000 inhabitants in Cyprus and 3.5 per 1 000 inhabitants in Luxembourg. The very low ratio of science graduates in Luxembourg and Cyprus might be explained to a large extent by the number of students who pursue their studies abroad. Since some of the graduates reported by a country may be foreigners who return home following their studies, this pushes up the ratio in the country where they studied and pulls down the ratio for their country of origin.'* For additional details: http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_R%26D_and_innovation

Considering the above remarks, what should one think of these rankings? Even if they trigger numerous concerns, these reports provide a useful performance calibration tool worthy to monitor. On one hand, these benchmarks summarize complex issues down to one single value, being thus extremely efficient communication tools that favour political debate and allow authorities to evaluate their policies by comparing them to best practice. On the other hand, due to press coverage, these benchmarks also have a significant impact on the brand image of a territory and can influence the investors' perception (nation branding perspective).

Consequently, it is important to avoid caving into the syndrome of ranking for the sake of ranking. The indications provided in a ranking are often of a character too general to be used and should help to focalize attention and lead to a more rigorous analysis. There is, indeed, no unique recipe. Different policies may be compared, but each country needs to adapt them to its own socio-economic environment. The strategies implemented succeed when economic imperatives and social cohesion are in perfect balance.

To this end, in 2003 the Tripartite Coordination Committee in Luxembourg had identified the need for an enlarged indicator scoreboard, that would take better into account the specificities of the country in order to gain a better insight into the national competitiveness. The Committee entrusted Professor Fontagné (University Paris I - Sorbonne) the task of elaborating proposals in this regard (November 2004)³¹. The Observatoire de la compétitivité updated this national scoreboard till 2016. The Economic and Social Council (ESC)³² prepared the revision of the scoreboard and the ESC unanimously adopted an opinion on a national indicators list for the new, updated and reorganized scoreboard in July 2016. The results of this new national system of indicators were presented for the first time in last year Competitiveness Report. A first annual update has been carried out in this 2018 Report³³.

³¹ FONTAGNÉ L., Compétitivité du Luxembourg : une paille dans l'acier, Rapport pour le Ministère de l'Économie et du Commerce extérieur, Luxembourg, November 2004, pp.102-120
For additional details: <https://gouvernement.lu/dam-assets/fr/publications/rapport-etude-analyse/minist-economie/observatoire-de-la-competitivite/perspectives-politique-economique/perspectives-politique-economique-03/ppe-003.pdf>

³² ESC, Le système d'indicateurs national, Avis, 8 July 2016
For additional details: <http://www.ces.public.lu/content/dam/ces/fr/actualites/2016/07/2016-indicateurs.pdf>

³³ See Chapter 3 in this Competitiveness Report.

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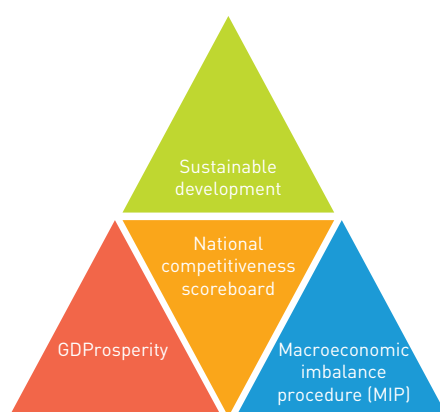
3 National competitiveness scoreboard

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3.1 National competitiveness scoreboard

3.1.1 Introduction

In 2016, the Economic and Social Council (ESC) finished revising the Competitiveness scoreboard. On one hand, indicators that had become irrelevant were replaced by new indicators with higher statistical quality. On the other hand, the ESC tried to take into account the current co-existence of a multitude of scoreboards, specifically Europe 2020 indicators, EU-wide Macroeconomic Imbalance Procedure (MIP) indicators, GDP prosperity and sustainable development indicators at national level. All these indicators overlap at different points and make it difficult to draw comparisons and obtain an overview of the economic, social and environmental situation in Luxembourg.



However, this review of the national scoreboard indicators did not equate to a full revision of the definition of competitiveness. The Observatoire de la compétitivité (ODC) continues to use the broad definition of the concept of competitiveness, a definition which was upheld by the Tripartite Coordination Committee and used by the ESC. Furthermore, the ESC sets the following objectives for the government: *'[...] the main role of the State is to contribute to achieving and upholding of a high, sustainable quality of life for the country's population'*¹. According to the ESC competitiveness is a means to achieve these objectives. According to a current definition, a country is internationally competitive if concurrently *'its productivity increases at a rate which is similar to or higher than that of its major trading partners with a comparable level of development; it maintains external equilibrium in the context of an open free-market economy; and it realises a high level of employment'*². Broadly speaking, the ESC defines competitiveness as *'a nation's ability to sustainably improve the quality of life of its inhabitants and ensure a high level of employment and social cohesion whilst also preserving the environment'*.

¹ <http://www.ces.public.lu/content/dam/ces/fr/avis/politique-generale/2001-role-etat.pdf>

² http://ec.europa.eu/economy_finance/publications/pages/publication8051_en.pdf

In order to ensure a clearly structured new set of indicators and an appropriate balance between the different aspects of sustainable development in the new system of indicators, the ESC decided to produce a single scoreboard covering economic, social and environmental dimensions.

The ESC has also decided to highlight a limited number of 'meta' indicators for each dimension. These are considered the most significant indicators in each of the respective dimensions and should ensure that Luxembourg can be compared with the rest of Europe. The other indicators focus on the specific features of Luxembourg and, although considered secondary, are nevertheless useful in terms of providing more detailed information should the need arise. An indicative, non-exhaustive list of relevant secondary indicators has been drawn up. However, those indicators should not be considered as an integral part of the new system of indicators.




The indicators which were retained for the new system of national indicators had to fulfil several criteria, notably:

- ▼ Ensure spatial and temporal comparability with EU-level indicators;
- ▼ Ensure that the relevance, statistical quality and frequency of indicator publication is sufficient to enrich future political and societal debates;
- ▼ Take into account the Europe 2020 and MIP indicators;
- ▼ Eliminate obsolete and inactive indicators as well as duplication.

The new system of indicators is not set in stone and may be adapted over time if necessary. It is designed to be used as the main reference tool for social dialogue and to enrich public debate. Furthermore, it should assist in shedding light on areas where Luxembourg's performance is unsatisfactory. The general diagnostics established by the new system of indicators may be followed up by a road map of activities with precise, quantifiable and measurable objectives drawn up in cooperation with all social partners. Therefore, the ODC decided to present a preview of the 2018 edition of the new scoreboard on 9 July 2018 to the 'Indicators' working group of the ESC. An in-depth discussion concerning some of the indicators ensued. It was deemed necessary to provide additional detail concerning certain indicators in text boxes. The social partners decided not to change the structure of the scoreboard for its 2018 edition and postpone the debate on the scoreboard until after it has been published and once the update has been completed. With this aim in mind, the ODC suggested launching its customary morning debates once again.

3.1.2 Methodology

The method of comparison does not vary from the method used in the previous iteration of the scoreboard. First, Luxembourg's position compared to the European average is highlighted.

-  If Luxembourg's performance is at least 20% better than the EU average, then the indicator is classified as 'green' (favourable position).
-  If Luxembourg's performance is between +20% and -20% in relation to the EU average, then the indicator is classified as 'orange' (neutral position).
-  If Luxembourg's performance is more than 20% lower than the EU average, then the indicator is classified as 'red' (unfavourable position).

This rating is a purely visual tool to quickly see where Luxembourg is in comparison with the EU average.

Secondly, Luxembourg's absolute performance is analysed over time by comparing the most recent data values with those from previous years. The arrows will indicate in which direction each indicator has recently changed (improvement or deterioration).

- ↑ If Luxembourg's performance has improved since the last edition of the Scoreboard, an arrow pointing upward will signal the indicator in question.
- If Luxembourg's performance has remained stable since the last edition of the Scoreboard, a horizontal arrow will signal the indicator in question.
- ↓ If Luxembourg's performance has deteriorated since the last edition of the Scoreboard, an arrow pointing downward will signal the indicator in question.

Apart from the comparison with the European average, Luxembourg is also compared to the best and worst countries from the EU.

3.1.3 Economic dimension

Table 1
Data for the economic dimension

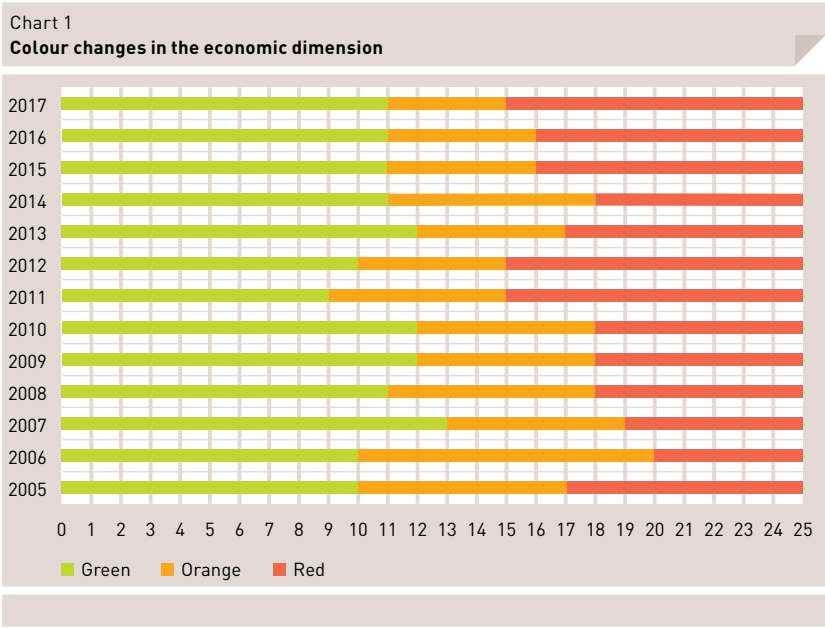
		Year	Trend	LU	Position	EU Average	DE	BE	FR	First	Last
A1	Public debt [% of GDP]	2017	↓	23.00	2 / 28	81.60	64.10	103.10	97.00	Estonia: 9.00	Greece: 178.60
A2	Government balance [% of GDP]	2017	↓	1.50	4 / 28	-0.90	1.30	-1.00	-2.60	Malta: 3.90	Spain: -3.10
A3	Current account balance, % of GDP (average over 3 years) ¹	2017	↑	5.00	21 / 28	3.97	8.40	2.30	2.60	Czech Republic: 1.00	Germany: 7.40
A4	Market share of world exports (% change over 5 years)	2017	↓	25.42	4 / 28	10.99	6.72	4.08	2.91	Ireland: 64.77	Greece: -9.84
A5	Net international investment position (% of GDP)	2017	↓	47.00	6 / 28	-28.99	54.00	52.60	-20.10	Malta: 62.60	Ireland: -149.30
A6	Real effective exchange rate (42 trade partners, % change over 3 years)	2017	↓	-1.10	19 / 28	-2.20	-2.80	0.70	-3.20	United Kingdom: -10.90	Czech Republic: 5.10
A7	Real GDP growth (%; average over 3 years)	2017	↓	2.77	17 / 28	2.23	2.03	1.50	1.50	Ireland: 12.43	Greece: 0.30
A8	Inflation rate [%] ²	2017	↓	1.73	2 / 28	1.70	1.70	1.50	1.20	Germany: 0.00	Estonia: 2.00
A9	Time required to set up a company (days)	2017	→	16.50	24 / 27	9.96	10.50	4.00	3.50	Denmark: 3.50	Poland: 37.00
A10	Long-term government bond yields	2017	↓	0.54	5 / 27	1.31	0.32	0.72	0.81	Lithuania: 0.31	Greece: 5.98
A11	Regulatory capital for risk-weighted assets	2017	↑	25.91	3 / 28	20.06	19.38	18.96	18.91	Estonia: 29.24	Portugal: 15.19
A12	Availability of financial resources for entrepreneurs	2017	↑	2.46	14 / 18	2.70	2.84		2.81	Netherlands: 3.65	Greece: 1.92
A13	Employment rate of population aged 20-64 [%]	2017	↑	71.50	16 / 28	72.20	79.20	68.50	71.00	Sweden: 81.80	Greece: 57.80
A14	Unemployment rate [%]	2017	↑	5.60	10 / 28	7.60	3.80	7.10	9.40	Czech Republic: 2.90	Greece: 21.50
A15	Average annual level of variation in total factor productivity in the economy overall [%]	2017	↓	-0.57	28 / 28	1.03	0.93	0.21	0.68	Ireland: 6.54	Luxembourg: -0.57
A16	Real labour productivity per hour worked (%; average growth rate over 3 years)	2017	↓	-0.50	26 / 27	0.97	0.97		0.70	Ireland: 8.50	Greece: -0.80
A17	Nominal unit labour costs (% change over 3 years)	2017	↓	7.90	23 / 28	0.90	5.10	1.00	1.30	Ireland: -17.20	Lithuania: 16.00
A18	Corporate tax rates [%]	2017	↑	27.08	23 / 28	21.51	29.79	33.99	33.33	Hungary: 9.00	Malta: 35.00
A19	Profitability of non-financial companies [%]	2016	↑	6.70	27 / 27	10.47	9.90	9.70	6.80	United Kingdom: 16.70	Luxembourg: 6.70
A20	GDP/hour worked (US=100%)	2017	↓	134.85	1 / 28	71.79	98.21	102.28	94.91	Luxembourg: 135.00	Bulgaria: 38.00
A21	Gross domestic R&D expenditure (% of GDP)	2016	↓	1.24	15 / 28	2.03	2.94	2.49	2.25	Sweden: 3.25	Latvia: 0.44
A22	Share of jobs in medium-high and high-tech manufacturing sectors (% of total jobs)	2017	↓	0.60	28 / 28	5.80	9.80	4.20	4.50	Czech Republic: 11.40	Luxembourg: 0.60
A23	Entrepreneurial intentions [%]	2017	↓	10.98	8 / 18	11.21	7.22		17.62	Estonia: 18.14	Bulgaria: 5.01
A24	Quality of the education system (average score; 1 to 7)	2017	↓	4.35	12 / 28	4.16	5.37	5.09	4.30	Finland: 5.81	Slovakia: 2.77
A25	Life-long learning as a % of the population aged 25-64	2017	↑	17.20	6 / 28	10.90	8.40	8.50	18.70	Sweden: 30.40	Romania: 1.10

⁽¹⁾ Countries are ranked based on the extent to which their current account balance deviates from the average of the two thresholds set by the MIP (the aim is for the balance to be close to +1% of the GDP).

⁽²⁾ Countries are ranked against the benchmark of the EU average inflation rate.

Note: the indicators in purple were already part of the former scoreboard (dark purple = without adaptation, light purple = with adaptations)

The economic dimension covers areas such as the stability and attractiveness of a country as well as cost-competitiveness and certain aspects of non-cost competitiveness. Luxembourg is in the leading group for a large part of the indicators. Four of the 25 indicators are orange, indicating that Luxembourg scores close to the EU average for these particular indicators. The trend for the indicators that are in green has been stable over the past years, going from 10 in 2005 to 13 in 2007, then to 11 green indicators in 2016 and 2017. The number of red indicators increased to 10 in 2017. For 8 out of the 25 indicators, Luxembourg's performance improved in 2017 compared to 2016. Performance in 2017 worsened for 16 out of the 25 indicators compared to 2016.



3.1.3.1 Detailed description of the economic dimension indicators

Alongside the government balance indicator (**A2** indicator), public debt (**A1**) gives information on the health of a Member State's public finances. Luxembourg had a gross public debt of 23% in 2017, which was one of the lowest rates in the European Union with only Estonia scoring better. However, this rate tripled since 2005 (7.4%). Only 13 EU Member States posted figures lower than the reference value set by EU rules (60% of GDP). Apart from Spain, all Member States meet from now on the threshold limit set for the government balance (-3% of GDP). Twelve Member States registered a government balance surplus in 2017: Luxembourg, Bulgaria, Malta, Croatia, Sweden, Germany, Greece, the Czech Republic, Cyprus, the Netherlands, Denmark and Lithuania. The main challenge facing European governments is ensuring the repayment of public debt while managing public spending in a manner which favours economic growth. The 2008 and subsequent years economic and financial crisis has seen many European governments face major challenges. Ten-year government bond yields (**A10**) are a marker of the confidence that the financial markets have in these countries' ability to implement healthy financial policies and thus to repay invested capital. In 2017, the rate in Lithuania was the lowest of the European Union with 0.31%, slightly above Germany (0.32%), who was able to sell its bonds at an 0.09% rate in 2016. In Luxembourg, the rate has doubled since 2016, going from 0.25% to 0.54%. It remains in the top tier with the Netherlands and Finland.

The current account balance (**A3**) provides an indication of the competitiveness and trade situation in a country compared with its main trade partners. In 2017, the average over 3 years in Luxembourg's current account balance was +5% of GDP. Consequently, Luxembourg's score was between the two thresholds (+6% and -4%) set by the European Commission as part of the macroeconomic imbalance procedure. In 2006, Luxembourg had still a rate of 10.9%. The United Kingdom and Cyprus were below the lower limit of -4% in 2017 whilst Malta, Germany, Ireland, Denmark and the Netherlands reported higher results than the upper limit of +6%. The current account balance forms part of the indicators in the MIP, in which it has been stated that a country is potentially at risk if its current account balance presents a deficit over -4% of GDP (lower threshold) or an excess of over +6% of PIB (upper threshold). It is therefore difficult to draw up a country-by-country classification. The ESC finally approved the OCD's proposal to rank countries according to their current account balance's position in relation to the average of the two thresholds (the objective being a current account balance of approximately +1% of GDP). In this scenario, Luxembourg comes 21st out of the 28 Member States.

The percentage change over 5 years in Luxembourg's market share of world exports (**A4**) stood at +25.42% in 2017. Only Ireland and Poland had a higher market share (+66.11% and 28.71% respectively) in 2017. This indicator, which is also part of the MIP and its system of indicators, factors in structural competitiveness losses which may accumulate. A country may lose export market share not only if its exports are reduced but also if its exports do not grow at the same rate as world exports, which could see the country's global position regress.

The net international investment position as a % of GDP (**A5**) denotes whether a country's stock of foreign assets is worth more or less than the stock of domestic assets owned by foreign investors. This determines whether a country is in credit or in debt vis-à-vis the rest of the world. This indicator is part of the MIP. Luxembourg's score in 2017 was +47%, with the country ranking 6th out of the 28 EU Member States.

The percentage change in the real effective exchange rate over 3 years (**A6**) serves to measure price competitiveness and cost competitiveness by providing a macroeconomic comparison of domestic and foreign prices in a common currency using a price or cost indicator to account for inflation. The MIP states that a country is potentially at risk if this indicator is over +5% or under -5%. For most of the years under analysis, Luxembourg was within this range and not considered to be at risk of imbalance.

In 2017, the average real GDP growth rate over three years (**A7**) in Luxembourg was +2.77%. Luxembourg's position dropped by 13 places in the country ranking compared to 2016. Ireland's performance is by far the best for this indicator but it must be noted that this rate is an average for 3 years and that it takes into account the spectacular increase in GDP of +26.3% in 2015 linked to the relocation of some major economic operators to the country.

Since 2011, the progression of the inflation rate (**A8**) has continued to slow down in Luxembourg, reaching +0.3% in 2016. In 2017, the inflation rate began rising again, reaching 1.5% in the euro area. Luxembourg's inflation rate was 1.7% in 2017, measured by the NICP. The inflation rate (**A8**) is problematic in terms of interpretation. This indicator has not even been included in the MIP scoreboard. Neither negative inflation rates nor excessively positive inflation rates are desirable. After consulting the ESC, the ODC decided to use the EU average as a benchmark and the countries are ranked according to the difference between their respective national inflation rates and the EU average.

The number of days required to set up a company (**A9**) is one of the indicators used by the World Bank in its 'Doing Business' report, which measures corporate legislation and its effective application. Luxembourg's performance is rather mediocre in comparison to the other Member States of the European Union as an average of 16.5 days are required to obtain all the paperwork necessary to set up a company. Since 2010, Luxembourg's score for this indicator has remained unchanged. In Denmark, the process of setting up a company requires an average of just 3.5 days. The recent creation (in 2017) in Luxembourg of the 'simplified limited liability company' status ('SARL simplifiée') should contribute over time to an improvement in this domain. However, due to the methodology used by the World Bank³, such an effective improvement might not be reflected in forthcoming editions of the 'Doing Business' report.

With a view to ensuring the stability and robustness of the banking system, the banking regulator introduced bank solvency requirements. The regulatory capital for risk-weighted assets indicator (**A11**) pertains to capital requirements for banks in relation to their credit risk. Each asset is assigned a weighted risk to ensure the bank is not exposed to a higher level of risk than it can bear. The ratio in Luxembourg was 25.9% in 2017. The highest score was posted by Estonia (29.2%) with Spain chalking up the lowest score (15.54%). Whilst on the one hand, a stable banking system has a significant impact on a country's competitiveness, it also means that banks which adhere to this ratio only offer safe loans, which does not make it easy for start-ups and SMEs to access credit. Indicator **A12**, which pertains to the availability of financial resources for small and medium-sized enterprises, was taken from the Global Entrepreneurship Monitor (GEM). Luxembourg scored below the EU average and placed 14 out of 18 countries. Entrepreneurial intent (**A23**) is also covered by the GEM study. This indicator sees Luxembourg score close to the European average with 10.98% in 2017. Romania led the standings with 29.01%.

Luxembourg posted a score close to the EU average for the indicator referring to the employment rate among 20 to 64-year-olds (**A13**). In 2017, Sweden posted a score of 81.8% whilst Luxembourg's figure was 71.5%. The unemployment rate (**A14**) in Luxembourg in 2017 was 5.6%. France's unemployment rate was 9.4% in 2017, an increase on the 2008 figure of 7.4% whilst Germany posted a rate of 3.8% in 2017, a reduction on the 2006 unemployment rate of 10.1%.

Over the last 2 years, Luxembourg has performed badly in indicator categories relating to price and cost competitiveness. Luxembourg was amongst the laggard countries in the European Union for average annual level of variation in total factor productivity in the economy overall (**A15**), real labour productivity per hour worked (**A16**), nominal unit salary costs (**A17**). Luxembourg brings up the rear of the EU standings as well for nominal corporate tax rates (**A18**) and profitability of non-financial companies (**A19**).

³ Information on the World Bank's methodology: <http://www.doingbusiness.org/en/methodology/starting-a-business>

Box

A weak gross operating surplus in Luxembourg, an analysis performed by Statec

In the ODC scoreboard, the profitability of non-financial companies (i.e. manufacturing, market services, with the exception of financial and insurance activities) is measured by means of the ratio between the gross operating surplus (GOS) and the turnover. The gross operating surplus rate is weak in Luxembourg: it stands well below the European average, far below that of the best-performing countries. According to the latest figures available, gross operating surplus stood at 6.5% in Luxembourg, which places the country at the bottom of the European comparative table.

Luxembourg's bad performance has attracted the attention of many bodies, including Statec, which provided details concerning the complexity of the indicator in its Bulletin no. 3/2018: A weak gross operating surplus in Luxembourg – does it matter? The present frame summarises the main conclusions put forward by Statec's analysis. For further information, the OCD invites interested readers to consult the Statec Bulletin, which is available here:

<http://www.statistiques.public.lu/fr/publications/series/bulletin-statec/2018/03-18-Taux-EBE/index.html>

In Luxembourg, there is a very low level of gross domestic R&D expenditure (**A21**): only 1.24% of GDP in 2017. The share of jobs in the medium-high and high technology manufacturing sectors (**A22**) totalled only 0.6% in 2017, which was the worst performance in the EU-28. The medium-high and high-technology sectors are defined as sectors requiring relatively high levels of R&D. These include activities such as aeronautic and spatial construction, the pharmaceutical industry, the manufacture of office machinery and IT equipment, electronics and communication, and scientific instruments for high technology. According to the World Economic Forum (WEF), Luxembourg has a service-based economic structure, and may obtain its innovation from sources other than R&D⁴.

In the WEF report, one of the indicators used to measure the quality of the national education system (**A24**) derives from the response given to the following question which was asked as part of the annual survey of economic decision-makers: 'How well does the education system in your country meet the needs of a competitive economy?' Luxembourg placed 12 amongst the 28 EU Member States with a score of 4.35 out of 7 (maximum score = 7), dropping down one position compared to 2016. Finland led the way in 2017 with a score of 5.81.

Life-long learning among the population aged 25-64 (**A25**) is of great importance for both the employability of employees and the competitiveness of companies. The Nordic countries, i.e. Sweden, Denmark, Finland, had the highest scores for life-long learning (30.4%, 26.8% and 27.4% respectively in 2017) whilst Luxembourg posted a score of 17.2% in 2017, which is improving compared to 2016.

⁴ World Economic Forum
– 'Global Competitiveness
Report (GCR)' 2014-2015

3.1.3.2 Data availability in the economic dimension

Table 2
Incomplete data in the economic dimension

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Economic dimension	21.4%	15.1%	14.3%	5.1%	4.9%	3.7%	2.7%	1.6%	1.9%	1.4%	2.1%	2.0%	11.3%

Most of the economic dimension data is readily available and is based on well-established indicators. However, some indicators have only been developed recently, such as regulatory capital for risk-weighted assets (A11), for which data has only existed since 2008. Indicators pertaining to the availability of financial resources for entrepreneurs (A12) and entrepreneurial intentions (A23) can be traced back to the Global Entrepreneurship Monitor (GEM) study. In 2017, the GEM database contains information from only 18 out of 28 countries. Luxembourg has only participated in the study since 2013 while countries such as the United Kingdom, the Netherlands and Spain have participated in the study every year since 2005.

17 of the 25 indicators displayed were provided by Eurostat, which drew up a European Statistics Code of Practice setting a standard for the development, production and dissemination of European statistics. The sources of the other 8 indicators are the World Bank, the Global Entrepreneurship Monitoring (GEM) study, AMECO database of the European Commission, the World Economic Forum (WEF) and the International Monetary Fund (IMF). Of the 25 indicators which make up the economic dimension, 8 indicators (A1, A3, A4, A5, A6, A14, A17 and A21) are used by the European Commission in the macroeconomic imbalance procedure.

14 of the indicators already featured in the former version of the scoreboard, although 4 of these have been slightly adapted to better suit the new system of indicators: the real effective exchange rate (**A6**) now takes account of 42 trade partners as supposed to 37 (alignment with the MIP scoreboard) whilst real GDP growth rate (**A7**) and real unit salary costs (**A17**) are highly volatile indicators which the ESC decided to measure over a 3-year period. Furthermore, the employment rate (**A13**) covers the population aged 20-64 (Europe 2020 strategy indicator) as opposed to using a 15-64 age range (former Lisbon strategy indicator).

Box

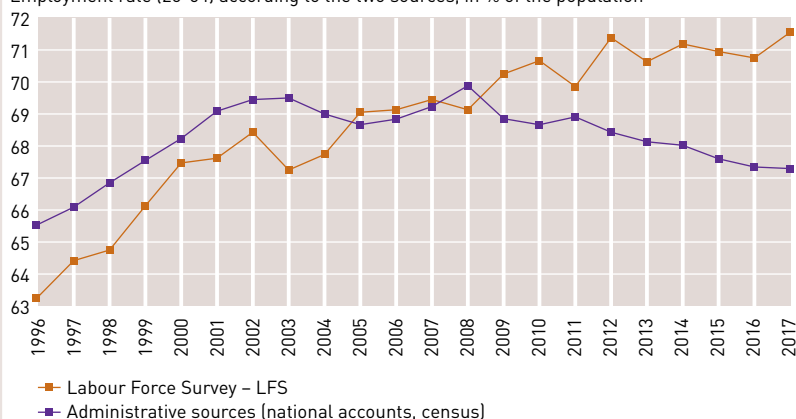
Employment rate developments in Luxembourg – methodological inconsistencies explained

The employment rate, i.e. the share of the working-age population (20-64 year-olds) in employment, can be calculated on the basis of two different sources: the Labour Force Survey (LFS) and administrative data. The employment rate based on administrative data takes stock of national employment from national accounts related to the population, an official figure from population censuses.

The use of national accounts is mainly based on data from the General Social Security Inspectorate (IGSS) and is calculated according to harmonised European-level rules. Over the past years, the development of the employment rate differs greatly depending on the sources consulted: the first indicates an increase in the employment rate, and the second reveals a decrease.

Decrease or increase of the employment rate?

Employment rate (20-64) according to the two sources, in % of the population



Source: STATEC

The analysis aims to demonstrate that the increase in the employment rate (LFS) is mainly the result of methodological changes aiming to improve the survey (improved response rate, improved coverage of people in employment, etc.).

The drop in the employment rate (administrative sources) can be explained by an increase in years spent in education, the introduction of parental leave and the ageing population.

For further information:
<https://statistiques.public.lu/catalogue-publications/cahiers-economiques/2018/PDF-Analyses-01-2018.pdf>

Reconciliation table

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
(1)	Total national employment – LFS [20-64]	202,147	205,227	213,419	219,071	221,147	233,343	236,597	245,007	250,972	256,590	266,229
-	(2) People working little, LFS**	100	100	100	100	1,174	1,525	1,392	1,204	1,818	1,458	1,541
+	(3) Salaried workers living in a collective household, NA	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
-	(4) Divergence self-employment	-4,054	-5,925	-3,113	-3,320	-2,142	-945	-994	-1,876	242	1,790	1,159
-	(5) Divergence outgoing residents (NA-LFS)	1,755	969	3,652	4,054	5,102	6,634	7,232	9,669	7,031	9,292	7,846
=	(6) Employment LFS, corrected according to the NA definition [20-64]	204,346	210,084	212,780	218,237	217,013	226,129	228,968	236,010	241,881	244,050	255,683
(7)	Total national employment – NA [20-64]*	203,684	209,545	211,344	214,923	220,689	225,964	230,632	236,139	241,134	246,656	253,752
(8)	Divergence LFS-NA (Total) [(1)-(7)]	-1,537	-4,318	2,075	4,148	458	7,379	5,965	8,868	9,838	9,934	12,477
(9)	Unexplained divergence (6)-(7)	662	539	1,436	3,315	-3,676	165	-1,665	-129	748	-2,607	1,931
(10)	Explained divergence (2)+(4)+(5)	-2,199	-4,857	639	834	4,134	7,214	7,629	8,997	9,091	12,540	10,546

Source: STATEC (NA – National accounts; LFS – Labour Force Survey)

* Total national employment – NA [20-64] is calculated based on the share of resident 20 to 64-year-olds in employment recorded by the IGSS.

**Estimate [2007-2010]

3.1.4 Social dimension

Table 3
Data for the social dimension

		Year	Trend	LU	Position			EU Average	DE	BE	FR	First	Last
B1	Long-term unemployment rate (%)	2017	↑	2.10	13	/	28	3.40	1.60	3.50	4.20	Czech Republic: 1.00	Greece: 15.60
B2	Risk of in-work poverty (%)	2016	↓	12.00	25	/	28	9.60	9.50	4.70	8.00	Finland: 3.10	Romania: 18.60
B3	Proportion of employees with fixed-term contracts (%)	2017	↓	7.60	10	/	28	11.30	10.00	8.40	13.90	Romania: 0.90	Spain: 22.10
B4	Young people not in employment, education or training (NEET) (%)	2017	↓	5.90	2	/	28	10.90	6.30	9.30	11.50	Netherlands: 4.00	Italy: 20.10
B5	Involuntary part-time work (%)	2017	↓	13.60	9	/	28	27.10	11.50	7.80	43.10	Belgium: 7.80	Greece: 70.70
B6	Employees with involuntary long hours	2015		35.00	24	/	28	30.00	30.00	28.00	32.00	Lithuania: 16.00	Sweden: 52.00
B7	Change in employment rate compared to the previous year (%)	2017	↑	3.40	3	/	28	1.60	1.40	1.40	1.10	Malta: 5.20	Lithuania: -0.50
B8	Individuals having prematurely left education and training	2017	↓	7.30	9	/	28	10.60	10.10	8.90	8.90	Croatia: 3.10	Malta: 18.60
B9	Level of higher education amongst 30 to 34-year-olds	2017	↓	52.70	4	/	28	39.90	34.00	45.90	44.30	Lithuania: 58.00	Romania: 26.30
B10	School year repetition rate (%)	2015	↑	30.90	25	/	28	12.00	18.10	34.00	22.10	Croatia: 1.60	Belgium: 34.00
B11	Median income (% change from previous year)	2016	↓	-4.12	27	/	28	2.42	2.94	2.96	1.39	Estonia: 9.58	Bulgaria: -5.43
B12	Median income expressed in purchasing power standard	2016	↓	27,973.00	1	/	28	16,451.60	21,179.00	21,313.00	20,624.00	Luxembourg: 27,973.00	Romania: 4,728.00
B13	Gender wage gap	2016	→	5.50	3	/	25	16.20	21.50	6.10	15.20	Romania: 5.20	Estonia: 25.30
B14	Wage changes (%) in the economy (real ULC), over 3 years	2017	↑	1.71	4	/	28	-0.41	0.13	-1.24	-0.33	Romania: 3.58	Ireland: -8.30
B15	Household debt (consolidated)	2016	↓	64.30	21	/	28	61.20	52.40	59.00	56.40	Romania: 16.60	Denmark: 129.20
B16	Net wealth per household (in EUR k)	2016	↑	768.40	1	/	20	208.26	214.30	330.30	243.10	Luxembourg: 768.40	Latvia: 40.00
B17	At-risk-of-poverty rate after social transfers (%)	2017	↓	18.68	16	/	24	17.00	16.10	15.90	13.30	Czech Republic: 9.10	Romania: 23.60
B18	Serious material deprivation rate (%)	2017	↑	1.17	2	/	26	6.70	3.40	5.10	4.10	Sweden: 1.10	Bulgaria: 30.00
B19	Gini index of income inequality (0 to 100)	2016	↓	31.00	17	/	28	30.80	29.50	26.30	29.30	Slovakia: 24.30	Bulgaria: 37.70

Continuing on next page

Table 3
Continued

B20	Effectiveness of social transfers (difference between the at-risk-of-poverty rate before and after social transfers)	2016	↓	27.90	10	/	28	27.20	26.90	28.70	31.40	Hungary: 33.10	Estonia: 18.00
B21	Individuals living in over-crowded accommodation (% of the total population)	2016	↓	8.10	11	/	28	16.60	7.20	3.70	7.70	Cyprus: 2.40	Romania: 48.40
B22	Incidence of housing cost being over 25% of household revenue (owners and tenants)	2016	↑	20.73	6	/	28	30.61	42.28	28.52	21.61	Malta: 12.45	Greece: 69.81
B23	Delinquency, violence or vandalism in the surrounding area	2016	↑	12.20	18	/	28	13.00	14.10	13.40	14.80	Croatia: 3.00	Bulgaria: 25.00
B24	Healthy life expectancy (years)	2016	↓	60.15	17	/	28	63.85	66.30	63.75	63.35	Sweden: 73.15	Romania: 53.60

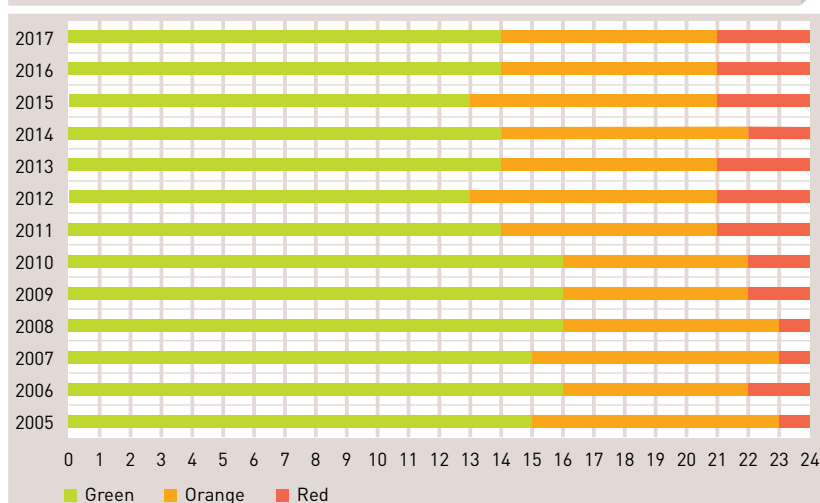
Note: the indicators in purple were already part of the former scoreboard (dark purple = without adaptation, light purple = with adaptations)

The social dimension seeks notably to ascertain developments in the standard of living, quality of life, well-being and social cohesion in Luxembourg. The indicators in this dimension primarily cover the labour market, education, income, assets and private indebtedness, social inequality and living conditions.

In 2017, 14 of the 24 indicators are green, which means that Luxembourg's performance in these areas was at least 20% above the EU average. Seven indicators are displayed in orange whilst three are red. There were fewer colour changes in the social dimension than in the economic dimension given that the social dimension is more structural than cyclical in nature. As far as upward and downward trends are concerned, it is interesting to note that Luxembourg's score deteriorated on the previous year's performance for 14 of the 24 indicators. It has improved for 8 indicators.

Chart 2

Colour changes in the social dimension



3.1.4.1 Detailed description of the social dimension indicators

In Luxembourg, the rate of long-term unemployment (**B1**), which notably affects jobseekers with low levels of qualifications, was 2.1% in 2017. This rate is relatively low when compared to the average but has nevertheless risen steadily over the last few years.

Involuntary part-time work (**B5**) oscillates depending on the unemployment rate, which indicates that individuals are obliged to work part-time rather than being allowed to work full-time during economic slumps. In Luxembourg, the involuntary part-time rate was 13.6% in 2017. Greece posted a score of 70.7% in 2017 whilst Belgium recorded the lowest rate, i.e. 7.8%.

Luxembourg performed very strongly compared to the other EU Member States for the change in employment rate (**B7**) indicator. In 2017, the employment rate increased by 3.4% compared to the previous year. Only Malta was able to outdo Luxembourg, posting a 5% growth in its employment rate in 2017. In Lithuania, employment decreased by 0.5% in 2017.

In 2017, the share of workers with fixed-term contracts (**B3**) was 11.3% in the EU-28. In France, 13.9% of workers had fixed-term contracts whilst 10% of their German counterparts found themselves in the same position. In Luxembourg and in Belgium, the rate was 7.6% and 8.4% respectively in 2017. In the other EU Member States, the proportion of employees with a fixed-term contract ranged from 22.1% in Spain to a mere 0.9% in Romania. The considerable variations between Member States are due to labour supply and demand, company growth forecasts and procedures set out in labour law pertaining to recruitment and dismissal of staff.

Luxembourg's performance in the indicators assessing household income was mixed. The median income after social transfers (**B12**) was the highest in the EU (EUR 27,975 in purchasing power standard) and rose by 2.8% over a 12-month period (**B11**), but Luxembourg ranked 25th for the risk of in-work poverty (**B2**) indicator with a score of 12%. The risk of in-work poverty indicator measures the proportion of people who are working but have an available income that is lower than the at-risk-of-poverty threshold, which is fixed at 60% of the median national available income (after social transfers).

The Gini index (**B19**) measures income inequality. A score of 0 would mean that all the population has the same revenue (perfect equality) whereas a score of 1 refers to a situation where a single individual earns the entirety of the income whilst everyone else has an income of 0 (total inequality). In 2017, Luxembourg's Gini coefficient was 31, close to the European average. Slovakia posted the lowest Gini coefficient (23.7) whilst the largest income disparity in the European Union is to be found in Bulgaria (40.7).

The percentage change in real ULC over 3 years (**B14**) improved slightly compared to the previous year (1.7% change). This indicator compares real labour costs and productivity expressed in volume. It presupposes 'price setter' behaviour and is identical to the wage share of GDP.

The at-risk-of-poverty after social transfers (**B17**) score was worse than that of the previous year with Luxembourg's figure for 2017 being 18.7%. Between 2013 and 2014, Luxembourg's at-risk-of-poverty rate rose by 0.5 percentage points (pp) before falling 1.1 pp in 2015 to 15.3%. Between 2005 and 2017, the at-risk-of-poverty rate remained relatively stable in the EU 28, increasing slightly from 15.4% to 17%.

In the EU-SILC survey, the rate of material deprivation (**B18**) indicator refers to the inability to procure certain goods and services which most individuals deem to be necessary for an acceptable standard of living. A distinction is therefore made between individuals who are unable to procure certain goods and services and those who don't have them for other reasons such as not wanting them or not deeming them necessary. Luxembourg ranked 2nd behind Sweden for this indicator.

Box

Persons at risk of poverty or social exclusion: Objective of the Europe 2020 strategy

The initial European objective defined by the European Commission for social inclusion concerned the reduction of poverty by twenty million at-risk-of-poverty people. The European Council has defined this population as the number of persons threatened by poverty or exclusion, on the basis of three indicators:

- ▼ At-risk-of-poverty rate: persons living on less than 60% of the national median income. This is a relative measure of poverty, related to the distribution of income, which takes into account all sources of monetary revenue, including market revenue and social transfers;
- ▼ Material deprivation rate: persons whose living conditions are severely impacted by a shortage of resources. The rate of material deprivation is a non-monetary measure of poverty;

▼ Persons living in a household in which none is employed: this population is defined by a zero or very low employment intensity over an entire year, in order to properly reflect situations of exclusion from the labour market.

The Competitiveness scoreboard takes the two first indicators into account. The indicator 'persons living in households in which none is employed' is lacking. In order to compare this indicator to that of other countries in the European Union, the unit 'percentage of under-60-year-olds in the population' must be used instead of 'in thousands of persons'. Taking the break in the series in 2016 into account, the rate in Luxembourg is 6.6%. Only Estonia, Poland and Slovakia are ahead of Luxembourg. The EU average was 10.5% in 2016. In thousands of persons, 6.6% represents 31,000 persons in Luxembourg.

In 2017, 18.3% of the EU population lived in overcrowded accommodation (**B21**). The highest rates of overcrowding amongst the EU Member States were in Romania (47%) and Poland (40.5%), whilst Cyprus (2.8%), Belgium (5.1%), the Netherlands (4.1%), Ireland (3.2%) and Malta (2.6%) had the lowest rates of overcrowding. The rate of overcrowding in Luxembourg in 2016 was 8.1%, deteriorating compared to 2015.

In 2016, 20.7% of the Luxembourg population faced housing costs that were more than 25% of the available household income (owners and tenants) (**B22**). In the 2005-2015 period, the rate remained relatively stable in Luxembourg, while this rate decreased in the EU 28, from 37.1% in 2005 to 30.7% in 2016. Some countries, such as Bulgaria, Croatia and Hungary, were able to drastically reduce their scores over the same period. However, the rate in Greece increased from 39.4% in 2007 to 70.3% in 2017.

Household debt (**B15**) refers to liabilities incurred by households. Private sector debt is calculated based on credit. These data are presented in consolidated terms; hence they exclude transactions between units in the same sector. The indicator for Luxembourg is orange and is therefore close to the EU average.

Net household wealth (**B16**) measures the difference between real and financial assets on the one hand and liabilities such as loans and mortgages on the other. Luxembourg topped the EU rankings with a net wealth of EUR 768,400.

Box

Standard Eurobarometer 89

The Standard Eurobarometer survey has existed since 1974 and it is the result of approximately 1,000 face-to-face interviews. The reports are published twice a year.

How do you assess the current financial situation of your household and your professional situation? 88% of Luxembourgish citizens believe that the financial situation of their household is good.

In 2017, 89% of the survey respondents in Luxembourg were satisfied with the financial situation of their household.

Since 2013, this question has been included in the Standard Eurobarometer questionnaire. The rate of Luxembourgish citizens who were satisfied with the financial situation of their household has remained stable over the past few years.

	2013	2014	2015	2016	2017	2018
Luxembourg	86%	86%	84%	87%	89%	88%

Whilst the proportion of young people not in employment, education or training (NEETs) (**B4**) remained reasonably stable in the EU between 2005 and 2017, there have been significant changes in some Member States over the last decade. The greatest reductions in the NEET percentage were recorded in Bulgaria (-9.8 pp), the Czech Republic (-7.3 pp), Germany (-4.6 pp), Sweden (-4.3 pp), Cyprus (-3.4 pp), Slovakia (-3.7 pp), Poland (-4 pp) and Malta (-3.9 pp). However, the NEET rate increased significantly in Italy (+3 pp), the United Kingdom (+1.9 pp) and Finland (+1.6 pp) over the same period.

Individuals having prematurely left education or training (**B8**) is an education indicator which provides key information for the Europe 2020 strategy objectives. Luxembourg's figure for 2017 was 7.3%. It should be noted that these data are taken from the Community Labour Force Survey (LFS) and that this indicator is not a full reflection of the situation in Luxembourg due to the limited sampling carried out in Luxembourg for the LFS. Luxembourg's National Education Ministry uses an additional method to calculate early school-leaving rates. The resultant early-leaving rate for the 2014/2015 school year was 13.5%⁵ in Luxembourg.

In 2017, the percentage of the population aged 30-34 with a higher education qualification (**B9**) was 52.7% in Luxembourg, with the country ranking 4th amongst the 28 EU Member States and losing 2 positions compared to 2016. Lithuania, Cyprus and Ireland were the only countries to perform better than Luxembourg, posting a score of 58%, 55.8% and 53.5% respectively. The lowest rate in the EU in 2017 was in Romania (25.3%).

The school year repetition rate (**B10**) is one of the three indicators classified in red for Luxembourg, which posted a score of 30.9% in 2015. The lowest rate was in Croatia (1.6% in 2015).

The indicator labelled 'delinquency, violence or vandalism in the surrounding area' (**B23**) measures a population's sense of insecurity and is taken from the EU-SILC study on well-being, which measures levels of satisfaction in a range of specific areas. Luxembourg posted a score of 12.2% for this indicator in 2016 whilst Bulgaria registered the highest score in the EU.

Healthy life expectancy (**B24**) stood at 60.2 years in 2016, earning Luxembourg 17th place in the EU rankings. This indicator measures the number of years that a person of a specific age should be able to live without moderate or severe health problems. This indicator is also known as 'disability-free life expectancy'. Therefore, this is a composite indicator which combines mortality and health data.

⁵ Le décrochage scolaire, Année scolaire 2014/2015, Ministry of National Education, Childhood and Youth, February 2017.

Box

Life expectancy in good health: Luxembourg loses two 2 years

Finding out how many additional years can be lived in good health thanks to prolonged life expectancy is important. Life expectancy figures at birth cannot fully respond to that question, so indicators for health expectancy in good health have been developed. These indicators concern quality of life (life in good health) rather than longevity, as is measured by life expectancy. Years of life in good health represent a good indicator of health in relation to European Union (EU) populations. Life expectancy in good health measures the number of years a person may expect to live in good health (at birth). It is an indicator of health expectancy, which combines quantitative, mortality and qualitative data concerning operational health.

The data used to calculate the indicator are prevalence measurements (proportions) of the population of a specific age, who are or are not limited in their daily activities, and the mortality rates by sex and age. In epidemiology, prevalence is a measurement of a given population's health status, providing the number of cases of illness at a given moment or over a defined time period. If life expectancy in good health is analysed, it is important to be aware of the risk of interpreting the developments, because variations from one year to another are insignificant from a statistical point of view. The indicator should be analysed over a longer period of time.

Luxembourg ranked 3rd for the gender pay gap (**B13**) indicator. The gap was 5.5% in Luxembourg whilst the EU average was 16.2%. It should be noted that the data only span industry, construction and services and do not cover public administration, defence or mandatory social security.

3.1.4.2 Data availability in the social dimension

Of the 24 indicators, 20 are calculated by Eurostat. The data for indicator **B6** (employees with involuntary long hours) were gathered by Eurofound (European Foundation for the Improvement of Living and Working Conditions) as part of a study. The school year repetition rate (**B10**) data came from the OECD database and the real unit labour cost (**B14**) information was provided by AMECO. The household wealth (**B16**) information was provided by the ECB. Of the 24 indicators in the social dimension, 5 (B1, B4, B7, B17 and B18) are used by the European Commission as part of the MIP.

Nine of the 24 indicators featured in the former version of the scoreboard. However, two indicators, namely NEETs (**B4**) and involuntary part-time (**B5**), have been adapted slightly. Indicator B5 only covers involuntary part-time whilst indicator B4 only takes account of young people not in employment, education or training (the former indicator grouped together all unemployed young people).

Table 4
Incomplete data in the social dimension

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Social dimension	24.4%	21.1%	14.7%	14.7%	11.1%	13.1%	13.0%	8.7%	10.3%	12.0%	4.4%	9.6%	27.4%

Data are generally made available only with a certain time lag, which explains why there is a data incompleteness figure of 27.4% for 2017.

Data for indicator **B6** (employees with involuntary long hours) were only available for 2015 and thus do not adhere to the ESC criteria, especially those aiming to ensure temporal comparability.

Data on the school year repetition rate (**B10**) are published as part of the OECD's PISA study and were only available for three calendar years (2009, 2012, 2015).

The data for indicator **B22** (housing costs more than 25% of available household income) factors in the percentage of homeowners/tenants in each Member State and the housing costs for each household. The calculation was performed by the ODC using data published by Eurostat.

3.1.5 Environment dimension

Table 5
Data for the environment dimension

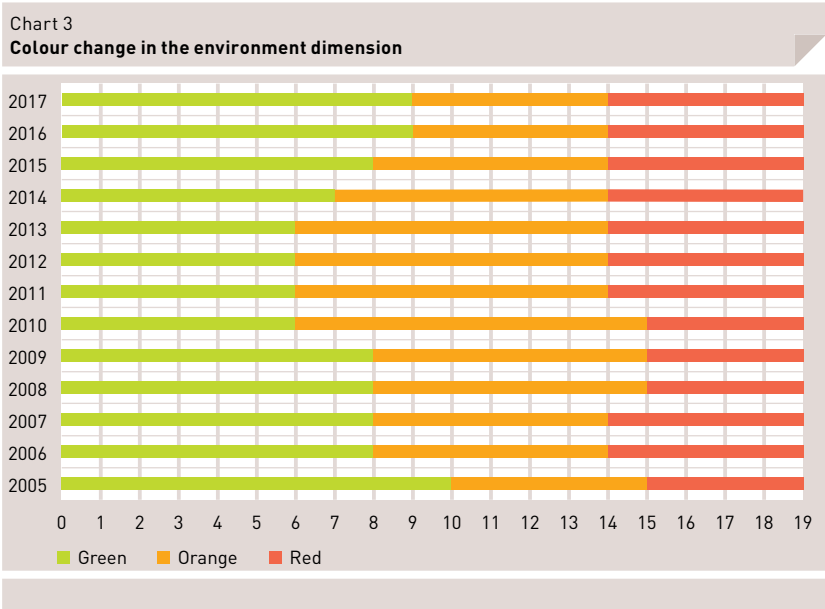
		Year t_1	Trend	LU	Position			EU Average	DE	BE	FR	First	Last
C1	Energy intensity (energy consumption per GDP unit) (kilograms of oil equivalents per EUR)	2016	↑	87.94	4	/	28	118.36	110.52	147.72	117.08	Ireland: 58.82	Bulgaria: 422.56
C2	Share of crude oil and petroleum products in total household energy consumption (%)	2016	↑	33.80	26	/	28	11.60	20.60	29.20	14.40	Sweden: 0.30	Ireland: 38.10
C3	Energy productivity (EUR (PPS) per kilogram of oil equivalent)	2016	→	10.50	6	/	28	9.10	9.40	6.70	8.20	Malta: 17.20	Estonia: 4.80
C4	Resource productivity (EUR (PPS) per kilogram)	2017	↑	3.03	5	/	28	2.20	2.36	2.63	2.77	Netherlands: 3.96	Bulgaria: 0.71
C5	Domestic raw material consumption (RMC) (in tonnes per head)	2017	↑	25.00	25	/	28	13.58	15.61	13.20	11.26	Italy: 8.49	Finland: 32.30
C6	Renewable energy share (% of national 2020 target)	2016	↑	49.09	27	/	28	85.00	82.22	66.92	69.57	Croatia: 141.50	Netherlands: 42.86
C7	Greenhouse gas emission intensity (index 100 in 2000)	2016	↑	92.60	22	/	28	87.90	95.70	83.60	85.00	Malta: 61.00	Bulgaria: 106.20
C8	Waste production per head (kilograms per person)	2014	↑	12,713.00	24	/	28	4,915.00	4,785.00	5,025.00	4,913.00	Croatia: 879.00	Bulgaria: 24,872.00
C9	Municipal waste recycling rate (%)	2016	↑	48.30	7	/	27	45.30	66.10	53.50	41.70	Germany: 66.10	Malta: 7.10
C10	E-waste recycling rate (%)	2016	↑	45.60	11	/	23	41.20	39.00	34.00	37.10	Bulgaria: 105.20	Latvia: 23.20
C11	Urban population exposure to air pollution / Emissions-concentration NOx (micrograms per cubic metre)	2013	↓	1,544.50	4	/	24	3,153.16	3,148.60	2,299.30	3,788.20	Romania: 573.90	Italy: 5,759.80
C12	Air: quality and satisfaction rate (micrograms per cubic metre)	2015	↓	21.40	14	/	27	22.80	18.80	21.00	20.40	Finland: 11.30	Bulgaria: 36.20
C13	Water: quality and satisfaction rate (milligrams of oxygen per litre)	2014	→	1.88	10	/	18	1.94		2.38	1.14	Slovenia: 0.88	Romania: 2.96
C14	Total expenditure on environmental protection (% of GDP)	2017	↑	1.10	1	/	2	0.75	0.6	0.8	0.9	Luxembourg: 1.10	Denmark: 0.40
C15	Land protected (%)	2017	→	27.00	6	/	28	18.00	15.00	13.00	13.00	Slovenia: 38.00	Denmark: 8.00
C16	Eco-innovation Index (EU index 100)	2017	↓	139.00	3	/	28	100.00	139.00	83.00	99.00	Sweden: 144.00	Bulgaria: 38.00
C17	Greening (% of GDP)	2012	↑	4.19	9	/	11	5.31	5.43	8.18	4.14	Austria: 11.74	Bulgaria: 2.73
C18	Number of green jobs (% of total jobs)	2012	↓	2.57	4	/	11	1.82	1.17	2.05	1.63	Austria: 4.30	Bulgaria: 0.85
C19	Non-energetic material productivity (EUR per kilogram)	2017	↑	3.82	5	/	28	2.84	3.47	3.37	3.33	Netherlands: 6.80	Romania: 0.83
C20	Circular economy												

Note: the indicators in purple were already part of the former scoreboard (dark purple = without adaptation, light purple = with adaptations)

A country’s development which is fostered at the expense of the environment is not only untenable in the long term but also deprives citizens of another form of wealth, namely natural heritage. Sustainable preservation of the natural environment appears to be a crucial matter and thus the environmental dimension is an integral part of the new system of indicators. A range of indicators cover issues such as raw materials, energy efficiency, renewable energies, harmful emissions, waste processing, nature and the ecosystem, biodiversity and the transition towards a green economy.

Luxembourg’s performance is more mixed for this dimension than it was for the other two dimensions, with 5 of the 18 indicators being red in colour. This number has remained unchanged since 2011 whilst the number of green indicators increased from 6 in 2011 to 9 2017. According to the last available data, Luxembourg was able to improve its performance in 12 indicators pertaining to the environment.

It should be noted that for 5 indicators, the most recent data were from 2012 or 2013.



3.1.5.1 Detailed description of the environment dimension indicators

As part of the Europe 2020 strategy, the European Council set the following European objective: *'reducing greenhouse gas emissions by 20% compared to 1990 levels; increasing the share of renewables in final energy consumption to 20%; and moving towards a 20% increase in energy efficiency'*.

The intensity of greenhouse gas emissions (**C7**) is the ratio between greenhouse gas emissions linked to energy production (carbon dioxide, methane, nitrogen oxide) and gross domestic energy consumption. This index (year 2000=100) shows that several Member States have been able to reduce their GHG emissions since 2000. However, this index does not provide any information on the initial level of consumption. Luxembourg ranked close to the EU average with an index of 92.6 in 2016.

When it comes to the share of renewable energy in gross domestic energy consumption (achieved % of the national 2020 target) (**C6**), many countries had already reached their 2020 targets by 2015: Bulgaria, the Czech Republic, Denmark, Estonia, Croatia, Italy, Lithuania, Hungary, Romania, Finland and Sweden. Luxembourg achieved 49.09% of its the national 2020 target but remains on-track to meet its target.

Energy intensity refers to energy consumption per unit of GDP (**C1**). For this indicator, Luxembourg (87.94) stood alongside Denmark (66.38), Ireland (58.82), Italy (98.5) and Malta (81.08) as the countries with the lowest energy intensity in 2016. The highest energy intensity score was recorded in Bulgaria (422.56). Energy productivity (**C3**) is calculated by dividing the gross domestic product (GDP) by the gross domestic energy consumption over the course of a given calendar year.

Indicator **C2** refers to the share of crude oil and petroleum products in the total energy consumption of the residential sector. In Luxembourg, the figure was 33.8% in 2016, thus placing the country 26th among the 28 EU Member States.

To calculate the productivity of resources (**C4**) indicator, GDP is divided by the domestic consumption of raw materials. Luxembourg scored 3.03 in 2016 and topped the rankings (5th position) together with Italy (3.38), the Netherlands (3.96), the United Kingdom (3.56) and Spain (3.16).

Domestic consumption of raw materials (**C5**) in Luxembourg equated to 25 tons per head. The top-performing EU Member State was Italy with 8.49 tons per head. This indicator takes account of raw materials imported into national economies. It also covers all imported solids, liquids and gases, except for water and air. Over the last few years, the indicator levels have remained stable for most countries.

Luxembourg performed relatively poorly in terms of waste produced per head (**C8**). In 2014, Luxembourg produced around 12.7 tons of waste per head of the population. Other countries, such as Sweden, Estonia and Bulgaria, produce even more waste. Croatia (879 kg per head) produces the least waste in the EU. As regards the recycling of municipal waste (**C9**), Luxembourg managed a rate of 48.3% in 2016 but still trailed Germany, which achieved a recycling rate of 66.1% in 2016. Luxembourg (45.60%) performed slightly better than the EU average 41.2% in 2016) in terms of e-waste recycling (**C10**). Posting a score of 105.2%, Bulgaria earned the top spot in the EU rankings in 2016.

The urban population exposure to air pollution (concentration of NO_x emissions) (**C11**) calculates the weighted ozone concentration to which the urban population is potentially exposed. In 2013, Luxembourg registered a score of 1,545 micrograms per cubic metre per day. The indicator score is five times higher in Greece than in Luxembourg. Luxembourg's performances for air quality and satisfaction with air quality (**C12**) and water quality (**C13**) were average. Slovenia recorded the best water quality and satisfaction with water quality score in 2014 (latest available figures). The air quality indicator saw Finland and Sweden perform the best in 2014, scoring 11.3% and 12.2% respectively. Luxembourg's total expenditure on environmental protection (**C14**) is amongst the highest in the European Union with a score of 0.9% of GDP in 2016. Only Hungary, Malta and the Netherlands posted a higher score.

27% of the surface area of Luxembourg is protected land (**C15**). This figure placed Luxembourg in 6th position in the EU rankings behind Slovenia, Croatia, Bulgaria, Slovakia and Cyprus.

The Eco-Innovation Observatory (EIO) defines eco-innovation as an innovation that reduces both the use of natural resources and the emission of harmful substances throughout the whole life cycle. The eco-innovation index (**C16**) and the corresponding scoreboard seek to cover the different aspects of eco-innovation through 16 indicators which span five thematic areas⁶: (1) measuring the financial and human resources earmarked for starting eco-innovation activities, (2) illustrate the extent to which companies in a given country are active in the field of eco-innovation, (3) quantify the efficiency of eco-innovation activities in patents, academic publications and the media, (4) measure efficiency whilst framing eco-innovation in the context of the efficient use of a country's resources (i.e. energy, water) and the efficiency and intensity of GHG emissions, (5) quantify the socioeconomic benefits illustrating the level at which eco-innovation can generate positive social (employment) and economic (turnover, exports) outcomes. In 2017, Luxembourg and Germany placed 3rd in the rankings, just behind Finland and Sweden.

⁶ Source:
https://ec.europa.eu/environment/ecoap/scoreboard_en

Combating climate change and using natural resources in an efficient way are not only necessary for ensuring sustainable development but also provide new opportunities for the economy. Green activities (**C17**) accounted for 4.19% of Luxembourg's GDP in 2012. Estonia and Austria posted scores of 14.1% and 10.27% respectively in 2015. This not only enables new sectors of the environmental economy to emerge but also green jobs to be created. The number of green jobs as a percentage of total jobs (**C18**) refers to jobs created by commitments to protect the environment and natural resources. The figure for Luxembourg was 2.57% in 2012. Finland and Estonia were leading countries, posting scores of 5.27% and 4.93% respectively in 2015. It should be borne in mind that many countries do not have any available data on green jobs.

3.1.5.2 Data availability in the environment dimension

Table 6
Incomplete data in the environment dimension

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Environment dimension	26.9%	18.4%	22.0%	15.1%	17.4%	8.7%	12.3%	7.6%	10.9%	4.6%	15.0%	24.0%	55.7%

In the environment dimension, 24.6% of the data are not available. Other indicators have only existed for a few years or are in the process of being adapted. Worthy of mention is the fact that the UN adopted 17 sustainable development goals in September 2015 with new indicators to measure achieved progress. These indicators could also serve as a source of inspiration for indicators to be adapted in the future.

Data on waste production per head (C8) were only available for one year in every two (2006, 2008, 2010, 2012, 2014).

For **C17** (production of green activities) and **C18** (number of green jobs), the data available dates from 2012.

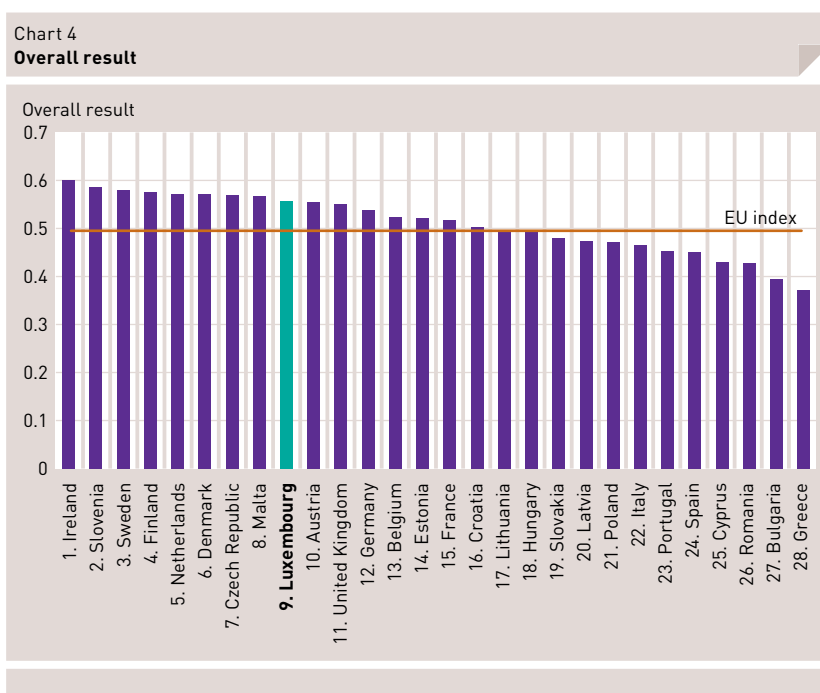
The circular economy (indicator **C20**) is a very complex issue. There is a European definition of the term but standards and indicators to measure it are yet to be established.

3.2 Competitiveness composite indicator⁷

A composite indicator can be used to summarise the performances of a country for the various indicators under the three different dimensions of Economy, Social and Environment, with all the pros and the cons that this entails. Often appreciated by the media, appreciating instantaneous compact information, such a composite indicator - and the country rankings which are drawn up as a result - cannot replace a serious and detailed analysis, looking more specifically at the individual indicators and dimensions. On the contrary the composite indicator should in fact prompt readers to consult the base data used in greater detail⁸.

3.2.1 Overall result

In the ODC's composite indicator calculated based on the new national system of indicators for the year 2017, Luxembourg ranked 9th among the EU-28, ahead of Austria, the United Kingdom and its neighbouring countries. Germany was 12th, Belgium 13th and France 15th in the overall rankings.



⁷ Data used in this section were updated on: 9/10/2018.

⁸ See chapter 2 'Benchmarks and comparative competitiveness analysis'.

The countries are split into 4 performance groups, depending on their average results in terms of competitiveness.

The 'competitiveness champion' group includes countries whose results in terms of competitiveness are significantly higher than the composite index for the EU in 2017 (performance above 115% of the EU composite index⁹). This group is composed of Ireland, Slovenia, Sweden, Finland and the Netherlands.

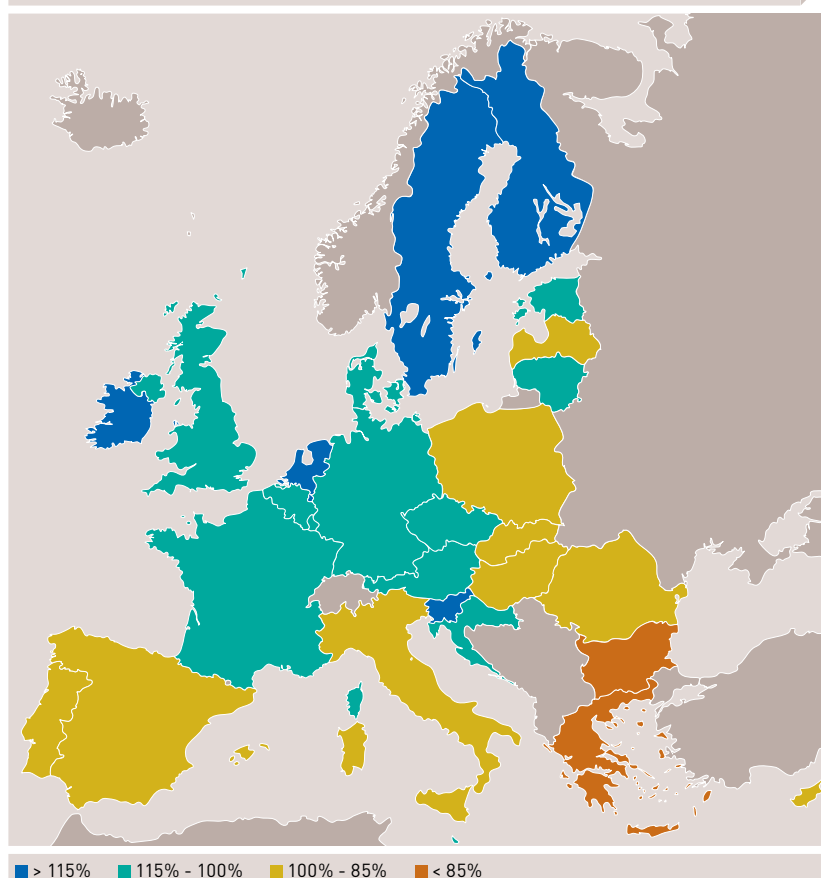
The group of 'high performance' countries includes those whose results are higher than the composite index of the EU (performance between 100% and 115% of the composite index of the EU). This group includes Denmark, the Czech Republic, Malta, Luxembourg, Austria, the United Kingdom, Germany, Belgium, Estonia, France, Croatia and Lithuania.

The group of 'moderate performance' countries includes those whose results are equal to or lower than the composite index of the EU (performance between 85% and 100% of the composite index of the EU). Hungary, Slovakia, Latvia, Poland, Italy, Portugal, Spain, Cyprus and Romania compose this group.

The group of 'modest performance' countries includes those whose results are significantly lower than the composite index of the EU (performance lower than 85% of the composite index of the EU). Bulgaria and Greece compose this group.

Chart 5

Overall results – Performance groups¹⁰



⁹ The EU composite indicator is calculated in the same way as for the country indicators.

¹⁰ Terms and conditions for the use of Europe maps: this work is under Creative Commons Attribution-Share Alike 3.0 Unported licence. It is attributed to Phil Archer and the original version can be found under <https://philarcher.org/diary/2013/euromap/>

The ranking of most of these countries did not change much between 2016 and 2017. There are a few exceptions, though: Denmark, the Czech Republic and Luxembourg lost 3 and 2 places respectively. They now find themselves in 6th, 7th and 9th position. Malta has gone up 3 places, and Slovenia progressed by 6 places, positioning them in the 8th and 2nd position respectively.

In addition to 2017, the ODC has also recalculated the general ranking of the new national system of indicators for 2005 to 2016. Over the entire 2005-2014 period, Denmark came top. From 2015 onwards, Ireland took that place. Luxembourg experienced a positive trend between 2005 and 2014, moving from the 7th to the 2nd place. The country lost 7 places between 2014 and 2017, however.

Some more or less important changes can be seen in the country ranking over the years. When comparing the situation of 2017 to that of 2005, the greatest negative variations were experienced by Denmark, Italy and the United Kingdom, which all lost 5 places. On the other hand, some countries considerably improved their ranking in the overall classification. Examples of this trend between 2005 and 2017 are: Ireland (from 8th to 1st), Slovenia (9th to 2nd), and the Czech Republic (from 13th to 7th).

Table 7
Overall rankings from 2005 to 2017

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Germany	14	11	11	12	12	10	9	7	10	15	12	12	12
Austria	5	5	5	4	2	2	3	2	3	5	11	10	10
Belgium	11	12	12	9	8	7	7	9	8	11	14	13	13
Bulgaria	27	28	27	28	27	26	27	27	27	27	27	28	27
Cyprus	21	20	18	17	17	18	22	24	26	26	26	25	25
Croatia	16	17	19	20	20	19	21	21	21	20	20	18	16
Denmark	1	1	1	1	1	1	1	1	1	1	2	3	6
Spain	22	23	24	23	23	23	24	23	24	23	23	24	24
Estonia	15	15	16	16	19	21	16	16	17	16	16	14	14
Finland	2	4	4	2	6	5	6	5	5	7	6	4	4
France	12	14	14	14	13	13	13	14	13	14	13	15	15
Greece	26	26	26	25	25	27	28	28	28	28	28	27	28
Hungary	23	22	23	22	21	17	15	19	16	17	17	17	18
Ireland	8	6	7	13	14	14	14	13	9	4	1	1	1
Italy	17	18	20	18	15	15	17	20	20	21	21	21	22
Latvia	19	21	21	26	28	28	23	17	18	19	19	19	20
Lithuania	18	16	15	19	22	24	18	15	15	10	15	16	17
Luxembourg	7	7	6	6	3	3	2	4	2	2	4	7	9
Malta	10	13	13	10	10	11	12	12	11	13	9	11	8
Netherlands	4	3	3	3	4	6	5	3	6	9	7	6	5
Poland	24	24	22	21	16	20	19	22	22	22	22	22	21
Portugal	25	25	25	24	24	22	25	25	23	25	24	23	23
Romania	28	27	28	27	26	25	26	26	25	24	25	26	26
United Kingdom	6	8	10	8	9	8	10	10	7	12	10	9	11
Czech Republic	13	10	9	11	11	12	11	11	12	6	5	5	7
Slovakia	20	19	17	15	18	16	20	18	19	18	18	20	19
Slovenia	9	9	8	7	7	9	8	8	14	8	8	8	2
Sweden	3	2	2	5	5	4	4	6	4	3	3	2	3

It is important to note that the update of the scoreboard also takes regular reviews of statistical data for the former years into account (from 2005 to 2016 for the current edition). The revisions of the national accounts by national statistics institutes in the respective Member States have had an impact on some indicators, namely on the indicators for GDP in the denominator. This is why the results for 2016 in the composite index, published in the 2017 Report, may differ from the 2016 result of the composite index published in the 2018 edition.

3.2.2 Results for each dimension

Here, the results of the composite indices are explained by section. It is important to decompose the composite index because it can conceal important information concerning the sub-indicators.

Thus, the ODC assessed the performance of the EU Member States along three dimensions: the economic dimension, the social dimension, and the environment dimension, while calculating a composite index for each one, which summarises the underlying information.

3.2.2.1 Results for the economic dimension

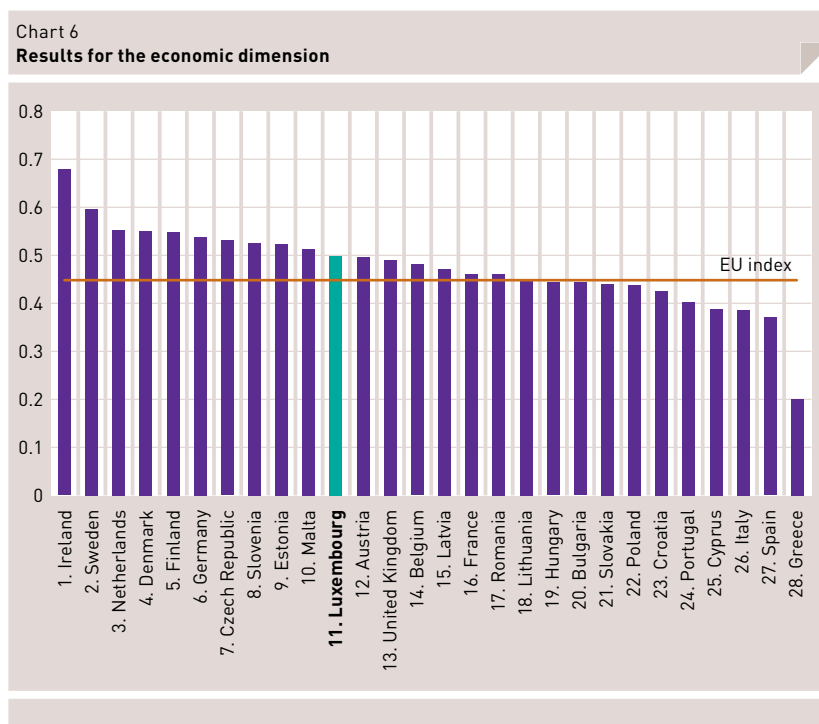
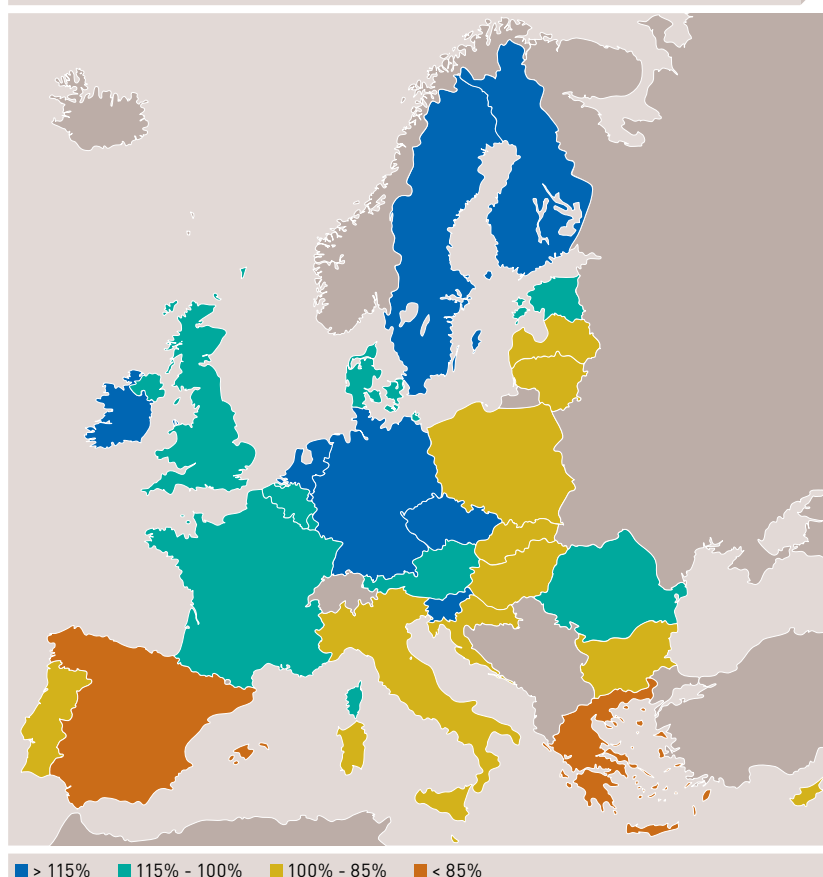


Chart 7
Results for the economic dimension – Performance groups



Just as in the general results, the countries are classified into 4 groups.

The champions of the Economy aspect are: Ireland, Sweden, the Netherlands, Denmark, Finland, Germany, the Czech Republic, Slovenia and Estonia. Amongst others, Luxembourg, Belgium, France and the United Kingdom are in the high-performance group. In the moderate-performance group, there are some countries from Southern Europe, such as Portugal, Italy and Cyprus, as well as from Eastern Europe, such as Poland and Slovakia. The group of modest-performance countries is comprised of only Spain and Greece.

Compared to its neighbours and the Netherlands, Luxembourg ranks in the middle, in 11th place, behind the Netherlands (3rd) and Germany (6th). Luxembourg ranks above Belgium (14th) and France (16th).

In this dimension, Ireland and Greece are interesting cases: Ireland's values are much higher than the others', and those of Greece are much lower.

For the economic dimension, Ireland ranks top for six indicators, hence why it is often top of the ranking. These indicators are: the nominal UWC (A17), the real productivity of labour per hour worked (A16), the real GDP growth (A7), the market share of global exports (A4), the productivity of non-financial companies (A19) and the average annual variation rate of the factors in the overall economy (A15). However, indicator A7 presents an outlier for Ireland. Consequently, it has been corrected, giving Ireland the second highest value. The method applied to process outliers is described in greater detail in the frame concerning methodology.

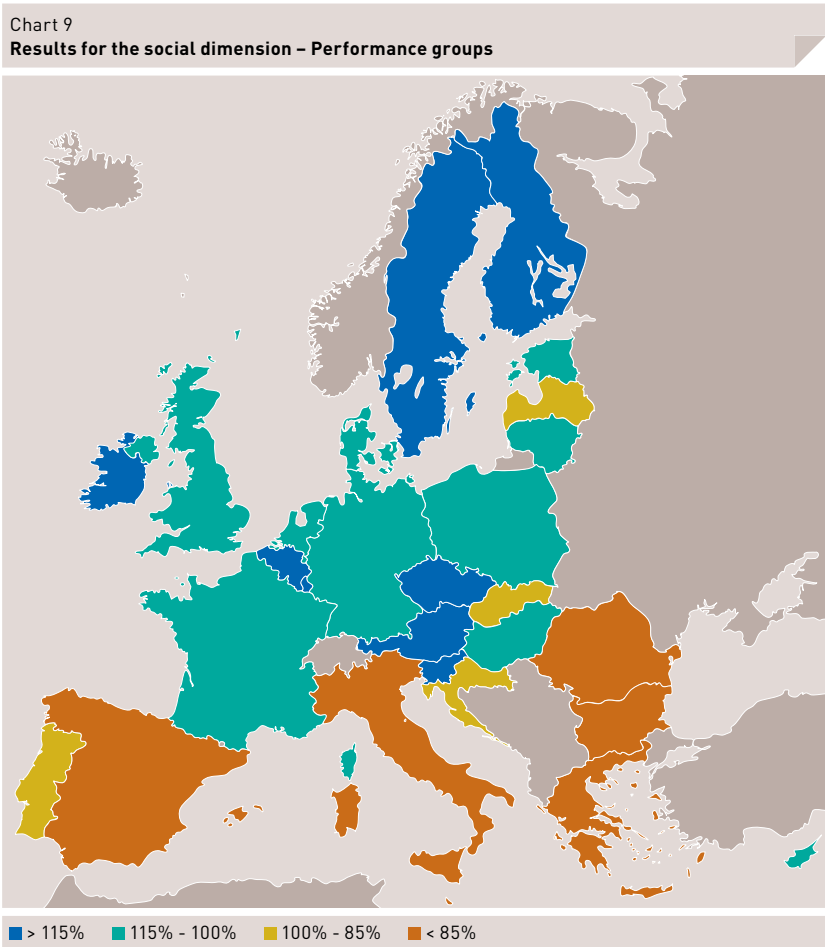
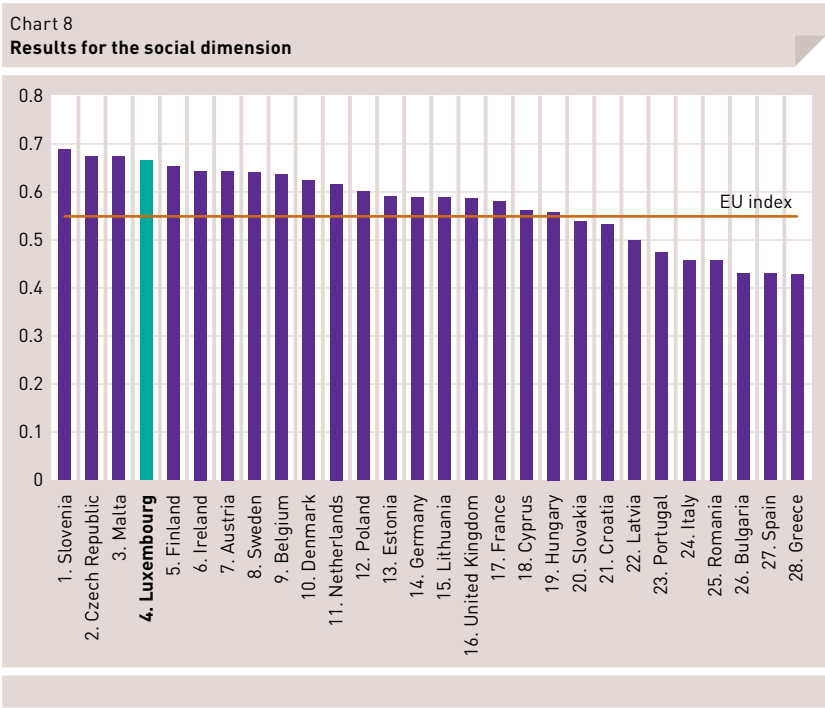
Ireland has evolved greatly since 2010. Indeed, it jumped from rank 16 in 2010 to the top in 2015. Since then, Ireland has remained top of the ranking for the economic dimension.

Greece comes bottom for 8 of the 25 indicators of the economic dimension. The indicators for which Greece comes bottom are: the market share of global exports (A4), the real GDP growth rate (A7), the real labour productivity per worked hour (A16), the income from long-term government bonds (A10), public debt (A1), the unemployment rate (A14), the employment rate for 20 to 64-year-olds (A14) and the availability of financial resources for entrepreneurs (A12).

Luxembourg comes bottom three times: for the average annual variation rate of total factor productivity in the overall economy (A15), the profitability of non-financial companies (A19)¹¹ and the share of employment in the medium-high and high technology manufacturing sector (A22). On the other hand, Luxembourg comes top for the inflation rate indicator (A8) and the GDP per hour worked indicator (A20), as well as second for the public debt indicator (A1).

¹¹ See the box on companies' profitability above.

3.2.2.2 Results for the social dimension



For the social dimension, the champions include Slovenia, the Czech Republic, Malta, Luxembourg, Finland, Ireland, Austria, Sweden and Belgium. The values for Malta, Luxembourg and the Czech Republic are all quite similar. Therefore, minimal variations of one single indicator out of 24 covered by the social dimension may suffice to affect the classification.

The group of high-performance countries includes: Denmark, the Netherlands, Poland, Estonia, Germany, Lithuania, the United Kingdom, France, Cyprus and Hungary.

Portugal as well as some countries from Eastern Europe, such as Slovakia, Croatia and Latvia find themselves in the moderate-performance group.

The group of modest-performance countries includes Italy, Romania, Bulgaria, Spain and Greece.

Luxembourg ranks above its neighbours, Belgium (9th), Germany (14th), and France (17th), as well as above the Netherlands (11th). It comes top for the indicator concerning the median income for purchasing power (B12) and net wealth per household (B16). In addition, it comes second for the indicator of young people who are neither in employment, education or training (NEET) (B4) and for the serious material deprivation rate (B18). However, regarding the median revenue indicator (variation in % compared to the previous year) (B11), Luxembourg comes bottom.

3.2.2.3 Results for the environment dimension

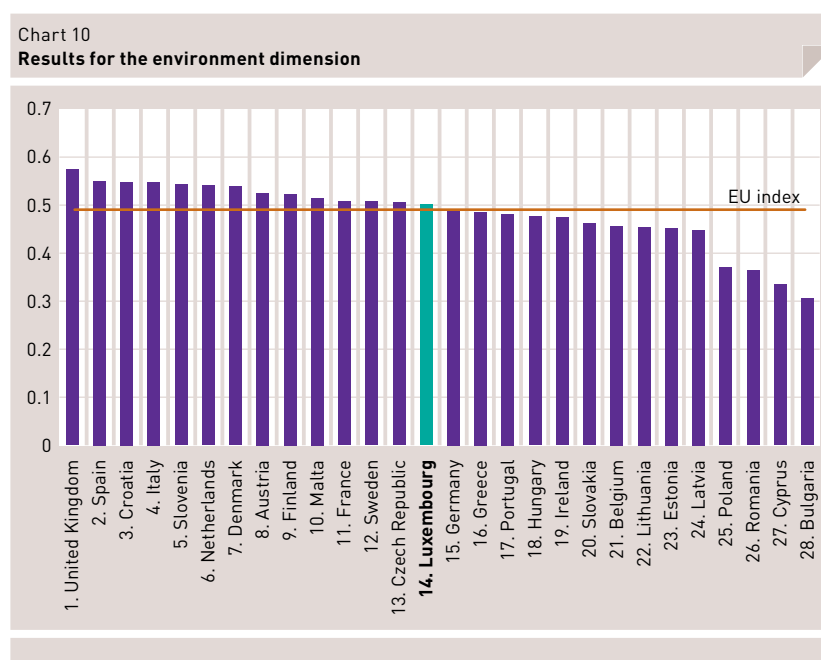
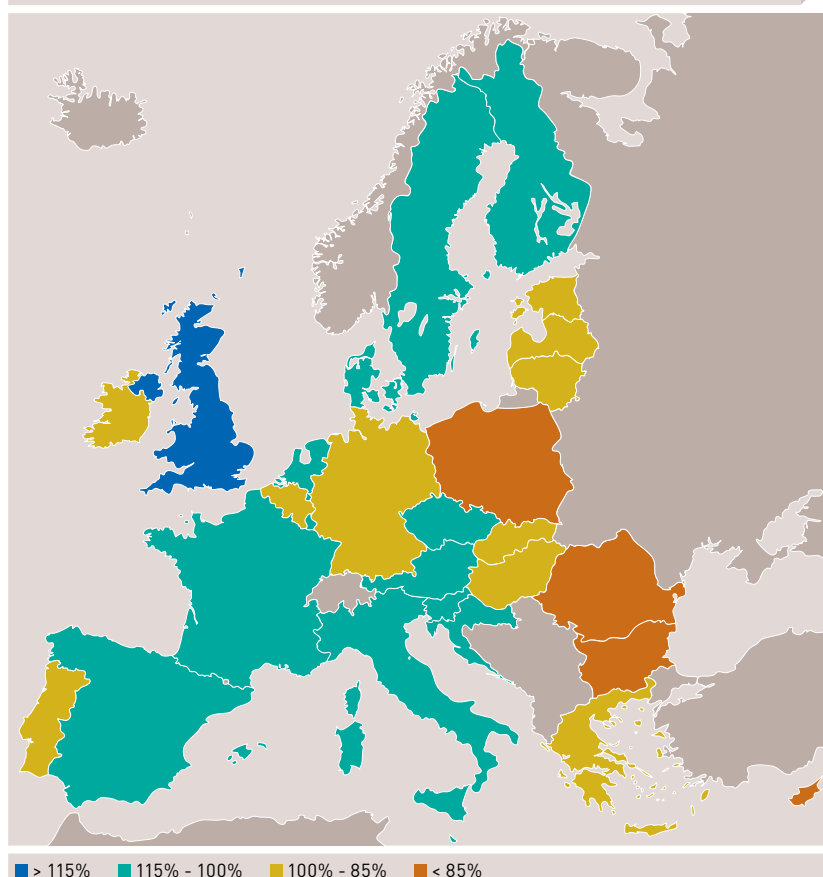


Chart 11
Results for the environment dimension – Performance groups



Only the United Kingdom is in the champions' group for the environment dimension.

Spain, Croatia, Italy, Slovenia, the Netherlands, Denmark, Austria, Finland, Malta, France, Sweden, the Czech Republic and Luxembourg are in the high-performance group.

Germany, Greece, Portugal, Hungary, Ireland, Slovakia, Belgium, Lithuania, Estonia and Latvia find themselves in the moderate-performance group.

The group of modest-performance countries for the environment dimension includes Poland, Romania, Cyprus and Bulgaria. Compared to other EU Member States, the countries in this group come bottom of the ranking for most of the indicators under this dimension, and experience fewer variations in their respective positions.

Luxembourg ranks below the Netherlands (6th) and France (11th), but above Germany (15th) and Belgium (21st).

In terms of renewables (C6), Luxembourg ranks before-last. On the other hand, Luxembourg ranks third for the indicator concerning the total expenditure for the protection of the environment (C14) and the Eco-innovation Index indicator (C16). It comes fourth for the energy intensity indicator (C1).

3.2.3 Luxembourg's development

In the overall ranking of the composite indicator of 2017, Luxembourg ranks two places lower than in 2016. When analysing this result in detail, it seems that it is especially under the economic and social dimensions that the country's performance dropped in 2017 compared to 2016. The crucial question is to know whether Luxembourg's performance is negative, or whether other countries have improved more than Luxembourg. However, it is difficult – if not impossible – to provide a comprehensive answer to that question by using composite indicators¹². It is important to note that it is fundamental that the core data used be analysed in order to understand the performance of the composite indicators for Luxembourg. The choice of indicators requiring a more in-depth analysis is performed according to the difference in ranking between 2016 and 2017.

From a methodological viewpoint, it is important to note that this is a relative classification, which means that Luxembourg's ranking is also dependent on other countries' performance. Even if Luxembourg's performance is good, other countries may have done even better, thus having a negative impact on Luxembourg's final position. The classification reveals nothing of the absolute performance of a given country. On the contrary, an improved country ranking may be the result of other countries' drop in performance. This is why the ODC recommends that the classification be interpreted and analysed on the basis of data from the scoreboard, i.e. the core indicators.

3.2.3.1 Performance under the economic dimension

The comparison of the economic dimension results of 2016 and 2017 demonstrate that Luxembourg's position is lower in 2017 in relation to other EU Member States. This does not reveal anything about the evolution of the indicator values, however.

¹² The values of the composite indicators are not comparable over time because each year (and each indicator) has its own basis values (maximum, minimum) that are used to calculate the composite indicators. See box Methodology.

Table 8
Performance in positions and value in the economic dimension

Indicator	Rank			Value	Indicator	Rank			Value
	2016	2017	Difference			2016	2017	Difference	
A1	2	2		DET	A14	11	10	1	AM
A2	1	4	-3	DET	A15	22	28	-6	DET
A3	21	21		AM	A16	16	27	-11	DET
A4	2	4	-2	DET	A17	14	23	-9	DET
A5	5	6	-1	DET	A18	23	23		AM
A6	17	19	-2	DET	A19	28	28		
A7	4	17	-13	DET	A20	1	1		DET
A8	2	2		DET	A21	15	15		
A9	24	25	-1	EGAL	A22	27	28	-1	DET
A10	2	5	-3	DET	A23	13	13		DET
A11	4	3	1	AM	A24	11	12	-1	DET
A12	23	22	1	AM	A25	6	6		AM
A13	14	16	-2	AM					

Indicators A7, A15, A16 and A17 present the greatest variation between 2016 and 2017, with a difference ranging between -6 to -13 positions. The change of positions alone does not indicate whether the values have increased, decreased or if they have remained stable.

Real GDP growth (%; average over 3 years) (A7)

Table 9 Performance in positions and value in the indicator A7				
2016			2017	
Value	Country	Position	Country	Value
13.0	Ireland	1	Ireland	12.4
7.6	Malta	2	Malta	7.1
4.0	Romania	3	Romania	5.2
3.9	Luxembourg	4	Czech Republic	4.0
3.5	Czech Republic	5	Poland	3.9
3.4	Poland	6	Bulgaria	3.7
3.4	Slovakia	7	Cyprus	3.7
3.3	Hungary	8	Slovakia	3.5
3.3	Sweden	9	Estonia	3.4
3.1	Bulgaria	10	Slovenia	3.4
2.8	Slovenia	11	Hungary	3.3
2.8	Estonia	12	Spain	3.3
2.7	Spain	13	Latvia	3.2
2.6	Lithuania	14	Sweden	3.1
2.3	Latvia	15	Croatia	2.9
2.3	United Kingdom	16	Lithuania	2.8
2.0	Germany	17	Luxembourg	2.8
1.9	Croatia	18	Netherlands	2.4
1.9	Netherlands	19	Portugal	2.2
1.8	Cyprus	20	Germany	2.0
1.7	Denmark	21	Denmark	2.0
1.5	Portugal	22	United Kingdom	1.9
1.4	Belgium	23	Austria	1.9
1.3	Austria	24	Finland	1.8
1.1	France	25	Belgium	1.5
0.7	Italy	26	France	1.5
0.7	Finland	27	Italy	1.2
0.1	Greece	28	Greece	0.3

The real GDP growth rate dropped by 3.9% in 2016 and 2.8% in 2017. Consequently, Luxembourg ranks 17th, whereas it came 4th in 2016. However, Luxembourg remains above the Netherlands, Germany, Belgium and France.

The rate for Germany remains stable, at 2%, but its position fell because other countries, such as the Netherlands – which rose by one place – are improving. Belgium and France have lost ground in terms of their positions whereas their growth rate is increasing.

**Average annual level of variation in total factor productivity
in the economy overall (%) (A15)**

Table 10

Performance in positions and value in the indicator A15

2016			2017	
Value	Country	Position	Country	Value
4.5	Latvia	1	Ireland	6.5
4.2	Romania	2	Latvia	5.7
2.7	Bulgaria	3	Romania	4.3
2.4	Slovenia	4	Slovenia	3.4
2.2	Croatia	5	Czech Republic	2.7
1.8	Slovakia	6	Poland	2.3
1.6	Finland	7	Lithuania	2.3
1.5	Ireland	8	Estonia	2.2
1.2	Czech Republic	9	Slovakia	1.9
1.2	Sweden	10	Hungary	1.8
1.1	Spain	11	Bulgaria	1.6
1.0	Poland	12	Malta	1.4
0.8	Netherlands	13	Finland	1.4
0.8	Portugal	14	Netherlands	1.3
0.8	Cyprus	15	Austria	1.2
0.8	Germany	16	Italy	1.0
0.8	Estonia	17	Spain	0.9
0.5	United Kingdom	18	Germany	0.9
0.4	Denmark	19	Portugal	0.7
0.4	France	20	Greece	0.7
0.3	Hungary	21	France	0.7
0.3	Luxembourg	22	Croatia	0.7
0.2	Malta	23	Denmark	0.5
0.1	Austria	24	Cyprus	0.5
0.1	Italy	25	United Kingdom	0.5
0.1	Greece	26	Belgium	0.2
0.1	Belgium	27	Sweden	-0.1
-0.2	Lithuania	28	Luxembourg	-0.6

The average annual variation rate for global productivity in the overall Luxembourgish economy dropped by 0.3% to -0,6%. The country therefore ranked 28th in 2017, compared to 22nd in 2016.

The Netherlands, Germany, France and Belgium saw their rates rise, but with the exception of Belgium, which gained one place, all the other countries dropped in the ranking.

Real labour productivity per hour worked
(%; average growth rate over 3 years)

Table 11
Performance in positions and value in the indicator A16

2016			2017	
Value	Country	Position	Country	Value
8.9	Ireland	1	Ireland	8.5
4.8	Romania	2	Romania	5.0
2.8	Latvia	3	Latvia	3.8
2.8	Malta	4	Croatia	2.9
2.7	Bulgaria	5	Poland	2.9
2.0	Czech Republic	6	Bulgaria	2.9
2.0	Slovakia	7	Slovenia	2.6
1.9	Croatia	8	Malta	2.6
1.8	Poland	9	Czech Republic	2.3
1.8	Slovenia	10	Slovakia	2.2
1.7	Estonia	11	Lithuania	1.8
1.4	Sweden	12	Estonia	1.5
1.0	Germany	13	Finland	1.4
0.8	Finland	14	Sweden	1.2
0.8	Belgium	15	Hungary	1.0
0.8	Luxembourg	16	Germany	1.0
0.7	Denmark	17	Austria	0.8
0.7	Austria	18	Spain	0.7
0.6	Netherlands	19	Netherlands	0.7
0.6	France	20	France	0.7
0.5	Cyprus	21	United Kingdom	0.6
0.4	Spain	22	Denmark	0.6
0.4	United Kingdom	23	Belgium	0.5
0.1	Lithuania	24	Cyprus	0.4
0.0	Italy	25	Italy	0.1
-0.2	Greece	26	Portugal	-0.2
-0.3	Portugal	27	Luxembourg	-0.5
-0.4	Hungary	28	Greece	-0.8

Real labour productivity per hour worked dropped by 0.8% to -0.5%. As a result, Luxembourg lost 11 places and comes in the second-to-last position, just before Greece.

Like Luxembourg, the indicator for Belgium also worsened: Belgium dropped by 9 places. For Germany, on the other hand, the indicator remained stable, but it lost 3 places due to the other countries' performance. The indicator for the Netherlands and France increased by 0.1 percentage points and the two countries went up one place in the ranking.

Nominal unit salary costs (% change over 3 years) (A17)

Table 12

Performance in positions and value in the indicator A17

2016			2017	
Value	Country	Position	Country	Value
-18.8	Ireland	1	Ireland	-17.2
-6.9	Cyprus	2	Croatia	-4.3
-5.1	Croatia	3	Cyprus	-2.7
-3.3	Greece	4	Finland	-2.5
-0.6	Netherlands	5	Greece	-0.6
-0.5	Belgium	6	Netherlands	-0.2
-0.5	Spain	7	Spain	0.0
0.1	Portugal	8	Belgium	1.0
0.2	Malta	9	Italy	1.1
0.9	Slovenia	10	France	1.3
1.3	France	11	Malta	1.7
1.3	Finland	12	Denmark	3.0
1.6	Italy	13	Slovenia	3.4
2.5	Luxembourg	14	Portugal	3.5
2.5	Poland	15	Austria	3.7
2.5	Sweden	16	Sweden	3.7
2.7	Czech Republic	17	Poland	4.5
3.0	United Kingdom	18	Germany	5.1
3.1	Slovakia	19	United Kingdom	5.4
3.3	Denmark	20	Czech Republic	5.9
3.8	Hungary	21	Hungary	6.7
4.7	Germany	22	Slovakia	6.9
5.3	Austria	23	Luxembourg	7.9
7.1	Romania	24	Romania	12.2
9.1	Bulgaria	25	Estonia	12.4
12.0	Estonia	26	Bulgaria	13.6
15.3	Lithuania	27	Latvia	14.7
16.9	Latvia	28	Lithuania	16.0

The comparison between 2016 and 2017 shows that the value of the indicator for Luxembourg increased by 5.4 percentage points. This explains why Luxembourg came 23rd in 2017, compared to 14th in 2016. The indicator for the Netherlands, Belgium and Germany increased in value. Germany gained four places whereas the Netherlands lost one place and Belgium two.

While it went up by two places in the classification, the indicator value for France remained stable (1.3%).

3.2.3.2 Performance under the social dimension

The comparison of the social dimension results of 2016 and 2017 demonstrate that Luxembourg's position was lower in 2017 in relation to other EU Member States.

Table 13
Performance in positions and value in the social dimension

Indicator	Rank			Value	Indicator	Rank			Value
	2016	2017	Difference			2016	2017	Difference	
B1	9	13	-4	AM	B13	3	3		
B2	25	24	1	EGAL	B14	8	4	4	AM
B3	10	10		DET	B15	21	21		EGAL
B4	2	2		DET	B16	1	1		EGAL
B5	4	9	-5	DET	B17	14	19	-5	DET
B6	24	24		EGAL	B18	2	2		AM
B7	5	3	2	AM	B19	17	18	-1	EGAL
B8	5	9	-4	DET	B20	10	11	-1	EGAL
B9	2	4	-2	DET	B21	11	11		EGAL
B10	25	25		EGAL	B22	6	7	-1	EGAL
B11	27	28	-1	EGAL	B23	18	18		EGAL
B12	1	1		EGAL	B24	17	17		

Indicators B1, B5, B8 and B14 present the greatest variations between 2016 and 2017, with variations ranging between -4 places (for indicators B1 and B8), -5 places (for B5 and B17), and +4 places (indicator B14). Once again, the ranks do not indicate whether the values of the indicators have increased, diminished or remained stable.

Long-term unemployment rate (%) (B1)

Table 14

Performance in positions and value in the indicator B1

2016			2017	
Value	Country	Position	Country	Value
1.3	Sweden	1	Czech Republic	1.0
1.3	United Kingdom	2	United Kingdom	1.1
1.4	Denmark	3	Sweden	1.2
1.7	Czech Republic	4	Denmark	1.3
1.7	Germany	5	Poland	1.5
1.9	Malta	6	Germany	1.6
1.9	Austria	7	Hungary	1.7
2.1	Estonia	8	Malta	1.8
2.2	Luxembourg	9	Austria	1.8
2.2	Poland	10	Estonia	1.9
2.3	Finland	11	Netherlands	1.9
2.4	Hungary	12	Romania	2.0
2.5	Netherlands	13	Luxembourg	2.1
3.0	Lithuania	14	Finland	2.1
3.0	Romania	15	Lithuania	2.7
4.0	Belgium	16	Ireland	3.0
4.0	Latvia	17	Slovenia	3.1
4.2	Ireland	18	Latvia	3.3
4.3	Slovenia	19	Bulgaria	3.4
4.5	Bulgaria	20	Belgium	3.5
4.6	France	21	France	4.2
5.8	Cyprus	22	Cyprus	4.5
5.8	Slovakia	23	Portugal	4.5
6.2	Portugal	24	Croatia	4.6
6.6	Croatia	25	Slovakia	5.1
6.7	Italy	26	Italy	6.5
9.5	Spain	27	Spain	7.7
17.0	Greece	28	Greece	15.6

Between 2016 and 2017, the long-term unemployment rate in Luxembourg diminished by 0.1 percentage points. Despite this positive development, Luxembourg ranked 13th in 2017, whereas it ranked 9th in 2016. This result implies that countries that were behind Luxembourg in 2016 have improved their figures and overtook Luxembourg in 2017.

For Germany, the Netherlands, Belgium and France, the indicator improved. However, not all these countries enjoyed the same progress in terms of ranking. Belgium and Germany lost 4 and 2 places respectively, but France remained stable and the Netherlands moved up 2 places.

Involuntary part-time work (%) (B5)

Table 15
Performance in positions and value in the indicator B5

2016			2017	
Value	Country	Position	Country	Value
8.8	Belgium	1	Belgium	7.8
10.4	Estonia	2	Estonia	7.8
11.0	Netherlands	3	Netherlands	9.1
11.7	Luxembourg	4	Czech Republic	9.4
11.8	Malta	5	Malta	11.0
12.2	Germany	6	Slovenia	11.3
13.0	Austria	7	Germany	11.5
14.3	Czech Republic	8	Austria	12.4
14.9	Slovenia	9	Luxembourg	13.6
16.2	Denmark	10	United Kingdom	14.8
16.4	United Kingdom	11	Denmark	16.3
26.1	Poland	12	Poland	21.5
28.6	Sweden	13	Ireland	25.4
30.0	Hungary	14	Hungary	26.9
30.8	Croatia	15	Sweden	27.4
31.7	Lithuania	16	Lithuania	31.0
33.1	Ireland	17	Slovakia	32.0
34.7	Slovakia	18	Finland	34.2
36.8	Latvia	19	Croatia	36.3
36.8	Finland	20	Latvia	36.5
44.4	France	21	France	43.1
49.2	Portugal	22	Portugal	48.5
58.1	Romania	23	Romania	56.5
59.2	Bulgaria	24	Bulgaria	59.0
62.4	Spain	25	Spain	61.9
64.2	Italy	26	Italy	62.4
69.7	Cyprus	27	Cyprus	68.3
72.3	Greece	28	Greece	70.7

In Luxembourg, involuntary part-time employment increased by 1.9 percentage points between 2016 and 2017. In 2017, Luxembourg's position dropped by 5 places compared to 2016.

For Belgium, the Netherlands, Germany and France, the indicator improved. The Netherlands, Belgium and France remained in the same position, whereas Germany lost one place compared to 2016.

Individuals having prematurely left education and training (B8)

Table 16
Performance in positions and value in the indicator B8

2016			2017	
Value	Country	Position	Country	Value
2.8	Croatia	1	Croatia	3.1
4.8	Lithuania	2	Slovenia	4.3
4.9	Slovenia	3	Poland	5.0
5.2	Poland	4	Ireland	5.1
5.5	Luxembourg	5	Lithuania	5.4
6.2	Ireland	6	Greece	6.0
6.2	Greece	7	Czech Republic	6.7
6.6	Czech Republic	8	Netherlands	7.1
6.9	Austria	9	Luxembourg	7.3
7.2	Denmark	10	Austria	7.4
7.4	Slovakia	11	Sweden	7.7
7.4	Sweden	12	Finland	8.2
7.6	Cyprus	13	Cyprus	8.6
7.9	Finland	14	Latvia	8.6
8.0	Netherlands	15	Denmark	8.8
8.8	Belgium	16	Belgium	8.9
8.8	France	17	France	8.9
10.0	Latvia	18	Slovakia	9.3
10.3	Germany	19	Germany	10.1
10.9	Estonia	20	United Kingdom	10.6
11.2	United Kingdom	21	Estonia	10.8
12.4	Hungary	22	Hungary	12.5
13.8	Bulgaria	23	Portugal	12.6
13.8	Italy	24	Bulgaria	12.7
14.0	Portugal	25	Italy	14.0
18.5	Romania	26	Romania	18.1
19.0	Spain	27	Spain	18.3
19.7	Malta	28	Malta	18.6

In Luxembourg, the percentage of individuals having left education or training prematurely increased by 1.8 percentage points between 2016 and 2017. In 2017, Luxembourg came in 9th place, i.e. 4 places lower than in 2016.

The value and ranking for the Netherlands improved, and they now find themselves just ahead of Luxembourg, in 8th place. The values of the indicator for Belgium and France deteriorated slightly, but the two countries remained in the same positions. The same applies to Germany: it remained in the same position despite the fact that the value of the indicator dropped a little.

Wage changes (%) in the economy (real ULC), over 3 years (B14)

Table 17

Performance in positions and value in the indicator B14

2016			2017	
Value	Country	Position	Country	Value
4.44	Latvia	1	Latvia	3.58
3.88	Lithuania	2	Lithuania	3.27
2.81	Estonia	3	Slovakia	1.71
1.43	Bulgaria	4	Luxembourg	1.71
1.42	Slovakia	5	Bulgaria	1.54
0.52	Denmark	6	Estonia	1.45
0.37	Poland	7	Czech Republic	0.80
0.31	Luxembourg	8	Romania	0.66
0.17	Greece	9	Hungary	0.43
0.11	Austria	10	Denmark	0.32
-0.02	Germany	11	United Kingdom	0.31
-0.06	Spain	12	Greece	0.23
-0.29	France	13	Germany	0.13
-0.36	Romania	14	Poland	-0.06
-0.37	United Kingdom	15	Austria	-0.25
-0.39	Italy	16	France	-0.33
-0.63	Slovenia	17	Portugal	-0.36
-0.66	Czech Republic	18	Spain	-0.39
-0.87	Netherlands	19	Slovenia	-0.41
-0.87	Finland	20	Italy	-0.43
-0.90	Hungary	21	Cyprus	-0.64
-1.03	Cyprus	22	Sweden	-0.88
-1.11	Sweden	23	Netherlands	-1.13
-1.14	Portugal	24	Belgium	-1.24
-1.30	Belgium	25	Malta	-1.73
-2.08	Croatia	26	Finland	-1.82
-2.13	Malta	27	Croatia	-2.13
-8.86	Ireland	28	Ireland	-8.30

The indicator for real unit wage costs in the Luxembourgish economy increased by 1.4 percentage points, and the country went up by 4 positions in the ranking.

The values of the indicator diminished for France and the Netherlands, which respectively lost 3 and 4 positions compared to the previous year. Belgium improved in terms of indicator value and went up one place in the classification. Germany's indicator value improved, but it lost 3 positions due to more positive developments in other countries.

At-risk-of-poverty rate after social transfers (%) (B17)

Table 18

Performance in positions and value in the indicator B17

2016			2017	
Value	Country	Position	Country	Value
9.7	Czech Republic	1	Czech Republic	9.1
11.6	Finland	2	Finland	11.5
11.9	Denmark	3	Denmark	12.4
12.7	Netherlands	4	Slovakia	12.7
12.7	Slovakia	5	Netherlands	13.2
13.6	France	6	France	13.3
13.9	Slovenia	7	Slovenia	13.3
14.1	Austria	8	Hungary	13.4
14.5	Hungary	9	Austria	14.4
15.5	Belgium	10	Poland	15.0
15.9	United Kingdom	11	Cyprus	15.7
16.1	Cyprus	12	Sweden	15.8
16.2	Sweden	13	Belgium	15.9
16.5	Luxembourg	14	United Kingdom	15.9
16.5	Germany	15	Germany	16.1
16.5	Malta	16	Ireland	16.6
16.6	Ireland	17	Malta	16.8
17.3	Poland	18	Portugal	18.3
19.0	Portugal	19	Luxembourg	18.7
19.5	Croatia	20	Croatia	19.5
20.6	Italy	21	Greece	20.2
21.2	Greece	22	Italy	20.3
21.7	Estonia	23	Estonia	21.0
21.8	Latvia	24	Spain	21.6
21.9	Lithuania	25	Latvia	22.1
22.3	Spain	26	Lithuania	22.9
22.9	Bulgaria	27	Bulgaria	23.4
25.3	Romania	28	Romania	23.6

The indicator for at-risk of poverty rate after social transfers for Luxembourg increased by 2.2 percentage points between 2016 and 2017. Luxembourg was in 19th place, compared to 14th in 2016.

The Netherlands and Belgium had higher rates in 2017 and lost 1 and 3 places respectively. France and Germany improved slightly in value but remained in the same positions.

3.2.3.3 Performance under the environment dimension

The comparison of results under the environment dimension for 2016 and 2017 show that Luxembourg enjoyed the same position in 2016 and 2017 for most indicators.

Table 19

Performance in positions and value in the environment dimension

Indicator	Rank			Value	Indicator	Rank			Value
	2016	2017	Difference			2016	2017	Difference	
C1	4	4			C11	5	5		EGAL
C2	26	26			C12	14	14		
C3	6	6			C13				
C4	5	5		AM	C14	4	3	1	AM
C5	25	25		AM	C15	6	6		EGAL
C6	27	27			C16	1	3	-2	DET
C7	22	22			C17	21	21		
C8					C18	10	10		
C9	7	7			C19	5	5		AM
C10	12	12			C20				

For the indicators C4, C5 and C19, Luxembourg remained stable in the ranking despite the fact that the indicator improved.

For the indicators C14 and C16, Luxembourg went up one place and lost two places respectively, and the values of the indicators improved and deteriorated respectively.

Generally speaking, this category presents fewer variations from year to year than the two other dimensions. Moreover, for part of the indicators, there are no updated data (i.e. for 2017).

3.2.4 Links with competitiveness

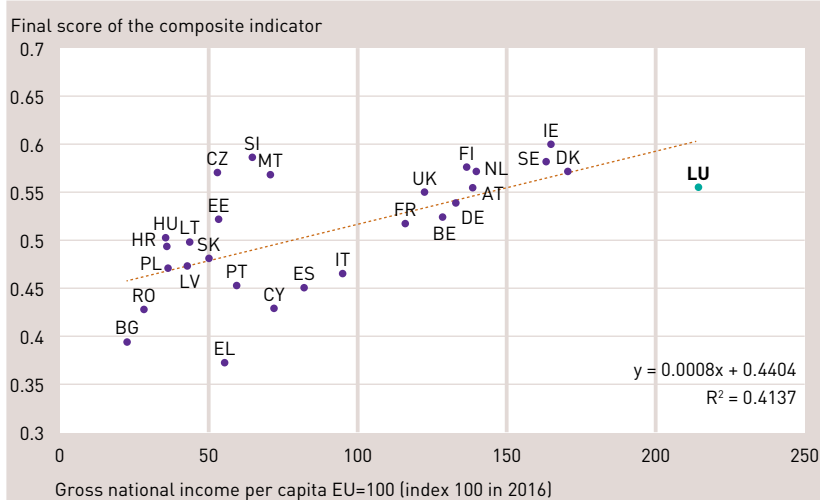
It is interesting to ask oneself whether there is a link between a country's competitiveness and its wealth. Along the same vein, the relation between the size of a country or the number of its inhabitants and competitiveness is regularly discussed. In order to attempt to answer those questions, it is revealing to analyse the correlations between the above elements.

3.2.4.1 Competitiveness and wealth

When the standard of living of the country's inhabitants (axis x – gross national income per inhabitant) is cross-referenced with national competitiveness level (axis y – final composite indicator result according to the new system of indicators), a positive correlation between these two variables can be observed. Luxembourg seems to be an outlier in this respect as its wealth per inhabitant is well above the curve. The net wealth per inhabitant for Luxembourgers therefore appears to be much higher than the country's level of competitiveness would initially suggest (according to the curve).

Chart 12

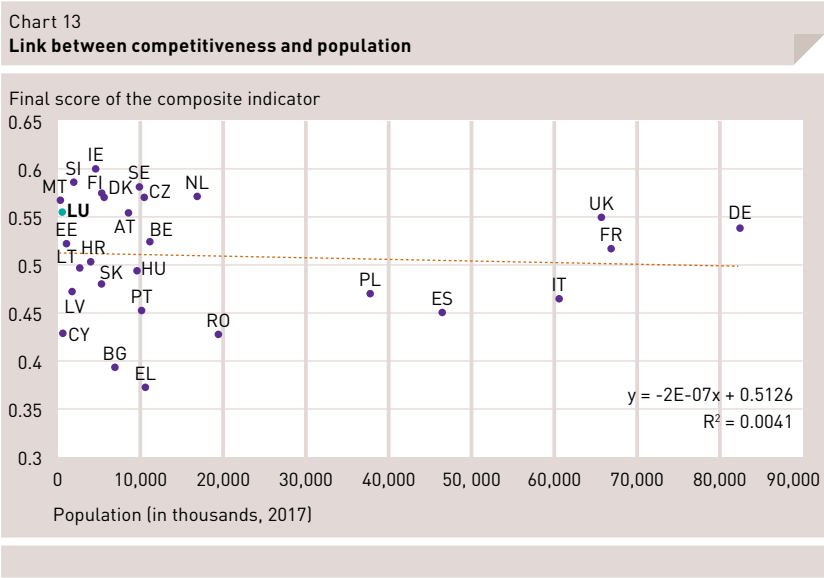
Link between competitiveness and wealth



Note: Gross national income at market prices, per inhabitant in PPS (2016 data)

3.2.4.2 Competitiveness and population size

The composite indicator results for 2017 indicate that there is no clear answer for determining whether population size has a positive or negative impact on competitiveness. The correlation between the final result for the composite indicator and population size is not statistically relevant ($r^2= 0.006$), which demonstrates that the indicator has no linear link with population size. This is also true when we look at the three dimensions individually.



3.2.5 Methodology

3.2.5.1 Calculation method

The methodology for calculating the composite indicator based on the new national system of indicators remains unchanged compared to previous editions. Please see below for a reminder of the calculation methodology.

Box Methodology

The methodology for calculating the composite indicator is not different from the one used in the former national scoreboard and we take the recommendations made by the audit into account (2010 Competitiveness Report, Perspectives économiques No. 15).

In order to address the problem of missing values, the 'hot-deck imputation' method is used. The idea is to estimate a country's missing values based on the values of a country that shows a similar performance for the other indicators in the same dimension.

For some indicators, there are outliers¹³. This means there is a country that has a value significantly higher or lower than all other countries. As these indicators are likely to influence the result too much, extreme values were replaced by the value of the country in second position.

To calculate the composite indicator, the core indicators must be standardised first. This means that if it is an indicator that must be maximised, the country with the highest value scores 1, the one with the lowest value scores 0, and the remaining countries are awarded a score between 0 and 1. The same method applies if an indicator must be minimised, but the other way around. Each indicator i is transformed by means of the following formula per country j at time t .

Indicators to be maximised:

$$y_{ij}^t = \frac{x_{ij}^t - \min_j x_{ij}^t}{\max_j x_{ij}^t - \min_j x_{ij}^t}$$

Indicators to be minimised:

$$y_{ij}^t = \frac{x_{ij}^t - \max_j x_{ij}^t}{\min_j x_{ij}^t - \max_j x_{ij}^t}$$

The inflation indicators and those of the current account balance are not maximised or minimised. They are evaluated according to how far removed from a defined value they are: for the inflation indicator, this value is the average of the European Union, and for the indicator for the current account balance, it is the average of -4% and +6%¹⁴.

The composite indicator C – also called composite indicator – for an aspect k ($k = 1, 2, 3$) at time t is calculated through a simple arithmetic mean of the sub-indicators of this aspect in the new scale:

$$C_{k,j}^t = \frac{1}{m_k} \sum_{i=1}^{m_k} y_{ij}^t$$

The final composite indicator CI is achieved by a simple arithmetic mean of these composite indicators by dimension:

$$CI_j^t = \frac{1}{k} \sum_{i=1}^k C_{k,j}^t$$

¹³ Technically, these indicators have been identified by the fact they have a very high skewness and kurtosis (skewness > 2 and kurtosis > 7).

¹⁴ For this indicator, the European Commission has agreed under the MIP that a country is potentially at risk if it has a current account balance with either a deficit higher than -4% of GDP or a surplus of over +6% of GDP.

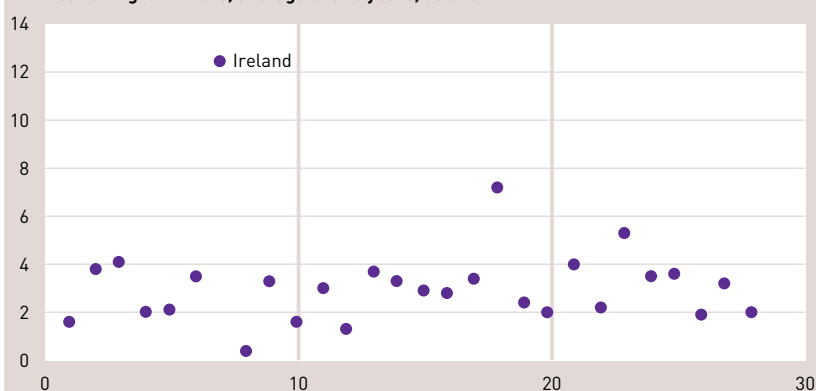
3.2.5.2 Dealing with outliers

The min-max method (see box Methodology) is usually sensitive to outliers. If these are not processed correctly, they can become unintentional reference points. Moreover, outliers can have a significant impact on the correlation structure and thereby introduce bias into the interpretation of results. While there are numerous suitable methods for detecting outliers, in the context of strengthening composite indicators it seems particularly appropriate to use a combination of skewness and kurtosis. A skewness value of more than 2 with a kurtosis value of more than 7 (in absolute terms) was used to detect problematic indicators which need to be processed before generating the composite indicator. In the 2010 JRC audit, the recommended values for detecting outliers were 1 for skewness and 3.5 for kurtosis; however, the ODC applies a broader range to keep data processing to a minimum.

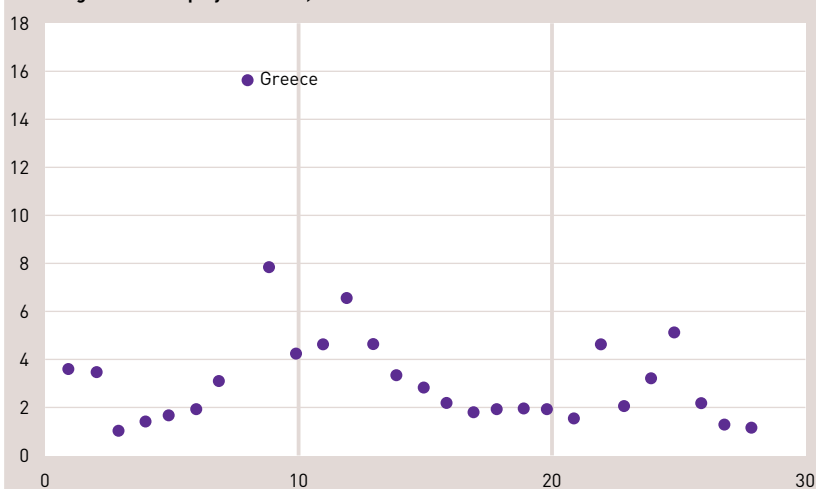
There were two indicators for 2017 which were considered problematic from this point of view: real GDP growth rate (A7) and long-term unemployment rate (B1). Ireland's value is considered an outlier for the indicator A7 (real GDP growth rate). Greece is an outlier for indicator B1 (long-term unemployment rate).

Charts 14 and 15
Outliers

A7: Real GDP growth rate, average over 3 years, as a %



B1: Long-term unemployment rate, as a %



In accordance with the advocated methodology, the outliers are replaced by the next best value. For indicator A7, the value for Ireland (12.43%) was replaced by that of Malta (7.13%). For indicator B1, the value for Greece (15.6%) was replaced by that of Spain (7.7%).

3.2.6 Robustness analysis

In their opinion paper on the national system of indicators, the ESC announced that a statistical robustness test should be carried out to assess data availability and reliability. Such a test is vital to ensure the quality of the indicators system and better understand Luxembourg's competitiveness and how this interacts with specific national characteristics. The analyses below were mainly inspired by the European Commission Joint Research Centre (JRC)¹⁵ audit commissioned by the ODC in 2010 pertaining to the former version of the national competitiveness scoreboard¹⁶.

3.2.6.1 The composite indicator stress test

The ODC carried out a stress test on its composite indicator based on the new system of indicators. The test consists in recalculating the overall rankings with one of the 67 indicators excluded from the calculation each time.

The table below reveals that Luxembourg varied between 7th and 12th place depending on the different scenarios.

There is a certain level of volatility, but it remains acceptable, and can be considered solid. To be more specific, a single indicator may modify the classification by three positions maximum.

¹⁵ For more details:
<http://composite-indicators.jrc.ec.europa.eu/>

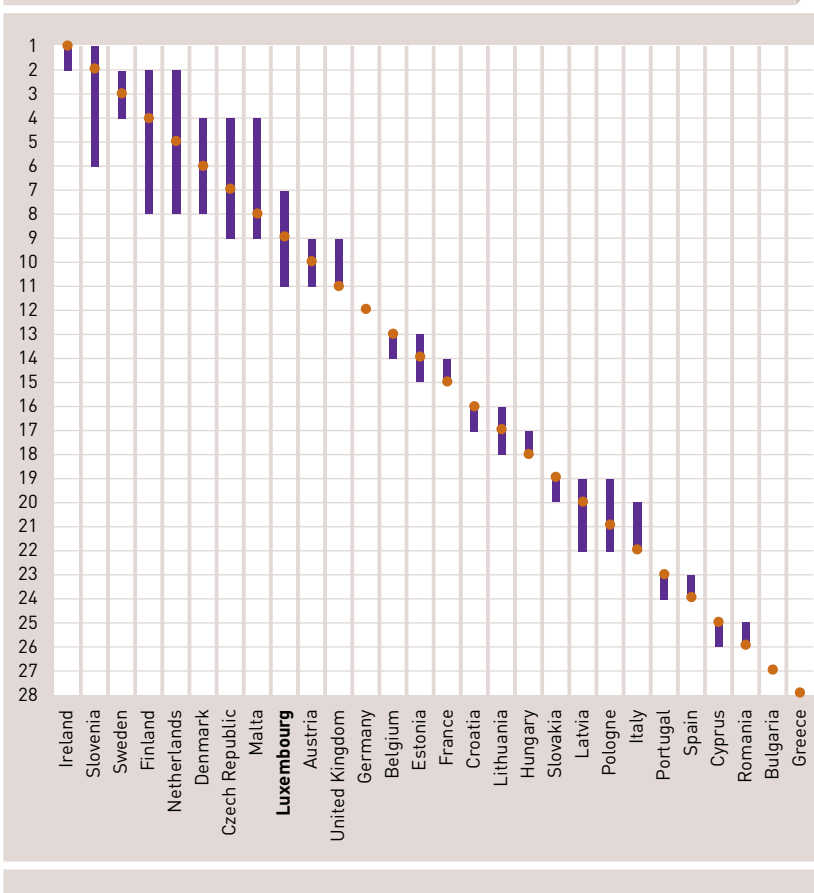
¹⁶ Perspectives de politique économique No.15:
The Luxembourg Competitiveness Index:
Analysis & Recommendations:
<https://odc.gouvernement.lu/fr/publications/rapport-etude-analyse/perspectives-politique-economique/perspectives-politique-economique-15.html>

Table 20
Stress test, as a %

	Average of alternative scenarios	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Ireland	1,21	99	1																										
Slovenia	2,26	1	87	7	3		1																						
Sweden	3,48		9	85	6																								
Finland	3,76		1	4	66	19		6	3																				
Netherlands	4,91		1	3	9	24	28	26	9																				
Denmark	5,42				4	25	32	26	12																				
Czech Republic	7,52				6	22	28	24	19	1																			
Malta	7,67				6	10	10	16	56	1																			
Luxembourg	8,79							1	1	57	28	12																	
Austria	10,03									37	54	9																	
United Kingdom	11,53									3	18	79																	
Germany	11,92												100																
Belgium	12,61													68	32														
Estonia	14,32													32	47	21													
France	15,27														21	79													
Croatia	15,45																90	10											
Lithuania	16,85																10	74	16										
Hungary	18,06																	16	84										
Slovakia	18,94																			93	7								
Latvia	20,24																			6	71	19	4						
Poland	20,92																			1	19	72	7						
Italy	21,83																				3	9	88						
Portugal	23,00																							75	25				
Spain	24,00																							25	75				
Cyprus	25,32																										51	49	
Romania	25,68																									49	51		
Bulgaria	27,03																												100
Greece	27,97																												100

Source: Observatoire de la compétitivité

Chart 16

Distribution of positions

3.2.6.2 Correlation between the three dimensions and the composite indicator

The Pearson correlations, calculated by ODC, suggest that the dimensions are positively and significantly linked to one another and the overall index.

3.2.6.3 Correlation between dimension result and underlying indicators¹⁷

The aim of each indicator under a given dimension is to correlate positively with the overall dimension result. For each dimension, however, there is at least one indicator which is pointing in the wrong direction. If an indicator is maximised, the higher the value of the indicator, the higher the final score of the composite indicator. If an indicator is minimised, the lower the value of the indicator, the lower the final score of the composite indicator. In the opposite cases, the final score of the composite indicator is weaker. This rationale is not always true, however. It is the case when an indicator that must be minimised has a positive correlation with the overall result or, on the contrary, when an indicator that must be maximised has a negative correlation with the overall result.

¹⁷ Note: the green dot represents Luxembourg's value.

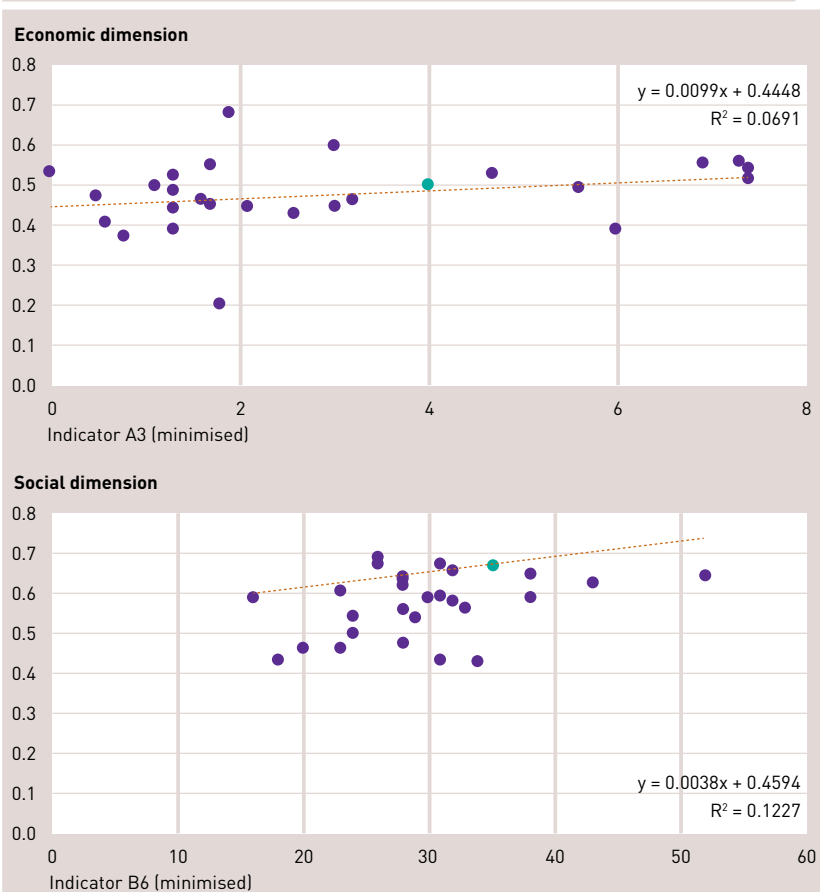
Moreover, causality – i.e. the fact that the final score of a composite indicator or the score of a dimension result from a good performance in the underlying indicators or vice versa – cannot be determined.

For the economic dimension, indicator A3 (current account balance in % of GDP) is positively correlated with the overall result and the result for this dimension, which means a low score goes hand in hand with an improvement in competitiveness. However, the source of this positive correlation could be the calculation method. Current account balance is one of the European Union MIP indicators, which stated that a country may be at risk if its current account balance either falls below -4% of GDP (lower threshold) or exceeds +6% of GDP (upper threshold). For the purposes of the composite indicator in the current system of indicators, the countries are nonetheless ranked based on how much their current account balance diverges from the simple arithmetic mean between the two limits (therefore the aim is for the balance to be around 1% of GDP).

The indicator of salaried workers with long involuntary hours (B6) is positively correlated with the composite indicator. The improvement of said indicator, i.e. its decreased value, results in a deterioration of competitiveness measured by means of the composite indicator.

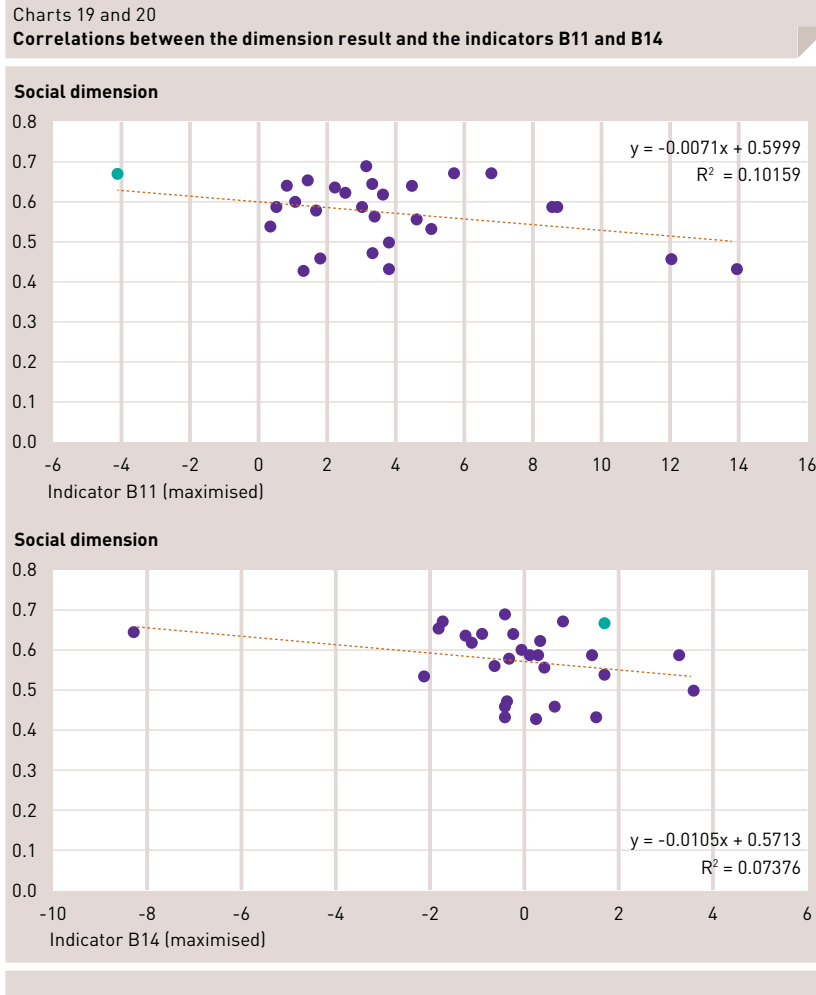
Charts 17 and 18

Correlations between the dimension result and the indicators A3 and B6



The indicator for median income (variation in % compared to the previous year) (B11) is negatively correlated with the composite indicator.

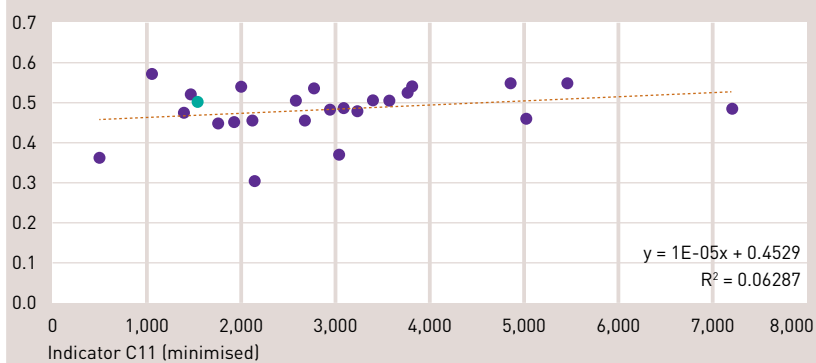
The unit labour cost indicator (B14) (variation) is negatively correlated with the composite indicator.



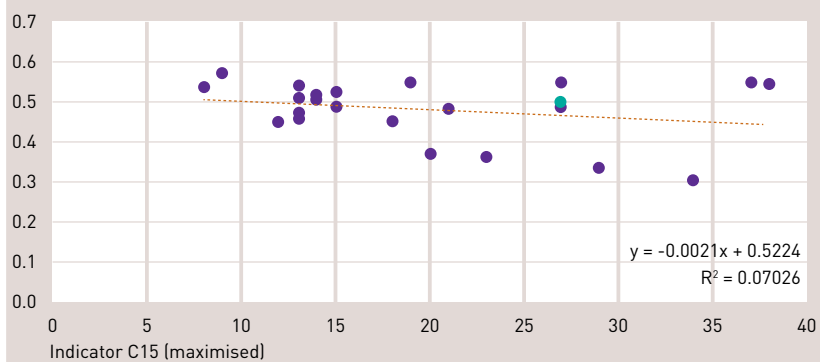
The urban population exposure to air pollution / emissions-concentration NO_x (C11) indicator is positively correlated with the overall result and the environment dimension. The C15 indicator (land protected) is negatively correlated with the overall result and that of the environment dimension.

Correlations between the dimension result and the indicators C11 and C15

Environment dimension



Environment dimension



Tables 21, 22 and 23

Overview of intra-dimension correlations in 2017

Economic dimension		Social dimension		Environment dimension	
Indicator	Correlation	Indicator	Correlation	Indicator	Correlation
A3	-0.26	B6	-0.35	C15	-0.27
A8	-0.13	B11	-0.32	C11	-0.11
A23	-0.02	B14	-0.27	C6	-0.09
A6	0.05	B15	-0.23	C10	-0.07
A18	0.09	B13	-0.09	C20	0.00
A17	0.17	B24	0.04	C18	0.01
A9	0.18	B3	0.04	C2	0.03
A22	0.23	B10	0.10	C17	0.11
A2	0.26	B7	0.13	C3	0.25
A15	0.32	B23	0.21	C14	0.26
A4	0.32	B20	0.25	C8	0.31
A19	0.43	B1	0.36	C13	0.34
A5	0.43	B22	0.37	C5	0.38
A7	0.44	B9	0.43	C9	0.38
A21	0.46	B8	0.43	C7	0.48
A16	0.48	B21	0.53	C12	0.49
A12	0.48	B12	0.62	C19	0.59
A20	0.50	B17	0.67	C1	0.60
A25	0.52	B1	0.69	C4	0.64
A11	0.57	B2	0.70	C16	0.69
A1	0.63	B19	0.70		
A24	0.66	B18	0.72		
A14	0.73	B4	0.76		
A10	0.74	B5	0.83		
A13	0.74				

Note: These tables show the intra-dimension correlations by using standardised values between 0 and 1. All negative correlations show that the indicator in question has an insignificant effect on the composite indicator of the dimension when the correlation is very close to 0, or is incoherent.

3.3 Annex

3.3.1 Secondary indicators

The ESC drew up an indicative, non-exhaustive list of relevant secondary indicators in its opinion paper on the national system of indicators. These indicators are not integrated into the composite indicator calculations, to avoid overloading the key element of the system of indicators. Nonetheless, the secondary indicators are pertinent and are therefore presented here for indicative purposes. They provide more information on specific areas and can help provide a more targeted analysis where needed. As such, they provide a fuller overview of the three economic, social and environment dimensions.

It must be noted however that, at this stage, there are several problems related to the availability of data for these secondary indicators. For some, no data was available at all, while for others the information is only available for Luxembourg. The corresponding fields in the tables are left blank where this is the case but will be filled in as soon as the relevant data becomes available.

3.3.1.1 Economic dimension (secondary indicators)

Table 24
Secondary indicators for the economic dimension

		Year t_1	Trend	LU	Position			EU Average	DE	BE	FR	First	Last
D1	Net external debt (as a % of GDP)	2017	↑	5.00	22	/	28	2.61	8.00	-0.20	-0.60	Cyprus: -6.7	Malta: 13.6
D2	Terms of trade per item (% variation over 5 years)	2017	↓	-1.20	27	/	28	3.36	5.80	0.80	5.00	Italy: 7.7	Slovakia: -1.5
D3	Real effective exchange rate for the euro area (% variation over 3 years)	2016	↓	-0.20	11	/	28	-1.14	0.40	2.10	0.10	United Kingdom: 5.1	Sweden: -7.7
D4	Direct Investment in the reporting economy (stocks, in % of GDP)	2017	↓	7867.40	1	/	28	471.29	42.20	197.40	46.50	Luxembourg: 7,867.4	Greece: 17.4
D5	Direct investment in reporting economy (flows, in % of GDP)	2017	↓	-422.30	28	/	28	-8.79	2.10	-6.20	1.90	Cyprus: 48.6	Luxembourg: -422.3
D6	Net trade balance for energy products as a % of GDP	2017	↓	-2.80	20	/	28	-2.37	-1.80	-2.50	-1.70	Denmark: -0.1	Malta: -8.9
D7	Share of OECD exports market (% variation over 5 years)	2017	↓	15.17	4	/	28	5.76	2.06	-1.59	-0.41	Ireland: 59.16	Greece: -13.78
D8	Export market share (% variation over 5 years)	2017	↓	20.43	4	/	28	10.58	6.72	2.90	4.13	Ireland: 66.42	Greece: -9.84
D9	Rate of growth in liabilities for the entire financial sector (% variation over 5 years)	2016	↓	17.57	1	/	28	5.05	4.20	2.23	3.77	Luxembourg: 17.57	Greece: -3.13
D10	10-year bond returns	2017	↓	0.54	5	/	27	1.31	0.32	0.72	0.81	Lithuania: 0.31	Greece: 5.98
D11	Number of days needed to acquire a building permit	2017	→	157.00	14	/	28	175.07	126.00	212.00	183.00	Denmark: 64	Cyprus: 507
D12	Regulation quality index	2016	↑	1.72	7	/	28	1.17	1.82	1.34	1.07	Netherlands: 1.98	Greece: 0.15
D13	Administration efficiency index	2016	↓	1.69	6	/	28	1.11	1.74	1.33	1.41	Denmark: 1.89	Romania: -0.17
D14	Flexibility of wage determination	2017	↑	5.10	10	/	28	4.78	4.30	4.30	5.00	Estonia: 6.2	Finland: 2.2
D15	Hiring and firing practice	2017	↑	3.68	17	/	28	3.62	4.59	3.19	2.39	France: 2.39	Denmark: 5.23
D16	Price of electricity - Industrial users (euro/kWh)	2017	↑	0.08	7	/	28	0.11	0.15	0.11	0.10	Sweden: 0.06	Germany: 0.15
D17	Price of gas - industrial users (euro/GJ)	2017	↑	8.85	25	/	26	7.11	7.69	6.12	7.69	Romania: 4.79	Sweden: 9.08
D18	Broadband Internet access rates (USD/MB)	2014	↑	6.56	8	/	20	24.02	25.58	1.73	6.29	Belgium: 1.73	Poland: 188.8
D19	Venture capital investment (% PIB)	2017	↓	0.35	1	/	28	0.12	0.07	0.11	0.24	Luxembourg: 0.35	Malta: 0
D20	R&D expenditure in the business sector (% PIB)	2016	↓	0.64	16	/	28	1.32	2.00	1.73	1.43	Sweden: 2.26	Latvia: 0.11
D21	Non-R&D innovation expenditure as % of turnover	2014	↓	0.13	28	/	28	0.76	1.26	0.56	0.50	Lithuania: 2.01	Luxembourg: 0.13
D22	SMEs innovating inhouse as % SMEs	2014	↓	32.24	8	/	28	28.77	37.90	39.75	31.55	Ireland: 41.33	Romania: 4.54
D23	Innovative SMEs collaborating with others as % SMEs	2014	↑	9.18	17	/	28	11.22	10.10	28.59	13.21	Belgium: 28.59	Romania: 1.78
D24	Public-private co-publications per million population	2017	↓	25.40	13	/	28	40.93	62.44	79.99	42.83	Denmark: 162.82	Malta: 0

Continuing on next page

Table 24
Continued

D25	Patents applications per billion GDP	2015	↓	1.75	12	/	28	3.53	6.11	3.16	3.98	Sweden: 9.08	Romania: 0.22
D26	Patents applications in health and environment per billion GDP	2012		0.68	10	/	28	1.01	1.47	0.77	0.92	Denmark: 2.05	Romania: 0.04
D27	USPTO issued patents per million inhabitants	2015	↑	90.59	11	/	28	86.79	203.81	100.64	98.85	Sweden: 270.12	Latvia: 2.01
D28	Patents applications per million inhabitants	2014	↓	111.16	9	/	28	111.97	256.97	137.73	138.74	Sweden: 350.41	Croatia: 3.43
D29	SMEs introducing product or process innovation as % of SMEs	2014	↓	36.95	9	/	28	30.90	41.56	48.26	35.47	Belgium: 48.26	Romania: 4.92
D30	SMEs introducing marketing or organisational innovation as % of SMEs	2014	↑	54.35	1	/	28	34.89	49.09	45.14	41.62	Luxembourg: 54.35	Romania: 8.84
D31	Employment in fast-growing firms of innovative sectors	2015	↑	4.60	15	/	27	4.85	4.63	2.66	4.13	Hungary: 8.7	Cyprus: 0.13
D32	Financing for entrepreneurs the availability of financial resources	2017	↑	2.46	14	/	18	2.70	2.84		2.81	Netherlands: 3.65	Greece: 1.92
D33	Taxes and bureaucracy - The extent to which public policies support entrepreneurship	2017	↑	3.35	2	/	18	2.40	2.48		3.03	Netherlands: 3.42	Croatia: 1.43
D34	Basic-school Entrepreneurial education and training	2017	↓	1.89	11	/	18	2.03	1.56		1.84	Netherlands: 3.4	Poland: 1.49
D35	Post-school entrepreneurial education and training	2017	↓	2.98	5	/	18	2.82	2.58		3.33	Netherlands: 3.71	Croatia: 2.25
D36	Perceived capabilities for entrepreneurship	2017	↑	40.86	13	/	18	43.95	37.45		36.31	Slovenia: 53.31	Italy: 30.39
D37	Entrepreneurship as a good career choice	2017	↑	42.98	18	/	18	58.58	51.31		59.06	Netherlands: 81	Luxembourg: 42.98
D38	Cultural and social norms	2017	↑	2.50	12	/	18	2.73	2.62		2.63	Netherlands: 4.01	Croatia: 1.8
D39	PISA math and sciences scores	2015	↓	486.00	17	/	22	495.23	506.00	507.00	493.00	Estonia: 520	Greece: 454
D40	New doctorate graduates per 1,000 population aged 25-54	2016	→	1.28	18	/	28	2.01	2.78	1.93	1.70	Slovenia: 3.55	Poland: 0.63
D41	International scientific co-publications per million population	2017	↓	1715.01	3	/	28	517.45	812.25	1 467.62	726.24	Denmark: 2,345.89	Romania: 181.78
D42	Scientific publications among the top 10% most cited worldwide	2015	↑	13.06	4	/	28	10.57	11.33	12.58	11.00	United Kingdom: 14.98	Bulgaria: 4.19
D43	Non-EU doctorate students as a % of all doctorate students	2016	→	86.99	1	/	27	26.07	9.12	41.80	40.05	Luxembourg: 86.99	Poland: 1.96

3.3.1.2 Social dimension (secondary indicators)

Table 25

Secondary indicators for the social dimension

		Year t_1	Trend	LU	Position			EU Average	DE	BE	FR	First	Last
E1	Share of low-wage workers as a % of the overall workforce	2014	↑	11.94	7	/	28	17.19	22.48	3.79	8.81	Sweden: 2.64	Latvia: 25.46
E2	Participation rate (%)	2017	↑	70.20	22	/	28	73.40	78.20	68.00	71.50	Sweden: 82.5	Italy: 65.4
E3	Quality of Work-Index					/							
E4	People living in households with very low labour intensity (%)	2016	↓	6.60	4	/	28	10.50	9.60	14.60	8.40	Estonia: 5.8	Ireland: 18.2
E5	Fatal accidents in the workplace (%)	2016	↓	6.32	26	/	26	1.52	0.88	1.64	2.24	Netherlands: 0.5	Luxembourg: 6.32
E6	Feeling of job insecurity (%)	2017	↓	3.20	9	/	22	5.31	2.00	4.80	5.00	Czech Republic: 1.8	Greece: 17.4
E7	Workers who report they are satisfied with their work-life balance	2013		7.20	1	/	1	7.20					
E8	Level of studies achieved (% of the population with a university qualification)	2015	↓	39.79	1	/	1	39.79					
E9	Reading skills in 15-year old students (PISA)	2015	↓	481.44	20	/	28	486.00	509.10	498.52	499.31	Finland: 526.42	Bulgaria: 431.72
E10	Knowledge and use of Luxembourgish, French, German and/or English					/							
E11	Civic skills of students	2009		473.00	20	/	22	511.36		514.00		Denmark: 576	Cyprus: 453
E12	Support from social network (%)	2015	↑	87.10	27	/	28	94.10	96.70	92.20	93.10	Czech Republic: 98.1	Italy: 86.8
E13	Participation in social, cultural and sports associations (%)	2015	↑	82.70	5	/	28	67.30	77.20	72.50	80.50	Sweden: 88.1	Romania: 29.6
E14	Time spent volunteering	2015	↓	30.30	8	/	28	22.20	11.40	20.80	23.30	Netherlands: 82.5	Malta: 0.9
E15	Frequency of social contacts (%)	2015	↑	70.70	9	/	28	63.80	66.80	70.00	58.90	Cyprus: 84.3	Poland: 37.3
E16	Number of voters as a % of the voting age population	2017	→	91.00	1	/	22	68.00	72.00	89.00	75.00	Luxembourg: 91	Slovenia: 52
E17	Existence of formal consultation procedures during law-making and production of regulations	2017	→	1.50	16	/	22	2.00	2.10	2.20	2.10	Slovakia: 2.9	Ireland: 0.8
E18	Participation in political and civic associations (%)	2006		4.70	11	/	25	4.20	6.40		2.70	Denmark: 12.2	Lithuania: 1.9
E19	Trust in institutions	2013		5.47	9	/	28	4.67	5.53	5.23	4.37	Finland: 7.13	Croatia: 3.05
E20	Tax rate for physical persons (en %)	2017		42.00	18	/	28	33.68	45.00	50.00	45.00	Bulgaria: 10	Austria: 55

Continuing on next page

Table 25

Continued

E21	Real annual growth rate of different income statistics per household	2015	↑	103.00	1	/	1	103.00					
E22	Overall household consumption including non-market services					/							
E23	Population unable to make ends meet (%)	2016	→	8.20	5	/	28	15.00	4.60	12.20	15.00	Sweden: 4.5	Greece: 36.2
E24	Rooms per person	2017	→	2.00	3	/	22	1.65	1.80	2.20	1.80	Belgium: 2.2	Poland: 1.1
E25	Number of houses built per year	2013	↑	2642.00	1	/	1	2642.00					
E26	Social housing					/							
E27	Time spent on pastimes and personal hobbies	2017	↓	15.15	10	/	22	15.14	15.55	15.77	16.36	France: 16.36	Latvia: 13.83
E28	Relative incidence of parental leave	2015	↓	0.32	1	/	1	0.32					
E29	Feeling of discrimination (nationality) (%)	2014	↑	24.00	1	/	1	24.00					
E30	Feeling of security (%)	2017		72.00	12	/	22	71.73	75.90	70.70	69.60	Slovenia: 84.7	Hungary: 50.7
E31	Satisfaction with life	2017	↑	6.90	8	/	22	6.44	7.00	6.90	6.40	Denmark: 7.5	Greece: 5.2
E32	Incidence and seriousness of mental health problems					/							
E33	Suicide rate	2015	↓	13.91	18	/	28	10.91	11.67	16.85	14.14	Cyprus: 4.45	Lithuania: 30.28
E34	Death rate according to cause	2015	↑	459.98	1	/	22	561.00	557.03	537.69		Luxembourg: 459.98	Lithuania: 871.26
E35	Consumption of psychotropic drugs	2014	↑	5.55	1	/	1	5.55					
E36	Adults who report they are in good or very good health (%)	2016	↓	23.10	11	/	28	20.50	18.00	29.60	21.90	Greece: 45	Latvia: 5.1
E37	Adults who report they have a long-term illness or health problem (%)	2015	↓	23.20	1	/	1	23.20					
E38	Adults who report they are unable to perform their usual activities due to a health problem (%)	2015	↓	25.70	1	/	1	25.70					

3.3.1.3 Environment dimension (secondary indicators)

Table 26

Secondary indicators for the environment dimension

		Year t_1	Trend	LU	Position			EU Average	DE	BE	FR	First	Last
F1	Final energy consumption - accountability mechanism	2016	↓	87.20	8	/	28	90.00	93.20	95.40	90.50	Lithuania: 75.1	Estonia: 113.8
F2	Final energy consumption - accountability mechanism	2016	→	4.00	5	/	28	1107.70	216.40	36.30	147.20	Malta: 0.6	Germany: 216.4
F3A	Share of renewable energy - solar panels (%)	2016	↓	6.88	8	/	28	4.29	8.30	8.66	2.94	Malta: 61.02	Estonia: 0
F3B	Share of renewable energy - wind (%)	2016	↑	7.92	15	/	28	14.29	4.47	1.04	21.61	Austria: 35.06	Cyprus: 0
F3C	Share of renewable energy - wind (%)	2016	↓	6.96	15	/	28	12.36	17.12	15.25	7.70	Ireland: 54.35	Malta: 0
F3D	Share of renewable energy - cogeneration					/							
F3E	Share of renewable energy - thermal (%)	2016	↓	1.60	7	/	28	2.05	1.70	0.75	0.42	Cyprus: 55.6	Estonia: 0
F4	Number of subsidies granted					/							
F5A	Total greenhouse gas emissions per capita - ETS	2016	↑	5.24	21	/	28	3.72	5.91	4.21	1.77	Latvia: 1.43	Estonia: 10.53
F5B	Total greenhouse gas emissions per million inhabitants - non-ETS	2016	↑	14.77	28	/	28	4.98	5.48	6.59	5.35	Malta: 2.98	Luxembourg: 14.77
F5C	Total greenhouse gas emissions per million inhabitants - of which transport	2016	↑	9.51	28	/	28	1.83	2.03	2.33	1.99	Romania: 0.85	Luxembourg: 9.51
F5D	Total greenhouse gas emissions per capita - buildings					/							
F6	Urban population exposure to air pollution (NO _x emissions and concentration)	2015	↓	11.70	7	/	24	14.50	13.30	13.50	13.50	Sweden: 5.2	Poland: 23.8
F7A	NH ₃ /thousand people	2015	↑	10.06	23	/	27	7.87	9.33	5.80	10.19	United Kingdom: 4.49	Ireland: 22.98
F7B	NH ₃ /GDP	2015	↑	0.12	1	/	27	0.30	0.27	0.17	0.32	Luxembourg: 0.12	Romania: 1.13
F8A	NMVO emissions/ thousand people	2015	↓	17.81	22	/	27	13.82	13.26	10.58	13.98	Netherlands: 8.67	Denmark: 23.9
F8B	NMVO emissions/GDP	2015	↓	0.22	1	/	27	0.52	0.39	0.31	0.44	Luxembourg: 0.22	Bulgaria: 2.26
F9	Environmental morbidity rate (%)	2012		0.13	5	/	28	0.14	0.13	0.13	0.13	Denmark: 0.12	Romania: 0.18
F10	Noise (%)	2016	↑	19.70	22	/	28	17.90	25.10	15.60	17.70	Ireland: 7.9	Malta: 26.2
F11	Dangerous waste generated (kg/person)	2014	↑	426.00	26	/	28	187.00	269.00	262.00	163.00	Greece: 20	Estonia: 7,919
F12	Packaging waste per type of waste and waste flow	2015	↑	32.50	7	/	26	40.30	48.80	42.60	25.50	Finland: 23.7	Slovenia: 63.4
F13	Organic crop area by agricultural production methods and crops (%)	2016	↑	3.27	22	/	28	6.69	6.82	5.80	5.29	Austria: 21.25	Malta: 0.21
F14	Number of ISO 14001 and EMAS certifications per 100,000 inhabitants	2016	↓	15.10	20	/	28	21.85	11.49	10.32	10.03	Malta: 143.2	Cyprus: 8.02

Continuing on next page

Table 26
Continued

F15	Number of ISO 9001 certifications per 100,000 inhabitants	2016	↓	36.27	24	/	28	82.11	80.60	32.13	35.07	Malta: 413.84	Poland: 32.01
F16	Gross fresh water abstractions per capita (cubic metres per inhabitant)	2015	↑	45.83	3	/	13	107.71				Romania: 29.69	Greece: 516.78
F17	Built-up areas (en %)	2015	→	2.60	25	/	28	1.30	2.50	5.50	1.50	Finland: 0.3	Malta: 15.6
F18	Houses in "Wohnvorranggemeinden"					/							

4 Luxembourg in the European semester

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This chapter is monitoring Luxembourg's indicators and targets within the framework of the European Union strategy for growth and jobs (Europe 2020 strategy) and the macroeconomic imbalance procedure¹. These two pillars of the European economic governance were implemented by the REGULATION (EU) No. 1175/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 November 2011 amending Council Regulation (EC) No. 1466/97 on the strengthening of the surveillance of budgetary positions and the surveillance and coordination of economic policies².

This chapter focuses mainly on Luxembourg performances and national targets. Consequently, it doesn't aim to assess indicators and objectives at EU level.

4.1 Thematic coordination of structural policies

4.1.1 Implementation of thematic coordination under the Europe 2020 strategy

The Europe 2020 strategy³, which is a central element of the EU's response to the global economic crisis, has been designed to update and replace the Lisbon strategy⁴ that was launched in March 2000 and renewed in 2005 as a European strategy for growth and jobs. This new strategy involves closer coordination of economic policies and focuses on the key areas where action must be taken to boost the potential of sustainable and inclusive growth and competitiveness in Europe. It was considered that the end of the crisis should be the entry point into a social market economy, a greener and smarter economy, in which prosperity will be the result of the capacity to innovate and of a better use of resources, and where knowledge will be a key element. In early 2010, the Commission made proposals to implement this new Europe 2020 strategy⁵. In March 2010, on the basis of a communication from the Commission, the European Council discussed and approved the strategy's main elements, including key objectives which will guide its implementation, as well as provisions to improve monitoring. The European Council agreed on a series of elements⁶. The June European Council⁷ finally completed the development of the new Europe 2020 strategy.

¹ However, the analysis of the situation of Luxembourg in the coordination of budgetary policies (SGP) is not the subject of this section. With regards to the economic policy measures implemented by Luxembourg to achieve the objectives of the Europe 2020 strategy, reference is made to the NRP submitted in April 2018 by the government to the European Commission within the framework of the European Semester.

² For additional details: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:306:0012:0024:FR:PDF>

³ For additional details: https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_fr

⁴ For additional details: http://ec.europa.eu/archives/growthandjobs_2009/

⁵ EUROPEAN COMMISSION, EUROPE 2020 - Une stratégie pour une croissance intelligente, durable et inclusive, COM(2010) 2020, Brussels, 3.3.2010

⁶ EUROPEAN COUNCIL, Conclusions, Brussels, March 2010
For additional information: http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/fr/ec/113602.pdf

⁷ EUROPEAN COUNCIL, Conclusions, Brussels, June 2010
For additional information: http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/fr/ec/115348.pdf

The European Council confirmed in particular five major EU objectives, which are shared objectives guiding the action of Member States and of the EU in terms of promoting employment, improving the conditions for innovation and R&D, achieving the objectives in the field of climate change and energy, improving education levels and promoting social inclusion, in particular by reducing poverty:

- ▼ *Aiming to raise to 75% the employment rate for women and men aged 20-64, including through the greater participation of young people, older workers and low-skilled workers and the better integration of legal migrants;*
- ▼ *Improving the conditions for research and development, in particular with the aim of raising combined public and private investment levels in this sector to 3% of GDP; the Commission will elaborate an indicator reflecting R&D and innovation intensity;*
- ▼ *Reducing greenhouse gas emissions by 20% compared to 1990 levels; increasing the share of renewables in final energy consumption to 20%; and moving towards a 20% increase in energy efficiency; the EU is committed to taking a decision to move to a 30% reduction by 2020 compared to 1990 levels as its conditional offer with a view to a global and comprehensive agreement for the period beyond 2012, provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities;*
- ▼ *Improving education levels, in particular by aiming to reduce school dropout rates to less than 10% and by increasing the share of 30-34 years old having completed tertiary or equivalent education to at least 40%;*
- ▼ *Promoting social inclusion, in particular through the reduction of poverty, by aiming to lift at least 20 million people out of the risk of poverty and exclusion. The population is defined as the number of persons who are at risk-of-poverty and exclusion according to three indicators (at-risk-of poverty; material deprivation; jobless household), leaving Member States free to set their national targets on the basis of the most appropriate indicators.*

In 2014-2015, the European Commission performed a mid-term review⁸ of the Europe 2020 strategy. The review included a public consultation which concluded that the strategy was still an appropriate framework for the promotion of growth and employment. The European Commission therefore decided to continue pushing the strategy forward while ensuring its monitoring within the European semester.

⁸ For additional details:
<http://ec.europa.eu/transparency/regdoc/rep/1/2014/EN/1-2014-130-EN-F2-1.Pdf>

4.1.2 Priorities, objectives and indicators

Obviously the governance of the Europe 2020 strategy, including main objectives and monitoring indicators, will not alone create growth, jobs and prosperity. It should nevertheless ensure that major emphasis on quantitative targets and indicators. Implementing policies without measurable goals and without monitoring indicators is not the way forward because the assessment would then be totally subjective. Despite the many limitations of the indicators (data availability, comparability, etc.) such a tool for decision support is the best way to measure the performance of policies. Past experience has shown that for a successful monitoring the system must meet certain initial conditions. It is not enough to base the monitoring mechanism only on territory rankings resulting from a list of indicators selected during painstaking negotiations and based on compromise (and which is therefore likely to please everyone); to discuss objectives and indicators only amongst experts, without ensuring an adequate involvement of the general public; to be restricted to ex-ante indicators (input) measuring the resources invested, without resorting to indicators measuring ex post performance and the efficiency of the resources involved (output).

The 'thematic coordination of structural policies' component of the Europe 2020 strategy is based on three priorities, five objectives and ten indicators:

- ▼ Three mutually reinforcing priorities - smart growth, sustainable growth and inclusive growth;
- ▼ Five major European objectives to reach by 2020 - to improve the conditions for R&D, to improve education levels, to reach the climate change and energy objectives, to promote employment and to reduce poverty;
- ▼ Ten indicators to measure the progress in achieving the objectives⁹ - gross domestic expenditure on R&D, early school leaving rate, proportion of higher education graduates or with an equivalent level of education, greenhouse gas emissions, share of renewable energy sources in final energy consumption, energy efficiency, employment rate for women and men aged 20-64, risk of poverty, material deprivation and jobless households.

⁹ For additional details:
http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_background

Chart 1
Priorities, objectives and indicators of the 'thematic coordination' in Europe 2020

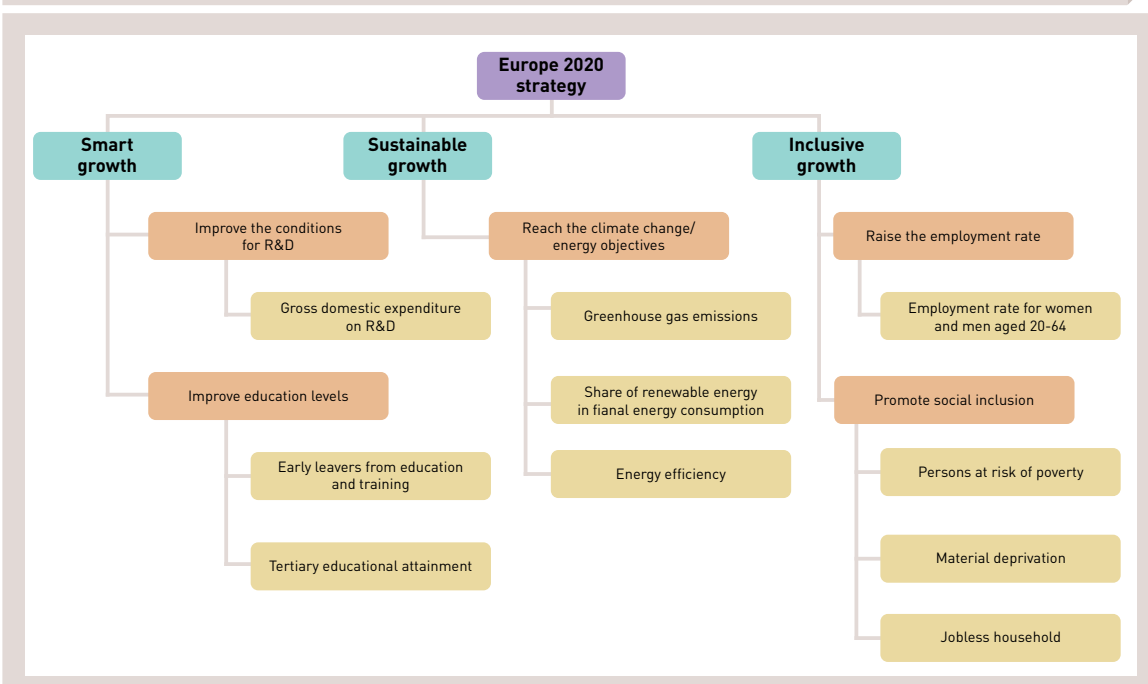
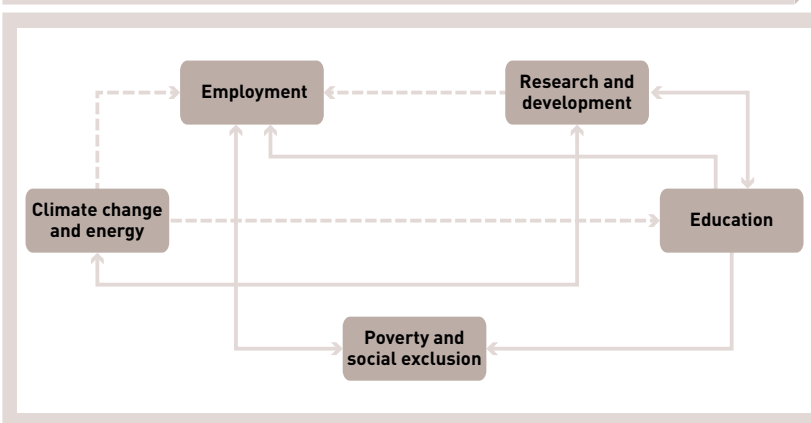


Chart 2
Links between the 5 objectives of the Europe 2020 strategy



Source: Eurostat

These priorities and objectives are closely linked. For example, higher education levels improve employability and help increase the employment rate, which helps reduce poverty, and a greater R&D and innovation capacity combined with increased resource efficiency improves competitiveness and promotes job creation; investing in cleaner and low carbon technologies improves the environment, contributes to fight against climate change and creates new innovative and sustainable business and job opportunities.

Given the diversity of EU Member States and their varying levels of development, applying the same objectives and criteria to all Member States as it had been originally done in the context of the Lisbon Agenda, has not proven to be the right approach. The major European objectives therefore no longer apply uniformly to all Member States in the context of Europe 2020. They are European objectives to be broken down into national targets, according to the initial conditions and specificities of each Member State, in dialogue with the European Commission.

Table 1
National objectives set by Luxembourg, 2018 NRP

		European objective 2020	Luxembourg national objective 2020
Priority 1 'smart growth'	Objective 1	'[...] raising combined public and private investment levels to 3%	2.3-2.6%
	Objective 2	'[...] reduce the early school leaving rate to less than 10%'	sustainably less than 10% ^a
		'[...] increasing the share of people aged 30-34 who graduated from higher education or reached an equivalent level to at least 40%'	66% ^b
Priority 2 'sustainable growth'	Objective 3	'[...] reducing greenhouse gas emissions by 20% (...)'	reducing non-ETS greenhouse gas emissions by -20% compared to 2005 (emissions of approximately 8.117 Mt CO ₂ in 2020) ^c
		'[...] increasing the share of renewable energy sources in final energy consumption to 20%'	11% ^c (2015/2016 average 5.45%)
		'[...] moving towards a 20% increase in energy efficiency'	Final energy consumption 49,292 GWh, being 4,239.2 ktoe
Priority 3 'inclusive growth'	Objective 4	'[...] raise to 75% the employment rate for women and men aged 20-64'	73%
	Objective 5	'[...] lift at least 20 million people out of the risk of poverty and exclusion.'	reduce the number of people at risk of poverty or social exclusion by 6,000 people by 2020 ^d

Sources: European Council, Eurostat

^a National data will also be used as a measuring instrument, since the indicator calculated by Eurostat, from the Labour force survey, is not fully representative for Luxembourg. Attention should be paid to producing statistics that better distinguish people who attended schools in Luxembourg, in order to measure the quality of the national education system (national resident population) and assess the ability of the Luxembourg school system to train young people.

^b Luxembourg would like this indicator to provide information on the ability of the national education system to make young people able to successfully complete tertiary education, rather than it being a reflection of the skills needed within the higher education labour market. In Luxembourg there is a strong disparity by country of birth (according to Eurostat, the foreigner resident rate is close to 60% and the national resident rate is somewhat above 40%), while in neighbouring countries, the differences between these two populations are much less pronounced and the proportion of graduates in these countries is higher among indigenous people than among non-indigenous people.

^c For greenhouse gas emissions and renewable energy binding national targets already existed before the launch of the Europe 2020 strategy. For the 2013-2020 post-Kyoto period only non-ETS sectors are subject to targets set at Member State level. The 2020 non-ETS emissions reduction objective is compared to the level of 2005.

^d As regards the methodology, the indicator used in the Europe 2020 strategy does not sufficiently take into account national demographics. Luxembourg has very dynamic demographics, even in times of crisis, and thus the relative nature of the indicator used, i.e. a % of the population, inevitably leads to an increase in the absolute number of people concerned. The government also supports this objective by means of measures aiming to increase the employment rate for women and single parents, in order to reach an employment rate of 73%.

European objectives can only be achieved if, on the one hand the sum of national targets leads to the fulfilment of European objectives and on the other hand, the first condition being fulfilled, if each Member State meets its national commitments for 2020. This type of governance therefore includes a de facto system of 'peer pressure', which should ensure that countries that do not adequately implement their national commitments are called to order by their peers as they may cause the failure of major European objectives, and therefore also the efforts of those countries that have fulfilled their commitments.

Eurostat publishes periodically monitoring indicators for each Member State in order to be able to annually take stock of the state and determine if performances are going in the right direction.

The following pages will analyse the updated indicators for Luxembourg and a descriptive overview¹⁰ will be presented based on last available data (downloaded early July 2018). Reference is made to the 2018 NRP for Luxembourg for more details on the measures implemented, in order to explain the evolution of the indicators¹¹.

A. Smart growth

a.1 Improving conditions for innovation and R&D

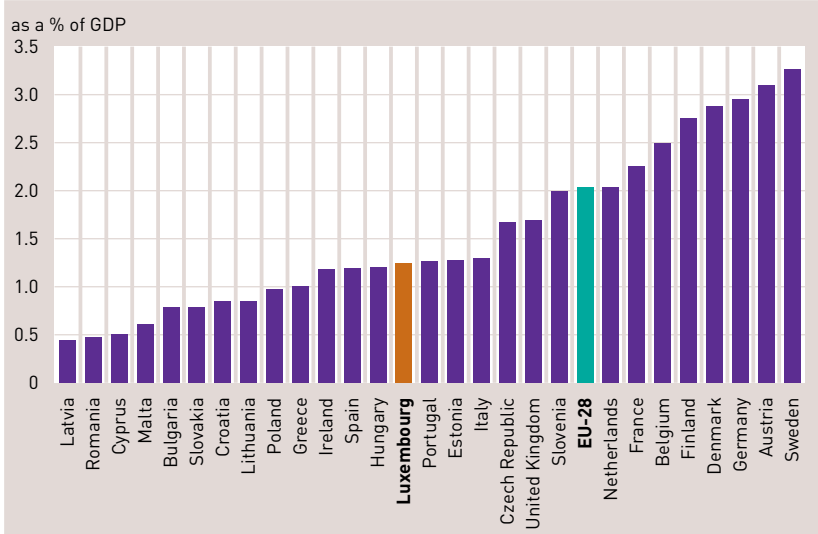
Investment in R&D, along with human capital, is essential for the development of knowledge and new technologies. The Barcelona European Council set the spending target of 3% of GDP on R&D in March 2002. This was one of the two key objectives of the former Lisbon strategy. The logic underlying the setting of this objective was that knowledge-based economies allocated a significant portion of their resources to R&D when the Lisbon strategy was launched (e.g. in 2000 2.7% in the United States and 3% in Japan). For the Europe 2020 strategy, it was proposed that this 3% European objective be maintained as a symbol, to focus political attention on the importance of R&D. The evolution of this indicator will largely depend on structural factors and public policies promoting R&D.

The average R&D expenditure rate for EU countries in 2016 was 2%. With a rate of 1.24% in 2016, Luxembourg therefore falls short of the EU average for R&D expenditure.

¹⁰ On its website Eurostat provides comments regarding the quality of the statistics for the different Member States (series breaks, projections, uncertain data, etc.), which will not be repeated here.

¹¹ For additional details: <https://odc.gouvernement.lu/dam-assets/publications/rapport-etude-analyse/programme-national-de-reforme/2018-pnr-luxembourg-2020/18-04-27-pnr-2018-rapport-lux-2020-2018-0427.pdf>

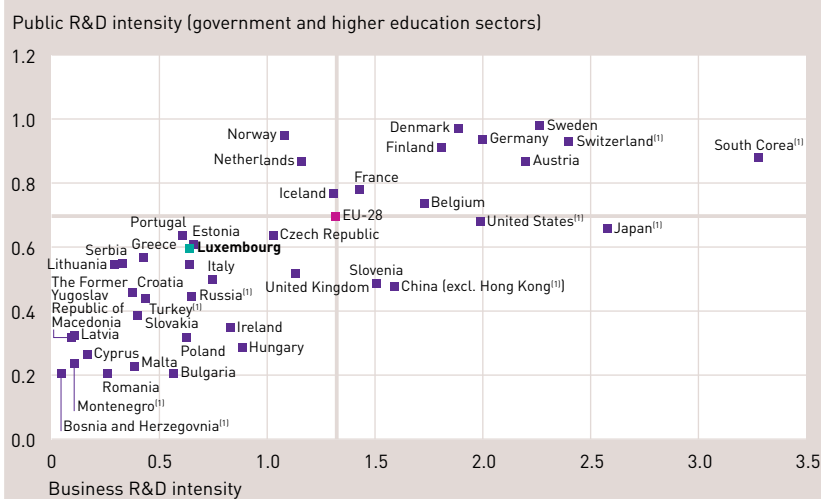
Chart 3
Gross domestic expenditure on R&D, as a % of GDP, 2016



Source: Eurostat

Luxembourg is one of a group of Member States whose private company level expenditure on R&D is much lower than the EU-28 average, although its public R&D expenditure is close to the EU-28 average.

Chart 4
Gross domestic expenditure on R&D, private and public, as a % of GDP, 2016

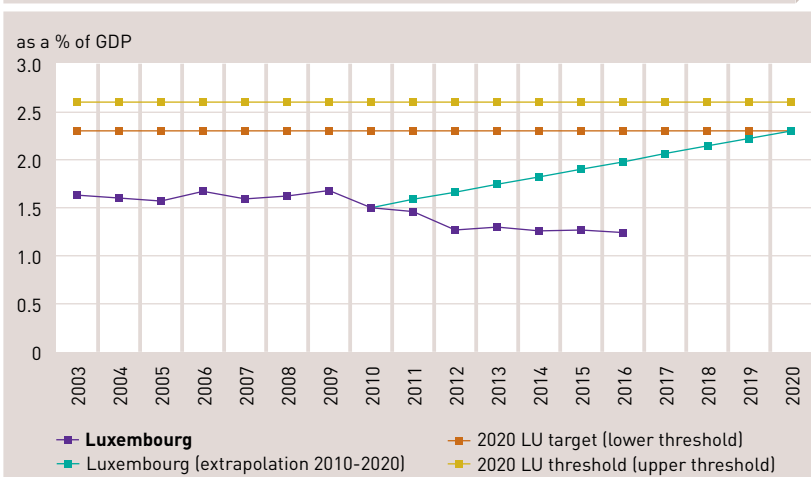


Source: Eurostat

As part of its NRP, Luxembourg set a national target to be achieved in 2020 of spending 2.3-2.6% of GDP by 2020, with 1.5-1.9% being contributed by the private sector and 0.7-0.8% by the public sector. In 2016 Luxembourg is still far from achieving its national target for 2020, as well as being significantly below the upward trend which needs to materialize if it is to achieve this national 2020 target. Public spending on R&D and innovation in Luxembourg has risen year on year since 2000, whereas private R&D expenditure¹², in EUR millions fell between 2007 and 2012, only to begin slowly climbing again from 2013 onwards. The share of overall R&D expenditure spent on public research in Luxembourg has therefore increased from 7.5% in 2000 to almost 49% at present (of which public research represents 30% and higher education 19%). R&D activities carried out by companies in the private sector therefore currently still account for just over 50% of total expenditure¹³. However, as the European Commission recorded in its 2018 country report for Luxembourg as part of the European Semester, the relatively low level of R&D expenditure on the part of companies could be partially due to the weight of the financial sector (25% of GDP) and the low level of investment required for this sector's activities.

Chart 5

Gross domestic expenditure on R&D, as a % of GDP¹⁴



Source: Eurostat, 2018 NRP

Note: The green line connecting the years 2010-2020 is an example to illustrate the linear trend Luxembourg's performance should display after 2010 in order to achieve national target set for 2020. In this specific case of gross expenditure on R&D, the lower threshold limit is the national target set for 2020, i.e. 2.3%.

¹² The R&D expenditure (in millions of euros) of companies with commercial economic activity employing at least 10 people.

¹³ For additional details: http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_R%26D_and_innovation

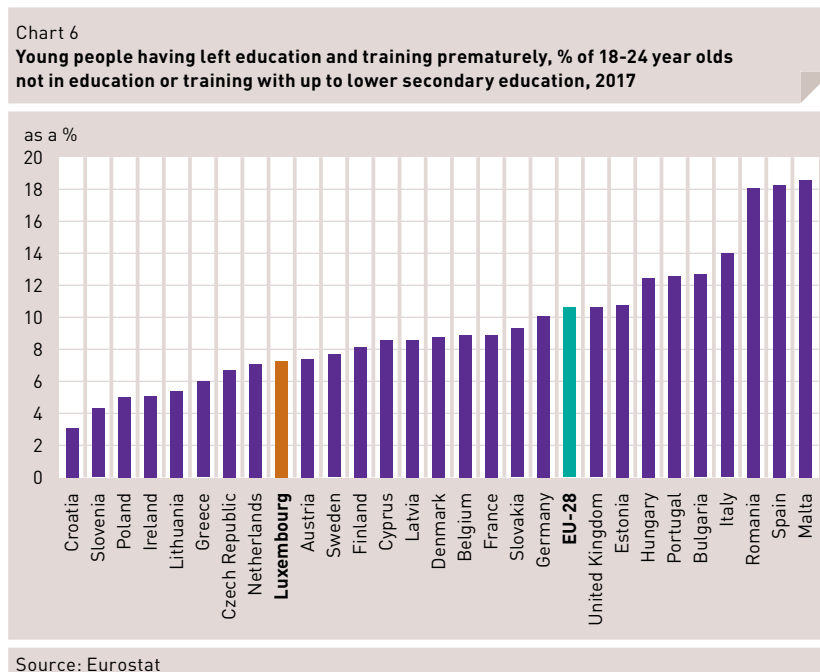
¹⁴ Definition: R&D comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications (Frascati Manual, 2002 edition, § 63). R&D is an activity where there are significant transfers of resources between units, organizations and sectors and it is important to trace the flow of R&D funds.

a.2 Improving education levels

Investments in human resources alongside those in R&D are essential to ensure the development of knowledge and new technologies. The objective of the Europe 2020 strategy is smart and inclusive growth, two objectives are fixed for education and training. The trajectory of these two indicators is determined by demographic and social changes as well as political and institutional reforms, and should not therefore be influenced by cyclic fluctuations.

a.2.1 Early school leavers

The EU-28 average for early school leavers^{15,16} is 10.6% in 2017. Luxembourg's average score is 7.3% at national level, and this rate is at 9.8% for men and 4.6% for women.



Young people having dropped out of education and training prematurely may face great difficulty on the labour market. In the following chart, the Member States are classified according to the percentage of young people (18-24 year olds) having left school or training early. Moreover, a distinction is made between those who are in employment or not, and if not, whether they wish to work or not¹⁷.

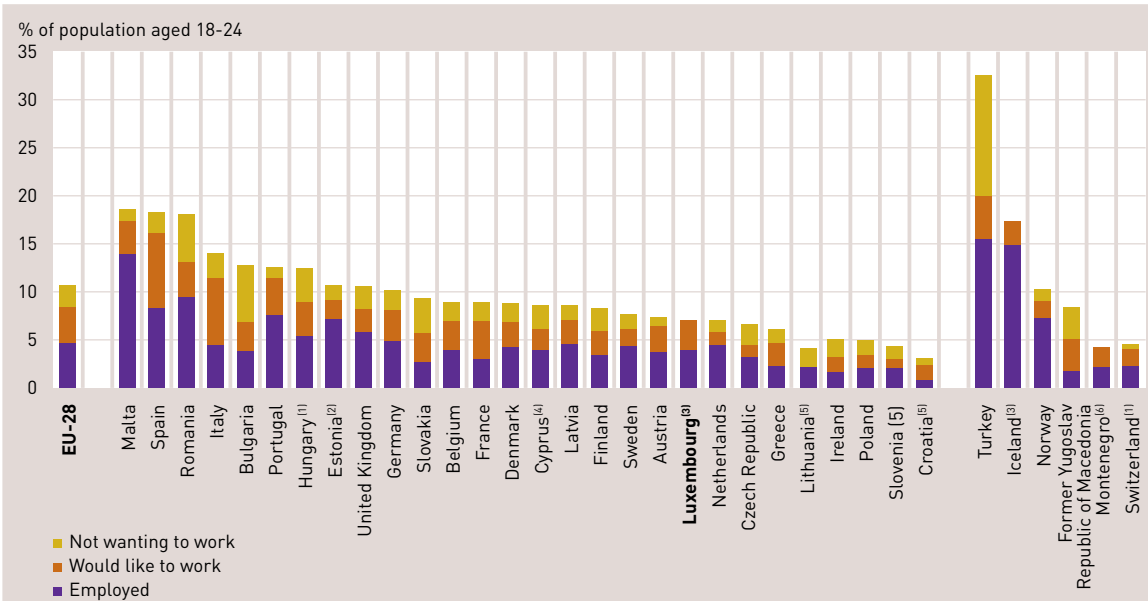
¹⁵ Definition: From 20 November 2009, this indicator is based on annual averages of quarterly data instead of one unique reference quarter in spring. Early school leavers refers to persons aged 18 to 24 fulfilling the following two conditions: first, the highest level of education or training attained is ISCED 0, 1, 2 or 3c short, second, respondents declared not having received any education or training in the four weeks preceding the survey (numerator). The denominator consists of the total population of the same age group, excluding no answers to the questions 'highest level of education or training attained' and 'participation to education and training'. Both the numerators and the denominators come from the EU Labour Force Survey.

¹⁶ For additional details: http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_education

¹⁷ For additional details: http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Early_leavers_from_education_and_training#Analysis_by_labour_status

Chart 7

Distribution of young people having left education or training systems early, in accordance with their employment status, 2017



Note: ranked on overall share of early leavers

⁽¹⁾ Not wanting to work: low reliability⁽²⁾ Not wanting to work and would like to work: low reliability⁽³⁾ Not wanting to work: not available due to a very low reliability⁽⁴⁾ Would like to work: low reliability⁽⁵⁾ Low reliability⁽⁶⁾ Would like to work and employed: low reliability. Not wanting to work: not available due to a very low reliability

Source: Eurostat

The EU has set an objective for an early school leaving rate of under 10% by 2020. Luxembourg has rallied behind this European objective and has set a national target to keep the early school leaving rate under the 10% mark in the long-term.

The underlying statistics of this indicator calculated by Eurostat result from the Labour Force Survey (LFS)¹⁸ and are prone to yearly variations for Luxembourg, due to the limited size of the survey sample for small country such as Luxembourg. The Ministry of National Education in Luxembourg has therefore set up its own national survey on early school leaving¹⁹, and levels of early school leaving calculated are different from LFS ones. The approach of the present analysis acts as a complement to that of the LFS, because it focuses on students having prematurely left the Luxembourgish school system during a specific reference period. The LFS, however, bases its entire assessment on the population residing in Luxembourg, which includes a high percentage of residents who did not attend school in the Luxembourgish school system.

¹⁸ For additional details: http://ec.europa.eu/eurostat/statistics-explained/index.php/Early_leavers_from_education_and_training

¹⁹ For additional details: <http://www.men.public.lu/fr/actualites/publications/secon-daire/statistiques-analyses/decrochage-scolaire/index.html>

Table 2
Statistics on early school-leaving rate according to the national study
on early school leaving (national figures)

Study	Early school-leaving rate
1	2003-2004 17.20%
2	2005-2006 14.90%
3	2006-2007 9.40%
4	2007-2008 11.20%
5	2008-2009 9.00%
6	2009-2010 9.00%
7	2010-2011 9.00%
8	2011-2012 9.20%
9	2012-2013 11.60%
10	2013-2014 13.00%
11	2014-2015 13.50%

Source: Ministry of National Education, Childhood and Youth (MENEJ)

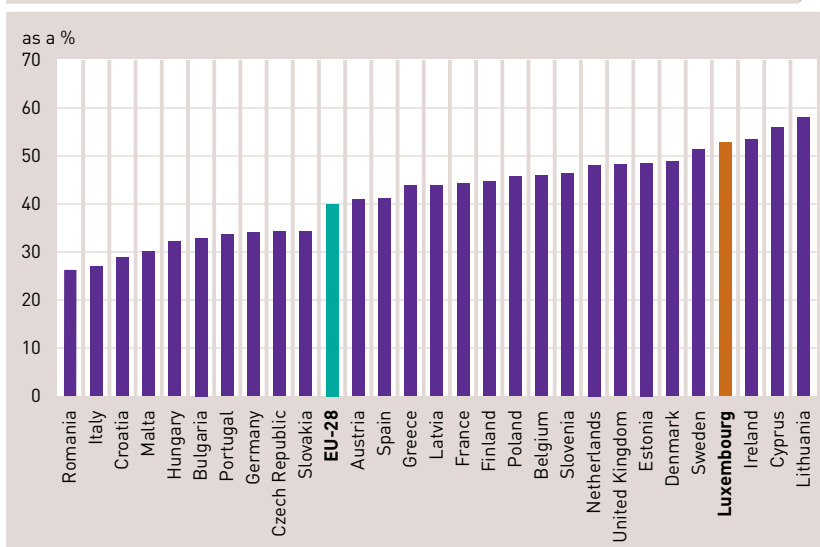
Definition: The notion of 'early school leavers' refers to young people who permanently left school without a diploma and who joined the labour market, benefiting from a professional integration measure or not having a specific occupation. It also includes young people who, after an initial leaving, have re-registered in a school, and then left again during the same period of observation, and for whose any additional information on their current situation is not available.

According to Eurostat, Luxembourg is therefore under its national target of 10%. However, according to national statistics, Luxembourg exceeds again this symbolic threshold since 2012/2013 school year.

a.2.2 Share of higher education graduates

In 2017, the percentage of the population aged 30-34 with a higher education qualification was 39.9% for the EU-28. With a rate close to 53% in 2017, Luxembourg is one of the best-performing Member States in this regard²⁰.

Chart 8
Level of higher education graduates in the age group 30-34 (%), 2017



Source: Eurostat

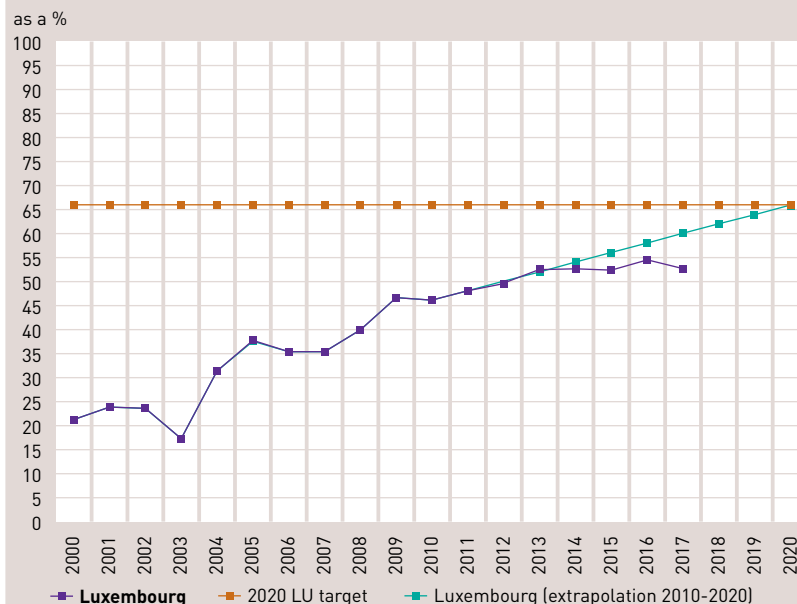
²⁰ For additional details:
http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_education

The overall EU objective is to achieve a rate of 40% of people aged 30-34 graduated in higher education by 2020. Luxembourg set a much higher objective in its NRP (66%). Luxembourg has experienced a significant increase in this indicator, which rose from 21.2% in 2000 to close to 53% in 2017. As an example, in 2017, the rate of individuals having obtained a higher-education diploma was 47.6% for men and 55.5% for women. Luxembourg thus already exceeds by now the European objective and shows a positive mid- and long-term trend.

As the indicator for early school leaving, this indicator results from the Labour Force Survey (LFS). It is not fully representative for Luxembourg. On the one hand it includes foreign graduates living and working in Luxembourg (around 45% of residents in Luxembourg do not have Luxembourg nationality). On the other hand this indicator can neither capture nationals from Luxembourg who graduated and work abroad, nor the numerous cross-border workers coming to Luxembourg (around 45% of the total workforce in Luxembourg).

Chart 9

Level of higher education graduates in the age group 30-34 (%)²¹



Source: Eurostat, 2018 NRP

Note: The green line connecting the years 2010-2020 is an example to illustrate the linear trend Luxembourg's performance should display after 2010 in order to achieve national target set for 2020.

²¹ Definition: The share of the population aged 30-34 years who have successfully completed university or university-like (tertiary-level) education with an education level ISCED 1997 (International Standard Classification of Education) of 5-6.

B. Sustainable growth

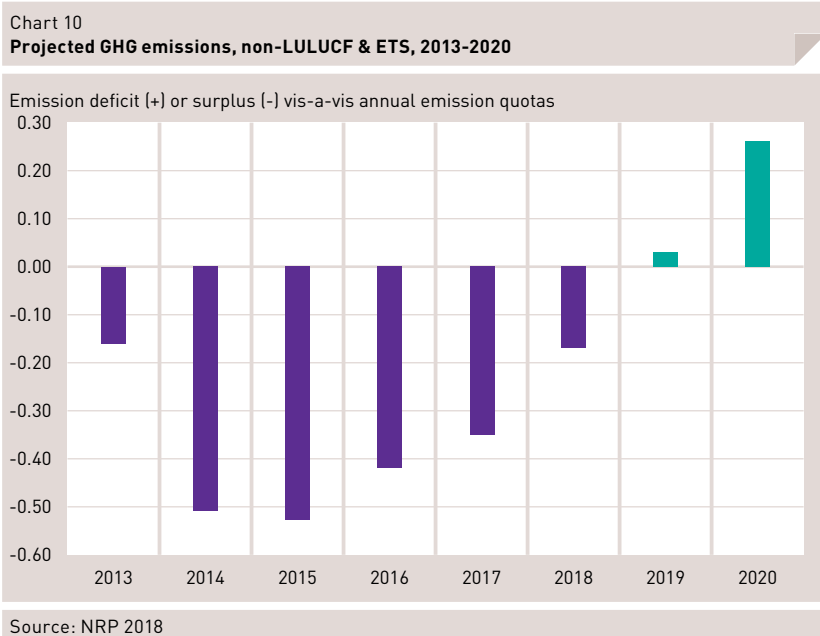
b.1 Reaching the climate change and energy objectives

In order to reach the climate change and energy objectives, the objectives set at the European Council in March 2007 were kept within the framework of the Europe 2020 strategy. The greenhouse gas emissions reduction targets and the share of renewable energy in the total energy consumption are legally binding^{22,23}.

b.1.1 Greenhouse gas emissions

In the 2013-2020 post-Kyoto period, only the non-ETS sectors have objectives which are set at Member State level. In Luxembourg, the 2020 target for non-ETS emissions is a 20% reduction on the 2005 reference level. This target is to be achieved following a linear path with the 2013 starting point consisting of the average rate of emissions between 2008 and 2010. The effects of the economic crisis have certainly not been favourable to Luxembourg as there has been a reduction in the emissions budget post-2013. The annual budget is based on annual emission allocations. In 2020, non-ETS emissions will be limited to 8,117 Mt CO₂.

According to the forecast sent by Luxembourg to the European Commission, featured in the 2018 NRP, the government predicts in its primary scenario that, for the 2013-2020 period, Luxembourg could generate an emission surplus of around 1.85 Mt CO₂e in the central scenario by using existing measures (total over the period). Over this eight-year period, stocktaking and forecasts show that Luxembourg will begin to have an emission deficit vis-à-vis its annual emission quota in 2019. However, these calculations are heavily dependent on the expected developments in one particular sector, namely road transport, which alone represents almost two thirds of total non-ETS emissions.

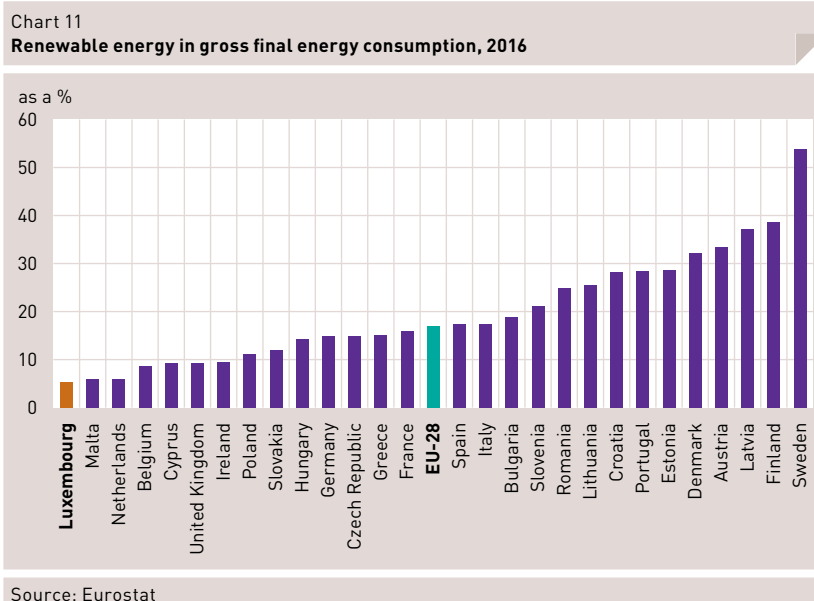


²² See EU Directive 2006/32/CE. The reduction in energy consumption is a policy objective endorsed by the Member States in their Energy efficiency action plan.

²³ For additional details: http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_climate_change_and_energy

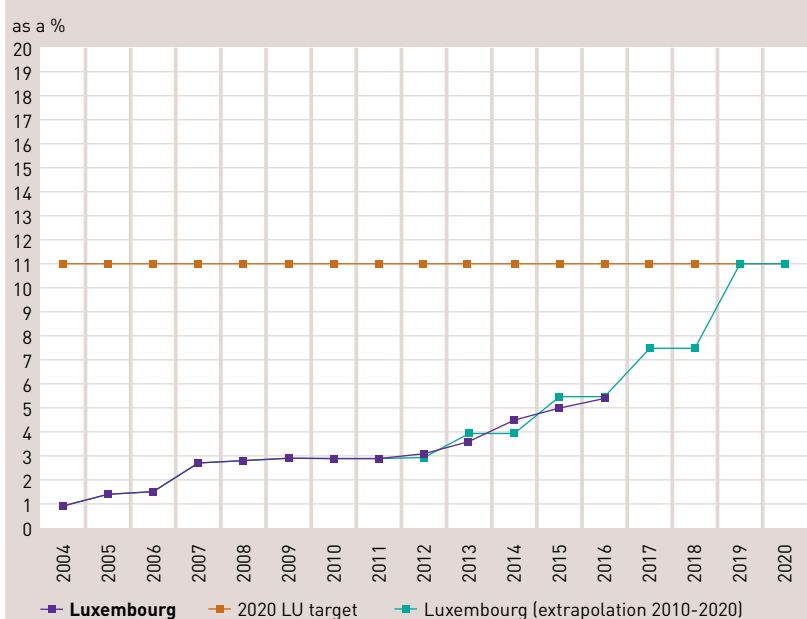
b.1.2 Share of renewable energy in energy consumption

In 2016, the share of renewable energies in gross final energy consumption accounted for an average of 17% among the EU-28. Luxembourg's rate was 5.4%, placing it at the bottom of the EU rankings.



As an objective, the EU has set the share of renewable energy to 20% by 2020. In this context, Luxembourg has set an overall target of 11% share of renewable energy in final energy consumption, with a series of interim targets. Luxembourg is in this interim development but will have to make significant efforts in the coming years to achieve its 2020 national target, since the country is at this stage only halfway (49%) towards its national target.

Chart 12
Share of renewable energy in gross final energy consumption²⁴



Source: Eurostat, 2018 NRP

Note: The green line is the interim development set by the government after 2010 in order to achieve the national target set for 2020.

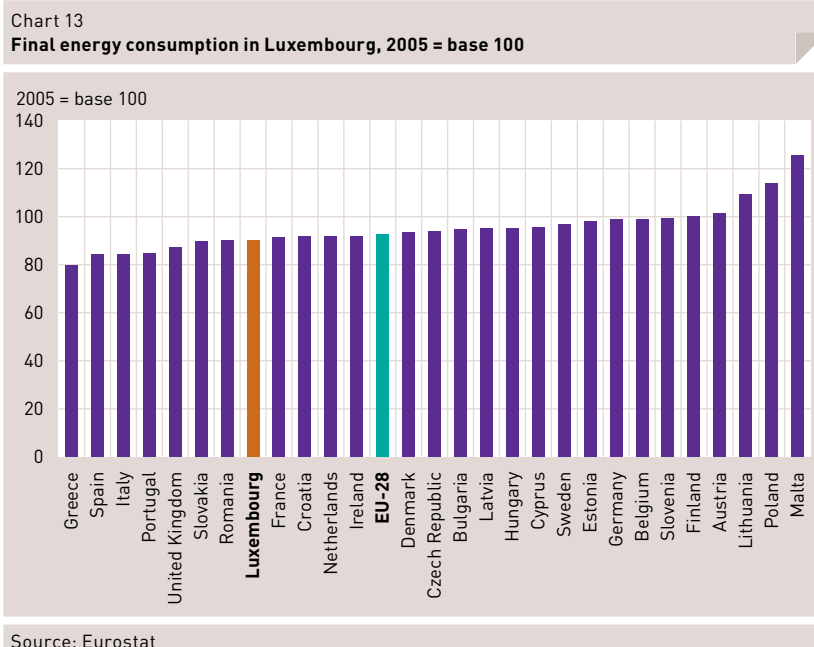
b.1.3 Energy efficiency

The Energy Efficiency Directive has set an energy efficiency objective for the whole of Europe by 2020. The EU has set an objective of a 20% increase in energy efficiency by that date. Although it applies to the EU as a whole, the Europe 2020 indicator does not provide practical information about national energy efficiency rates in the Member States. In fact, the Europe 2020 indicator only takes into account the energy savings of the EU in comparison to a scenario whereby policies remained unchanged, and based on economic predictions dating from 2007. Member States were obliged to set indicative national targets for primary and/or final energy consumption levels. In order to draw comparisons on the basis of this information regarding energy consumption, Eurostat subsequently calculates the primary and final energy consumption in million tonnes oil equivalent²⁵ in order to assess the progress made in energy efficiency at national level. It is worth noting that the economic and financial crisis which began in 2008, and the resulting downturn in economic activity, had a significant impact on energy consumption during the period of time taken into consideration. Therefore, the reduction in the volume of energy recorded in recent years, both in the EU as a whole and in the Member States, may not necessarily only signal an increase in energy efficiency, but may also be the result of declining activity.

²⁴ Definition: This indicator is calculated on the basis of energy statistics covered by the Energy Statistics Regulation. It may be considered an estimate of the indicator described in Directive 2009/28/EC, as the statistical system for some renewable energy technologies is not yet fully developed to meet the requirements of this Directive. However, the contribution of these technologies is rather marginal for the time being. More information about the renewable energy shares calculation methodology and Eurostat's annual energy statistics can be found in the Renewable Energy Directive 2009/28/EC, the Energy Statistics Regulation 1099/2008 and in DG ENERGY transparency platform.

²⁵ Definition: The term 'primary energy consumption' means gross inland consumption with the exception of any non-energy use of energy products (e.g. natural gas used not for combustion but for the production of chemicals). This quantity is relevant to measure the actual energy consumption. 'Percentage of savings' is calculated using 2005 values and their forecasts for 2020. The Europe 2020 target will be achieved when this value reaches the level of 20%.

Taking all factors into account, final energy consumption fell more between 2005 and 2016 in Luxembourg (indicator of 90.3, 2005 = base 100) than in the EU as a whole (92.9). As a result, final energy consumption was about 9.7% lower in 2016 in Luxembourg than in 2005.



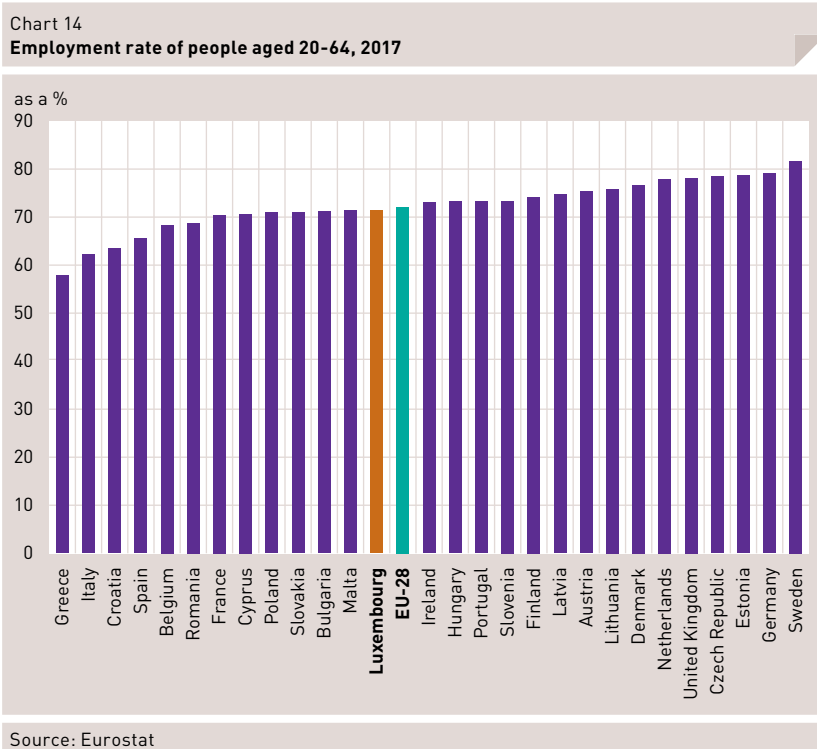
Luxembourg set a national target for 2020 with the aim being for annual consumption to be less than 49,292 GWh (4,239.2 ktoe). In addition to the energy efficiency target, Luxembourg also set itself the goal of saving 5,993 GWh by the end of 2020. Luxembourg intends to achieve all of its energy saving targets via a system of energy efficiency obligations, which were established in 2015. Even though the energy saving target is not linked to the energy efficiency target given that the latter is completely independent of the variation in final annual energy consumption, the energy efficiency obligations are one of the primary instruments in the bid to meet the energy efficiency target.

C. Inclusive growth

c.1 Promoting employment

The Lisbon strategy (2000-2010) included a target related to employment policies, namely the employment rate. The new Europe 2020 target shows two major changes compared to the former Lisbon objective: firstly, the age range considered (20-64 for 2020 instead of 15-64 for 2010) in order to reduce potential conflicts between employment policies and education policies, and secondly the reference value to be achieved (75% by 2020 instead of 70% by 2010). Developments in the employment rate depend on many uncertainties, which must be considered when setting quantified targets for the Europe 2020 strategy. Indeed, the employment rate indicator is a very cyclical indicator. For example, the actual exit date of the 2008/2009 crisis plays a key role in the development of this indicator.

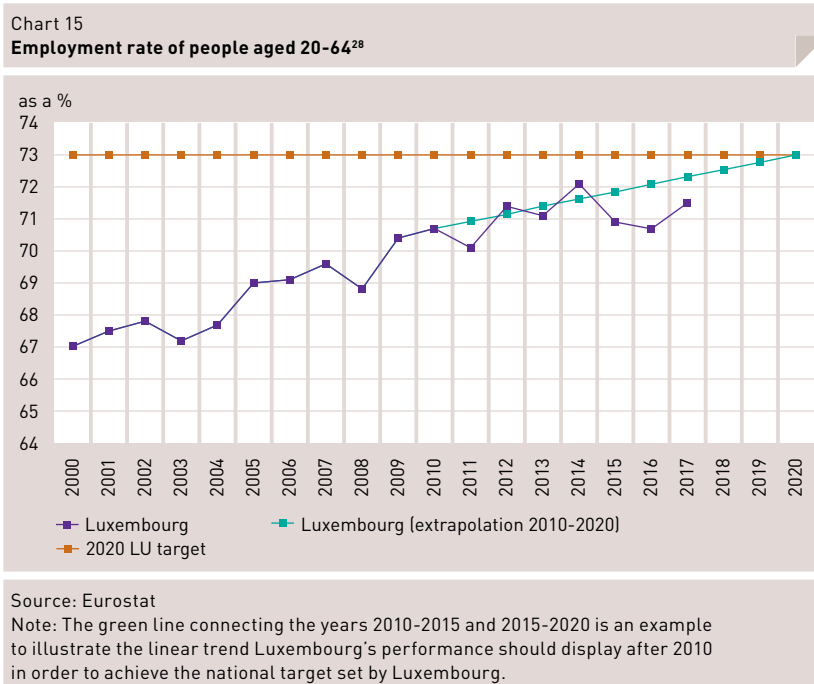
The EU-28 employment rate was 72.2% in 2017. With an employment rate of 71.5%, Luxembourg ranks slightly below the EU average²⁶.



The employment rate, which is an average of the resident workforce, does however hide considerable differences in the employment rate per socio-economic category observed. Proceeding to a narrower segmentation of the employment rate, for example according to gender or age of the worker, reveals important fluctuations in the employment rate. For example, in 2017, the male employment rate is 75.4% in Luxembourg whilst the female employment rate is 67.5%. The employment rate for 55-59 year olds is close to 56% whilst the employment rate for 60-64 year olds is close to 20%.

²⁶ For additional details:
http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_employment

Luxembourg set as a national target a 73% employment rate by 2020. The employment rate in the country has increased from 67% (2000) to 71.5% (2017), especially through an increase in the female and senior employment rates. This employment rate is calculated on the basis of data from the LFS (Labour Force Survey), and therefore reveals an upwards trend for the past few years in Luxembourg. However, this trend must be interpreted with care. STATEC has performed technical analyses²⁷ on this indicator in Luxembourg, including the impact of improved methods applied for the LFS over the past few years.



Finally, although a higher employment rate generally allows increasing the supply of domestic labour, boosting growth and relieving social spending and public spending, these statements must be put in perspective in the case of Luxembourg. Labour supply in Luxembourg consists of three components: the indigenous, cross-border and the immigrant offers. However cross-border workers are not considered in the definition of the employment rate. This is a purely national concept, related to the place of residence of the worker. Yet cross-border workers in Luxembourg make up more than 45% of domestic employment. As noted by the Economic and Social Council (ESC)²⁹, this indicator *'is not representative of macroeconomic reality in Luxembourg and is even less suitable for a macroeconomic employment target, on which employment policy should be defined'*. In contrast, the employment rate for young people, women and older workers is useful for understanding the use of human resources in the economy.

²⁷ <https://statistiques.public.lu/catalogue-publications/cahiers-economiques/2018/PDF-Analyses-01-2018.pdf>

²⁸ Definition: The employment rate is calculated by dividing the number of persons aged 20 to 64 in employment by the total population of the same age group. The indicator is based on the EU Labour Force Survey. The survey covers the entire population living in private households and excludes those in collective households such as boarding houses, halls of residence and hospitals. Employed population consists of those persons who during the reference week did any work for pay or profit for at least one hour, or were not working but had jobs from which they were temporarily absent.

²⁹ ESC, Deuxième avis sur les Grandes Orientations des Politiques Économiques des États membres et de la Communauté (GOPE), Luxembourg, 2003. For more information: <http://www.ces.public.lu/fr/avis/index.html>

c.2 Reducing poverty

The European objective that was initially proposed by the European Commission for social inclusion focused on reducing poverty by 20 million people at risk of poverty. However, in order to meet the Europe 2020 strategy objective of promoting inclusive growth, the European Council in March 2010 had asked the Commission to work further on social inclusion indicators, including also non-monetary indicators. In June 2010 the European Council decided to ensure that 20 million people at least no longer be faced with the risk of poverty and exclusion, and defined this population as the number of people at risk of poverty and exclusion according to three indicators, Member States being free to set their national targets on the basis of indicators they consider most appropriate among these:

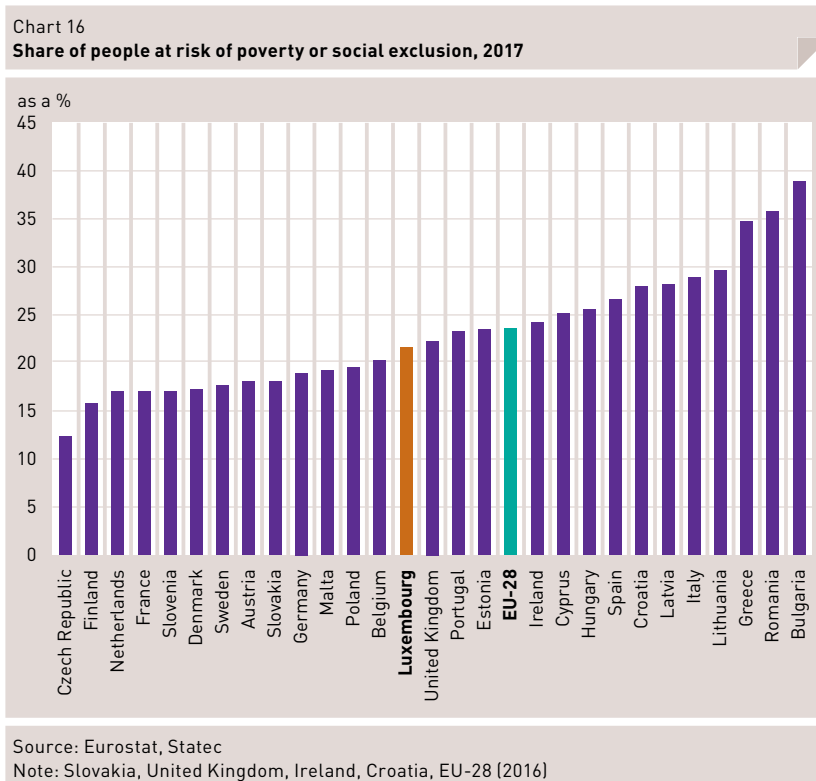
- ▼ At-risk-of-poverty rate: people living on less than 60% of the national median income. The at-risk-of-poverty rate is the key indicator to measure and monitor poverty in the EU. This is a relative measure of poverty, linked to the income distribution, which takes into account all sources of monetary income, including market revenues and social transfers. It reflects the role of employment and social protection in the prevention and reduction of poverty;
- ▼ Material deprivation rate: people whose lives are severely limited by a lack of resources³⁰. The material deprivation rate is a non-monetary measure of poverty, which also reflects the different levels of prosperity and quality of life in the EU, as it is based on a single European level;
- ▼ People living in households with very low work intensity: this population is defined relative to zero or very low work intensity over an entire year, in order to properly reflect the situations of prolonged exclusion from the labour market. These are people living in families in a situation of long-term exclusion from the labour market. The long-term exclusion from the labour market is one of the main factors of poverty and increases the risk of transmission of disadvantage from one generation to another.

³⁰ Definition: Currently the agreed EU material deprivation indicator is defined as the share of people are concerned with at least 3 out of the 9 following situations: people cannot afford i) to pay their rent or utility bills, ii) keep their home adequately warm, iii) face unexpected expenses, iv) eat meat, fish, or a protein equivalent every second day, v) a week of holiday away from home once a year, vi) a car, vii) a washing machine, viii) a colour tv, or ix) a telephone.

The risks that have an impact on the evolution of poverty indicators are related to macroeconomic developments, but also to the ability of employment policies to promote an inclusive labour market, employment opportunities for all and to the welfare system's capacity to improve efficiency and effectiveness because of the constraints on public finances. Note that monetary indicators of poverty, such as the poverty rate, are significantly limited. They do not take into account the many non-monetary public services that are available to citizens. In Luxembourg, among other things, we can mention in this context the service vouchers that are not taken into account.

For a more comprehensive view of people experiencing poverty or exclusion, Eurostat has developed an indicator to better quantify the percentage of the population facing the risk of poverty or exclusion, by combining the three individual indicators mentioned above.

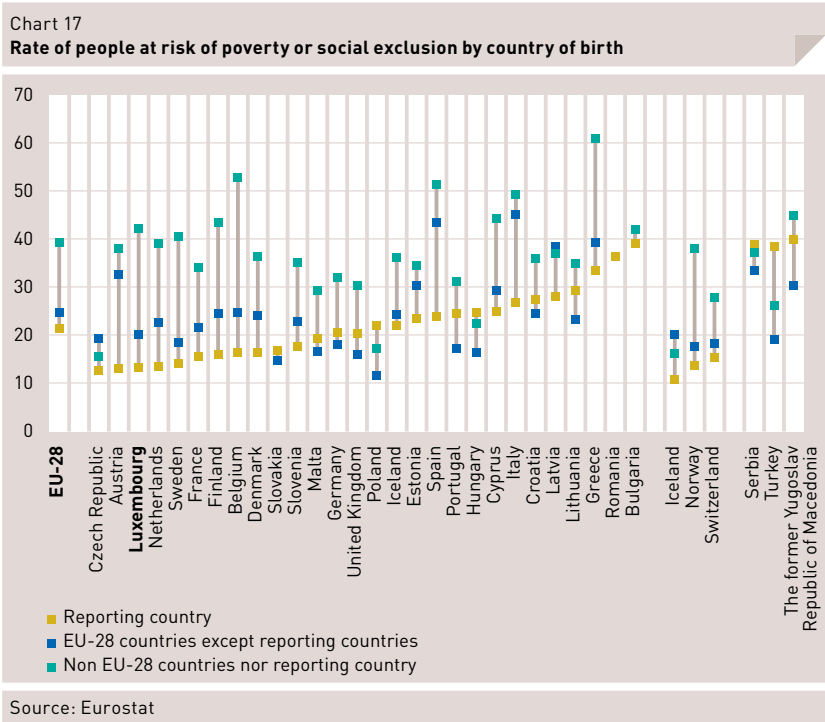
In 2017, an average of 23.5% of the overall population in the EU-28 was considered at risk of poverty or social exclusion. The share of people at risk of poverty or social exclusion was 21.5% in Luxembourg in 2017 and has therefore increased.



In 2017, the people considered to be at risk of poverty or social exclusion in Luxembourg are^{31, 32}:

- Primarily people at risk of poverty following social transfers (18.6%);
- To a much lesser extent, people living in a family with a very low work intensity (7%);
- To a much lesser extent also, people living in severe material deprivation (1.1%).

For example, the share of people at risk of poverty or social exclusion in 2016 in the EU was higher for third country nationals than for residents from other EU countries or nationals residing in their Member State of origin³³. This situation is also true in Luxembourg.



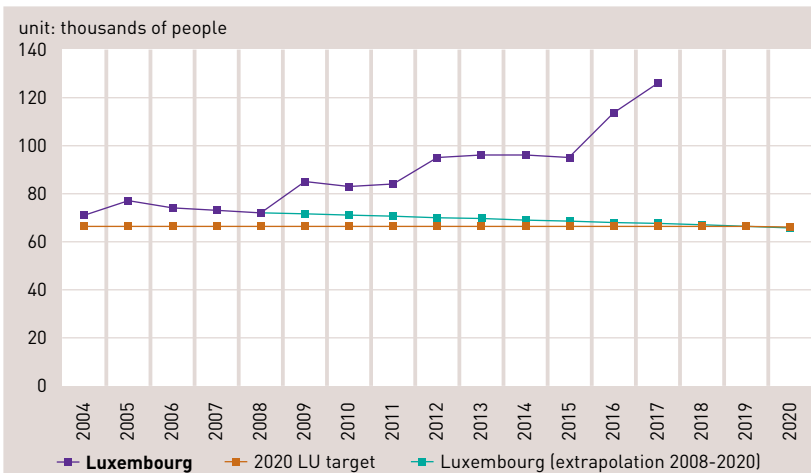
³¹ For additional details: http://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_integration_statistics_-_at_risk_of_poverty_and_social_exclusion

³² For additional details, see also: http://ec.europa.eu/europe2020/pdf/themes/2016/poverty_social_exclusion_201605.pdf

³³ For additional details: http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Europe_2020_indicators_-_poverty_and_social_exclusion

In its NRP Luxembourg has adopted a national objective for 2020, which is 'to reduce by 6,000 the number of people at risk of poverty or social exclusion'. As is the case for the vast majority of Member States, Luxembourg is far from reaching its national 2020 target. In fact, since the recent economic and financial crisis, the number of people at risk of poverty or social exclusion has been steadily rising in Luxembourg. With about 126,000 people in 2017, Luxembourg is way above the downward trend necessary to reach its national target by 2020, according to the methodology used by the European Commission in its assessment (taking 2008 as the reference year). The national target would need Luxembourg to display 6,000 people less in 2020 as compared to 2008 (72,000 people). This would imply that in 2020 only 66,000 people should be at risk of poverty or social exclusion in Luxembourg.

Chart 18
Trend in rate of people at risk of poverty or social exclusion, 2004-2017



Source: Eurostat, Statec, 2018 NRP

Note: The green line connecting the years 2008-2020 is an example to illustrate the linear trend Luxembourg's performance should display after 2008 in order to achieve national target set for 2020. 2020 target corresponds thus to 2008 figure minus the 6,000 people Luxembourg intends to lift out of poverty or social exclusion.

4.1.3 Conclusions – Taking stock of the situation in Luxembourg

The review of the indicators for Luxembourg in the previous section paint a descriptive overview of the situation in Luxembourg regarding its national targets within the framework of the Europe 2020 strategy. For some targets, the indicators are progressing in the right direction, whereas others are not so positive, and, in the light of the current trends, the 2020 targets seem unattainable.

Table 3
Summary table of the Europe 2020 strategy objectives

Priorities	Smart growth			Sustainable growth			Inclusive growth	
Objectives	Improving conditions for innovation and R&D	Improving education levels		Reaching the climate change/energy objectives			Promoting employment	Reducing poverty
Indicators	R&D	Early school leaving rate	Higher education	GHG emissions	Renewable energy	Energy efficiency	Employment rate	Poverty
Unit	% of GDP	%	% of 30-34 year olds	Mtoe	%	Mtoe	% of 20-64 year olds	People
LU*	1.24	7.3**	52.7	8.51	5.4	4.0	71.5	126,000
National target 2020	2.3-2.6%	<10%	66%	8.117***	11%	4.2****	73.0%	66,000

Source: Eurostat, 2018 NRP

Remarques: * Update according to the most recent data available

** Most recent national data (MENEJ): 13.5% (2014/2015)

*** -20% in relation to 2005

**** Final energy consumption

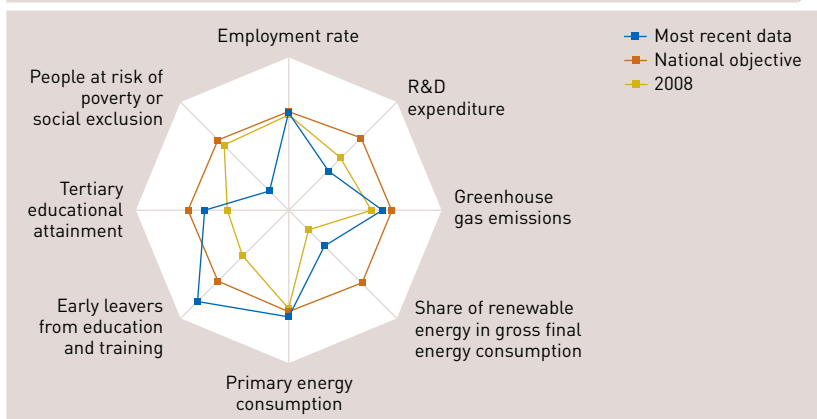
In the Luxembourg country report³⁴ as part of the European Semester (March 2018), the European Commission made the following comments on Luxembourg's range of national targets: *'Regarding progress in reaching the national targets under the Europe 2020 strategy, Luxembourg is on track to reach the renewable energy target and the energy efficiency target in 2020. However, Luxembourg is expected to miss its 2020 target reductions in greenhouse gas emissions. (...) Little progress has been made towards the targets for R&D investment and reducing poverty risk, and the employment rate, which remain below target.'*

³⁴ For additional details: <https://ec.europa.eu/info/sites/info/files/2018-european-semester-country-report-luxembourg-fr.pdf>

In its latest statistical report on achievements in implementing the Europe 2020 strategy (July 2018)³⁵, Eurostat made the following observation concerning Luxembourg: *'Luxembourg has continuously exceeded its target on early leavers from education and training since 2009. The country has the most ambitious target on tertiary education across the EU, aiming for 66% of the population aged 30 to 34 having attained tertiary education by 2020. Despite a 12.9 percentage point rise between 2008 and 2017, it still has further to go to meet its national target than other Member States. Although in 2017 Luxembourg was closer to its employment target than the EU as a whole, a gap of 1.5 percentage points persists. In 2016, the country spent relatively less on R&D as a percentage of GDP than the EU overall and it has moved further away from its national target since 2008. The number of people at risk of poverty or social exclusion increased by 58.3% between 2008 and 2016, pushing Luxembourg further from its national target. In terms of climate change mitigation, it did not reach its national target on the expansion of renewable energy and had the lowest shares of renewables in gross final energy consumption in the EU in 2016. Also, the 16.1% reduction in non-ETS GHG emissions in 2016 (compared to 1990) was not enough for the country to reach its national target to reduce emissions by 20%. On the other hand, Luxembourg has continued to meet its target on primary energy consumption since 2011.'*³⁶

Chart 19

Luxembourg profile: 2008, most recent data and national objectives 2020



Source: Eurostat

³⁵ EUROSTAT, Smarter, greener, more inclusive? Indicators to support the Europe 2020 strategy - 2018 edition, Eurostat statistical books, Luxembourg, 2018. Source: <http://ec.europa.eu/eurostat/documents/2995521/9080797/1-17072018-AP-EN.pdf/f7c15c9a-13ca-49d0-883b-fac3796f925e>

³⁶ Source: http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Europe_2020_indicators_-_Luxembourg#Overview

4.2 Macroeconomic surveillance

4.2.1 Implementation of the monitoring of macroeconomic imbalances

The years before the 2008/2009 financial and economic crisis were characterized in the euro area by divergent macroeconomic developments that have created imbalances among Member States. However, before the onset of the global economic and financial crisis, little attention was paid to these imbalances within the EU, in particular within the euro area. For example, public and private debt rose sharply in Greece, real estate bubbles were created in Spain and Ireland, and Italy, Spain, Portugal and Greece experienced significant losses in cost competitiveness³⁷. Public attention only started to focus on this unhealthy situation after the crisis began. As a result, new challenges have arisen in monetary policy and coordination of economic and fiscal policies because of the interdependence of the European economies and because the existing mechanisms were insufficient. It was therefore important to reinforce and further coordinate economic policy.

So, the Commission proposed to further strengthen the coordination of economic policy. In its May 2010 communication 'Reinforcing Economic Policy Coordination', the Commission highlighted a persistent accumulation of macroeconomic imbalances, which is able to destabilize the euro area and the functioning of the European Monetary Union. Based on this communication, in June 2010 the European Council decided to establish a European stabilization mechanism. The Commission subsequently developed its ideas in its 'Enhancing economic policy coordination for stability, growth and jobs – Tools for stronger EU economic governance' communication on the governance of economic policy and proposed to develop a new structured mechanism to detect and to correct macroeconomic imbalances. In order to better detect these imbalances, the Commission along with the Member States established a first scoreboard with economic and financial indicators. On 29 September 2010, the Commission finally proposed a legislative package ('Six Pack'), which includes the monitoring of internal and external macroeconomic imbalances in the Member States, such as housing and increasing differences in cost competitiveness between Member States³⁸. The European Parliament finally voted this legislative package on economic governance on 28 September 2011 and the European regulation entered into force in late 2011.

³⁷ MONETARY POLICY & THE ECONOMY, Prevention and Correction of Macroeconomic Imbalances: the Excessive Imbalances Procedure, Q4/2011

³⁸ Based on both European regulations 1176/2011 and 1174/2011. For additional details: <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32011R1176>

<http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32011R1174>

4.2.2 Macroeconomic imbalance procedure

The monitoring procedure includes a preventive and a corrective arm.

a. The preventive arm

In the preventive component of the procedure, a scoreboard was established and is published annually by the Commission. The first edition of this scoreboard was published in the Alert Mechanism Report (AMR)³⁹ in February 2012. For each Member State this mechanism analyses several indicators compared with 'alert thresholds' and is accompanied by an economic reading of the indicators, so as to not limit the interpretation to a 'mechanical' reading. This procedure allows the Commission to identify a potential risk. If this initial scoreboard reveals the existence of a potential macroeconomic imbalance within a Member State, in a second step the Commission calls for an in-depth analysis. This further analysis examines the origin, nature and severity of a potential imbalance.

In the analytical work carried out within the context of the implementation of this scoreboard, it proved to be very difficult to agree on 'one size fits all' indicators for all Member States, which can take into account both the specificities of each Member State and the potential methodological problems. It was thus agreed that the results should not be limited to a 'mechanical' interpretation but to accompany the reading by an economic analysis. The selection of indicators is mainly based on four guidelines: indicators should detect the major macroeconomic imbalances and signs of loss of competitiveness; indicators should enable the analysis of both the level and flows; indicators should serve as an important communication tool; the statistical quality of data should be high and suitable to make international comparisons.

The initially adopted main scoreboard included eleven indicators divided into two categories: external and internal imbalances. The analysis of external imbalances includes indicators such as the current account balance (foreign exchange of a country), or factors having a direct impact on this aggregate such as cost competitiveness. In terms of internal imbalances, the experience gained through the crises in the past has allowed identifying various key indicators such as unusual developments in the financial sector; extreme changes in credit with a high increase in house prices. Statistics that are used annually in the scoreboard are updated periodically by Eurostat⁴⁰. For each of these indicators, the Commission - in collaboration with Member States - had also defined the thresholds at which performances can be regarded as potentially 'at risk' based on the historical statistical distribution of each indicator⁴¹. This means that if a Member State exceeds a threshold, it could display a macroeconomic imbalance. It is important to stress that the defined thresholds are usually the same for all Member States, making a difference only in some cases between Member States being in or out the euro area.

³⁹ EUROPEAN COMMISSION, Alert Mechanism Report, Report prepared in accordance with Articles 3 and 4 of the Regulation on the prevention and correction of macro-economic imbalances, Brussels, 14.2.2012 COM (2012) 68 final

⁴⁰ For additional details: <http://ec.europa.eu/eurostat/web/macroeconomic-imbances-procedure/indicators>

⁴¹ For more details about the implementation methodology of the AMR scoreboard: EUROPEAN COMMISSION, Scoreboard for the surveillance of macroeconomic imbalances, European Economy, Occasional Papers 92, Brussels, February 2012. Source: http://ec.europa.eu/economy_finance/publications/occasional_paper/2012/op92_en.htm

Since late 2015, the European Commission has added three new employment indicators to the initial scoreboard: the activity rate in the total population (aged 15-64), long-term unemployment rate (active population aged 15-74), youth unemployment rate (active population aged 15-24). The scoreboard now contains fourteen main indicators⁴² for the identification and monitoring of internal and external macroeconomic imbalances, as well as for employment trends and for the social situation, with the aim of better understanding the social implications of macroeconomic imbalances. The indicators and thresholds of the scoreboard must not be seen as objectives or public policy instruments. Their interpretation must be complemented by a critical, country-specific economic analysis. The composition of the series of indicators is reviewed regularly and may be modified over time.

b. The corrective arm

If in-depth examination, which is performed after the scoreboard-based analysis, finds that an excessive macroeconomic imbalance exists in a Member State, the corrective arm of the procedure is triggered. The Member State concerned is then placed in an excessive imbalance situation. In this case the Member State must submit a corrective action plan to the Council specifying concrete measures and a detailed implementation schedule. The Commission and the Council assess the corrective action plan that is either found to be satisfactory, which leads to the issuing of regular progress reports to the Council, or insufficient, and the Member State is then requested to amend its action plan. If, after the amendments, the action plan remains insufficient, the Council adopts sanctions on the basis of recommendations of the Commission, unless the Council supports the arguments of exceptional economic circumstances by a reverse qualified majority.

⁴² In addition to the main scoreboard, there is an auxiliary scoreboard which enables performing more detailed analyses. This will not be reviewed in this chapter. For more details: http://ec.europa.eu/eurostat/cache/Imbalance_Scoreboard/MIPs_AUX_FR_banner.html

4.2.3 The 2018 edition of the macroeconomic imbalance procedure

The seventh edition of the scoreboard was published in the Alert Mechanism Report released in November 2017 as part of the European Semester. In this edition, the European Commission concluded Luxembourg analysis as follows: *'In the previous round of the MIP, no macroeconomic imbalances were identified in Luxembourg. In the updated scoreboard, a number of indicators are beyond the indicative threshold, namely private sector debt as well as the increase in the youth unemployment rate. The external position continues to show broadly stable current account surpluses and a positive NIIP where changes are to a large extent reflecting the country's position as an international financial centre rather than the activity of the domestic economy. Cumulated gains in export market have been large, favoured by the recent stability in cost competitiveness as underpinned by the subdued evolution in unit labour cost. For many consecutive years, real house prices have continued to grow at a relatively high rate and warrant close attention. House price growth is underpinned by the dynamic labour market combined with the sizeable net migration flows and favourable financing conditions while supply remains relatively constraint. Housing affordability keeps on deteriorating in view of constantly increasing house prices. While corporate indebtedness is mostly related to cross-border intracompany loans, the level of households' debt, which is mostly mortgage debt, has steadily increased reflecting the increasing house prices. Risks for the country financial stability are however mitigated by the solidity of the banking sector. Public debt remains very low. In a context of strong growth conditions the labour market is tightening and unemployment declining. Overall, the economic reading points mainly to some contained risks related to constantly increasing housing prices and households debt. Therefore, the Commission will at this stage not carry out further in-depth analysis in the context of the MIP.'*

Table 4
AMR scoreboard indicator results (November 2017 edition)

Year 2016	External imbalances and competitiveness					Internal imbalances						Employment indicators		
	Current account balance - % of GDP (3 year average)	Net international investment position (% of GDP)	Real effective exchange rate - 42 trading partners, HICP deflator (3 year % change)	Export market share - % of world exports (5 year % change)	Nominal unit labour cost index (2010=100) (3 year % change)	House price index (2015=100), deflated (1 year % change)	Private sector credit flow, consolidated (% of GDP)	Private sector debt, consolidated (% of GDP)	General government gross debt (% of GDP)	Unemployment rate (3 year average)	Total financial sector liabilities, non-consolidated (1 year % change)	Activity rate - % of total population aged 15-64 (3 year change in pp)	Long-term unemployment rate - % of active population aged 15-74 (3 year change in pp)	Youth unemployment rate - % of active population aged 15-24 (3 year change in pp)
Thresholds	-4/+6%	-35%	±5% (EA) ±11% (Non-EA)	-6%	9% (EA) 12% (Non-EA)	6%	14%	133%	60%	10%	16.5%	-0.2 pp	0.5 pp	2 pp
BE	-0.3	51.2	-0.4	-2.3	-0.6	1.0p	13.3	190.1	105.7	8.3	1.2	0.1	0.1	-3.6
BG	1.8	-47.0	-4.7	8.2	9.5p	7.1p	4.0	104.9	29.0	9.4	11.1	0.3	-2.9	-11.2
CZ	0.5	-24.6	-3.7	2.9	2.9	6.7p	4.4	68.7	36.8	5.1	14.5	2.1	-1.3	-8.4
DK	8.4	54.8	-1.5	-4.2	3.4	4.2	-10.4	210.7	37.7	6.3	3.3	1.9b	-0.4b	-1.0
DE	8.1	54.4	-2.6	2.8	5.2	5.4	3.8	99.3	68.1	4.6	5.2	0.3	-0.6	-0.7
EE	1.4	-37.1	4.5	-0.7	13.4	3.8	5.9	115.4	9.4	6.8	7.2	2.4	-1.7	-5.3
IE	5.5	-176.2	-6.6	59.8	-20.5	6.6p	-19.0	278.1	72.8	9.5	2.5	0.7	-3.6	-9.6
EL	-1.0	-139.4	-3.9	-19.0	-3.3p	-2.0e	-1.7p	124.7p	180.8	25.0	-16.6	0.7	-1.5	-11.0
ES	1.4	-83.9	-4.3	2.2	0.4p	4.7	-1.0p	146.7p	99.0	22.1	0.9	-0.1	-3.5	-11.1
FR	-0.7	-15.7	-3.1	-2.4	1.4p	1.0	6.2p	146.9p	96.5	10.3	4.3	0.7	0.2	-0.3
HR	2.9	-70.1	0.1	8.1	-5.9d	2.1	-0.1e	106.1e	82.9	15.6	2.5	1.9	-4.4	-18.1
IT	2.1	-9.8	-3.4	-2.8	1.9	-0.8p	0.6	113.6	132.0	12.1	3.2	1.5	-0.2	-2.2
CY	-3.6	-127.8	-6.5	-3.0	-6.2p	1.6	10.2p	344.6p	107.1	14.7	0.7	-0.2	-0.3	-9.8
LV	-0.3	-58.9	4.9	9.3	16.5	7.4	0.3	88.3	40.6	10.1	5.8	2.3	-1.7	-5.9
LT	-0.3	-43.2	5.4	5.4	14.7	4.5	4.3	56.2	40.1	9.2	16.3	3.1	-2.1	-7.4
LU	5.0	34.7	-1.5	26.2	2.5	5.9	1.5	343.6	20.8	6.3	7.5	0.1	0.4	2.2
HU	3.6	-65.0	-5.0	-0.4	3.3	13.6	-3.6	77.0	73.9	6.5	19.5	5.4	-2.5	-13.7
MT	6.7	47.6	-2.5	8.7	-0.1	4.8p	11.1	128.4	57.6	5.3	1.7	4.1	-1.0	-2.0
NL	8.8	69.1	-2.3	0.1	-1.1p	4.4	1.5p	221.5p	61.8	6.8	5.3p	0.3	0.0	-2.4
AT	2.2	5.6	1.0	-4.0	5.8	7.2	3.2	124.0	83.6	5.8	-2.4	0.7	0.6	1.5
PL	-1.0	-60.7	-5.0	18.1	2.1p	2.5	4.7	81.6	54.1	7.6	8.9	1.8	-2.2	-9.6
PT	0.3	-104.7	-1.9	5.8	0.9p	6.1	-2.2p	171.4p	130.1	12.6	-0.2	0.7	-3.1	-9.9
RO	-1.3	-49.9	-2.5	23.6	6.0p	6.5	0.6p	55.8p	37.6	6.5	7.6	0.7	-0.2	-3.1
SI	5.1	-36.9	-0.5	4.0	0.7	3.6	-0.8	80.5	78.5	8.9	3.2	1.1	-0.9	-6.4
SK	-0.7	-62.4	-1.6	7.3	3.5	7.0	9.2	94.7	51.8	11.5	8.5	2.0	-4.2	-11.5
FI	-1.2	-2.3	0.5	-14.1	2.1	-0.3	2.2	149.3	63.1	9.0	4.5	0.7	0.6	0.2
SE	4.6	11.2	-9.2	-7.9	2.0	7.6	7.6	188.5	42.2	7.4	9.0	1.0	-0.1	-4.7
UK	-5.5	-1.1	0.2	-0.1	3.1	5.5	8.2	168.1	88.3	5.4	11.6	0.9	-1.4	-7.7

Flags: b: Break in series, e: Estimated, p: Provisional.

1) For the employment indicators, see page 2 of the AMR 2016. 2) House price index e = source NCB for EL.

3) For NULC HR, d: employment data use national concept instead of domestic concept.

4) Private sector debt, private sector credit flow: the decline for IE relative to 2015 predominantly reflects restructuring and re-domiciling activities of large multinational companies.

Source: European Commission, Eurostat and Directorate General for Economic and Financial Affairs (for Real Effective Exchange Rate), and International Monetary Fund data, WEO (for world exports series)

4.2.4 Updating alert mechanism scoreboard data

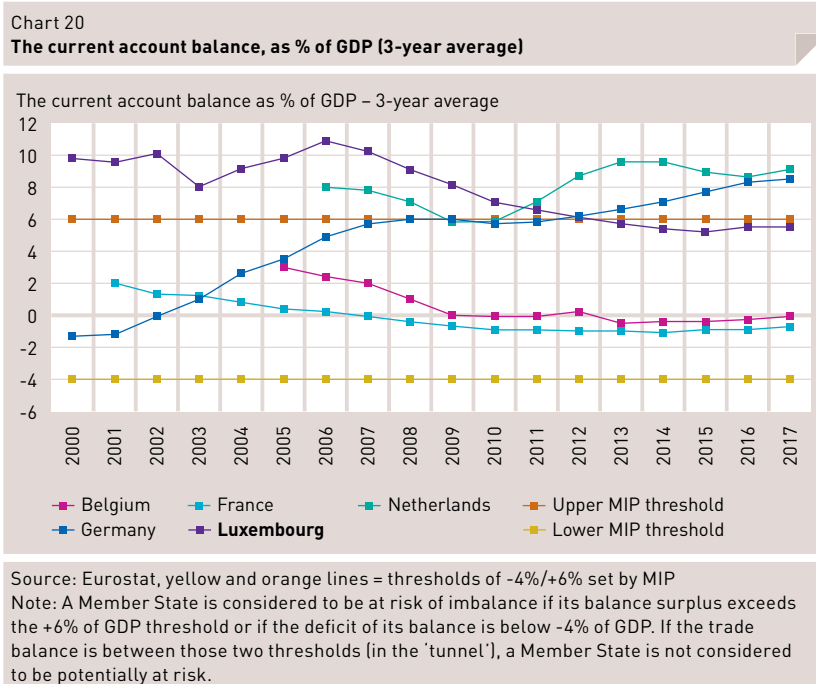
The data used in this chapter to illustrate the position of Luxembourg under the alert mechanism come from Eurostat database. This is an update of the data published in the last AMR scoreboard (November 2017). Therefore, differences can occur between the present results in the 2018 Competitiveness Report and those of the last alert mechanism scoreboard. The present data were downloaded early July 2018, and are thus an update halfway between the last alert mechanism report and the one that the Commission will publish in November 2018 in the context of its annual Growth Survey, which will launch the 2019 European semester.

4.2.4.1 External and competitiveness imbalances

a. Current account balance⁴³

Regarding the current account balance, unlike a country financing need (negative balance), a financing capacity (positive balance) does not seem an evidence of imbalance since it doesn't threaten the sustainability of its external debt. For this indicator, it has been agreed under the MIP that a country is potentially at risk if it has a current account balance with either a deficit higher than -4% of GDP or a surplus of over +6% of GDP.

Luxembourg exceeded the upper threshold limit between 2000 and 2012 but, over the last decade, its current account surplus has fallen and, since 2013, has been slightly below the upper threshold limit and is thus included in the interval defined as not posing a macroeconomic imbalance risk.



⁴³ The balance of payments is a statistical statement that systematically summarizes, for a specific period, the economic transactions of an economy with the rest of the world. It is divided into three main sub-balances: the current account, the capital account and the financial account. The current account is the main determinant of the financing capacity or need of an economy; it provides important information on the economic relations of a country with the rest of the world. It reports all transactions (other than those recorded under financial headings) in economic values that occur between resident and non-resident units.

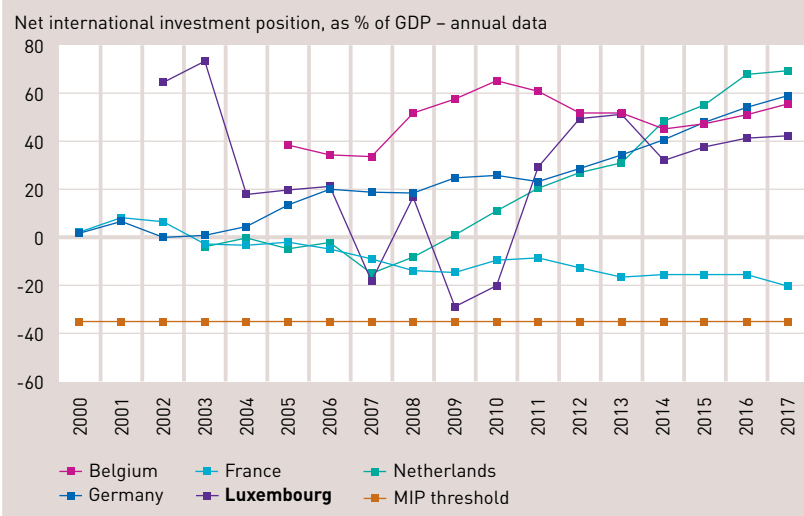
b. Net international investment position⁴⁴

The indicator of the net external position provides information on the relationship between foreign assets and the external debt of a country⁴⁵. For this indicator, it has been agreed under the MIP that a country is potentially at risk if it has a negative balance over -35% of GDP.

Luxembourg's performance varies wildly. However, over the entire period for which data on Luxembourg are available, i.e. until 2017, Luxembourg is above the threshold limit. In line with a large current account surplus, Luxembourg adheres to the criteria with regard to its net international position. Luxembourg's foreign assets far outweigh its foreign liabilities.

Chart 21

Net international investment position, as % of GDP



Source: Eurostat, orange line = threshold of -35% set by MIP

Note: A Member State is considered to be at risk of imbalance if its net international position is below -35% of GDP. If the indicator is above this threshold, a Member State is not considered to be at risk.

⁴⁴ The statistics of the international investment position (IIP) records the status of financial assets and liabilities of a country relative to the rest of the world. They are an important measure of the net position of the domestic economic sectors relative to the rest of the world. The net international investment position (NIIP) is calculated by the difference between assets and liabilities in the IIP. It allows a stock flow analysis of external positions.

⁴⁵ For additional details: http://ec.europa.eu/eurostat/statistics-explained/index.php/International_investment_position_statistics

⁴⁶ The REER aims to assess the price competitiveness or the cost competitiveness of a country compared to its main competitors in international markets. Changes in cost competitiveness and price competitiveness depend not only on changes in the exchange rate, but also on the cost and price evolution. The specific REER for excessive imbalance procedure is deflated with the price index compared to a group of 42 countries (double weighting of exports is used to calculate the REER in order to take into account not only the competition on the domestic markets of the various competitors, but also on other export markets). A positive value implies a real appreciation. Data are given in 3-year percentage change and in 1-year percentage change. The scoreboard indicator corresponds to the 3-year percentage change of the real effective exchange rate based on the consumer price index of the 42 trading partners.

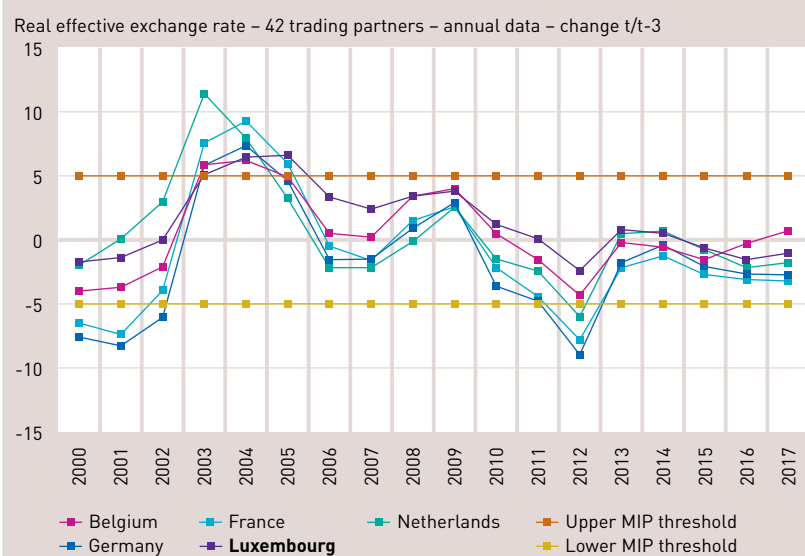
c. Real effective exchange rate (REER)⁴⁶

The REER indicator tracks the evolution of price competitiveness and cost competitiveness by analysing the relationship between domestic prices or costs and foreign prices or costs in euro. Thus, an increase in the REER is usually equivalent to a decline of competitiveness, due to the fact that domestic prices/costs increase faster than those in foreign countries. The REER is constructed from currencies of major trading partners.

For this indicator, it has been agreed for the euro area Member States that a country is potentially at risk if the REER indicator is above + 5% or under -5%.

Just like its neighbouring countries, Luxembourg often ranks in the interval considered as not posing a risk of imbalances.

Chart 22
The real effective exchange rate, % change over 3 years



Source: Eurostat, orange and yellow lines = thresholds of +/- 5% for euro area Member States
Note: A euro area Member State is considered to be at risk of imbalance if its REER is above +5% or below -5%. If REER changes are within these two thresholds (in the 'tunnel'), a Member State is not considered to be at risk.

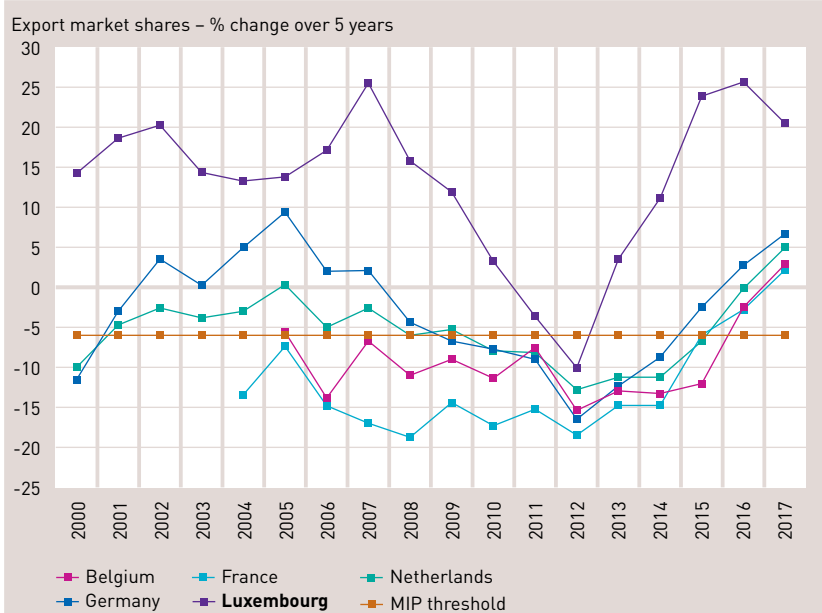
d. Export market shares⁴⁷

The scoreboard includes an indicator on changes in the market share of a country in global exports of goods and services, in order to measure in volume the slow and persistent losses in competitiveness. It is an outcome indicator, which also captures the components of non-cost competitiveness, or the ability of a country to exploit new business opportunities due to the increased demand. For this indicator, it has been agreed under the MIP that a country is potentially at risk if this indicator is less than -6%.

For the majority of the years under observation, Luxembourg has observed the established threshold limits, with the exception of 2012. Between 2007 and 2012, Luxembourg's shares fell significantly but, since 2013, they have been on the rise again.

⁴⁷ This indicator shows the evolution of the export shares of goods and services of the EU Member States in total world exports. Data on the values of exports of goods and services are developed in the context of the balance of payments of each country. To take into account the structural losses of competitiveness that can accumulate over long periods, the indicator is calculated by comparing year Y to year Y-5. The indicator is based on the data from the balance of payments provided to Eurostat by the 28 EU Member States.

Chart 23
Export market shares, % change over 5 years



Source: Eurostat, orange line = threshold of -6% set by the MIP

Note: A Member State is considered to be at risk of imbalance if the change in its export market shares is below -6%. If the indicator is above this threshold, a Member State is not considered to be at risk

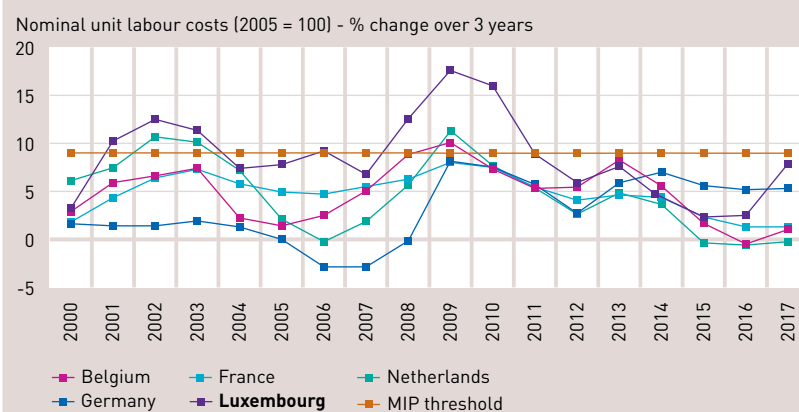
e. Nominal unit labour costs⁴⁸

The nominal unit labour costs (nominal ULC) are the indicator traditionally used to measure the cost-competitiveness of an economy. The change in domestic nominal unit labour costs of a country, or the cost of labour per unit of value added produced, is compared to those of the main trading partner countries. Thus this indicator includes two factors: firstly, the average labour cost in an economy and secondly, the level of productivity. For this indicator, it has been agreed that a country is at risk if this indicator is higher than +9%.

Luxembourg's performance for this indicator has varied somewhat. The increase between 2008 and 2010 is largely due to a drop-in productivity, which can be observed in almost all sectors. An explanation for Luxembourg's sub-par performance is the stronger weighting of the financial sector in Luxembourg's economy, a sector whose significant loss of productivity over the last few years has heavily contributed to the increase in Luxembourg's ULC. The same explanation can be given for industry, which, over the course of the most recent years of the crisis, has implemented major job-saving plans. Luxembourg has scored under the threshold limit in the period 2011-2017 and therefore does not constitute a macroeconomic imbalances risk under this indicator.

⁴⁸ The nominal unit labour costs (NULC) are defined as the ratio of total employee compensation (D1), in millions of national currency, relative to the total number of employees, divided by the ratio of GDP at market prices in millions, expressed in chain-linked volume for the reference year 2010 with the 2005 exchange rate into national currency relative to the total number of people employed. The change in nominal unit labour costs is the change in the total compensation of employees by number of employees not covered by the change in labour productivity as well as the change in the proportion of employees in total employment. The input data are obtained through official data transmissions from countries' national accounts in the SEC2010 transmission programme. Data are expressed as a percentage change in indices between the year Y and the year Y-3

Chart 24
Nominal ULC, % change over 3 years



Source: Eurostat, orange line = threshold of +9% for euro area Member States
Note: A euro area Member State is considered to be at risk of imbalance if the change in its nominal ULC is above +9%. If the indicator is below this threshold, a Member State is not considered to be at risk.

4.2.4.2 Internal imbalances

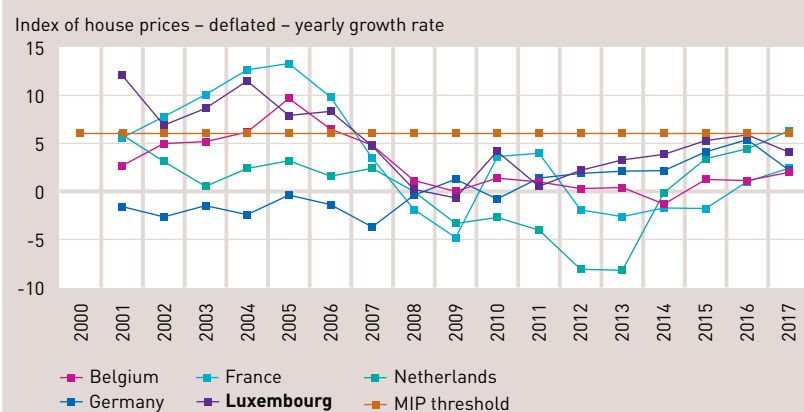
a. House prices⁴⁹

This indicator measures changes in the acquisition prices of real estate within the EU Member States to detect internal imbalances linked to a potential 'housing bubble'. It has been agreed under the MIP that a country is at risk if this indicator is higher than +6%.

Real estate prices (housing) have risen, in real terms, almost continuously since 2001, with the exception being in 2009. Between 2001 and 2006, Luxembourg was above the threshold limit, with prices rising too quickly. Since 2007, annual price rises have been below the threshold limit although Luxembourg's score was very close to the threshold limit in 2015 and 2016.

⁴⁹ The deflated index of house prices is the ratio between the housing price index and the deflator of private final consumption expenditure (households and non-profit institutions). Therefore, this indicator measures inflation in the housing market compared to that of final consumption of households and NPI. Eurostat index of housing prices reflects the price changes of all types of housing purchased by households (apartments, detached and non-detached houses, etc.), both new and existing, regardless of their final use and previous owner. Only market prices are considered, so built housing on own account is excluded. The land is included. Data show changes in percentage from year Y compared to the year Y-1.

Chart 25
Deflated index of house prices, % change over 1 year



Source: Eurostat, orange line = threshold of +6% set by MIP

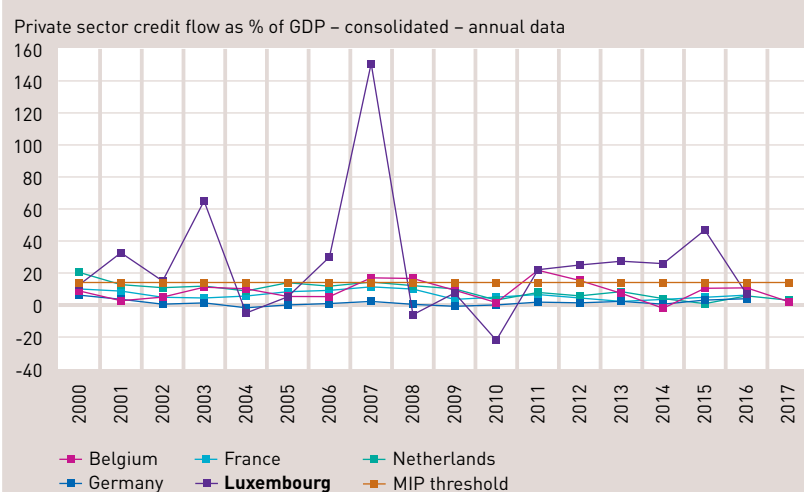
Note: A Member State is considered to be at risk of imbalance if the change in housing prices is above +6%. If the indicator is below this threshold, a Member State is not considered to be at risk.

b. Private sector credit flow⁵⁰

This indicator measures the credit flow of the private sector that corresponds to the net changes in liabilities of the non-financial corporate sectors, households and non-profit institutions serving households. A country is at risk if this indicator is above +14%.

Luxembourg's performance for this indicator varies greatly, much more than the performance of neighbouring countries. The structure of the Luxembourg economy, a very small but open economy, home to several large, non-financial companies, whose financial decisions can have a major impact on the national economy, could be the explanation for this situation.

Chart 26
Private sector credit flow, as % of GDP



Source: Eurostat, orange line = threshold of +14% set by MIP

Note: A Member State is considered to be at risk of imbalance if the change of private sector credit flows is above +14%. If the indicator is below this threshold, a member State is not considered to be at risk.

⁵⁰ The private sector credit flow corresponds to the net changes in liabilities of the non-financial corporate sectors (S.11), households and non-profit institutions serving households (S.14_S.15) incurred during the year. The instruments included in the calculation of private sector credit flow are the 'Securities other than shares' (F.3) and 'Credits' (F.4), to the exclusion of any other instrument. The concepts used in the definition of sectors and instruments are consistent with SEC2010. Data are expressed in EUR million and calculated on a non-consolidated basis, i.e. by including transactions among units of the same sector.

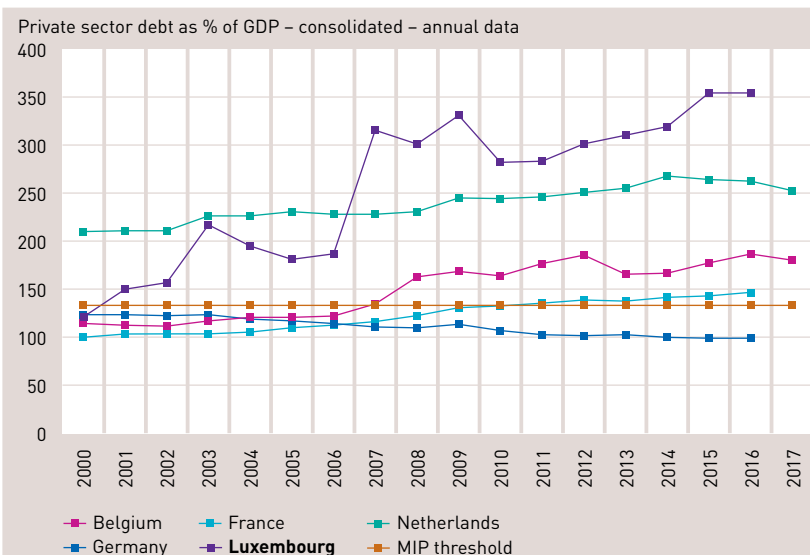
c. Private sector debt⁵¹

The private sector debt indicator is important because if it is excessively high, private sector debt involves significant risks to growth and financial stability of a country. The indicator measures the level of private debt of the economy: non-financial corporations, private households and non-profit institutions serving households (as a % of GDP). The indicator is based on non-consolidated data, meaning it includes for example intra-sector debt at national level. It has been agreed that a country is potentially at risk if this indicator is above +133% of GDP.

Since 2001 in Luxembourg, this indicator significantly overruns the threshold set by the MIP. However, for Luxembourg this indicator should be interpreted with caution because non-financial companies incur most of this private sector debt. Given the liquidity of financial markets and the experience in international transactions, a company may choose to incur debt through funding in Luxembourg, not for its own need but for another related entity that may be located abroad (e.g. intra-group loans). This debt then contributes to the numerator of the 'private sector debt relative to GDP' indicator used here, without taking into account the added value produced by this funding if it is out of Luxembourg because the GDP (denominator) is a national concept. For a small and very open economy such as Luxembourg, this indicator therefore tends to be overestimated because the numerator (debt) is overvalued and the denominator (GDP) is undervalued because the added value created abroad from these sources of financing (debt) raised inside the country is not taken into account. With particular regard to household debt, this debt results mainly from loans taken for housing acquisition.

Chart 27

Consolidated private sector debt, as a % of GDP



Source: Eurostat, orange line = threshold of 133% set by MIP

Note: A Member State is considered to be at risk of imbalance if the private sector debt exceeds 133% of GDP. If the indicator is below this threshold, a Member State is not considered to be at risk.

⁵¹ The private sector debt corresponds to the outstanding amount of liabilities of non-financial corporate sectors (S.11), households and non-profit institutions serving households (S.14_S.15). Instruments included in the calculation of the private sector debt are 'Securities other than shares', to the exclusion of financial derivatives (F.33) and 'Credits' (F.4) to the exclusion of any other instrument. The concepts used in the definition of sectors and instruments are consistent with SEC2010. Data is calculated on a non-consolidated basis, i.e. excluding transactions among units of the same sector. The PDM indicator is calculated as a percentage of GDP.

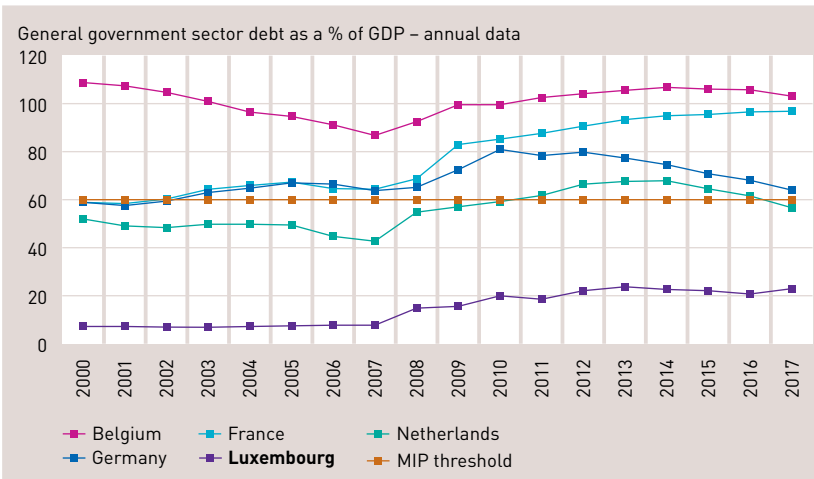
d. General government sector debt⁵²

This indicator takes into account the potential contribution of general government sector debt to macroeconomic imbalances. The definition used is that set by the Stability and Growth Pact (SGP). This indicator is not included to monitor the risk of unsustainable public finances, but should be considered as a complement to the indicator on private debt. A high level of government debt is more alarming when accompanied by a high level of private debt. For this indicator, it has been agreed under the MIP that a country is potentially at risk if this indicator is above +60% of GDP.

The rate of gross government sector debt is well below the 'Maastricht' threshold (60% of GDP). However, government sector debt started to rise considerably in Luxembourg with the beginning of the economic and financial crisis in 2008 before stabilizing in the past few years.

Chart 28

General government sector debt as a % of GDP



Source: Eurostat, orange line = threshold of 60% set by the Maastricht treaty

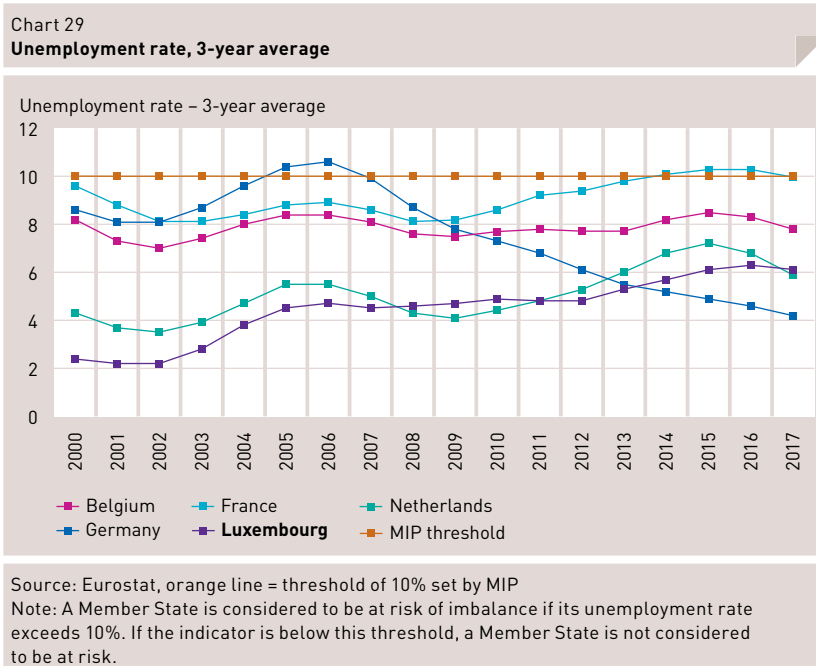
Note: A Member State is considered to be at risk of imbalance if its general government sector debt exceeds 60% of GDP. If the indicator is below this threshold, a Member State is not considered to be at risk.

⁵² General government gross debt is defined in the Maastricht Treaty as the consolidated gross debt of the whole general government sector in nominal value at the end of the year. The government sector includes the following subsectors: central government, State government, local government and social security funds. Definitions are available in the 479/2009 Regulation, as amended by the 679/2010 Council Regulation. National data for the general government sector are consolidated over sub-sectors. The series are available as a percentage of GDP. GDP denominator comes from the SEC2010 transmission programme, and not from the EDP notifications. The revised GDP data being transmitted in a delayed schedule, it may result in potential differences in debt as a % of GDP, according to the source, EDP or AMR score-board.

e. Unemployment rate⁵³

This indicator is intended to monitor high and persistent unemployment rates and it points a possible misallocation of resources (incompatibility) and the general lack of responsiveness in the economy. It should therefore be read in conjunction with other more future-oriented indicators and should be used to better understand the potential severity of macroeconomic imbalances. It has been agreed that a country is at risk if this indicator is above 10%.

Luxembourg has an unemployment rate well below the threshold. However, since 2000 the unemployment rate has risen sharply in Luxembourg.

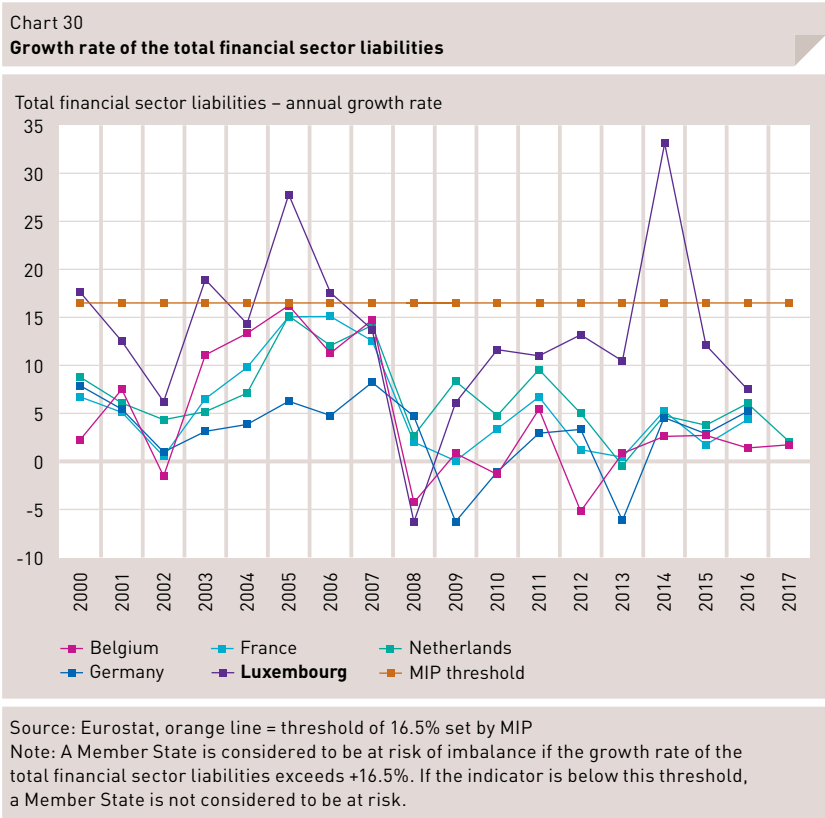


⁵³ The unemployment rate represents the number of unemployed persons as a percentage of the labour force as defined by the International Labour Organization (ILO). The labour force consists of employed and unemployed persons. Unemployed persons are those aged 15 to 74 who: - were jobless during the reference week - were available for work during the next two weeks - and were either looking actively for a job during the previous four weeks or had already found a job that began in the following three months. Data are 3-year moving averages, i.e. year Y data are the arithmetic mean of the years Y, Y -1, Y -2. In this context, it is not the national definition of unemployment used in Luxembourg, which is the one used by the Agency for Employment Development (Adem): 'The unemployment rate is the ratio between the number of resident jobseekers available and the labour force. The latter consists of all persons living in the country who are working (employee or self-employed) or looking for a job (jobseeker)'. For additional details: <http://adem.public.lu>

f. Total financial sector liabilities⁵⁴

This indicator measures the evolution of the sum of the liabilities of the entire financial sector of a country. The indicator is expressed as an annual growth rate. For this indicator, it has been agreed under the MIP that a country is potentially at risk if this indicator is higher than +16.5%.

In most of the years under analysis, Luxembourg was below the threshold limit. In 2000, 2003, 2005, 2006 and 2014, Luxembourg exceeded the threshold. In 2016, the year of the latest available data, Luxembourg was again below the threshold limit.



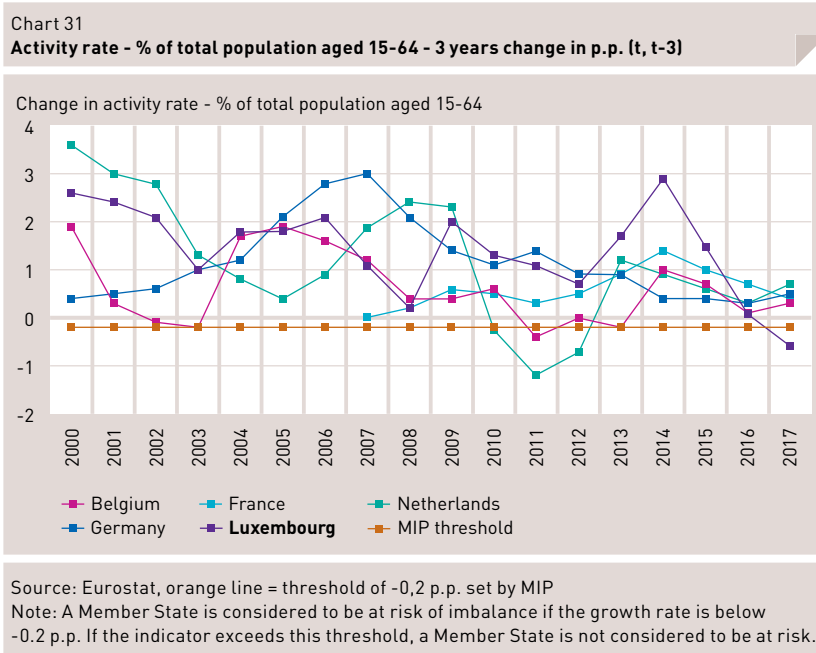
⁵⁴ Total financial sector liabilities measure the evolution of the sum of all liabilities (including currency and deposits, securities other than shares, loans, shares and other equity, insurance technical reserves and other accounts payable) of the entire financial sector. The indicator is expressed as an annual growth rate.

4.2.4.3 Employment indicators

a. Activity rate⁵⁵

This indicator measures variations in the activity rate amongst Member State residents. The indicator is expressed in percentage points over a three-year period. For this indicator, a country is deemed to be potentially at risk if the activity rate falls by more than -0.2 p.p. over the period in question.

Between 2000 and 2016, the activity rate rose in Luxembourg, so the threshold was respected. On the opposite, in 2017, the activity rate in Luxembourg dropped (-0.6) and the threshold was no longer respected.



⁵⁵ The activity rate is the ratio between the number of economically active individuals aged 15-64 years and the total population in the same age bracket. In line with the International Labour Organization (ILO) definitions and for the purpose of compiling labour market statistics, individuals are categorized as follows: employed, unemployed and economically inactive. The economically active population (also referred to as 'the labour force') corresponds to the sum of employed and unemployed individuals. Inactive individuals are individuals who, during the reference period, were neither employed or unemployed. The scoreboard indicator reveals the change over three years expressed in percentage points. The indicative threshold is -0.2 p.p. This indicator is based on the results of the EU's quarterly Labour Force Survey (LFS), which covers the resident population living in private households.

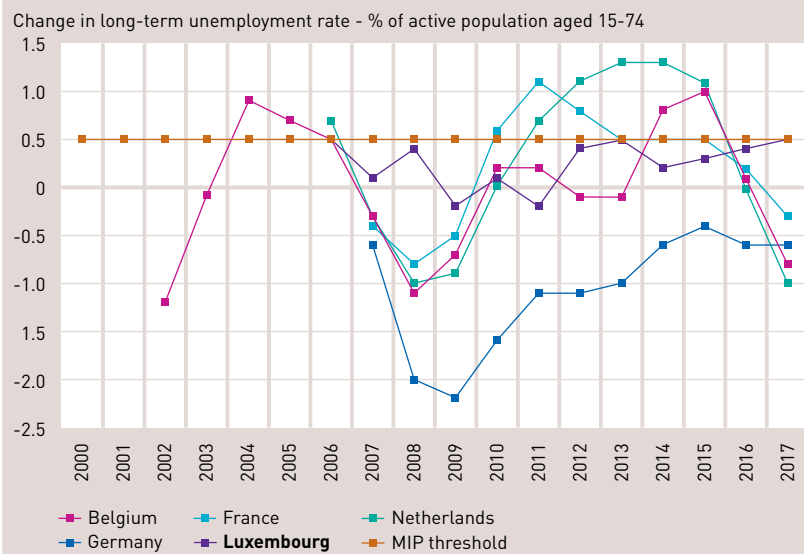
b. Long-term unemployment rate⁵⁶

This indicator measures the variation in long-term unemployment rates in the Member States. The indicator is expressed in percentage points and measured over a three-year period. For this indicator, a country is deemed potentially at risk if the rate increases by more than +0.5 p.p. over the period in question.

Over the entire period under analysis, Luxembourg's long-term unemployment rate variation has been below or equal to the threshold limit, even if the country is again on the threshold limit in 2017.

Chart 32

Long-term unemployment rate - % of active population aged 15-74 - 3 years change in p.p. (t, t-3)



Source: Eurostat, orange line = threshold of +0,5 p.p. set by MIP

Note: A Member State is considered to be at risk of imbalance if the growth rate exceeds +0,5 p.p. If the indicator is below this threshold, a Member State is not considered to be at risk.

⁵⁶ The long-term unemployment rate is the number of individuals who have been unemployed for at least 12 months expressed as a percentage of the active population (the economically active population). The unemployment rate is the percentage of unemployed individuals in the active population (the total number of persons employed and unemployed), as per the International Labour Organization (ILO) definition. The term 'unemployed' covers individuals aged 15-74 who meet the following criteria: - unemployed during the reference week; - available to begin work within the following two weeks; - actively looking for a job during the four previous weeks or have found a job which they will start within the following three months.

The scoreboard indicator corresponds to the change in percentage points over a three-year period. The indicative threshold is 0.5 p.p. This indicator is based on the results of the EU's quarterly Labour Force Survey (LFS), which covers the resident population living in private households.

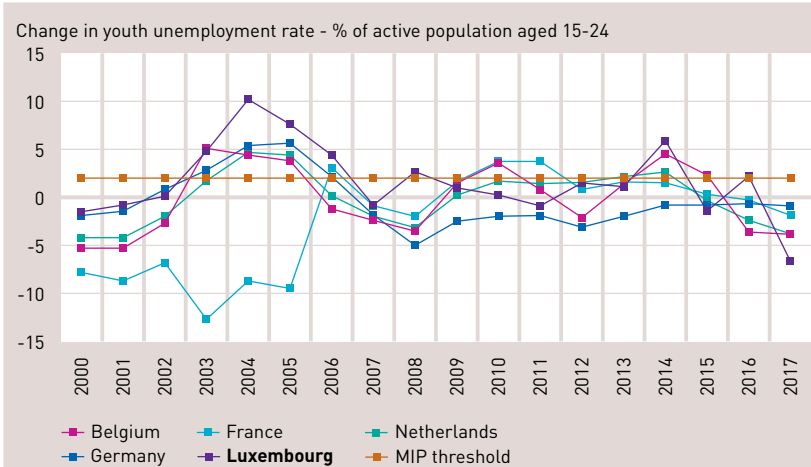
c. Youth unemployment rate⁵⁷

This indicator measures the variation in the youth unemployment rate in the Member States. The indicator is expressed in percentage points over a three-year period. For this indicator, a country is deemed to be at risk if the rate increases by more than +2 p.p. over the period in question.

The youth unemployment rate in Luxembourg has been oscillating around the threshold. In some years the indicator has risen above the threshold, whereas in other years it has remained below. Luxembourg was far below the threshold in 2017 (-6.8 p.p.).

Chart 33

Youth unemployment rate - % of active population aged 15-24 - 3 years change in p.p. (t, t-3)



Source: Eurostat, orange line = threshold of +2 p.p. set by MIP

Note: A Member State is considered to be at risk of imbalance if the growth rate exceeds +2 p.p. If the indicator is below this threshold, a Member State is not considered to be at risk.

⁵⁷ The youth unemployment rate is the percentage of unemployed individuals aged 15-24 in the active population of the same age bracket. The unemployment rate is the percentage of unemployed individuals in the active population (the total number of persons employed and unemployed), as per the International Labour Organization (ILO) definition. The term 'unemployed' covers individuals aged 15-74 who meet the following criteria: - unemployed during the reference week; - available to begin work within the following two weeks; - actively looking for a job during the four previous weeks or have found a job which they will start within the following three months.

The scoreboard indicator corresponds to the change in percentage points over a three-year period. The indicative threshold is +2 p.p. This indicator is based on the results of the EU's quarterly Labour Force Survey (LFS), which covers the resident population living in private households.

4.2.4.4 Interim conclusions

Based on the updated data used in this chapter, and pending the 2019 Alert Mechanism Report, issued in November 2018 by the European Commission, we note that Luxembourg has exceeded 2 thresholds:

- ▼ The consolidated private sector debt;
- ▼ The variation in the activity rate of population aged 15-64.

Table 5
Summary table of the alert mechanism update, July 2018

	External imbalances					Internal imbalances						Employment indicators		
	Current account balance	Net international investment position	Real effective exchange rate	Export market share	Nominal ULC	Deflated house prices	Private sector credit flow*	Private sector debt*	General government sector debt	Unemployment rate	Total financial sector liabilities*	Activity rate	Long-term unemployment rate	Youth unemployment rate
LUX*	5.5	42.3	-1.1	20.4	7.9	4.1	7.2	354.9	23	6.1	7.5	-0.6	0.5	-6.8
Thresholds**	> -4% < +6%	> -35%	> -5% < +5%	> -6%	< +9%	< +6%	< +14%	< 133%	< 60%	< 10%	< +16.5%	> -0.2 p.p.	< +0.5 p.p.	< +2 p.p.

Source: European Commission, Eurostat

Notes: * Data 2017, except for the private sector credit flow, the private sector debt and the total financial sector liabilities (2016)

** Conditions for not being considered imbalanced (for some indicators these thresholds are different for the euro area Member States and for other Member States).

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5 The economic impact of the 5 new priority sectors

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5.1 Introduction

The Observatoire de la compétitivité (ODC) has carried out this study to produce a pool of statistics so as to better assess developments in the government's 5 new priority sectors, namely information and communication technologies (ICT), space technologies, logistics, health sciences and technologies and eco-technologies. The aim is to measure and analyse the economic impact of these new sectors on economic growth and employment.

Following an analysis of the available studies and the proposal of a single definition for each of the 5 sectors in question (see 2014 Competitiveness Report¹), it was possible to identify several indicators for monitoring the developments in the government's 5 new priority sectors.

5.2 Methodology

The results set out in this study were calculated based on the available data provided by STATEC and the RCS (Trade and Companies Register). While respecting the confidentiality rules applicable to STATEC data, the ODC calculated the value added at factor cost for each company according to the International Accounting Standards (IAS), namely the Commission Regulation (EC) 250/2009 of 11 March 2009².

The difference between the charts published in the current chapter and those of previous years can be explained primarily by the regular updating of annual business accounts and/or national accounts published by STATEC.

The data published in this 2018 Competitiveness Report date from the years prior to and including 2016, according to the availability of data. Therefore, they do not take into account more recent projects or stakeholders implemented in these priority sectors.

Finally, this study only analyses businesses in the private sector with headquarters in Luxembourg and whose main activities can be considered as directly linked to the 5 new priority sectors.

¹ <https://odc.gouvernement.lu/fr/publications/rapport-etude-analyse/perspectives-politique-economique/perspectives-politique-economique-29.html>

² Value added at factor cost refers to 'turnover, plus capitalised production, plus other operating income (including operating subsidies), plus or minus the changes in stocks, minus the purchases of goods and services, minus other taxes on products which are linked to turnover but not deductible, minus the duties and taxes linked to production'.

5.3 Macroeconomic indicators of the 5 new priority sectors

5.3.1 Information and communication technologies (ICT)

ICT is a cross-cutting tool for the economy. The sector, as initially defined in the 2014 Competitiveness Report, is composed of three categories of stakeholders³:

- ▼ ICT producers, according to the strict OECD or Eurostat definitions (electronic hardware and components, telecommunications, ICT services or software, etc.);
- ▼ Activities involving digital content, the existence of which is linked to the emergence of ICT (online services, video games, e-commerce, etc.);
- ▼ ICT users who use ICT to make productivity gains but whose activities pre-date the emergence of ICT (banks, insurance, automotive and aeronautics, distribution, administration and tourism, etc.).

This analysis draws upon two previously employed definitions:

- ▼ Strict definition: this definition includes the production of ICT hardware and software (manufacturing), the distribution of ICT products and services (commerce) and the provision of services to facilitate the use of ICT (service activities), on the basis of the OECD and Eurostat definitions of the ICT sector⁴;
- ▼ Broad definition: this definition is more difficult to pinpoint as it comprises other activities indirectly linked to ICT use, such as activities which are dependent upon the emergence of ICT, e.g. e-commerce, media and digital content.

Statistical analysis of ICT in the private sector is based upon activities which fall under the strict and broad definitions of the sector.

³ Sociétal no. 73, L'impact de l'économie numérique, 2011

⁴ OECD, Guide to measuring the information society, 2011

a) ICT (strict definition)

The strict definition of the ICT sector is underpinned by the analysis of activities listed in the European nomenclature of economic activities, NACE Rev. 2, based on the Eurostat definition (Table 1).

Activities	NACE Rev. 2 Code	Description
Manufacturing industries	26.110	Manufacture of electronic components
	26.120	Manufacture of loaded electronic boards
	26.200	Manufacture of computers and peripheral equipment
	26.300	Manufacture of communication equipment
	26.400	Manufacture of consumer electronics
	26.800	Manufacture of magnetic and optical media
Services industries	46.510	Wholesale of computers, computer peripheral equipment and software
	46.520	Wholesale of electronic and telecommunications equipment and parts
	58.210	Publishing of computer games
	58.290	Other software publishing
	61.100	Wired telecommunications activities
	61.200	Wireless telecommunications activities
	61.300	Satellite telecommunications activities
	61.900	Other telecommunications activities
	62.010	Computer programming activities
	62.020	Computer consultancy activities
	62.030	Computer facilities management activities
	62.090	Other information technology and computer service activities
	63.110	Data processing, hosting and related activities
	63.120	Web portals
	95.110	Wholesale of computers, computer peripheral equipment and software
	95.120	Wholesale of electronic and telecommunications equipment and parts

Table 2 lists several macroeconomic indicators showing how the ICT sector has developed since 2005.

Table 2
Indicators relating to the ICT services sector

ICT (strict definition)	2005	... 2007	... 2009	... 2011	2012	2013	2014	2015	2016
Number of companies	1,357	1,497	1,618	1,755	1,838	1,960	2,054	2,203	2,266
	5.1%	5.3%	5.3%	5.4%	5.5%	5.6%	5.7%	6.0%	6.1%
Number of people employed	10,467	12,458	13,888	15,022	15,353	15,833	16,493	16,726	17,319
	3.4%	3.7%	3.9%	4.1%	4.0%	4.1%	4.2%	4.1%	4.1%
Number of salaried workers	10,303	12,309	13,722	14,816	15,169	15,613	16,252	16,429	16,955
	3.5%	3.9%	4.1%	4.2%	4.2%	4.3%	4.3%	4.3%	4.3%
Value added at factor cost (in EUR million)	1,593.4	1,887.3	2,186.1	2,766.1	2,853.3	2,989.7	3,520.8	3,459.4	3,242.5
	6.0%	5.8%	6.7%	7.2%	7.3%	7.3%	8.0%	7.5%	6.8%
Turnover (in EUR million)	5,398.0	6,064.7	6,635.9	9,694.2	11,487.2*	14,652.6	17,226.8	16,767.0	14,313.1
Staff costs (in EUR million)	629.6	802.3	920.1	1,074.1	1,079.1	1,139.2	1,210.1	1,268.8	1,304.5
Gross investment in tangible goods (in EUR million)	125.7	340.8	454.6	649.3	628.7	336.1	928.5	611.2	346.5
Turnover per employee (in EUR million)	515.7	486.8	477.8	645.3	745.7	925.4	1,044.4	1,002.4	826.4
Apparent labour productivity (gross value added per employee) (in EUR million)	152.2	151.5	157.4	184.1	185.8	188.9	213.5	206.8	187.2
Investment rate (investment/value added at factor cost)	7.9%	18.1%	20.8%	23.5%	22.0%	11.2%	26.4%	17.7%	10.7%

Note : Aside from the 'number of companies' variable, which refers to the whole of the ICT industry (manufacturing and service providers), all other above indicators refer only to ICT services due to the confidential nature of data relating to ICT manufacturing activities (3 companies).

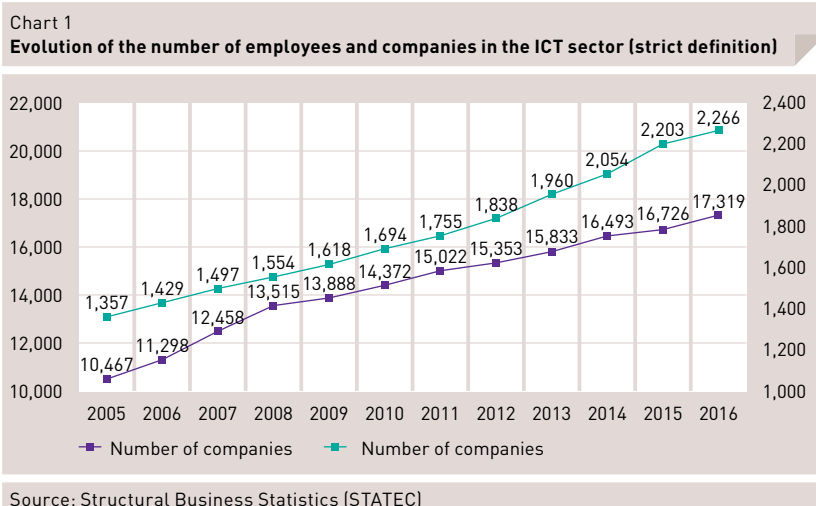
The percentages shown in italics represent the sector's share of the total indicator for Luxembourg.

* Break in the series due to the reclassification of certain companies.

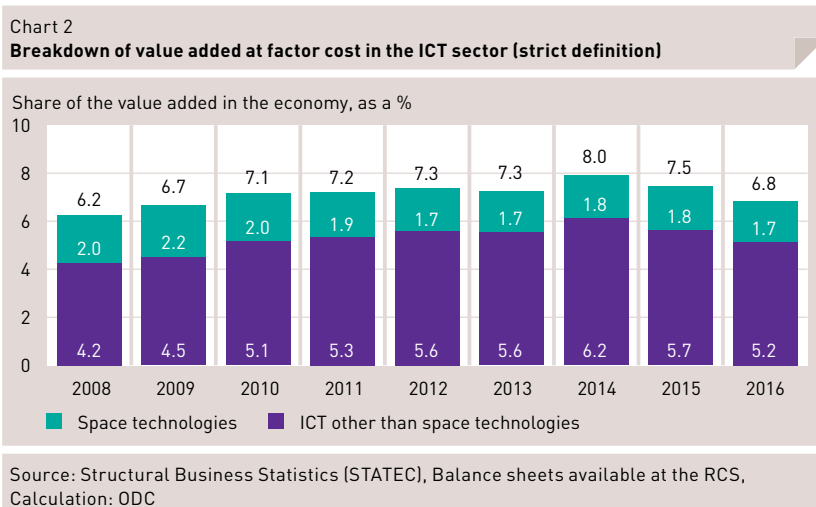
Source: Structural Business Statistics (STATEC)

Between 2015 and 2016, the number of businesses active in the ICT sector has increased considerably: in 2005 there were 1,357 listed ICT companies, a figure which had risen to 2,266 by 2016 (+67%, i.e. an average annual growth rate of +4.8%), with the strongest growth (+7.3%) registered between 2015 and 2016. In 2016 these companies, which represented 6.1% of the total number of companies in Luxembourg, employed 17,319 staff, which corresponded to 4.1% of workers employed in the country.

Following a sharp rise in the number of jobs in ICT before the crisis (2005-2008), recruitment in the sector has continued to increase (Chart 1). Between 2005 and 2016, the number of jobs has increased by 65.5%, with a more significant job growth (+3.5% between 2015 and 2016).



By the end of 2016, the 2,266 ICT companies were creating 6.8% of the value added of the Luxembourg economy, i.e. over EUR 3.2 billion (an increase of 104% compared to 2005, however constantly decreasing since 2014). 1.7% of this value added was generated by companies in the space technology sector, which fell under the Eurostat definition of ICT companies (see paragraph 5.3.2)(Chart 2).



Telecommunications activities (most of which are represented by the space technologies sector) created most of the value added for the whole ICT sector in 2016 (47.5%), on the rise compared to 2014 (46.8%). Programming, consultancy and other ICT activities and electronic games and other software production reached respectively 27.4% and 3.6% of the whole ICT sector (compared to 22.9% and 3.8% in 2014). In total, the ICT sector (strict definition) thus generated a gross value added of over EUR 3.2 billion and a turnover of over EUR 14.3 billion in 2016.

However, since 2014, there has been a drop in the turnover of the ICT sector. This phenomenon could be linked to a reduction in online purchases made by European consumers following the change to e-VAT regulations, or to the migration of part of the sector's large players' turnover to branches outside the country, and which formerly entered the accounts of Luxembourgish bodies, or even the permanent departure abroad of some companies. Despite the drop in turnover of these companies (approximately EUR 2.9 billion less than in 2014) and decrease of the generated value added, the ICT sector is in good shape if one takes into account the number of new companies and jobs created in the sector between 2014 and 2016. Indeed, in 2016, the sector represented 4.3% of the salaried jobs in the country (compared to 3.5% in 2005), i.e. practically 17,000 salaried jobs.

Jobs in the ICT sector are mainly concentrated in the ICT services (89.6%) and trade (10.2%) sectors. ICT manufacturing in Luxembourg only provides 0.2% of the total number of paid jobs in the sector⁵. However, while over half of the jobs in the sector were to be found in the domain of programming, consultancy and other ICT activities, with over 9,460 workers, these activities represented just 27.4% of the overall value added of the sector, i.e. nearly EUR 890 million and a turnover of around EUR 2.4 billion⁶. The 115 companies active in the production of electronic games and other software (+47.4% compared to 2014) produced 3.6% of the value added of the sector, i.e. EUR 118 million, a slight increase compared to 2015.

b) ICT (broad definition)

Content and media

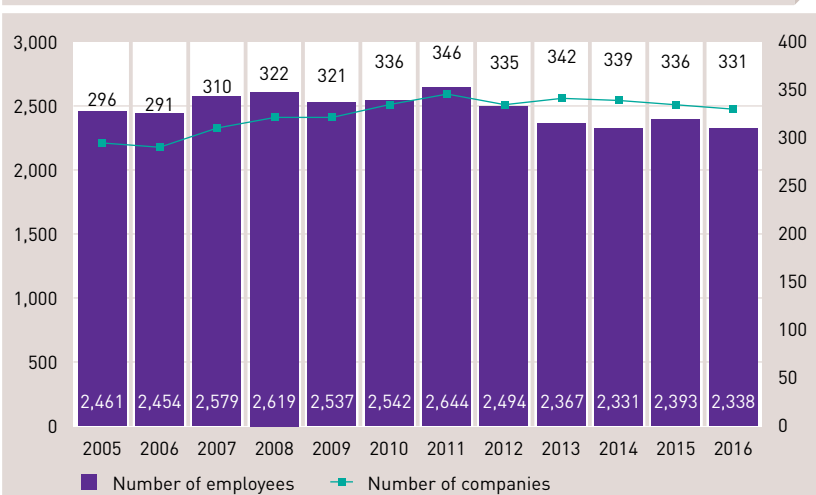
In addition to Eurostat's definition of the ICT sector, the ODC carried out analysis of ICT-related activities in a bid to gain a more comprehensive understanding of the sector and include activities whose existence is dependent upon ICT. Therefore, the sector which the OECD refers to as 'content and media' and Eurostat calls 'information services'⁷ was analysed. At the end of 2016 this sector featured 331 companies employing 2,338 staff and represented a gross value added of the country's economy of 0.5% (Chart 3). RTL Group is Luxembourg's major stakeholder in this sector (Chart 3).

⁵ Source: IGSS

⁶ Source: Structural Business Statistics (STATEC)

⁷ Definition of the 'information services' sector: NACE code 58.1 – Publishing of books, periodicals and other publishing activities, 59.1 – Motion picture, video and television programme activities, 59.2 – Sound recording and music publishing activities, 60.1 – Radio broadcasting, 60.2 – Television programming and broadcasting activities, 63.9 – Other information service activities.

Chart 3
Evolution of the content and media sector



Source: Structural Business Statistics (STATEC)

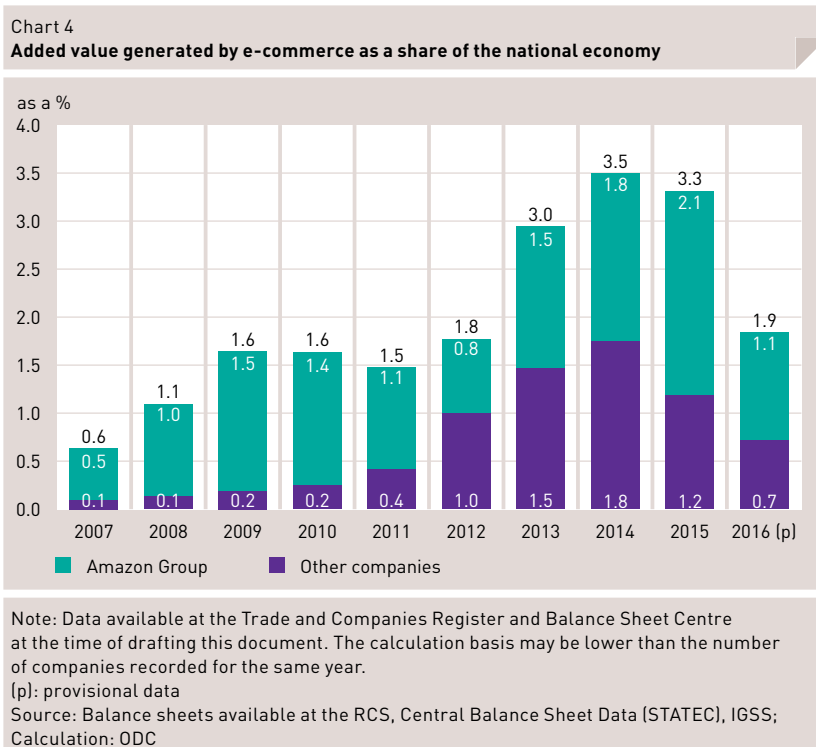
E-commerce

In addition to the 'content and media' activities, distance selling (e-commerce) should also be included as it is an activity which needs 'traditional' ICT infrastructure to exist. Such activities, very significant in Luxembourg's ICT landscape, deserve special attention in order to present the as complete snapshot as possible of the ICT sector. The e-commerce sector has grown exponentially since its arrival in Luxembourg, a country which, for several years, has been very attractive for e-commerce companies in spite of the recent departure of some large companies in the sector, e.g. Netflix, Kabam and Zynga.

In order to measure the economic characteristics of this sector, the Ministry of the Economy worked with the Ministry of State's Media and Communications Service to develop a list of key players in the sector. The list was based on a definition of e-commerce that included several activities such as distance selling, online gaming and financing (predominantly mobile payment) which are dependent upon e-commerce and could not exist without it. Since then, indicators related to the economic performance of the companies on this list have been monitored and updated so as to take the sector's new important players into account.

Following changes to regulation concerning distant selling (e-VAT) in the EU, entering into force on 1 January 2015, several companies left Luxembourg and a direct impact on the turnover of other ones was recorded, despite the increase in e-commerce activities. Thus, the effect of these regulatory changes has begun to be felt on the economic performance of companies in the sector in Luxembourg, namely those who continue exercising their activities from Luxembourg despite the legal changes.

The departure of large players has had an impact on the overall performance of the sector. The value added generated by this type of activity in 2016 continued to fall in absolute terms and represented under EUR 900 million, i.e. only 1.9% of the economy (Chart 4). Based on data collected by the Trade and Company Register and on calculations performed by the ODC, the Amazon Group remained the largest player in the sector in Luxembourg, now only generating 1.1% of the total value added in the economy. This decrease, compared to the last two years' share, can probably be attributed to regulatory changes beginning in 2016⁸. It is also the case for other companies who also witnessed the direct or indirect impact of these regulatory changes, following a possible drop in European consumers' online purchases or the migration of part of the turnover to other branches of the same groups abroad. Despite these developments, the number of employees in Luxembourg of the Amazon Group went from 880 in 2015 to 1,210 in 2016⁹.



Note that this analysis considers only those companies which were in the initially established list and whose main activity is e-commerce. In fact, the impact of this kind of activity is therefore larger than what is actually reported in this document.

⁸ Luxembourg could retain 30% of the VAT revenue in 2015 and 2016 from companies providing electronic services from Luxembourg and choosing to use the one-stop-shop system. For 2017 and 2018, the withholding rate dropped to 15%, and as from 2019, it will be 0%. Source: http://www.mf.public.lu/publications/programme/16e_progr_stabilite_croissance.pdf (p.18).

⁹ Source: List of the largest employers on 1st January 2003-2018 (STATEC)

ICT (broad definition)

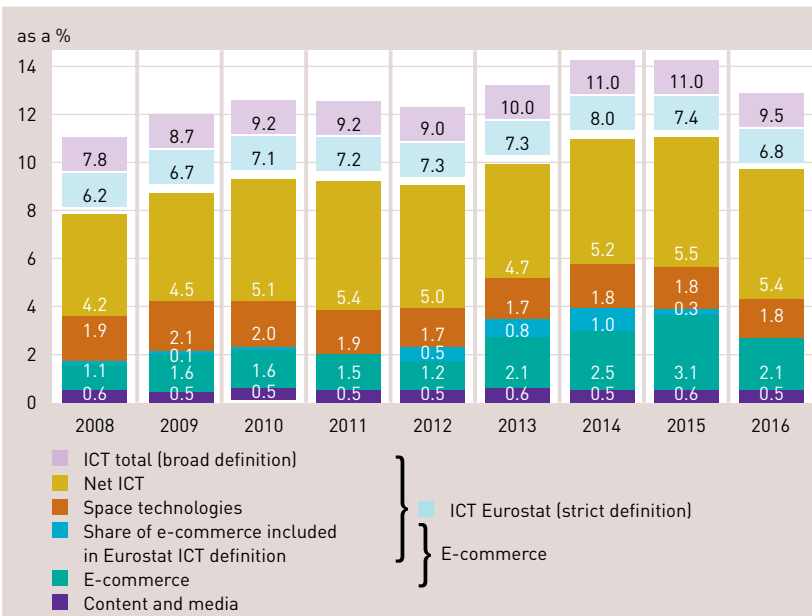
In order to appraise the ICT sector in its broader definition, it seems useful to add up the results of the different aspects to obtain a comprehensive overview of the sector. As a whole, the ICT sector employed 21,103 salaried workers (5.3% of the total salaried workforce) in 2,641 companies in Luxembourg (7.1% of companies) in 2016. Since 2005, the number of companies and the size of the salaried workforce increased by 59.1% and 65.4% respectively, with a respective annual growth rate of 4.3% and 4.7%.

The added value generated by the ICT sector as a whole is thus made of different sub-sectors. In 2016, the gross added value of ICT according to the Eurostat definition (including space technologies) was 6.8% (see section 5.3.2). However, by also including related activities such as e-commerce and the content and media sector, which are dependent on ICT, the figure was close to 9.5% of Luxembourg's economy.

2016 was therefore a good year for the ICT sector in absolute terms, namely in terms of company and job creation, despite a drop in turnover in some of the sector's companies. The value added generated is also impacted by this phenomenon: value added has been falling since 2014, reaching 6.8% of the economy according to Eurostat's ICT definition. The same downward trend can also be seen in the ICT sector (broad definition). Indeed, in 2016, it represented 9.5% of the country's value added (Chart 5).

Chart 5

Evolution of the share of ICT (broad definition) added value as a % of the economy as a whole



Calculation: ODC

5.3.2 Space technologies

The definition of the space sector which has been used in this study is an adaptation of the OECD definition: *'all activities and resources used which create and offer value and advantages to human beings in space exploration, management and use'*. Consequently, the space economy taken on for Luxembourg includes private sector players' activities *'involved in the development, supply and use of space-related products and services, ranging from research and development and the manufacturing and use of space infrastructure (ground stations, launchers and satellites) to applications for space components (navigation equipment, satellite telephones, weather service) and to scientific knowledge generated by these activities'*. The areas of application for space technologies are satellite communication, satellite navigation, satellite earth observation, space exploration and space science.

In 2016, the sector comprised 19 companies employing 653 individuals (Table 3), with 498 people employed by SES group, by far Luxembourg's largest employer in the sector (76.2% of total jobs in the sector).

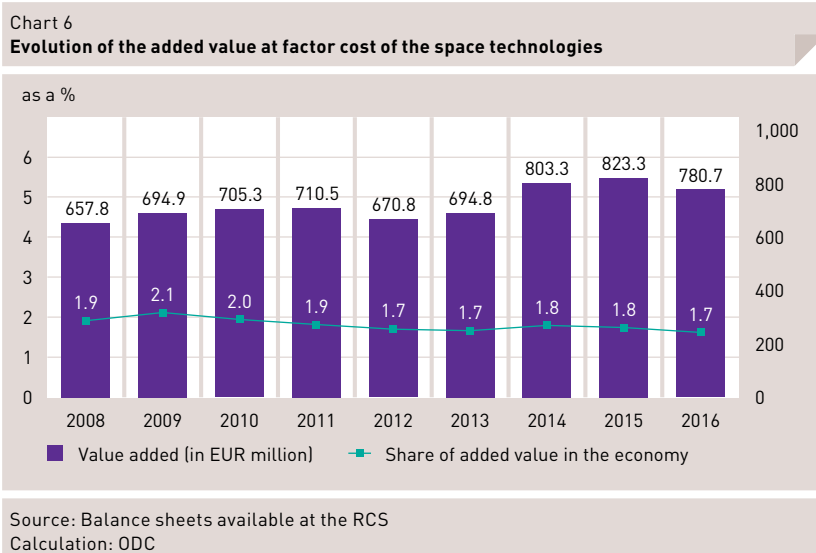
Table 3

Space technologies sector indicators – Private sector

Space technologies	2008	2009	2010	2011	2012	2013	2014	2015	2016 (p)
Number of companies	14	14	16	16	16	18	18	19	19
	<i>0.1%</i>	<i>0.1%</i>	<i>0.1%</i>	<i>0.1%</i>	<i>0.1%</i>	<i>0.1%</i>	<i>0.1%</i>	<i>0.1%</i>	<i>0.1%</i>
Number of employees	-	-	596	597	639	634	598	618	653
	-	-	<i>0.2%</i>	<i>0.2%</i>	<i>0.2%</i>	<i>0.2%</i>	<i>0.2%</i>	<i>0.2%</i>	<i>0.2%</i>
Value added at factor cost (in EUR million)	657.8	694.9	705.3	710.1	670.8	694.8	803.3	823.3	780.7
	<i>1.9%</i>	<i>2.1%</i>	<i>2.0%</i>	<i>1.9%</i>	<i>1.7%</i>	<i>1.7%</i>	<i>1.8%</i>	<i>1.8%</i>	<i>1.7%</i>
Sample size:	8	10	10	14	16	16	17	19	19

Note: The percentages in italics show the share of the sector in the overall value of the indicator for Luxembourg. Employment data was not available for the years 2008 and 2009. Information on the value added of the sector is available only for the number of companies mentioned under 'sample size'. Estimates of the share of jobs and value added generated by space technologies were made based on estimates provided by companies during personal interviews and/or via targeted questionnaires. (p): provisional data
Source: Balance sheets available at the RCS, STATEC.
Calculation: ODC

That same year these 19 companies generated nearly 1.7% of Luxembourg value added, which amounts to over EUR 780 million (+18.7% compared to 2008, or an annual growth rate of +2.2%). Although new operators have recently established premises in Luxembourg, in 2016 almost all the value added has been generated by the SES group (Chart 6).



Since the creation of SES in 1985 telecommunications and media capabilities via satellite and corresponding land infrastructure have generated most of the growth in the space sector in Luxembourg. While this aspect remains dominant for the moment, it is now offset by the recent arrival of new operators in the domain of earth observation, and more specifically geo-information services. Luxembourg's activities in the domains of space exploration and the use of spatial resources are also gaining ground.

5.3.3 Logistics

The analysis of the economic impact of the logistics sector only focuses on aspects linked to freight transport, thus excluding passenger transport and removal activities. Therefore, the indicators shown below are based on logistics activities as defined in the NACE, which refer to a company's main activity (Table 4).

Table 4
Overview of logistics sector activities

NACE Rev. 2 Code	Description
49.200	Freight rail transport
49.410	Freight transport by road
50.200	Sea and coastal freight water transport
50.400	Inland freight water transport
51.210	Freight air transport
52.100	Warehousing and storage
52.210	Service activities incidental to land transportation
52.220	Service activities incidental to water transportation
52.230	Service activities incidental to air transportation
52.240	Cargo handling
52.290	Other transportation support activities
53.200	Other postal and courier activities

It must be noted that this definition does not consider companies with a large logistical activity component that is not their core field of activity, and that are consequently classified under other NACE codes (such as Champ Cargosystems, CTI Systems, FANUC, RAK Porcelain, Amazon or even NSPA, just to name a few).

Table 5 displays a selection of the macroeconomic indicators analysed for the logistics sector. Since 2011, the number of companies active in the goods transport sector has fallen (717 companies in 2016 compared to 746 in 2011). However, the value added generated in 2016 by these companies was above EUR 1.1 billion, one of the highest figures recorded in the logistics sector in Luxembourg. Its peak was reached in 2015. Simultaneous to the growth in the number of jobs in the sector, since 2009, there has been an increase of productivity in these companies.

Table 5

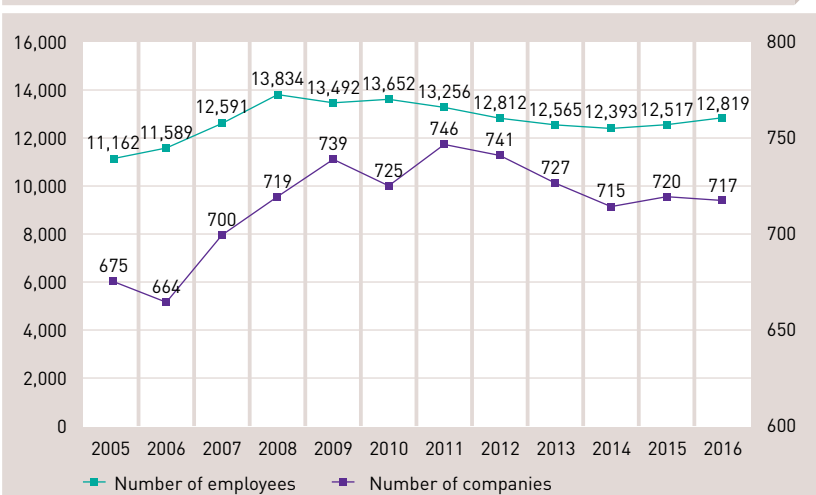
Logistics sector indicators – Private sector

Logistics	2005	... 2007	... 2009	... 2011	2012	2013	2014	2015	2016
Number of companies	675	700	739	746	741	727	715	720	717
	2.5%	2.5%	2.4%	2.3%	2.2%	2.1%	2.0%	2.0%	1.9%
Number of employees	11,162	12,591	13,492	13,256	12,812	12,565	12,393	12,517	12,819
	3.6%	3.8%	3.8%	3.6%	3.4%	3.3%	3.1%	3.1%	3.1%
Number of salaried workers	10,995	12,454	13,285	12,975	12,635	12,458	12,275	12,397	12,698
	3.8%	3.9%	4.0%	3.7%	3.5%	3.4%	3.3%	3.2%	3.2%
Value added at factor cost (in EUR million)	765.8	817.3	673.1	800.0	824.3	859.8	998.9	1,149.8	1,134.9
	2.9%	2.5%	2.0%	2.1%	2.1%	2.1%	2.3%	2.5%	2.4%
Turnover (in EUR million)	2,696.8	3,434.3	3,048.8	3,850.8	3,742.9	3,843.6	4,396.5	4,433.8	4,343.7
Staff costs (in EUR million)	485.1	564.0	623.3	653.3	653.8	657.1	673.9	687.2	711.2
Gross investment in tangible goods (in EUR million)	80.7	185.2	85.9	67.0	567.3	371.9	442.5	428.9	326.8
Turnover per employee (in EUR million)	241.6	272.8	226.0	290.5	292.1	305.9	354.8	354.1	338.8
Apparent labour productivity (gross added value per employee) (in EUR million)	68.6	64.9	49.9	60.4	64.3	68.4	80.6	91.8	88.5
Investment rate (investment/added value at factor cost)	10.5%	22.7%	12.8%	8.4%	68.8%	43.3%	44.3 %	37.3 %	28.8 %

Note: Percentages in italics refer to the sector's share of the total indicator figure for Luxembourg.
Source: Structural Business Statistics (STATEC)

Between 2005 and 2016, there were 12,800 people employed in this sector, i.e. an increase of 14.8% (annual growth rate of 1.3%), a figure that has risen constantly since 2014 (Chart 7).

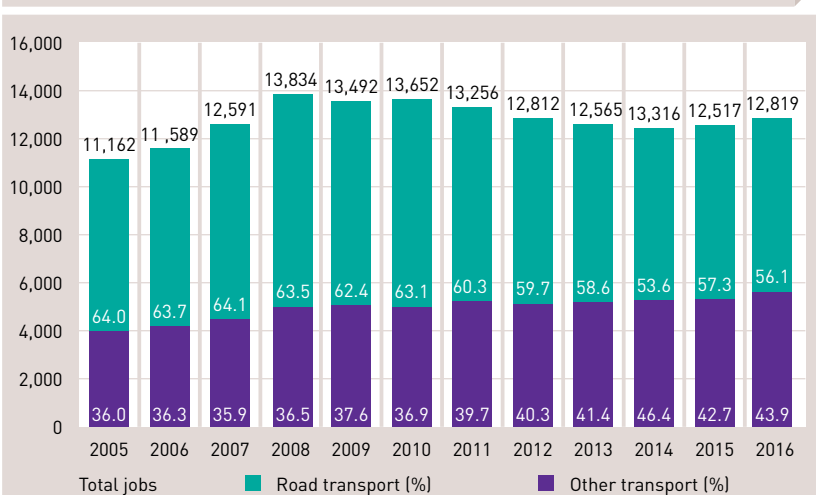
Chart 7
Evolution of the number of employees and companies in the logistics sector



Source: Structural Business Statistics (STATEC)

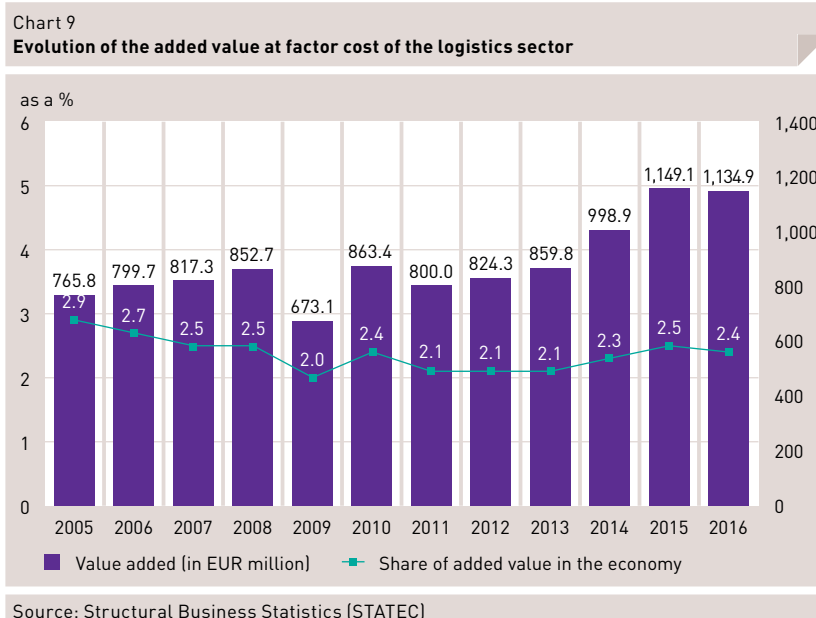
Whereas road freight transport represented 64% of the jobs in the sector in 2005 (employees), but only 56.1% in 2016, other freight transport activities have experienced constant growth since 2005 (Chart 8). The number of companies providing transportation support activities has increased continually, going from 153 companies in 2006 to 201 in 2016. Despite a renewed rise in jobs in the sector of road transportation between 2014 and 2016 (+115 salaried jobs), the share of jobs in road transport within the logistics sector has been falling since more jobs were created in the field of services with strong value added and other related services (from 36% to 43.9% between 2005 and 2016), in line with the sector's strategic objectives.

Chart 8
Evolution of the share of workers in the logistics sector



Source: Structural Business Statistics (STATEC), Calculation: ODC

The turnover generated in 2016 by the logistics sector surpassed EUR 4.3 billion. The value added also increased considerably in absolute terms over the past years, reaching more than EUR 1.1 billion in 2016, i.e. 2.4% of the value added generated in Luxembourg (Chart 9).



In 2016, the logistics sector consisted of 414 road freight transport companies (57.7% of the sector's companies producing 35.1% of the sector's added value, compared to 60% and 36.7% respectively in 2014), 201 others providing auxiliary transport services and a further 66 companies engaged in postal and courier activities (compared to 51 in 2014, i.e. an increase of +29.4%). In addition, there were 6 air transport companies and one firm providing rail freight services (CFL Cargo) and 6 warehousing and storage companies. Cargolux Airlines International SA, the leader in air freight, accounted for over 36.9% of 2016 sector's turnover.

That same year, the turnover for road freight transport companies was over EUR 1.2 billion, with a growth in the value added generated, reaching practically EUR 400 million as a consequence (Table 6). In 2016, these companies represented 1.7% of total employment with 7,252 employees. On the other hand, the number of companies providing transportation support activities have continued to grow since 2006, reaching a total of 201 companies in 2016 (compared to 160 in 2005).

Table 6 Road freight transport indicators									
Road freight transport	2005	... 2007	... 2009	... 2011	2012	2013	2014	2015	2016
Number of companies	433	453	483	482	468	445	429	423	414
Number of employees	7,141	8,066	8,416	7,991	7,647	7,361	7,131	7,169	7,252
Number of salaried workers	7,030	7,976	8,260	7,761	7,520	7,298	7,072	7,098	7,187
Value added at factor cost (in EUR million)	338.8	379.8	358.9	366.7	367.5	351.1	366.5	395.8	398.1
Turnover (in EUR million)	898.1	1,077.8	1,037.2	1,209.5	1,187.3	1,177.9	1,186.5	1,209.3	1,233.5
Source: Structural Business Statistics (STATEC)									

5.3.4 Health sciences and technologies

According to the initial definition of the sector in 2008, it was described as being composed of companies whose activities were related to 'health technologies'. Later, the sector was then broadened to include the bio-medical field, as well as the outcomes and synergies between sectors and technologies.

In 2016 there were around 30 companies and more than 668 workers in this sector; almost quadruple the numbers recorded in 2008 (Table 7). At the same time, the value added generated had reached EUR 105 million and had nearly tripled since 2008 and reached 0.22% of the overall value added of the national economy.

These figures do not take into account considerable efforts made over the past years in the public sector, including in public research in health sciences and technologies, such as at the University of Luxembourg, more specifically at the Luxembourg Centre for Systems Biomedicine (LCSB) and the Life Sciences Research Unit (LSRU), the Luxembourg Institute of Health (LIH), which now hosts the Integrated Biobank of Luxembourg (IBBL), and the National Health Laboratory (Laboratoire National de Santé) (LNS). The number of employees in these institutes totalled approximately 880 in 2016, whereas in 2005, there were only 480 of them. This represents an increase of 83%.

Table 7 Indicators for the health sciences and technologies sector - private sector									
Health sciences and technologies	2008	2009	2010	2011	2012	2013	2014	2015	2016
Health sciences and technologies	17	19	22	29	31	30	29	33	32
	<i>0.06%</i>	<i>0.06%</i>	<i>0.07%</i>	<i>0.09%</i>	<i>0.09%</i>	<i>0.09%</i>	<i>0.08%</i>	<i>0.09%</i>	<i>0.09%</i>
Number of companies	168	202	233	473	552	572	599	627	668
	<i>0.05%</i>	<i>0.06%</i>	<i>0.07%</i>	<i>0.14%</i>	<i>0.16%</i>	<i>0.16%</i>	<i>0.16%</i>	<i>0.16%</i>	<i>0.17%</i>
Number of salaried workers (in EUR million)	37.7	38.4	39.5	49.0	65.7	100.4	76.6	90.2	105.7
	<i>0.11%</i>	<i>0.12%</i>	<i>0.11%</i>	<i>0.13%</i>	<i>0.17%</i>	<i>0.24%</i>	<i>0.17%</i>	<i>0.19%</i>	<i>0.22%</i>
Sample size:	9	10	11	24	27	26	26	33	27

Note: The percentages in italics denote the share of the sector in the total value of the indicator for Luxembourg. Information on numbers of employees and the added value of the sector is only available for the number of companies listed in the 'sample size' row. Numbers of employees were not available.
Source: Balance sheets available at the RCS, STATEC and IGSS, Calculation: ODC

5.3.5 Eco-technologies

a) Eco-technology producers

In 2012 a first list of companies active in the eco-technologies sector was drawn up by sector's national experts. It included 134 companies 'producing' eco-technologies that were involved in the sector in varying degrees:

- a) The eco-technologies sector, under the strict definition of the term, consisted of 30 companies. The main activity of these companies was oriented towards developing and selling products and services aimed at measuring, preventing, limiting or redressing environmental impacts and reducing the consumption of natural resources whilst still meeting the same needs as traditional techniques;
- b) 104 companies were developing eco-technologies focussed on clean production, without necessarily being part of the eco-technologies sector (e.g. Bétons Feidt, Goodyear, Paul Wurth, etc.). These eco-activities covered all goods and services production tasks which support environmental protection and rational management of natural resources.

In addition to these two categories, many companies in Luxembourg may be considered as 'environmentally responsible' since considerable efforts have been made to protect the environment through strict regulations. Furthermore, SuperDrecksKëscht, an initiative with almost 3,600 affiliate companies directly involved in the optimal management of waste (and which can thus be considered 'environmentally responsible'), was recognised as an example of 'best practice' in Europe¹⁰.

Since then, the updated list has permitted the monitoring of indicators related to the sector. Today, the eco-technologies sector (in the strict definition of the term) remains small. The 33 companies in the sector whose main activity is related to the development of eco-technologies and their 634 employees produced practically 0.2% of Luxembourg's gross value added in 2016, i.e., an increase of 150% of the value added generated between 2008 and 2016 (Chart 8).

¹⁰ <https://www.sdk.lu/index.php/fr/a-propos-de-nous>

Table 8

Indicators relating to the eco-technologies sector (strict definition) – Private sector

Eco-technologies	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of companies	22	22	24	29	32	35	37	38	33
	<i>0.07%</i>	<i>0.07%</i>	<i>0.08%</i>	<i>0.09%</i>	<i>0.10%</i>	<i>0.10%</i>	<i>0.10%</i>	<i>0.10%</i>	<i>0.09%</i>
Number of salaried workers	497	543	535	569	579	637	640	621	634
	<i>0.15%</i>	<i>0.16%</i>	<i>0.16%</i>	<i>0.16%</i>	<i>0.16%</i>	<i>0.18%</i>	<i>0.17%</i>	<i>0.16%</i>	<i>0.16%</i>
Value added at factor cost	27.7	23.9	19.2	39.9	36.1	40.1	37.6	54.4	69.2
(in EUR million)	<i>0.08%</i>	<i>0.07%</i>	<i>0.05%</i>	<i>0.10%</i>	<i>0.09%</i>	<i>0.10%</i>	<i>0.09%</i>	<i>0.12%</i>	<i>0.16%</i>
Sample size:	10	10	13	26	30	22	33	34	32

Note: Percentages shown in italics represent the sector's share of the total indicator figure for Luxembourg. Information pertaining to the number of salaried workers and the sector's added value was only available for the companies included in the 'sample size'. Data on employee numbers were not available

Source: Balance sheets available at the RCS, STATEC and IGSS, Calculation: ODC

The number of companies producing eco-technologies (strict definition) and the share of the national value added still remain low in spite of the fact that these companies have created several hundred jobs. However, the figures do not include companies that are developing eco-innovative products, such as Goodyear and Arcelor, but cannot be included in the sector as this is not their primary activity.

b) Eco-technology users

Whilst the previous section of the analysis only covers companies whose principal activity is the development of new technologies with a view to fulfilling sustainable development goals, several other companies make use of these technologies. Given the growing importance of the development of environmentally friendly processes and products, several companies in a wide range of different sectors are developing innovative products or processes which have a positive impact on the environment whilst also improving the efficiency and productivity of the company's internal processes. Such activities are analysed by STATEC in the context of the environmental goods and services sector (EGSS), collected by Eurostat. Production activities of goods and services seeking to prevent, measure, control, limit, minimise or redress environmental damage and the depletion of natural resources are measured. According to the last available data, such activities represented in 2015 almost 1.8% of the Luxembourg's gross added value across all sectors of the nation's economy and accounted for more than 9,200 jobs. This industrial sector, as a whole, produced the lion's share (57.1%) of the gross added value of the EGSS (Table 9).

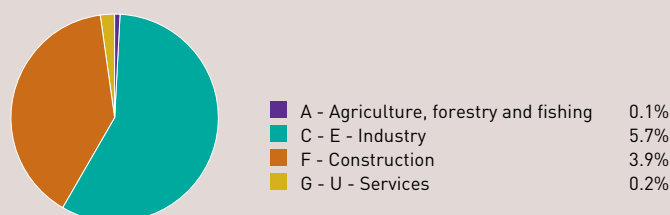
Table 9 EGSS data								
EGSS data	2008	2009	2010	2011	2012	2013	2014	2015
Production	1,766.4	1,406.3	1,592.2	1,757.9	1,710.3	1,760.9	1,883.3	1,927.0
(in EUR million)	<i>1.6%</i>	<i>1.4%</i>	<i>1.4%</i>	<i>1.4%</i>	<i>1.3%</i>	<i>1.2%</i>	<i>1.1%</i>	<i>1.0%</i>
Gross added value	649.4	591.6	700.9	747.5	732.2	767.8	830.6	821.1
(in EUR million)	<i>1.9%</i>	<i>1.8%</i>	<i>2.0%</i>	<i>1.9%</i>	<i>1.9%</i>	<i>1.9%</i>	<i>1.9%</i>	<i>1.8%</i>
Employees	10,474.3	8,963.2	9,692.0	9,779.7	9,798.1	9,646.1	9,677.4	9,224.5
(EPT)	<i>3.0%</i>	<i>2.5%</i>	<i>2.7%</i>	<i>2.6%</i>	<i>2.6%</i>	<i>2.5%</i>	<i>2.4%</i>	<i>2.3%</i>

Note: Percentages shown in italics represent the sector's share of the total indicator value for Luxembourg.
FTE = full-time equivalents
Source: STATEC

In 2015, the construction sector was the highest contributing sector (composed of one section only, represented by one 'letter') with 38.6% of the gross value added in terms of environmental goods and services¹¹ (Chart 10).

¹¹ The definition of this industry covers all activities to do with the manufacturing, production and distribution of electricity, gas, steam and conditioned air as well as water production and distribution activities, sanitation, waste management and pollution control.

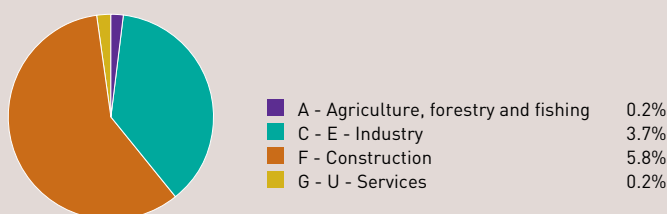
Chart 10
Breakdown of gross added value linked to environmental goods and services by branch, 2015



Source: STATEC

As regards employment, these proportions were similar between industry and construction accounting for 36.7% and 58.4% of EGSS jobs respectively in 2015. This demonstrates the intensity of EGSS jobs in the construction sector (Chart 11).

Chart 11
Breakdown of jobs linked to EGSS per branch, 2015



Source: STATEC

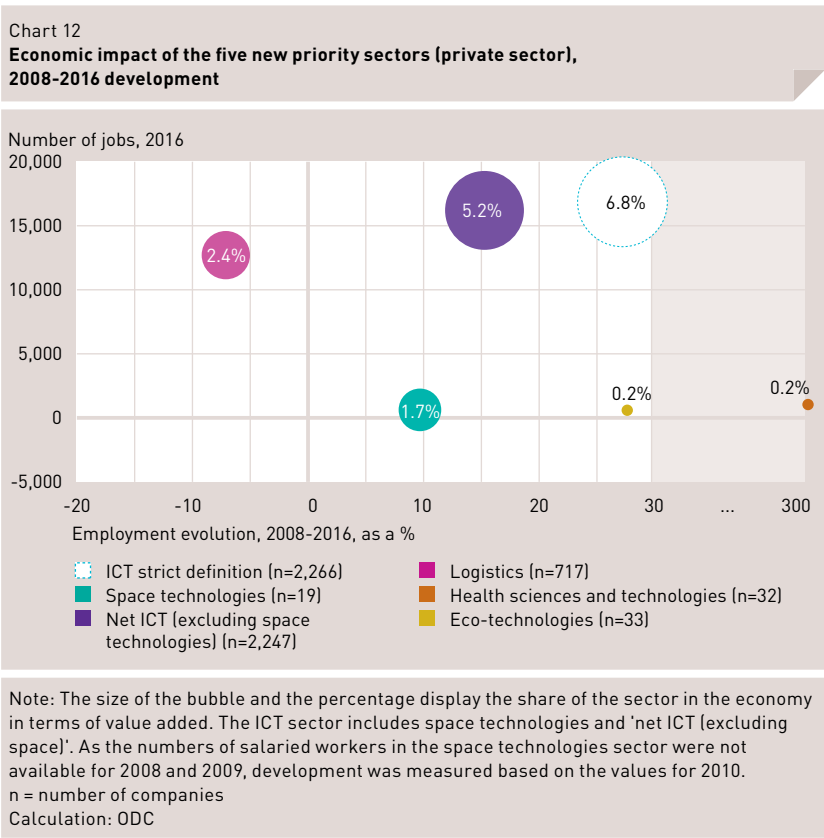
In addition to the development of the eco-technology sector, eco-innovation enables greater competitiveness in all sectors, especially via a circular economy approach aiming to decouple growth from the use of raw materials and thereby reduce companies' exposure to price volatility. In a 2014 study, the Ministry of the Economy concluded that currently at least 7,000 jobs in Luxembourg would be dependent upon the circular economy¹². By further developing the circular economy, Luxembourg could create numerous jobs in the years to come and make substantial savings on the cost of raw materials.

¹² https://gouvernement.lu/dam-assets/fr/actualites/communiqués/2015/02-fevrier/09-closer-economie/Presentations-a-la-Chambre-de-Commerce_9-fevrier-2015.pdf

5.4 Conclusions

In 2016, the 5 new priority sectors for the private sector (not the public sector), according to their strict definitions, accounted for 9.6% of the value added of the national economy and nearly 31,000 salaried jobs in 3,047 companies.¹³

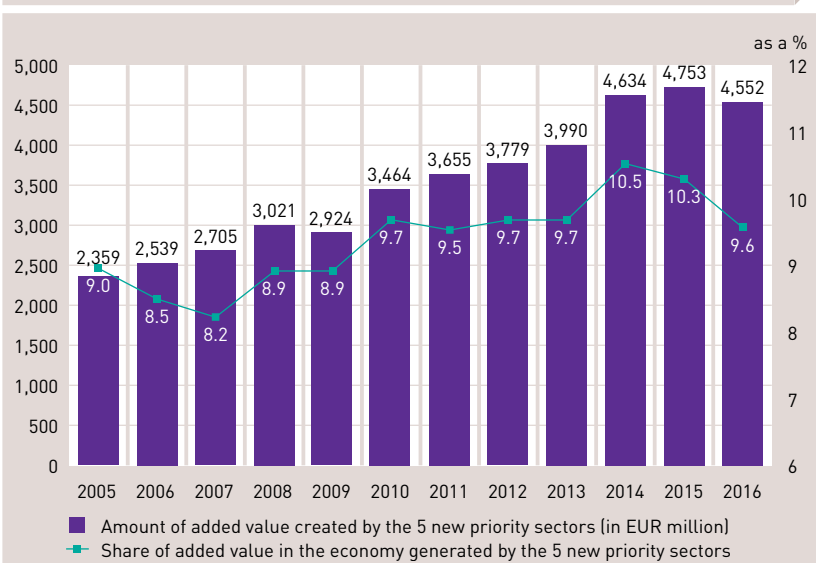
ICT was by far the ‘new sector’ which has generated the most value added and created the most new jobs in the economy, followed by logistics and space technologies. Although the number of jobs has increased consistently since 2008 in 4 of the 5 new sectors, the logistics sector has recorded until 2014 a slight drop in the number of jobs, mainly due to the decline of road freight transport following stiff international competition in the sector. The sector is recovering since then (Chart 12).



In absolute terms, the value added generated by the 5 new priority sectors (strict definition) has grown consistently between 2005 and 2015, with the exception of 2009 (following the economic and financial crisis). In 2016 there was a slight decrease in the generated added value, which reached EUR 4.5 billion, accounting for 9.6% of the total value added of the economy (Chart 13).

¹³ The data displayed in this chapter date from the years prior to and including 2016 and therefore do not yet take into account any more recent changes or projects, such as the recently launched ‘Space Resources’ initiative. <http://www.spaceresources.public.lu/en.html>

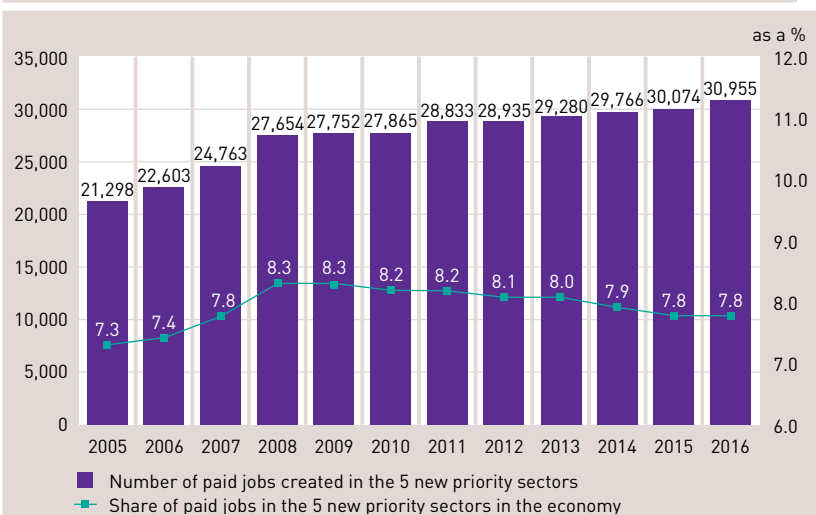
Chart 13

Evolution of the added value generated by the 5 new priority sectors, private sector

Calculation: ODC

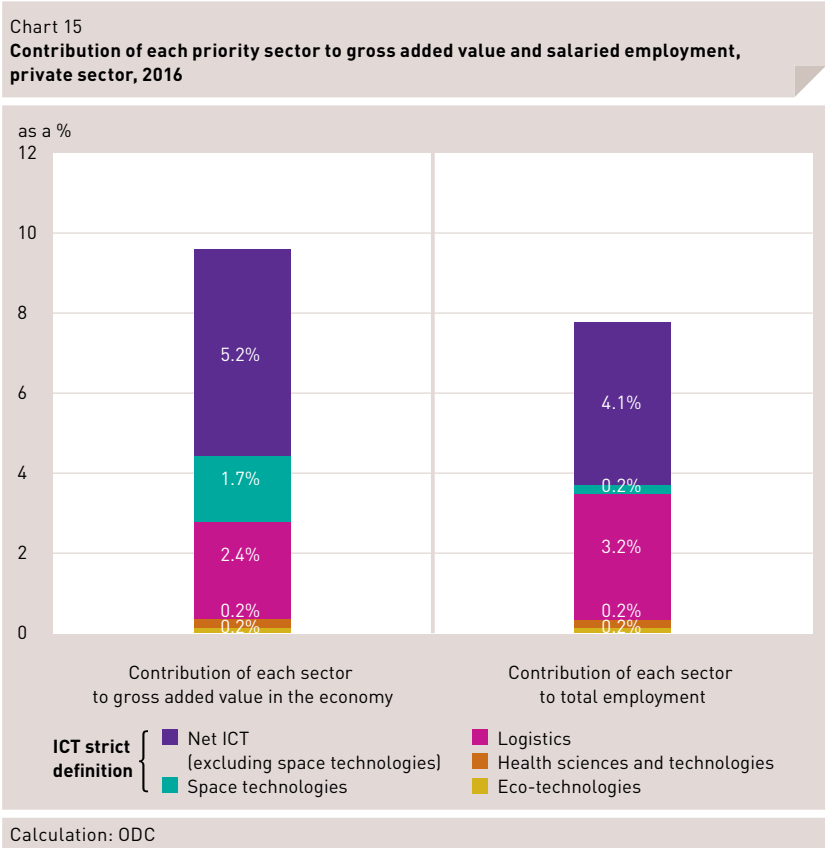
The number of jobs has been steadily rising since 2005 and reached almost 31,000 salaried jobs in 2016 across the 5 priority sectors under analysis, i.e. an increase of more than 9,650 jobs over an 11-year period. After three years of rapid growth between 2005 and 2008, new jobs recorded in these new sectors fell slightly to 7.8% of total jobs in Luxembourg in 2016 (Chart 14).

Chart 14

Evolution of the jobs created in the 5 new priority sectors, private sector

Calculation: ODC

The ICT sector, defined in the strict sense including space technologies, remained the main contributor to value added and jobs created in the 5 new priority sectors in 2016. ICT (strict definition) represented 6.8% of the gross value added to the economy and 4.3% of Luxembourg's total salaried employment. The logistics sector was in second place, accounting for 2.4% of gross value added and 3.2% of total jobs in Luxembourg. Currently the contribution made to these two macro-economic indicators by health sciences and technologies and eco-technologies remains low (Chart 15). Figures relating to e-commerce and media and content could be added and would register a value added of nearly 2 percentage points to the Luxembourg economy and account for almost half a percentage point of their share in the number of jobs created.



The main conclusions for each sector under analysis are outlined below. However, it should be borne in mind that the data used in this chapter refers to 2016. This means that the figures do not take into account more recent information and projects.

- ▼ In 2016 the **ICT** sector was the best-established of the 5 new priority sectors identified by the government and represented 6.8% of gross added value in the economy and 4.3% of Luxembourg's salaried employment. The number of jobs and ICT production companies based in Luxembourg and active in this sector, according to the strict definition, has grown continuously between 2005 and 2014, mainly due to public and private significant investment in creating high-quality infrastructure (data centres, broadband networks, etc.) and to a favourable business environment. However, since 2014, the turnover of companies has dropped, probably following recent regulatory changes to the EU's e-VAT system. There has been a decrease to the value added generated by several companies performing this type of activity, and other players have left the sector. This phenomenon also occurred in the field of e-commerce based in Luxembourg: until 2014, there was great growth in this area, but since then, its share has been dropping. A positive evolution may still be seen on the level of the creation of new companies and jobs in the sector, as well as in the growing number of ICT users across all sectors of the economy.
- ▼ The **space technologies** sector, which is an integral part of the definition of the ICT sector, is dominated by a major international operator: the SES group makes up almost the entirety of the sector. The government would like to strengthen its position in the sector by investing in flagship projects and supporting space research, particularly via the smaller companies which are also present in the Luxembourg space sector. Moreover, as part of the 'Space Resources' project, the government of Luxembourg has recently approved a law aiming to establish the country as a pioneer in space exploration and the use of space resources. One of the main aims of this law is to ensure legal security for economic operators and investors with regard to ownership of minerals and other valuable space resources. In so doing, Luxembourg is the first European country to establish a legal framework giving private operators guarantees regarding their rights over resources extracted in space.
- ▼ After a continual drop in the **logistics** sector between 2008 and 2014 due to increased international competition in road freight transport, jobs have been created in the road transport of goods as well as in the overall sector. Since 2015, the evolution in terms of generated value added has reached the highest levels recorded. In 2016, the sector generated practically 12,700 salaried jobs and EUR 1.13 billion in value added.
- ▼ Activities in the domain of **health sciences and technologies** were still very limited in the private sector. The number of active companies was small and the value added created remained small too. Therefore, a great deal of progress still needs to be made in adapting the regulatory framework to promote dynamism in the sector and develop and attract more private companies to the sector.

- ▼ The impact of the **eco-technologies sector** remains difficult to assess, as innovations in this sector are often subject to increasingly strict regulations. Although the number of companies producing eco-technologies remains very small in Luxembourg, the environment is becoming an increasingly important issue for both companies and households. The number of companies using eco-technologies has been increasing consistently for several years and attention paid to circular economy has been rising steadily in Luxembourg.

Note that it is quite difficult to compare (benchmark) these sectors due to their numerous different characteristics. For example, levels of maturity vary widely depending on the sector. While the ICT and logistics sectors are well-established priority sectors for over a decade, other sectors which depend heavily on R&D such as space technologies, health sciences and technologies and eco-technologies became priorities at a much later stage. Therefore, while the health sciences and technologies sector has mainly developed in the public domain so far, the eco-technologies sector has developed along rather different lines. Although the number of companies producing eco-technologies based in Luxembourg remains very small, Luxembourgish companies are experiencing a change in mind-set in terms of the attention they pay to the environment and to the use of resources. For example, they are trying to reduce the energy and environmental impact caused by their operations by developing production methods for goods and services which use of eco-technologies to prevent, measure, check, restrict, minimize or counteract environmental damage and the using up of natural resources. The macroeconomic impact is therefore indirect rather than direct, as more efficient production is ensured. Moreover, other factors such as R&D activities or the current regulatory framework have bolstered or hampered the development of certain sectors in comparison to others in relation to the macroeconomic indicators taken into consideration in this analysis.

6 The level of diversification of the Luxembourgish economy

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6.1 Introduction

This chapter describes the evolution of the structure and level of diversification of the Luxembourgish economy since 1995. It is in part based on L. Bertinelli's and E. Strobl's analysis of the country's sectoral diversification, which was published in the 2007 Competitiveness Report.

6.1.1 Objectives and contents

The subject matter is addressed on a macroeconomic level, by presenting the size and share of the various branches in terms of value added generated in the economy. Specific attention is paid to the development of diversification, which is measured by means of a concentration index. The descriptive analysis reflects the situation over the years and does neither address the problem related to the optimisation of the structure of the economy nor sectoral productivity issues. Accordingly, the study does not proceed to an assessment of the diversification policies undertaken by the various Luxembourgish governments, nor does it aim to provide political, strategic or economic recommendations regarding the structure of the national economy.

The introduction is completed by explanations on the notion of diversification, namely its determinant factors and related stakes. Afterwards, the methodology applied is described and evaluated. The analysis section begins with an explanation concerning the diversification of the overall Luxembourgish economy, before moving on to a detailed analysis of three representative sections of the national economy, i.e. financial and insurance activities, manufacturing and knowledge-intensive services. Finally, an international comparison is provided in order to compare the level of overall diversification in Luxembourg and that of the European Union (EU), its Member States and other selected European countries. To conclude, the main results are summarised.

6.1.2 Notions of diversification

In his definition, Berthélemy (2005) states that an *'economy is described as diverse if its productive structure is distributed across a large number of different activities, in terms of the nature of the goods and services produced'*. However, the concept of diversification is not exclusively limited to production. Indeed, it can also be applied to other macroeconomic variables, such as employment, trade exchanges and partnerships, or even value added.

Basically, the stakes in this matter are related to the polarity between the mitigation of risks by means of the diversification of the economic fabric and the exploitation of scale returns through specialisation in a small number of sectors in which a given country has comparative advantages. A more diverse economy is believed to be less vulnerable to cyclical downturns, and more resilient in the event of external shocks, as well as less prone to being affected by technological changes or the arrival of new competitors on the market. Berthélemy points out that these arguments in favour of diversification are in contradiction with the teachings of pure international trade theory, which indicates that specialisations according to comparative advantages promote economic efficiency and permit the maximisation of the well-being of a given economy. Moreover, to complement this statement, the author refers to the concept of a diversified specialisation, in which the accumulation of know-how can lead to greater diversification. For more advanced technological products that are intensive in both terms of financial and human capital, a country can export a highly diversified range of products while respecting its own comparative advantages in each of its bilateral trade relations. In this type of situation, a higher level of development would be associated to a greater level of diversification, without being in conflict with the theory of comparative advantages that advocates specialisation. As far as the size of a country is concerned, Berthélemy notes that *'if small countries tend to trade more than large countries – all things being equal – it is normal that their economic activity should be more concentrated, because they do not have a market allowing them to expand the diversity of their activities like large ones do, namely in relation to production factors.'* For small countries, Bertinelli and Strobl add that excessive specialisation incurs significant constraints when it comes to striking the right balance between the exploitation of returns of scale and the adequate mitigation of risks. These authors also state that dependence on a dominant sector is not necessarily cause for concern, as long as the yield of the dominant sector exceeds the risk of encountering a sectoral shock.

Based on the challenges of a small and very open economy such as Luxembourg, which is also relatively poor in natural resources, diversification is seen as a major stake for the country for several decades. Bertinelli and Strobl remind their readers that diversification has been a priority on Luxembourg's political agenda for many years, and that decision-makers have always striven to counter-balance specialisation forces in order to expand its economic foundations. Various international organisations and institutions have recently focused on the issue of economic diversification in Luxembourg. In an OECD working document, Stráský and Wurzel (2015) concluded that *'the development of the activity in areas other than finance would support growth and provide resistance to a potential drop in production and in the trend productivity growth as seen in the Luxembourgish economy'*. In a country report on selected matters, the International Monetary Fund (IMF, 2017b) stated that the economy of Luxembourg is less diverse than that of other countries in terms of value added created by branch, and noted that diversification is important to strengthen the economy's resilience to shocks. In its 2017 country report for Luxembourg, the European Commission (2017) considered diversification as *'a central long-term stake for Luxembourg'* and specified that the *'diversification of the economy targeting new activities with high value added remains a major challenge for the development and economic sustainability of Luxembourg'*.

6.2 Methodology

This section presents the data employed and describes the statistical tool used for the analysis of the level of diversification of the economy. It is then completed by a critical assessment of this methodology.

6.2.1 Statistical data and tool

The analyses process data from STATEC, the National Institute of Statistics and Economic Studies of the Grand-Duchy of Luxembourg, and from Eurostat, the Statistical Office of the European Union. The data was downloaded at the end of May 2018. All calculations were performed by the Observatoire de la compétitivité. Unless otherwise indicated, the economic activity, the size of the respective branches and the level of diversification are measured in terms of gross value added, which is the result of production minus intermediary consumption, calculated before the consumption of fixed capital. The value added is expressed in constant 2010 prices. Such an evaluation in volume permits the assessment of the deformation of the structure of the economy by eliminating the 'price fluctuation' factor. The classification of activities is taken from the revised version of the Statistical Classification of Economic Activities in the European Community (NACE Rev. 2).

For the analyses, a two-tier hierarchical classification was applied. The first level includes the items identified by means of an alphabetical code (referred to as 'sections' in NACE terminology). The second level is composed of the items identified by a two-digit numerical code (divisions). For purposes of statistical privacy and on the basis of the level of detail of the data made available, some of the items pertaining to the second level have been pooled. In this manner, Eurostat defines maximum 64 branches for all sections and divisions. However, the data for Luxembourg are aggregated to an even greater extent, and the analyses are performed on the basis of groups of 20 and 45 branches, which is the maximum level of detail publicly available for Luxembourg¹. In order to make comparisons between countries possible, the EU data and that of other European economies have been aggregated on the basis of the groups available for Luxembourg.

In order to calculate the level of economic diversification, Berthélemy (2005) points out that '*various measures of diversification may be considered [...]. The most frequently-used category [...] is the calculation of concentration indices [...], for which the most general formula is: $I = \sum_{i=1}^n P_i * w_i$, in which n is the number of products considered, P_i is the proportion of the product i in the overall activity, w_i is a ponderation attributed to product i , which is an increasing function of P_i if a concentration index is defined (and therefore a decreasing function if a diversification index is defined).*' Berthélemy presents three specific applications of such an index, i.e., the entropy index, the Herfindahl index and the share of the N largest productions in the total.

¹ Two tables, showing the groups of 20 and 45 branches as they are used in the analyses, are reproduced in the annex of this chapter.

In the evaluation, the author concludes that *'the entropy index seems to be the most suited to the analysis'* and explains that *'the entropy index is better suited than the Herfindahl index because it can be decomposed. Taking into account the fact that all these indices are sensitive to the level of disaggregation of the nomenclature, the ability to decompose it [...] is an advantage. For the same reasons, entropy is also a better indicator than the share of N largest values.'* Bertinelli and Strobl (2007) specify that a difference between the entropy index and the Herfindahl index is that the entropy index is more sensitive to very small sectors. In its Note de conjoncture no. 1-08, STATEC remarked that the usage of the Herfindahl index or the entropy index as a diversification index leads to very similar results.

In the analyses of the present chapter, the level of diversification is measured by means of the entropy index for which the term w_i of the general formula is equal to $\ln(1/P_i)$ – which is the usual definition of dispersion as used in the field of physical sciences. Indeed, initially, the entropy index was developed to measure the (dis)order of molecules in thermodynamics. The entropy index E is calculated by the means of the formula $E = \sum_{i=1}^n P_i * \ln(1/P_i)$. In this form, the entropy index takes values between 0 and $\ln(n)$ and the value of the index depends in part on the number of branches considered. To remedy this problem and render the direct comparison of results easier, the entropy index is standardised by the formula $E^* = E/\ln(n)$. Thus, the index adopts theoretical values between 0, the equivalent of a situation of absolute concentration, and 1, synonymous with maximum diversification. The entropy index used here can therefore be interpreted as an indicator of diversification, which grows with the diversity of economic activity.

6.2.2 Evaluation of the methodology

The use of the entropy index allows responding to the complexity of the topic and reveals the diversity of the economic fabric in a very simplified manner by summing-up the level of diversification in one single value. However, this statistical tool can only provide a very approximate overall view of a given economy because of the various inherent methodological limitations. For instance – all things being equal – the decline of a dominant branch would directly result in an increase of the overall level of diversification due to a more balanced distribution between the various branches. Consequently, the analysis of the level of diversification has to be completed by an analysis of the evolution of the value added in absolute figures, in order to provide an overview of the development of the country's economic structure.

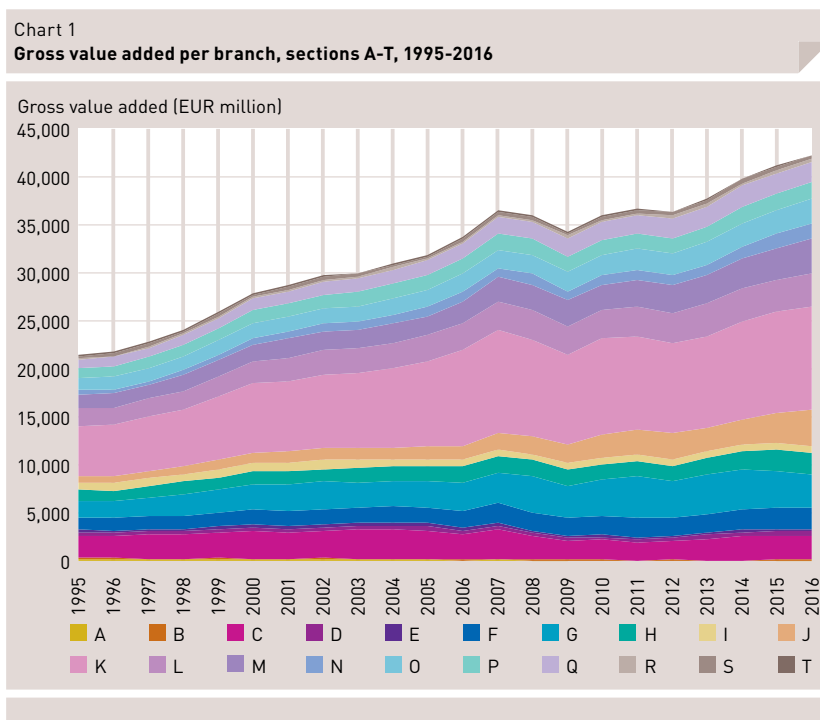
A major problem with the index in question is its sensitivity in relation to the level of aggregation of the variables. Indeed, based on the respective share of each branch, the index reveals the diversity of a given number of branches, which, all together, form a whole. Each modification to the bundles of economic activities changes the proportion of the branches in relation to the others, and therefore has an impact on the calculated level of diversification. Generally, the higher the number of variables, the more precise and significant the index. The use of excessively aggregated data may distort the level of diversification and negatively affect the pertinence of the analyses. This characteristic must be taken into account when interpreting the results, because the analyses are based on the two top levels of NACE and that in this case, they only include maximum 45 branches. In this context, it must also be noted that the aggregation of the data is somewhat arbitrary because some economic activities are recorded in greater detail than others for reasons related to statistical conventions.

Another disadvantage in terms of methodology is incurred by the classification rules defined in NACE. In the event of a unit exercising several different activities, it is classified in terms of its main economic activity, which is the one that contributes the most to the total value added generated by the unit in question. Consequently, intra-company diversification is not reflected in the diversification index. There is a similar problem on the level of the branches. Indeed, if the diversification takes place within one same branch, the variety of activities is not reflected in the diversification index. In addition, the reclassification of a company in another branch of NACE – which is required in the event of a change of said company's main activity – leads to a form of break in the data series, and thus obviously has an impact on the calculation of the level of diversification and analysis of the economic structure. Due to all these restrictions, the methodology applied does not reflect the level of diversification of the economy properly. The results of the calculations and analyses must therefore be interpreted with care, in order to prevent any misunderstanding. Despite the fact that the development of new activities enriches the economic fabric, it does not necessarily lead to a higher level of diversification.

Finally, it must also be noted that the index of economic diversification is not meaningful for the evaluation of the level of exposure to risk of a given economy. Due to its highly targeted and specific orientation, it is simply inadequate for the assessment of risks inherent to the economic structure of a country.

6.3 The overall level of diversification of the Luxembourgish economy

This first part of the analysis reveals the evolution of the various branches in terms of volume and traces the overall level of diversification of the Luxembourgish economy.



In volume, the value added generated in Luxembourg practically doubled between 1995 and 2016. The average annual growth rate was 3.3%. The various branches evolved differently, and their respective contributions to the overall growth rate varied greatly. For over twenty years, following the decline of the steel industry, financial and insurance activities (K) have dominated the Luxembourgish economy, creating on average over a quarter of the country's wealth. This is also the sector which has increased the most in absolute volume over the two decades in question. The branch which grew the most was that of information and communication (J), representing 9.4% of value added for Luxembourg in 2016. This recent growth allowed this branch to overtake wholesale and retail trade and repair of motor vehicles and motorcycles (G) and real estate activities (L), placing it second top in the list of the most important branches in 2016. At the bottom of the scale, manufacturing (C) is the branch which lost the most ground in terms of gross value added in the economy over the twenty past years. In 1995, manufacturing came second top in the overall economy, with 11.4%, but in 2016, it was classified seventh, with only 5.9%. The annual average growth rates per branch reveal their evolution, distributed across different time periods.

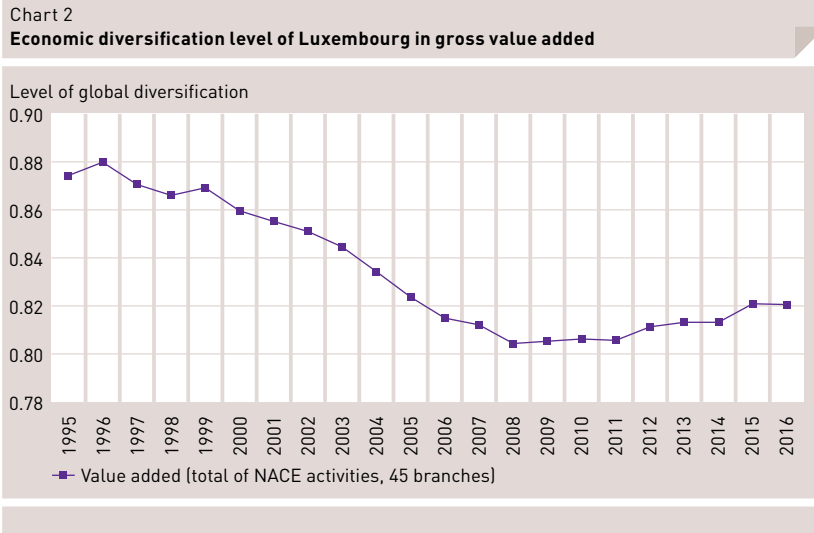
Table 1

Average annual growth rates per branch, sections A-T, selected periods

NACE code / Denomination		1995 - 2006	2007 - 2011	2012 - 2016	1995 - 2016
TOTAL – All NACE activities		4.3%	1.8%	2.7%	3.3%
A	Agriculture, forestry and fishing	-7.2%	-6.7%	4.7%	-4.4%
B	Mining and quarrying	-0.4%	-7.0%	-7.7%	-3.8%
C	Manufacturing	0.9%	-7.0%	6.2%	0.2%
D	Electricity, gas, steam and air conditioning supply	3.4%	-1.8%	6.6%	2.9%
E	Water supply; sewerage; waste management and remediation activities	2.0%	-10.6%	2.3%	-1.1%
F	Construction	3.2%	3.5%	1.7%	2.9%
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	4.4%	7.7%	-4.3%	3.0%
H	Transporting and storage	3.2%	0.0%	6.4%	3.2%
I	Accommodation and food service activities	-1.3%	0.9%	-0.4%	-0.6%
J	Information and communication	7.9%	10.7%	9.4%	8.9%
K	Financial and insurance activities	6.1%	-0.6%	1.9%	3.5%
L	Real estate activities	3.6%	2.0%	2.7%	3.0%
M	Professional, scientific and technical activities	4.5%	3.9%	5.1%	4.5%
N	Administrative and support service activities	8.5%	3.0%	6.1%	6.6%
O	Public administration	3.7%	3.3%	3.3%	3.5%
P	Education	3.0%	-0.3%	2.7%	2.1%
Q	Human health and social work activities	5.9%	4.3%	2.3%	4.7%
R	Arts, entertainment and recreation	5.7%	1.4%	2.1%	3.8%
S	Other service activities	2.7%	4.1%	0.0%	2.3%
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	-1.7%	-4.9%	-4.4%	-3.1%

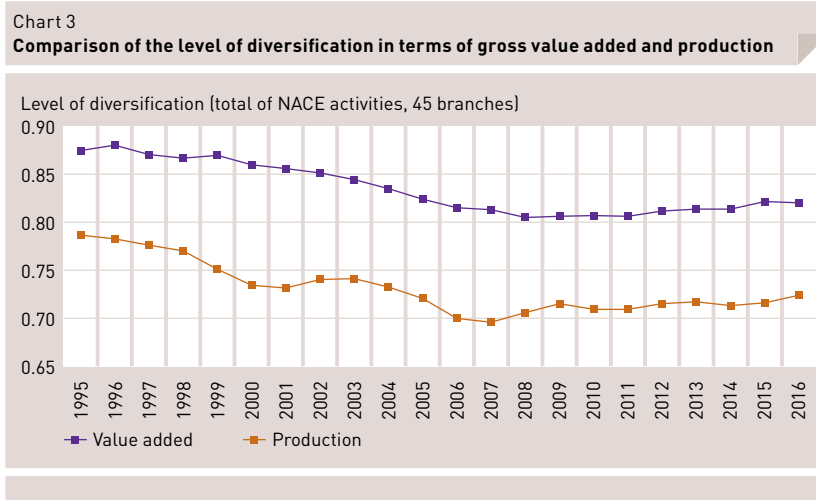
The branch of information and communication (J) grew the most with an average annual growth rate of 8.9% between 1995 and 2016. Professional, scientific and technical activities (M), ranking third in the economy in 2016, also experienced an above-average growth rate in the overall economy. If one considers the total period covered, the evolution of financial and insurance activities (K) was slightly above average, although the growth rate of this branch has slowed down over the past years, namely since the financial and economic crisis of 2008 and following years. Overall, real estate activities (L) and wholesale and retail trade and repair of motor vehicles and motorcycles (G) grew at a slightly slower rate than the total economy. A drop in volume for the 2012-2016 period was noted in the wholesale and retail trade and repair of motor vehicles and motorcycles branch. The growth rate in manufacturing (C) was practically zero for the overall period. However, in this section, activities have been somewhat recovered since 2012. The branch that lost the most ground in terms of volume is that of agriculture, forestry and fishing (A). Consequently, the share of this branch has been diminishing more and more over the years. In 2016, value added created by agriculture, forestry and fishing represented less than 0.3% of the overall economy of Luxembourg.

The brief analysis of the economic structure of Luxembourg in terms of gross value added provides a first indication of the level of diversification of the country's economy. Following this first step, the level of overall diversification will be quantified by means of an entropy index calculated based on the NACE distribution of activities in 45 branches.



The diversification level has dropped considerably over the period under consideration. Between 1995 and 2016, the index dropped by over 6%. In a first stage, the diversification of the economy of Luxembourg fell both significantly and continually, mainly due to the rapid development of the financial sector in the country. Economic concentration reached its peak in 2008. Since then, the economic diversification of Luxembourg has stabilised, even growing little by little, but the trend has reversed only minimally. Indeed, the positive slope of the curve since 2008 has been much weaker than the negative slope of the former years. The upturn is mainly the result of two factors. First, growth in the dominant sector, i.e. financial activities, has slowed down since the economic and financial crisis of 2008 and the following years. Secondly, new activities have developed in other sectors, namely in the information and communication branch, as well as in professional, scientific and technical activities. These recent developments have resulted in a somewhat more balanced economic structure, and consequently in a slight increase of the overall level of diversification.

In order to complete the analysis, the level of diversification in terms of gross value added is briefly compared to that in terms of production, i.e., the volume of goods and services generated by combining resources within the exclusive framework of production before the deduction of intermediary consumption.



Over the entire period under consideration, diversification in terms of production is significantly lower than that in terms of value added. However, the overall trend is the same for both of the variables in the analysis: basically, the diversification level dropped between 1995 and 2007/2008 before stabilising and then slightly increasing.

6.4 Diversification in selected sections of the economy

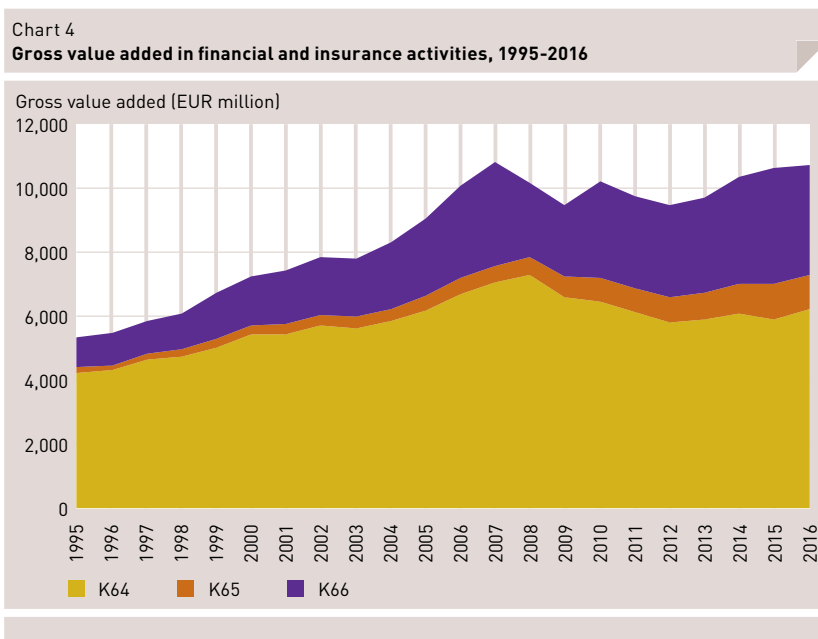
The second part of the present analysis aims to assess the structure and diversification level of a selection of three representative areas of activities of the economy of Luxembourg, i.e., the financial and insurance sector, manufacturing and knowledge-intensive services.

6.4.1 Diversification of financial and insurance activities

The analysis of financial and insurance activities is divided into two components. First, the structure and diversification of the activities grouped in section K of NACE are analysed in terms of value added. Then, the geographical diversification in terms of partner countries for the trade in Luxembourgish financial services is assessed.

6.4.1.1 Diversification of financial and insurance activities in terms of value added

Financial and insurance activities developed a great deal over the period under consideration. Gross value added practically doubled, mainly due to the sector's very positive evolution between 1995 and 2007. After the economic and financial crisis of 2008 and the following years, however, the value added in terms of volume dropped considerably. Since 2012, financial and insurance activities steadily gained ground once again, practically reaching their pre-crisis levels.



The respective branches, i.e. financial service activities, except insurance and pension funding (K64), insurance (K65) and activities auxiliary to financial services and insurance activities (K66) have all contributed to the increase in value added. Financial services remain the dominant branch, but their share in the overall K section has decreased continually over the past twenty years, losing ground namely to activities auxiliary to financial services and insurance activities.

The share of financial and insurance activities in the overall economy varied slightly from year to year, but remained high across the entire period under consideration, representing approximately 25% on average. On the branch level, the importance of financial services (K64) dropped, but it is still high, representing 14.5% of the overall value added of Luxembourg in 2016. The two other branches increased their shares: insurance activities (K65) increased from 0.7% in 1995 to 2.5% in 2016; and activities auxiliary to financial services and insurance activities (K66) practically doubled their share in twenty years, reaching 8.0% of gross value added in Luxembourg in 2016.

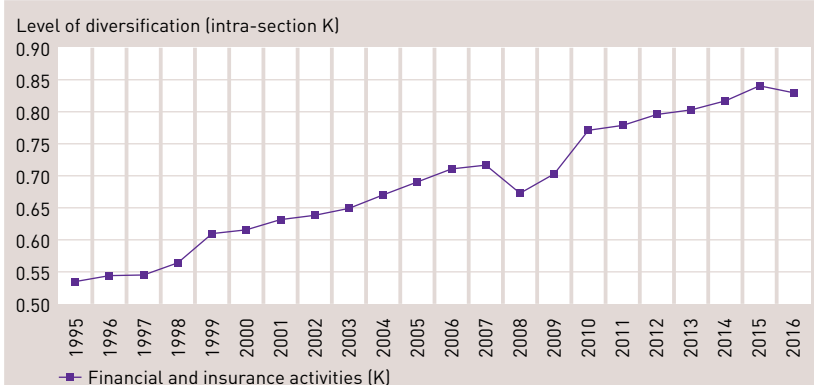
Table 2

Share of financial and insurance activities in the overall economy, selected years

NACE code / Denomination		1996	2006	2011	2016
K	Financial and insurance activities	23.3%	29.6%	26.4%	25.0%
K64	Financial service activities, except insurance and pension funding	18.3%	19.6%	16.6%	14.5%
K65	Insurance	0.7%	1.5%	2.1%	2.5%
K66	Activities auxiliary to financial services and insurance activities	4.3%	8.5%	7.7%	8.0%

Concerning the diversification level in the financial sector, the European Commission (2017) remarked that in Luxembourg, *'the sector has diversified considerably over the years, and continues to diversify in new areas'*. Due to the unavailability of detailed data, the development of new services and activities is not revealed by the present calculated entropy index. Indeed, the calculation of the diversification level is based solely on the three branches defined in NACE for the section of financial and insurance activities. Consequently, the pertinence of the results is limited, although the analysis does provide valid indications for the evaluation of the development of the diversification level.

Chart 5
Level of diversification of financial and insurance activities in terms of gross value added



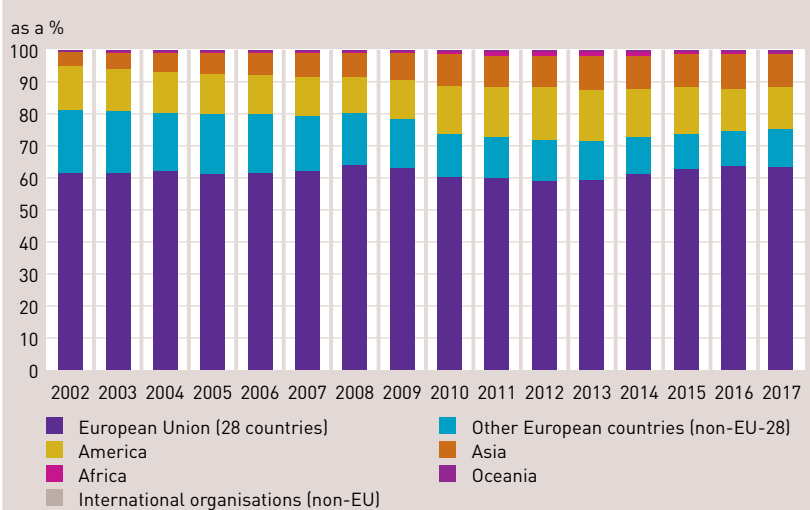
The diversification index for financial and insurance activities reveals strong growth between 1995 and 2016. With the exception of the drop in 2008, the increase of the diversification level is both considerable and practically continual over the entire period.

6.4.1.2 Geographical diversification of the trade in financial services

In addition to the diversification of activities in terms of value added, a related aspect has been put forward by several institutions: that of the geographical diversification in terms of the trade in financial services. In Luxembourg, the Economic and Social Council (2014) was of the opinion that *'the geographical diversification of clients on the financial sector is very important'*, and it concluded that *'the financial centre of Luxembourg must develop a strategy to retain clients in Europe and diversify its clientele outside the EU'*. In the same context, the International Monetary Fund (IMF, 2017b) has positively assessed the efforts undertaken by the public authorities and the private sector to secure the future of Luxembourg as a major financial centre by diversifying its clientele outside Europe.

The data from STATEC on foreign economic relations have been used to analyse and evaluate the geographical diversification of financial services. The available data cover the 2002-2017 period. In order to approach the subject, the table below shows the various regions of the world in terms of Luxembourg's total volume of trade in financial services, exports and imports added.

Chart 6
Share of the various regions of the world in terms of Luxembourg's volume of trade in financial services, 2002 - 2017



The Member States of the EU are by far Luxembourg's main partners in the trade in financial services. This is also true of the trade in goods and services. Over the period under consideration, the share of EU countries in the trade in financial services remains relatively stable and is above 60% on average. On the other hand, the weight of other European countries (outside the EU) has considerably dropped and only represented 11.7% in 2017. Apart from weak annual fluctuations, the American continent has remained relatively stable, with 13.6% on average. The trade in financial services between Luxembourg and Asia has increased since the year 2000. The volume of trade with Asia grew eight-fold in fifteen years. This allowed Asia to double its overall share, reaching 9.9% in 2017, and become an increasingly important trade partner for Luxembourg. The respective weights of Africa and Oceania in the trade in financial services were and still are minimal.

The analysis of the flows broken down by partner country provides further detail on the geographical diversification of the trade in financial services of Luxembourg. The six diagrams below show the respective shares of the five main trade partners for exports and imports for the selected years.

Chart 7
Main partner countries in the trade in financial services, by flow, selected years

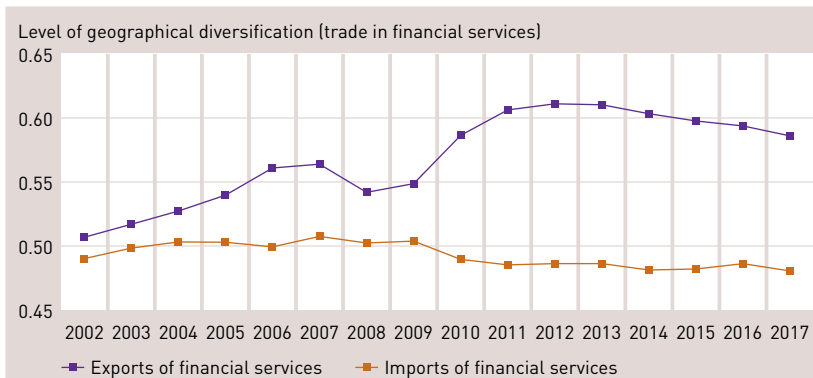


Concerning exports, the cumulated share of the five main recipient countries has dropped throughout the period under consideration, which indicates a greater level of geographical diversification. Their share, however, remains high, with 56.7% in 2017. It must be noted that the main recipient countries and their respective positions in the ranking have changed over this period. The high increase of the United Kingdom is worthy of note, namely due to Brexit, for which preparation is under way. The United Kingdom was not yet an important trading partner in 2002, but in 2017, it ranked second in the list of recipient countries for financial service exports.

As to imports, the trend is the exact opposite of the exports trend. The cumulated share of the five main countries in terms of origin, which was already high to start with, increased even more between 2002 and 2017. Moreover, the share of the United Kingdom, the main trade partner, has regularly increased since 2004. Germany and the USA have cemented their position as important partners, whereas Switzerland has lost ground. In addition, Singapore has entered the Top 5, reflecting Asia's growth.

The first elements of the analysis provide pertinent indications on the evolution of the geographical diversification of the country's trade in financial services. The chart below illustrates the level of geographical diversification of the export and import of financial services. The calculations are based on the 238 territorial units defined by STATEC for the data in question.

Chart 8
Geographical diversification of the trade in financial services, 2002 - 2017

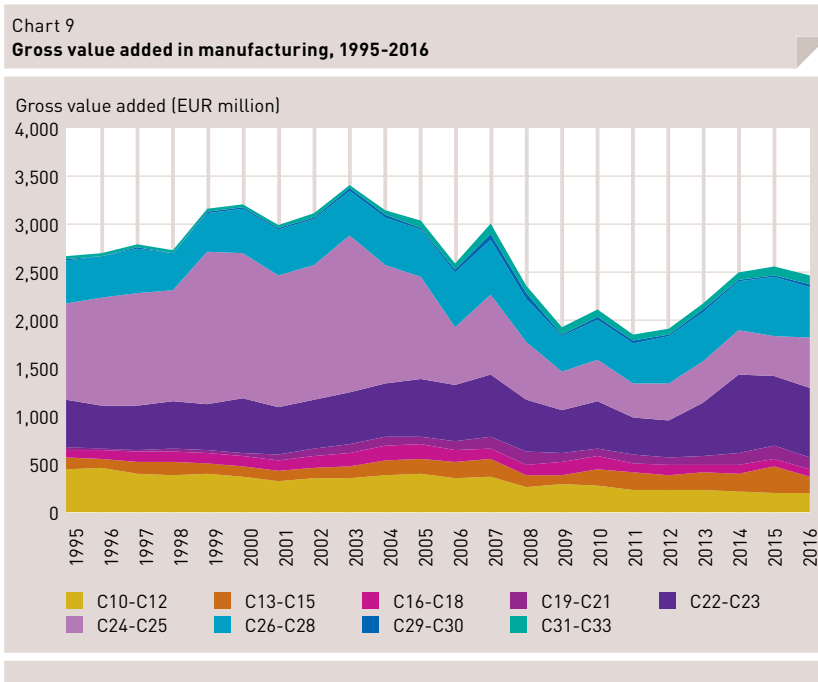


For the period under consideration, the geographical diversification of the imports of financial services has dropped slightly. Following a weak increase between 2002 and 2007, the value of the index then decreased, dropping below its initial level since 2011. The geographical diversification of the exports, on the other hand, increased between 2002 and 2017. Luxembourg has managed to broaden and diversify its clientele. The regular increase of the level of diversification between 2002 and 2006 slowed down in 2007. The increasing trend was temporarily reversed in 2008, at the beginning of the financial crisis. As from 2009, the diversification of financial service exports began rising once more, reaching its peak in 2012. Since then, the geographical diversification of exports has fallen a little every year, but it is still well above the average of the past fifteen years.

6.4.2 Diversification in manufacturing

Since the end of the 1950s, manufacturing has held a privileged position in terms of targeted diversification in the country. Initially, the aim was to reduce the strong dependence of Luxembourg on the steel industry, which represented over a third of the country's economy until the 1970s. As mentioned above, the relative weight of manufacturing in the overall Luxembourgish economy fell over the period under consideration. Due to this fact, it is fundamental to assess whether this evolution has affected all branches of manufacturing (i.e. section C of NACE), or if some branches have been immune to this development.

The chart below illustrates the evolution of the gross value added of the various manufacturing activities. Three branches dominate over the entire period: the manufacture of rubber and plastic products, and of other non-metallic mineral products (C22-C23), the manufacture of basic metals and of fabricated metal products, except machinery and equipment (C24-C25), as well as the manufacture of computer, electronic and optical products, of electrical equipment and manufacture of machinery and equipment n.e.c. (C26-C28). Together, on average, these three branches represent approximately three quarters of the value added for manufacturing over the period under consideration.



The table below shows the weight of the manufacturing industry and its various branches in the Luxembourgish economy for the various selected years.

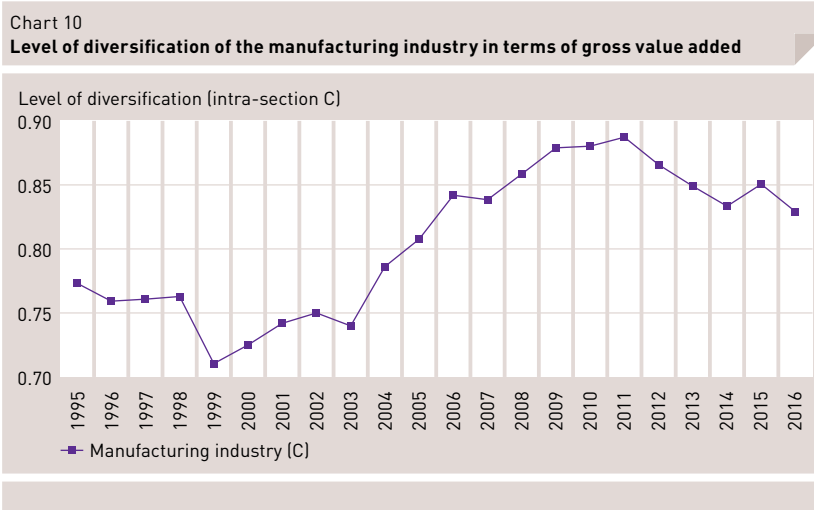
Table 3
Share of the manufacturing industry in the overall economy, selected years

NACE code / Denomination		1996	2006	2011	2016
C	Manufacturing	11.5%	7.6%	5.0%	5.7%
C10-C12	Manufacture of food products; Manufacture of beverages; Manufacture of tobacco products	1.9%	1.1%	0.6%	0.5%
C13-C15	Manufacture of textiles; Manufacture of wearing apparel; Manufacture of leather and related products	0.4%	0.5%	0.5%	0.4%
C16-C18	Manufacture of wood and of paper, printing and reproduction	0.4%	0.4%	0.3%	0.2%
C19-C21	Manufacture of coke and refined petroleum products; Manufacture of chemicals and chemical products; Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.1%	0.3%	0.2%	0.3%
C22-C23	Manufacture of rubber and plastic products; Manufacture of other non-metallic mineral products	1.9%	1.7%	1.1%	1.7%
C24-C25	Manufacture of basic metals; Manufacture of fabricated metal products, except machinery and equipment	4.7%	1.8%	1.0%	1.2%
C26-C28	Manufacture of computer, electronic and optical products; Manufacture of electrical equipment; Manufacture of machinery and equipment n.e.c.	1.9%	1.6%	1.1%	1.2%
C29-C30	Manufacture of motor vehicles, trailers and semi-trailers; Manufacture of other transport equipment	0.0%	0.1%	0.1%	0.0%
C31-C33	Manufacture of furniture; Manufacture of jewellery, bijouterie and related articles; musical instruments; games and toys; Repair and installation of machinery and equipment	0.1%	0.2%	0.2%	0.2%

In 1996, manufacturing still represented 11.5% of the gross value added of Luxembourg, but by 2016, its share had dropped to 5.7%. The manufacture of rubber and plastic products, as well as of other non-metal mineral products (C22-C23) now occupies a more important place in the economy and has become to the dominant branch of the manufacturing industry with a share of 1.7% in the overall economy in 2016. It developed greatly namely between 2012 and 2016. The manufacture of computer, electronic and optical products, as well as of electrical equipment and machines, and other equipment not elsewhere classified (C26-C28) also increased in volume. Currently, this is the second largest branch in the manufacturing industry in Luxembourg, with a share of 1.2% in 2016. The branch that lost the most ground was the metallurgy industry and the manufacture of metal products (C24-C25). Its value added dropped by half over the period under consideration. It used to be the dominant branch, but today, the metallurgy industry and the manufacture of metal products only ranks third of the manufacturing industry in terms of value added, with a share of 1.2% in 2016. As in the case of the two aforementioned branches, its activities have increased somewhat since 2012.

The food industry, the manufacture of beverages and tobacco products (C10-C12) also lost some ground. Following a decline that practically continued over the entire period, it only weighed 0.5% in the overall economy in 2016. The other branches of the manufacturing industry also remained weak throughout.

As to the diversification of the manufacturing industry, it must be noted that the calculation of the diversification index is based on the nine pre-defined branches. Due to the limited number of variables, the results are not that precise, although their analysis reveals some general trends. The development of the level of diversification is illustrated by the chart below.



In total, the level of diversification of the manufacturing industry in Luxembourg increased over the period under observation, but its evolution was irregular and characterised by a few sudden reversals over the years. Stages of higher concentration were followed by stages of higher diversification and vice versa. After a drop between 1995 and 1999, the level of diversification began rising once more and peaked in 2011. This can be explained by two factors. On one hand, additional activities were launched, namely in the branch that covers the manufacture of rubber and plastic products as well as other non-metal mineral products, and in the branch covering the manufacture of computer, electronic and optical products, electrical equipment and machinery and equipment not elsewhere classified. On the other hand, the increase in the level of diversification within the manufacturing industry section is due to the decline of the metallurgy industry and the manufacture of metal products, the former dominant branch of this section. After 2011, the trend was reversed, and the level of diversification began dropping again. In 2016, the diversification index of the manufacturing industry was at its lowest since 2006, but it remained above its average of the twenty past years.

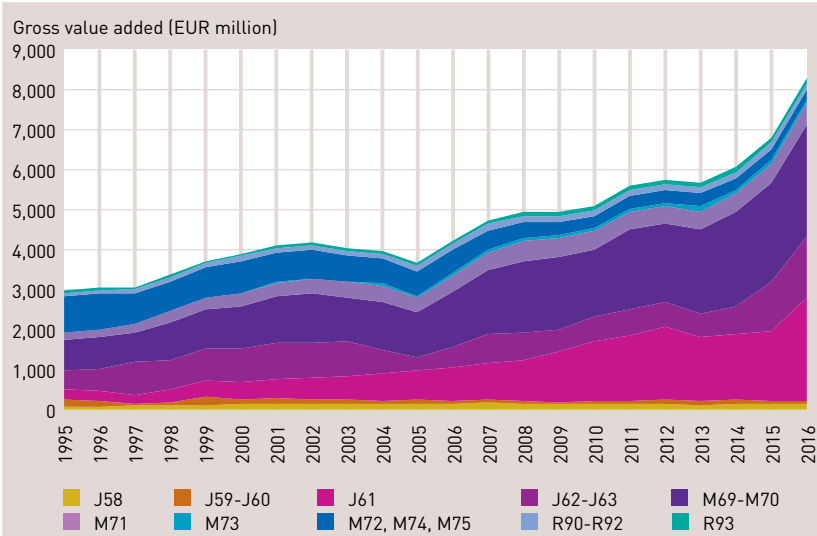
6.4.3 Diversification of knowledge-intensive services

Knowledge-intensive services (KIS) are generally characterised by a strong value added and are consequently promising activities in terms of economic diversification and development of Luxembourg. This is not a specific NACE branch, but Eurostat has defined various branches of the NACE as knowledge-intensive services. For the analyses in the present chapter, the branches grouped as KIS have been somewhat modified. Financial and insurance activities have not been included because they are the object of a separate and detailed analysis above. Water transport (H50), air transport (H51), employment activities (N78) and security and investigation activities (N80) have also been excluded due to the confidential nature of their data for Luxembourg. Finally, public administration (O), education (P) and human health and social work activities (Q) are not included because of lacking detailed data.

Consequently, the KIS covered by this analysis are composed on the basis of the ten following NACE branches: publishing activities (J58); motion picture, video and television programme activities, and programming and broadcasting activities (J59, J60); telecommunications (J61); computer programming, consultancy and related activities, and information service activities (J62, J63); legal and accounting activities, activities of head offices, management consultancy activities (M69, M70); architectural and engineering activities; technical testing and analysis (M71); advertising and market research (M73); scientific research and development, other professional, scientific and technical activities, veterinary activities (M72, M74, M75); creative, arts and entertainment activities, libraries, archives, museums and other cultural activities, gambling and betting activities (R90, R91, R92); and sports activities and amusement and recreation activities (R93).

Overall, the development of KIS was very positive between 1995 and 2016. These ten branches often experienced growth rates that were above the average for the total economy. For some years now, the two branches that have largely dominated KIS have been: telecommunications (J61) and legal and accounting activities, activities of head offices, management consultancy activities (M69, M70). Together, they created 68.6% of gross added value for KIS in 2016. Over the past twenty years, the average growth rates for these two branches have largely surpassed those of the overall Luxembourgish economy.

Chart 11
Gross value added in knowledge-intensive services, 1995-2016



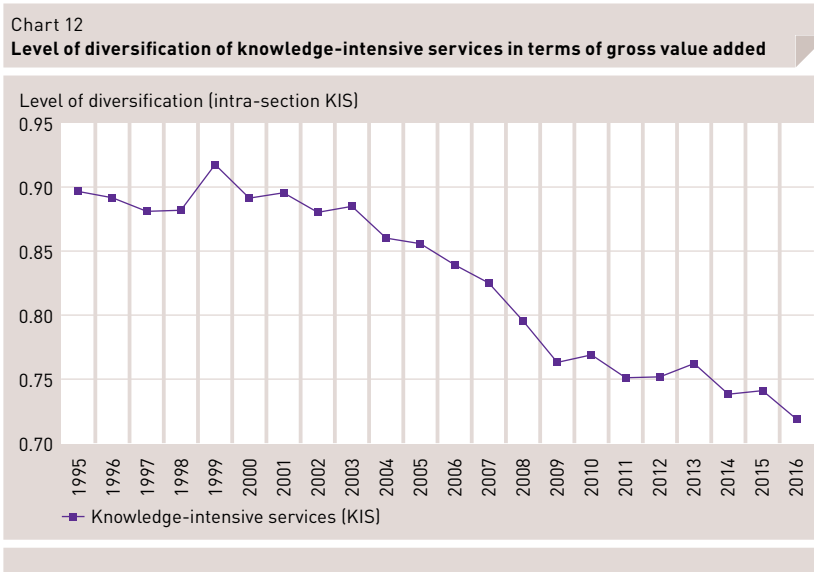
The share of knowledge-intensive services in the overall economy has risen by over six percentage points since 1995, reaching 19.3% in 2016. The table below summarises the share of KIS for the selected years.

Table 4
Share of knowledge-intensive services in the overall economy, selected years

Code NACE / Dénomination	1996	2006	2011	2016
KIS Knowledge-intensive services	13.0%	12.4%	15.2%	19.3%
J58 Publishing activities	0.4%	0.5%	0.4%	0.3%
J59-J60 Motion picture, video and television programme production, programming and broadcasting activities	0.6%	0.2%	0.2%	0.2%
J61 Telecommunications	1.0%	2.4%	4.4%	6.0%
J62-J63 Computer programming, consultancy and related activities, information service activities	2.3%	1.6%	1.8%	3.6%
M69-M70 Legal and accounting activities, activities of head offices, management consultancy activities	3.4%	4.0%	5.4%	6.5%
M71 Architectural and engineering activities, technical testing and analysis	0.8%	1.2%	1.2%	1.2%
M73 Advertising and market research	0.0%	0.2%	0.2%	0.2%
M72, M74, M75 Scientific research and development, other professional, scientific and technical activities, veterinary activities	3.9%	1.7%	0.9%	0.6%
R90-R92 Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	0.3%	0.5%	0.4%	0.4%
R93 Sports activities and amusement and recreation activities	0.3%	0.2%	0.3%	0.3%

Legal and accounting activities, activities of head offices, and management consultancy (M69, M70) have consolidated their position as the largest KIS branch. It has practically doubled its share over the period under consideration, reaching 6.5% in 2016. Following steady growth between 1995 and 2006, its growth rate has increased even more since. In absolute terms, telecommunications (J61) are the second driver of growth of knowledge-intensive services, with a share of 6.0% of value added in 2016. Following extraordinary growth between 1995 and 2011, the development of the branch slowed down somewhat between 2012 and 2016, but its growth rate still remains considerably higher than that of the total of activities during the same period. The branch pooling computer programming, consultancy and other information services (J62, J63) is the third largest contributor to KIS, with a share of 3.6% in 2016. At the bottom of the ranking, the largest relative drop was that of scientific research and development, other specialised, scientific and technical services, veterinary services (M72, M74, M75), a branch which has now become quite insignificant. Other KIS branches remain weak.

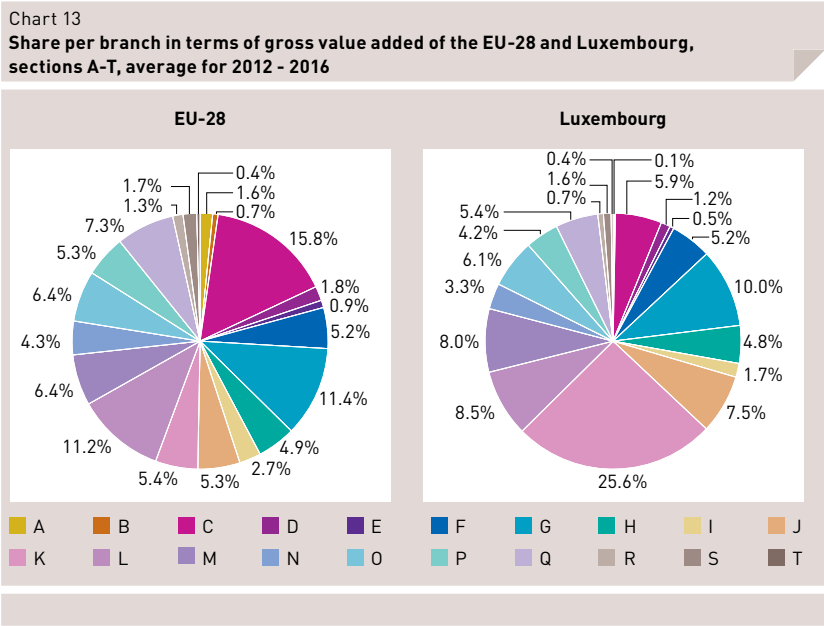
The concentration of growth in a reduced number of specific branches has led to a significant decrease in the diversification of knowledge-intensive services. The corresponding index therefore reveals a decreasing trend.



The period between 1995 and 2003 was characterised by relatively weak alternating increases and decreases in the level of diversification. Since 2004, the concentration of KIS activities has increased considerably. In twenty years, its diversification index has dropped by practically 20%. A more in-depth analysis, however, reveals that knowledge-intensive services have had a positive impact on the overall diversification level of the economy of Luxembourg over the period under consideration, despite the recorded growing concentration for KIS activities themselves. The development of a few specific activities, synonymous with a diversified specialisation, is therefore compatible with an increased level of overall diversification.

6.5 Diversification of the Luxembourgish economy compared to the rest of the EU

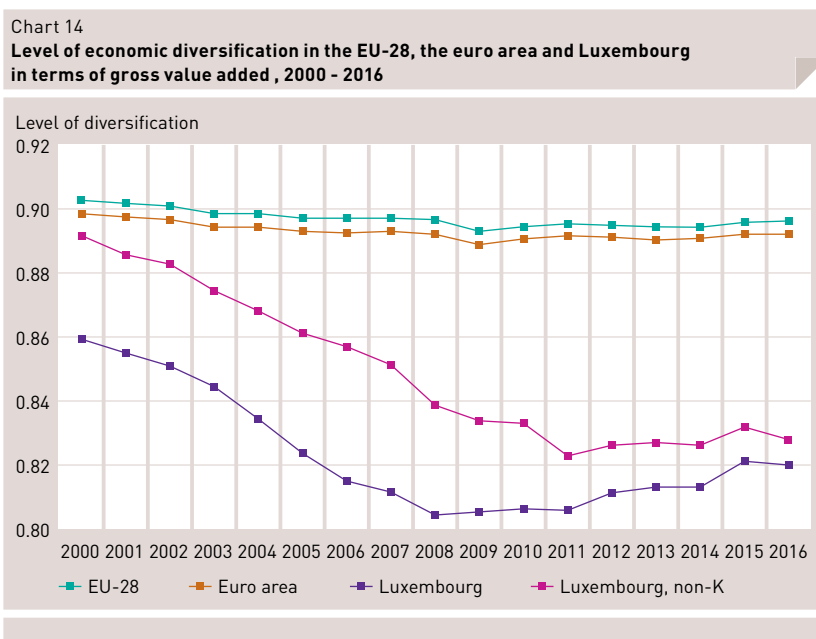
Following a detailed analysis of the national situation, the position of Luxembourg in terms of economic diversification will now be compared to the rest of the EU, its Member States and other European countries. For reasons relating to the availability of data, this part only covers the period from 2000 to 2016. The analysis is performed on two levels. First, the share per branch in the overall economy is presented for the EU-28 and for Luxembourg (A-T NACE sections). By considering only the average of the years ranging from 2012 and 2016, this approach limits itself to a summary of the recent situation. This does not, however, prevent readers from reaching some preliminary conclusions concerning the economic structure. Afterwards, a comparison of the levels of economic diversification of European economies is made. Like before, the analysis is made in terms of gross value added at constant prices and based on a distribution of activities across 45 branches.



The chart above shows at first glance the fact that the Luxembourgish economy is less diversified than that of the 28 Member States of the EU as a whole. In Luxembourg, financial and insurance activities dominate the scene, accounting for 25.6% of total value added. For the EU-28, the main section (i.e. manufacturing in this case) only contributes 15.8% of the creation of overall wealth. Moreover, Luxembourg has six very small branches, with a share of under 1% each.

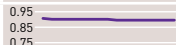
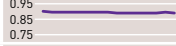







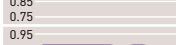










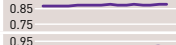











In the EU-28, there are only three of these very small branches. Finally, a simple statistical analysis of shares per branch permits the identification of a weaker economic diversification for Luxembourg. Indeed, the standard deviation of the respective data is higher for Luxembourg than for the EU-28, meaning that the distribution of shares is less balanced in Luxembourg, and that consequently, the presence of one or several dominant or insignificant branches is more likely.

The analysis of the level of economic diversification confirms the weak result for Luxembourg in this realm. The chart below highlights the fact that economic activities are less diversified in Luxembourg than in the EU or in the euro area. This conclusion remains true even if the current dominant sector in the Luxembourgish economy were to be removed from the analysis, i.e. section K of NACE, grouping financial and insurance activities.



Unlike the development in Luxembourg, the degree of diversification of the EU and the euro area only diminished very little and slowly until 2009 and has remained at practically the same level since. The gap between the level of diversification of the Luxembourgish economy and that of the EU and the euro area as a whole has widened over the years. The economic diversification of Luxembourg is weak not only compared to the EU, but also compared to other European economies.

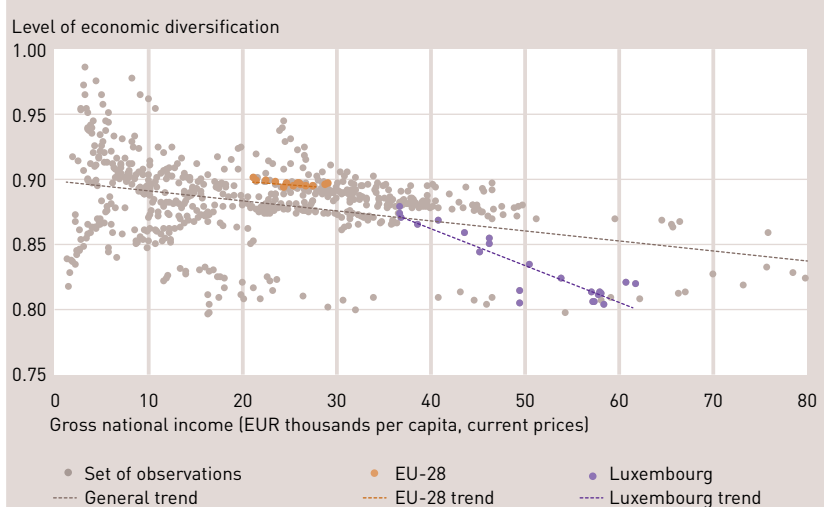
Table 5
Level of diversification of the EU and European economies,
selected years and general trend

	2000	2005	2010	2015	Trend 2000 - 2016
EU-28	0,9028	0,8974	0,8944	0,8960	
Euro area	0,8988	0,8931	0,8908	0,8922	
Belgium	0,8780	0,8723	0,8661	0,8668	
Bulgaria	0,8284	0,8480	0,8692	0,8973	
Czech Republic	0,9333	0,9141	0,8905	0,8900	
Denmark	0,8949	0,8882	0,8761	0,8788	
Germany	0,9226	0,8971	0,8869	0,8851	
Estonia	0,9100	0,9023	0,8820	0,8933	
Ireland	0,8932	0,8812	0,8636	N/A	
Greece	0,8696	0,8646	0,8213	0,7960	
Spain	0,8791	0,8796	0,8790	0,8808	
France	0,8766	0,8742	0,8696	0,8716	
Croatia	0,9034	0,8958	0,8920	0,8962	
Italy	0,8862	0,8808	0,8793	0,8751	
Cyprus	0,8277	0,8247	0,8247	0,8162	
Latvia	0,9002	0,8816	0,8611	0,8593	
Lithuania	0,8576	0,8594	0,8520	0,8534	
Luxembourg	0,8592	0,8237	0,8061	0,8208	
Hungary	0,9167	0,9002	0,8900	0,8843	
Malta	0,9012	0,9089	0,8977	0,8835	
Netherlands	0,8894	0,8850	0,8823	0,8789	
Austria	0,8881	0,8893	0,8805	0,8836	
Poland	0,9338	0,9092	0,8906	0,8986	
Portugal	0,8625	0,8680	0,8725	0,8748	
Romania	0,8846	0,8651	0,8657	0,9119	
Slovenia	0,9251	0,9019	0,8948	0,8964	
Slovakia	0,9203	0,9122	0,8823	0,8869	
Finland	0,8972	0,8848	0,8799	0,8805	
Sweden	0,8956	0,8963	0,8941	0,8969	
United Kingdom	0,9054	0,8936	0,8835	0,8838	
Norway	0,8090	0,7972	0,8132	0,8270	
Switzerland	0,8784	0,8727	0,8692	0,8588	

Overall, the analysis confirms the observations of the various international institutions and organisations that stated that Luxembourg has a weak level of economic diversification, not only compared to other countries with a relatively low population, such as Malta, Slovenia or the Baltic countries, but also compared to other financial centres such as Switzerland. The analysis on the European level also demonstrates that the level of diversification has dropped in most countries over the period under consideration. This trend was at its strongest between 2000 and 2010, before slowing down after the economic and financial crisis of 2008 and following years, even reversing in some countries. On average, Poland, the Czech Republic, Slovenia, and for a short time now, Romania, are the countries with the most diversified economies, whereas the countries with the least diversified economies are Greece, Luxembourg, Cyprus and Norway. An interesting conclusion, to say the least, is that the EU as a whole is more diversified than the majority of its Member States taken individually. This may mean that the countries specialised in different areas, probably as a result of their comparative advantages vis-à-vis others, and that there is a certain degree of complementarity between the economic activities of the various Member States.

The scientific literature presents different determinant factors to explain the level of economic diversification. In a comparative study, Imbs and Wacziarg (2003) have chosen an interesting approach and link the level of diversification to the level of economic development. Their analyses reveal an inversed 'U' shape between these two factors. By going through the stages of development, the level of diversification of an economy begins by growing, then it decreases, depending on income. The observations also reveal that the inversed 'U' shape is asymmetrical. Indeed, after having reached its peak then reversing, the level of diversification does not drop to its former level: it remains at a higher level than at the beginning of the economic growth. Taking these elements into account, it is interesting to apply this type of analysis to the data regarding the EU, European economies and Luxembourg. For the purposes of the analysis, economic development is measured by the gross national income per capita, so as to allow us to consider the national characteristics of Luxembourg, because the gross domestic product per capita does not account for the high number of cross-border workers in the Luxembourgish economy. The levels of diversification per country and per year are those calculated for the previous analyses. The chart below displays the results.

Chart 15
Relation between income per capita and the level of diversification



Generally speaking, the analysis confirms the results put forward by Imbs and Wacziarg. The greater the economic development, the weaker the level of diversification. Luxembourg enjoys a higher income per capita than that of the EU, and its economic structure is less diversified than the latter. The analysis also reveals that in Luxembourg, the two variables fluctuate to a greater extent, and variations are more frequent than on the level of the EU. Both, the EU in general and Luxembourg in particular seem to find themselves at a stage of growing economic specialisation.

6.6 Conclusions

Despite the shortfalls and restrictions presented by the statistical tool used, and the resulting methodological disadvantages, the analyses performed reveal a great deal of information.

Internationally, the Luxembourgish economy is not very diversified. Its level of economic diversification was already relatively low in 1995 and has dropped further since. However, recently, Luxembourg has managed to reverse this trend, and its level of diversification has slightly increased since 2008. The current dominant sector is the financial sector, which has created on average over a quarter of the value added over the past two decades. This in part explains the results. The analysis of the economic diversification without including financial and insurance activities tells us, however, that the important weight of the financial sector is not the only explanation. Indeed, the level of diversification of Luxembourg is also dropping for the rest of the economy. The works by Imbs and Wacziarg (2003), as well as that of Berthélemy (2005), on the determinant factors of economic diversification may give us some indications as to how to determine the causes underlying the results. There are two tentative explanations. First, the small size of the country implies a limitation of production factors and a limited domestic market, resulting in a weak diversification of economic activities. Secondly, Luxembourg's level of development is very high, and it is common for levels of diversification to drop after a country has reached a certain level of economic development.

The respective conclusions vary for the analysis of the three selected sections.

The impact of the financial sector on the overall level of diversification of the economy, measured in value added, remains negative despite the fact that diversification within the sector itself is on the rise. Regarding the trade in financial services, the players have expanded their client base, in particular by increasing their financial activities in Asia. High geographical diversification may be considered positive so as to mitigate risks.

The analysis of the manufacturing industry has demonstrated that the weight of that sector is decreasing. The decline of the metallurgy industry, which used to be the dominant branch in Luxembourg, as well as the development of activities in the field of the manufacture of rubber and plastic products, other non-metal mineral products, computer, electronic and optical products, electrical equipment has led to an increase in the level of intra-sectoral diversification of manufacturing activities.

Knowledge-intensive services (KIS) represent a promising section for the economic diversification of the country. The annual average growth rates of KIS are above the average of the rest of the economy, thus making it an engine of economic growth in Luxembourg. The development of only a limited number of specific branches can be observed here. At the expense of limited diversification in the section of knowledge-intensive services, this diversified specialisation has a positive impact on the overall diversification of the economy.

Annex

Table 6
Grouping of activities in 20 branches (NACE Rev. 2)

NACE code	Denomination (section)
A	Agriculture, forestry and fishing
B	Mining and quarrying
C	Manufacturing
D	Electricity, gas, steam and air conditioning supply
E	Water supply; sewerage; waste management and remediation activities
F	Construction
G	Wholesale and retail trade; repair of motor vehicles and motorcycles
H	Transporting and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance activities
L	Real estate activities
M	Professional, scientific and technical activities
N	Administrative and support service activities
O	Public administration
P	Education
Q	Human health and social work activities
R	Arts, entertainment and recreation
S	Other service activities
T	Activities of households as employers; undifferentiated goods - and services - producing activities of households for own use

Table 7
Grouping of activities in 45 branches (NACE Rev. 2)

NACE code	Denomination (section / division)
(A) 01	Crop and animal production, hunting and related service activities
(A) 02	Forestry and logging
(A) 03	Fishing and aquaculture
(B) 05, 06, 07, 08, 09	Mining and quarrying
(C) 10, 11, 12	Manufacture of food products; Manufacture of beverages; Manufacture of tobacco products
(C) 13, 14, 15	Manufacture of textiles; Manufacture of wearing apparel; Manufacture of leather and related products
(C) 16, 17, 18	Manufacture of wood and of paper, printing and reproduction
(C) 19, 20, 21	Manufacture of coke and refined petroleum products; Manufacture of chemicals and chemical products; Manufacture of basic pharmaceutical products and pharmaceutical preparations
(C) 22, 23	Manufacture of rubber and plastic products; Manufacture of other non-metallic mineral products
(C) 24, 25	Manufacture of basic metals; Manufacture of fabricated metal products, except machinery and equipment
(C) 26, 27, 28	Manufacture of computer, electronic and optical products; Manufacture of electrical equipment; Manufacture of machinery and equipment n.e.c.
(C) 29, 30	Manufacture of motor vehicles, trailers and semi-trailers; Building of ships and boats
(C) 31, 32, 33	Manufacture of furniture; Manufacture of jewellery, bijouterie and related articles; musical instruments; games and toys; Repair and installation of machinery and equipment
(D) 35	Electricity, gas, steam and air conditioning supply
(E) 36	Water collection, treatment and supply
(E) 37, 38, 39	Waste collection, treatment and disposal activities; materials recovery
(F) 41, 42, 43	Construction
(G) 45	Wholesale and retail trade; repair of motor vehicles and motorcycles
(G) 46	Wholesale trade, except of motor vehicles and motorcycles
(G) 47	Retail trade, except of motor vehicles and motorcycles
(H) 49, 50, 51, 52, 53	Transporting and storage
(I) 55, 56	Accommodation and food service activities
(J) 58	Publishing activities
(J) 59, 60	Motion picture, video and television programme production, programming and broadcasting activities
(J) 61	Telecommunications
(J) 62, 63	Computer programming, consultancy and related activities, Information service activities
(K) 64	Financial service activities, except insurance and pension funding
(K) 65	Insurance
(K) 66	Activities auxiliary to financial services and insurance activities
(L) 68	Real estate activities
(M) 69, 70	Legal and accounting activities, activities of head offices, management consultancy activities
(M) 71	Architectural and engineering activities, technical testing and analysis
(M) 73	Advertising and market research
(M) 72, 74, 75	Scientific research and development, other professional, scientific and technical activities, veterinary activities
(N) 77, 78, 79, 80, 81, 82	Administrative and support service activities
(O) 84	Public administration
(P) 85	Education
(Q) 86	Human health activities
(Q) 87, 88	Residential care activities; Social work activities without accommodation
(R) 90, 91, 92	Creative, arts and entertainment activities; Libraries, archives, museums and other cultural activities; Gambling and betting activities
(R) 93	Sports activities and amusement and recreation activities
(S) 94	Activities of membership organisations
(S) 95	Repair of computers and personal and household goods
(S) 96	Other personal service activities
(T) 97, 98	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use

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7 International conference: 'Competitiveness strategies for the small EU States: economic and social perspectives'

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On 19 and 20 April 2018, the Observatoire de la compétitivité organised an international conference in collaboration with the 'Islands and Small States Institute' of the University of Malta and STATEC. National and international researchers attended the conference, which was also open to the interested public. The objective was to discuss issues relating to competitiveness, particularly in connection with the characteristics of small States. The countries represented included Luxembourg, Ireland, Montenegro, Macedonia, Malta, Cyprus, Lithuania, Albania and Slovenia. In addition to the three plenary sessions, the conference programme included parallel sessions articulated around six different themes: strategies, entrepreneurship, economic development, global indicators, policy framework and social aspects. This chapter summarises the discussions that took place. The detailed presentations of the various speakers can be downloaded on the website of the Observatoire de la compétitivité¹.

During his keynote speech in the plenary session, **Enrico Spolaore** discussed the stakes of international integration for small States. Indeed, chances of small States prospering are greater in an open world with a high level of economic integration. Thus, small States have benefited from increased international openness over the past decades. Using examples of increasingly popular anti-Europe movements, Brexit and tensions in international trade, the speaker concluded that currently, international openness is under threat, both on a European level and worldwide. The speaker then focused on what he calls the European dilemma: economies of scale achieved thanks to institutional integration and the benefits of diversity for the Single Market were set up against the costs of heterogeneity due to differing preferences concerning public assets and policies. The European project aims to overcome the constraints resulting from different preferences by means of a partial integration strategy aiming mainly at areas with high economies of scale and relatively low costs linked to heterogeneity, such as trade integration. The specificity of the European project is that integration in the various areas should be carried out in stages. However, the expectation that economic integration would lead to political integration has not materialised in all cases. Incomplete integration has even become one of the reasons underlying the current institutional problems of the European Union. To conclude, the speaker stated that the European Union should shelve its stage-based integration strategy for the various political areas, and that it should concentrate on reforms that make economic and political sense in their own right, and which are democratically approved by European voters. Small States should be at the forefront of this process, because they benefit most from integration.

¹ <https://odc.gouvernement.lu/en/actualites/mes-actualites/2018/Conference-Small-States.html>

In his keynote speech, **Patrice Pieretti** asked whether small countries are forced to be tax havens in order to be competitive. He observed that generally, small countries do not have much capital or human resources and are therefore very dependent on foreign resources – which they need to attract. In this context, is tax competition or tax dumping a possible solution to attract required resources? The speaker gave an overview of some of the economic literature that has been published on this matter. It appears that countries do not only compete on the level of taxes, but that assets on the level of tangible and intangible infrastructures, as well as public services, are just as important to attract foreign resources. It is not imperative for a small State to adopt low tax models. Instead, it can attract foreign capital by providing better public assets to investors. Afterwards, in a dynamic perspective, the speaker discussed the issue of the economic survival of small States in a competitive world with mobile resources. The analysis took into account two opposite characteristics of small countries: first, their greater flexibility for decision-making, and secondly, their limited institution capacity. The analysis also considers the level of international openness, mainly capital mobility. The results of the analysis are debatable. If the mobility of capital is weak, a small country may reduce its tax rates without larger, rival countries reacting. In this specific case, institutional efficiency is not a determinant factor for the attractiveness of a country. If, on the other hand, the mobility of capital takes place at an intermediary level, institutional efficiency becomes more important, and a weak level of efficiency may lower the international attractiveness of a country. Finally, if capital mobility is high, international competition can harm small economies. In this situation, low tax rates and flexibility in decision-making cannot compensate for low institutional efficiency.

7.1 Parallel session: Strategies

Small States face specific disadvantages if one considers the size of their domestic markets or their limited natural resources. Some small States, however, have managed to generate relatively high levels of GDP per capita. What are their competitiveness strategies and how do they differ from those of large States? In her presentation, **Catherine Wong**, from the University of Luxembourg, compared the development strategies of Luxembourg and Singapore. The two States have made decisive investments in niche sectors and chose policies that are very different to those of their regional and international competitors. Their relative success requires more explanations concerning the State, and must be understood within the larger context of global geopolitical and economic reconfiguration processes. The new empirical data used were obtained from interviews with political and economic decision-makers in Luxembourg and Singapore, while offering a short explanation on the paths followed and those that will be taken by the two countries to face their shared challenges as modest yet highly globalised States. **Mario Hirsch** has a similar point of view, highlighting the niche policy practised by Luxembourg by the middle of the 19th century. Luxembourg has implemented such policies ever since that time, i.e., the beginning of the economic progression of the country. This presentation gave three examples to illustrate the opportunities and limitations of this approach. The selected examples come from three symbolic sectors for the country: steel, communications and finance. A common element is the fact that Luxembourg has deliberately chosen to adopt a minimalistic approach in the legal framework, i.e. one with few constraints and prescriptions. **Godfrey Baldacchino** underscored the 'flexible adaptation strategy' of small countries in order to reach the best results. The smaller the State, the greater the likelihood that its internal affairs will be dominated by exogenous factors. On the other hand, the smaller the territory, the greater the obligation of its government and institutions to make forecasts, propose leadership and prospective approaches in its development trajectory, while at the same time remaining agile so as to be able to seize opportunities when they arise, even if they do not fit the pre-defined plan. Thanks to secondary data and personal experience, the speaker first spoke of how 'flexible specialisation' dictates and pushes forward a considerable number of activities and decisions in small jurisdictions. He then examined how these structural obligations are transformed in competitive niches, while gathering a number of specific skills and demanding particular infrastructures. In addition to Luxembourg and Singapore, two other countries were mentioned: Montenegro and Macedonia, especially against the backdrop of EU accession.

Milorad Katnic discussed the stakes of the economy of Montenegro on the road to EU accession. The speaker believes that, in order to ensure the long-term competitiveness of the economy in Montenegro, it is key to have simple regulation, with minimal administrative burdens and a flexible education system. The implementation of European standards may even lead to a loss of competitiveness for the country. According to **Marjan Petreski** and **Igor Velickovski**, Macedonia has made impressive progress in terms of its competitiveness in World Economic Forum and World Bank rankings. The speakers analysed the strong points which improved competitiveness and the role of the government in the reform process, namely in the field of investment policy. On the other hand, they focused on the remaining weaknesses in various areas, such as the business environment, education and the labour market.

7.2 Parallel session: Entrepreneurship

One of the European Commission's priorities is to ensure a regulatory, legal and financial framework that is supportive of entrepreneurship, which plays a core role in economic growth and job creation. Regarding small States, **Cesare A. F. Riillo** explored the issue of whether the size of a country shapes the relationship between entrepreneurship and economic growth. The economic literature suggests that both entrepreneurial spirit and the population are important determinant factors for growth. There may be a link between the size of a country and growth. Several separatist movements state that there are economic advantages that are related to the size of a country. Large countries benefit from economies of scale, but small countries may benefit from specialisation, lower transaction costs and greater flexibility. The study confirms the importance of entrepreneurship for economic growth. The results are inconclusive in relation to the size of a country, which can be justified by the high level of heterogeneity between countries and the existence of strategies aiming to mitigate size-related inconveniences. Large countries can decentralise their government in order to increase their flexibility by means of small administrative units, whereas small countries can integrate an economic union so as to benefit from economies of scale. Such policies can have an impact on the link between economic growth and country size. The presentation of **Mike Devaney** and **Jan Gallagher** provided an overview of the collaboration of Enterprise Ireland with the ministries to provide business support, with the aim of developing the Irish industry and promote exports and job creation. Tools such as the 'Company Competitiveness Health Check' help improve operational performance and competitive advantages thanks to high quality standards and cost-cutting, while at the same time improving customer service. **Vasja Sivec** analysed how productivity growth can be explained by means of global, regional and country-specific factors. For small States, a greater proportion of productivity growth can be explained by global factors. This is not the case for large countries. A possible explanation is that small countries need to access global markets in order to develop their potential, because their small size means that they cannot depend on domestic markets like larger countries do. Overall, about one third of productivity growth in small countries can be explained by global and regional factors (20% and 13% respectively). The other two-thirds are related to country-specific factors.

7.3 Parallel session: Economic development

Over the past years, countries have been increasing their commitments to reach the sustainable development goals. Many of these objectives aim at improving the environment quality. **Charles-Henri Dimaria** discussed the economic efficiency of countries relating it to their ecological footprint. This presentation suggested a new ranking per country thanks to an indicator measuring the economic performance of countries in accordance with a sustainability criterion, and it analysed whether the size of a country is in correlation with these two indicators. The results demonstrated that economic efficiency was in positive correlation with the size of a country. However, small States' ranking depends on their economic efficiency adjusted by sustainability. Malta, Cyprus and Lithuania belong to the Member States that accessed the European Union in 2004. During this session, the presentations retraced the development of these countries both before and after their entry into the Union. The presentation of **Algirdas Miskinis** focused on factors that influence the economic development of Lithuania, a small economy in transition. The speaker compared the structure and performance of the Lithuanian economy both before and after EU accession, and provided success stories, mentioning the drivers behind these changes. However, he also identified the challenges faced by the Lithuanian economy, by pointing at rising inequalities, high emigration levels, weak innovation and weak labour productivity – all factors that influence competitiveness. The presentation of **Andreas Theophanous** and **Marat Yuldashev** focused on the current situation of the economy of Cyprus. Five years after the economic downturn in March 2013, Cyprus now finds itself in a much better situation and the country has gained stability. In 2016, economic growth was moderate. However, serious problems remain, and they must be addressed, including the challenge of non-performing loans (NPL), the high level of private debt and persistent structural unemployment. **Nicolas Arsalides**, from the European Investment Bank, presented the results of the investment dynamics in Malta, while also highlighting areas requiring political attention. The speaker explained that corporate investments are continuing to rise in Malta and that forecasts remain positive. The main risk to a sustained recovery in investment activities in Malta lies in the shortage of skills. Nearly nine companies out of ten already consider that this represents a hurdle for their investment activities. From a political viewpoint, EIBIS 2017 suggested that the lack of skills, improvements to the transport system, a cut in energy costs and the simplification of trade regulations must be marked as priorities. The presentation of **Michal Jasinski** aimed to analyse the competitiveness of the tourism sector in the small States of the European Union (Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta and Slovenia) compared to larger States in the EU and other tourist destinations in the world. The indicator used to measure competitiveness in tourism is the *Travel & Tourism Competitiveness Report* index.

7.4 Parallel session: Global indicators

In this parallel session, the ranking of small States according to international benchmarks was discussed. **Bambos Papageorgiou** presented the global performance of Cyprus, as well as its performance in the sub-indices of the *Global Competitiveness Report*. He identified the areas in which Cyprus has exceptionally high or low scores and briefly outlined the underlying reasons. **Serge Allegrezza** used the composite indicator of Luxembourg national scoreboard to answer the question as to whether size plays a role in terms of competitiveness. This is a crucial question for small Member States due to the small size of their domestic markets and their inability to benefit from economies of scale. Empirical studies on the impact of size on country performance have been inconclusive. A working document published by Alouini and Hubert (2010) which uses a composite indicator to measure the size of the country has demonstrated that there is a clearly negative relation between the size of a country and its GDP growth rate. However, they concluded that opening up to international trade clearly has a positive impact on growth. By using a panel of 28 Member States over 16 years (2000 to 2015), the regression of the GNI on the composite indicator calculated by the Observatoire de la compétitivité and on the population led to a mixed result, in which the population plays a limited role, whereas competitiveness is highly significant. **Mimoza Agolli** used the benchmarks to compare the level of competitiveness for the small Western Balkan States with the Baltic States, by focusing on four main areas of the *Global Competitiveness Report*, i.e. the institutions, market efficiency, business sophistication and labour market innovation. The idea is to measure the impact of the political framework on the competitiveness ranking of the small Balkan States. To do so, the changes to the competitiveness rankings in a dynamic perspective were analysed, so as to identify the impact of the integration process in those countries. **Lino Briguglio** tested the correlation between economic resilience and competitiveness. In this analysis, resilience was associated to good economic, social and political governance, and vulnerability was associated with exposure to external shocks, mainly as a result of a high level of openness to trade. The results indicated that the small EU States tend to have a high level of economic vulnerability, while at the same time enjoying quite high positions in the competitiveness ranking. This suggests that economic resilience and competitiveness are linked, and a correlation test in the study confirmed this fact.

7.5 Parallel session: Policy framework

“The ‘Luxembourg way of doing things’ is characterised by pragmatism, an ability to adapt and a commitment to constant improvement, while taking advantage of the country’s small size, with its close connections, its great proximity to the decision-makers and its unparalleled flexibility.”² (Luxembourg: Country profile, by the Nation Branding Inter-ministerial Coordination Committee.) In Luxembourgish public bodies, ministries usually employ generalists who can multitask and are adaptable. When comparing the international rankings in areas relating to the organisation and management of the government, Luxembourg’s results are quite positive compared to those of the other 27 Member States. In 2016, for inter-ministerial coordination, Luxembourg ranked in the Top 5: it did very well in terms of governmental efficiency (rank 7) and implementation (rank 6). In this context, **Danielle Bossaert** analysed the typical assets of the public administration in Luxembourg, such as its great agility, reactivity and adaptability, while at the same time illustrating the risks of limited specialisation, which implies great dependence on other countries for expertise and know-how. **Jadranka Kaludjerovic** presented Montenegro’s tax system as a factor of competitiveness, as VAT and profit tax are low in the country. However, efforts must still be made, because income tax and social contributions are very high and represent a burden for businesses. Moreover, some taxes and municipal duties represent an additional cost and are not usually the focus of national policies aiming to create a better business environment.

² <http://www.inspiringluxembourg.public.lu/fr/outils/publications/nation-branding/nation-branding/guide-reference-NB-FR.pdf>

7.6 Parallel session: Social aspects

Francesco Sarracino focused on the well-being of citizens in small States. The recent revival of separatist tensions has brought the issue of autonomous regions and their social and economic performance to the table for a public debate. Is it best to be small? The speaker responded to that question by basing his answers on life satisfaction. Former studies have revealed a systematic gap in life satisfaction between Western and Eastern countries, as well as between North and South. Differences in economic and social performance explain this rift in part. The speaker used European studies on quality of life (2003-2011) to see if, on average, citizens living in small countries were more satisfied with their lives than those living in large countries. The figures indicate that on average, inhabitants of small Western countries are more satisfied with their lives than other Europeans. The figures also confirmed a well-being gap between Eastern and Western Europe. A decomposition using the Blinder-Oaxaca method demonstrated that the difference between the levels of life satisfaction is the result of two factors: on average, residents in small Western countries are richer and more active on the labour market, and trust political institutions more. These results are also confirmed when using the Eurobarometer data (2009-2015). The labour market in Luxembourg is clearly atypical, due to the high number of foreigners and cross-border workers. **Claudia Hartmann** examined the data on immigration in Luxembourg and its policies. She stressed specific policies that are typical of small and micro-States aiming to attract highly qualified workers. **Franz Clément** linked the Luxembourgish labour market to social cohesion. The study attempted to demonstrate how an increase in integration and social cohesion for cross-border workers and foreign workers is felt and viewed in Luxembourgish society. Then he went on to describe the institutions that have been founded and measures designed to reach that objective, as well as proposed measures that may be successful. Unlike the Luxembourgish labour market, Lithuania's job market is suffering from unprecedented emigration levels. Young talented and promising workers are fleeing Lithuania, leading the country's economic competitiveness level to drop from rank 35 in 2016 to 41 in 2017, according to the *Global Competitiveness Report* published by the World Economic Forum. **Néringa Ramanauskė** described how local companies deal with increasing constraints when selecting the required specialists. As a result, the Lithuanian government introduced the new Labour Code in 2017, with the aim of balancing the rights of employers and employees in order to make access to employment more flexible.

7.7 Conclusion

The conference participants approved a 'Final Statement' that was also posted on the website. It was agreed that in a globalised context of free trade, competitiveness is a means to survive and prosper for both companies and the country itself. Competitiveness is particularly important for small States due to their dependence on international trade as a result of the small size of their domestic markets (meaning that they are very dependent on exports) and the limited availability of natural resources (making them very dependent on imports). It was thus recommended that research on the competitiveness of small States be pursued, and that conferences be organised in order to exchange views on the specificities of small Member States.

