National Productivity Board

Annual Report 2024

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Executive summary

Productivity growth is crucial. Indeed, not only is it an important factor for the growth of real incomes, but, as the main determinant of economic growth, productivity growth also means that many of the challenges we face today are easier to bear financially. One obvious example is the budgetary cost of ageing population. With an increase in average annual labour productivity growth from 1.2 % to 1.3 %, the budgetary cost of ageing would fall by 0.6 pp of GDP over the period 2023-2070[1]. Furthermore, large-scale investments are also needed to adapt to climate change and the climate transition, and other societal challenges that are emerging in, e.g., the areas of mobility, social cohesion, new developments in health care, geopolitical developments, defence, etc. These challenges require additional resources/investments, both private and public, which without economic growth could only be financed by a decline in consumption and/or would put further pressure on the sustainability of public finances.

The present report looks at the state of play of productivity growth in Belgium and focuses on two levers that are important to boost productivity growth.

Key messages:

Productivity growth has been on a downward trend for some time, averaging only 0.5 % over the period 2019-2023. This is significantly lower than the average annual growth in labour productivity assumed in the reference scenario (1.2 %) by the Study Committee on Ageing. It is therefore crucial to make productivity a priority on the political agenda.

Even though there is still a lot of uncertainty, there are various reasons to believe that Artificial Intelligence (AI) can provide substantial aggregate effects on productivity. However, as previous waves of digitisation showed, these effects on productivity will not materialise by themselves. There is a need for coherent policies that facilitate a broad uptake of AI, with a specific focus on small and medium-sized enterprises (SMEs), which have substantially lower uptake rates than large companies. A key policy focus is the data ecosystem. The availability and accessibility of quality data (e.g., health (care) data) needs to be strengthened, and regulations must not create any unnecessary barriers in this regard. Furthermore, rolling out high-quality data and connectivity infrastructure, the availability of the right skills and strengthening governance are also important elements in an AI policy.

A second lever for productivity growth discussed in this report is public investment. Despite improvements in recent years, the government's net capital stock currently remains lower than it was in the mid-1990s and, at the current pace, is not expected to reach the target of 4 % of GDP by 2030 set by the previous government. At the same time, Belgium is confronted with major challenges as regards the sustainability of its public finances. It will therefore be essential to allocate public resources effectively, and focus on the areas where we expect a clear return in terms of productivity, and which subscribe to a long-term digital and green transition. In addition, the necessary reforms from the Recovery and Resilience Plan must urgently be implemented, so that no European recovery funds go to waste.

Diagnosis of productivity growth

The declining trend in labour productivity gains, which started in the late 1970s and accelerated after the global financial crisis of 2008, was exacerbated by successive crises in recent times. While the average annual growth rate of labour productivity per hour in Belgium still reached 0.7 % over the period 2000-2023, the figure was only 0.5 % for the period 2019-2023 (as a reminder, the Study Committee on Ageing assumes an average growth rate of 1.2 % over the period 2023-2070).

Divergent evolution of productivity has been observed in major sectors of activity in the more recent period. In particular, the Belgian manufacturing, like its French counterpart, is experiencing a decline in productivity, while productivity growth in market services is accelerating, in Belgium as well as in Germany and the Netherlands.

[1] High Council of Finance, Study Committee on Ageing, Annual Report 2024, Table 7, p. 36.

The difference in performance of Belgian manufacturing industries is also growing, with 6 industries seeing a reduction in labour productivity, accelerated for some of them such as chemicals and metals, and 5 industries seeing an acceleration in productivity growth, such as manufacturing of motor vehicles, electronic products and machinery and equipment.

The recovery in the average annual growth rate of market services over the period 2019-2023 compared to the period 2012-2019 is thanks to the performance of 5 industries (Trade, Computer services, Real Estate activities, Scientific R&D, and Advertising and technical services) where productivity is accelerating along with an acceleration in value-added growth by volume, and two industries where the reduction in productivity has weakened somewhat (Publishing, film, video, and Accommodation and food services).

For the three regions individually, the available time series are not as long, so the effect of the energy crisis is not yet visible, but even in the individual regions a slowdown in productivity growth following the financial and economic crisis is clearly visible. The evolution of sectoral productivity does however show regional differences.

Contribution of non-market services to productivity growth: focus on education

In the absence of market prices for non-market services, it is not possible to construct a measure of the productivity of these activities on the basis of data from national accounts alone as relevant as the one for market activities. We therefore need to look at other indicators to supplement the information from the national accounts, and to monitor the evolution of the contribution of these services to the economy as a whole. Given the importance of human capital in productivity growth, we focus our investigation in the context of this report on education. A number of regional indicators were also discussed in this analysis, depending on the availability of data.

The analysis shows that the education and training system has contributed to a spectacular improvement in the education of the Belgian population over the last 20 years. This increase in human capital has clearly been beneficial to the Belgian productive sector. However, this favourable evolution is not enough to meet all the needs of businesses, especially in the context of the two transitions, digital and environmental. As already indicated in previous reports, Belgium has witnessed a growing shortage of graduates in STEM, and in information and communication technology. Furthermore, in Belgium more than elsewhere, the results of secondary school students are strongly correlated with their socioeconomic status, and this limited role of the basic education system in correcting initial socioeconomic inequalities limits the number of young people who could acquire the most useful skills for our society. Secondary education, along with pre-primary and primary education, also proportionately attracts the most financial resources in Belgium compared to the three neighbouring countries. It is therefore in this area that the largest efficiency gains seem to be achievable.

The improvement in human capital contributed 0.2 percentage point every year to productivity growth over the period 2000-2019, and this contribution has been extremely stable overtime despite the crises that have come along. In contrast, the role of human capital in the contribution of TFP is more ambiguous, as the latter has visibly slowed down in recent years. A sub-optimal allocation of skilled personnel between companies could be one explanation for this. Another explanation could be that life-long learning is not fully exploited to maintain and improve workers' skills.

Potential of artificial intelligence for productivity growth

Artificial Intelligence - and in particular the rise of Generative AI (GenAI) - is leading to high expectations for productivity growth. Indeed, generative AI is seen as the next General Purpose Technology (GPT). Due to the broad applicability of these types of technologies in virtually all sectors/activities, they can offer significant and long-lasting effects on productivity growth. Moreover, (Gen)AI stands apart from other technologies due to its impact on science and technology - think of the use of (Gen)AI in research for new drugs, new materials, etc. This technology can therefore give a strong boost to innovation.

Controlled experiments within companies have already shown substantial productivity gains for workers who use AI for specific tasks. However, despite these positive figures at the company and task level, we do not (yet) see these effects at the aggregate level. Among other things, the macroeconomic impact will depend on how

successfully the technology is applied. For new technologies - and GPTs in particular - to generate productivity gains, they must be sufficiently widespread in the economy and supplemented by complementary (often intangible) investments.

As regards the spread of AI, we are still at an early stage. Even though Belgium scores fairly well from a European perspective (4th place out of 27), in absolute terms the proportion of companies using at least one AI technology is still limited (14%). In order to fully realise the potential benefits of AI, policies will therefore need to further encourage the adoption of this new technology across businesses and sectors.

Various elements need to come together in this regard. One crucial element involves strengthening the data ecosystem. It is important that the competent authorities devise a coherent data strategy as soon as possible which provides solutions to optimise the availability and access to quality data and to facilitate mutual data exchange. Specific attention is needed in this regard for strategic sectors such as health care, where it is crucial to make progress on a Health Data Agency (HDA) as soon as possible. Moreover, it must be ensured that (European) regulations are not too restrictive and strike a balance between protection on the one hand and stimulating innovation on the other. There is also a need to focus on high-quality data and connectivity infrastructure (e.g. fibre optic networks (FTTP) and 5G coverage) and the skills needed for the digital transition. Finally, there needs to be a specific focus for SMEs that have substantially lower adoption rates of AI than larger companies. It will be important to support these companies in their continued digitisation, guiding them and making them aware of the importance of AI.

In addition to the spread of AI technologies, efforts also need to be made at the European level, to build up our own AI ecosystem. Belgium needs to look at how it can support this EU policy and in what areas Belgian companies can integrate in the European AI ecosystem, taking into account our relative strengths.

In general, effective AI policy also requires strengthening governance. There are policies/strategies at various levels to encourage AI development and adoption, but it is important to envisage how the initiatives can reinforce each other. Alignment and coordination between the different policy areas and levels of government will be important in this regard. Moreover, the speed at which the technology is changing also calls for a learning approach, whereby existing policies are evaluated and adapted as necessary on a regular basis.

Intermediate evaluation of the Recovery and Resilience Facility

In July 2020, in response to the COVID crisis, a historic recovery plan was adopted at the European level, with the main element being the Recovery and Resilience Facility (RRF). The goal of the RRF was not only to foster a post-pandemic recovery, but also to enhance resilience in the face of future crises. To benefit from the RRF, member states had to submit a Recovery and Resilience Plan (RRP) with national investment and reform agendas for the period 2021-2026.

Notwithstanding the positive elements in the design of the facility to make the funding more effective, a number of challenges were identified when the plans were implemented. For example, the number of payment requests submitted to the EC is lower than envisaged in the operational arrangements, with the risk that not all planned measures will be completed within the implementation period of the RRF.

Belgium is also running behind the initial planning. Our country has since submitted two payment requests, but besides the pre-funding, has only received a partial payment on the first instalment. For Belgium, as for several other member states, it is therefore a question of significantly accelerating the implementation of the Recovery and Resilience Plan, including the REPowerEU chapter, by completing reforms and investments by August 2026.

Investment needs will still be high even after the implementation of the RRF, not least because of the investments needed to realise the green and digital transitions. In Belgium, public investment in particular is a matter of concern. Even though gross fixed capital formation increased in recent years, the government's net capital stock currently remains lower than in the mid-1990s (44 % of GDP in 2021 versus 50 % in 1995).

At the same time, Belgium is confronted with major challenges as regards the sustainability of its public finances. It will therefore be crucial more than ever to allocate government resources efficiently. In choosing investments, it is important to focus on the areas where we expect a clear return in terms of productivity, and which subscribe

to a long-term digital and green transition. The Study Committee for Public Investment can play an important role in this regard, and must be further supported. Furthermore, it must be explored how the selected investments can be made more efficient. Better coordination of the various entities with investment authority in Belgium could help in this regard.

But intra-EU coordination is also important, not only to achieve the necessary scale effects, but also to take into account the external effects of one country's investments on other EU countries and to avoid distorting the level playing field between member states. There is therefore a need to strengthen the European approach, whereby public and private funds are channelled in a more coordinated manner. This should make it possible to pursue an efficient industrial policy without creating distortions between member states.

This report takes into account data from national accounts up until October 2024.

Introduction

Productivity growth is crucial. Indeed, as the main determinant of economic growth - in fact, in the long run, the only source of potential output - productivity growth means that many of the challenges we face today are easier to bear financially. Think of the sharply rising social spending due to an ageing population; but also the extensive investments needed to adapt to climate change and the climate transition; and other societal challenges that are emerging, e.g., in the areas of mobility, social cohesion, new developments in health care, etc. These challenges require additional resources/investments, both private and public, which, without economic growth, will have to be financed by a decrease in consumption and/or will put further pressure on the sustainability of public finances. Moreover, productivity growth is also an important condition for growth in real incomes.

In the first part of this report, we make a diagnosis of productivity growth in Belgium. In previous reports, we observed that productivity growth has been slowing for some time and that recently the slowdown in economic growth following the war in Ukraine also negatively affected hourly labour productivity growth in Belgium. In this report, we analyse whether this trend is continuing, both at the national and regional levels. We then also consider the problems of measuring the productivity of non-market services, and specifically evaluate the contribution of the education and training system to the overall production function in Belgium.

The second part focuses on a number of levers for achieving productivity growth. In the previous report of the National Productivity Council, we identified three - interrelated - strands that are critical to achieving productivity growth: an adequate supply of skilled labour, sufficient public investment, and stimulating innovation. In this report, we go into more depth with two of these strands.

In particular, we will first look at the importance of digital innovation and, more specifically, the opportunities offered by Artificial Intelligence (AI) in this area. As also stated in the recent Draghi report, the widening productivity gap between the EU and the US is largely explained by a different impact of digital technologies, both in terms of the proliferation of new tech companies and the spread of digital technologies in the economy. It will therefore be crucial that we do not miss the coming AI wave. In this chapter, we explore in more detail the expected effects of AI on productivity, the development and adoption of this technology in Europe and Belgium, and the conditions that must be met to take full advantage of it.

The second lever explored in more detail in this report is public investment. More specifically, an interim assessment is made of the Recovery and Resilience Facility (RRF), the main component of the NextGenerationEU plan, and the future public investment challenges are explored.

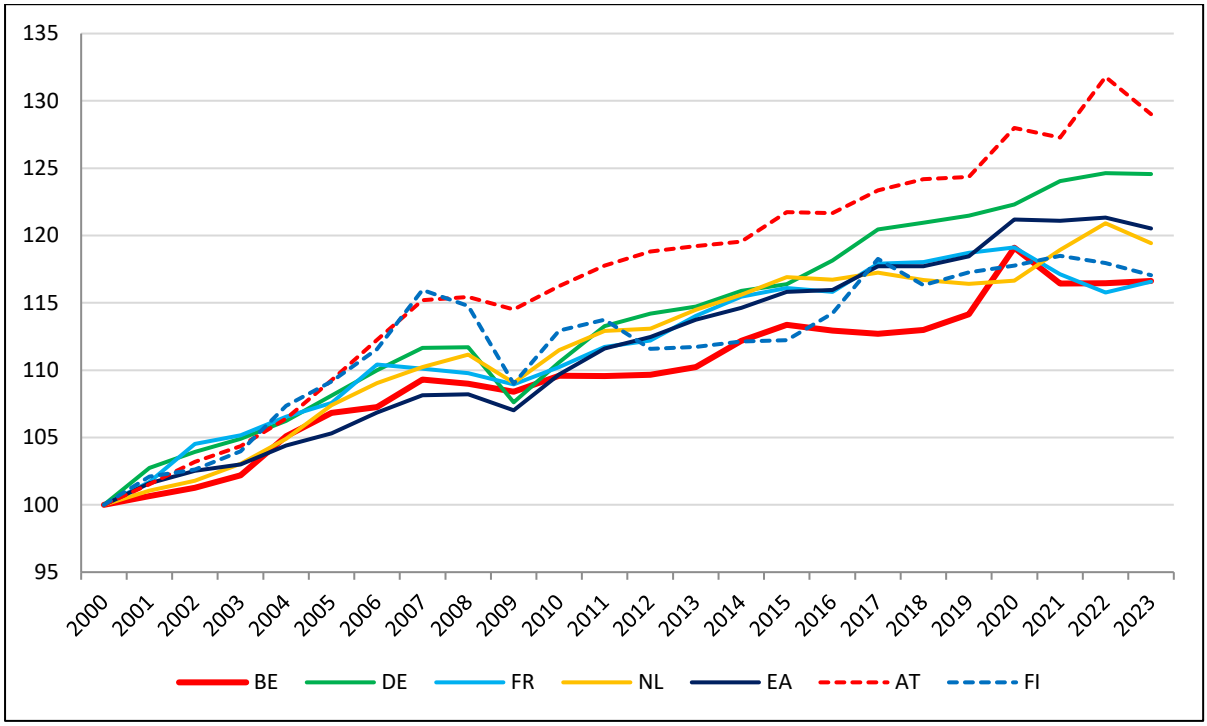
1. Findings

1.1. National Diagnosis

a. Confirmation of the slowdown in labour productivity growth after a succession of crises

Productivity growth remains weak in Belgium, as in its neighbouring countries and on average in the Euro area (see graph 1).

Graph 1. Trend in hourly labour productivity
Index 2000=100



Source: Eurostat, October 2024 and NAI October 2024.

Over the entire 2000-2023 period, the average annual growth rate of hourly labour productivity was less than 1 % in Belgium, as in the Euro area as a whole (see table 1), continuing the downward trend in productivity gains that began in the late 1970s.

Table 1. Average annual growth rate of hourly labour productivity
In %

	2000-2023	2000-2007	2007-2012	2012-2019	2019-2023
Belgium	0.7	1.3	0.1	0.6	0.5
EA 20	0.8	1.1	0.8	0.7	0.5
Germany	1.0	1.6	0.5	0.9	0.6
France	0.7	1.4	0.4	0.8	-0.5
Netherlands	0.8	1.4	0.5	0.4	0.6
Austria	1.1	2.0	0.6	0.7	0.9
Finland	0.7	2.1	-0.8	0.7	0.0

Source: Eurostat, October 2024 and NAI October 2024.

The growth rate of hourly productivity over the recent period (2019-2023) was lower than that recorded over the entire period (2000-2023), and slowed compared to the previous period (2012-2019) in Belgium as in all the countries studied, with the exception of the Netherlands and Austria.

As table 2 shows, the recent period (2019-2023) was characterised by moderate growth in value added in volume, while in most of the countries studied and in Belgium, the hours worked dynamic remained stable. However, in Germany and Austria, the two countries with the largest reduction in the growth rate of value added in volume over the recent period, hours worked have contracted.

Table 2. Average annual growth rates of value added in volume and hours worked
In %

	2000-2023		2012-2019		2019-2023	
	VA	H	VA	H	VA	H
Belgium	1.6	0.9	1.5	0.9	1.7	1.2
EA 20	1.3	0.4	1.6	0.8	1.0	0.5
Germany	1.2	0.2	1.6	0.7	0.3	-0.3
France	1.3	0.6	1.3	0.5	0.7	1.2
Netherlands	1.6	0.9	1.9	1.5	2.0	1.4
Austria	1.4	0.3	1.5	0.9	0.7	-0.3
Finland	1.1	0.4	1.0	0.3	0.5	0.5

Source: Eurostat, October 2024 and NAI October 2024.

b. Sectoral divergence in hourly productivity trends persists

A comparison of hourly productivity trends in the major sectors of the economy shows that, over the entire 2000-2023 period, manufacturing had the highest productivity growth rate in Belgium, as well as in the three main neighbouring countries (see table 3).

Table 3. Average annual growth rate of hourly labour productivity, sectors
In %

	Belgium	Germany	France	Netherlands
		2000-2023		
Total economy	0.7	1.0	0.7	0.8
Manufacturing	1.8	2.0	1.8	2.5
Market services	0.7	1.1	0.4	1.0
Non-market services	0.3	0.2	0.6	0.0
		2000-2007		
Total economy	1.3	1.6	1.4	1.4
Manufacturing	3.4	3.6	3.7	4.5
Market services	1.3	1.6	1.0	1.5
Non-market services	0.0	-0.2	0.8	-0.2
		2012-2019		
Total economy	0.6	0.9	0.8	0.4
Manufacturing	2.0	1.4	1.5	1.5
Market services	0.7	1.3	0.5	0.5
Non-market services	-0.1	-0.2	0.6	-0.1
		2019-2023		
Total economy	0.5	0.6	-0.5	0.6
Manufacturing	-0.3	2.0	-0.3	2.3
Market services	1.0	1.1	-0.5	1.3
Non-market services	1.1	1.0	0.1	0.0

Note: Manufacturing corresponds to heading C, market services cover headings G to N and non-market services cover headings O to U of NACE rev 2.
Source: Eurostat, October 2024 and NAI October 2024.

Despite this overall strong performance, the growth rate of productivity in manufacturing in Belgium and France has continuously slowed from one period to the next, with the most recent period (2019-2023) marking a decline in productivity. Conversely, Germany and especially the Netherlands experienced a rebound in productivity growth in manufacturing over the same period.

The recent period also saw an acceleration in productivity growth in market services in Belgium and the Netherlands. Among the countries being compared, only France showed a clear fall in productivity gains in market services, with a negative growth rate over the 2019-2023 period.

As shown in the National Productivity Board (NPB) 2022 annual report, which breaks down productivity growth using the "Generalised Exactly Additive Decomposition" method, the slowdown in the productivity growth rate for the economy as a whole is mainly due to weaker productivity gains at industry level, rather than a change in the structure of activities. Indeed, the two effects of input reallocation - on the one hand, the effect of input reallocation between industries with different productivity levels (Denison effect), which is positive in Belgium, and on the other hand, the effect of input reallocation between industries with different productivity growth rates (Baumol effect), which is negative - are relatively weak and shrank over the 2012-2019 period compared to the 2000-2007 period.

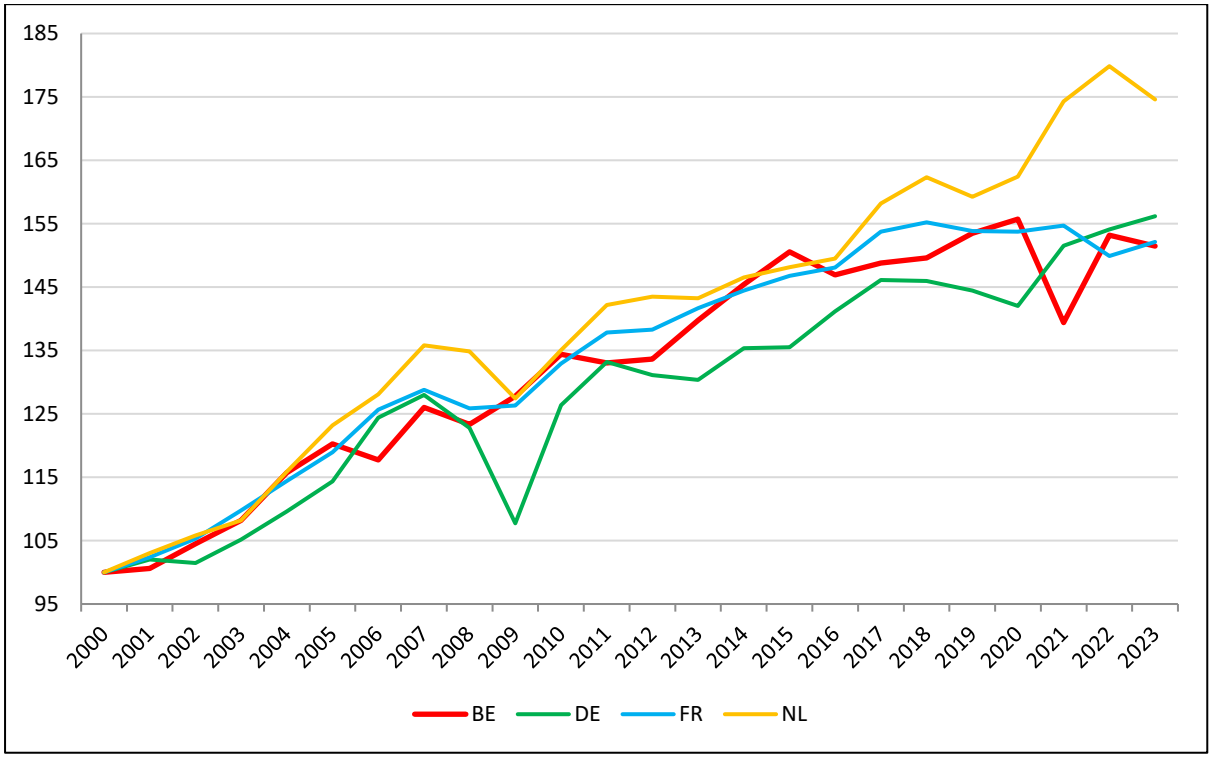
As in the past, the two major sectors, manufacturing and market services, are analysed in greater detail. This analysis is based on activities under the A38 classification of the national accounts, which is the most detailed sectoral level for which official data on hours worked are available in Belgium.

Manufacturing

As shown in graph 2, the recent succession of crises has had a negative impact on labour productivity trends in the Belgian and French manufacturing, in contrast to Germany and especially the Netherlands. The result has been a performance dispersion between Belgium and its three main neighbouring countries since 2020.

The reduction in hourly labour productivity in Belgian manufacturing over the 2019-2023 period is primarily explained by the decline in value added in volume, with hours worked continuing to fall but at a slower pace than in the previous period, as shown in table 4.

Graph 2. Trend in hourly labour productivity in manufacturing
Index 2000=100



Source: Eurostat, October 2024 and NAI October 2024.

Table 1. Average annual growth rates of value added in volume, hours worked and hourly productivity in Belgian manufacturing

In %

	Value added			Hours worked			Productivity		
	00-23	12-19	19-23	00-23	12-19	19-23	00-23	12-19	19-23
Manufacturing	0.5	1.4	-0.6	-1.3	-0.6	-0.2	1.8	2.0	-0.3
Food industry	0.6	-1.0	0.4	0.1	0.8	1.3	0.5	-1.9	-0.9
Textile industry	-4.1	-3.2	-2.9	-4.9	-2.9	-2.4	0.8	-0.4	-0.5
Wood and paper industry	-0.9	-1.4	-3.6	-2.0	-1.6	-2.1	1.1	0.2	-1.5
Oil refining	3.1	0.2	8.3	-0.5	1.3	-3.6	3.7	-1.1	12.4
Chemical industry	-1.7	1.3	-8.1	-1.0	-0.4	0.9	-0.7	1.7	-8.9
Pharmaceutical industry	7.7	9.3	8.3	2.2	2.6	3.3	5.4	6.6	4.9
Rubber and plastics industry	-0.2	0.8	-5.1	-0.8	-0.3	-0.5	0.5	1.1	-4.7
Metallurgical industry	-1.2	1.6	-6.8	-2.0	-2.1	-1.5	0.9	3.8	-5.3
Electronics manufacturing	0.9	1.6	2.1	-3.3	-0.1	-0.5	4.4	1.6	2.7
Manufacturing of electrical equipment	-3.0	-4.2	-2.7	-2.9	-2.4	-2.9	-0.1	-1.8	0.2
Manufacturing of machines and equipment	0.1	-2.1	2.6	-0.9	-2.1	1.9	1.1	0.1	0.7
Motor vehicle manufacturing	-1.3	0.2	1.5	-3.3	-2.3	-2.5	2.1	2.6	4.1
Other manufacturing industries	1.6	3.2	-0.3	0.6	1.9	-0.6	1.0	1.3	0.3

Source: Eurostat, October 2024 and NAI October 2024.

The recent 2019-2023 period also saw divergence in the performance of the industries making up manufacturing. Six of the thirteen industries recorded a contraction in labour productivity, at a sustained rate for some, such as the chemical and metallurgical industries. With the exception of the food industry, all sectors where labour productivity declined saw their value added in volume fall. Two industries, including the pharmaceutical industry experienced a slowdown in the labour productivity growth rate. However, five industries recorded an acceleration in productivity growth, including motor vehicle, electronics and machine and equipment manufacturing. The high labour productivity growth rate in oil refining is explained by the strong growth in value added in volume, itself explained by the behaviour of production and intermediate consumption deflators in the context of the energy crisis.

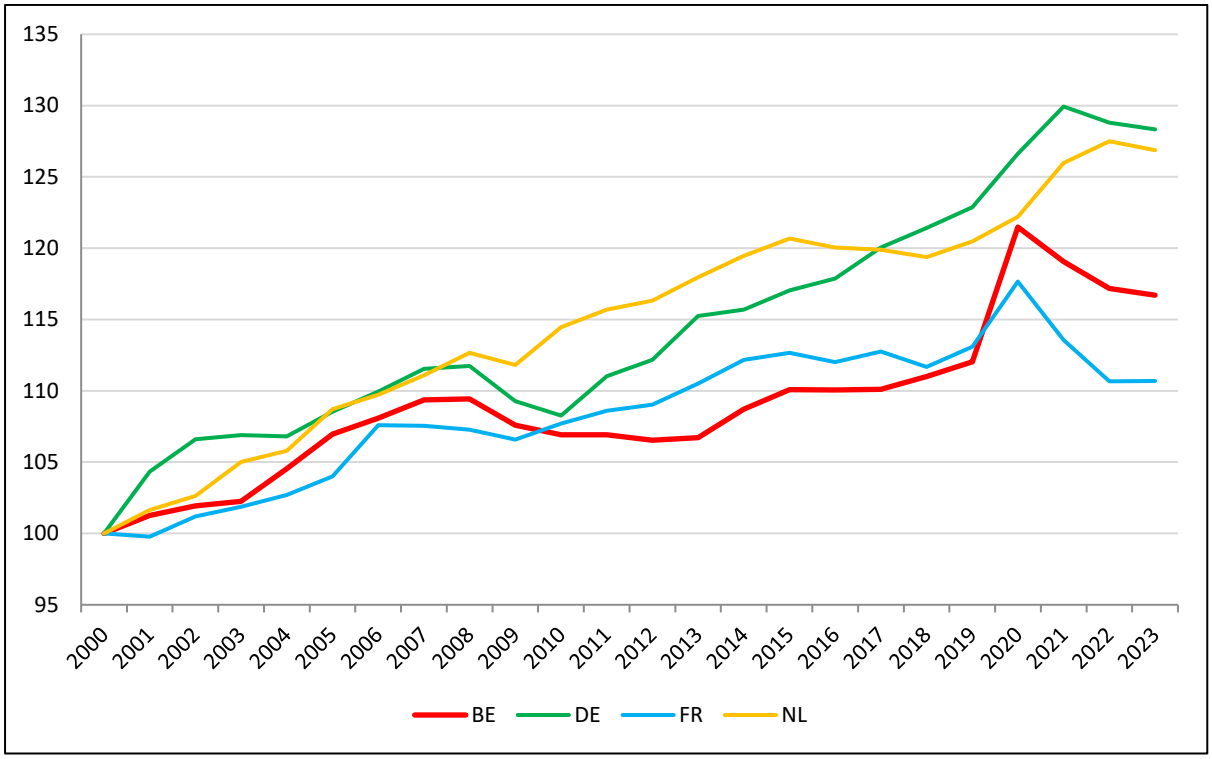
Only two industries, the pharmaceutical industry and machines and equipment manufacturing, recorded positive productivity growth over the 2019-2023 period, while also increasing hours worked.

Market services

The recent period also saw dispersion in productivity performance between the four countries studied in relation to market services (see graph 3). Since the COVID crisis, productivity has declined in Belgium and especially in France, while it has remained stable in the other two countries. The graph highlights the importance of 2020 in explaining the acceleration in the average annual productivity growth rate of Belgian market services over the 2019-2023 period compared with the 2012-2019 period.

Graph 3. Trend in hourly labour productivity in market services

Index 2000=100



Source: Eurostat, October 2024 and NAI October 2024.

Table 5. Average annual growth rates of value added in volume, hours worked and hourly productivity in Belgian market services

In %

	Value added			Hours worked			Productivity		
	00-23	12-19	19-23	00-23	12-19	19-23	00-23	12-19	19-23
Market services	2.2	2.0	2.3	1.5	1.3	1.3	0.7	0.7	1.0
Wholesale and retail trade	1.5	0.1	3.7	-0.2	-0.3	0.1	1.7	0.4	3.6
Transportation and storage	0.4	0.8	-0.6	0.0	0.6	1.0	0.4	0.2	-1.6
Accomodation adn food service activities	1.1	0.9	1.6	0.9	1.9	2.3	0.3	-1.0	-0.7
Publishing, cinema, video	0.0	-0.9	-0.4	0.0	0.2	0.6	0.0	-1.1	-1.0
Telecommunications	4.5	4.8	0.4	-1.8	-2.6	-3.1	6.3	7.6	3.6
IT Services	5.4	5.3	6.5	4.3	5.0	4.0	1.1	0.3	2.4
Financial and insurance activities	1.3	1.3	-1.5	-1.4	-1.6	-1.1	2.7	2.9	-0.3
Real estate activities	2.5	1.9	3.3	1.8	3.0	-0.4	0.7	-1.0	3.7
Legal and accounting activities	3.6	3.4	3.8	4.0	1.7	2.4	-0.4	1.7	1.3
Scientific R&D	3.2	-0.4	11.4	3.3	4.8	4.9	-0.1	-4.9	6.2
Advertising, technical Services	2.8	2.7	7.0	1.3	2.8	1.0	1.5	0.0	5.9
Administrative and support services	2.7	6.0	0.1	2.8	3.5	0.6	-0.1	2.5	-0.5

Source: Eurostat, National Accounts, October 2024.

The analysis of hourly labour productivity trends in the 12 industries that make up the Belgian market services shows that the recovery in the overall annual growth rate of market services over the 2019-2023 period compared with 2012-2019 is based on the performance of 5 industries (wholesale and retail trade, IT services, real estate, scientific R&D and advertising and technical services), where productivity was accelerating in tandem with faster growth in value added by volume, and two industries where the reduction in productivity slowed slightly (publishing, film and video and accommodation and food services).

The dispersion of productivity performance in market services narrowed over the 2019-2023 period compared with the previous period, due to the fall in the average annual productivity growth rate of the most dynamic sector (telecommunications over the 2012-2019 period and scientific R&D over the 2019-2023 period) and the reduction in the negative growth rate of the least dynamic sector (scientific R&D over the 2012-2019 period and transportation and storage over the 2019-2023 period).

1.2. Regional diagnosis[2]

The regional diagnosis is designed to analyse regional labour productivity data in order to highlight the dynamics from this perspective, which were previously examined at the national level.

Methodology

Data

The regional diagnosis is based on data from the regional accounts published by the National Accounts Institute (NAI) in February 2024. As usual, value added was provisionally estimated for the most recent year (i.e. 2022), but no estimates were made for labour volumes, which are only available for the previous year (2021). All of these statistical series start in 2003.

Additional assumptions

While the results are presented according to the major categories of activities (manufacturing, construction, market services, non-market services and other), hourly productivity estimates are first made for 38 sectors (A.38).

However, the series of hours worked for the self-employed are only available for 10 industries (A.10) in the accounts. For each region, the hours worked by the self-employed by A.38 industry, the level of sectoral dis-aggregation published for employees, therefore needs to be estimated. The following method was used: the average working hours of the self-employed by A.38 sector is obtained by weighting the average working hours of salaried workers in the same region, by A.38 industry, by the ratio between the average working hours of the self-employed and the salaried workers, both evaluated by A.10 industry. The result between this estimated average duration and the number of self-employed workers by A.38 sector gives an estimate of the number of hours worked by the self-employed by A.38 industry[3]. In each region, the breakdown by A.38 industry resulting from this estimate is then used to break down the volume of hours published for each A.10 industry between the different A.38 industries from which it is composed.

In addition, value added by volume by industry needs to be measured. In the absence of regional information on prices, regional value added by volume, both in this analysis and in the regional accounts[4] is obtained using the national deflators at a level of detail of 64 industries (A.64) and additional assumptions relating to the volume of government activity in these industries. This approach makes it possible to consider regional price differences associated with the structure of the activity of regional economies.

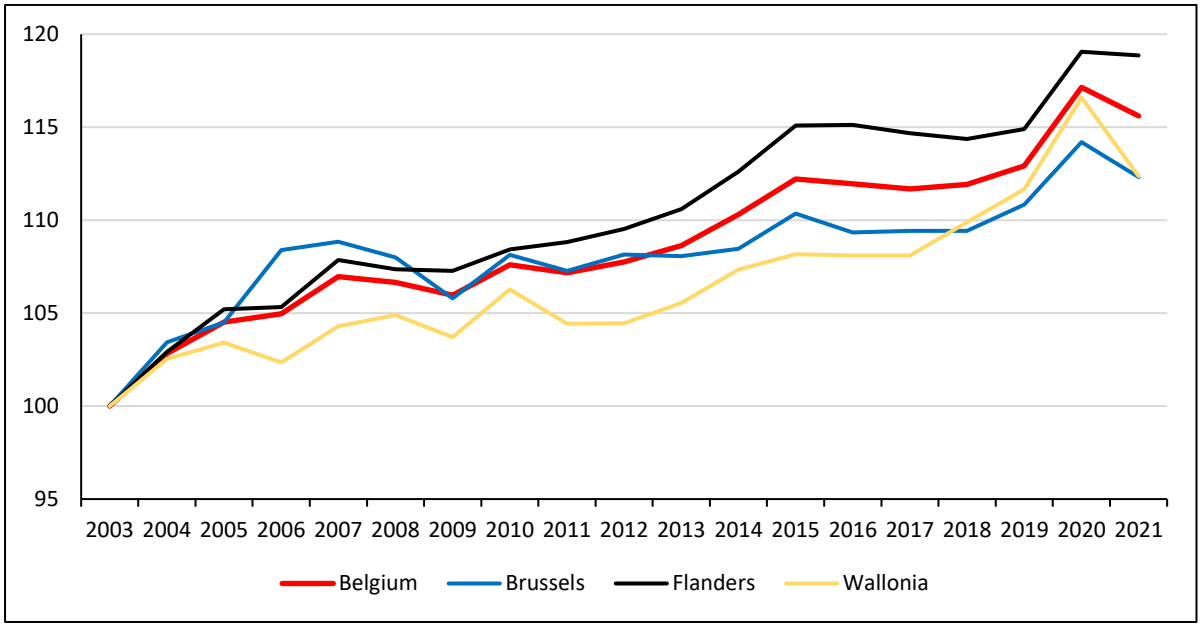
a. Analysis of the productivity dynamics of the Belgian regions

On average for the entire 2003-2021 period, Flanders had the highest hourly labour productivity growth rate (1.0 %), ahead of Wallonia (0.7 %) and the Brussels Region (0.6 %). Graph 4 shows how these average trends mask differences in the growth trajectories of labour productivity between regions.

[2] The analysis in this section was prepared by the Brussels Institute for Statistics and Analysis (BISA), the Institut wallon de l'évaluation, de la prospective et de la statistique (IWEPS) and Statistiek Vlaanderen.
[3] An alternative estimation method, whereby the national series are regionalised by A.38 industry, produces similar results. These results were therefore not included in the analysis.
[4] Nevertheless, the NAI's regional accounts currently only provide an aggregate volume for the economy as a whole.

Graph 4. Trend in hourly labour productivity in Belgium and its regions

Index 2003=100



Source: Regional Accounts.

As is the case for Belgium as a whole, a general trend towards a slowdown in regional productivity gains over the last few decades has been documented in previous NPB reports. This decline continued over the period preceding the health crisis, as evidenced by the slowdown in average annual hourly productivity growth rates measured over the two periods in which there was no major crisis, i.e. 2003-2007 and 2012-2019 (see table 6).

Table 6. Average annual growth rate of hourly labour productivity in Belgium and its regions

In %

	2003-2021	2003-2007	2007-2012	2012-2019	2019-2021
Belgium	0.8	1.7	0.1	0.7	1.2
Brussels-Capital Region	0.6	2.1	-0.1	0.4	0.7
Flemish Region	1.0	1.9	0.3	0.7	1.7
Walloon Region	0.7	1.1	0.0	1.0	0.3

Source: Regional Accounts.

The declining hourly productivity gains are most pronounced in the Brussels-Capital Region and Flanders, while the average hourly productivity in Wallonia only declined slightly. This trend stems from contrasting underlying regional trends in economic activity and labour volumes (see table 7). Over the 2012-2019 period, the general slowdown in average economic growth rates was similar in the Brussels-Capital Region and the Flemish Region, with a relatively resilient volume of hours worked. The increase in the number of hours worked remained at 1.1 % per year on average in Flanders, and even increased slightly in Brussels (0.4 % per year on average), but this rate of growth remained lower than in the other two regions. However, in Wallonia, the growth in activity (1.7 %) was equivalent to that observed in Flanders (1.8 %), and was accompanied by a more moderate increase in the number of hours worked (0.7 %).

Table 7. Average annual growth rates of value added (by volume), labour volume and hourly productivity, 2003-2007 and 2012-2019

In %

	2003-2021		2003-2007		2012-2019		2019-2021	
	VA	H	VA	H	VA	H	VA	H
Belgium	1.6	0.8	2.9	1.2	1.6	0.9	0.7	-0.5
Brussels-Capital Region	0.9	0.2	2.2	0.1	0.8	0.4	-0.5	-1.2
Flemish Region	1.9	0.9	3.3	1.4	1.8	1.1	1.5	-0.2
Walloon Region	1.4	0.8	2.7	1.6	1.7	0.7	-0.7	-1.0

Source: Regional Accounts.

In 2020 and 2021, the public support measures adopted in response to the health crisis and the simultaneous shock to economic activity, targeting the labour market in particular, were substantial and contributed to the resilience of the channels supporting productivity[5]. The loss of activity in 2020 was primarily reflected by a substantial decrease in working hours, and much less in an adjustment in employment, largely unaffected as conditions for accessing temporary unemployment measures were eased. The considerable adjustment in hours worked was therefore rendered into a marked rise in hourly productivity in all three Belgian regions, while apparent labour productivity fell due to the limited decrease in the number of workers. This trend was reversed in 2021 due to the sharp upturn in economic activity. Over the two-year period as a whole, hourly labour productivity rose in all three regions, with Flanders recording the greatest increase. In Brussels and Wallonia, the recovery in activity was only partial (-0.5 % for Brussels and -0.7 % for Wallonia, compared with 1.5 % in Flanders), and the contraction in the volume of hours worked was more marked in Brussels (-1.2 %) and Wallonia (-1.0 %) than in Flanders (-0.2 %).

b. Sectoral breakdown of regional productivity growth

A comparison of hourly productivity trends in the major industries of the economy reveals that, over the 2003-2021 period as a whole, labour productivity gains in the manufacturing industry were significantly higher in the three regions compared with the other major industries. There was also strong productivity growth in the construction sector in Flanders and Wallonia. Hourly productivity growth in market services in Wallonia appears to lag behind the increases observed in Brussels and Flanders. These results are shown in table 8.

A comparison of the recent trends in sectoral productivity in the regions between the two periods in which there was no crisis, i.e. 2003-2007 and 2012-2019, confirms the existence of regional disparities (see table 8).

Table 8. Average annual growth rates of hourly labour productivity in Belgium and its regions, sectors
In %

	Belgium	Brussels-Capital Region	Flemish Region	Walloon Region
		2003-2021		
Manufacturing	2.0	1.5	2.2	1.6
Construction	0.9	0.4	0.9	0.9
Market services	1.1	1.1	1.2	0.9
Non-market services	-0.1	0.2	-0.3	0.0
		2003-2007		
Manufacturing	3.9	7.4	3.6	3.8
Construction	3.1	4.3	3.1	2.9
Market services	1.7	2.3	2.0	0.8
Non-market services	0.2	0.8	0.1	0.0
		2012-2019		
Manufacturing	2.1	3.1	1.6	3.7
Construction	1.1	-0.3	1.3	0.8
Market services	0.8	0.7	0.8	1.1
Non-market services	-0.2	-0.1	-0.2	-0.1
		2019-2021		
Manufacturing	0.7	-6.4	3.1	-4.9
Construction	-1.9	-1.2	-3.0	0.4
Market services	2.8	2.0	3.3	2.6
Non-market services	-0.5	-0.2	-0.8	-0.3

Notes: (1) Manufacturing industry corresponds to heading C, market services cover headings G to N and non-market services cover headings O to U of NACE rev 2; (2) A large part of the Flemish public services are located in the Brussels-Capital Region. These are therefore included in the "non-market services" sector in Brussels and not in Flanders, thereby reducing the relative importance of this sector in the Flemish economy.

Source: Regional Accounts.

[5] NPB (2021), Third Annual Report of the National Productivity Board, October 2021.

The marked slowdown in industrial productivity growth observed nationally between these two periods is particularly pronounced in Brussels, but also in Flanders. Overall, the Walloon manufacturing industry seems to have recovered, with average productivity gains between 2012 and 2019 close to pre-financial crisis levels.

Wallonia stands out from the other two regions, recording a slight upturn in productivity growth in market services over the 2012-2019 period, while the Brussels-Capital Region and the Flemish Region suffered from lower labour productivity growth in the tertiary market sector, which was higher than in Wallonia. In contrast, productivity growth in the construction sector clearly slowed in all three regions, with the Brussels-Capital Region even recording productivity losses.

Productivity growth can be broken down by distinguishing between real productivity growth within each industry and what relates to a change in the sectoral structure of employment. As indicated in the NPB's 2022 annual report, this breakdown over the two sub-periods without a crisis, specifically 2003-2007 and 2012-2019, shows that the marked slowdown in productivity gains observed in Brussels and Flanders is largely explained by an exhaustion of productivity dynamics within industries. In Flanders, net reallocation dynamics improved, due to an increase in the effect of employment reallocation in industries with different productivity levels. In Brussels, the impact of sectoral reallocations remained unchanged, with the reduction in the negative effect of employment reallocation in industries with different growth rates being offset by the unfavourable (negative) trend in the contribution of employment reallocation between industries with different productivity levels. In Wallonia, the slight decline in intrasectoral performances was partly offset by the easing of the negative effect of growth reallocation.

The impact of the health crisis did not eliminate the regional disparities in productivity by industry. Consequently, Flanders recorded a strong recovery in industrial productivity in 2019-2021, while this declined in Wallonia, and productivity losses were recorded in Brussels' industry, which admittedly accounted for a much smaller share of the economic structure than in the other two regions. In contrast, productivity growth in market services accelerated in all three regions. Wallonia, and to a lesser extent Brussels, also benefited from significant productivity gains in the construction sector. Finally, all three regions contributed to the decline in productivity in non-market services observed at the national level.

c. Productivity gains and sectoral contributions

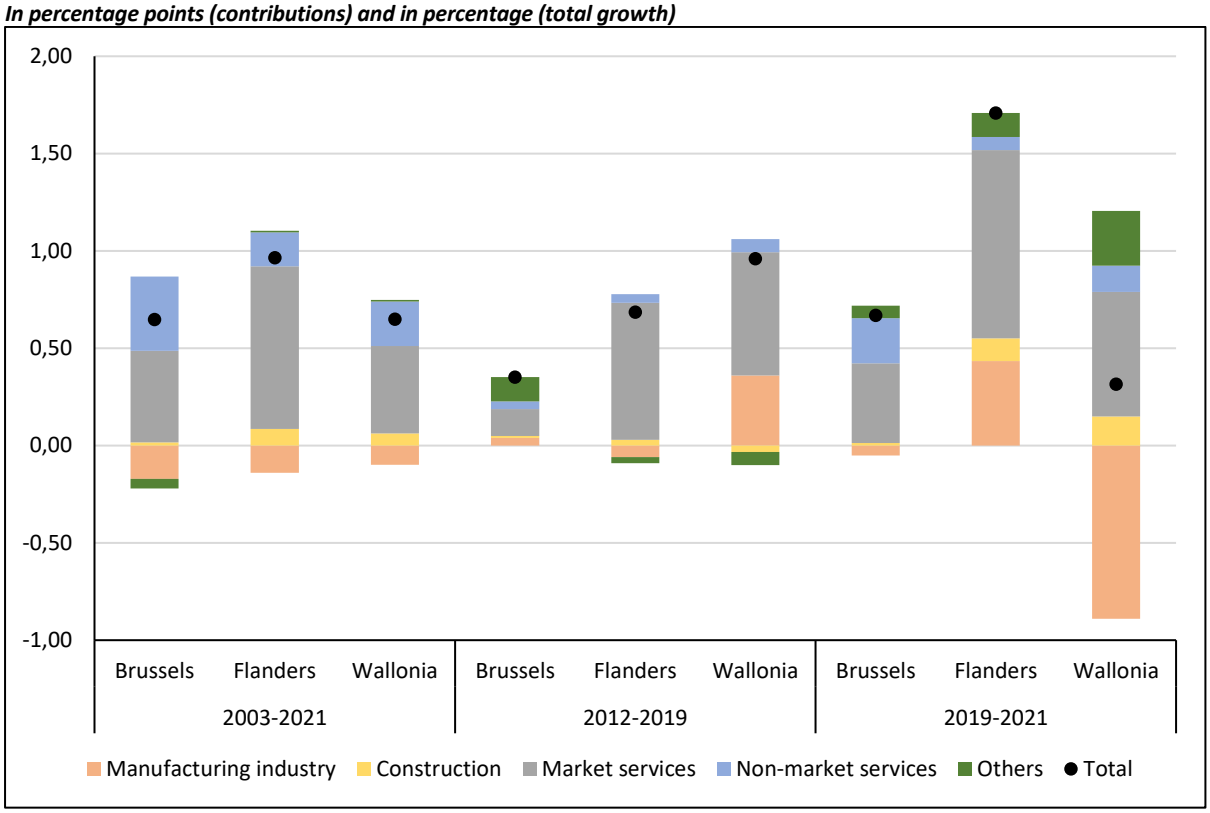
The sectoral breakdown of productivity growth, according to the contribution of the major industries, can be used to assess the trend in sectoral contributions to the growth of aggregate labour productivity. Over the entire period (2003-2021), labour productivity growth was mainly driven by the development of market and non-market services. In contrast, manufacturing industries made a negative contribution to productivity growth in the three regions where industrial activity kept pace with overall regional economic growth. Sectoral contributions to productivity growth during the pre-crisis period (2012-2019) and the crisis period (2019-2021) are shown in graph 5.

The slowdown in aggregate labour productivity over the period preceding the health crisis reflects a different trend in sectoral contributions within the Belgian regions. Over the 2012-2019 period, the decline in the average annual productivity growth rate in Brussels and Flanders can be explained by a general decrease in sectoral contributions, led by market services and, to a lesser extent, non-market services. This trend is emphasized by the fact that the construction sector made no contribution in any of the three regions. In Wallonia, the contribution of the tertiary industries remained broadly unchanged, while the manufacturing industry resumed its positive contribution to average annual productivity growth.

Over the 2019-2021 period, labour productivity growth in the three regions was primarily driven by productivity gains in market and non-market services, where activity was broadly restricted by the various social distancing measures, without any corresponding adjustment in labour volume. The contribution of the manufacturing industry to the rise in labour productivity, which remained significant in Flanders due to the rapid rebound in foreign trade from 2021, was strongly negative in Wallonia, due to the downturn in value added in the pharmaceutical industry in 2021.

Graph 5. Sectoral contributions to the average annual growth rate of hourly labour productivity

In percentage points (contributions) and in percentage (total growth)



Note: Manufacturing corresponds to heading C, market services cover headings G to N and non-market services cover headings O to U of NACE rev 2.

Source: Regional Accounts.

2. Analysing productivity in non-market services

2.1. The problem of measuring labour productivity in non-market sectors

Introducing a global system of price and volume indices covering all jobs and resources of goods and services encounters a particular difficulty in terms of measuring the production of non-market services in volume. Non-market services differ from market services in that they are not sold at market prices. Most public services and services provided by non-profit organisations are characterised by the fact that they are made available to users free of charge or at an insignificant price, far lower than their production cost. Under these conditions, either there is no price, or the price does not reflect the conditions of supply and demand. These include police, justice and education services, for example.

Initially, the national accountants assessed the value of non-market service production by the sum of its costs. In this case, the production volume of non-market services is obtained by dividing each production cost item by a corresponding price index. This is the **input method**, which has the major drawback of showing no significant change in productivity. Most of the value added of public services is in fact comprised of employee compensation. The trend in value added therefore remains virtually parallel to that of payroll at both current and constant prices.

In an attempt to address this issue, a distinction is made between two categories of public services: collective public services and individual services.

Collective public services are provided simultaneously to a group of people, as is the case with the justice or police services. The activities of these services are mainly recorded under the "Public administration" sector in the national accounts category (sector O of NACE Rev 2). Difficulties in defining correct quantity indicators for these services have resulted in the continued use of the input method to measure their production.

Individual services are acquired by one person for the purpose of satisfying their own needs, to the exclusion of any possibility of acquisition by another person. These include health and education services. In Belgium's national accounts, the value added of healthcare services is estimated based on administrative data, such as hospital accounts. However, the "human healthcare" sector is also characterised by a certain level of government intervention (indirectly, through reimbursements), which often means that there is no market price for this type of service. According to Eurostat's recommendations in the "Handbook on price and volume measures in national accounts", it is preferable to establish direct volume indices in this case. In Belgium, these volume indicators are based on the number of services provided per service type. This method of calculating volume directly from units of quantity is the **output method**. The handbook also contains a restriction on making additional explicit adjustments for quality variations in this volume estimate. This is due to the lack of consensus at European level on the methodology that should be used. This may result in some quality-related adjustments being reflected in the deflator and not in the volume estimate.

Similar reasoning applies to education services. In Belgium, this type of service is mainly provided by the government. Consequently, according to the ESA 2010 definitions, the production of non-market educational services is equal to the sum of its costs. In order to estimate volume, a direct volume indicator is estimated based on the number of pupils and teaching hours, broken down by the type of education at a relatively detailed level (primary, secondary, tertiary, etc.). For this sector, the deflator is therefore also a derived estimate based on both value and volume. Here too, there is the problem of measuring quality adjustments.

While the output method represents progress in recording the activity of individual non-market services, it is not without its problems. Indeed, it is not enough to define quantity indicators; their quality must also be taken into account to calculate productivity trends accurately.

There is a third method, the **outcome method** which is a results-based method that assumes that the utility of a service is based on its result. But the difficulty in defining the expected result of a service and obtaining a reliable measure of it, and the difficulty in distinguishing between the input of the service provider and the

personal efforts of the service users (such as pupils' desire to learn for the education system) make this method more theoretical than conceivable in the context of national accounts.

In conclusion, the national accounts do not yet allow us to establish a measure of labour productivity in non-market services of the same quality as that established for market activities.

In the absence of an accurate measure of hourly labour productivity in these services, it is worthwhile investigating whether there are indicators that can supplement national accounts data, which can be used to track changes in the contribution of these services to productivity of the economy as a whole. Given the importance of human capital to productivity growth, this report focuses on education.

2.2. Education: the main tool for human capital accumulation

The aim is to bring together indicators and results from the literature to assess changes in the contribution of the education and training system to Belgium's overall production function. This does not mean assessing the achievement of all the objectives assigned to education and training activities by our society, but focusing on their contribution to productivity growth of the Belgian economy as a whole.

In this context, the main function of education is to contribute to the formation of human capital. This function is analysed in comparison with other European countries, and in particular with Belgium's three main neighbours, using quantitative and qualitative indicators. The contribution of improved human capital to economic and labour productivity growth is then assessed using the growth accounting. This contribution to the growth of the education function is also compared with its cost to society, through the evolution of public spending on education, in order to gain a better understanding of the efficiency of the education system.

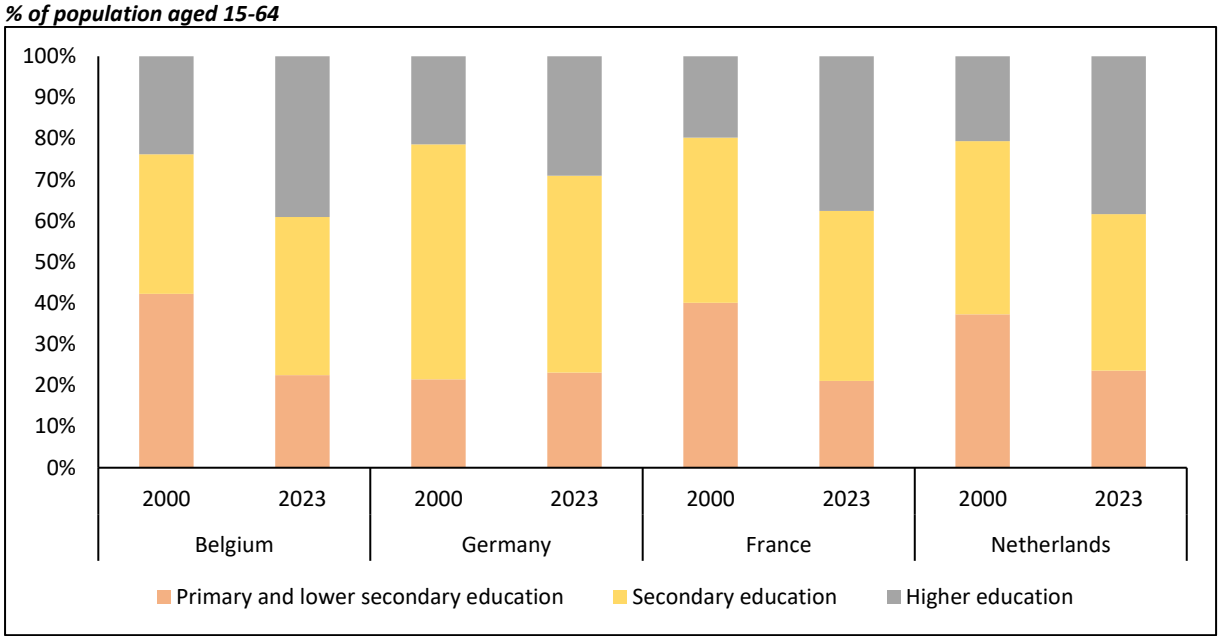
Where data are available, the analysis includes the community and/or regional dimension of Belgium. This dimension depends on the available source. Data relating to individuals, notably in the Labour Force Survey (LFS), are regional, while administrative data are often at community level.

a. Qualifications of the workforce and the population: quantitative indicators

In less than a generation, the qualification profile of the population, as measured by the highest qualification obtained, has dramatically changed in Belgium. While in 2000, the largest group of the population aged 15 to 64 (42.3 %) had only a lower secondary education qualification, in 2023, higher education graduates were most numerous, representing 39.1 % of the Belgian population, placing Belgium well above the Euro area average (31.5 %).

This trend can also be seen in our three main neighbours, although to a lesser extent in Germany, where by 2000, due to the quality of its technical education, a significantly higher proportion of the population had a secondary school qualification than in the other countries (see graph 6). It should also be noted that Germany is the only country among those compared where the proportion of individuals with only a lower secondary education qualification increased between 2000 and 2023. This could be a result of immigration of young people and low-skilled workers or those with qualifications not recognised in the EU.

Graph 6. Breakdown of the population by highest qualification obtained
% of population aged 15-64



Source: Eurostat, Labour Force Survey (edat_lfse_03).

National trends are mirrored at regional level, as shown in table 9. These statistics are based on the place of residence.

Table 9. Breakdown of the population aged 15 to 64 according to qualification obtained, 2000 and 2023
In %

	Primary and lower secondary		Secondary		Higher	
	2000	2023	2000	2023	2000	2023
Brussels-Capital Region	40.1	25.8	26.7	28.0	33.1	46.2
Flemish Region	41.9	20.3	34.4	39.7	23.7	40.0
Walloon Region	45.9	25.4	32.9	39.7	21.2	35.0

Source: Eurostat, Labour Force Survey (lfst_r_lfsd2pop).

The "higher education" category was the largest in the Brussels-Capital Region in 2023 (46.2 %), as for Belgium as a whole. In the Flemish Region, the "higher education" category (40.0 %) is roughly equal to the "secondary" category (39.7 %). In contrast, the Walloon Region is characterised by a higher proportion of "secondary" (39.7 %) than "higher" (35.0 %).

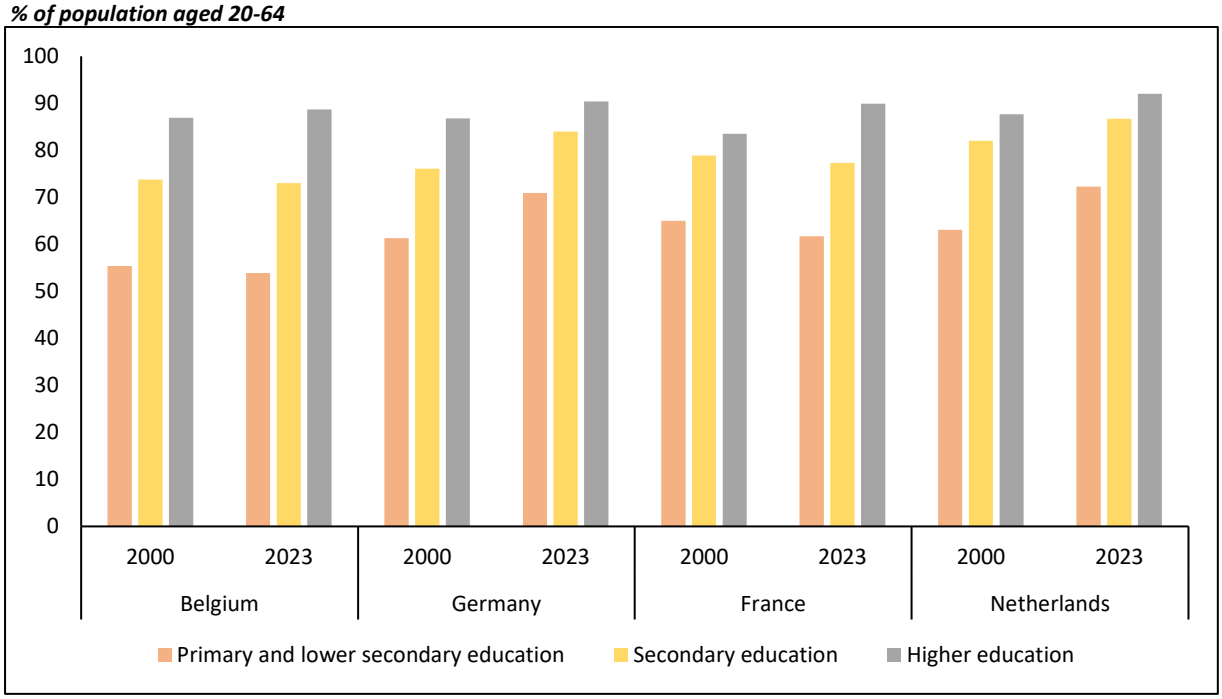
Compared with 2000, the higher education category and, to a lesser extent, the secondary education category have increased substantially in all three regions, to the detriment of the primary and lower secondary education category.

Training the population is an important first step in strengthening the human capital available to the economy, but this alone is not enough. This population also needs to be willing to enter the labour market. It is therefore interesting to qualify this initial observation with regard to the activity rate by qualification level.

In all the countries considered, the activity rate, measured by the ratio of the number of employed individuals and jobseekers to the total working-age population, clearly increases with the qualification level. In Germany and the Netherlands, the activity rate clearly rose between 2000 and 2023 for all qualification levels considered. However, in France and Belgium between 2000 and 2023, the activity rate only increased for the highest qualification level.

Graph 7. Activity rate of individuals aged 20-64 by qualification level

% of population aged 20-64



Source: Eurostat, Labour Force Survey, Quarterly Detailed Results (lfsq_argaed).

This graph also highlights the relatively low activity rate in Belgium. In fact, regardless of the qualification level considered, Belgium has the lowest rate of all the countries compared. In the last quarter of 2023, the activity rate for individuals with a higher education qualification reached 88.7 % in Belgium, compared with 89.4 % in the Euro area, 89.9 % in France, 90.4 % in Germany and 92 % in the Netherlands. It is also interesting to note that the gap in activity rates compared with neighbouring countries increases as the level of education decreases.

Regional data are only available on an annual basis and are presented in Table 10.

Table 10. Activity rate of the population aged 20 to 64 by qualification level, 2000 and 2023

In %

	Primary and lower secondary		Secondary		Higher	
	2000	2023	2000	2023	2000	2023
Belgium	56.8	53.3	73.9	72.6	87.8	88.5
Brussels-Capital Region	59.4	54.2	65.4	65.9	83.1	87.4
Flemish Region	56.8	55.7	76.1	76.3	89.5	90.1
Walloon Region	56.1	49.6	71.7	67.7	86.5	85.7

Source: Eurostat, Labour Force Survey (lfst_r_lfp2actrtn).

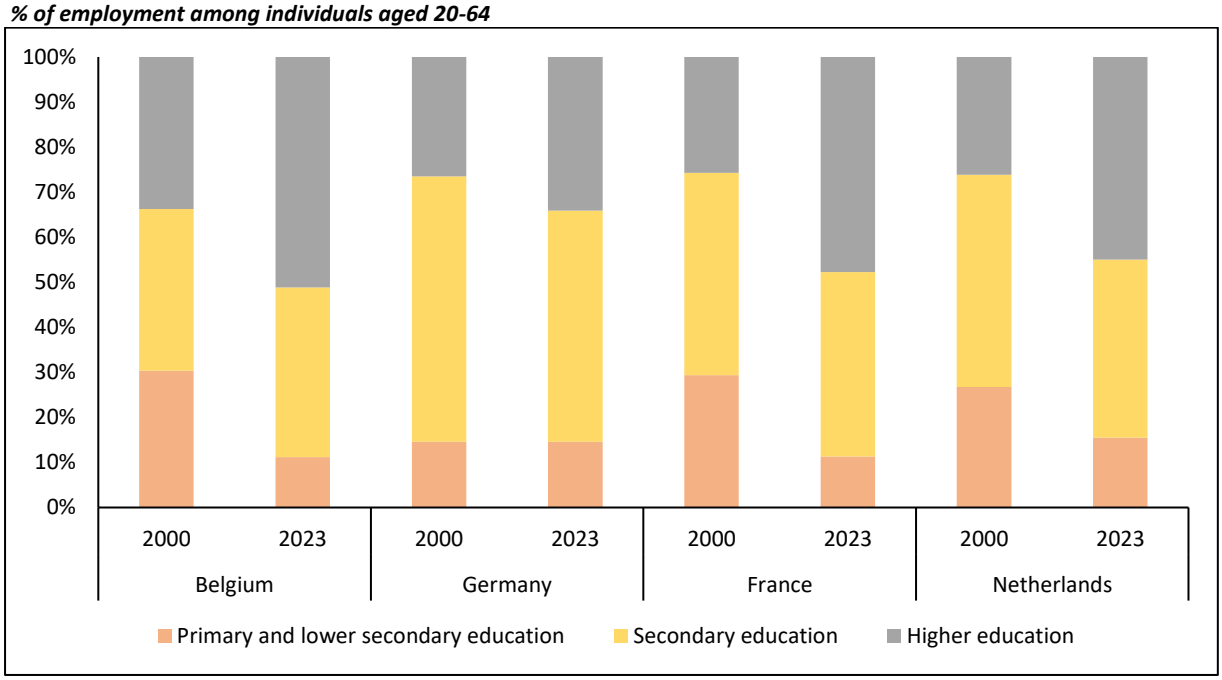
In all Belgian regions, the activity rate among those aged 20-64 is highest in the higher education category: from 85.7 % in the Walloon Region to 90.1 % in the Flemish Region in 2023. Activity rates decrease as the level of education decreases.

Compared with 2000, the Brussels-Capital Region saw a significant increase in activity rates in the "higher education" category, but an equally significant drop in the "primary and lower secondary education" category. The same picture applies to the Flemish region, although the differences were much less pronounced. The Walloon region is the only Belgian region to record a reduction in the activity rate between 2000 and 2023 for all qualification levels considered, including individuals with higher education qualifications.

Alongside this change in the labour supply, there was also a shift in the employment structure towards greater qualification. This was particularly true in Belgium, which saw the sharpest fall in the share of employment accounted for by people with, at most, a lower secondary school qualification.

Graph 8. Employment (individuals) by qualification level

% of employment among individuals aged 20-64



Source: Eurostat, Labour Force Survey (lfsa_egaed).

In 2023, Belgium also had the highest proportion of workers (more than 1 in 2) with higher education qualifications.

Regional data are only available for the population aged 15 to 64. Despite this difference in the definition of the reference population, there is little difference in the percentages, given that compulsory schooling applies to people aged up to 18 in Belgium.

Table 11. Employment in the population aged 15 to 64 by qualification level, 2000 and 2023

In %

	Primary and lower secondary		Secondary		Higher	
	2000	2023	2000	2023	2000	2023
Belgium	30.7	11.9	36.0	37.7	33.3	50.4
Brussels-Capital Region	27.1	13.5	25.4	24.8	47.5	61.7
Flemish Region	29.8	11.2	37.6	39.3	32.5	49.5
Walloon Region	33.4	12.8	35.5	39.2	31.0	48.0

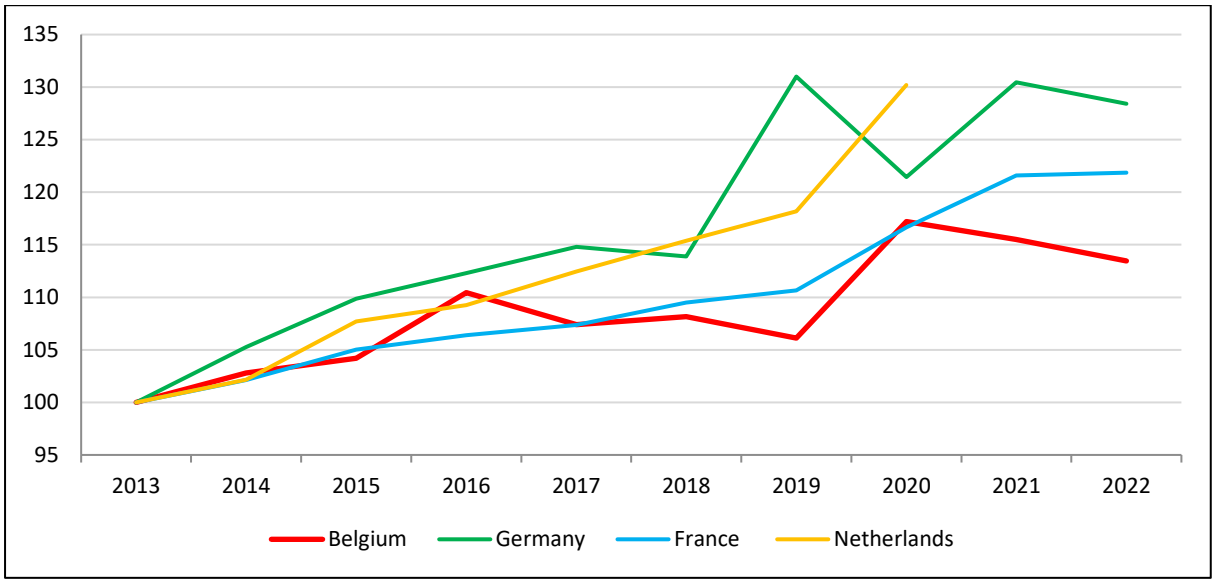
Source: Eurostat, Labour Force Survey (lfst_r_lfe2eedu).

In each region, the category of working population with higher education qualifications was the largest in 2023. This was particularly true in the Brussels-Capital region (61.7 %). In the Flemish and Walloon Regions, this category accounted for just under 50 %, which is still more than in the 3 neighbouring countries. The proportion of the working population with secondary education qualifications was the second largest in each region. The proportion of the working population with primary and lower secondary education qualifications was the lowest.

Compared with 2000, the proportion of the "primary and lower secondary" category decreased, while that of the "higher education" category increased in each region. There were no significant changes in the "secondary" category.

This analysis clearly highlights the importance for the economy of having enough workers entering the labour market with high qualifications. In this respect, the number of higher education graduates has continued to show positive growth in Belgium over the last few years available, but, since 2017, this growth has been the weakest among the countries compared (see graph 9).

Graph 9. Number of higher education graduates (level 5-8)
Index 2013 = 100



Source: Eurostat, Education and training (educ_uoe_grad01).

Another dimension of the education and training system that helps to improve workers' skills is continuing education or lifelong learning. Unfortunately, the statistical coverage of this dimension is considerably worse than that of the education system. One of the main sources of information is the Adult Education Survey (AES) carried out every 5 years by Eurostat. According to this source, the participation of employees (aged 25 to 64) in formal or informal training over the 12 months preceding the survey, was lower in Belgium than the average for the Euro area and neighbouring countries. More worryingly, the participation rate fell between 2016 and 2022.

Table 12. Participation of employees (aged 25 to 64) in formal and informal training
As % of total

	2007	2011	2016	2022
Euro area	41.9	52.1	55.7	56.9
Belgium	48.9	46.2	54.2	51.1
Germany	53.0	56.7	57.2	66.7
France	42.3	57.5	59.4	58.4
Netherlands	52.7	69.7	74.0	71.5

Source: Eurostat, Education and training, AES (trng_aes_103).

However, it should be noted that since the last survey, the federal government, as part of the Recovery and Resilience Plan, has amended the Law of 5 March 2017 on feasible and manageable work by the Law of 3 October 2022, which provides that from 2024, all workers are entitled to 5 days of training per year averaged over a 5-year period, whereas the previous objective was 5 days per year on average within the company. This reform of the law, which gives every worker an individual right to training (training account), is accompanied by a tax incentive in the form of a partial withholding tax exemption (11.75 %) for employees taking part in at least 10 days of training over the year. It is too early to assess the impact of this initiative on the development of continuing education for workers in Belgium.

b. Qualifications of the workforce and the population: qualitative indicators

The increase in the qualifications of the population and workforce helps to improve human capital. However, it is just as important for productivity growth that the field of study corresponds to the present and future needs of the productive sector.

The breakdown of higher education graduates by field of study shows a marked specialisation in Belgium in the field of health and welfare, which accounted for over a quarter of all graduates in 2022. The vast majority of these graduates are in the healthcare sector, which includes doctors (4.4 % of graduates, compared with 2.9 % in Germany and 5.3 % in France) and pharmacists (1.5 % of graduates in Belgium, compared with only 0.4 % in Germany and 0.6 % in France). This specialisation could partly be explained by the large number of foreign students, particularly French, enrolled in Belgian medical and paramedical programmes. It could also be due to the strong presence of pharmaceutical companies in Belgium, providing many job prospects for such graduates.

Table 13. Breakdown of graduates by field of study, 2022
As a % of total qualifications

Field of study	Belgium	Germany	France	Netherlands
Education	8.8	10.0	4.1	7.9
Humanities and arts	8.7	9.1	8.7	7.6
Social sciences, journalism and information	10.7	7.0	7.1	15.4
Business, administration and law	22.7	25.1	31.2	27.5
Natural sciences, mathematics and statistics	4.1	7.9	12.7	6.4
Information and Communication Technologies (ICT)	3.0	5.5	4.1	4.4
Engineering, processing and construction industries	11.7	22.5	13.8	9.3
Agriculture, forestry, fisheries and veterinary science	2.0	1.7	1.5	1.2
Health and welfare	26.8	7.9	13.2	15.4
- *Health*	*21.2*	*4.6*	*10.9*	n.d.
Services	1.5	3.3	3.7	4.8

Source: Eurostat, Education and training (educ_uoe_grad03).

Business, administration and law ranks second in terms of its share of Belgian higher education graduates, with more than one in 5 graduates in this field. In the three neighbouring countries, this field is in first place, particularly in France with 31.2 % of graduates in 2022.

Belgium also stands out for having the lowest percentage of graduates in two fields that are particularly important for the integration of digital technologies into the economy and for research and innovation activities: natural sciences, mathematics and statistics and ICT. The proportion of graduates in engineering, processing and construction in Belgium is also lower than in France and, particularly, Germany. These low percentages explain why, in 2022, Belgium only had 16.4 higher education graduates in science, mathematics, IT, engineering, processing and production (STEM) per 1,000 inhabitants aged 20 to 29. This was slightly more than the Netherlands (15.4), but well below the 24.3 posted by Germany and the 35.3 achieved by France

The level and trend of the job vacancy rate by sector provide an indication of the extent to which the fields of study of higher education graduates align with the current needs of the productive sector.

Between 2015 and 2023, the vacancy rate rose in all sectors in Belgium, with the exception of real estate. The industries with the highest job vacancy rates were the same in 2023 as in 2015: administrative and support services, professional, scientific and technical activities, information and communication and accommodation and food service activities.

In 2023, job vacancy rates were highest in Belgium, and especially in the Netherlands, with the exception of human health and social work activities, where the job vacancy rate was the highest in Germany. Among the countries being compared, Belgium has the highest job vacancy rates for accommodation and food service activities, information and communication, professional, scientific and technical activities and administrative and support service activities. These relative shortages not only correspond to the low number of STEM

graduates in Belgium, but also confirm the lack of less skilled labour in certain industries. This is the case for accommodation and food services, as well as for certain activities in the administrative and support services, which includes service voucher jobs.

Table 14. Job vacancy rates in the main sectors

Annual average in %

Main sectors	Belgium		Germany	France	Netherlands
	2015	2023	2023	2023	2023
Manufacturing	1.7	3.8	2.6	2.6	4.1
Electricity, gas, steam and air conditioning supply	1.7	4.3	2.3	0.8	6.0
Water supply; sewerage; waste management and remediation activities	1.2	3.4	2.9	1.9	4.3
Construction	2.4	5.4	6.4	4.0	6.8
Wholesale and retail trade; repair of motor vehicles and motorcycles	2.4	4.1	3.1	2.7	5.2
Transportation and storage	1.5	3.7	4.2	2.1	4.3
Accommodation and food service activities	2.6	6.9	5.6	4.9	6.4
Information and communication	4.8	7.0	4.4	3.9	6.0
Financial and insurance activities	2.0	3.6	2.7	2.0	4.4
Real estate activities	2.9	2.8	2.3	3.7	3.9
Professional, scientific and technical activities	4.2	7.5	5.2	3.4	5.8
Administrative and support service activities	6.2	9.0	8.1	2.4	2.8
Public administration	2.0	3.2	1.3	n.d.	4.1
Education	1.2	3.2	2.9	2.4	2.2
Human health and social work activities	1.3	3.0	4.3	3.6	4.2
Arts, entertainment and recreation; other service activities	2.7	3.3	3.3	3.8	4.5

Source: Eurostat, Labour Market (jvs_a_rate_r2).

The quality of the education system is also reflected in its ability to minimise the number of early school leavers and the number of young people neither in employment nor in education or training. Minimising these figures was one of the objectives of the previous European strategy, Europe2020 and has been achieved in both Belgium and its neighbouring countries in recent years.

In 2023, Belgium, like the Netherlands, had 6.2 % of early school leavers, the lowest percentage of all the countries compared. The trend in this indicator in Germany is unusual, as the percentage has increased over the period under review. In 2023, it reached more than double the percentage recorded by Belgium and the Netherlands. The German indicator began to rise after its 2014 low of 9.5 % and increased notably in 2021 to 12.5 %.

Belgium's performance in terms of young people neither in employment nor in education or training is not quite as good, as the percentage remained higher in 2023 than in Germany and the Netherlands. However, the dynamic is positive, given the reduction recorded between 2010 and 2023.

Table 15. Early school leavers and young people aged 18 to 24 neither in employment nor in education or training

% of population aged 18 to 24

	Early school leavers		Young people not in employment, education or training	
	2010	2023	2010	2023
Belgium	11.9	6.2	13.7	10.9
Germany	11.8	12.8	12.5	10.1
France	12.7	7.6	15.4	13.1
Netherlands	10.1	6.2	7.0	5.9

Source: Eurostat, Labour Force Survey (edat_lfse_14 et edat_lfse_23).

The breakdown by Belgian region is shown in table 16.

Table 16. Proportion of early school leavers and young people aged 18 to 24 neither in employment nor in education or training by Belgian region, 2010 and 2023
In %

	Early school leavers (aged 18-24)		Young people neither in employment nor in education or training (aged 18-24)	
	2010	2023	2010	2023
Brussels-Capital Region	18.4	8.7	21.0	11.3
Flemish Region	9.6	5.4	9.9	7.2
Walloon Region	13.7	6.7	19.3	11.8

Source: Eurostat, Labour Force Survey (edat_lfse_16 en edat_lfse_22).

The proportion of early school leavers aged 18 to 24 in the Flemish Region was 5.4 % in 2023. The Walloon Region (6.7 %) and especially the Brussels-Capital Region (8.7 %) recorded higher figures. In every region, the indicator has fallen since 2010. In the Brussels-Capital Region, it even fell by almost 10 percentage points. Every region therefore has a lower figure than Germany, with the Flemish and Walloon regions also doing better than France.

The proportion of young people neither in employment nor in education or training was 7.2 % in the Flemish Region in 2023. This figure is lower than in the other two regions (between 11 and 12 %). The Flemish Region ranks behind the Netherlands, but ahead of Germany and France. The other two regions only did better than France. The value of this indicator fell everywhere compared with 2010. This decline was particularly pronounced in the Brussels-Capital Region (nearly 10 percentage points).

In the *Beleidsnota Werk en Sociale economie 2019-2024* policy brief, the minister stated that he aimed to develop local activation networks with specialist partners to address complex issues in the areas of employment, care, welfare, integration and education.
In 2022, the Flemish government decided to actively identify young people neither in employment nor in education or training, so as to give them better support. There were three stages to this process: 1° Track young people not in employment, education or training through links to databases, which requires a clearly established legal framework (data protection). 2° Connect with these young people through the deployment of youth advisors and appropriate communication actions. 3° Support these young people when the VDAB offers training courses and cooperates with various specialist partners.

Every three years, the OECD organises the PISA (Programme of Student Assessment) tests to assess the mathematical, reading and scientific skills acquired by students aged 15. The tests cover the 2003-2022 period. The test scores indicate an average performance for Belgium. In 2022, Belgium recorded a score of 489 points compared with the OECD average of 472 points in mathematics, 479 points in reading compared with the OECD average of 476 points and 491 points in science compared with the OECD average of 485 points[6]. Along with the majority of OECD countries, over the 2003-2022 period, Belgium saw a downward trend in results for the three subjects tested. According to the OECD, Belgium's results are strongly linked to students' socio-economic status and therefore an education system which is not very egalitarian. So, for example, Belgium has one of the greatest differences in mathematics performance between students in the top and bottom quarters of the economic, social and cultural status index (PISA score 117, rank 6/79, 2022), and is one of the countries with the strongest relationship between reading performance and socio-economic status (17.9 %, rank 7/79, 2022).

Castanheira and Mariani (2024) also analyse this finding of the limited role of the education system in correcting initial socio-economic inequalities. The authors adopt the view of education provision as a public good, based on the geographical location of primary and secondary schools in Belgium. They construct an index of educational accessibility based on the number of schools available within a given radius and the distance to reach them. They show that access is substantially higher in Flanders and Brussels than in Wallonia. The authors also identify which socio-economic classes of the population have the best and worst access to education at a detailed geographical level. They find that the distribution of the affordability index is more unequal than that of income. Their econometric

[6] Source: https://gpseducation.oecd.org/CountryProfile?primaryCountry=BEL&treshold=10&topic=PI, accessed on 23/08/2024.

analysis shows that, at constant population density, access to school increases with income: a 10 % rise in local income per capita increases access to education by around 0.3 %, highlighting a potential regressive effect of the supply of this public good. The authors recommend more smaller schools in sparsely populated areas: "…this could be used to improve their geographic distribution, boost access by reducing commuting costs, and, therefore, help disadvantaged families in these areas. Conversely, the more favourable financial condition of the Flemish community appears to have been exploited to perform exactly that: not only it has a more evenly distributed population, it can also support more schools, allowing Flemish families to travel shorter distances to take their children to school."

The OECD also organises surveys to assess the skills of adults between the ages of 16 and 65 in key areas of information processing - literacy, numeracy and problem-solving (PIAAC Programme for the International Assessment of Adult Competencies). Only the Flemish Region participates in these surveys, so no data are available at the national level.

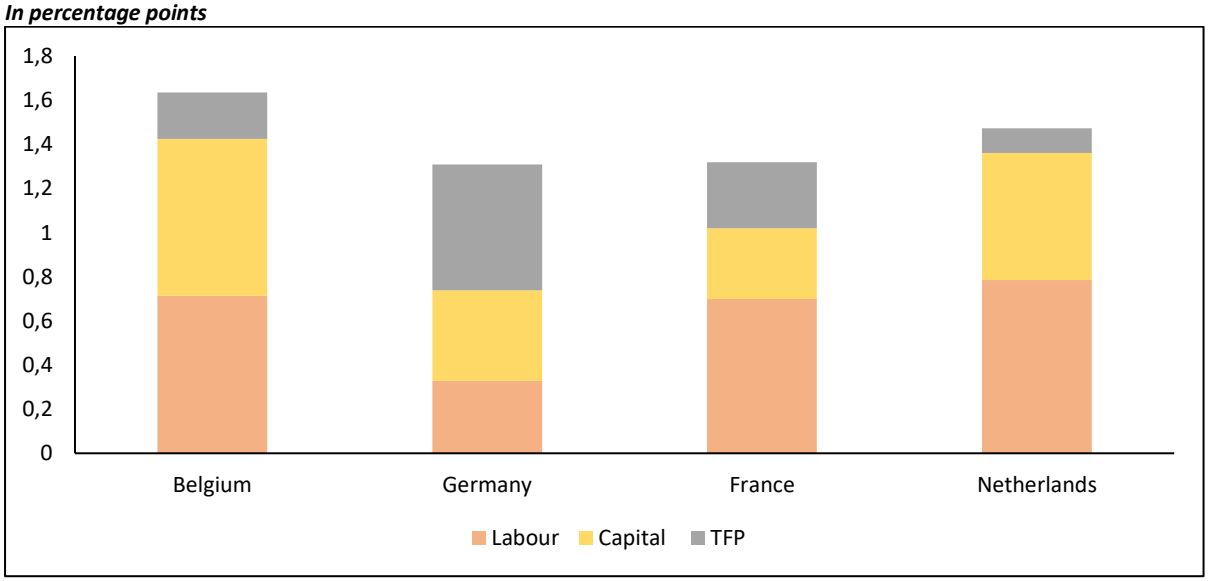
c. Contribution of human capital stock to economic growth

Growth accounting is a useful tool in assessing how human capital has contributed to economic growth in recent years, as it enables the growth rate of value added to be broken down into contributions from labour, capital and total factor productivity (TFP). The contribution of the two factors of production depends on both the quantity and the quality of the factors involved in the production process. Consequently, the contribution of the labour factor takes into account the variation in hours worked in the economy, as well as changes in the composition of hours worked by type of work (gender, age, qualification). Without any change in the number of hours worked, an improvement in workers' qualifications can therefore make a positive contribution to growth in value added.

Graph 10 shows the contributions to growth in value added for Belgium and neighbouring countries over the 2000-2019 period. During the COVID period, the contributions changed significantly, influencing the trend over the whole period. The period analysed therefore stops before the COVID years.

In Belgium, labour contributed 0.7 p.p. to the growth in value added, which is equivalent to that observed in France, and slightly below that of the Netherlands. In contrast, Germany recorded a much lower contribution from labour over the period. However, Germany is characterised by a high contribution of TFP, much higher than in the other three countries. The 2021 annual report has previously highlighted the sharp reduction in the contribution of TFP in Belgium over the same period.

Graph 10. Contribution to average growth in value added, total economy, 2000-2019
In percentage points



Source: Euklems & INTANProd database, 2023 release; FPB.

d. Contribution of human capital stock to productivity growth: the labour composition effect

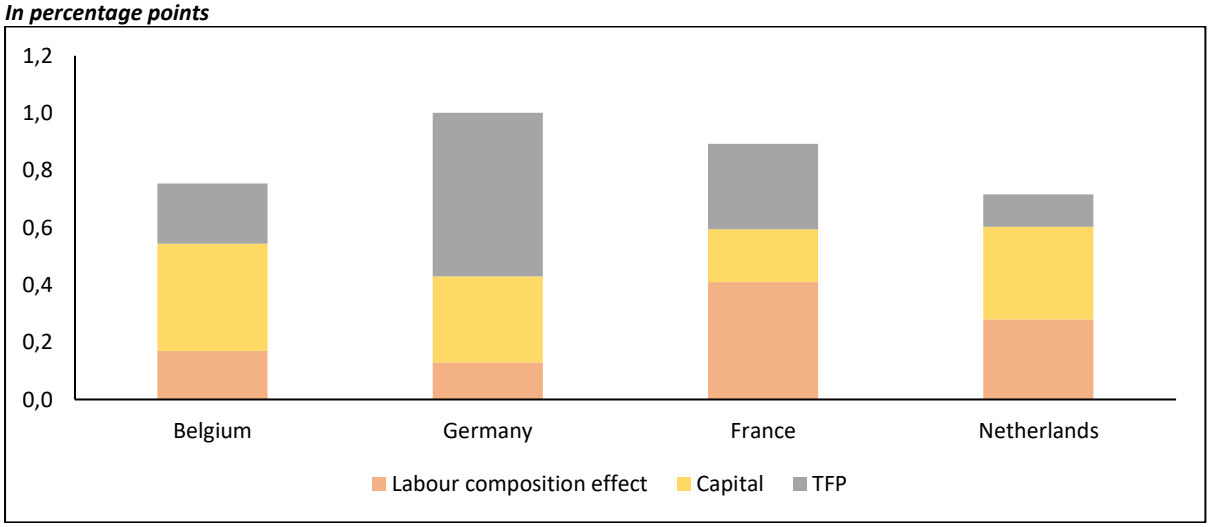
When the decomposition exercise focuses on labour productivity growth, the contribution of the labour factor is limited to the labour composition effect, which relates to the effect of changes in worker characteristics (gender, age, qualifications) on productivity. In the EUKLEMS database, three age groups are identified (15-29 years, 30-49 years and 50 years and over), along with three qualification levels (high qualification or tertiary diploma, medium qualification or upper secondary diploma, low qualification or lower secondary education) in addition to the gender distinction. The labour composition effect captures the fact that workers with different characteristics do not have the same productivity. Its measurement is obviously based on the assumptions inherent[7] to the exercise, such as the remuneration of production factors at their marginal productivity.

The contribution of the labour composition effect to productivity growth amounted to 0.2 p.p. in Belgium over the 2000-2019 period, which was higher than in Germany (0.1 p.p.), but lower than in the Netherlands (0.3 p.p.) and France (0.4 p.p.) (see graph 11).

In Belgium, half of the growth in hourly labour productivity over the period was due to the increase in capital per hour worked (capital deepening), and the other half to the composition effect and TFP. As already mentioned, it should be remembered that, over and above the direct effect on productivity growth through the composition effect, improving human capital also makes a major contribution to innovation and its dissemination, and as such also has a positive indirect effect through its positive impact on TFP. In this regard, Vandenberghe (2018) highlights that the efficiency gains brought about by skilled workers, particularly those with a master's degree, are all the more important when these workers are employed by companies close to the technological frontier. However, in Belgium, over the 2008-2014 period, this study shows that many of these workers were in fact employed by companies that were far from the frontier. The author emphasises that the reallocation of skilled workers could therefore have a positive impact on overall efficiency.

However, other analyses call for caution, highlighting the deleterious effect of the hiring policies of certain large, well-established companies on productivity growth. Thus Akcigit and Goldschlag (2024) document the innovation-stifling hiring behaviour practised by large US corporations to deprive young start-ups of their innovation potential. Offering more attractive salary packages, they poach innovators from start-ups, but instead of using these new recruits to drive innovation, they place them in roles that do not take full advantage of their talents. As a result, these people become less innovative, and the innovative capacity of the economy as a whole suffers.

Graph 11. Contribution to average annual growth of hourly productivity, total economy, 2000-2019
In percentage points



Source: Euklems & INTANProd database, 2023 release; FPB.

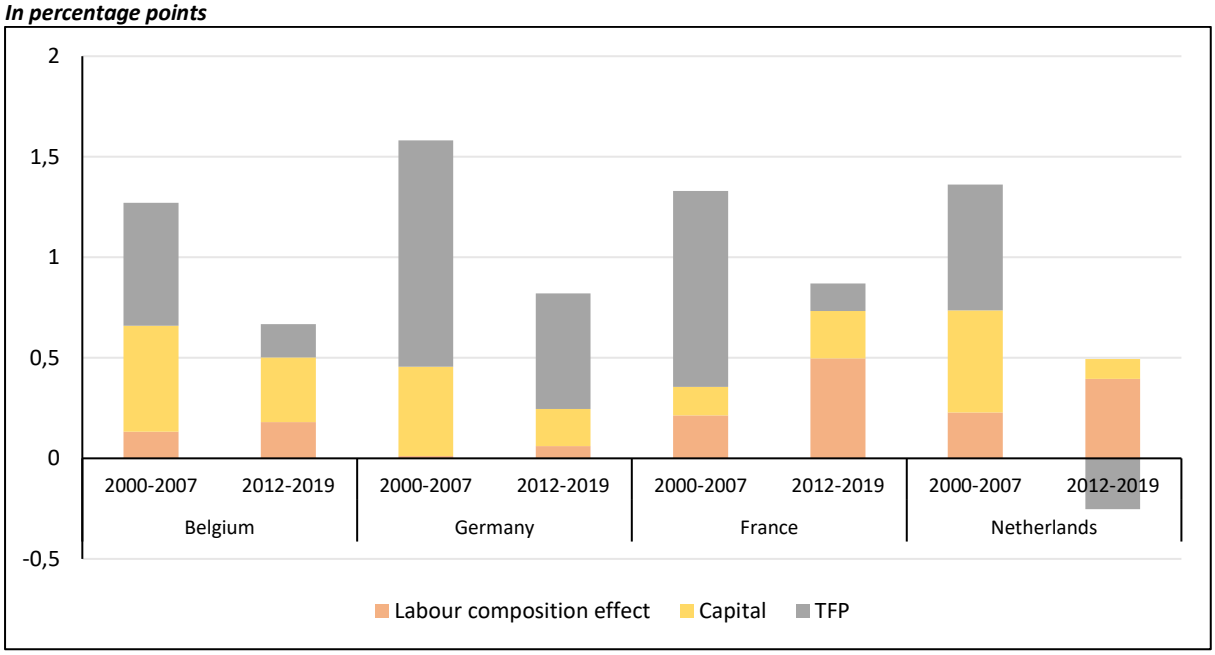
[7] Neo-classical production function characterised by constant returns to scale, diminishing marginal productivity of inputs and perfect competition in factor and product markets.

The composition effect varies from one sector to another: on average over the 2000-2019 period, 0 % in administrative and support service activities (sector NN)[8] and in electricity and gas supply (sector DD) to 0.8 % in other service activities (sector SS). These variations are not necessarily linked to the proportion of highly-qualified individuals in the sector, but to a change in hours worked in favour of workers with higher wages and therefore higher productivity (more skilled or older workers). The top 5 sectors with a significant labour composition effect include two manufacturing sectors, computer, electronic and optical products (CI) and textiles, leather and footwear (CB), and two service sectors, public administration (OO) and R&D (MB).

By distinguishing two sub-periods, before and after the global financial crisis, we can compare the trend in contributions. In Belgium, the slowdown in labour productivity over the 2012-2019 period is explained by the sharp reduction in the contribution of capital deepening and TFP. However, the contribution of the labour composition effect increased between the two sub-periods, as it did in the three neighbouring countries. Belgium's contribution remained well below that of France and the Netherlands over this second period.

Graph 12. Contribution to average annual growth of hourly productivity, total economy, 2000-2007 and 2012-2019

In percentage points



Source: Euklems & INTANProd database, 2023 release; FPB.

e. Government expenditure on education

The education and training system plays a major role in the accumulation of human capital, but it also mobilises public resources. The results achieved must therefore be compared with the public funding used to gain an indication of the system's efficiency.

In 2022, the most recent year available, Belgian government expenditure on education represented 6.3 % of GDP (or 12 % of total government expenditure). This percentage was higher than the Euro area average (4.6 %) and the highest among the countries being compared (Germany: 4.5 %, France: 5.2 % and the Netherlands: 5.1 %). This percentage also experienced the sharpest rise over the 2000-2022 period.

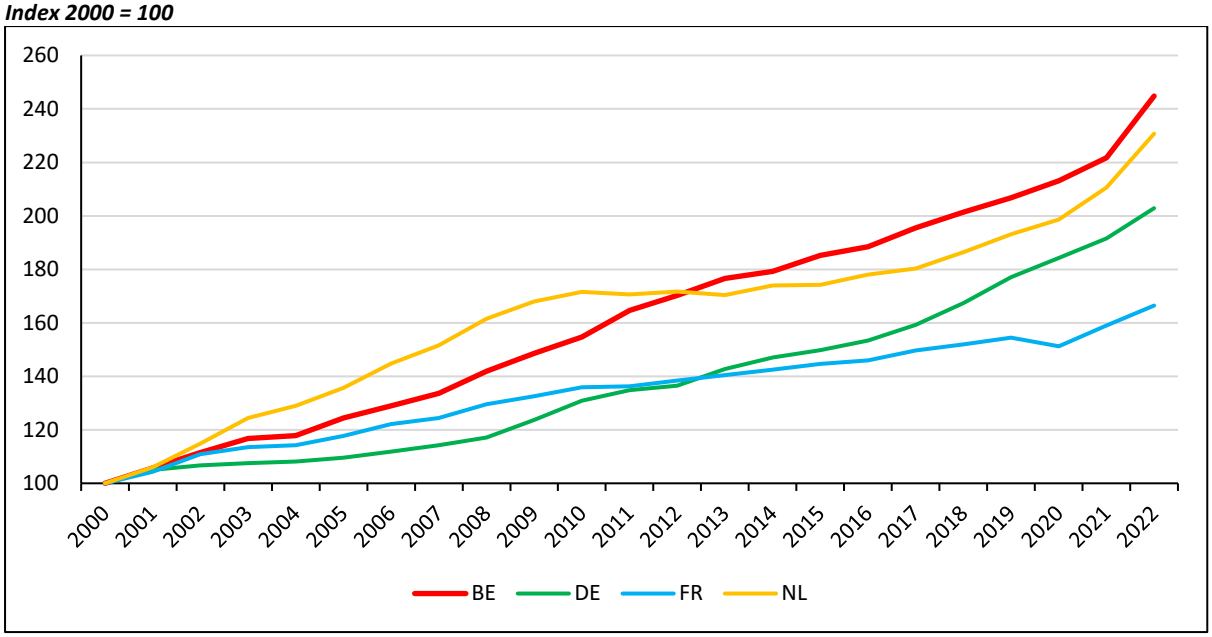
In terms of composition, 81 % of this government expenditure was for staff remuneration and 6 % for gross fixed capital formation. The proportion of government expenditure on education used for staff remuneration was higher than the Euro area average (65 %) and in the three major neighbouring countries (Germany: 56 %, Netherlands: 58 % and France: 71 %). In contrast, the proportion of government expenditure dedicated to

[8] This sector includes service vouchers.

investment was lower than the Euro area average (8 %) and in neighbouring countries (Netherlands: 10 %, Germany: 9 % and France: 8 %).

Graph 13. Government expenditure on education in % of GDP

Index 2000 = 100

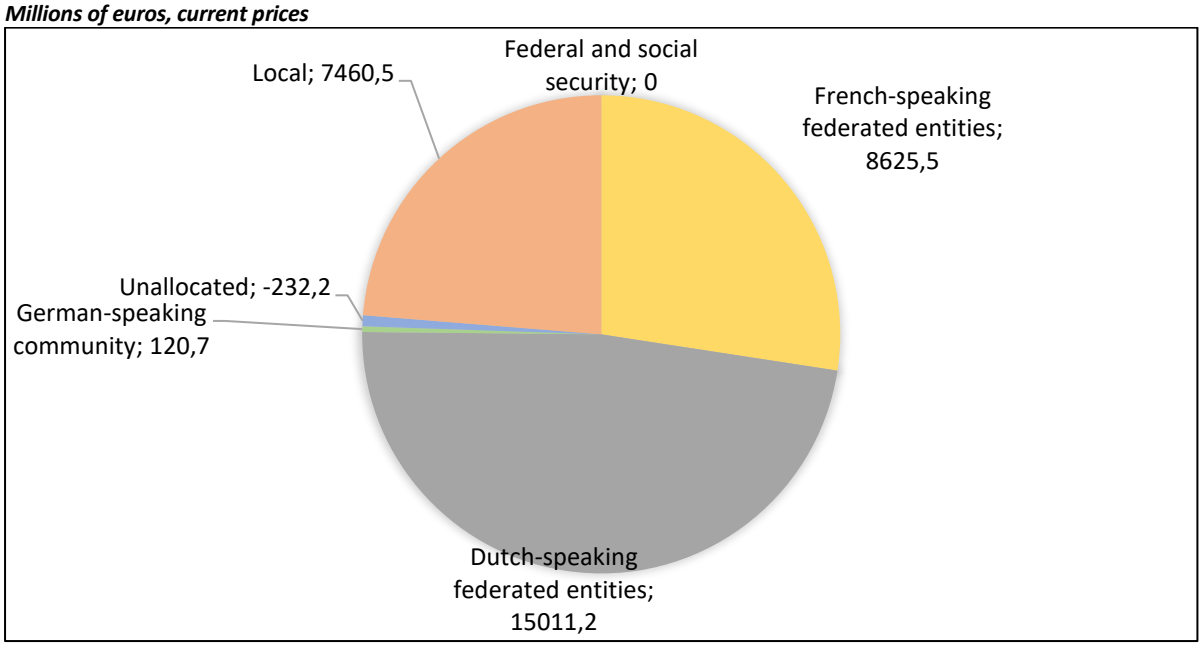


Source: Eurostat, COFOG.

In terms of the level of education, government expenditure on pre-primary and primary education represented 2.0 % of GDP in Belgium in 2022, compared with 1.4 % of GDP in France and Germany and 1.5 % of GDP in the Netherlands. Government expenditure on secondary education represented 2.4 % of GDP in Belgium, compared with 1.7 % in Germany, 2 % in the Netherlands and 2.2 % in France. Government expenditure on tertiary education amounted to 0.9 % of GDP, compared with 0.7 % in France, 0.8 % in Germany and 1.2 % in the Netherlands. Finally, spending on education not defined by level represented 0.9 % of GDP in Belgium and France, compared with 0.6 % of GDP in Germany, but only 0.3 % of GDP in the Netherlands. The pre-primary and primary levels, secondary level and education not defined by level therefore presented higher levels of government expenditure compared to neighbouring countries.

Graph 14. Breakdown of spending on education in Belgium, 2022

Millions of euros, current prices



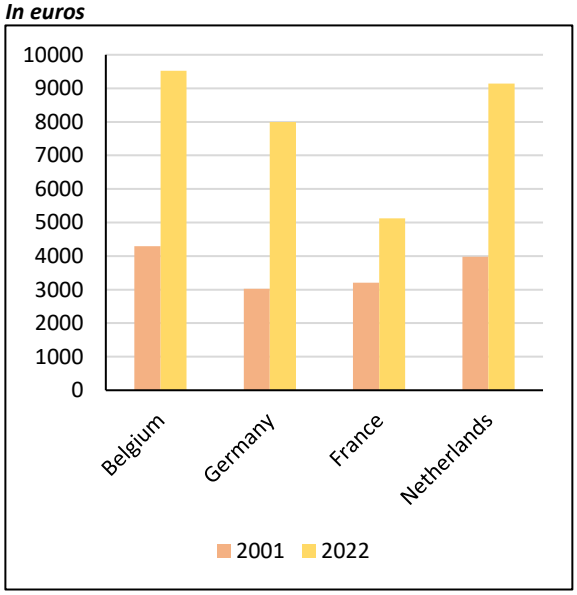
Source: National Accounts.

It is not easy to get a clear picture of public spending by level of government in Belgium. Indeed, education is a community responsibility, which means, for example, that Flemish government expenditure is divided between the Flemish Region and the Brussels-Capital Region. In addition, there are community commissions that support education, and a portion of the salaries of lower-level administrations are financed by the Communities. Budgetary data from the national accounts, available via COFOG, i.e. for education, give a certain degree of detail for each federated entity that organises education, and for all local authorities, which are also organising authorities. Graph 14 shows the breakdown of government expenditure on education in Belgium in 2022.

To put these levels of government expenditure into perspective, Godefroid, Stinglhamber and van Parys (2021) propose tracking spending on basic education (pre-primary and primary) per child aged 3 to 11, and spending on secondary education per child aged 12 to 18. In 2001 and 2022, Belgium had the highest government expenditure per child of the countries compared, for both pre-primary, primary and secondary education (see graphs 15 and 16).

Graph 15. Pre-primary and primary education, expenditure per child aged 3 to 11

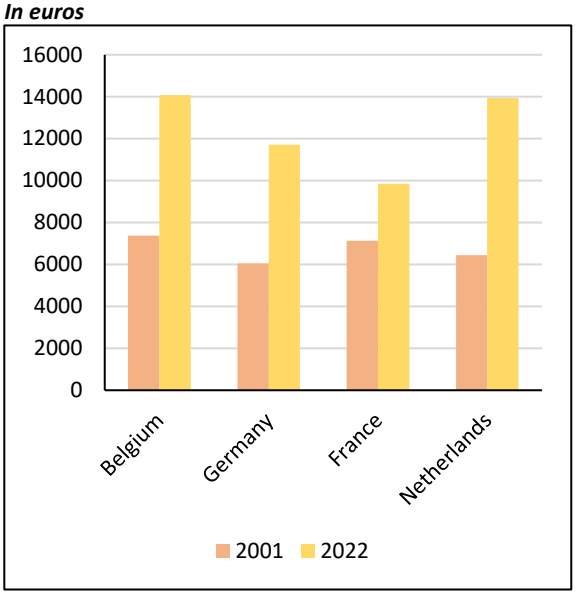
In euros



Source: Eurostat, COFOG and Population.

Graph 16. Secondary education, expenditure per child aged 12 to 18

In euros



Source: Eurostat, COFOG and Population.

While Belgium's spending is the highest of the countries being compared, its growth dynamic between 2001 and 2022 is not the strongest. In fact, for the pre-primary and primary levels, Germany recorded the sharpest increase (+164 %), with Belgium (+122 %) coming third after the Netherlands (+130 %). At secondary level, the Netherlands recorded the greatest increase (+117 %), with Belgium (+91 %) once again in third place after Germany (+94 %).

According to the authors of the study, the high level of government expenditure on education per child in pre-primary, primary and secondary education could be explained by the lower number of pupils per full-time equivalent teacher than in other countries. In 2020, the number of pupils per teacher, indicator published by the OECD, placed Belgium (12.46) below the OECD average (14.76) and below France (18.42), the Netherlands (16.28) and Germany (14.86) for primary education. For secondary education, the same indicator placed Belgium (9.12) at the bottom of the ranking, well below the OECD average (13.42) and below the three neighbouring countries (Netherlands 16.66, France 13.07 and Germany 12.64).

In addition to the number of pupils per teacher, the authors of the study point to other possible reasons for the higher level of government expenditure on education in Belgium, including the division into language communities, the coexistence of several networks, the repetition rate, compulsory schooling up to the age of 18 and the low proportion of primary and secondary education provided by the private sector, particularly in comparison with Germany and the Netherlands.

Table 17 shows a breakdown of spending on education by type of education based on regional budgetary data.

Table 17. Spending on education per pupil in the 3 communities, 2021-2022 school year
In euro

	Flemish Community	French Community	German-speaking Community	Belgium (3)
Primary education (1)	6,554	5,342	5,090	6,054
Secondary education	10,004	8,980	9,627	9,840
Special needs education	20,599	22,746	43,750	21,153
Higher education (2)	8,912	6,291	15,727	14,878
Total	8,685	7,786	7,933	8,930

(1) Nursery and primary school included.
(2) Estimate for the French Community.
(3) Also includes other governments, see above.
Source: Regional budgetary data, calculations by FPS Employment, Labour and Social Dialogue.

Everywhere, spending on education is proportionally highest for special needs education. Total spending on education amounted to 8,685 euros per pupil in the Flemish Community for the 2021-2022 school year. This was slightly lower in the German-speaking and French-speaking Communities (7,933 and 7,786 euros respectively).

f. Efficiency of the education system

The efficiency of the education and training system, defined as its ability to achieve the best possible results using the fewest possible resources, is not easy to measure, not least because of the difficulty of defining the expected output(s). Cornille, Stinglhamber and Van Meenseel (2017) propose defining the output of the education system as a composite indicator aggregating pupils' PISA scores (mathematics, reading and science), the proportion of the population with a secondary education qualification as a minimum, language skills, citizens' satisfaction with the education system, the perceived quality of the education system and the availability of skilled workers. The authors use public and private spending on education (as a % of GDP, average 2000-2015) as the system's input. They then graph all the input-output combinations observable in European countries to estimate the efficient frontier and position Belgium in relation to this frontier[9]. Their analysis shows that Germany and Finland are the two most efficient countries in terms of their education systems. In contrast, education systems in southern Europe are the least efficient overall. Belgium occupies an intermediate position, less efficient than the Netherlands and Germany but more efficient than France.

An article by De Witte and Lopez-Torres (2017) provides a review of the literature on measuring efficiency in education. Their study catalogues the variables and methods used. They conclude that the influence of environmental variables (e.g. motivation, family status, school characteristics) on the study results needs to be identified. Indeed, efficiency is determined by underlying mechanisms and further research is needed to gain a better understanding the differences between education outcomes and education system characteristics in different countries. In addition, improvements are needed in the quality of variables relating to student skills, school financing and investment in ICT. Finally, there needs to be more research on the value added by improving efficiency in education.

The authors also show that studies on educational efficiency differ from standard studies on the economic performance of education in several respects. While the latter focus on results and simulations of policy measures, studies on efficiency are more concerned with the transformation of inputs into outputs.

g. Conclusion

The education and training system has contributed to a spectacular increase in the qualifications of the Belgian population over the past 20 years. This is an important development; not only is the activity rate of people with a higher education qualification greater, it is also the only rate to increase in recent decades. This increase in human capital has clearly benefited the Belgian productive system. In 2023, among the countries being compared, Belgium had the highest proportion of workers with higher education qualifications, at more than 1 in 2. However, this favourable trend is not enough to cover all businesses' needs, particularly in the context of the

[9] This is the efficiency analysis method known as DEA for "Data Envelopment Analysis".

dual digital and ecological transition. As highlighted in previous reports, Belgium has a growing shortage of STEM and ICT graduates. Furthermore, in Belgium more than anywhere else, the results of secondary school pupils are strongly linked to their socio-economic status. This limited role of the basic education system in correcting socio-economic inequalities at the outset reduces the number of young people likely to acquire the skills most useful to our society. It is also secondary education, along with pre-primary and primary education, that proportionally mobilises the most financial resources in Belgium compared to the three neighbouring countries. It is therefore at this level that potential efficiency gains seem to be highest.

Ultimately, improvements in human capital contributed 0.2 percentage point per year to productivity growth over the 2000-2019 period, and this contribution remained stable despite the crises experienced. However, the role of human capital in the contribution of TFP is more ambiguous, as TFP has clearly slowed in recent years. A sub-optimal allocation of skilled personnel between companies could be one explanation for this finding. Another could stem from the insufficient use of life-long learning to maintain and enhance workers' skills.

3. Artificial intelligence and productivity growth

AI is a broad field that encompasses a range of technologies and approaches to create machines that can perform tasks that would normally require human-level intelligence. It has been around for years, but the recent emergence of so-called Generative AI (GenAI), with models and systems that are able to generate new, original output (text, image, audio and/or video) which is indistinguishable, or difficult to distinguish, from human output, was a new breakthrough that has substantially expanded the potential application possibilities. Below, we look at what the opportunities are for productivity growth and the conditions that must be met in this regard.

3.1. High expectations, but up to now little effect on aggregate productivity

The expectations of AI for productivity growth are high. This technology is increasingly seen as the next General Purpose Technology (GPT), like the steam engine, electricity, the computer and the Internet before it. Economists use the term GPT for a technology that has broad application throughout the economy, continually improves its own performance, and leads to innovations in the sectors that use it. In this way, a GPT can significantly and sustainably increase productivity growth.

In particular, generative AI has shifted the possibilities from task-specific models to systems that are more flexible and applicable across domains and industries. These advances are centred around so-called 'foundation' models - basic models that are trained on large amounts of data and can be adapted to a broad range of downstream tasks (e.g. Open AI's GPT series) or can be fine-tuned to gain insights relevant to a specific sector or activity (OECD, 2024a).

Like the computer and the Internet before it, AI primarily influences cognitive tasks, but the tasks produced by AI are a lot more versatile and sophisticated. Examples include supporting customer interactions via chatbots, generating creative content for marketing and sales, writing computer programmes based on prompts in ordinary language... According to McKinsey (2023), today's AI along with other technologies has the potential to automate work tasks that currently take up 60-70 % of workers' time, thereby freeing up labour for more advanced tasks or tasks that cannot be automated. AI can also accelerate innovation (Filippucci et al., 2024). Generative AI, for example, has already shown promising results in accelerating and improving the process of developing medicines, for developing and improving materials ... and could play a key role in the energy transition. These two factors - automating tasks and innovation - could significantly boost the productivity of our economies.

Studies on the impact of AI on productivity are limited for now, but micro-level research already appears to have observed a positive link between AI adoption and firm's productivity. The recent analysis made by the Federal Planning Bureau (Dumont, 2023) on the use of AI by companies in Belgium shows that AI is most widespread among the 10 % most productive companies (at 18,5 %) and least widespread among the 10 % least productive companies (7,5 % of those companies use it). Moreover, it shows that the relationship between the use of AI and the productivity of the firm remains positive after controlling for firm size, firm age, industry and complementary information and communication technologies (ICT) applications such as broadband and cloud computing. While those figures must be interpreted with caution, as they do not necessarily imply a causal relationship (the most productive firms could simply be the one with the greatest financial capacity to invest in AI), they provide a first insight of the effect of AI at the firm level.

Controlled experiments within companies have also revealed substantial productivity gains for workers (with different qualifications) who use AI for specific tasks, for example in service sectors. Specifically, a rise in both the quality of output and the speed at which tasks are completed. Software engineers, for example, can programme up to twice as fast by using an AI-based tool (Kalliamvakou, 2022); professional copywriting tasks have been performed significantly faster (Noy and Zahng, 2023); call centre operators became 14 % more productive by using AI tools (Brynjolfsson, Li and Raymond, 2023; Noy and Zhang, 2023). Even though these studies were typically carried out with early adopters, and the results therefore do not necessarily apply to all companies, they nevertheless show that the productivity gains of AI for employees can be substantial. Moreover,

the provided examples show the potential that this technology can have for the service sector[10], a sector that on average experiences lower productivity growth and, on account of its large share of the economy, has a significant impact on overall productivity growth.

Despite these positive figures at the company and task level, we do not (yet) see these effects at the aggregate level, however. It was shown in Chapter 1 that a fair number of developed economies, including Belgium, have experienced fairly slow productivity growth in recent years. One exception to this is the US, which over the period 1995-2005 benefited from the previous digital revolution spearheaded by the Internet, but then also experienced another decline in productivity growth. Once again, we seem to be confronted with Solow's paradox (1987). Back then, he claimed that "you can see the computer age everywhere but in the productivity statistics". The same is happening with AI, we see it everywhere, but we do not observe any improvement in productivity growth yet [11].

An argument sometimes mentioned in the literature to explain this paradox is the measurement error. GDP, which is a common measure of economic growth, may not accurately capture the value created by digital goods and services. Much of the most valuable content online is free and therefore is not captured by an increase in the consumer surplus when computing GDP and productivity growth (Scott and Varian, 2015; Brynjolfsson, Eggers and Gannamaneni, 2017; Greenstein and McDevitt, 2011; Goolsbee and Klenow, 2006).

Brynjolfsson et al. (2017) however argue that the biggest contributor to the paradox are the lags in the implementation of AI. One typical feature of technological innovations, and GPTs in particular, is that they can take some time to generate productivity gains. Firstly, the technology must be sufficiently widespread; a new technology needs to have sufficiently broad adoption in order to have an aggregate economic impact. Currently, only a small proportion of companies are using AI (see figures in Section 3.2). The slower implementation of new digital technology in Europe compared to the United States could delay the implementation of AI by companies and therefore potential productivity gains.

Moreover, achieving productivity gains is not purely a question of technology. It requires substantial, additional (often intangible) investment. For example, new ICT specialists need to be recruited, and staff need education and training to acquire the necessary skills to use the new technology. And for the technology to generate significant gains, companies must also often make substantial changes in the way they organise production, manage their staff, gather and use information, interact with customers and suppliers, etc. This requires creativity and experimentation by managers, which is risky and time-consuming (Filippucci et al., 2024).

To fully realise the potential of a GPT, a shift is needed from using it in 'point solutions' to 'system solutions', as was the case with electricity, for example. The commercial potential of electricity was first demonstrated around 1880, but it took 4 decades for the introduction of the technology to be reflected in statistics. The largest benefits only came when managers also started to fundamentally reorganise work by giving individual machines their own electric motors instead of using a centralised power source at the factory. This allowed much more flexibility in installing machines, and made effective assembly lines possible. The total productivity impact of electricity was therefore mainly driven by this (Agrawal et al., 2019).

Data-driven technologies - and AI in particular - may be at the same stage as electricity in the late 19th century[12]. The potential of the technology is already obvious, but introducing system solutions that boost productivity may still require a lot of experimentation and co-inventions, and then significant investment in new business

[10] This includes both market services, and non-market services. In education, for example, AI can be used to provide personalised feedback to students, create real-time assessments, personalise learning plans, etc. Another example is the field of healthcare, where AI can read scans and suggest diagnoses and treatment protocols and reduce the administrative burden by e.g. preparing insurance claims or summarising doctors' notes.

[11] In principle, the fact that we are not yet seeing productivity gains does not necessarily mean that AI is not having any effect. It cannot be ruled out that productivity growth would have been even lower without AI adoption.

[12] According to the OECD (2024), current applications of AI are mainly point solutions. For example, fraud detection or assessing the risk of default in the financial sector. Adopting AI for these types of tasks was relatively easy, since the data sets were already in place and prediction was a key part of the process.

processes, skills development, data collection/aggregation ... which takes time. In general, the deeper and more far-reaching the potential restructuring, the bigger the time lag between the initial invention and the visible increase in productivity[13].

Finally, it is important to consider the role of other factors such as macroeconomic policies and product market regulations, framework conditions on the labour market, and the broader social and economic context. These factors may also play a role in shaping productivity growth and the impact of AI. For example, an overly permissive competition policy is often cited as a possible cause for the limited impact of the digital revolution on productivity growth, and which has led to the emergence of a number of superstar companies (GAFAM) and inhibited the entry of new companies, with negative effects on the growth of the overall economy (Commission de l'intelligence artificielle, 2024).

Although expectations are generally high, at this moment of technological development and AI adoption, it is impossible to know to what extent AI will deliver on its promise. Productivity gains will depend on how the technology and complementary technologies continue to evolve, how effectively the challenges and risks inherent in AI can be addressed, and how successfully the technology is applied. For example, Acemoglu (2024) found that as long as microeconomic effects are driven by cost savings in work processes, the macroeconomic effects, albeit not trivial, are rather modest - no more than a 0.66 % increase in total factor productivity (TFP). But there is potential that we need to seize as much as possible. Indeed, if we fail to jump onto this new wave of technology, we risk not only missing out on 'the AI economy' - whereby our economic value is increasingly taken over by others - but may also lead to a weakening of existing activities/sectors.

3.2. AI in Europe and Belgium: some figures

a. Europe lags behind in the development of AI

The country that has historically been at the forefront of AI is the US. It has a larger and more established tech industry, with huge companies such as Google, Amazon, and Facebook, which have played an important role in the development of AI. In addition, the US also has a well-established ecosystem of venture capital and start-up funding, which has helped drive the growth of innovative AI companies. Consequently, they dominate in the area of Venture Capital (VC) investments in AI. But China is clearly catching up. In fact, the country currently has the largest number of AI research publications in the world[14].

Europe also scores well in terms of the number of AI research publications, but is clearly behind in the global race for AI investment, and the gap with the rest of the world has only widened since 2015 (European Court of Auditors, 2024). Moreover, not only is the total investment lower in Europe, but the size of the average investment is also much lower than in the US. Two major AI start-ups from the US - OpenAI and Anthropic - alone raised 6 times more funding than the roughly 669 AI start-ups in the EU (EC, 2024a). This makes it difficult for European AI start-ups to be competitive at the international level.

The dominance of American players can be seen in particular in the upstream part of the AI value chain. In the market for computing power - an essential ingredient for training and using AI models - American companies account for the bulk of the global market share, both for the design of semiconductor components, and data centre-based service providers (cloud). Another essential ingredient is data; training AI models is based to a significant extent on access to large volumes of quality data. Europe also clearly lags behind the US in this area, where US tech companies (especially GAFAM) have immense data sets at their disposal[15]. Together with the

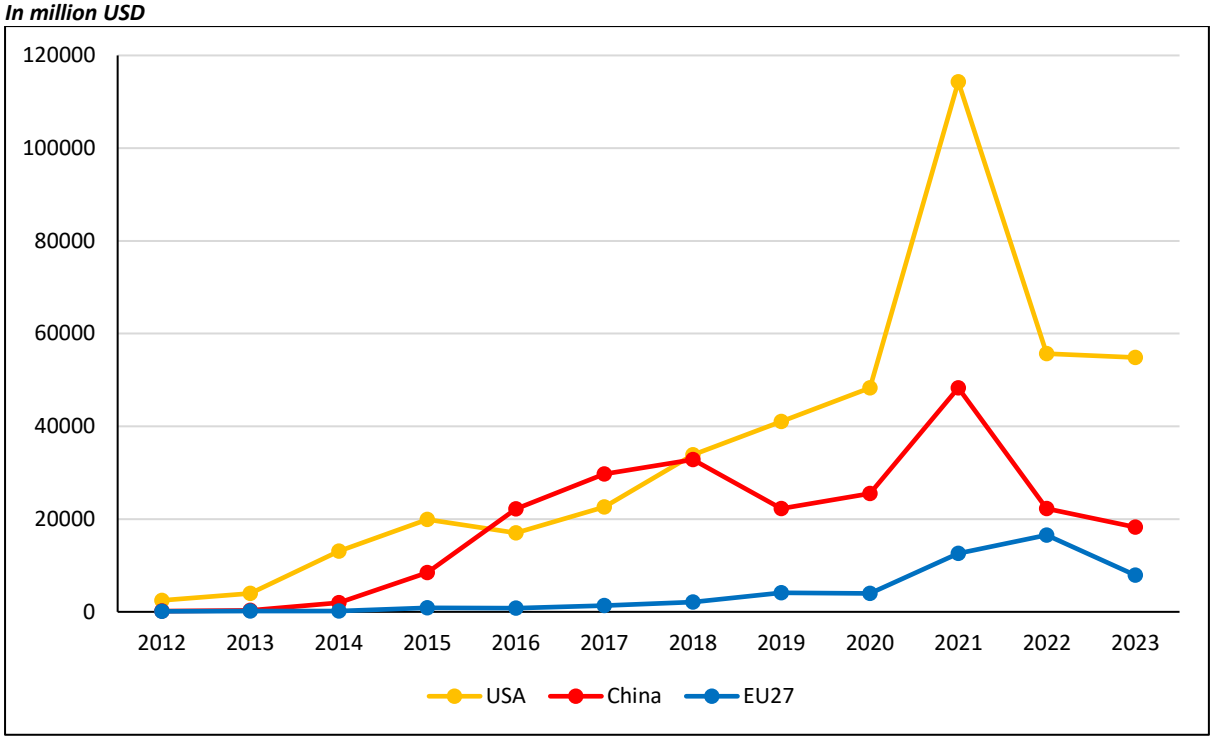
[13] The ease with which GenAI can be deployed in the economy could potentially shorten the time lag (Commission de l'intelligence artificielle, 2024), but fully exploiting the productivity potential of AI still requires complementary digital infrastructure and skills, as was the case with previous digital technologies (Filippucci et al., 2024).

[14] https://oecd.ai/en/data?selectedArea=ai-research

[15] The EU is also at a disadvantage to China, as the latter can use its central institutions to generate data.

extensive access to VC in the US, it is therefore not surprising that the country is also currently the global centre for the (costly) development of AI foundation models such as, e.g., GPT-4 on which ChatGPT was built.

Graph 17. Total Venture Capital investments in AI
In million USD



Source: OECD.AI (2024).

The dominance of the US in this area means that European AI startups are largely dependent on these companies for data. From the perspective of European productivity, this should not be problematic in theory, provided that foundation models remain sufficiently accessible. Too high prices (due to lack of competition) and regulatory differences between countries can make this access difficult.

From the perspective of productivity growth, it is crucial that foundation models are tested and used quickly and widely. Indeed, significant economic benefit is expected from implementation and innovation based on these models and, more generally, from rapid and widespread uptake of AI. In parallel, Europe also needs to build its own AI ecosystem. This is important not only on account of the direct economic value created by these activities, but a weak European tech sector can also be a drag on innovation performance in other sectors (Draghi, 2024).

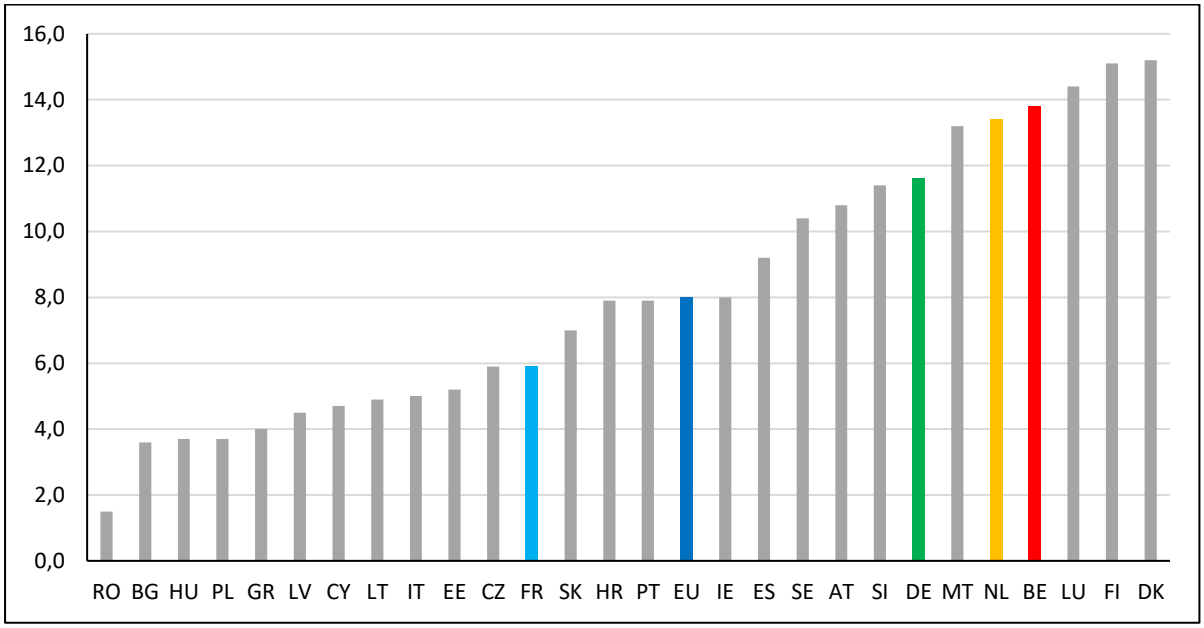
b. AI in Belgium

Within Europe, Belgium scores relatively well in terms of AI adoption. In 2023, Belgium ranked 4th compared to other EU countries (cfr. graph 18), with almost 14 % of enterprises using at least one AI technology. A sharp increase over 2021 (+34 %) and well above the EU average of 8%, but still far from the European target of 75 % uptake by 2030.

It should be noted, however, that the rapid advances in generative AI mean that there may be a lag between the figures and the actual situation. According to a recent survey by Microsoft and LinkedIn, global use of AI doubled in the past 6 months, although it is largely individual use, without an AI business plan or strategy. The same survey states that 60 % of business leaders are concerned that their organisation lacks a plan and vision to implement AI.

Graph 18. Enterprises using at least one AI technology, firms with 10 employees or more, all activities except financial sector, 2023

In %



Note: AI technologies include : text mining, speech recognition, natural language generation, image recognition & image processing, machine learning, AI based software robotic process automation, autonomous robots, self-driving vehicles, autonomous drones.
Source: Eurostat.

Even though the spread of AI in Belgium is higher than the average in Europe, our country is not a leader in AI startups. Only 2.7 % of AI startups[16] in Europe are based in Belgium (Hutchinson et al., 2024). This is lower than in some comparable small countries such as the Netherlands (10.9 %), Sweden (8.2 %) and Finland (4.2 %), a finding that is in line with the low start-up rate that characterises Belgium in general (see graph 19).

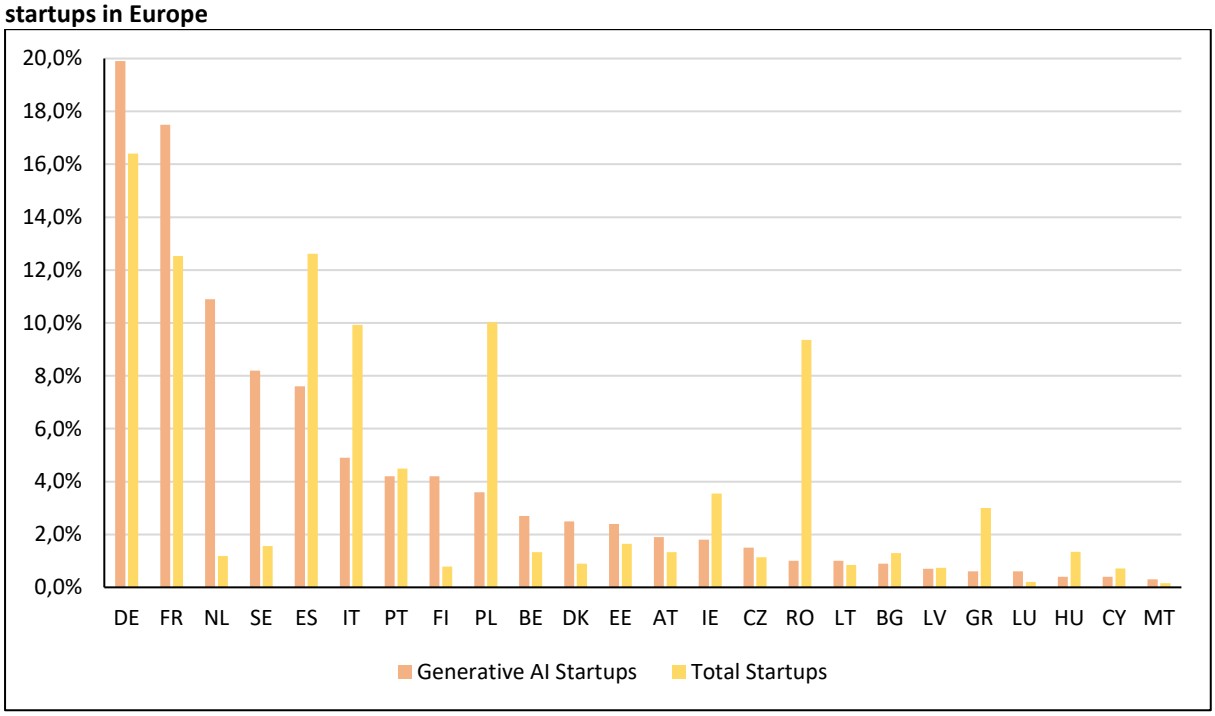
The use of AI is heterogeneous across firms and varies depending on the size of the company. While large firms, with 250 employees or more, represent only 1 % of the total firms in Belgium, 48 % of them were using one AI technology in 2023, according to Eurostat date. For very small companies, with 2 to 9 employees, only 7.5 % of them are AI adopters. Economies of scale related to the cost of using AI and the need for additional investments, notably in ICT and skills explain the more widespread use of AI in large companies.

Moreover, firms which are more likely to use AI are also those which are at first more digitalized (Calvino and Fontanelli, 2023). This finding is also in line with Brynjolfsson et al. (2021) pointing out the existence of complementarities between the adoption of AI within a firm and its overall level of digitalisation. A digitalised company will face fewer barriers when adopting AI since it already developed a series of complementary assets, such as their internal business digital capabilities or the acquisition of large datasets.

In general, Belgium scores relatively well for the digitisation of businesses. In 2022, 77 % of Belgian SMEs had a basic level of digital intensity, compared to 69 % on average in Europe. And uptake of big data and the cloud are also higher than the EU average (23 % vs. 14 % and 47 % vs. 34 %, respectively). But we are still (far) below the European targets for 2030 for all indicators. By that date, the goal is to have 90 % of SMEs with at least a basic level of digital intensity, 75 % of companies with uptake of big data and/or 75 % of companies purchasing intermediate or sophisticated cloud services.

[16] These are start-ups working on developing foundation models; working on development tools and infrastructure for generative AI models; and/or working on downstream applications on top of existing large foundation models.

Graph 19. Geographic distribution of the number of startups and GenAI startups and the total number of startups in Europe



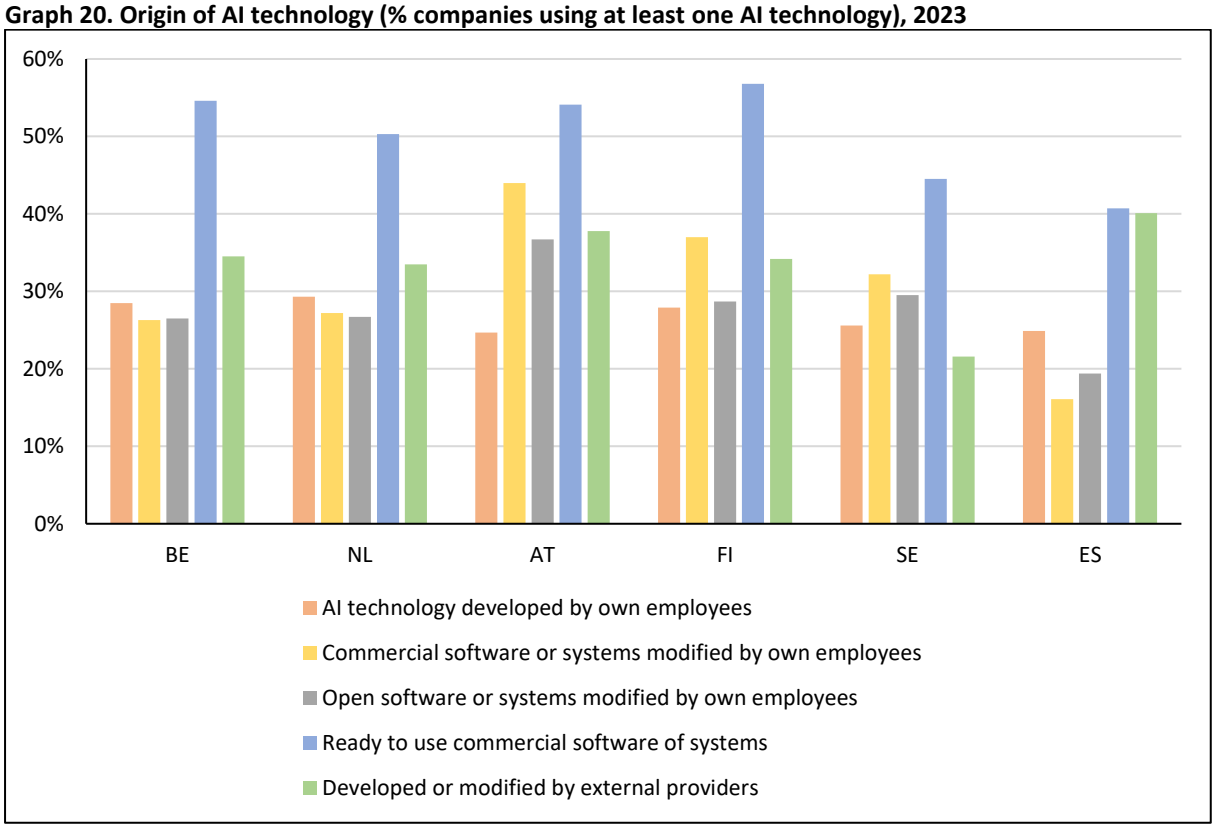
Note: Total number of startups refers to the number of new businesses with at least one employee in 2022.
Source: Hutchinson et al. (2024); Eurostat.

Eurostat's survey on the use of AI by firms also reveals regional disparities. The largest share of firms using AI occurs in Brussels at 17 %. In Flanders, 14 % of firms are using at least one technology considered as an AI while in Wallonia this share only reaches 12 %. These differences may be related to different location of large companies in the three regions. Moreover, the observation that a higher proportion of the firms in question can be found in capital city regions was already the case for previous digital technologies (Goldfarb and Tucker, 2019; Forman et al., 2005, 2008; Dranove et al., 2014).

Moreover, there are of course different forms of uptake. Most AI adoption is by default, e.g., via updates to existing software. This results in small productivity gains in a large group of firms, which can have a substantial effect at the aggregate level. However, the most significant productivity gains occur when AI also transforms companies' core business (see above), which often assumes a more active form of adoption. Calvino and Fontanelli (2023) found evidence that firms that develop their own AI algorithms experience more direct effects of AI on their productivity.

Figures by Eurostat on the origin of AI technologies used show that most technologies were acquired by purchases of off-the-shelf AI software or systems, followed at quite some distance by AI technologies developed or modified by external providers (see graph 20). As in other countries, fewer than 30 % of AI companies in Belgium developed their own AI software/systems or adapted those software/systems in-house.

Graph 20. Origin of AI technology (% companies using at least one AI technology), 2023



Source: Eurostat.

3.3. Which policies are needed to exploit the full potential of AI?

Artificial intelligence (AI) is vital to today's economic and industrial transformations and promises substantial productivity and innovation gains. However, these benefits will not fully materialise until AI use is widespread among companies and bolstered by a robust European ecosystem. Nevertheless, as previous waves of digitisation have shown, this will not just happen by itself, it requires appropriate policies.

The European Union has set up an action plan to promote the responsible development and integration of AI, in particular by adopting the AI Act. For its part, Belgium also has specific organisations and measures in place to regulate and encourage the development of AI.

EUROPEAN AND BELGIAN AI POLICY

In 2018, the European Commission (EC) launched the 'Coordinated Plan on Artificial intelligence' aimed at developing and using 'Made in Europe' AI, and in 2021 this plan was reviewed. The goal was to create a roadmap to becoming a leader in AI. The plan includes coordinated actions to be taken by the EC or member states to create the conditions for the development and deployment of AI, ensure that the EU becomes a place of excellence (from lab to market), ensure that AI serves people and society, and that the EU develops strategic leadership in various sectors having a substantial impact[17].

The EU has recently taken an important step in developing a harmonised framework for regulating AI, the AI Act. This Act, the first of its kind in the world, includes harmonised rules for placing on the market, deploying and using AI systems in the EU. The Act must guarantee that AI is trustworthy and safe, and that the EU's fundamental rights are respected, while also boosting innovation. To achieve this, there will be requirements for AI systems

[17] These include environment, health, robotics, public sector, home affairs, mobility and agriculture.

based on the risk they pose: unacceptable risk[18] (prohibited), high risk[19] (constrained by rules), limited risk [20] (transparency). To support innovation, the Act provides for regulatory 'sandboxes', so that SMEs and startups can test innovative AI systems.

There are also AI strategies and programmes at various levels in Belgium. For example, the federal government set up the AI4Belgium coalition, which brings together AI players from government agencies, the private sector, the academic world and civil society. This coalition published a report with policy recommendations in 2019 which was translated into the federal "National convergence plan for the development of Artificial Intelligence" in 2022, which contains specific proposals to make Belgium a 'Smart AI Nation'. These include guaranteeing cybersecurity and reliable AI; enhancing the country's competitiveness and attractiveness through AI; developing a data-driven economy and high-end infrastructure; focusing on AI in several specific areas (health care, mobility and environment and public services); and providing better quality lifelong learning.

In Flanders, the Flemish Policy Plan for AI (https://www.flandersai.be/en) was recently updated for a second cycle (2024-2029) following the first version over the period 2019-2024. In total, there will be annual investment of around €35 million intended for: 1/ strengthening strategic basic research at Flemish research institutes and universities; 2/ stimulating the use of AI, including by raising awareness, informing, advising and guiding companies in their initial experiences with AI (on top of the existing grant instruments from VLAIO); and 3/ raising awareness, training and providing ethical guidance. Among other things, this is implemented via the Knowledge Centre Data and Society (Kenniscentrum Data en Maatschappij), which provides policymakers, companies and the general public with usable guidelines and advice on legal, ethical and social aspects of AI and data applications, and via the Flemish AI Academy (Vlaamse AI-academie), which provides for the rollout of an overarching AI PhD School and a range of continuing training courses on AI from the Flemish higher education institutions. Another example is the project 'amai!', which is designed to inspire, advise and mobilise citizens around AI by developing smart AI solutions for specific themes (climate and environment, mobility, health and work) in consultation with citizens and experts.

In Wallonia, AI is the central component of two regional strategies. The Walloon digital strategy, generally referred to as 'Digital Wallonia', introduced a specific programme - Digitalwallonia.4ai - built around four development strands: 1/ raising the general level of information among the Walloon population and raising awareness among businesses on the various challenges and opportunities of AI; 2/ supporting and accelerating the digital transformation processes of companies, leading to the creation of 'augmented' products and services; 3/ attending training courses to raise the average level of technical proficiency in AI for active and non-active segments of the population, and 4/ forming a network of specialised national and international players in the field of AI, to accelerate the development and consolidation of our progress in AI. A budget of €1 to 5 million per year was envisaged, and various measures were devised[21]. . In addition to the Walloon Digital Strategy, the Walloon Research and Innovation Strategy, also known as the Smart Specialisation Strategy (S3), has also focused one of its initiatives on artificial intelligence. TRAIL (Trusted AI Labs) is one of the strategic innovation initiatives of the Walloon S3, with the aim of achieving excellence in AI by bringing together the complete ecosystem (R&D, training, companies) and seizing current and future opportunities at regional and European level. The goal is to consolidate a critical mass of players and innovation projects in the field of AI for the benefit

[18] These include manipulative or misleading techniques, abusing the vulnerability of individuals, biometric categorisation or identification systems, social scoring systems, or even emotion recognition in the workplace or in education. These are prohibited by this Act.

[19] Systems that potentially pose a high risk to health, safety, fundamental rights, environment, democracy and the rule of law. These systems must be subject to a mandatory impact analysis of fundamental rights, and must meet specific legal requirements.

[20] Systems not considered unacceptable or high risk, but subject to a duty of transparency, namely AI-generated content labelling and specific measures for 'deep fakes'.

[21] Various actions have been undertaken in the context of this strategy, including a programme of guidance for companies, associations and public authorities, "Start IA", to identify opportunities related to AI and the activities of these structures, thanks to trained experts, and with the aim of making future innovative digital projects successful. This is supplemented by "Tremplin IA" which makes it possible to develop a Proof of Concept (PoC) and test the feasibility of an AI project to improve, in the case of companies, competitiveness.

of industrial sectors where there is potential, such as health care, mobility, industry 4.0, etc., including the research project "ARIAC" which has access to €32 million spread over 6 years[22].

In the Brussels region, the AI strategy consists of various components. AI is part of the Brussels Regional Innovation Plan 2021-2027 and the Smart Specialisation Strategy (RIS3), underscoring the region's intention to integrate AI into broader innovation and technology frameworks, in particular in sectors such as mobility, healthcare and sustainability. One of the most prominent initiatives is FARI - AI for the Common Good Institute, a pioneering collaboration between two of Brussels' leading universities, Université libre de Bruxelles (ULB) and Vrije Universiteit Brussel (VUB). FARI embodies the vision of using AI to address societal challenges and organises education, via the AI Academy, and research & innovation. Another cornerstone in the Brussels AI strategy is SustAIn.brussels, a European Digital Innovation Hub (EDIH). This initiative provides support to local organisations and businesses by helping them make their operations future-proof using advanced AI technologies, while keeping a focus on sustainability. Furthermore, Innoviris, the Brussels public service for research and innovation, actively supports AI-related projects through various funding mechanisms[23]. Finally, Paradigm.Brussels, the IT partner of the Brussels Capital Region which supports the digital transformation of public services, is vital to the integration of AI into public administration, using it to improve the efficiency and quality of services for citizens.

There are therefore various initiatives to encourage the development and use of AI, both at the European level and in Belgium. Nevertheless, more efforts are needed to realise the full potential of AI. A number of key levers are identified below.

a. At the international level, keep focusing on safe AI systems that respect fundamental rights without harming innovation

Artificial intelligence (AI) raises various concerns, in particular regarding transparency, accountability, the protection of various fundamental rights such as non-discrimination and the right to privacy and data protection, ethical practices, etc. Regulation will be necessary in order to allay these concerns. Indeed, confidence in technology is an essential condition in order to fully seize the opportunities offered by this technology. Moreover, regulations also need to provide clarity and certainty; indeed, these are essential conditions for investment.

At the same time, it is crucial that regulations do not unnecessarily hinder innovation. For example, it has been estimated that the costs of compliance with the GDPR are high. For data-intensive industries, such as software, costs can be up to 24 % higher (Demirer et al., 2024). Limitations on data storing and processing hinder the creation of large, integrated data sets for training AI models (Draghi, 2024, p.22). The regulatory framework must therefore strike a balance between protecting against the risks of AI on the one hand and encouraging innovation on the other.

Given the cross-border nature of (Generative) AI, divergent developments between major economic blocs should be avoided as much as possible. Ideally, the goal should be global alignment to mitigate the risks of AI, boost confidence in the technology and create a level playing field. Europe and Belgium needs to see how they can further contribute to the work of international organisations trying to establish guidelines for AI.

Within the EU, the AI Act is the main legislative framework for the development and use of AI. The Act is immediately applicable in Belgium, but our country now needs to fully work on implementation and enforcement. Goldplating - whereby additional requirements, obligations or standards are imposed which go further than those of EU legislation - should be strictly avoided in this regard. To avoid additional complexity, implementation requires good coordination and cooperation between the federal level and the regions. Finally,

[22] The research project "ARIAC" (Applications et Recherche pour un IA de Confiance), with funding of €32 million spread over 6 years, will be based around human-AI interaction, trust mechanisms for AI, the integration of AI models, the optimal implementation of AI, and TRAIL Factory (where companies are provided with resources developed by scientists from universities, research centres or industry, as well as related expertise or infrastructure).

[23] One of these initiatives is the Innovative Starters Award, which supports start-ups with high innovation potential to implement strategic plans that can drive the development of AI in various sectors. In addition, Innoviris encourages partnerships between research institutions and the private sector to advance AI research and applications.

it will also be important to raise awareness among competent authorities, business and other stakeholders, and provide guidance in order to eliminate uncertainty about how to interpret laws and regulations.

b. Strengthening AI governance

Even though AI is the focus of both European and Belgian policies, it is still crucial to strengthen the governance of these initiatives.

Strong governance implies not only a broad-based vision of the direction Belgium should take in terms of AI. Based on this vision, a strategy needs to be set out, with concrete and measurable objectives and priority action items that are defined in detailed roadmaps with clear timing for implementation of the measures.

An effective policy requires a coherent policy framework that fosters synergies between different policy areas and different competent entities. Alignment and coordination between different policy areas and levels of government will be essential in this regard. On this last point, for example, it could be examined how the different levels of government can reinforce each other's efforts on a number of common themes, including on societal challenges such as health, environment, energy, mobility... Strengthening coordination is not only a national challenge. For example, the European Court of Auditors (2024) recently found that the EC is also failing to effectively coordinate European and national measures (especially measures to scale up AI investments).

Finally, the rapid developments in the field of AI demand an iterative and learning approach. It is important to continue monitoring the technology and its impact, and follow up on the extent to which policies are responding to it. Applying a learning approach, it should be evaluated on a regular basis in the coming years whether there is a need for any (new) actions or policies. Here, open collaboration between government authorities, businesses and the scientific community is beneficial; indeed, that way signals can be picked up early on about where adjustments are needed.

c. Developing skills

To safeguard the future of AI in Belgium, it is crucial to invest in education and training at all levels. Indeed, AI has the potential to change the content of jobs as well as the types of profiles and skills companies want. Digital skills will become essential, as will soft skills (complementary to AI) (Lane et al, 2023; Lassébie and Quintini, 2023). The demand for specialists will also rise significantly due to the necessary development, maintenance and use of AI within companies (Wilson et al, 2017).

According to data from Eurostat, in Belgium, 15.4 % of companies with 10 or more employees will have recruited or tried to recruit information and communications technology (ICT) specialists in 2022. Of these, around 70% had recruitment problems. Although Belgium already has a number of scientific and technical training programmes - including several specifically focused on AI, such as the Master in AI at KU Leuven or short courses such as HandsOnAI at UMons, the FARI AI Academy at ULB and VUB, and the Flemish AI ACADEMY - there are an insufficient number of ICT specialists to meet demand. Increasing the supply of this kind of training course, encouraging young students to choose these study areas, and relaxing migration policies for ICT specialists are all opportunities to improve the spread of AI in our companies. Furthermore, it is also essential for basic digital skills (in the area of AI, cybersecurity, ethics and technology, etc.) to be integrated into all levels of education, to foster AI adoption.

Besides education, lifelong learning also needs to address the transformation of professions as a result of AI. The ability of companies and workers to adapt to the implementation of AI through reorganisation of their work also depends on the existing skills levels of workers and the efforts in terms of continuing education made by companies to improve workers' skills as needed. In this sense, it is concerning that as of 2023, 40.6 % of the Belgian population lacked basic digital skills. Although significant, this share is lower than the EU average (45.8 %). In 2022, 33 % of companies with 10 employees or more offered training to their staff to develop their digital skills (Eurostat), one of the highest figures in the EU after the Nordic countries (Denmark 33.3 %, Sweden 34.2 % and Finland 39.8 %). This figure rises from 26.8 % for firms with 10 to 49 employees, to 57.6 % for firms with 50 to 249 employees, and climbs to 87.1 % for very large firms of more than 250 employees. Although not available for SMEs (fewer than 10 employees), the figures generally indicate a negative correlation between

continuing training and the size of the firm. One possible solution would be to develop a network of AI training centres for SMEs.

d. Developing a data strategy supported by a high-quality infrastructure

Training AI models requires large volumes of high-quality data. Europe clearly lags behind the US and China in this area (see above). It is crucial that further action is taken at the European level to address this disadvantage and establish a genuinely unified market for data.

But efforts also need to be made within Belgium to strengthen the data ecosystem. It is vital that the competent authorities develop a data strategy as rapidly as possible, which is aligned with the European data strategy. This strategy should provide solutions to optimise the generation, provision and reuse of data, to improve data quality and to facilitate mutual data exchange. Among other things, this requires making data available through the FAIR (Findable, Accessible, Interoperable and Reusable) principle and encouraging firms to build secure and efficient data sharing infrastructure. In addition to focusing on the supply of data, initiatives are also needed to promote data use and foster a data culture. Expertise and skills necessary to evolve in the data ecosystem will be an important element in this regard.

There needs to be a special focus on strategic sectors such as health care. Improved access to health (care) data can not only contribute to better health (care) policy, but also the development of new therapies. In this sense, setting up the Health Data Agency (HDA) to facilitate the secondary use of health (care) data (or related data) in Belgium is a good initiative, where there needs to be progress as rapidly as possible. Indeed, opening the secondary use of health data for research will be important to anchor the R&D activities of the pharma and biotech sectors in Belgium, and prevent the pharmaceutical industry in Belgium from losing ground to other countries.

Besides a data strategy, there also need to be efforts to provide high-quality infrastructure that ensures connectivity and makes it possible to digitally process, store, secure and transport the data used for AI. This requires substantial investment, at both European and national level. As regards Belgium, the EC notes in its most recent Digital Decade Report that, despite the progress made, the connectivity infrastructure lags far behind the European average for the roll-out of fibre optic networks (FTTP) and 5G coverage, and that it is therefore important to press on with the (announced) plans. In the area of computing and storage infrastructure, it will be important to identify current and future needs, and how these can be met. Moreover, it must also be ensured that this capacity is sufficiently accessible to SMEs and start-ups. In this report, the EC also states that Belgium scores well for uptake of cloud, also by SMEs, but needs to support a broad uptake of next-generation cloud infrastructure and services (EC, 2024a, p. 6).

Finally, the AI transition also requires a sufficient supply of (green) energy. Training and running AI models and maintaining data centres is extremely energy intensive. Data centres currently account for 2.7 % of European electricity demand, but by 2030 their consumption is expected to rise to 28 % (Draghi, 2024, p. 31). Sufficient investments in energy generation and grid capacity are therefore necessary to take full advantage of the digital transition.

e. Work towards an ecosystem that promotes the spread of innovation and facilitates AI startups

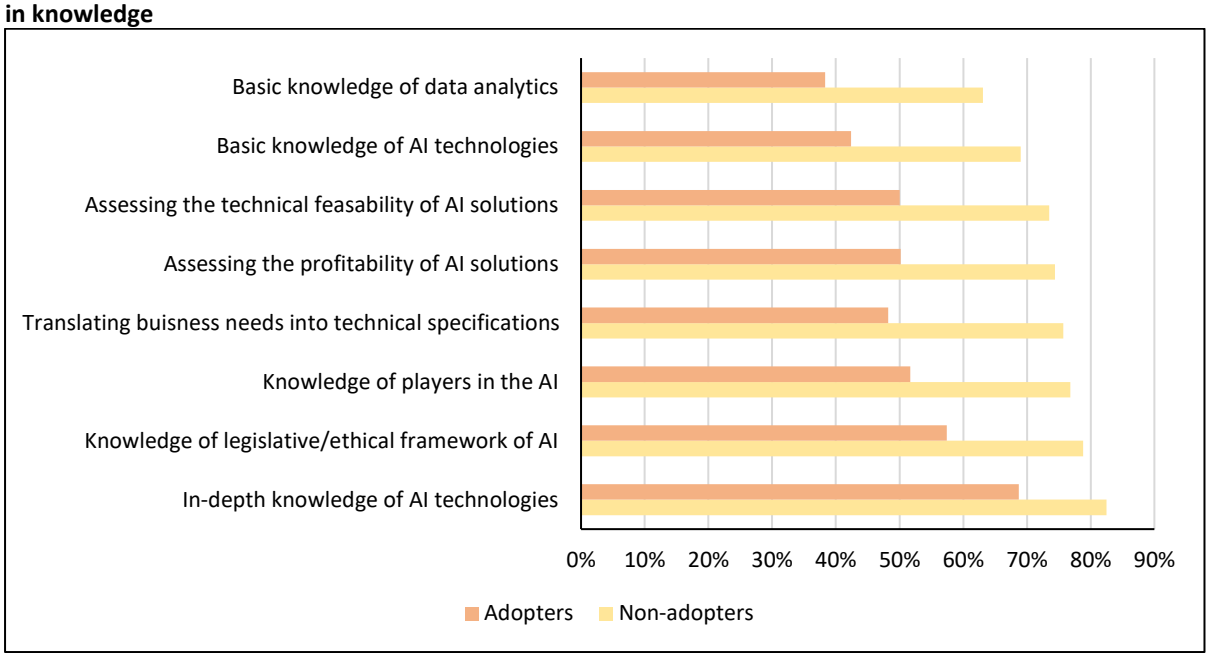
In the first instance, AI innovation implies a broad adoption of AI applications in existing sectors/businesses of the economy. Indeed, companies that fail to adopt the technology quickly and in a structured way risk seeing their market share and margins eroded, or may even ultimately disappear. But in addition, it also needs to be explored where there is potential for developing new activities and therefore how Belgium can integrate into the European AI ecosystem. These two elements are discussed in turn below.

Support for the spread of AI, in particular for SMEs

It will only be possible to fully capitalise on AI if there is widespread uptake of AI within businesses. However, as explained in Section 3.2, the proportion of companies using an AI technology remains limited. An analysis of the barriers to the use of AI is interesting to work out how to promote the use of AI in Belgium.

The main barrier to the adoption of AI - not only in Belgium, but also in other countries - is the lack of relevant expertise and knowledge. The Flemish AI Barometer analyses in closer detail the kind of knowledge, skills and experience lacking in Flemish companies which indicated shortfalls in knowledge. As such, it is not only (in-depth) knowledge of AI and data technologies which is lacking, but also knowledge of the legislative and/or ethical framework; knowledge of the players in the AI landscape; and the capacity to translate practical business needs into technical specifications for AI solutions, to assess the profitability of AI solutions, and to assess the technical feasibility of AI solutions. Guidance and training in this area can therefore be beneficial, as can raising awareness of importance of AI for businesses and sharing best practices.

Graph 21. Specific knowledge, skills and experience lacking in Flemish companies which indicated shortfalls in knowledge



Source: AI Barometer Flanders, situation in 2023.

Frequently cited barriers for the adoption of AI are the incompatibility with existing equipment, software or systems, costs which are too high, or difficulties with availability or quality of the necessary data. Policies should therefore focus as much as possible on eliminating or lowering these barriers.

There needs to be a specific focus for SMEs in this regard, which have a much lower adoption rate of AI than larger companies. This focus is important not only because of the direct impact, but also to avoid a concentration of the market structure. Investment in AI is currently concentrated in large companies, because the latter have the financial resources to develop and procure AI, and as they invest in AI, these companies gain sales, employment and market share (Babina, Fedyk, He, & Hodson, 2024).

The slower adoption of AI by SMEs compared to large companies is in part due to the lower initial digitisation rate. These companies, for example, typically lack the digital infrastructure and data streams to train, test and deploy AI applications. Even though the adoption of digital technologies by SMEs in Belgium is higher than the EU average, the gap between large and small companies is wider than in the rest of Europe. As such, the EC (2024b) has argued that in order to foster the digitisation of smaller companies in Belgium, it will be crucial to further support SMEs in these efforts. Partnerships (such as collective research centres, cluster organisations, etc.) can play a role in this regard, both in terms of raising awareness and by investing in common building blocks that are important to many companies in the sector (e.g. common training courses; specific coaching; explanations on regulatory compliance, etc.).

The public sector could also boost its rate of use of AI tools. Artificial Intelligence can raise the efficiency and quality of decision making in the public sector and improve public services (e.g., providing advice and services that better match citizens' needs; programmes used by public employment services to promote job matching, etc.). In addition, access to public contracts can provide AI start-ups with a market for their products and services.

Facilitating the creation of AI start-ups

The current dominance of the United States and China in the field of AI poses challenges not only in terms of productivity, but also in terms of technological sovereignty. As stated above, it is crucial for Europe to develop a solid internal offering in the field of AI. The substantial investments needed for this require cooperation at the European level. Belgium needs to look at how it can support this EU policy and in what areas Belgian companies can integrate in the European AI ecosystem, taking into account our relative strengths.

Given the strong position of the pharmaceutical sector and the potential applications of AI in this domain, healthcare already seems to be a possible domain where AI actors could develop in Belgium. Thanks to its large pharmaceutical companies and advanced research centres, Belgium is well positioned to develop and apply AI to accelerate discoveries of drugs, personalise treatments and optimise clinical trials, etc. But the potential of other sectors (e.g., semiconductors, finance, logistics, culture, etc.) also needs to be explored. Based on these analyses, the sectors/activities need to be identified in which Belgian companies can play a role in the broader European AI ecosystem, as do the actions needed to get these new activities off the ground.

Research and Development (R&D) and innovation will be crucial in this regard. Belgium already enjoys an advantageous position in the area of innovation, being among the strong innovators in Europe, alongside the Scandinavian countries and the Netherlands. Moreover, there seems to be a strong scientific foundation for research in the field of AI[24]. One sore point for Belgium, however, is the dynamics of successfully turning innovation into commercial services and applications (EC, 2024b). The economic valorisation of innovation requires sufficient (ambitious) entrepreneurship. Indeed, it is often young companies that bring innovations to the market, and also prompt existing companies to innovate. In the area of start-ups and scale-ups, Belgium generally scores weakly. The policy must therefore work to create an environment that facilitates innovation and entrepreneurship in the area of AI.

[24] 4th place European ranking according to The Global AI Index - Tortoise (tortoisemedia.com) and 11th place for development.

4. Intermediate evaluation Recovery and Resilience Facility

In July 2020, in response to the COVID crisis, a historic recovery plan was adopted at the European level. This was the Next Generation EU Plan, the core element of which was the Recovery and Resilience Facility (RRF). With this plan, the EC aimed to mitigate the economic and social impact of the COVID pandemic, make the economies and societies of member states more resilient and sustainable, and better prepare them for the challenges and opportunities of the green transition. The objectives were two-pronged: to foster a post-pandemic recovery and also to enhance resilience in the face of future crises. In response to the energy crisis that erupted in the wake of the war in Ukraine, the EU subsequently set up the REPowerEU Plan in 2022, which allows countries to supplement their Recovery and Resilience Plan with a REPowerEU chapter to finance energy-related reforms and investments.

To benefit from the Recovery and Resilience Facility, member states had to submit a Recovery and Resilience Plan with national investment and reform agendas for the period 2021-2026. These proposals had to meet certain conditions, including responding to the country-specific recommendations made by the European Council in the context of the European Semester and making an actual contribution to the green and digital transition. In its annual report for 2021, the NPB made an initial assessment of Belgium's Recovery and Resilience Plan. Below is an interim evaluation both of the European funding facility and the Belgian Recovery and Resilience Plan, as well as a brief look ahead.

4.1. EU Recovery and Resilience Facility

At the start of this year, the EC published an interim evaluation of the RRF on the basis of which the European Council formulated council conclusions. The initial results in the area of economic growth and resilience, employment and investment were given a positive assessment. The facility effectively supported the recovery from the COVID crisis, helped by the pre-funding that made it possible to provide rapid financial support to member states, and it has also contributed to the green and digital transitions and other EU priorities. However, it is too early to make a full impact assessment of the RRF. An ex-post evaluation is envisaged by the legislation in 2028. As requested by the European Council, it will be important to refine the tools to assess the macroeconomic impact.

A number of interesting elements in the design of the facility should increase the effectiveness of the funding. The first is the combination of reforms and investments within one facility; RRF funding is conditional on member states implementing coherent packages of investments as well as reforms. In this way, the facility also supports the country-specific structural reforms recommended in the context of the European Semester. Another positive element is that the facility was used to bolster common EU priorities, in particular the green and digital transition, via specific objectives. And performance-based funding is also intended to make the facility more effective. Funds are disbursed after concrete results are achieved regarding the milestones and targets set out in the member states' plans, and which represent concrete steps in the implementation of reforms and investments. This way of working should allow effective monitoring of the implementation of the national recovery and resilience plans (RRPs) and ensure tangible results. This approach ensures there are actual incentives for member states to also implement reforms (not necessarily involving financial costs) recommended in the context of the European Semester, sometimes for multiple years.

Notwithstanding these positive elements, a number of challenges were identified when the plans were implemented. As noted by the European Council, the large increase in available EU funding through the RRF, combined with external shocks, created significant challenges for the absorption capacity of national administrations. In line with this, the European Court of Auditors, in its recent evaluation of the absorption of funds from the RRF, found that the number of payment requests submitted to the Commission was significantly lower than envisaged in the operational arrangements. This is attributed to various factors, including problems with the administrative capacity of member states, delivery problems, etc., but also certain implementing rules of the RRF and different interpretations regarding implementation meant that the implementation of the measures took longer than anticipated. Moreover, the Court of Auditors notes that disbursements of RRF funds do not necessarily reflect the quantity and importance of milestones and targets included. This may result in the risk of a significant proportion of RRF funding being paid without member states having completed the

corresponding measures. Finally, the ECA suggests that in the second half of the RRF implementation period, the quantity and nature of the milestones and targets to be achieved, as well as the shift from reforms to investments, are likely to pose additional challenges to the timely absorption of funds. It therefore believes that there is a risk that not all planned measures will be completed within the RRF's implementation timeframe.

4.2. Belgian Recovery and Resilience Plan

Belgium's Recovery and Resilience Plan includes a wide range of investments and reforms. It will be financed through grants amounting to €5 billion and loans amounting to €264 million over the period 2021-2026, equivalent to 0.9 % of Belgium's GDP in 2023. The 119 investment projects and 40 reforms put a strong focus on the green transition, with 51 % of the available funds going to measures that support climate goals. Projects focused on the digital transition represent 27 % of the total funds. And the Belgian plan also has a strong social dimension with social protection measures, in particular focused on retraining and upskilling measures (EC, 2024c).

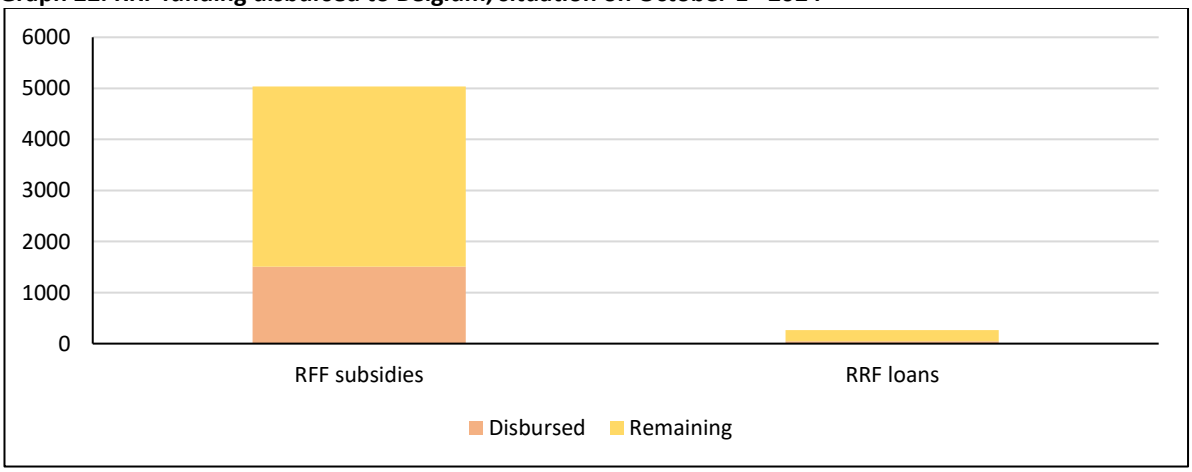
But implementation in Belgium is running behind the initial planning. Belgium has since submitted two payment requests, but besides the pre-funding, has only received a partial payment on the first instalment.

The first request in September 2023 included important steps in realising the 9 reforms and 7 investments that will bring about a positive change for both citizens and businesses in Belgium, in the areas of digitalisation (rollout of 5G networks and fibre optic network), personal mobility, education and training for adults, employment and managing public finances. The European Commission approved a positive evaluation of 19 of the 20 milestones and targets related to this first payment request from Belgium. *Indeed, it found that the reform of the pension system did not yet meet all the requirements in the Council's implementing decision. In the EC's view, Belgium has not sufficiently reformed its pension system to improve its financial sustainability. As such, the Commission initiated the 'suspension of payments' procedure as provided in Article 24, paragraph 6 of the RRF Regulation, thereby leaving an amount of €31 million pending. A second payment request of €909 million was submitted in July 2024, but an evaluation was suspended pending approval by the Council of the amendment to the Council implementing decision of the Belgian plan.*

In early October 2024, about halfway through the implementation period, Belgium had received 29 % of the envisaged funding, while only 8 % of the milestones and targets still received a positive assessment from the EC in an implementing decision[25].

Belgium, like several other member states, therefore needs to accelerate the implementation of the Recovery and Resilience Plan by mid-2026, including the REPowerEU chapter, by finalising reforms and investments.

Graph 22. RRF funding disbursed to Belgium, situation on October 1st 2024



Source: EC, Recovery and resilience scoreboard.

[25] https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/country_overview.html

4.3. The need for additional investments on top of the Recovery and Resilience Facility

Notwithstanding the substantial amounts released with the RRF, there are still significant investment needs. Since the 2008-09 financial and economic crisis, private investment in the EU has lagged behind that in the US. At the same time, the private investment gap between the two economies was not offset by higher public investment, which also fell back after the financial and economic crisis and was lower in Europe than in the US (Draghi, 2024). It is therefore crucial to raise European investment, not least because the digital and green transition require significant additional investment. However, besides raising investment, it will also be essential to bolster intra-EU coordination.

Indeed, the fragmentation of funds is a barrier to scaling up and investing in breakthrough innovation. Most member states by themselves cannot achieve the necessary scale to achieve state-of-the-art research and technological advances, which limits their R&I capacity. More coordination is also needed to take into account the external effects of one country's investments on other EU countries. Certain investments create positive external effects in other countries (for example, investments in grids and interconnections, in research and development, etc.). Without joint funding and planning, these projects risk being underfunded. But there can also be negative external effects, for example when EU countries with the largest fiscal room for manoeuvre can provide more generous support than others. This distorts the level playing field between member states, with a detrimental impact on the single market.

There is therefore a need to strengthen the European approach, whereby public and private funds are channelled in a more coordinated manner. This should make it possible to pursue an efficient industrial policy without creating distortions between member states. A common fiscal capacity via, in particular, the Carbon Border Adjustment Mechanism (CBAM) or through the issuance of common debt, could strengthen this coordination.

But nationally funded investments are also important. In Belgium, public investment in particular is a matter of concern. Years of under-investment by the public sector meant that over a long period of time, government investment expenditure was not enough to offset the depreciation of existing fixed assets, and the government's net capital stock expressed as a % of GDP therefore declined. The result was a drop in the quality of public infrastructure, which also weighed on private investment. According to the recent report of the Study Committee for Public Investment, the rise in gross investment in recent years (from 2 % of GDP in 2002 to 2.7 % of GDP in 2022) prompted net fixed investment to turn positive again in 2009, but the government's net capital stock currently remains lower than in the mid-1990s (44 % of GDP in 2021 versus 50 % in 1995).

The Study Committee for Public Investment (2024) concludes that, with unchanged policy, the objective set forth in the federal coalition agreement of September 2020 to realise an investment ratio of 4 % of GDP by 2030 will not be achieved. With unchanged policy, i.e., without a decision for additional public investment, the level of public gross fixed capital formation (GFCF) would fall back to 2.8 % of GDP in 2029, after peaking at over 3 % in 2024, which can be explained by the gradual phasing out of the various investment plans, specifically the recovery plans.

Additional investment will therefore be needed to meet the objective. At the same time, Belgium faces major challenges as regards the sustainability of it public finances, as evidenced by the excessive deficit procedure initiated by the European Union. It will therefore be crucial to allocate government resources efficiently. In choosing investments, it is important to focus on the areas where we expect a clear return in terms of productivity, and which subscribe to a long-term digital and green transition. The Study Committee for Public Investment can play an important role in this regard, and must be further supported. Furthermore, it must be explored how the selected investments can be made more efficient. Better coordination of the various entities with investment powers could help in this regard (EC, 2024c). In this context, the Study Committee for Public Investment also calls for substantial coordination of investment policy between entities in Belgium, given the operational dependencies, budget implications and the new European budgetary framework that calls for an integrated investment plan.

5. Activity report

5.1. The Board

Creation of the Board

Following the report "Completing Europe's Economic and Monetary Union" prepared by the "Five Presidents" (22 June 2015), the Council of the European Union adopted a recommendation on 20 September 2016 encouraging Member States to set up a National Productivity Board. Setting up such a council responds to a desire to enhance competitiveness in the long term so that economies are more resilient and can therefore recover more quickly from economic shocks. The role of the Productivity Board is to analyse competitiveness in the broadest sense, to enrich the knowledge base and to contribute to the national debate, in order to strengthen the take-up of policies and reforms.
In Belgium, the National Productivity Board was officially set up on 14 May 2019, in accordance with the law of 25 November 2018 establishing the National Productivity Board (published in the Belgian Official Journal on 7 December 2018), which transposes the European recommendation.

Mission of the Board

The National Productivity Board in Belgium is responsible for:

- performing diagnoses and analyses of trends in productivity and competitiveness;
- analysing policy issues in the area of productivity and competitiveness;
- assessing the consequences of policy options in the above-mentioned areas.

In performing these tasks, the National Productivity Board may forge contacts with Productivity Board in other Member States, communicate publicly when opportune, obtain appropriate access to information available from public administrations and consult stakeholders.
The National Productivity Board performs its tasks in the context of the European Semester, in particular by assisting the European Commission in collecting data and by assisting governments in preparing the drafting of the national reform programme.
The National Productivity Board publishes an annual report.

Composition of the Board

The National Productivity Board is managed by a Bureau made up of:

- a Chair, proposed by the secretariat of the Central Economic Council (CEC) and
- two Vice-Chairs, one proposed by the National Bank of Belgium (NBB) and one by the Federal Planning Bureau (FPB).

The Bureau determines the agenda for meetings and the themes to be discussed by the Board.
The National Productivity Board has 12 members, six at federal level and six at regional level:

- Siska Vandecandelaere (CEC)
- Luc Denayer (CEC)
- Catherine Fuss (NBB)
- Tim Hermans (NBB)
- Chantal Kegels (FPB)
- Joost Verlinden (FPB)
- Micael Castanheira (Brussels-Capital Region)
- Koen Declercq (Brussels-Capital Region)
- Caroline Ven (Flemish Region)
- Joep Konings (Flemish Region)
- Maxime Fontaine (Walloon Region)
- Vincent Vandenberghe (Walloon Region)

The FPS Economy acts as Secretariat for the Board.

The members of the Board and the Secretariat are appointed by the King.

5.2. Activities 2024

Board Meeting

The National Productivity Board met 4 times, including on:

- March 20th 2024: Preparation of the Annual Report 2024;
- June 28th 2024: Progress report on the 2024 Annual Report and discussions on the drafting of a note for the government *formateur* and the presidents of political parties likely to participate in the federal government;
- September 11th 2024: Discussions on the first draft of the 2024 Annual Report;
- November 6th 2024: Finalisation and validation of the 2024 Annual Report.

External activities

In addition to the meetings of the National Productivity Board, the members of the Board participated in a number of activities initiated by external organisations, notably the:

- January 15th 2024: Presentation of the 2023 Annual Report at the European Commission's Fact Finding Mission at the Federal Planning Bureau;
- April 15th 2024: Presentation of the 2023 Annual Report to the Central Economic Council;
- June 14th 2024: Presentation of the CNP's work to the High Council for Employment;
- October 10th 2024: Presentation of the contributions of business sectors to productivity growth to the Economic Policy Committee (627th meeting), European Commission.

Annex: Avis du Conseil Central de l'Economie (CCE 2024-2700) – 18 décembre 2024

1. Saisine

§1. L'article 4 de la loi du 25 novembre 2018 portant création du Conseil national de la productivité (CNP) prévoit dans son paragraphe 2 que les études et les rapports de cette institution puissent faire l'objet d'un débat au sein du Conseil central de l'économie (CCE), préalablement à leur publication. Si ce dernier souhaite formuler un avis, cet avis sera joint en annexe lors de la publication de l'étude ou du rapport. Le rapport annuel 2024 sur la productivité a été transmis au Conseil central de l'économie le 13 novembre 2024. Ce rapport a pour objectif de définir l'état de la connaissance sur la productivité et la compétitivité pour permettre d'en apprendre davantage sur les sources de la croissance de la productivité et d'identifier les causes éventuelles de son ralentissement.

§2. Le projet d'avis, qui est le résultat des discussions menées au sein de la sous-commission « Conseil de la productivité », a été approuvé en séance plénière le 18 décembre 2024.

§3. Il s'inscrit dans la continuité de la demande adressée en septembre par les responsables du Conseil central de l'économie, du Conseil supérieur de l'emploi et du Conseil national de la productivité au formateur et aux présidents des partis pressentis pour la formation du prochain gouvernement en vue d'inviter ceux-ci à faire de la productivité une priorité dans l'agenda politique.

2. Les concepts de productivité et de compétitivité

Productivité et compétitivité

§4. La croissance de la productivité a un rôle essentiel à jouer dans le processus de création de richesse et dans la réponse aux défis sociétaux et environnementaux auxquels la Belgique fait face (le changement climatique, le vieillissement de la population, la transition numérique, les soins de santé, la mobilité, l'inclusion, l'autonomie stratégique…).

§5. Les gains de productivité devraient être théoriquement le fondement d'une amélioration des revenus réels et de baisses des prix relatifs. Grâce aux gains de productivité, les entreprises peuvent aussi maintenir leur rentabilité, laquelle est déterminante pour les investissements futurs et la création d'emplois. Ces différents éléments sont nécessaires pour un maintien de la compétitivité. Le CCE définit ainsi la compétitivité comme « la capacité d'une économie d'améliorer, à un rythme similaire ou supérieur à celui observé dans des pays de structure comparable, le niveau de vie de ses habitants et à leur procurer un taux d'emploi élevé et un haut niveau de cohésion sociale, et ce, de manière durable, c'est-à-dire sans détérioration de l'équilibre extérieur, et en s'assurant de la soutenabilité des finances publiques et de la soutenabilité environnementale ». Dans une économie compétitive, les entreprises se trouvent dans une position concurrentielle par rapport aux entreprises étrangères.

Productivité, cohésion sociale et environnement

§6. Aux yeux du CCE, la productivité, le progrès social et des politiques environnementales ambitieuses peuvent aller de pair, mais cela ne se fait pas spontanément. L'environnement, par exemple, détermine dans une large mesure les possibilités de créer des richesses pour les générations futures. À ce titre, le CCE rappelle que notre modèle de développement économique est confronté à des contraintes écologiques et qu'il y a lieu d'encourager autant que possible le découplage entre la croissance économique et l'utilisation des ressources naturelles (en particulier l'utilisation des combustibles fossiles). Préserver la planète implique d'éviter l'épuisement des ressources naturelles et de sauvegarder la biodiversité, de lutter contre le changement climatique (et ses conséquences) et de promouvoir la qualité de l'environnement (air, eau et sol). Dans ce but, il faut œuvrer à la transformation du système économique vers une économie neutre en carbone et garantissant une création de bien-être avec une utilisation circulaire des ressources la plus efficace possible.

Productivité et finances publiques

§7. Préserver la soutenabilité des finances publiques est essentiel pour maintenir l'autonomie dans les choix politiques et garantir l'avenir de notre système de protection sociale à long terme, en particulier face aux défis des transitions démographique, écologique et technologique. Une dette publique élevée et croissante est susceptible d'accroître la vulnérabilité des politiques publiques, particulièrement dans un contexte de hausse des taux d'intérêt et des primes de risque. En Belgique, cette soutenabilité subit actuellement des pressions.

§8. Dans ce contexte, accroître la productivité ainsi que le taux d'emploi constitue une priorité importante. Davantage d'investissements et de réformes visant à améliorer la productivité sont nécessaires en raison du rôle décisif de la productivité dans le processus de création de richesses. La croissance de la productivité crée de nouveau une marge de manœuvre budgétaire qui permet d'élargir l'éventail des choix politiques possibles pour financer les réponses politiques aux défis socio-économiques (notamment l'impact de la transition climatique et le vieillissement de la population, qui entraînent une hausse des dépenses publiques), tout en préservant la soutenabilité sociale et financière à long terme de notre système de protection sociale. L'augmentation du taux d'emploi crée également une marge de manœuvre pour relever les défis budgétaires[26].

Coopération entre les niveaux de pouvoir

§9. Le CCE insiste sur l'importance de la coopération entre les diverses entités du pays en vue de répondre aux défis posés. À l'occasion des élections de juin 2024, 9 conseils consultatifs[27] ont ainsi lancé un appel aux différents gouvernements qui seront mis en place aux niveaux fédéral, régional et communautaire afin qu'ils œuvrent à mettre en place une meilleure coopération structurelle entre les niveaux politiques, qui permette aussi un renforcement mutuel de ceux-ci (CCE 2024-1719).

§10. Ce besoin de coopération n'existe pas seulement pour des thèmes politiques spécifiques tels que le climat, l'énergie, la mobilité, l'économie circulaire, le marché du travail, la politique industrielle, etc. Des thèmes horizontaux nécessitent également une coopération renforcée, tels que les services publics intégrés, la représentation et les relations internationales, la recherche, l'évaluation, le partage d'informations et de données, l'application de la législation, la politique fiscale et budgétaire...

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[26] Dans son dernier rapport sur l'état des lieux des finances publiques dans le contexte du nouveau cadre budgétaire européen (CCE 2024-2205), le CCE met en lumière les défis auxquels les finances publiques sont confrontées et formule différentes propositions pour y faire face.

[27] Les conseils consultatifs en question représentent la société civile active dans les Régions, les Communautés et au niveau fédéral. Il s'agit du Conseil fédéral du développement durable, du Conseil national du travail et du Conseil central de l'économie pour le niveau fédéral, du Milieu- en natuurraad van Vlaanderen, du Sociaal-Economische Raad van Vlaanderen, du Conseil de l'environnement de la Région de Bruxelles-Capitale, du Conseil économique, social et environnemental de Wallonie, du Conseil économique et social de la Région de Bruxelles-Capitale (BruPartners) et du Conseil économique et social germanophone (WSR).

§11. Les conseils demandent également une évaluation de l'efficience, de l'efficacité et de la cohérence des formes de coopération existantes (par exemple, le comité de concertation, les conférences interministérielles, les accords de coopération, les obligations d'information, les obligations de conseil...). Cette évaluation devrait déboucher sur des propositions visant à éliminer les obstacles identifiés.

3. Constats

3.1. Diagnostic national

§12. Dans ses différents rapports, le CNP a observé un ralentissement de la croissance de la productivité de l'économie totale en Belgique, comme dans les autres pays de comparaison, au cours des dernières décennies. Le taux de croissance annuel moyen de la productivité horaire du travail en Belgique était encore de 1,3 % entre 2000 et 2007. Il a baissé à 0,6 % sur la période 2012-2019, et à 0,5 % sur la période 2019-2023.

Tableau 3-1 Taux de croissance annuel moyen de la productivité horaire du travail et décomposition

	2000-2023			2012-2019			2019-2023		
	VA	H	VA/H	VA	H	VA/H	VA	H	VA/H
Belgique	1,6%	0,9%	**0,7%**	1,5%	0,9%	**0,6%**	1,7%	1,2%	**0,5%**
ZE 20	1,3%	0,4%	**0,8%**	1,6%	0,8%	**0,7%**	1,0%	0,5%	**0,5%**
Allemagne	1,2%	0,2%	**1,0%**	1,6%	0,7%	**0,9%**	0,3%	-0,3%	**0,6%**
France	1,3%	0,6%	**0,7%**	1,3%	0,5%	**0,8%**	0,7%	1,2%	**-0,5%**
Pays-Bas	1,6%	0,9%	**0,8%**	1,9%	1,5%	**0,4%**	2,0%	1,4%	**0,6%**

Source : Rapport annuel 2024 du Conseil national de la productivité

Combiner croissance du volume de travail et productivité élevée

§13. Le taux de croissance annuel de la productivité horaire entre 2019 et 2023 (0,5 %) est inférieur à celui enregistré sur l'ensemble de la période 2000-2023 (0,7 %). Il convient toutefois de nuancer ce constat. La croissance de la valeur ajoutée, principal indicateur de richesse d'une économie, dépend d'une part de la productivité du travail et d'autre part des heures travaillées. Pour que l'économie belge se développe, il est important de combiner un niveau élevé du volume de travail et une croissance élevée de la productivité du travail. Entre 2019 et 2023, la croissance modeste, bien que positive, de la productivité du travail en Belgique s'est accompagnée d'une croissance significative du volume de travail : la croissance annuelle des heures travaillées est restée soutenue (1,2 %) et même supérieure à la croissance observée sur l'ensemble de la période 2000-2023 (0,9 %). Par conséquent, la croissance de la valeur ajoutée (en volume) en Belgique (1,7 %) a été similaire à la croissance observée sur l'ensemble de la période (1,6 %) et supérieure à celle de la zone euro sur la période récente (1,0 %). Parmi les pays étudiés dans le rapport, seuls les Pays-Bas ont connu un taux de croissance annuel moyen de la valeur ajoutée (en volume) supérieur à celui de la Belgique, en réussissant à accroître de manière significative les deux facteurs cités (volume de travail et productivité). L'Allemagne a connu une contraction du volume de travail, la France une croissance négative de la productivité du travail.

§14. Parallèlement à la productivité, la croissance du volume de travail doit également rester un point d'attention dans le futur, d'autant plus que les dernières projections macroéconomiques pour la Belgique tablent sur une croissance plus faible de l'emploi à moyen et long terme. Selon le dernier rapport du Comité d'étude sur le vieillissement, la croissance économique devrait ainsi s'élever en moyenne à 1,4 % par an sur la période 2023-2070, principalement soutenue par des gains de productivité de 1,2 % par an en moyenne. La croissance de l'emploi ne s'élèverait qu'à 0,2 % par an en moyenne (Conseil supérieur des finances 2024, p. 27).

Accorder une attention particulière à l'industrie

§15. Les évolutions de la productivité horaire divergent en fonction des secteurs. L'industrie constitue généralement le moteur des gains de productivité (en Belgique comme dans les principaux pays voisins). Entre 2000 et 2023, les gains de productivité ont été significativement supérieurs dans l'industrie (1,8 %) par rapport aux services marchands (0,7 %). Il est donc particulièrement inquiétant de constater que, dans notre pays, la croissance de la productivité horaire dans l'industrie a été négative entre 2019 et 2023, en raison essentiellement d'une contraction de la valeur ajoutée créée (en volume). La Belgique est par ailleurs le seul pays qui a connu une croissance de la productivité plus faible dans l'industrie (-0,3 %) que dans les services marchands (1,0 %) au cours de la période récente.

§16. Il convient dès lors de se pencher sur les causes de ce déclin de la productivité dans l'industrie et de s'entendre sur une politique industrielle à mettre en œuvre pour y remédier, en s'inspirant notamment du rapport Draghi sur l'avenir de la compétitivité européenne.

Tableau 3-2 Taux de croissance annuel moyen de la productivité horaire du travail et décomposition dans l'industrie manufacturière et les services marchands belges

	2000-2023			2012-2019			2019-2023		
	VA	H	VA/H	VA	H	VA/H	VA	H	VA/H
Industrie m.	0,5%	-1,3%	**1,8%**	1,4%	-0,6%	**2,0%**	-0,6%	-0,2%	**-0,3%**
Services m.	2,2%	1,5%	**0,7%**	2,0%	1,3%	**0,7%**	2,3%	1,3%	**1,0%**

Source : Rapport annuel 2024 du Conseil national de la productivité

Analyser les niveaux de productivité

§17. Le rapport du CNP met l'accent sur la croissance de la productivité. Le CCE estime qu'une analyse plus poussée pourrait être réalisée tant par rapport au niveau de la productivité qu'au niveau de la croissance. Ainsi, le niveau de productivité, tel que calculé à l'aide de la productivité apparente du travail en valeur, est plus élevé en Belgique (pour le secteur marchand) que dans ses principaux pays voisins[28]. Par conséquent, la Belgique pourrait être confrontée à des écarts de croissance de productivité avec ses principaux voisins qui s'expliqueraient par la proximité de la frontière technologique[29].

3.2. Diagnostic régional

§18. Comme au niveau national, une tendance générale à un ralentissement des gains de productivité a été observée par le CNP dans les trois Régions belges au cours des dernières décennies. Comme chaque année, le CCE invite le CNP à présenter ses résultats et à entrer en dialogue avec les différents Conseils économiques et sociaux régionaux du pays. Des domaines importants analysés par le CNP relèvent en effet de la responsabilité partielle ou exclusive des Régions ou des Communautés.

4. Productivité des branches non marchandes

§19. Le CCE accueille favorablement la volonté du CNP de se pencher sur la problématique de la mesure de la productivité du travail dans les branches non marchandes. À l'heure actuelle, cette mesure de la pro-

[28] Cf. le rapport sur le handicap des coûts salariaux (CCE 2024-0553) pour une discussion plus détaillée sur cet indicateur.

[29] La « frontière technologique » renvoie à l'utilisation de la meilleure technologie disponible (dans un certain domaine de production) à travers le monde. Un pays qui se situe en deçà de la frontière peut, par imitation des technologies existantes, accroître rapidement sa productivité. Un pays qui, en revanche, se situe à la frontière technologique, doit s'employer à la déplacer par le développement d'innovations.

ductivité ne permet pas de refléter la manière dont l'efficience des services publics et des services rendus par les institutions sans but lucratif évolue au cours du temps. Et ce, alors que ces acteurs jouent un rôle essentiel dans la société.

§20. À ce titre, le CCE appelle à l'établissement rapide d'un consensus au niveau européen afin de définir une méthodologie harmonisée sur l'ajustement de la qualité des services pour les biens et services individualisés non marchands (dans la méthode « output »).

§21. Il convient toutefois de rester conscient des limites d'un tel exercice. Bien qu'il soit utile de rechercher des gains d'efficience au sein de ces branches en vue de maximiser les retombées positives des finances publiques, les organisations non marchandes n'ont pas pour objectif (premier) de créer de la valeur ajoutée économique propre. Il serait dès lors intéressant de disposer d'un indicateur complémentaire de l'économie totale ajustée, qui ne comprendrait pas les services non marchands. Un tel indicateur offrirait une meilleure vue de l'évolution de la productivité de notre économie (telle qu'elle est généralement mesurée).

§22. Par ailleurs, les services publics contribuent eux-mêmes à la croissance de la productivité dans les branches marchandes. Ainsi, comme l'indique le CNP, l'éducation est le principal outil d'accumulation du capital humain. L'amélioration du capital humain contribue à la croissance économique et à la croissance de la productivité du travail. De même, des services de soins et des services aux personnes (crèches, maisons de repos, soutien aux ménages…) accessibles, de qualité et soutenables financièrement, sont non seulement d'une importance immédiate pour le bien-être de la population mais aussi une condition indispensable au développement économique durable.

5. Leviers de la productivité et de la compétitivité

§23. Dans son rapport annuel 2024, le CNP a choisi d'examiner l'importance de l'innovation numérique et, plus spécifiquement, les possibilités qu'offre l'intelligence artificielle (IA) dans ce domaine. Le rapport s'intéresse ensuite aux investissements publics, en présentant un bilan intermédiaire du Plan national pour la reprise et la résilience (PRR). Le CCE se penche sur ces deux éléments avant de mettre en évidence quelques thématiques complémentaires également importantes pour assurer la croissance de la productivité et la compétitivité : la politique industrielle, la concurrence, et l'offre de main-d'œuvre qualifiée.

5.1. Innovation et intelligence artificielle

Soutenir l'innovation et sa diffusion

§24. Selon le European Innovation Scoreboard, ou Tableau de bord européen de l'innovation, (Commission européenne 2024a), notre pays fait partie du groupe des « Strong innovators », notamment grâce à ses excellentes performances en matière de copublications publiques-privées, de PME innovantes qui collaborent avec d'autres et de copublications internationales scientifiques. Les dépenses de R&D sont également élevées en Belgique. Ainsi, les dépenses de R&D des entreprises belges figurent parmi les plus élevées de tous les pays de l'UE.

§25. Les dépenses de R&D sont toutefois fortement concentrées, bien qu'il convienne de noter que toutes les entreprises n'ont pas la capacité de faire de la R&D. Les entreprises comptant au minimum 500 travailleurs sont responsables de près de la moitié de toutes les dépenses de R&D, alors que les entreprises comptant moins de 10 travailleurs (95 % de toutes les entreprises) représentent seulement 5 % des dépenses. De plus, les dépenses allouées à la R&D sont concentrées sur un nombre limité de secteurs d'activité, avec une part importante dans le secteur pharmaceutique et les services professionnels, scientifiques et techniques, qui représentaient 47 % des dépenses de R&D totales en 2021. Cela n'empêche pas différents secteurs d'activité d'avoir une proportion plus élevée de dépenses de R&D totales que la moyenne en Europe. Ainsi, une précédente analyse effectuée par le CCE (2021) a révélé que la

production de métaux de base, les services financiers et d'assurance et le secteur alimentaire en Belgique font proportionnellement beaucoup de R&D en comparaison avec d'autres pays européens[30].

§26. Par rapport à la moyenne européenne, l'impact de la R&D et de l'innovation sur l'emploi, mesuré dans le Tableau de bord européen de l'innovation comme la part de l'emploi dans les entreprises à forte intensité de connaissances et innovantes, est élevé. Cependant, nous observons que les excellentes performances en matière de R&D ne s'accompagnent pas d'une forte croissance de la productivité au niveau macro. La constitution de capital intellectuel et l'exportation de produits de moyenne et de haute technologie et les services à forte intensité de connaissances sont également faibles par rapport à la moyenne de l'UE.

§27. Les bons résultats de la Belgique en matière de R&D vont de pair avec l'un des niveaux les plus élevés d'aides publiques versées aux entreprises en faveur de la R&D, principalement à travers des avantages fiscaux. Il est dès lors crucial que ce soutien contribue un maximum à la création de valeur sociétale, dans un premier temps à travers sa contribution à la croissance économique.

§28. Cela requiert une innovation en matière de processus et de produits et la valorisation de cette innovation. Pour ce dernier point, les jeunes entreprises sont importantes. En effet, ce sont typiquement les start-up qui mettent des innovations sur le marché et qui stimulent de surcroît les entreprises existantes à innover.

§29. De plus, il est également important que le soutien à la R&D contribue à des solutions aux défis sociétaux. L'innovation sera par exemple importante pour réaliser la transition vers une économie climatiquement neutre. Plusieurs raisons expliquent pourquoi les marchés investissent trop peu dans les technologies propres (dépendance au sentier qui engendre souvent des verrouillages, échecs de coordination, pas de débouchés (ou pas encore assez développés, etc.). Mais nous avons aussi besoin de plus d'innovation pour une meilleure santé, une meilleure autonomie stratégique, etc.

§30. Si la création de nouvelles technologies est évidemment importante, la diffusion de ces technologies est également considérée comme une source importante de croissance de la productivité agrégée. La divergence croissante de la productivité entre les entreprises qui se trouvent à la frontière technologique mondiale[31] et celles qui sont à la traîne est souvent attribuée à un manque de diffusion des technologies et des connaissances développées à la frontière (CCE 2021-2685). Des recherches supplémentaires apparaissent nécessaires pour comprendre comment améliorer concrètement ce processus de diffusion de l'innovation. Un des axes essentiels – et qui est spécifique à la Belgique – est le rôle joué par les innovateurs, à savoir les centres de recherche collective et de diffusion de l'innovation (en particulier vers les PME) qui sont organisés au niveau sectoriel.

Développer et intégrer l'IA dans l'économie belge

§31. Selon le CNP, les attentes vis-à-vis de l'intelligence artificielle (IA) en matière de croissance de la productivité sont élevées, même si peu d'effets sur la productivité globale ont été constatés jusqu'à présent. En raison de son caractère à usage général, l'IA générative offre de nombreuses opportunités et est susceptible de générer des gains de productivité dans de nombreux secteurs, que ce soit dans l'industrie ou dans les services (la santé, les transports, le commerce de détail, les services financiers…).

§32. Il est dès lors essentiel de ne pas passer à côté de la vague émergente de l'IA, en développant des politiques qui maximisent les bénéfices de cette technologie, en en saisissant les opportunités, tout en minimisant les risques associés pour les travailleurs. Dans une étude récente (OCDE 2024b), l'OCDE identifie les opportunités et les risques posés par l'utilisation de l'IA sur le lieu de travail.

§33. Pour limiter les risques de l'IA sur le lieu de travail et pouvoir parallèlement bénéficier des avantages de l'IA, il faut soutenir l'élaboration d'une approche orientée humain pour l'intégration des technologies

[30] Cela concerne des chiffres relatifs à l'année 2017. En raison de données manquantes, le groupe de référence a été limité aux pays suivants : DK, DE, IE, ES, FR, IT, AT, PT, FI et VK.

[31] Ce qui signifie qu'elles sont parmi les plus performantes de leur branche d'activité au niveau international.

numériques dans le monde du travail. Une concertation sociale à propos de la conception et de la mise en œuvre de l'utilisation de systèmes d'IA dans le monde du travail est importante pour ce faire. Cette approche favorise la création de solutions qui répondent à la fois aux besoins des entreprises en matière de compétitivité et aux préoccupations des travailleurs quant à l'introduction de l'IA sur leur lieu de travail. Compte tenu de leurs contacts étroits avec le terrain, les partenaires sociaux sont bien placés pour explorer le potentiel des technologies numériques et de l'IA en vue d'augmenter la productivité de l'entreprise et le bien-être des travailleurs. Le Conseil national du travail assure d'ores et déjà le suivi de ce thème.

§34. Dans ce cadre, les partenaires sociaux veillent à ce que le paysage socio-juridique belge soit conforme à l'Accord-cadre des partenaires sociaux européens relatif à la transformation numérique et au Règlement européen sur l'intelligence artificielle (AI Act) afin de régir de manière opportune l'introduction de nouvelles technologies au sein des entreprises et de permettre que cette introduction se fasse de façon adaptée à leur situation et à leurs besoins.

§35. Dans leur mémorandum (CCE 2024-1750), les interlocuteurs sociaux de la distribution ont mis en avant une série de recommandations communes prioritaires pour la prochaine législature. Pour lever les barrières existantes à l'adoption des technologies numériques (dont l'intelligence artificielle) par les entreprises établies en Belgique, ils ont notamment appelé à mettre en place des programmes d'information et de formation sur les applications de l'IA et des autres nouvelles technologies pertinentes au sein des entreprises (dont les TPE/PME), à renforcer les efforts en R&D dans le secteur des TIC, à mettre en œuvre une politique ambitieuse en matière d'infrastructures de haute connectivité numérique et de stockage de données, et à créer un cadre légal clair (éthique, sécurité, gestion des données, fiscalité, responsabilité) concernant les nouvelles technologies, pour permettre aux entreprises d'investir de façon sécurisée et de lever les inquiétudes qui existent à ce stade autour notamment du développement de l'IA et de la robotique.

5.2. Plan de relance européen et investissements

Assurer la mise en œuvre du plan de relance européen

§36. Le plan pour la reprise et la résilience prévoit un ensemble de réformes et d'investissements qui se renforcent mutuellement et qui doivent être mis en œuvre pour 2026 au plus tard. Ceux-ci doivent permettre à la Belgique de relever une partie des défis auxquels elle est confrontée. Dans ce délai serré, il est essentiel de poursuivre la mise en œuvre rapide et efficace du plan, y compris le volet REPowerEU, pour renforcer la compétitivité à long terme de la Belgique par les transitions écologique et numérique, tout en veillant à l'équité sociale. Associer systématiquement les entités régionales et les Communautés, les interlocuteurs sociaux, la société civile et les autres parties prenantes concernées demeure essentiel pour garantir une large appropriation en vue de la bonne mise en œuvre du plan.

La productivité au cœur des réflexions pour donner suite au plan de relance européen

§37. L'UE souhaite faire de la productivité un axe stratégique de la relance, en exploitant les potentialités des transitions écologique et numérique pour bâtir une économie plus résiliente et compétitive, capable de générer une croissance durable à long terme.

§38. La Commission a publié en mars 2023 une communication intitulée « La compétitivité à long terme de l'UE : se projeter au-delà de 2030 », dans le but d'éclairer les décisions relatives aux politiques à mener et de créer les conditions cadres d'un renforcement de la croissance. Cette communication définit la compétitivité selon neuf facteurs qui se renforcent mutuellement. Parmi ces facteurs, l'accès aux capitaux privés, la recherche et l'innovation, l'éducation et les compétences, ainsi que le marché unique figurent parmi les facteurs prioritaires en matière de réformes et d'investissements pour remédier aux problèmes actuels de productivité et accroître la compétitivité à long terme de l'UE et de ses États membres.

§39. Des experts tels que M. Draghi plaident en faveur d'investissements massifs annuels, notamment dans la transition climatique, la défense et les nouvelles technologies (cf. 5.3.1). Ils soulignent l'importance

de mobiliser principalement le secteur privé pour financer ces initiatives, tout en insistant sur la nécessité d'une impulsion des finances publiques. En intégrant ces recommandations, la Commission européenne pourrait orienter l'après-plan de relance vers une Europe plus productive et compétitive, consolidant ainsi les bases d'une croissance durable et renforçant la cohésion économique, sociale et territoriale au sein de l'Union.

§40. Selon le CNP, « nous avons besoin de renforcer l'approche européenne de façon à canaliser de manière plus coordonnée les ressources publiques et privées. Cela doit permettre de mener une politique industrielle efficace sans causer de perturbations entre les différents États membres ». Pour le CCE (CCE 2024-1185), la création d'une « capacité budgétaire » commune financée par un endettement commun devrait permettre de relancer les investissements publics européens et de soutenir la double transition - numérique et écologique - à l'image de la Facilité pour la reprise et la résilience. Le CCE est par conséquent favorable à un instrument de suivi qui renforce le budget pour les investissements des États membres dans la transition et qui permettrait aussi de créer des conditions de concurrence équitables entre les États membres pour attirer des investissements cruciaux, notamment pour les transitions numérique, énergétique et climatique. En plus, la mise en place d'une « capacité budgétaire » commune pourrait renforcer le marché unique européen, en finançant des initiatives qui cadrent dans une politique industrielle coordonnée, qui éliminent les obstacles au commerce, et qui stimulent une concurrence équitable. Elle permettrait de mieux répondre aux chocs économiques et aux crises financières qui peuvent toucher différents États membres de l'UE.

§41. La Belgique est un petit pays avec certaines particularités, dont une économie très ouverte. Pour le CCE, il est essentiel de veiller, dans les développements actuels des initiatives de la Commission, à garantir le « level playing field » intra-européen, sans quoi les pays comme le nôtre risquent d'être défavorisés par rapport aux puissances économiques plus importantes.

Accélérer le rythme et l'ampleur des investissements en Belgique

§42. Au sein de notre pays, le CCE et le Conseil national du travail (CNT) pointent une nécessaire accélération du rythme et de l'ampleur des investissements tant publics que privés accompagnée d'un dialogue social selon les règles légales et conventionnelles existantes afin que notre pays joue un rôle actif dans les **transitions verte et numérique** et ne soit pas à la traîne par rapport aux autres pays (CCE 2023-2500). S'ils sont bien sélectionnés et réalisés, les investissements constituent une valeur ajoutée au regard de la croissance durable et de l'emploi mais aussi de la cohésion sociale.

§43. La transition écologique constitue une opportunité pour stimuler la productivité, mais présente aussi des défis. En effet, la transition écologique à mener va induire une obsolescence accélérée d'une part importante des équipements et du capital. Des investissements sont nécessaires dans les infrastructures liées, entre autres, à l'énergie et à la mobilité. Outre les investissements en capital physique, des investissements seront aussi nécessaires dans des innovations conduisant à des produits et services neutres en carbone ainsi que dans la formation aux nouveaux métiers de la transition climatique et de l'économie circulaire.

§44. De nombreux scénarios sont possibles pour atteindre la neutralité carbone en Belgique d'ici 2050. Quel que soit le scénario choisi, des **investissements décarbonés** seront nécessaires[32]. En fonction des scénarios de neutralité carbone, les investissements supplémentaires (par rapport au scénario de référence) fluctuent entre 0 et 700 milliards d'euros sur la période 2020-2050. Sur une base annuelle, cela représente un investissement supplémentaire de 0 à 23 milliards d'euros, soit de 0 % à 4,5 % du PIB (SPF Santé publique, 2024)[33].

[32] Les investissements décarbonés font référence tant aux investissements dans les infrastructures et dans l'aménagement du territoire qu'aux investissements dans les innovations, l'efficacité énergétique et les technologies décarbonées.

[33] Ces prévisions sont cohérentes avec les chiffres de la BNB (2023) qui estiment que l'élimination des émissions de gaz à effet de serre aura un coût total de l'ordre de 20 milliards d'euros par an.

§45. En matière d'énergie, une étude récente d'Elia (2024) tire la sonnette d'alarme : avec le parc de production actuel en Belgique et les investissements déjà décidés, la production domestique d'électricité bas carbone ne suffira pas - le potentiel en la matière est limité - pour répondre à la demande en hausse, et ce, dès 2035, puisqu'elle ne couvrira que la moitié de la demande. La fourniture pour l'autre moitié doit encore être déterminée, ce qui est une opportunité à saisir, faute de quoi, la dépendance électrique du pays aux importations (bas carbone) va sans cesse augmenter. Une absence de décision est, dans tous les scénarios envisagés, l'option la plus coûteuse.

§46. Dans leur avis récent sur la révision du plan national énergie-climat 2030 (CCE 2024-0640), le Conseil fédéral du Développement durable et le CCE demandent de mettre en place une politique industrielle coordonnée en matière d'énergie. Ils estiment que le PNEC manque d'une vision commune pour construire l'infrastructure nécessaire au transport de l'énergie. Dans le cadre d'un fédéralisme de coopération, les Conseils plaident également pour l'application du principe de mutualité, selon lequel chaque niveau de pouvoir cherche à agir de manière à renforcer l'efficacité de tous les autres niveaux de pouvoir.

§47. En matière d'investissements publics, il importe par ailleurs de rappeler le rôle du **Comité d'étude sur les investissements publics** (CEIP). Le CEIP a été créé en septembre 2023 en vue de centraliser et de développer de l'expertise en matière d'investissements publics au niveau fédéral et de conseiller le gouvernement dans l'élaboration de sa politique d'investissement. Le CCE demande que le CEIP reçoive les fonds nécessaires pour mener à bien les missions qui lui ont été assignées. Ces missions[34] ont en effet tout leur sens dans le cadre de la double transition (écologique et numérique). En s'appuyant sur une vision stratégique de long terme, tenant compte d'un cadre budgétaire serré, le CEIP pourra jouer un rôle central dans l'orientation et la coordination des investissements publics, contribuant à la fois à la modernisation des infrastructures et au développement de projets innovants, créateurs de valeur et répondant aux défis sociétaux.

§48. Les investissements publics doivent avoir un effet d'entrainement significatif sur l'investissement privé et sur sa résilience en général, ainsi qu'un effet multiplicateur démontrable sur le reste de l'économie. Pour **encourager les investissements privés**, il faut un cadre réglementaire clair, cohérent et stable, garantissant aux investisseurs la sécurité juridique nécessaire. Celui-ci doit simultanément garantir les droits fondamentaux des travailleurs et des citoyens, la protection de la santé et de l'environnement et éviter un impact négatif sur la vitalité des entreprises (CCE 2021-2780).

§49. On peut en particulier viser à l'amélioration de l'accès au financement et au capital-risque pour les PME, en orientant et en attirant les investissements privés, en réduisant les risques liés aux projets innovants, en surmontant les défaillances du marché et en favorisant des liens plus étroits entre les instituts de recherche et les entreprises. Il convient également de faciliter l'accès des PME aux marchés publics, en garantissant le principe de proportionnalité[35]. En Belgique, l'accès aux marchés publics pour les PME reste très compliqué et le pays est l'un des plus mauvais élèves européens en la matière. Le CCE s'est prononcé à ce sujet dans un avis visant à tendre vers des marchés publics plus durables qui soutiennent au mieux l'activité et l'emploi local. La notion de « durabilité » doit être considérée dans toutes ses composantes (économique, sociale, éthique, environnementale et respect des droits de l'homme) (CCE 2022-2610).

[34] Les missions du CEIP comportent cinq volets : (1) dresser un état des lieux thématique en matière d'investissements publics ; (2) identifier les besoins et les opportunités en matière d'investissements publics, notamment dans le cadre de la double transition (écologique et numérique) ; (3) identifier et évaluer les obstacles dans la mise en œuvre des investissements publics et des pistes de solutions ; (4) recommander des outils méthodologiques et procédures ; (5) inciter le dialogue technique entre les entités du pays en matière d'investissements publics et organiser l'échange de bonnes pratiques entre elles.

[35] Le principe de proportionnalité exige que toute mesure soit à la fois nécessaire et appropriée au regard du besoin à satisfaire.

5.3. Autres leviers de la productivité

Politique industrielle

§50. La baisse de la productivité dans l'industrie relance le débat sur la nécessité de développer et mettre en œuvre une nouvelle politique industrielle. Le rapport Letta sur l'avenir du marché unique européen (Letta 2024) et le rapport Draghi sur l'avenir de la compétitivité européenne (Commission européenne 2024d) fournissent des pistes de réflexions en ce sens. Le rapport Draghi met en avant la nécessité de renforcer les fondations économiques de l'Europe tout en maintenant les avantages du modèle social européen et en s'inscrivant de manière durable dans la transition climatique et numérique. Selon le rapport, les économies européennes doivent accroître leur productivité, renforcer leurs chaînes d'approvisionnement et devenir moins dépendantes des ressources extérieures, notamment pour les matériaux critiques et les technologies propres. Ces transformations nécessitent une coordination étroite entre les États membres et une plus grande autonomie stratégique de l'UE.

§51. Il convient de rappeler également la publication en 2023 par la Commission européenne de son « Green Deal Industrial Plan » pour la neutralité climatique, visant à stimuler le **développement des technologies propres** dans l'UE et à assurer l'autonomie stratégique de l'UE. Dans la conduite des politiques publiques, il est important que la Belgique joue un rôle dans la révolution des technologies propres, tout en poursuivant des objectifs en matière de recherche, d'innovation, d'emploi, de formation, de création d'entreprises, de lutte contre la pauvreté et de revitalisation du tissu industriel.

§52. L'Europe, et particulièrement des pays comme la Belgique, est fortement dépendante des **matières premières critiques et stratégiques** nécessaires particulièrement à la transition énergétique. Son approvisionnement en ces ressources stratégiques se heurte à une concurrence mondiale intense, laissant l'Europe en situation de retard. Ces dépendances concernent également des technologies essentielles pour la digitalisation, comme les semi-conducteurs. Pour y remédier, l'Union européenne envisage dans le Critical Raw Materials Act (CRMA)[36] des mesures pour sécuriser ses ressources critiques. Cela inclut la mise en œuvre rapide et intégrale de la règlementation sur les matières premières critiques, ainsi qu'une stratégie couvrant toutes les étapes de la chaîne d'approvisionnement, de l'extraction au recyclage.

§53. En matière d'énergie, le rapport Draghi insiste sur la réduction des **coûts énergétiques pour les entreprises et les consommateurs** afin de maintenir la compétitivité face à des régions où l'énergie est moins coûteuse. La décarbonation offre l'opportunité de réduire les prix de l'énergie, d'être à la pointe des technologies propres et de renforcer sa sécurité énergétique. Dans le même domaine, le rapport Letta appelle à accélérer l'intégration du marché unique de l'énergie pour répondre aux défis de sécurité, de durabilité, et de compétitivité tout en soutenant la décarbonation du secteur énergétique européen.

§54. Enfin, le rapport Draghi suggère d'accroître le soutien à l'innovation, d'améliorer la formation des compétences et d'encourager des initiatives de recherche et développement à l'échelle continentale. Le rapport plaide également pour des réformes liées à la gouvernance économique européenne, avec des politiques fiscales et de soutien plus unifiées, afin de créer un marché unique plus intégré et résilient, prêt à affronter les enjeux mondiaux.

Concurrence

§55. Bien que la Belgique ait réalisé des progrès substantiels au cours des 20 dernières années pour rendre son **environnement réglementaire** plus favorable à l'entrepreneuriat et à la concurrence, elle dispose encore de marges de manœuvre importantes pour l'améliorer (OCDE 2024a, p.132). D'après les indicateurs de l'OCDE sur la réglementation des marchés de produits, la Belgique se situe en deçà de la moyenne de l'OCDE et des pays les plus performants dans quatre domaines essentiels pour les petites et moyennes entreprises (PME).

[36] Cette législation européenne, adoptée en mars 2023, vise à garantir un approvisionnement sûr et durable pour l'industrie européenne, réduisant ainsi la dépendance envers des fournisseurs uniques.

§56. Selon l'OCDE, même si des efforts ont été faits pour simplifier les charges administratives en Belgique, les entrepreneurs doivent encore traiter avec plusieurs organismes pour créer une entreprise, ce qui rend le processus plus complexe qu'il ne devrait l'être. Malgré l'existence de guichets uniques numériques, le parcours administratif reste lourd et contraignant. Les obligations administratives liées à la création d'une entreprise demeurent complexes, freinant ainsi l'initiative entrepreneuriale. Des obstacles à l'entrée persistent dans certains secteurs (notamment les professions d'avocat, de comptable et d'architecte), où la réglementation reste trop restrictive[37]. Ces règles limitent la concurrence et ralentissent l'entrée de nouvelles entreprises, freinant la dynamisation de ces marchés. Par ailleurs, l'organisation indique que la transparence relative aux activités de lobbying pourrait être améliorée pour favoriser un environnement accessible à l'ensemble des acteurs économiques.

§57. La Commission européenne (2024c) a elle aussi recommandé à la Belgique de s'attacher à améliorer l'environnement et la dynamique des entreprises en réduisant la charge et la complexité réglementaires et en assouplissant les restrictions dans le secteur des services. Le CCE souscrit à ces recommandations, pour autant que la protection des travailleurs, des consommateurs et de l'environnement ne soit pas remise en question.

§58. L'évaluation de la réglementation aussi bien ex ante que ex post doit aussi faire l'objet d'une plus grande attention. Lors du choix de la solution, il convient d'opter pour celle qui réalise l'objectif de la façon la plus efficace possible, en tenant compte de la possibilité de mise en application de la réglementation et du coût des charges administratives. Les ressources et le temps utilisés pour se conformer à la réglementation ne peuvent en effet être consacrés à d'autres activités, comme l'innovation.

§59. La revalorisation du budget de **l'Autorité belge de la Concurrence** (ABC) a permis certains ajustements structurels, notamment la refonte de la structure organisationnelle interne avec la mise en place de pratiques et de groupes de travail spécialisés. Afin d'utiliser au mieux ses ressources, l'ABC se concentre sur plusieurs secteurs prioritaires tout en poursuivant les infractions dans l'ensemble de l'économie (Autorité belge de la Concurrence 2024).

§60. Le CCE plaide pour une augmentation additionnelle du budget (en fonction des besoins) afin de donner à l'ABC les moyens suffisants pour analyser de manière approfondie l'ensemble des secteurs de l'économie belge.

Offre de main-d'œuvre qualifiée

§61. Les profonds changements qui se produiront dans le monde du travail sur le plan des compétences requises au cours des prochaines décennies doivent être anticipés et appellent une contribution de tous les acteurs impliqués.

§62. Ces changements impliquent **une responsabilité partagée** entre l'État (niveaux fédéral et régional), les interlocuteurs sociaux, les entreprises et les citoyens (tant les futurs travailleurs que les personnes actuellement en âge de travailler) pour la formation tout au long de la vie. Le dialogue social doit faire partie intégrante du processus d'élaboration et de mise en œuvre des politiques.

§63. La réaffectation de la main-d'œuvre entre les secteurs d'activité nécessitera des politiques publiques et des investissements dans la reconversion et/ou le perfectionnement professionnels pour permettre de relever efficacement les défis en matière de cohésion sociale et de compétitivité. Le CNT et le CCE plaident pour un apprentissage tout au long de la vie. Il est important que les filières de formations ne laissent personne de côté et puissent rencontrer les besoins des entreprises – petites et grandes. Ces filières devraient permettre, pour tous les citoyens (tant les futurs travailleurs que les personnes actuellement en âge de travailler), de faciliter la transition professionnelle du chômage ou de l'inactivité vers l'emploi mais aussi la transition entre emplois et notamment vers des secteurs et des professions émergents. Le gouvernement et les partenaires sociaux ont déjà prévu des trajets de formation. La loi a ins-

[37] Dans ce cadre, les réformes récentes visant à assouplir la réglementation pour les professions d'agent immobilier et d'architecte doivent être soulignées.

tauré à partir du 01/01/2024 un droit individuel de 5 jours de formation par an pour un travailleur occupé à temps plein. Ce nombre de jours peut être réduit par CCT sectorielle et il n'est pas applicable dans les entreprises de moins de 10 travailleurs. L'enseignement et la formation tout au long de la vie restent importants pour toutes les personnes en âge de travailler.

§64. Les entreprises, pour s'adapter et rester compétitives, auront besoin de travailleurs disposant de compétences et de qualifications en phase avec les besoins du marché. C'est valable pour les entreprises existantes, mais aussi pour les entreprises naissantes et innovantes afin d'exploiter pleinement les opportunités de création d'emploi et de croissance. Cependant, pour répondre à leurs besoins de recrutement, elles devront tenir compte du nombre moins élevé de nouveaux entrants sur le marché du travail en raison du vieillissement de la population. En outre, pour (re)mobiliser les autres réserves de main-d'œuvre, il faudra notamment prendre en main les défis des inadéquations entre l'offre et la demande de qualifications et de compétences. En l'état actuel, toutes choses étant égales par ailleurs, la pénurie de compétences et de qualifications engendrera une limitation de la croissance. (CCE 2023-2500).

§65. La Belgique fait face à d'importantes pénuries de main-d'œuvre. Elle partage ce problème avec l'Autriche et les Pays-Bas, en tête du classement européen. Au fil du temps, ces difficultés se sont intensifiées dans les différentes Régions. La liste des métiers en pénurie est relativement diversifiée, mais trois secteurs y sont notamment surreprésentés : la construction, la santé et les technologies de l'information (Conseil supérieur de l'emploi, 2023). Les pénuries de main-d'œuvre observées risquent d'empêcher les entreprises d'innover et de profiter pleinement des opportunités offertes, par exemple, par le développement de l'e-commerce (CCE 2023-2422).

§66. Du côté des citoyens (tant les futurs travailleurs que les personnes actuellement en âge de travailler), ceux-ci se retrouvent dans un marché du travail en constante évolution dans lequel les compétences et les qualifications évoluent elles aussi, ce qui peut entrainer des incertitudes pour leurs situations professionnelles et donc pour leurs situations sociales, avec un risque de nouvelles fractures sociales, au détriment surtout des personnes peu qualifiées. Le grand défi de l'amélioration de la concordance entre l'offre et la demande sur le marché du travail s'accompagne dès lors également du défi de la sécurisation des carrières professionnelles[38], laquelle doit permettre la mobilité sur le marché du travail tout en assurant une sécurité de revenu et une sécurité d'emploi décent durant l'entièreté de la carrière (CCE 2023-2500). Le CCE estime qu'il est important, en raison des impacts de la double transition écologique et numérique sur les besoins du marché de l'emploi et sur les travailleurs, d'encourager et de promouvoir l'apprentissage tout au long de la vie afin de conserver et d'acquérir des compétences permettant de participer pleinement à la société et de gérer avec succès les transitions vers et au sein du marché du travail. À cette fin, il est d'ailleurs essentiel que l'employabilité de chacun soit encouragée au travers de la formation tout au long de la vie et dans le cadre d'une responsabilité partagée entre les individus, les employeurs et les pouvoirs publics afin de remédier à l'inadéquation qualitative et quantitative des compétences, et ainsi, pourvoir aux postes vacants.

§67. Deux objectifs prioritaires ont été définis par le CCE pour faire face aux enjeux du vieillissement sur le marché du travail (CCE 2024-0540).

§68. D'une part, **augmenter le taux d'emploi**, grâce à une meilleure (ré)insertion ou un meilleur maintien des personnes sur le marché du travail, avec une attention particulière pour les groupes à risques dont les travailleurs de 50 ans et plus, les jeunes, les personnes ayant un passé migratoire, les femmes, les peu qualifiés et les malades de longue durée. Concrètement, ceci peut notamment être encouragé en prévoyant des dispositifs d'aide, de soin et d'accueil pour les enfants et autres personnes dépendantes, qui soient disponibles en suffisance, de qualité, et accessibles géographiquement, financièrement et en termes d'horaires ; en supprimant les pièges à l'emploi ; en prévenant le risque de tomber en incapacité

[38] La sécurisation des parcours professionnels accorde aux travailleurs les conditions pour mener à bien et garantir la stabilité de leurs projets professionnels, tout en tenant compte des besoins concrets et des réalités organisationnelles des entreprises.

primaire et invalidité via des politiques de prévention, d'activation et de réintégration efficaces, en veillant à ce que la faisabilité et l'attractivité des emplois tiennent compte de la capacité de travail de la personne intéressée ; tout en veillant aux conditions de travail.

§69. D'autre part, **réduire les inadéquations sur le marché du travail**, en sensibilisant la population aux filières et aux orientations porteuses dans l'enseignement (par exemple les STEM[39], l'enseignement ou les soins de santé), en revalorisant certains métiers et les formations techniques et professionnelles, en améliorant les liens entre enseignement et marché du travail, en améliorant la mobilité (inter)régionale et la mobilité professionnelle, en encourageant la formation tout au long de la vie, en réduisant les pièges à la promotion, etc.

6. Dialogue avec le CNP et travaux futurs

§70. Le CCE tient à rappeler que le dialogue avec le Conseil national de la productivité est important pour que ce dernier puisse s'informer de l'évolution du processus d'appropriation au sein du CCE ainsi que pour garantir une cohérence des analyses et des méthodologies utilisées dans le débat national en matière de productivité et de compétitivité. Ce dialogue peut également se muer en collaboration. Ainsi, dans un courrier adressé en septembre au formateur et aux présidents des partis pressentis pour la formation du prochain gouvernement, les responsables du Conseil central de l'économie, du Conseil supérieur de l'emploi et du Conseil national de la productivité ont attiré leur attention sur la nécessité de renouer avec une croissance soutenue de la productivité.

§71. En ce qui concerne les travaux futurs, il serait utile que le CNP établisse un programme de travail sur plusieurs années et qu'il présente une vue sur l'avancement des travaux en cours, ainsi que sur les prochains travaux envisagés.

§72. Améliorer la compréhension quant à l'évolution de la productivité et de la compétitivité en Belgique permet de mieux définir les politiques publiques susceptibles de stimuler la productivité ainsi que les conditions de leur mise en œuvre. À cet égard, le CNP doit pouvoir mener des analyses approfondies, notamment sur la base des demandes formulées par le CCE. Pour cela, il doit pouvoir faire appel si besoin à une expertise externe. Le CCE demande que des ressources soient mises à la disposition du CNP à cette fin.

[39] Les orientations STEM sont définies comme des orientations débouchant sur des diplômes en sciences, mathématiques, informatique, ingénierie, fabrication et construction.

7. Bibliographie

AUTORITÉ BELGE DE LA CONCURRENCE (2024), Note de priorités - 2024.

BANQUE NATIONALE DE BELGIQUE (2023), A (somewhat European) perspective on the macro impact of climate change, PPT présenté le 5 juin 2023 lors de la conférence « The macroeconomic implications of climate action », organisée par le Peterson Institute for International Economics, Washington DC, juin 2023.

CCE (2021), « Rapport – R&D et valorisation de la R&D en Belgique : un premier diagnostic », CCE 2021-2685.

CCE (2021), « Avis portant sur le Rapport annuel du Conseil national de la productivité », CCE 2021-2780.

CCE (2022), « Vers des marchés publics plus durables, qui soutiennent au mieux l'activité et l'emploi local », CCE 2022-2610.

CCE (2023), « Analyse de Porter : Compétitivité structurelle de l'e-commerce B2C belge », CCE 2023-2422.

CCE (2024), « Les carrières professionnelles en Belgique : enjeux et diagnostic », CCE 2024-0540.

CCE (2024), « Le handicap absolu des coûts salariaux, le handicap absolu des coûts salariaux corrigé pour le niveau de productivité et le handicap des coûts salariaux corrigé pour les diminutions de cotisations patronales et les subsides salariaux en Belgique et dans les États membres de référence depuis 1996 », CCE 2024-0553.

CCE (2024), « Avis sur la révision du plan national énergie-climat 2030 (PNEC) », CCE 2024-0640.

CCE (2024), « État des lieux des finances publiques belges », CCE 2024-1185.

CCE (2024), « Mémorandum : vers un secteur de la distribution compétitif et durable - Focus sur l'e-commerce », CCE 2024-1750.

CCE (2024), « Un appel aux différents gouvernements de notre pays », CCE 2024-1719.

CCE (2024), « État des lieux des finances publiques belges dans le contexte du nouveau cadre budgétaire européen », CCE 2024-2205.

CCE et CNT (2023), « Avis relatif à l'emploi, l'enseignement et la formation dans le cadre de la Conférence pour une transition juste », CCE 2023-2500, CNT Avis 2.383.

COMMISSION EUROPÉENNE (2024a), « European Innovation Scoreboard 2024 », Luxembourg.

COMMISSION EUROPÉENNE (2024b), « Belgium - 2024 Country Report », Bruxelles.

COMMISSION EUROPÉENNE (2024c), « Recommandation du Conseil relative aux politiques économique, sociale, de l'emploi, structurelle et budgétaire de la Belgique », Bruxelles.

COMMISSION EUROPÉENNE (2024d), "The future of European competitiveness", septembre 2024.

CONSEIL SUPÉRIEUR DE L'EMPLOI (2023), "État des lieux du marché du travail en Belgique et dans les régions" - juillet 2023.

CONSEIL SUPÉRIEUR DES FINANCES (2024), Comité d'Étude sur le Vieillissement - Rapport annuel, juillet 2024.

ELIA (2024), Belgian electricity system blueprint for 2035-2050, septembre 2024.

LETTA E. (2024), « Much more than a market – Speed, Security, Solidarity. Empowering the Single Market to deliver a sustainable future and prosperity for all EU Citizens », avril 2024.

OCDE (2023), OECD Employment Outlook 2023: Artificial Intelligence and the Labour Market, OECD Publishing, Paris.

OCDE (2024a), Études économiques de l'OCDE : Belgique 2024, Éditions OCDE, Paris.

OCDE (2024b), Using AI in the workplace: Opportunities, risks and policy responses, mars 2024.

SPF SANTÉ PUBLIQUE, SÉCURITEÉ DE LA CHAINE ALIMENTAIRE ET ENVIRONNEMENT (2024), Climate transition and public finances in Belgium, PPT présenté le 24 juin 2024 lors du séminaire « Le climat et la gouvernance économique dans un cadre européen : quelles implications pour la Belgique », organisé par le CCE-CFDD, Bruxelles, juin 2024.

References

Acemoglu, D. (2024), The Simple Macroeconomics of AI, NBER Working Paper No. 32487, May 2024.

Agrawal J. Gans and A. Goldfarb (2019), “Economic Policy for Artificial Intelligence”, Innovation Policy and the Economy, NBER, 19, 139-159.

Akcigit, U. et Goldschlag, N. (2024), “Understanding the innovation puzzle: Firm size, Inventors and Industrial Policy”, Working Paper, Chicago University.

Babina T., Fedyk A., He A. en J. Hodson (2024), “Artificial intelligence, firm growth, and product innovation”, Journal of Financial economics, vol. 151, No. 103745.

Baily, M.N. en A. Kane (2024), “How will AI affect productivity?”, Brookings articles.

Brynjolfsson E., F. Eggers and A. Gannamaneni (2017), “Using massive online choice experiments to measure changes in well-being”, MIT, Working Paper.

Brynjolfsson, E., D. Rock en C. Syverson (2017), “Artificial intelligence and the modern productivity paradox : a clash of expectations and statistics”, NBER Working Paper Series, Working Paper 21001.

Brynjolfsson, E., Jin, W. and McElheran, K. (2021), “The power of prediction : predictive analytics, workplace complements, and business performance”, Business Economics, 56(4) : 217-239.

Brynjolfsson, E., Li, D., Raymond, L.R. (2023), “Generative AI at work”, NBER working paper series, No. 31161.

Calvino, F. and Fontanelli, L. (2023), “A portrait of AI adopters across countries : Firm characteristics, assets’ complementarities and productivity”, OECD Science, Technology and Industry Working Papers, No. 2023/02, OECD Publishing, Paris.

Castanheira, M. et Mariani, G. P. (2024), "Des biens pas si publics que ça", dans : Inégalités en Belgique : un paradoxe ?, édité par André Decoster, Koen Decanq, Bram De Rock et Paula Gobbi, Ed. Racines.

Commission de l'intelligence artificielle (2024), "IA: Notre ambition pour la France, rapport au gouvernement français".

National Productivity Board (2021), Third Report of the National Productivity Board, October 2021.

High Council of Finance (2024), Study Committee on Ageing, Annual Report 2024.

Cornille, D., Stinglhamber, P., Van Meenseel, L. (2017), Public sector efficiency in Belgium, NBB Economic Review, June 2017.

De Witte, K. et Lopez-Torres, L. (2017), “Efficiency in education : a review of literature and a way forward, Journal of the Operational Research Society”, 68, pp. 339-363.

Demirer, M., D.J. Jiménez Hernandez, D. Li en S. Peng (2024), “Data, privacy laws and firm production: evidence from the GDPR”, February 2024.

Draghi, M. (2024), “The future of European competitiveness – A competitiveness strategy for Europe”, September 2024.

Dranove, D., Forman, C., Goldfarb, A. and Greenstein, S. (2014), “The trillion dollar conundrum : Complementarities and health information technology”, American Economic Journal : Economic Policy, 6(4):239-270.

Dumont, M. (2023), “Gebruik van Kunstmatige Intelligentie door ondernemingen in België”, Federaal Planbureau, maart 2023.

European Commission (2024a), “On boosting startups and innovation in trustworthy artificial intelligence, Communication from the commission to the European parliament, the Council, the European Economic and Social Committee and the Committee of the regions”, COM(2024)28 final.

European Commission (2024b), “Digital Decade Country Report 2024: Belgium”.

European Commission (2024c), “2024 Country report – Belgium”, Commission Staff Working Document, SWD (2024) 601 final.

European Court of Auditors (2024), “EU Artificial intelligence ambition - Stronger governance and increased, more focused investment essential going forward”, Special Report 08.

Filippucci, F., P. Gal, C. Jona-Lasinio, A. Leandro, G. Nicoletti (2024), “The impact of artificial intelligence on productivity, distribution and growth: key mechanisms, initial evidence and policy challenges”, OECD Artificial Intelligence Papers, April 2024.

Forman, C., Goldfarb, A. and Greenstein, S. (2005), “How Did Location Affect Adoption of the Commercial Internet ? Global Village vs. Urban Leadership”, Journal of Urban Economics, 58(3) : 389–420.

Forman, C., Goldfarb, A. and Greenstein, S. (2008), “Understanding the Inputs into Innovation : Do Cities Substitute for Internal Firm Resources ?”, Journal of Economics and Management Strategy, 17(2) : 295–316.

Godefroid, H., Stinglhamber, P., Van Parys, S. (2021), Public expenditure in Belgium comparison with neighbouring countries”, NBB Economic Review September 2021.

Goldfarb, A. and Tucker, C. (2019), “Digital Economics”, Journal of Economic Literature, 57(1) : 3-43.

Goolsbee, A. and Klenow, P.J. (2006), “Valuing Consumer Products By the Time Spent Using Them : An Application to the Internet”, American Economic Review, 96(2) : 108–113.

Greenstein, S., and Ryan C. McDevitt. 2011. “The Broadband Bonus : Estimating Broadband Internet’s Economic Value.” Telecommunications Policy 35 (7) : 617–632.

Hutchinson, P., Goll, F., Mügge, C. (2024), “Generative AI in the European Startup Landscape 2024, Applied AI institute for Europe”, 39 blz.

Kalliamvakou, E. (2022), Research: quantifying GitHub Copilot’s impact on developer productivity and happiness, Research: quantifying GitHub Copilot’s impact on developer productivity and happiness - The GitHub Blog.

Lane, M., Williams, M., Broecke, S. (2023), “The impact of AI on the workplace : Main findings from the OECD AI surveys of employers and workers”, OECD Social, Employment and Migration Working Papers, No. 288, OECD Publishing, Paris.

Lassébie, J. and Quintini, G. (2023), “What skills and abilities can automation technologies replicate and what does it mean for workers ? New evidence”, OECD Social, Employment and Migration Working Papers, No. 282, OECD Publishing, Paris.

McKinsey (2023), The economic potential of generative AI: the next productivity frontier, June 14, 2023 Report.

Microsoft and LinkedIn (2024), 2024 Work Trend Index Annual Report, May 8, 2024.

Noy, S. en W. Zhang (2023), Experimental Evidence on the productivity effects of generative artificial intelligence, Working Paper (not peer reviewed), March 2, 2023.

OECD (2024), OECD Digital Economy Outlook 2024 (Volume 1): Embracing the technology frontier.

Scott, S.L., and Varian, H.R. (2015), “Bayesian Variable Selection for Nowcasting Economic Time Series”, in Economic Analysis of the Digital Economy, edited by Goldfarb, A., Greenstein, S.M. and Tucker, C.E., 119–35. Chicago and London : University of Chicago Press.

Studiecommissie voor overheidsinvesteringen (2024), Stand van Zaken van overheidsinvesteringen in België 2024, Hoge Raad van Financiën, juli 2024.

Vandenberghe, V. (2018), The Contribution of Educated Workers to Firms’ Efficiency Gains: The Key Role of Proximity to the ‘Local’ Frontier, DE Economist 166, 259-283.

Vlaamse Regering (2019), Beleidsnota 2019-2024 : Werk en Sociale Economie, November 2019.

Wilson, H., Daugherty, P. and Morini-Bianzino, N. (2017), “The Jobs That Artificial Intelligence Will Create”, available at https://sloanreview.mit.edu/article/will-ai-create-as-many-jobs-as-it-eliminates/.