

CHAPTER 1

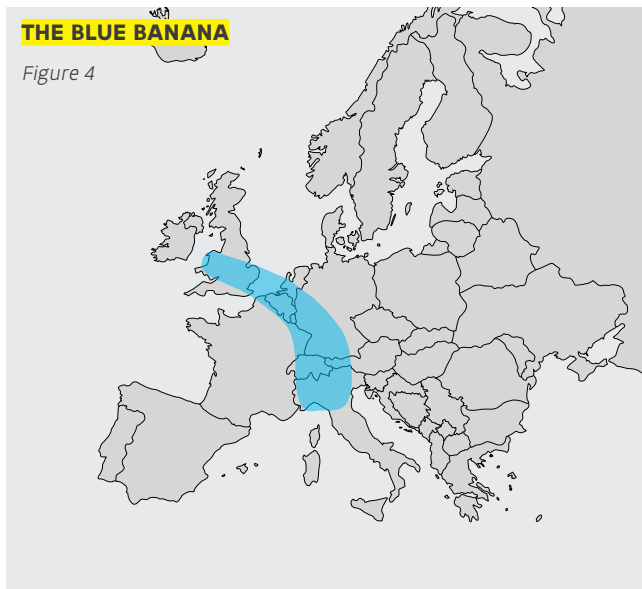
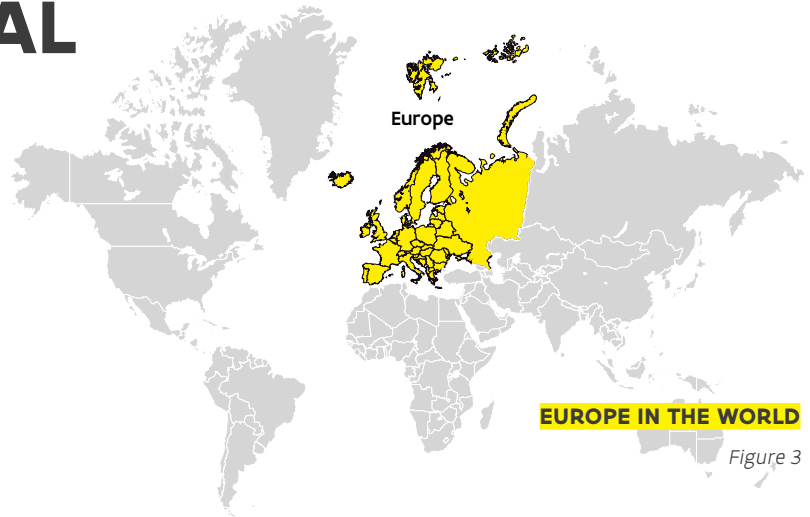
FLANDERS: INNOVATION HUB IN THE HEART OF EUROPE



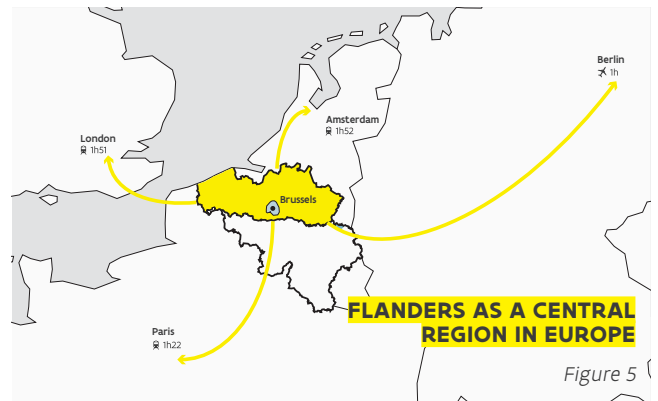
1

GEOGRAPHICAL CONTEXT

Flanders is situated on the European continent. Centrally located within the European Union, it is the northern region of Belgium.



Flanders is part of the area that is sometimes referred to as **the Blue Banana**. This area runs from the north of Italy to the United Kingdom over (parts of) Switzerland, Austria, Germany, France, Luxembourg, Belgium and the Netherlands. It is a series of densely populated urban areas responsible for a substantial part of the economic added value within the European Union.



Belgium's **neighbouring countries** are the Netherlands, Germany, Luxembourg and France. The North Sea forms a natural border with the United Kingdom.

2

INSTITUTIONAL CONTEXT: DIVISION OF R&D&I COMPETENCIES IN THE BELGIAN FEDERATION

While certain policy areas remain exclusively federal (e.g., defence policy, monetary policy, nuclear power research), other domains have largely or even completely been transferred to either the Communities or the Regions. The latter is the case for the Science, Technology and Innovation (STI) domain: **in terms of legislation and budget, scientific research is mainly a community competence, whereas innovation is almost completely a regional competence.** In Belgium, almost 80% of the total public R&D&I support is managed by the Communities and Regions. Flanders counts for 57% of all Belgian public R&D support (2022). The overall policy budget of Flanders now adds up to 61.6 billion euro of which 4.273 billion euro aimed at scientific research and innovation (2023i).

The **federal authority** remains responsible for a limited number of research programmes (notably in the field of climate and sustainable development), the support of research infrastructures of national interest, several federal scientific institutes, and a small number of exclusively attributed research themes, including the Belgian space policy, 'sustainable' nuclear energy and polar research at the Antarctic station. In addition, framework conditions such as IPR, normalisation, standardisation, tax credits and scientific visas for researchers also are exclusively managed by the federal authority. Tax credits aimed at R&D have become very substantial in Belgium in recent years. There is the so-called patent box (a lower tax rate on profits from a company's own innovation), a fiscal exemption of salaries' social contribution for R&D employees at research/

scientific institutes and companies in Belgium, a tax credit for investments in patents and R&D-assets, and a tax exemption for regional subsidies.

As a consequence of this state structure, it is not possible to speak about one Belgian research and innovation system. Given the almost complete autonomy of the regions to set up their own system, there are rather **three R&I-systems** (two large and one small) that compete and cooperate with one another, pretty much like the different R&I-systems of the EU Member States do.

The various activities and policy instruments that Flanders deploys in the field of science, research and innovation, can be divided into the following categories:

2.1 DIRECT SUPPORT FOR R&D&I IN THE BROAD SENSE

This includes:

- **subsidies** or other support channels for basic, fundamental, cutting-edge and applied research that is conducted by researchers at universities, institutes, companies, knowledge networks, etc.;
- all **business-oriented support** (e.g., technology transfer, technology advice, technology scans, networking, dissemination of innovation, knowledge and technology, valorisation or research results, feasibility studies, knowledge vouchers, etc.);
- various forms of **collective research** (joint industry-science research, innovative networks, clustering);
- **promotion and popularisation of STI** (in education, society, business, science centres, etc.), mobility of researchers, etc.

2.2

RESEARCH RELATED TO THE COMMUNITY

This includes:

- broad **innovation policy**, as well as scientific research policy (fundamental, applied and strategic basic research);
- (research at) **higher education institutions** (universities of applied sciences and arts, universities);
- (research at) **public research organisations** (PROs);
- (research at) **scientific institutes and policy research centres** of the Flemish Community;
- (research at) **various institutes** that generate knowledge or scientific output;
- **infrastructure** in the field of research and innovation (small, medium-scale and large-scale research infrastructure, such as supercomputers, data collections, networks, clean rooms, etc.);
- **science parks, technology parks, incubator sites**, etc.;
- **policy research** for the fields for which Flanders is responsible: economic support, industrial policy, entrepreneurship, social economy, public works, employment, environment, nature conservation, forestry, agriculture, energy (except for nuclear energy), heritage, (primary, secondary and higher) education, water management, transport, vocational training, health, culture, tourism, care, health and well-being, data transmission, sports, media, youth, etc.

2.3

ACCESS TO FINANCE

Support for start-ups, spin-offs, participations, seed capital, risk capital, guarantees, fast-growing or technology-oriented businesses, business angels, loans, etc.



3

SOCIO-ECONOMIC, TECHNOLOGICAL AND SCIENTIFIC CONTEXT

Flanders' **population** accounts for about 58% of Belgium's total population, whilst its surface area covers about 44% of the country. The major part of the companies and the active population of Belgium are in its northern region, which also has a higher employment rate.

As a result, the **economy of Flanders** represents about 59% of the Belgian economy (as measured in GDP). It is also a very

open economy: According to the ESA 2010 methodology Flemish exports of goods and services accounted for 106.3% of its GDP in 2021 (partly due to the 'transition' effect and the 'gate' (harbour) effect). On the other hand, the relative wealth of Flanders - as measured in GDP per capita - is about 20% higher than the EU-27 average. The small Brussels Capital Region causes a major "capital city" effect, with its strong presence of company headquarters and public administrations. If the wealth generated by the daily commuters from Flanders into the Brussels Capital Region were attributed to their residence in the Flemish Region, the Flemish GDP per capita would rise to 29% above the EU27 average. Total expenditure on R&D (GERD) in Flanders, which reaches almost 10.82 billion euro (3.65% of Flemish GDP), equates to over 63% of the Belgium total (2021) and the Flemish R&D intensity exceeds the national value for Belgium (for details see Annex III).



KEY FIGURES ON FLANDERS (FLEMISH REGION), BELGIUM AND EU-27

Table 1

	YEAR	UNIT	FLANDERS	BELGIUM	EU-27
SURFACE AREA		km ²	13,521	30,528	4,272,773
POPULATION	1/1/2023	million	6.77	11.52	447.96
GDP IN CURRENT PRICES	2021	billion euro	296.1	502.3	14,582.979
EXPORT	2021	billion euro	317	436	3176
GERD	2021	billion euro	10,816	17,235	331,032
GDP PER CAPITA (PPS)	2021	euro	39,956	39,059	32,517
R&D INTENSITY	2021	%	3.65	3.43	2.16
ANNUAL PUBLIC BUDGET FOR R&D&I FOR FLANDERS, (OF WHICH PUBLIC BUDGET FOR R&D IN STRICT SENSE), BY FUNDING AUTHORITY:	2023	million euro	4,845 (2,671)		
FLEMISH AUTHORITY:			4,273 (2,149)		
FEDERAL AUTHORITY:			330 (330)		
EU / HORIZON 2020:			192 (192)		
EU / ERDF + INTERREG:			50 (0)		
EMPLOYMENT RATE (% OF THE 20-64 YEARS OF AGE)	2021	%	75.6	70	72.7

	YEAR	UNIT	FLANDERS
ANNUAL PUBLIC BUDGET FOR R&D, (IN STRICT SENSE), BY FUNDING AUTHORITY:	2022	million euro	2,404.87 (0.74%)
FLEMISH AUTHORITY:			2,081.08 (0.64%)
FEDERAL AUTHORITY:			323.79 (0.10%)

The following table provides an overview of the weight of the main branches in the economy of the EU-27 and Flanders.

SHARE OF THE MAIN BRANCHES (AND CERTAIN SUB-BRANCHES) IN GROSS VALUE ADDED AND IN EMPLOYMENT IN THE EU-27 AND FLANDERS, 2023, %

Table 2

	GROSS VA		EMPLOYMENT	
	EU-27	FLANDERS	EU-27	FLANDERS
PRIMARY SECTOR	1.8%	0.9%	4%	1%
SECONDARY SECTOR	25.6%	25.9%	23.80%	21.40%
INDUSTRY (WITHOUT CONSTRUCTION)	20.2%	19.6%	17.9%	15.4%
CONSTRUCTION	5.4%	6.3%	5.8%	5.8%
TERTIARY SECTOR	71.2%	73.1%	72.2%	77.70%
TRADE, TRANSPORT, ACCOMMODATION AND FOOD SERVICE ACTIVITIES	18.4%	19.6%	24.5%	22.3%
INFORMATION AND COMMUNICATION	5.5%	4.4%	3.0%	2.9%
PROFESSIONAL, SCIENTIFIC, TECHNICAL, ADMINISTRATIVE AND SUPPORT ACTIVITIES	11.3%	16.7%	11.9%	16.5%
TOTAL	100%	100%	100%	100%
HIGH-TECHNOLOGY MANUFACTURING	2.4%*	2.3%*	1.1%	1.3%
MEDIUM HIGH-TECHNOLOGY MANUFACTURING	6.1%*	5.7%*	5.1%	3.9%
LOW AND MEDIUM LOW-TECHNOLOGY MANUFACTURING	6.4%*	8.8%*	10.1%	9.2%
TOTAL KNOWLEDGE-INTENSIVE SERVICES	39.8%*	42.2%*	39.0%	46.3%
KNOWLEDGE-INTENSIVE HIGH-TECHNOLOGY SERVICES	5.2%*	4.0%*	3.0%	3.7%
TOTAL LESS KNOWLEDGE-INTENSIVE SERVICES	35.0%	33.9%	31.1%	30.0%

Data year 2020 (provisional); For high-Technology and knowledge-intensive services: share of non-financial business economy (B-N_x_K_S95).

Data for EU-27 is no longer available after that year.

Source: Regional Accounts (NBB), Eurostat and OECD (2023)



The most important tertiary sectors in Flanders are 'trade & repair', 'consultancy & testing', 'real estate' (only according to gross value added), 'administrative and support services' (mainly according to employment), 'education' and 'transportation & storage'.

Flanders' share of the secondary sector is 25.9% in gross value added and 21.4% in employment. The relatively greater importance of the secondary sector in gross value added than in employment is an indication of its overall greater labour productivity, due to a greater exposure to international competition by trade, and the higher capital investment in these sectors. The main branches, apart from 'construction' are 'food & beverages', 'chemicals' (mainly according to gross value added) and Pharmaceuticals.

Eurostat provides a classification of the technology intensity of industry and the knowledge intensive services. Flanders has a significantly higher share of knowledge intensive services compared to the EU-27, but performs worse than the EU-27 average for medium high-technology manufacturing and knowledge intensive high-technology services.

3.1

PERFORMANCE OF BELGIUM AND/OR FLANDERS IN INTERNATIONAL PERSPECTIVE

Belgium and/or Flanders are listed in several EU or other international rankings based on (several) R&D&I criteria or indicators. The main indexes are:

3.1.1

EUROPEAN INNOVATION SCOREBOARD, EIS 2023

In the 2023 edition, Belgium is ranked again in the first group of 'innovation leaders'. In previous editions Since 2021 Belgium is ranked IN the first group 'strong innovators' and as the 5th EU member state overall in the EIS 2023 edition.

Strong increases since 2016 are: government support for business R&D, sales of innovative products and public-private co-publications. Strong decreases since 2016 are foreign doctorate students, innovative SMEs collaborating with others and most cited publications.

In terms of indicators, Belgium scores remarkably better than the EU-27 average (=100%) for the following indicators: 'Population with tertiary education (154.3%)', 'Foreign doctorate students (189.7%)', 'Government support for business R&D (176%)', 'Enterprises providing ICT training (160.9%)', 'business process innovators (157.0%)', Innovative SMEs collaborating with others (223.6%), 'Public-private co-publications (265.2%)', 'Employment in innovative enterprises (161.4%)', 'R&D expenditures in the business sector (153.5%), and 'International scientific co-publications (180.4%)'.

Compared to 2016, Belgium has improved its score more than the average EU-score.



3.1.2 REGIONAL INNOVATION SCOREBOARD, RIS, 2023, FROM THE EC

Flanders is a **'leader - innovator'** (= performance > 125% of the EU average), like some other EU regions such as London (UK), South East (UK), Utrecht (NL), Noord-Holland (NL), Hamburg (DE), Köln (DE), Ostschweiz (CH), Oslo og Viken (NO) and Ile de France (FR). Overall in the EU (ranking of 239 regions) Flanders ranks 23th whereas the two other Belgian regions rank 27th (Brussels Capital Region - 'innovation leader') and (Walloon Region 60th - 'strong innovator').

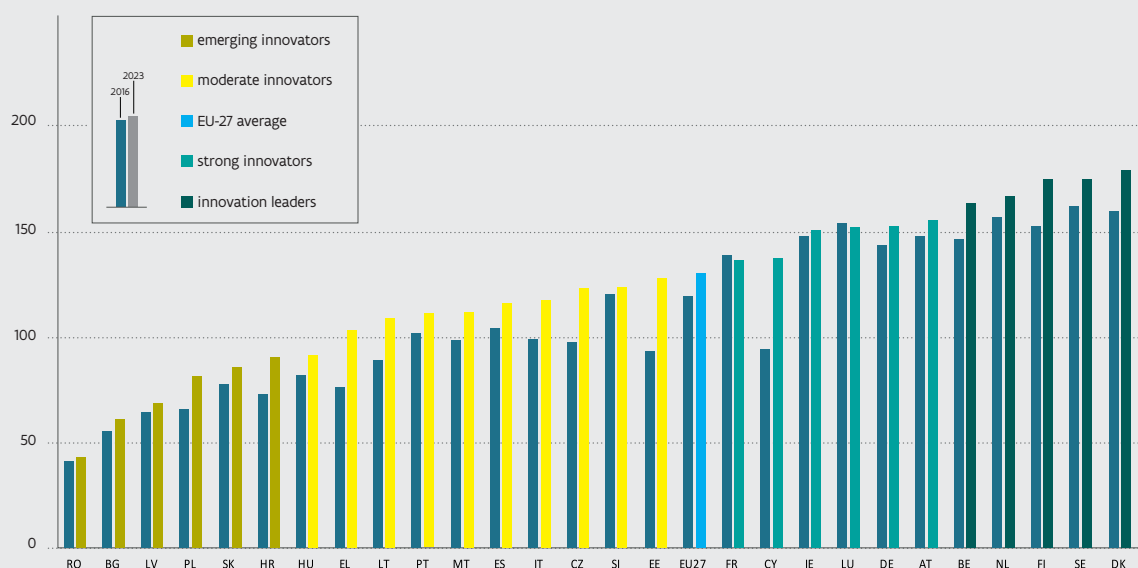
However, it is important to note that the RIS ranks a combination of regions both at the NUTS1 and the NUTS2 level. If the Flemish provinces (NUTS2) would be considered separately, as is done

fore.g. the Netherlands or Germany, the resulting score would differ.

The RIS for Flanders shows that relative strengths compared to the EU are in the categories of "Innovative SMEs collaborating with others", "Business process innovators", "Innovation expenditures per person employed", "Most cited scientific publications", "Product innovators", "Most cited scientific publications", "International scientific co- publications", "Tertiary education" and "Employment innovative enterprises" and "Public-private co-publications". It scores weaker for "Design applications" and "Trademark applications". The difference with the Belgian average is very limited indeed, which is evident because the Belgian figure and data consist for the largest part of the Flemish data therein.

EUROPEAN INNOVATION SCOREBOARD (2016 AND 2023)

Figure 6



3.1.3 GLOBAL INNOVATION INDEX, GII 2023

The GII considers Belgium ranks 23th for input and 22th for output.

Notable strengths are 'education', 'knowledge workers', 'GERD' and 'school life expectancy'.

For 10 indicators it reaches the **top 10 of the world**: education, school life expectancy, researchers (FTE/population), GERD (%GDP), logistics performance, finance for startups and scaleups, knowledge workers, GERD performed by business (%GDP), GERD financed by business (%GDP), Females employed in advanced degrees, University-industry R&D collaboration, GERD financed by abroad (%GDP), research talent (% in business).

3.1.4 COMMUNITY INNOVATION SURVEY, CIS, 2021

The CIS contains a broad set of indicators on innovation activities of enterprises and provides information on environmental benefits due to innovation.

With a score of 75% (versus 68% for Belgium) Flanders ranked first during the period 2018-2020 in the list of the highest proportion of enterprises with innovation activity (product innovations, business process innovations and/or ongoing or abandoned innovation activities), Flanders is ranked among the top countries Greece (73%), Norway (70%), Germany and Finland (both 69%). The EU average is 53% of enterprises of 10 employees or more that reported innovation activity during the period 2018-2020.

3.2 FOCUSING ON STRENGTHS AND "SPEARHEAD DOMAINS"

The **relative specialisation index** can be a useful indication to map the specialisation structure of the science, innovation and economy system, which in turn can be a starting point for the future potential for smart specialisation. This index compares the distribution of activities in science production, technology production, economic performance from a region or a country with the average distribution of the same type of activities in the whole of Europe (or the world). The statistics on respectively the scientific publications, patents and exports are used as proxies for these kinds of activities that can be considered as successive steps in the innovation trajectory, from idea to market. A more than average share of these suggests a specialisation in that specific domain.

3.2.1 SCIENTIFIC SPECIALISATIONS

The scientific specialisation pattern of Flanders is rather **typical for a mature economy with a long tradition in scientific research that covers the whole spectrum**. The Flemish profile is similar to that of most Western countries, with life sciences and medical sciences as the dominant publications areas.

Annex VI provides more details on the scientific publication performance (as well as on the citations and co-publications) and contains a spider web display that benchmarks Flanders to the world standard.

3.2.2 TECHNOLOGICAL SPECIALISATIONS

This section considers the technological specialisation pattern of Flanders. The RTAN index (Relative Technological Advantage Normalized Index) is used for mapping technological specialisation. It is based on a breakdown of EPO patents in 35 technology domains (ISI, Fraunhofer Gesellschaft). Patent data provide an insight in technological progression since they represent an indicator that is used to get a picture of the innovation degree within an organisation, region or innovation system. The index represents the share of a given technology domain in the Flemish patent portfolio, compared to the share of that technology domain in the patent portfolio of a reference group: EU-15, US, Canada, Switzerland, Japan and South-Korea.

An RTAN index between -1 and 0 implies relative under specialisation in Flanders, an index between 0 and +1 implies that Flanders is specialised in that domain.

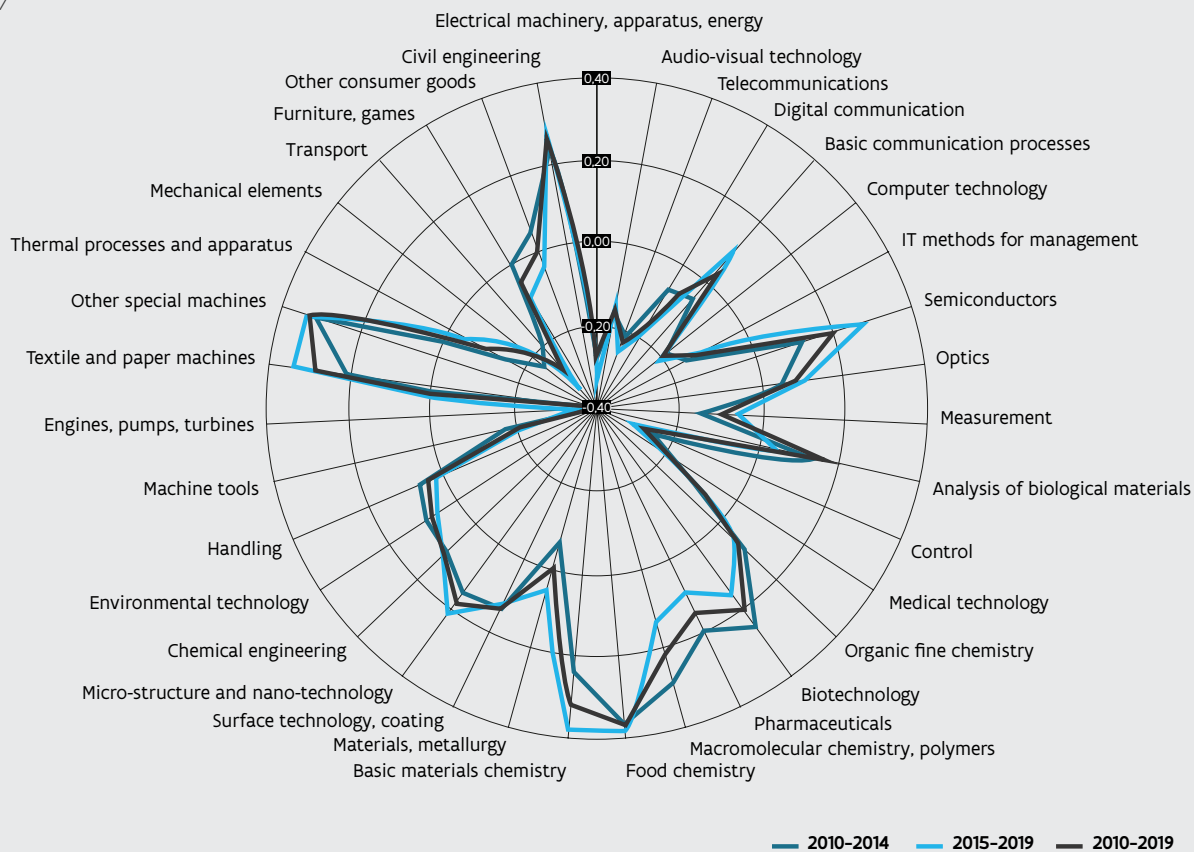
The radar graph (see Figure 7) reveals that Flanders has a relatively strong technological specialisation in chemical domains (e.g. basic materials chemistry, food chemistry, macromolecular chemistry, polymers), as well as biotechnology and pharmaceuticals, although specialisation in the latter ones has been decreasing over the considered time period. Further Flemish specialisations are semiconductors, textiles and paper machinery, all of which have been increasing over the considered period; as well as - but to a lesser extent - microstructures and nanotechnology.

This specialisation is driven on the one hand by several Flemish companies with strong in-house R&D in sectors such as machinery/mechatronics, foods and particularly pharmaceuticals (which is the largest high- technology sector in Flanders). On the other hand, these specialisations also reflect the activity of the different Flemish strategic research institutes: nanotechnology (IMEC), biotechnology (VIB), materials and energy (VITO) and specialised research departments at the five universities of the Flemish Community (see page chapter 3).

Flanders represents about two thirds of the total Belgian patent portfolio, whereby 82% of patent activity is accounted for by private companies (see Figure 7).

TECHNOLOGICAL SPECIALISATION (RTAN) OF FLANDERS BASED ON THE EPO PATENTS, 2010-2014, 2015-2019 EN 2010-2019, INDEX BETWEEN -1 AND +1.

Figure 7



For the calculation of the RCA values the NACE export value information of the following reference countries en regio were used: Flanders, Belgium, Austria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, The Netherlands, Portugal, Spain, Sweden and United Kingdom, US, Canada, Switzerland, Japan and South-Korea .

3.2.3 ECONOMIC SPECIALISATIONS

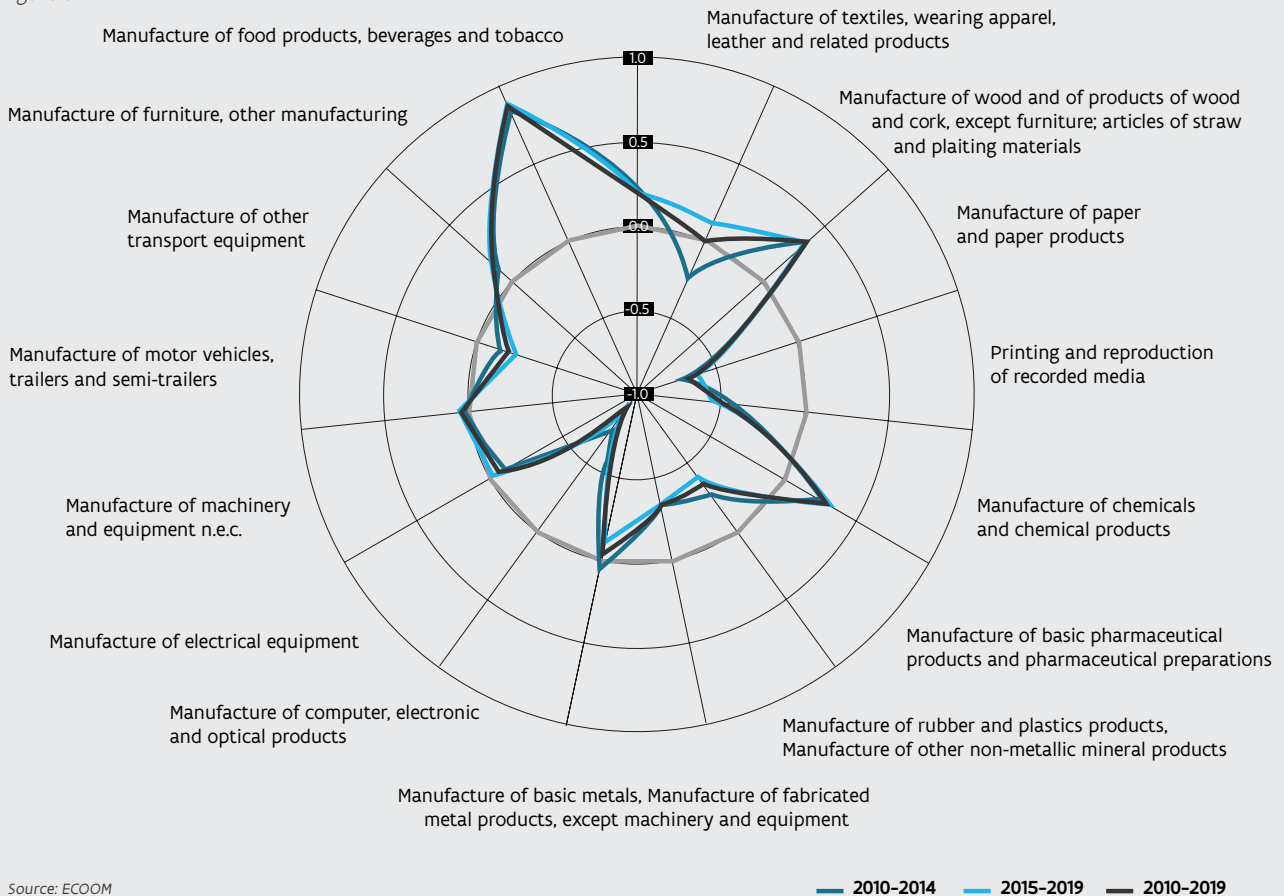
To establish the degree of economic specialisation, the Revealed Comparative Advantage (RCA) is used. It benchmarks the breakdown of Flemish export in sectors (NACE) to the sectoral breakdown of export in a set of reference regions and countries. The figures reveal a very strong specialisation of Flanders in printing and reproduction of recorded media and strong specialisations in the **manufacture of chemicals** and chemical products and **manufacture of food products, beverages and tobacco**. The specialisation in **manufacture of basic metals** and fabricated metal products, as well as **manufacture of wood and of products of wood and cork** is somewhat lower but still positive. These are usually sectors that are closely linked

to the intermediate position of Flanders in international value chains, whereby Flanders represents a link to larger economies, in particular Germany. In addition, Flanders is relatively specialised in a “traditional” sector like food products: it is a very important industrial sector in terms of employment with a wide set of specialisations such as pork meat, frozen vegetables and potatoes, etc. The economic specialisation patterns of Flanders has remained stable over the considered time period, with the exception of the manufacture of basic pharmaceutical products and pharmaceutical preparations, which has evolved from being relatively under specialised to a neutral degree of specialisation in Flanders.

The economic specialisation pattern of Flanders (see Figure 8) reflects that of a mature and (still) highly diversified economy.

**ECONOMIC SPECIALISATION (RCAN) PATTERN OF FLANDERS
BASED ON THE RELATIVE EXPORT SHARES, 2010-2014, 2015-2019
EN 2010-2019, INDEX BETWEEN -1 AND +1.**

Figure 8



NACE sector 19 (Manufacture of coke and refined petroleum products) were not included in the calculation. The reason is the missing export values for several EU-countries, whereby a distorted representation of the RCA values is created.

In most sectors, the Flemish economy has been able to maintain a critical mass and remain competitive, while the under-specialisation in some sectors is due to the conditions in Flanders (e.g. mining).

3.2.4 COMBINED TECHNOLOGICAL - ECONOMICAL SPECIALISATION PROFILES

The coherence of specialisations in the subsequent stages of the innovation trajectory for a specific industry, from idea to (export) market, can be considered as competitive advantage of a region or country for this specific industry. However, the correspondence between these classifications is only partially assured, hence there is no direct match between science classifications and technology classifications. Between technology and economic classifications this matching has been achieved based on the so-called "Fraunhofer classification" of technology domains.

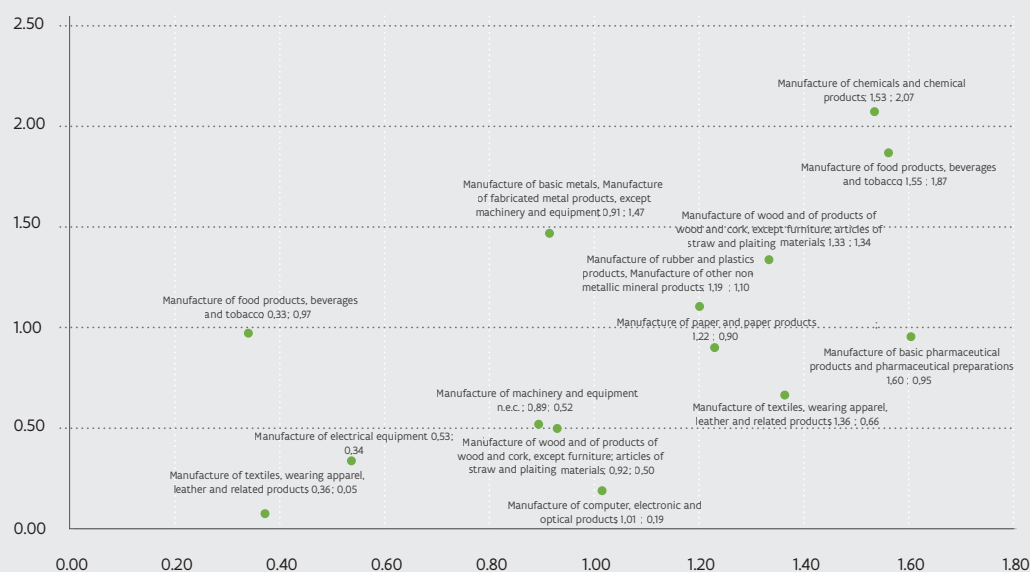
The figure below represents the alignment between technological (RTA) and economic (RCA) specialisation patterns in Flanders. For

most domains, technological and economic specialisation are in line with one another. They are both high for 'Printing and reproduction of recorded media', 'Manufacture of food products, beverages and tobacco', 'Manufacture of chemicals and chemical products', 'Manufacture of wood and of products of wood and cork, except furniture; articles of straw and plaiting materials' and 'Manufacture of rubber and plastics products'. They are both low for 'Other transport equipment', 'Manufacture of machinery and equipment' and 'Manufacture of furniture, other manufacturing'.

For some domains however, technological specialisation in Flanders is not fully translated into economic specialisation: 'Manufacture of basic pharmaceuticals and pharmaceutical preparations', 'Manufacture of paper and paper products', 'Manufacture of textiles, wearing apparel, leather and related products' and 'Manufacture of computer, electronic and optical products'. On the other hand, for 'Manufacture of basic metals, manufacture of fabricated metal products, except machinery and equipment', a considerable economic specialisation in Flanders is not fully mimicked in the Flemish technological specialisation pattern.

COMBINATION OF THE RELATIVE TECHNOLOGICAL SPECIALISATION PATTERNS (RTA) WITH THOSE FOR ECONOMIC SPECIALISATION (RCA) (2010-2019)

Figure 9



Source: ECOOM

For the calculation of the RCA values the NACE export value information of the following reference countries and regions were used: Flanders, Belgium, Austria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, The Netherlands, Portugal, Spain, Sweden and United Kingdom NACE sector 19 (Manufacture of coke and refined petroleum products) were not included in the calculation. The reason is the missing export values for several EU-countries, whereby a distorted representation of the RCA values is created. NACE sector 18 (Printing and reproduction of recorded media) has the highest RTA and RCA values (2.57; 16.51). This sector were not included in the graph in order to visualize, more clearly, the other sectors.