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2022 Country Report - Luxembourg

Accompanying the document

Recommendation for a COUNCIL RECOMMENDATION

on the 2022 National Reform Programme of Luxembourg and delivering a Council opinion on the 2022 Stability Programme of Luxembourg

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European Commission

Luxembourg

2022 Country Report

Building resilience in Luxembourg

Luxembourg's economy was growing dynamically before the COVID-19 pandemic. Between 2013 and 2019, real GDP grew by 2.8% on average per year, outpacing the slow recovery following the global financial recession, which had kept growth at an average 0.6% per year between 2008 and 2012. Underlying the upturn was the recovery of international trade, which triggered faster growth in Luxembourg's international transactions, in particular in financial services. With financial activities expanding constantly, the sector generates above 25% of GDP. It is the main contributor to Luxembourg's national income per person, which is among the highest in the world.

The economy proved resilient to the pandemic. In particular, some of the country's key characteristics helped manage the crisis response. Luxembourg's economy cushioned the shock well, partly owing to large public support schemes (see below). It bounced back strongly by the end of 2020. The government's calls to work from home did not affect business continuity in large segments of the economy. This was possible thanks to the very high proportion of jobs in financial and professional services that can be carried out from home, and the high-quality digital infrastructure. With more than half of employees working remotely and a relatively small overall population, the government was able to contain COVID-19 infections mainly with a system of individual testing, tracing and isolating. This may have helped avoid a general lockdown in the second wave of the pandemic. The estimated impact of this second wave was less than -0.4 percentage points (pps) of GDP in 2020 and 2021 ([1]). As a result, real GDP bounced back strongly to reach 6.9% in 2021, following a relatively limited fall by 1.8% in 2020, much less than the EU average of 5.9%.

Coordinated action at EU and international level underpins the good performance of the financial sector. Broad-based measures coordinated by European institutions ensured the functioning of the euro area's financial system. Banks continued to channel financial support, including grants and guaranteed credit from national emergency programmes and EU support instruments, which helped stabilise trade and financial market conditions. In turn, Luxembourg's banking income improved in 2021 while the country's financial activities attracted more investment, including significant savings accumulated by households during lockdowns. This benefited in particular the investment fund industry, where asset values reached a new all-time high at EUR 5.9 trillion in December 2021. These factors are behind the exceptionally good performance of international transactions during the pandemic, with exports growing at double-digit rates in 2021.

The strong recovery is also due to unprecedented measures to protect firms' cash flow and boost investment. Luxembourg's favourable budgetary situation and well-developed social protection system enabled the country to adopt two COVID-19 support packages in 2020. The measures consisted of short-term work schemes, special family leave, tax arrangements for cross-border workers and liquidity support for companies. As a result, the government deficit reached -3.4% in 2020. However, benefiting from a very strong economic rebound, the general government registered a surplus of

([1]) Compared with a 'no second wave' scenario. Compared with a 'general lockdown' scenario, positive impacts were estimated at 0.6 pps of GDP in 2020 and 4.2 pps of GDP in 2021 (Burzyński M, et al., 2021).

0.9% of GDP in 2021. A small deficit of -0.1% of GDP is projected for 2022. This is due to the expected slowdown in GDP growth to 2.2%, which would lower revenue growth, while the high inflation rate pushes expenditure up. The general government debt is gradually increasing, although from a low level. It reached 24.4% of GDP in 2021, which is still very low at present. However, in the longer-term, the perspective is different. This is because Luxembourg faces the sharpest increase in pension-related spending of all EU countries. The expected impact on public finances is also among the highest in the EU and threatens Luxembourg's long-term fiscal sustainability.

In the short run, Russia's invasion of Ukraine is expected to have mainly indirect effects on Luxembourg's economy. These are related to the worsening conditions on global financial markets and a potentially slower economic recovery in the EU. The increase in the cost-of-living allowance and the subsidies put in place to stabilise electricity and gas prices have helped protect households' purchasing power and household spending. Luxembourg's financial system's direct exposure to Russia and Ukraine as a share of total assets is very limited. However, heightened uncertainty about the duration of the invasion and the potential escalation of sanctions and retaliation could reduce the value of fund assets. The extent of this uncertainty will thus determine the overall impact of Russia's invasion.

In Luxembourg, rising oil prices have a higher impact on inflation than in other EU Member States. This is due to the relatively higher weight transport fuels have in the harmonised index of consumer prices, caused by the high number of cross-border workers commuting by car and the significant freight transport. Consumer price inflation increased by 3.5% in 2021 and the annual rate of change in energy prices was the second highest in the EU. Higher energy prices are expected to continue feeding into higher inflation in 2022. Soaring commodity prices are also projected to induce an additional acceleration of goods' prices. Moreover, following the automatic wage indexations in October 2021 and April 2022, the prices of services are expected to increase as well. As a result, headline inflation is expected to reach 6.8% in 2022. The subsequent stabilisation of energy prices is set to ease inflationary pressures in 2023.

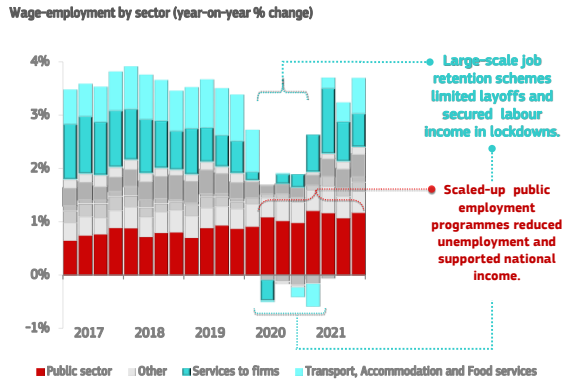
Continued strong house price increases have sustained concerns about overvaluation and high household indebtedness. A long period of rising prices, led by strong economic and demographic dynamics in the context of staggered house supply, has led to a build-up of house price overvaluation while household debt remains very high. Potential price correction would affect collateral values and could jeopardise resilience of borrowers and lenders, leading to tighter credit conditions with an adverse impact on economic growth. Nominal house prices rose by 14% annually both in 2020 and 2021. Borrower-based measures were activated in January 2021 as part of the macroprudential framework set up to comply with the relevant 2019 European Systemic Risk Board recommendation, with which the ESRB assessed Luxembourg's position as fully compliant (ESRB, 2022a). However, continued strong increases of house prices in 2021, led the ESRB to conclude in February 2022 that real-estate related risks were high and that the measures in place were partially appropriate and partially sufficient and to argue for additional income-based measures, such as debt-to-income limits (ESRB, 2022b). In that respect, the deceleration in house-price growth over the last three quarters to Q1-2022 is a positive development.

The very high ratio of household debt to disposable income poses a risk to the real economy. In line with increasing house prices, household debt also increased in recent years and some households need to spend a high share of their income on debt repayment. This situation could deteriorate, especially in times of rising interest rates or economic hardship, putting further pressure on the real economy. Compared to income, household debt remains among the highest in the EU (176% of disposable income). Around 30% of housing loans have a variable rate and are therefore exposed to interest rate changes. Mortgages

are concentrated within a limited number of domestic banks, which warrants continued monitoring (Annex 16). However, financial system risks are mitigated by effective oversight frameworks and a resilient banking sector with banks that are well capitalised.

Surging house prices have significantly worsened housing affordability and have become one of the main sources of inequality. In 2020, nearly 8 out of 10 households perceived the financial burden as a concern (STATEC, 2021, p.107). Increasing housing costs are weighing more heavily on lower income earners, especially younger generations. As stressed by the ESRB, structural factors also play a major role in house-price developments ([2]). Specifically the demand for residential housing has permanently exceeded the supply. Since well before the pandemic, the persistent and abnormally ([3]) low reactivity of housing supply to price changes has led to an acute housing shortage. Against the background of strong housing demand, addressing constraints that limit the supply of land, restricting construction, would help alleviate the shortage of housing in the medium term. In particular, by increasing land mobilisation and affordable housing and by improving the functioning of the construction sector. These obstacles could also be addressed through alternative measures complementing macroprudential policies. Such as fiscal incentives and taxation, and land use development consistent with the deployment of key public services, for instance transport and education. Luxembourg has recently taken first steps in this direction, which might contribute to price growth deceleration.

Graph 1.1: **Employment increased in 2020, although unevenly across sectors**



Source: Eurostat, quarterly national accounts of Luxembourg

Government support protected employment, job creation and household income during the pandemic, but the risk of poverty is rising (European Commission, 2021a). Large-scale short-time work schemes and scaled-up public employment programmes managed to save a significant amount of jobs and protected national income. After peaking at 7.7% in May 2020, the annual unemployment rate fell to the 2019 level (5.6%) in 2021. However, long-term unemployment is more persistent and affects almost 1 in 2 unemployed workers, giving a gauge of the skills mismatch in Luxembourg's labour market. A larger proportion of long-term unemployed people are low-skilled and older people, who are at a higher risk of social exclusion and poverty. This is highlighted by the social scoreboard underpinning the European Pillar of Social Rights (Annex 12). The UN's monitoring of the Sustainable Development Goals (SDGs) also points to a deterioration of the poverty index (Annex 1). This is mainly due to an increase in the proportion of 'people at risk of poverty or social exclusion' and 'people at risk of income poverty after social transfers'. In 2020, this proportion reached the EU average. Poverty has risen steadily and faster than in many other Member States (MESA, 2020). Large social transfers help Luxembourg perform relatively well on most SDGs related to fairness. Without these transfers, almost half of the population would fall below the poverty rate.

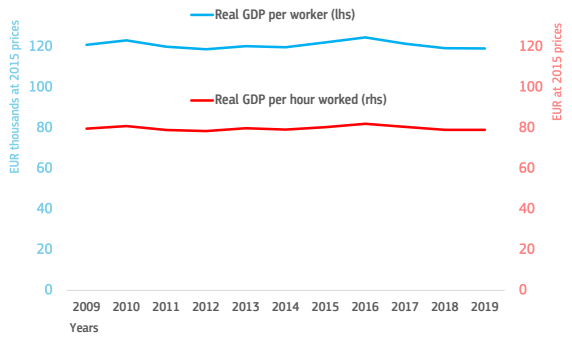
([2]) Structural factors, which are not usually taken into account by overvaluation measures, may lead to higher fundamental values for house prices (ESRB, 2022b).

([3]) Mainly due to high land-ownership concentration in the hands of a few private, individual landowners, and enabling fiscal and institutional frameworks, against the background of strong demand (driven by strong economic and demographic dynamics). This particular set-up enables inter-generational strategies by which landed families maximise proceeds from land sales (either piecemeal sales to corporate developers, which compete for these transactions, or after self-paced development on their own, which is also allowed. (Paccoud et al., 2021).

Labour shortages could hamper economic and employment growth. Reported labour shortages reached an all-time high in 2021 and concerned both high- and low-skilled jobs. High labour intensity makes Luxembourg's services-oriented economy more vulnerable to labour supply constraints. To preserve its growth model, Luxembourg should tackle the main factors limiting labour supply for the longer term: (i) an ageing population, (ii) the need for reskilling and upskilling to enable a faster green and digital transition, (iii) growing issues with housing and transport and (iv) education.

The scale of the challenges also calls for further diversification of the innovation ecosystem to enable the transition to a data-based economy. Government support for business investment in innovation remains marginal (Annex 9). Developing activities with high productivity and innovation potential could enhance Luxembourg's growth potential. Luxembourg is implementing large public-investment projects in new technologies. These projects are expected to facilitate the digital transformation of priority economic sectors, attract private international investment, boost business innovation and consolidate necessary skills.

Graph 1.2: **Labour Productivity has not increased in the last decade**



Source: Eurostat, annual national accounts of Luxembourg

Economic growth in Luxembourg will rely increasingly on productivity growth, which has stagnated in recent years. In 2019, labour productivity stood below the level of 2009 (Graph 1.2) while employment and GDP have both increased strongly. With labour shortages aggravating, economic growth in Luxembourg will increasingly rely on productivity growth. In the long term, capital investment could raise productivity. However, the share of gross fixed capital formation to GDP is persistently one of the lowest in the EU. Innovation and digital transformation, which are among Luxembourg's main challenges, also have the potential to trigger productivity growth (Annex 9).

Large-scale outsourcing did not translate into major productivity gains for Luxembourg. Intermediation services provided by firms outside the country account for a very high share of Luxembourg's services exports, especially in financial services, where around 70% of exports content is imported. This share has grown faster than service production. Thanks to information and communication technologies (ICT), a wider range of activities could potentially be outsourced. However, while decisions to relocate are in most cases driven by multinationals' interests, their medium-term potential impacts on Luxembourg's economy might be more difficult to estimate ([4]).

Luxembourg is stepping up its work to maintain its competitive advantage by developing its centre for green finance. This sector is striving to attract highly specialised workers to enter higher-value front-office activities. Overall, the sector's growth relies on the ability to maintain and expand the attractiveness of investing and working in Luxembourg. It will also depend on the sector's ability to improve quality management and expertise in the areas of investment advice and in providing transparent information on green financial instruments.

Luxembourg has made sizeable progress on the green transition, starting from a

([4]) Luxembourg's funds industry occupies a specific position in the financial global network, where European investment funds are mainly created and managed by large US asset management firms, investing money via London, and with Luxembourg and Ireland functioning as satellites*. The main financial activities in Luxembourg are thus in middle and back offices dealing with financial administration. *(Wójcik, D., Urban, M., Dörry, S., 2021).

low performance level. Luxembourg is highly dependent on energy imports for final consumption and has one of the lowest shares of renewable energy in the EU. Greenhouse gas (GHG) emissions per person have consistently exceeded the level of other Member States. They are driven by road transport, which accounts for two thirds of CO_2 emissions. Nevertheless, in 2020, Luxembourg exceeded its renewable energy target for transport (Eurostat, 2022) and recorded a sharp reduction in GHG emissions per person. This coincided with the outbreak of the COVID-19 pandemic. Estimated emissions in 2021 were still below 2019 levels. The phasing in of a carbon tax on 1 January 2021 played a part in this improvement, but the fuel tax gap with neighbouring countries remains significant.

Overall, Luxembourg performs relatively well on the SDGs although challenges remain in a few areas. The country performs very well on most SDGs related to environmental sustainability. However, despite recent improvements, the country still underperforms the EU average for CO_2 emissions and the share of renewables in the final energy consumption. Luxembourg does very well in the indicators related to macroeconomic stability and productivity level, with the exception of a relative deterioration of public finances in the last five years and the stagnation in performance of the education system, which will be an additional drag on productivity. In spite of the very high national income level per capita, poverty has continued rising in Luxembourg, which undermines the overall good performance of the indicators related to fairness (Annex 1).

THE RECOVERY AND RESILIENCE PLAN IS UNDERWAY

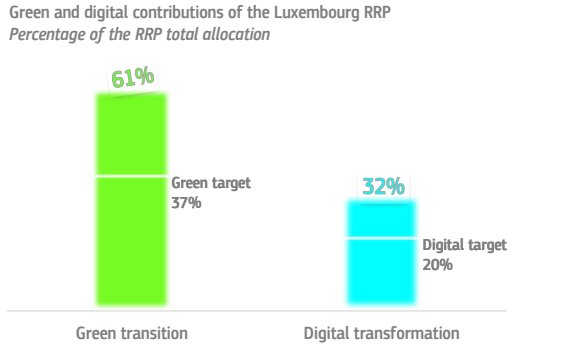
Luxembourg's recovery and resilience plan (RRP) covers a broad range of investments and reforms addressing a significant sub-set of challenges identified in the European Semester (Annex 2). The government supplemented the limited financial allocation of EUR 93.4 million in grants (0.15% of 2019 GDP) with funds from the national budget. This increased the financial resources available to support investment and reforms included in the RRP. The RRP aims to improve the health system's resilience, make the labour market more inclusive, and boost investment in the green and digital transition, among others. The plan is also expected to help address the shortage of affordable housing and to increase institutional resilience by reforming the anti-money laundering framework.

An additional economic impact is expected from the spillover effects of neighbouring Member States' plans. Luxembourg's high level of trade openness and financial integration in the EU enables it to benefit from the boost in external demand generated by investment and reforms in other Member States' RRPs ([5]).

A significant share of funding under Luxembourg's RRP is due to be paid at the beginning. Two thirds of the RRP measures are scheduled for the first two payment requests. A high number of measures were already part of the government's reform and investment agenda at the start of the Recovery and Resilience Facility (RRF).

The RRP helps tackle money laundering and the financing of terrorism. The measures included in the plan aim to make the anti-money laundering supervision of professionals providing trust and company services more effective. Another measure, with the objective to increase the quality and transparency of the business register, will help the authorities to better identify the ultimate beneficiaries of legal entities. This would deter criminals from using these entities to launder illicit money. It is also an effective way for the authorities to identify the people who ultimately own or control these entities.

Graph 2.1: **One of the greenest RRPs**



Source: Luxembourg's resilience and recovery plan

The RRP has a strong focus on environmental and climate challenges. As indicated in Annex 6, the RRP has a strong focus on the green transition. The RRP's 61% climate contribution is well above the mandatory target of 37%. The measures in this area include rolling out a system to generate renewable energy for a new housing area. This project investigates the feasibility of using geothermal energy for district heating. It is potentially relatively easy to expand this system, which could help decrease the country's very high dependency on imports for energy consumption. The RRP will help reduce the high level of GHG emissions from transport by implementing new measures to electrify the public sector fleet and through a financing scheme to expand the network of charging points for electric vehicles. However, the financial contribution under the RRF is

([5]) Simulations of the Commission's Quest model show that in the baseline scenario, NextGenerationEU in Luxembourg could lead to an increase of between 0.8% and 1% of GDP from spillover effects in 2022 and 2023 (if the funds are disbursed evenly over 6 and 3 years, respectively). (Pfeiffer et al., 2021).

limited. Therefore, only certain climate challenges are addressed (sustainable transport and renewable energy generation). The Housing Pact 2.0 reform included in the RRP will lead to investment in energy efficiency of buildings in the future even though there is no investment in this area in the plan.

The RRP will help accelerate the digital transition. The 32% share of funding for digital is well above the mandatory target of 20%. Luxembourg performs well in digital public services. The RRP supports the digital public administration and expands the digital offer of public services, putting in place online appointments and 12 new online services. Another measure is to develop the infrastructure for testing ultrasecure connection systems. These measures are expected to support the business sector's innovation and digitalisation, which are Luxembourg's main digital challenges.

The RRP also helps address the insufficient supply of affordable housing. The plan contains a new law replacing the Housing Pact (Box 1), which aims to increase the effectiveness of State support for municipalities to provide affordable housing. In particular, the Housing Pact 2.0 aims to improve the use of existing residential housing and increase the land potentially available for construction.

The RRP addresses vulnerabilities in the health sector. The COVID-19 pandemic has highlighted shortages in health professions, against the background of increasing demand for healthcare. Measures in the RRP aim to make staff management more efficient by investing in telemedicine and an electronic register of health professionals. This digital register should improve day-to-day staff management and help anticipate shortages of doctors and nurses. Policy action aims to improve the attractiveness of health professions, notably by recasting the competencies for healthcare professionals.

The 'skilling, reskilling and upskilling' component of the RRP is part of the government's labour market policies, helping to implement the European Pillar of Social Rights. Training under 'FutureSkills' is expected to attract job seekers, with special attention for those aged 45 and above. This is a welcome gradual shift from the pandemic-related emergency measures to preserve jobs towards more sustainable measures to support workers. It should also help job seekers aged 45 and above access activities that are more dynamic. This improves their chances to join and stay longer in the labour market while promoting economic growth. However, to achieve long-term sustainability of the pension system, and ultimately of public finances (Section 3), these measures would be more effective in combination with other

Housing Pact 2.0: the challenge of affordable housing

The Housing Pact 2.0 aims to help municipalities develop affordable and sustainable housing, to improve housing and neighbourhood quality. The government will acquire plots of land with construction permits and residential property to provide affordable housing (newly built or renovated) to rent at reasonable prices. In the medium term, this is expected to enable more and more people to rent affordable housing.

- The main aspects of the reform are that municipalities sign an initial agreement with the State, after which they draw up local housing action plans. Of each new construction project consisting of 10 to 25 units, at least 10% must be dedicated to affordable housing, and at least 15% of projects consisting of more than 25 units. This should lead to greater social diversity and should reduce social and economic disparities in the new neighbourhoods.
- Land prices weigh heavily on the creation of affordable housing. To reduce prices, the Housing Pact 2.0 Regulation authorises developers to build on an area that is up to 10% larger than the maximum allowed by law. This compensates developers for part of the land transferred to the municipality for the construction of affordable housing.

policy instruments, notably to limit early retirement. *Skillsdësch*, the strategic coordination board mentioned in the RRP, is about to present the national skills strategy, in collaboration with the Organisation for Economic Cooperation and Development (OECD). This strategy should lay the foundations of a more structural and integrated approach to vocational training. This is crucial in making the most of people's potential and thus in promoting inclusive economic growth.

Key deliverables of the recovery and resilience plan over 2022-2023

- Implement the Housing Pact 2.0 for affordable housing
- Implement vocational training programmes under the 'FutureSkills' initiative
- Digitalise healthcare system management
- Improve digital solutions for public services
- Reform the framework for environment and biodiversity protection.

FURTHER PRIORITIES AHEAD

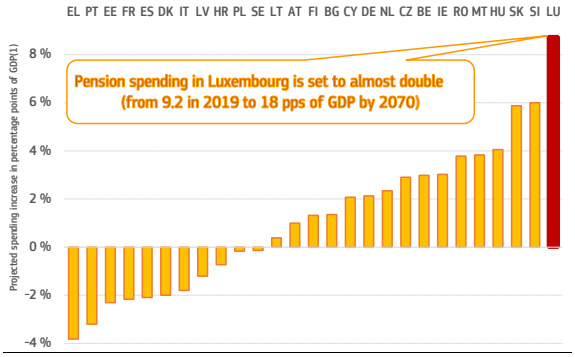
Luxembourg faces additional key challenges that are not or only partially covered in the RRP (Section 2). In particular, these include: i) sustainability issues, mainly stemming from the pension system; ii) legal loopholes that could be used by multinationals engaging in aggressive tax planning; iii) weaknesses in the education system that add to inequality; iv) issues with mobility in the transport network; and v) potential bottlenecks in the transition away from fossil fuels. Addressing these challenges would help make further progress in achieving the SDG indicators in the areas related to environmental sustainability, productivity and fairness.

Ensuring the sustainability of public finances

Despite a favourable position in the short to medium term, the pension system is expected to face rising challenges in the long term. Public finances weathered the COVID-19 crisis relatively well, and fiscal indicators are expected to improve already in 2021. However, the impact of demographic trends on public spending will intensify over the next decades. In particular, the number of pensioners per worker will steadily rise (i.e. the old-age dependency ratio), reflecting changes in the age pyramid.

Luxembourg's public pension is a pay-as-you-go system, which has been in surplus consistently, due to continued increases in cross-border workers. These surpluses are being saved in a reserve kept in an independent investment fund. The positive balance of the general pension scheme is shrinking progressively. Spending on pensions is expected to exceed revenue from contributions by the early 2030s. In subsequent years, deficits are projected to increase progressively. The reserve is thus projected to fall below the legal threshold of 1.5 times the amount of annual pension expenses by the early 2040s ([6]) and, at unchanged policies, to be completely depleted by the mid-2040s.

Graph 3.1: **Pension spending in Luxembourg is projected to increase steadily and to almost double by 2070 (in terms of GDP).**



(1) Pension spending increase. Percentage points of GDP.
Source: European Commission, The Ageing report 2021.

Projected increases in spending on pensions threaten the sustainability of the system in the long term. With unchanged policies, Luxembourg will face the EU's sharpest increase in spending on pensions, which will double, as a share of GDP, by 2070, equivalent to an increase in the government deficit of close to 9 pps of GDP (Graph 3.1) (European Commission, 2021b). This is among the highest in the EU, as is the projected spending on pensions (18% of GDP). This will significantly increase government debt (after the pension reserve is exhausted), implying a high risk for the sustainability of

([6]) The legal threshold is the reserve amount, in terms of years of pension spending, below which reforms are required in order to avoid the system's collapse. Projections show that the gap between the legal threshold and the full depletion of the reserve is about five years. This period seems to rule out a gradually phased-in reform before the system starts accumulating annual deficits recurrently.

the system and its ability to ensure intergenerational fairness.

Raising the effective retirement age would have the most beneficial macroeconomic impact. Population ageing drives the change in government spending on pensions. The relatively high pensions-to-wages ratio (86% in 2019) offers strong financial incentives to exit the labour market. Together with the facilitating role of early retirement schemes, this explains the early effective retirement age, at 61.3 on average, one of lowest in the EU. Therefore, raising the effective retirement age has the highest potential to reduce spending on pensions. Increasing older workers' working lives and participation rates would also support economic growth, as it would increase both labour supply and consumption due to higher lifetime incomes. Making an early start with reforms would enable them to be adjusted, and for the change to come in gradually, improving intergenerational equity.

Tackling aggressive tax planning

It is essential to tackle aggressive tax planning to prevent distortions of competition between firms, treat EU taxpayers fairly and safeguard public finances. Economic evidence suggests that Luxembourg's tax rules are used by companies that engage in aggressive tax planning. Luxembourg has the EU's highest incoming and outgoing foreign direct investments. A large majority of these are linked to special-purpose entities (SPEs) ([7]). The large proportion of direct investment stocks held by SPEs may be an indication of aggressive tax-planning practices. The level of capital flows (dividends, interest, but also royalties) is also among the highest in the EU, and at a high level compared to the size of the economy. Luxembourg is a small open economy, with a large financial sector, which in large part explains these financial flows. However, they also reflect the large presence of foreign-controlled companies in the country, which carry out intra-group financing or treasury activities.

A particular concern is the lack of withholding taxes on interest and royalty payments to low- or zero-tax jurisdictions, or measures with an equivalent effect. The lack of withholding taxes, outbound payments of interest, and royalties from Luxembourg-based companies to non-EU jurisdictions could lead to little or no taxation if these payments are not taxed or taxed at a low level in the recipient jurisdiction. No measure in Luxembourg's tax system addresses this issue sufficiently. The OECD Pillar 2 rules on a global minimum corporate tax-rate are yet to be implemented in the EU. Their scope will help to address the outbound payment issue in Luxembourg, but will not fully address it because of foreseen exemptions for certain sectors and entities of certain sizes.

Luxembourg has taken some steps to fight aggressive tax planning. However, these actions have been limited and insufficient to address the outbound payment issue in the tax system, which could be used by multinationals for aggressive tax planning. Luxembourg passed a law making interest and royalty payments to non-EU countries on the EU list of non-cooperative jurisdictions non-deductible. This act implemented an EU Council commitment, applicable to all EU Member States. The law adopted by Luxembourg targets jurisdictions considered as non-cooperative, and does not cover all zero- and low-tax jurisdictions. Therefore, it is not sufficient to effectively tackle aggressive tax planning.

Addressing inequality in the educational system

Pupils' basic skills are lower than the EU average and strongly linked to

([7]) A special purpose entity is a legal entity that has little or no employment, operations or physical presence in the jurisdiction where it is located. It is linked to another corporation, often by subsidiarity, typically located in a different jurisdiction.

socioeconomic background. Increasing the level of pupils' basic skills is essential for both economic growth and individual and social welfare. It can also support the green transition and economic recovery. In 2018, the OECD Programme for International Student Assessment (PISA) showed that in Luxembourg, average skill levels are significantly lower than the EU average in all three areas tested. In the same survey, Luxembourg recorded one of the largest score gaps in reading between advantaged and disadvantaged students across EU countries. National data (LUCET, 2021) show that the reading and mathematics skills of pupils' with a disadvantaged or non-Luxembourgish- or non-German-language background are much poorer than those of their peers. Learning gaps observed in the first years of schooling remain stable or even increase during later years. Tackling these challenges is key for Luxembourg to achieve the 2030 EU headline targets on employment, skills and poverty reduction.

Pupils' access to academic pathways depends more on their socioeconomic and linguistic background than on their school performance. Data suggest that disadvantaged pupils are oriented disproportionately more often to the lowest track of secondary education (*régime préparatoire*) and less often to the highest track (*enseignement secondaire classique; ESC*) (LUCET, 2021). Furthermore, pupils' study chances show a strong correlation with their linguistic background: pupils with a non-Luxembourgish- or non-German-language background access ESC much less often. Luxembourg's trilingual school system is challenging for all but especially for pupils who speak a language other than Luxembourgish at home (i.e. over 60%). The National Observatory of School Quality (ONQS) reported on the prevailing inequality based on pupils' socioeconomic and linguistic backgrounds. The way languages are taught and the way pupils are separated into different school tracks add to this inequality (ONQS, 2020). The ONQS calls to develop a national curriculum addressing the above challenges. Language learning that is better adapted to pupils' cognitive development could prevent early deficits in basic skills and enable all pupils to develop their full potential.

Green transition and fossil energy dependence

The National Mobility Plan 2035 has been adopted to foster multimodality and address growing traffic congestion. The National Mobility Plan (PNM) released end of April 2022 complements the Sustainable Mobility Strategy (Modu 2.0) adopted in 2018. Both documents detail the infrastructure projects and other measures to prepare Luxembourg's transport system for the significant growth in mobility expected up to 2035. This is a major challenge considering the high share of transport in Luxembourg's GHG emissions. The PNM adds updated details about the direct investments expected in infrastructure and public transport services in the coming decade and provides guidelines for all levels of government on how to minimize the need for mobility through spatial planning measures and increasing availability of housing. The PNM also refers to possible new incentives that could be explored to foster multimodality, although in a rather general manner.

Luxembourg will face increasing electricity demand and import dependency. The national grid will be transformed to allow growing shares of variable renewable energy sources, both from domestic generation and supply from neighbouring countries compatible with demand growth. Significant investments will be needed to reach the interconnection and transmission capacity securing electricity demand. Luxembourg has high electricity interconnection with other Member States but is very reliant on energy imports.

Luxembourg is highly dependent on fossil energy imports, and has not reached its full potential for renewable energy production and consumption efficiency. Luxembourg imports more than 90% of its energy consumption, which consists mainly of

oil (68.5%) and natural gas (17.8%). The high share of oil reflects the central role of transportation in Luxembourg's economy, with significant freight and a large proportion of the workforce commuting from neighbouring countries. The share of renewable energy consumption is among the lowest in the EU. Luxembourg envisages scaling down gas consumption and replacing it with solar (and possibly geothermal) to heat buildings and, in the medium term, with renewable hydrogen in the heavy industry. However, Luxembourg might have to revise its national strategy in line with the EU's response to Russia's invasion of Ukraine.

Russia's invasion of Ukraine calls for Luxembourg and the rest of the EU to step up joint action on the energy transition and diversification of supply. Luxembourg needs to strengthen coordination with other Member States to accelerate the impact of ongoing reforms and investments aiming to reduce energy consumption and reduce reliance on imported fossil fuels as set out in the Commission's REPowerEU Communication. It is important to note that, according to 2020 data, 27% of Luxembourg's gas imports come from Russia ([8]). Luxembourg may further exploit innovative energy sources, such as geothermal; the feasibility of which is being investigated under a given investment of the recovery and resilience plan. Luxembourg has the goal to be climate neutral by 2050 at the latest, and has adopted an energy efficiency obligation scheme and a long-term strategy on the energy performance of buildings. The deployment of smart meters is almost completed and provides for a wide range of demand-driven energy services: in particular, allowing consumers to become active market participants through the self-generation and self-consumption of electricity.

Achieving a swift and fair energy transition would also require the recalibration of incentives. Beyond carbon taxation, complementary reforms and investment would help enable a successful green transition: for instance, further improving public transportation in national and regional networks and further incentivising desired behavioural changes.

([8]) Eurostat (2020), share of Russian imports over total imports of natural gas. Total imports include intra-EU trade.

KEY FINDINGS

Luxembourg's recovery and resilience plan includes measures to address a series of its structural challenges through:

- a reform helping to increase the supply of affordable housing;
- vocational training programmes aimed to address the skills mismatch in the job market, promoting inclusive growth;
- the electrification of the public sector fleet and a financing scheme to expand the network of charging points for electric vehicles supporting the decarbonisation of transport; and
- the digitalisation of the public administration, including online solutions for citizens and businesses, as well as the digitalisation of the health sector.

In addition to the reforms and investment in the RRP, Luxembourg would benefit from:

- improving the long-term sustainability of the pension system to maintain sound public finances, which would ensure intergenerational fairness. Increasing the participation rate of older workers would also support economic growth ;
- taking actions to effectively tackle aggressive tax-planning, which would prevent distortions of competition between firms, treat EU taxpayers fairly and safeguard public finances;
- reducing the impact of inequalities in the education system and promoting equal opportunities for all students, which would improve the situation of students from lower socio-economic status and different linguistic backgrounds;
- tackling growing traffic congestion, which would mean taking on a major challenge in Luxembourg with economic, social and environmental consequences;
- reducing reliance on fossil fuels and accelerating the green transition, in particular, by investing in renewable energy and promoting energy efficiency, most notably in buildings and transport. This could be done by encouraging regional cooperation, developing the transmission capacity of clean energy and by providing sufficient support to municipalities.

ANNEXES

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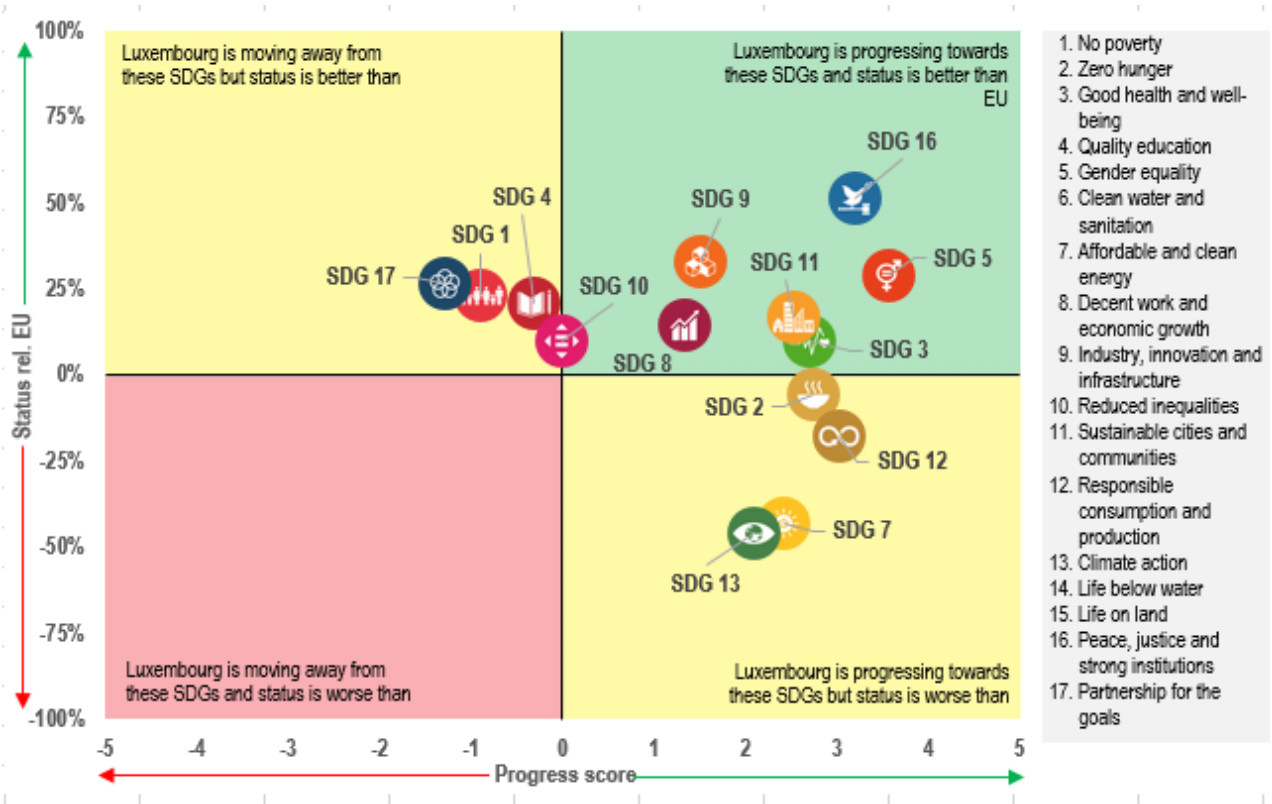
ANNEX 1: SUSTAINABLE DEVELOPMENT GOALS

This Annex assesses Luxembourg's progress on the Sustainable Development Goals (SDGs) along the four dimensions of competitive sustainability. The 17 SDGs and their related indicators provide a policy framework under the UN's 2030 Agenda for Sustainable Development. The aim is to end all forms of poverty, fight inequalities and tackle climate change, while ensuring that no one is left behind. The EU and its Member States are committed to this historic global framework agreement and to playing an active role in maximising progress on the SDGs. The graph below is based on the EU SDG indicator set developed to monitor progress on SDGs in an EU context.

Luxembourg already performs very well on several SDG indicators related to environmental sustainability (SDGs 9 and 15) and is improving on others (SDGs 2, 7, 12 and 13). Notably, the share of renewable energy in final energy consumption (SDG 7) more than doubled, up from 5.0% in 2015 to 11.7% in 2020. However, Luxembourg still performs under the EU average for this indicator (22.1% in 2020). Progress was also achieved in reducing average CO_2 emissions per km from new passenger cars (SDGs 12 and 13). Emissions dropped from 127.5 g per km in 2015 to 119.8 g in 2020, but are still above the EU average (108.2 g in 2020). Luxembourg's RRP has the highest percentage of green measures (61%) of the 22 RRPs approved in 2021, which will help to decarbonise transport in particular.

Luxembourg performs very well on most SDG indicators related to fairness (SDGs 1, 2, 3, 4, 5, 8 and 10). Luxembourg outperforms the EU average for most indicators related to good health and well-being, gender equality, inclusive growth and inequality (SDGs 3, 5, 8 and 10). However, there has been a deterioration in terms of poverty (SDG 1), with an increase of the percentage of people at risk of poverty or social exclusion up from 18.4% in 2015 to 19.9% in 2020 (EU average in 2020 at 21.9%). The share of people at

Graph A1.1: **Progress towards SDGs in Luxembourg in the last five years**



For detailed datasets on the various SDGs see the annual EUROSTAT report 'Sustainable development in the European Union', https://ec.europa.eu/eurostat/web/products-statistical-books/-/KS-03-21-096; Extensive country specific data on the short-term progress of Luxembourg can be found here: https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility/luxembourgs-recovery-and-resilience-plan_en

Source: Eurostat

risk of income poverty after social transfers has also gone up from 15.3% in 2015 to 17.4% in 2020, above the EU average (17.1%). The number of people with good or very good self-perceived health has further increased from 70.5% to 73.6% in 2020, well above the EU average (68.6%). The long-term unemployment rate has decreased from 2.2% of the active population in 2016 to 1.8% in 2021 (EU average at 2.8% in 2021). The RRP includes measures to strengthen the resilience of the health system, including by digitalising the sector, and improving skilling, upskilling and reskilling for people to join the labour market. Trainings under Future Skills are expected to attract job seekers, with special attention for those aged 45 and above.

Luxembourg generally performs very well on SDG indicators related to *productivity* (SDGs 4, 8 and 9). Notably, in the area of industry, innovation and infrastructure (SDG 9), the share of households with very high capacity network (VHCN) coverage (95.9%) was the second highest in the EU in 2021 (EU average: 70.2%). This represents significant progress on this indicator since 2016 (51.5% in 2015, EU: 25.2%). The percentage of international co-publications (79.5%) in the total number of publications was the highest in the EU in 2020 (EU average: 45.2%). Despite the overall 'quality of education' (SDG 4) being above EU average, underlying indicators convey a diverging picture. On the one hand, post-secondary education attainment went up from 51.5% in 2016 to 62.6% in 2021, well above the EU average (41.2% in 2021). On the other hand, the percentage of 15-year-old students with low reading scores has increased from 25.6% in 2015 to 29.3% in 2018, which is high compared to the EU average (22.5% in 2018). The RRP envisages several reforms and investments to promote a data-based economy and the digitalisation of public administration.

Luxembourg performs very well on SDG indicators related to macroeconomic stability (8 and 16). In particular, peace, justice, and the quality of institutions (SDG 16) have further improved. Real GDP per capita (SDG 8) remains the highest in the EU at EUR 86 550 in 2021 (EU average EUR 27 810). However, the general government gross debt as a percentage of GDP (SDG 17) has deteriorated. It has gone up from 19.6% in 2016 to 24.4% in 2021, remaining in any case well below the EU average (88.1% in 2021). Luxembourg's RRP includes measures to promote a transparent and fair economy. This includes action to make the anti-money-laundering supervision of professionals providing trust and company services more effective. Another measure with the objective to increase the quality and transparency of the business register will help the authorities to better identify the ultimate beneficiaries of legal entities. This would deter criminals from using these entities to launder illicit money.

The Recovery and Resilience Facility (RRF) is the centrepiece of the EU's efforts to support its recovery from the COVID-19 pandemic and strengthen resilience against future shocks. Luxembourg submitted its recovery and resilience plan (RRP) on 30 April 2021. The Commission's positive assessment on 18 June 2021 and the Council's approval on 13 July 2021 paved the way for disbursing EUR 93.4 million in grants under the RRF over 2021-2026. The financing agreement was signed on 27 July 2021. The key elements of the Luxembourg RRP are set out in Table A2.1.

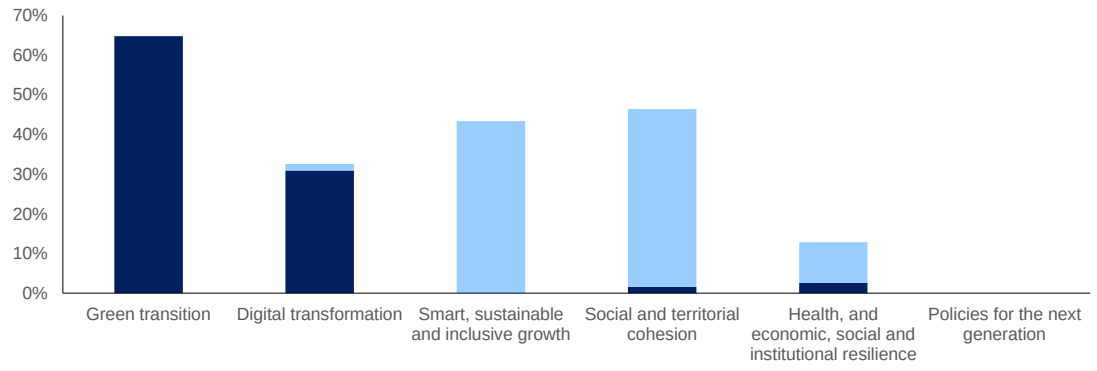
Table A2.1:**Key elements of the Luxembourg RRP**

Total allocation	EUR 93.4 million in grants (0.15% of 2019 GDP)
Investments and Reforms	12 investments and 10 reforms
Total number of Milestones and Targets	63
Estimated macroeconomic impact (1)	Raise GDP by 0.5%-0.6% by 2026 (0.6% in spillover effects)
Pre-financing disbursed	EUR 12 million (August 2021)
First instalment	Luxembourg did not yet submit a first payment request

(1) See Pfeiffer P., Varga J. and in 't Veld J. (2021), "Quantifying Spillovers of NGEU investment", European Economy Discussion Papers, No. 144 and Afman et al. (2021), "An overview of the economics of the Recovery and Resilience Facility", Quarterly Report on the Euro Area (QREA), Vol. 20, No. 3 pp. 7-16.
Source: European Commission 2022

Progress made by Luxembourg in implementing its plan is published in the Recovery and Resilience Scoreboard. The Scoreboard also gives a clear overview of the progress made in implementing the RRF as a whole.

Graph A2.1: **Share of RRF funds contributing to each policy pillar**

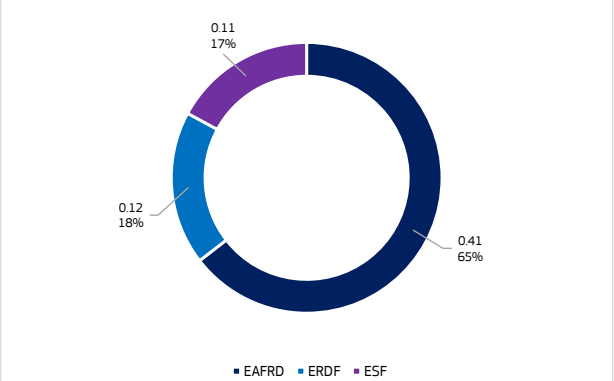


(1) Each measure contributes to two policy areas of the six pillars. Therefore, the total contribution to all pillars displayed on this chart amounts to 200% of the estimated cost of Luxembourg's RRP. The bottom part represents the amount of the primary pillar, the top part the amount of the secondary pillar.
Source: RRF Recovery and Resilience Scoreboard, https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/country_overview.html

The EU's budget of more than EUR 1.2 trillion for 2021-2027 is the investment lever to help implement EU priorities. Underpinned by an additional amount of about EUR 800 billion through NextGenerationEU and its largest instrument, the Recovery and Resilience Facility, it represents significant firepower to support the recovery and sustainable growth.

In 2021-2027, EU Cohesion policy funds ([9]) will support long-term development objectives in Luxembourg by investing EUR 70 million ([10]). This includes EUR 9.3 million from the Just Transition Fund to alleviate the socio-economic impact of the green transition in the most vulnerable regions. Partnership agreements and programmes of the 2021-2027 Cohesion policy funds take into account the 2019 and 2020 country–specific recommendations and European Semester investment guidance. This ensures synergies and complementarities with other EU funding. In addition, Luxembourg will benefit from EUR 224 million funding for the 2023-2027 period from the Common Agricultural Policy, which supports social, environmental, and economic sustainability and innovation in agriculture and rural areas, contributing to the European Green Deal, and ensuring long-term food security.

Graph A3.1: **ESIF 2014-2020 European Structural and Investment Funds - Total budget by fund**



Note: EUR billion in current prices and % of total
Source: Open Data Portal, finance implementation dataset, cut-off date 31/12/2021. European Commission, Cohesion Open Data. The data for the EAFRD and REACT-EU refer to the period 2014-2022

In 2014-2020, the European Structural and Investment Funds (ESIF) for Luxembourg are set to invest EUR 0.31 billion ([11]) from the EU budget. The total investment including national financing amounts to EUR 0.64 billion (Graph 3.1), representing around 0.16% of GDP and 3.67% of public investment ([12]) in 2014-2020. By 31 December 2021, 90% of the total had been allocated to specific projects and 66% had been reported as spent. This left EUR 220 million to be spent by the end of 2023 ([13]). Among the 11 ESIF thematic objectives, the most relevant ones for cohesion policy funding in Luxembourg are: i) research and innovation, ii) low-carbon economy, iii) sustainable and quality employment, iv) social inclusion, and v) education, training and vocational training for skills and lifelong learning (EUR 40 million in total). By the end of 2020, the European Regional Development Fund had supported 55 researchers now working in improved facilities, 106 firms cooperating with research institutions and the reduction of annual primary energy consumption of public buildings by 321 300 kWh/year. In addition, 21 000 people

([9]) European Regional Development Fund (ERDF), European Social Fund Plus, Cohesion Fund, Just Transition Fund and, Interreg.

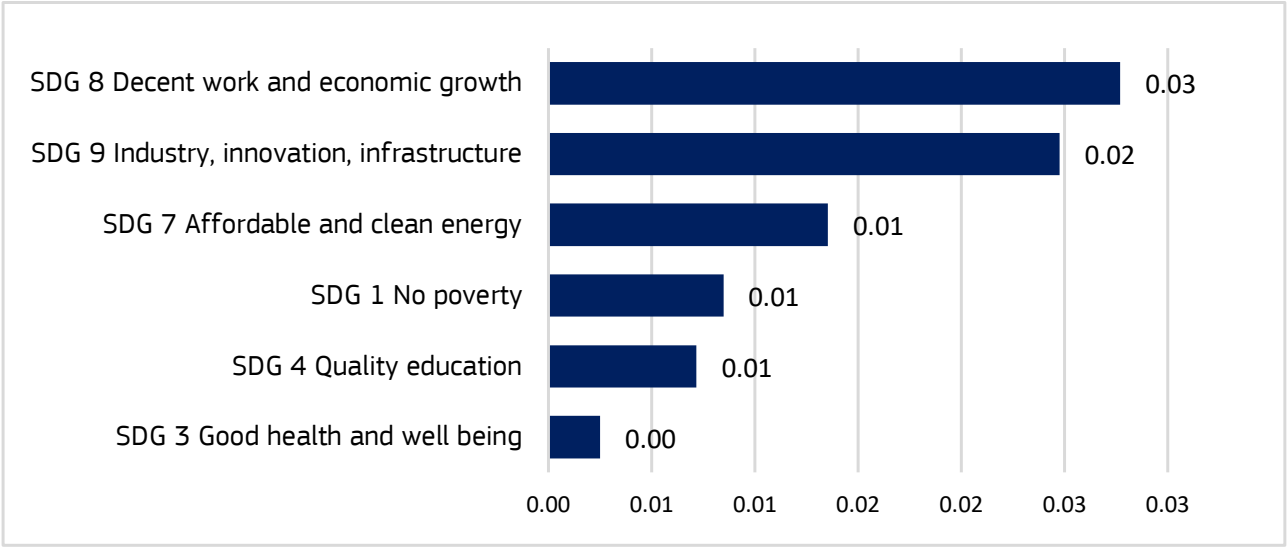
([10]) Current prices, source: Cohesion Open Data .

([11]) ESIF includes the cohesion policy funds, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund. According to the 'N+3 rule', the funds committed for 2014-2020 must be spent by 2023 at the latest (by 2025 for EAFRD). Data source: Cohesion Open Data, cut-off date 31.12.2021 for ERDF, ESF+, CF, Interreg; cut-off date 31.12.2020 for EAFRD and EMFF.

([12]) Public investment is gross fixed capital formation plus capital transfers, general government.

([13]) Including REACT-EU. ESIF data on https://cohesiondata.ec.europa.eu/countries/LU

Graph A3.2: **Cohesion policy contribution to the SDGs (EUR billion)**



Source: European Commission, DG REGIO

received European Social Fund support (of whom 29% had a migrant background). Out of 12 603 unemployed or inactive participants in the ESF programme offers, at least 2 370 found a job or became self-employed, within 6 months after completing a programme offer. Some 4 506 young participants received a quality job, continued education or apprenticeship offer under the Youth Guarantee, after completing an ESF project

Cohesion policy funds already substantial help in achieving the Sustainable Development Goals (SDGs). In Luxembourg, cohesion policy funds support 6 of the 17 SDGs with up to 96% of funds helping to attain the goals.

The REACT-EU instrument (Recovery Assistance for Cohesion and the Territories of Europe) under NextGenerationEU added EUR 139.6 million to the 2014-2020 cohesion policy allocations for Luxembourg. REACT-EU provided support to ensure a balanced recovery, boost convergence and provide vital support to regions following the coronavirus outbreak. In Luxembourg REACT-EU helped: i) purchase vaccines, ii) support short-time work schemes (primarily in companies scoring best against the criteria of a green, digital and resilient recovery of the economy), iii) improve primary healthcare, iv) strengthen education, training and skills development, v) promote energy efficiency and vi) reduce material deprivation with direct food delivery.

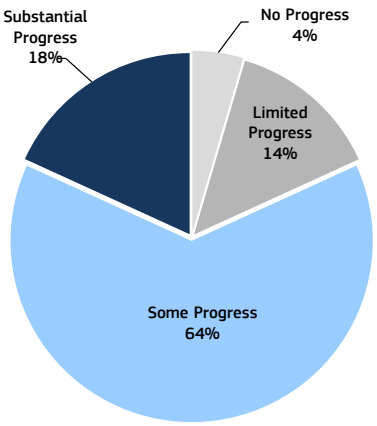
The Commission provide tailor-made expertise via the Technical Support Instrument to help Luxembourg design and implement growth enhancing reforms. Since 2018, Luxembourg has received assistance under five technical support projects. Projects delivered in 2021 aimed for example to strengthen the authorities' accounting capacity. In 2022 a new project will run to support reforms in this area.

Luxembourg also benefits from other EU programmes. For instance, the Connecting Europe Facility, which allocated EUR 51.5 million of EU funding to specific projects on strategic transport networks, and Horizon 2020, which allocated EUR 199.1 million of EU funding to research and innovation projects.

ANNEX 4: PROGRESS IN THE IMPLEMENTATION OF COUNTRY-SPECIFIC RECOMMENDATIONS

The Commission assessed the 2019-2021 country-specific recommendations (CSRs) ([14]) addressed to Luxembourg in the context of the European Semester. The assessment takes into account the policy action taken by Luxembourg to date ([15]), as well as the commitments in the Recovery and Resilience Plan (RRP) ([16]). At this early stage of the RRP implementation, overall 82% of the CSRs focusing on structural issues in 2019 and 2020 have recorded at least "some progress" while 18% recorded "limited" or "no progress" (Graph A4.1). Considerable additional progress in addressing structural CSRs is expected in the years to come with further implementation of the RRP.

Graph A4.1: **Luxembourg's progress on the 2019-2020 CSRs (2022 European Semester cycle)**



Source: European Commission

([14]) 2021 CSRs: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021H0729%2816%29&qid=1627675454457
2020 CSRs: EUR-Lex - 32020H0826(16) - EN - EUR-Lex (europa.eu)
2019 CSRs: EUR-Lex - 32019H0905(16) - EN - EUR-Lex (europa.eu)

([15]) Incl. policy action reported in the National Reform Programme, as well as in the RRF reporting (bi-annual reporting on the progress with implementation of milestones and targets and resulting from the payment request assessment).

([16]) Member States were asked to effectively address all or a significant subset of the relevant country-specific recommendations issued by the Council in 2019 and 2020 in their RRPs. The CSR assessment presented here takes into account the degree of implementation of the measures included in the RRP and of those done outside of the RRP at the time of assessment. Measures foreseen in the annex of the adopted Council Implementing Decision on the approval of the assessment of the RRP which are not yet adopted nor implemented but considered as credibly announced, in line with the CSR assessment methodology, warrant "limited progress". Once implemented, these measures can lead to "some/substantial progress" or "full implementation", depending on their relevance.

Table A4.1:**Summary table on 2019, 2020 and 2021 CSRs**

Luxembourg	Assessment in May 2022*	RRP coverage of CSRs until 2026
2019 CSR1	**Limited Progress**	
Increase the employment rate of older workers by enhancing their employment opportunities and employability.	Some Progress	Relevant RRP measures planned as of 2022.
Improve the long-term sustainability of the pension system, including by further limiting early retirement.	No Progress	
2019 CSR 2	**Limited Progress**	
Reduce barriers to competition in regulated professional business services.	Limited Progress	
2019 CSR 3	**Some Progress**	
Focus economic policy related to investment on fostering digitalisation	Some Progress	Relevant RRP measures planned as of 2021, 2022, 2023 and 2024.
and innovation,	Some Progress	Relevant RRP measures planned as of 2021, 2022, 2023 and 2024.
stimulating skills development,	Substantial Progress	Relevant RRP measures planned as of 2021 and 2022.
improving sustainable transport,	Some Progress	Relevant RRP measures planned as of 2021, 2022, 2023 and 2025.
and increasing housing supply, including by increasing incentives and lifting barriers to build.	Some Progress	Relevant RRP measures planned as of 2021, 2022, 2023, 2024 and 2025.
2019 CSR4	**Limited Progress**	
Address features of the tax system that may facilitate aggressive tax planning, in particular by means of outbound payments.	Limited Progress	
2020 CSR1	**Some Progress**	
Take all necessary measures, in line with the general escape clause of the Stability and Growth Pact, to effectively address the COVID-19 pandemic, sustain the economy and support the ensuing recovery. When economic conditions allow, pursue fiscal policies aimed at achieving prudent medium-term fiscal positions and ensuring debt sustainability, while enhancing investment.	Not relevant anymore	Not applicable
Improve the resilience of the health system by ensuring appropriate availability of health workers.	Some Progress	Relevant RRP measures planned as of 2021, 2022 and 2025.
Accelerate reforms to improve the governance of the health system and e-health.	Some Progress	Relevant RRP measures planned as of 2021, 2022 and 2025.
2020 CSR2	**Substantial Progress**	
Mitigate the employment impact of the COVID-19 crisis, with special consideration for people in a difficult labour market position.	Substantial Progress	Relevant RRP measures planned as of 2021 and 2022.
2020 CSR 3	**Some Progress**	
Ensure effective implementation of measures supporting the liquidity of businesses, in particular SMEs and the selfemployed.	Substantial Progress	Not applicable
Front-load mature public investment projects [to foster the economic recovery]	Substantial Progress	Relevant RRP measures planned as of 2021, 2022, 2023 and 2024.
and promote private investment to foster the economic recovery.	Some Progress	
Focus investment on the green and digital transition, in particular on sustainable transport	Some Progress	Relevant RRP measures planned as of 2021, 2022, 2023 and 2025.
and buildings,	Some Progress	Relevant RRP measures planned as of 2021, 2022, 2023, 2024 and 2025.
clean and efficient production and use of energy, contributing to a progressive decarbonisation of the economy.	Some Progress	Relevant RRP measures planned as of 2022, 2023, 2024 and 2025.
Foster innovation [in particular in the business sector]	Some Progress	Relevant RRP measures planned as of 2022 and 2023.
and digitalisation, in particular in the business sector.	Some Progress	Relevant RRP measures planned as of 2021, 2022, 2023 and 2024.
2020 CSR 4	**Limited Progress**	
Ensure effective supervision and enforcement of the anti-money laundering framework as regards professionals providing trust and company services, and investment services.	Some Progress	Relevant RRP measures planned as of 2021 and 2023.
Step up action to address features of the tax system that facilitate aggressive tax planning, in particular by means of outbound payments.	Limited Progress	

(Continued on the next page)

Table (continued)

2021 CSR1	**Some Progress**	
In 2022, pursue a supportive fiscal stance, including the impulse provided by the Recovery and Resilience Facility, and preserve nationally financed investment.	Full Implementation	Not applicable
When economic conditions allow, pursue a fiscal policy aimed at achieving prudent medium-term fiscal positions and ensuring fiscal sustainability in the medium term.	Full Implementation	Not applicable
At the same time, enhance investment to boost growth potential. Pay particular attention to the composition of public finances, on both the revenue and expenditure sides of the budget, and to the quality of budgetary measures in order to ensure a sustainable and inclusive recovery. Prioritise sustainable and growth-enhancing investment, in particular investment supporting the green and digital transition.	Some Progress	Not applicable
Give priority to fiscal structural reforms that will help provide financing for public policy priorities and contribute to the long-term sustainability of public finances, including, where relevant, by strengthening the coverage, adequacy and sustainability of health and social protection systems for all.	Limited Progress	Not applicable

(*) See footnote 16

Source: European Commission

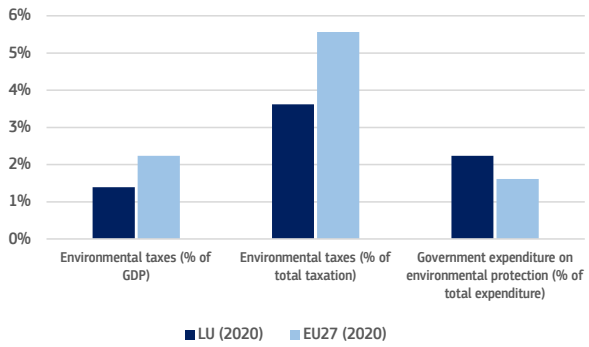
ANNEX 5: GREEN DEAL

The European Green Deal intends to transform the EU into a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use. This annex offers a snapshot of the most significant and economically relevant developments in Luxembourg in the respective building blocks of the European Green Deal. It is complemented by Annex 6 on the employment and social impact of the green transition and Annex 7 for circular economy aspects of the Green Deal.

If it does not take further action, Luxembourg will miss its EU and domestic targets for greenhouse gas reduction. According to its Climate Law, Luxembourg aims to reach climate neutrality (zero net emissions) by 2050. Luxembourg's national energy and climate plan also aims for a 55% reduction of the country's greenhouse gas (GHG) emissions by 2030 compared to the 2005 level for sectors not covered by the emissions trading system (ETS). This is more ambitious than the current 2030 reduction targets under the Effort Sharing Regulation (ESR) (40%) and the Commission proposal under the 'Fit for 55' package (50%). While total GHG emissions in Luxembourg increased between 2015 and 2019, they decreased when the COVID-19 pandemic started in 2020, with a drop of 15% compared to the previous year. This drop was mostly due to decreased activity in the transport sector. As a result, Luxembourg exceeded its 2020 emission-reduction target in effort-sharing sectors (20% reduction compared to 2005 levels) of 2 percentage points. However, emissions are expected to increase again if no additional measures are taken. In such a scenario, the 2030 ESR and Commission proposed 'Fit for 55' targets will be missed by 26 and 36 percentage points, respectively. The recovery and resilience plan (RRP) of Luxembourg allocates 61% of resources to climate objectives. The RRP also outlines reforms and investment to accelerate the transition to a more sustainable, low-carbon and climate-resilient economy ([17]). However, the financial contribution under the Recovery and Resilience Facility is limited. Therefore, only certain climate and energy challenges are addressed: sustainable transport and renewable-energy generation. Energy renovation of buildings, on the other hand, does not feature prominently in any RRP investment measure.

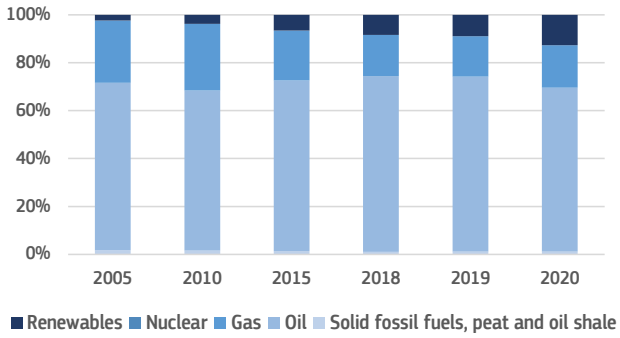
([17]) Share of financial allocation contributing to climate objectives calculated as in Annex VI of the RRF Regulation.

Graph A5.1: **Fiscal aspects of the green transition Taxation and government expenditure on environmental protection**



Source: Eurostat

Graph A5.2: **Thematic – Energy Share in energy mix (solids, oil, gas, nuclear, renewables)**



The energy mix is based on gross inland consumption, and excludes heat and electricity. The share of renewables includes biofuels and non-renewable waste

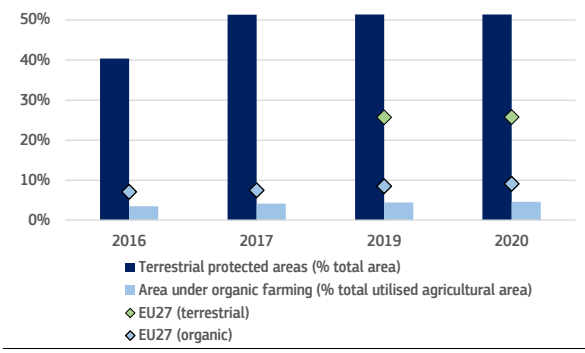
Source: Eurostat

Luxembourg's fiscal indicators show that there can be more space for environmental taxes. Luxembourg's environmental tax revenues, both as a share of total tax revenues and a share of GDP, are below the EU average. Environmental taxes are mostly made up of energy taxes and, to a smaller extent, transport taxes. A very small percentage are taxes on pollution (for more indicators on taxation, see Annex 17). At the same time, the government spends a smaller share of spending on environmental protection than in the EU overall. Budgetary exposure to climate hazards

(i.e. the climate risk to public finances due to uninsured assets) is considered low to moderate.

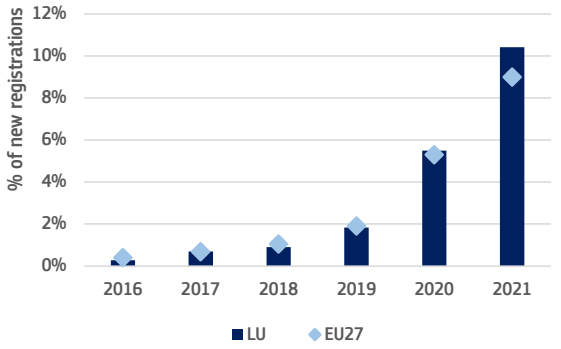
Although it saw a substantial increase from 2019 to 2020, Luxembourg has a relatively low share of renewable-energy consumption (11%). Luxembourg achieved the 2020 renewable-energy target thanks to statistical transfers from Lithuania and Estonia. Thus, it still requires significant investment to deliver its renewable-energy contribution to the EU 2030 target, which is a 25% share of renewable energy in gross final energy consumption. The main energy sources used in Luxembourg are oil and petroleum products (68%), reflecting the relatively large transit traffic through the country.

Graph A5.3: **Thematic – Biodiversity**
Terrestrial protected areas and organic farming



For terrestrial protected areas data for 2018, and data for the EU average (2016, 2017) is lacking
Source: European environment agency (terrestrial protected areas) and Eurostat (organic farming)

Graph A5.4: **Thematic – Mobility**
Share of zero emission vehicles (% of new registrations)



Zero-emission vehicles (passenger cars) include battery and fuel cell electric vehicles (BEV, FCEV)
Source: European Alternative Fuels Observatory.

In 2020, the primary and final energy consumption in Luxembourg plummeted due to COVID-19-related restrictions. Both primary energy consumption and final energy consumption fell by 13% compared with the 2019 level. According to the national climate and energy plan, energy efficiency is a top priority in achieving both energy and climate objectives. Luxembourg's national contribution to the 2030 EU-level target is set at a 40 to 44% reduction in final energy consumption, which amounts to 3.06 Mtoe (compared to the 2020 level of 3.8 Mtoe). As such, additional action is needed to further reduce final energy consumption.

In terms of biodiversity and ecosystem health, the results are mixed. Luxembourg is the EU front runner with 51.42% of protected land areas in 2020. However, it is below the EU average in terms of utilised agricultural area under organic farming and of share of forest areas. Moreover, while more of the country's habitats now have a good conservation status, more and more species have a bad or poor conservation status. The country is under high pressure due to its high level of urbanisation and agricultural activities. Luxembourg has one of the highest rates of net land take in the EU. It also has a high share of livestock in farm production, generating significant natural resource and biodiversity pressure.

Air quality in Luxembourg is generally good, with some exceptions. Emissions of key air pollutants have decreased significantly in Luxembourg over the last few years. In 2020, there were no reports that the limit values laid down by the Ambient Air Quality Directive were exceeded. However, Luxembourg will likely not meet its commitments for ammonia for 2020-2029 and 2030 onwards. The European Commission monitors an infringement procedure against Luxembourg for persistent breaches of air-quality requirements due to excess nitrogen dioxide limit values in several air-quality zones. These breaches have severe adverse effects on health and the environment. Luxembourg is among the Member States facing the greatest challenges in tackling nutrient pollution from agriculture.

Transport accounts for the largest share of emissions in Luxembourg. Therefore, increasing the share of sustainable transport is critical to reach the climate targets. Luxembourg is close to the EU average in terms of market development for zero-emission passenger vehicles. The uptake of electric cars is increasing fast. However, strong reliance on individual transport has increased

congestion. Further investment in shared zero-emission transport remains important to tackle these challenges. The country already has the highest share of electrified railway kilometres in the EU.

Table A5.1:**Indicators underpinning progress on the European Green Deal from a macroeconomic perspective**

						Target	Distance		'Fit for 55' Target	'Fit for 55' Distance	
			2005	2019	2020	2030	WEM	WAM	2030	WEM	WAM
Progress to policy targets	Non-ETS GHG emission reduction target [1]	MTCO2 eq; %; pp [2]	10.1	-9%	-22%	-40%	-26	13	-50%	-36	3

			2005	2016	2017	2018	2019	2020	National contribution to 2030 EU target
Progress to policy targets	Share of energy from renewable sources in gross final consumption of energy [1]	%	1%	5%	6%	9%	7%	12%	25%
	Energy efficiency: primary energy consumption [1]	Mtoe	4.8	4.2	4.3	4.5	4.5	3.9	-
	Energy efficiency: final energy consumption [1]	Mtoe	4.5	4.0	4.2	4.3	4.4	3.8	3.1

			LUXEMBOURG						EU		
			2015	2016	2017	2018	2019	2020	2018	2019	2020
Fiscal and financial indicators	Environmental taxes (% of GDP)	% of GDP	1.8	1.7	1.6	1.7	1.8	1.4	2.4	2.4	2.2
	Environmental taxes (% of total taxation)	% of taxation [3]	5.1	4.7	4.5	4.3	4.4	3.6	6.0	5.9	5.6
	Government expenditure on environmental protection	% of total exp.	1.93	1.78	1.98	2.09	2.06	2.24	1.66	1.70	1.61
	Investment in environmental protection	% of GDP [4]	0.25	0.29	0.33	0.36	-	-	0.42	0.38	0.41
	Fossil fuel subsidies	EUR2020bn	0.04	0.04	0.03	0.03	0.03	-	56.87	55.70	-
	Climate protection gap [5]	score 1-4	1.6 out of 4 (increase from historical level of 1). This is a low/medium risk category (4 being a high risk).								
Climate	Net GHG emissions	1990 = 100	81	78	91	95	96	83	79	76	69
	GHG emissions intensity of the economy	kg/EUR'10	0.22	0.20	0.20	0.20	0.20	0.19	0.32	0.31	0.30
	Energy intensity of the economy	kgoe/EUR'10	0.09	0.08	0.09	0.09	0.09	0.08	0.12	0.11	0.11
Energy	Final energy consumption (FEC)	2015=100	100.0	101.2	104.7	109.0	110.0	95.5	103.5	102.9	94.6
	FEC in residential building sector	2015=100	100.0	103.1	105.1	98.1	90.7	97.5	101.9	101.3	101.3
	FEC in services building sector	2015=100	100.0	100.8	113.2	116.1	130.9	124.3	102.4	100.1	94.4
Pollution	Smog-precursor emission intensity (to GDP) [4]	tonne/EUR'10 [6]	0.63	0.59	0.58	0.57	0.61	-	0.99	0.93	-
	Years of life lost caused due to air pollution by PM2.5	per 100.000 inh.	480	434	406	415	346	-	863	762	-
	Years of life lost due to air pollution by NO2	per 100.000 inh.	91	85	64	83	44	-	120	99	-
	Nitrate in ground water	mg NO3/litre	-	-	-	-	-	-	21.7	20.7	-
Biodiversity	Terrestrial protected areas	% of total	-	40.4	51.4	-	51.4	51.4	-	25.7	25.7
	Marine protected areas	% of total	-	-	-	-	-	-	-	10.7	-
	Organic farming	% of total utilised agricultural area	3.2	3.5	4.2	4.4	4.4	4.6	8.0	8.5	9.1

			2000-2006	2006-2012	2012-2018	00-06	06-12	12-18
Biodiversity	Net land take	per 10,000 km2	6.5	17.5	18.0	13.0	11.0	5.0

			2015	2016	2017	2018	2019	2020	2018	2019	2020
Mobility	GHG emissions intensity of transport (to GVA) [7]	kg/EUR'10	2.52	2.26	2.07	2.10	2.34	2.06	0.89	0.87	0.83
	Share of zero emission vehicles [8]	% in new registrations	0.2	0.3	0.7	0.9	1.8	5.6	1.0	1.9	5.4
	Number of plug-in electric vehicles per charging point		5	6	7	4	6	9	8	8	12
	Share of electrified railways	%	95.3	95.3	95.3	95.3	91.0	-	55.6	56.0	-
	Congestion (average number of hours spent in road congestion per year by a representative commuting driver)		32.2	35.7	36.9	36.6	36.1	-	28.9	28.8	-

			Year	LU	EU
Digital	Share of smart meters in total metering points [9] - electricity	% of total	2018	25.2	35.8
	Share of smart meters in total metering points [9] - gas	% of total	2018	16.6	13.1
	ICT used for environmental sustainability [10]	%	2021	80.0	65.9

(1) The 2030 non-ETS GHG target is based on the Effort Sharing Regulation. The Fit for 55 targets are based on the Commission proposal to increase the EU's climate ambition by 2030. Renewables and energy efficiency targets and national contributions under the Governance Regulation (Regulation (EU) 2018/1999). (2) Distance to target is the gap between Member States' 2030 target under the Effort Sharing Regulation and projected emissions, with existing measures (WEM) and with additional measures (WAM) respectively, as a percentage of 2005 base year emissions. (3) Percentage of total revenues from taxes and social contributions (excluding imputed social contributions). Revenues from the Emissions Trading System are included in environmental tax revenues (in 2017 they amounted to 1.5% of total environmental tax revenues at the EU level). (4) Covers spending on gross fixed capital formation to be used for the production of environmental protection services (i.e. abatement and prevention of pollution) covering all sectors, i.e. government, industry and specialised providers. (5) The climate protection gap indicator is part of the EU adaptation strategy (February 2021), and is defined as the share of non-insured economic losses caused by climate-related disasters. (6) Sulphur oxides (SO_2 equivalent), ammonia, particulates < 10 µm, nitrogen oxides in total economy (divided by GDP). (7) Transportation and storage (NACE Section H). (8) Zero emission vehicles include battery electric vehicles (BEV) and fuel cell electric vehicles (FCEV). (9) European Commission Report (2019) *Benchmarking smart metering deployment in the EU-28*. (10) European Commission (2021). Each year the Digital Economy Society Index is re-calculated for all countries for previous years to reflect any possible changes in the choice of indicators and corrections to the underlying data. Country scores and rankings may therefore differ compared with previous publications.

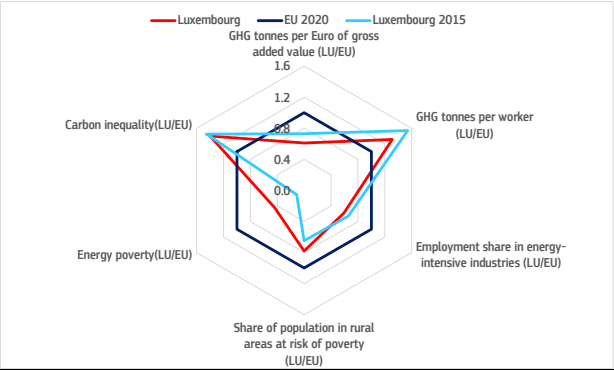
Source: Eurostat, JRC, European Commission, European Environment Agency, European Alternative Fuels Observatory

The green transition not only encompasses improvements to environmental sustainability, but also includes a significant social dimension. While measures here include the opportunity for sustainable growth and job creation, it must also be ensured that no one is left behind and all groups in society benefit from the transition.

Luxembourg's recovery and resilience plan (RRP) outlines reforms and investment for a fair green transition. The measures focus on sustainable transport, renewable-energy generation, environmental protection and biodiversity conservation. Luxembourg's RRP puts a significant focus on the green transition, with 60.9% of the RRP's total allocation contributing to the climate objective. The Neischmelz project, for example, primarily focuses on energy and the green transition. However, it also pursues a social objective: it helps beneficiaries of housing subsidies and applicants for subsidised rental housing cope with the shortage of affordable housing. In synergy with the Recovery and Resilience Facility, the European Social Fund Plus will help unlock the potential for 'green jobs' in Luxembourg. The Just Transition Fund (EUR 9.26 million, current prices) will help mitigate the social impact of the transition in areas suffering from the highest levels of greenhouse gas emissions (see Annex 3). The integrated national energy and climate plan of 20 May 2020 pays special attention to energy poverty. It refers to existing measures such as social welfare benefits for those in energy poverty, and to further measures that are being under development, notably on building renovation and affordable renting and living. However, it could provide more details on social, employment and skills impacts of planned objectives. Nevertheless, reforms of the adult learning system and training will help people find new jobs and increase job mobility against the background of the green transition.

The economy has slightly reduced its carbon footprint and although key energy-intensive sectors remain sizeable, the green economy is relatively large and provides strong potential for job creation. The greenhouse gas (GHG) emissions intensity of Luxembourg's economy decreased slightly between 2015 and 2020 (in terms of gross value added). It stands 40% below the EU average. However, the average carbon footprint per worker amounts to 17.77 tonnes of GHG emissions remaining above the EU average of 13.61 (see Graph A6.1). The cement and steel sectors have been identified ([18]) as the highest GHG emitters ([19]). They provide jobs for 4 000 workers, for whom up and reskilling could be particularly important. The environmental goods and services sector already provides jobs to a comparatively large share of the employed population (4.6%; EU average: 2.2%) ([20]). Wind and solar energy potential and energy efficiency improvements offer further opportunities for green jobs ([21]).

Graph A6.1: **Fair green transition challenges**



Source: Eurostat, World Inequality Database

As for the social dimension of the green transition, ensuring access to essential transport and energy services appears overall less of a challenge in Luxembourg. A stable share of the population at risk of poverty lives in rural areas (14.5%; EU average: 18.7%) ([22]). The share of the population being unable to keep their homes adequately warm significantly increased from 0.9% in 2015 to 3.6% in 2020. However, this remains below the EU average (8.2%). Lower-income groups are affected most (see Graph A6.2). Consumption patterns vary across the population: the average carbon

([18]) SWD(2021) 275 final

([19]) 2020 European Semester: Overview of Investment Guidance on the Just Transition Fund 2021-2027 per Member State (Annex D)

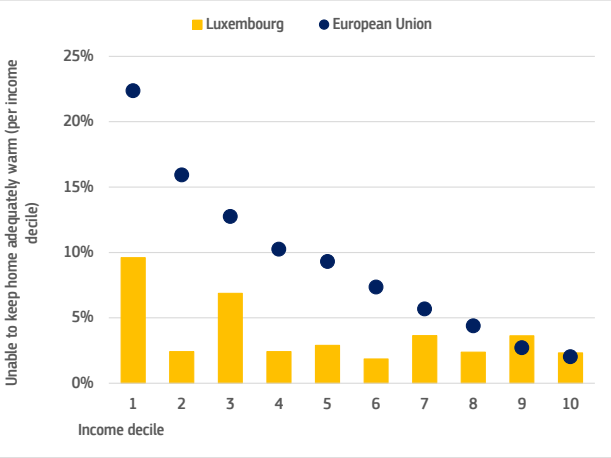
([20]) There is currently no common EU-wide definition of green jobs. The environmental goods and services sector (EGSS) accounts only report on an economic sector that generates environmental products, i.e. goods and services produced for environmental protection or resource management.

([21]) https://publications.jrc.ec.europa.eu/repository/handle/JRC126047

([22]) Based on COM(2021) 568 final (Annex I) as a proxy for potential transport challenges in the context of the green transition (e.g. due to vulnerability to fuel prices).

footprint of the top 10% of emitters is about 7.5 times higher than that of the bottom 50% of the population (5.3 times in the EU).

Graph A6.2: **Energy poverty by income decile**



Source: Eurostat EU-SILC survey (2020)

Tax systems are key to ensuring a fair transition towards climate neutrality ([23]). Luxembourg's revenues from total environmental taxes remained stable between 2015 and 2019 at 1.7% of GDP, but dropped to 1.4% in 2020 (compared to an EU average of 2.2%). It cut the income tax wedge for low-income earners ([24]) from 28.4% in 2015 to 24.4% in 2019 (with an increase to 26.8% in 2021) compared to an EU average of 31.9% in 2021 (see Annex 17).

([23]) COM(2021) 801 final.

([24]) Tax wedge for a single earner at 50% of the national average wage (Tax and benefits database, European Commission/OECD).

ANNEX 7: RESSOURCE EFFICIENCY AND PRODUCTIVITY

The efficient use of resources is key to ensuring competitiveness and open strategic autonomy, while minimising the environmental impact. The green transition presents a major opportunity for European industry by creating markets for clean technologies and products. It will have an impact across the entire value chain in sectors such as energy and transport, construction and renovation, food and electronics, thus helping create sustainable, local and well-paid jobs across Europe.

After a substantial decrease, Luxembourg has recently progressed in circular secondary material use. Between 2010 and 2016, the rate of circular material use dropped significantly in Luxembourg. The country still has a long way to go to return to its 2010 level. However, with 13.6% of circular material use in 2020, Luxembourg managed to reach and exceed the EU average (12.8%), but it is still far behind the EU's best performers. In February 2021, Luxembourg adopted a new circular-economy strategy called Circular Economy Strategy Luxembourg, to be implemented within 3 years. The strategy is comprehensive and targets the entire lifecycle of products.

Resource productivity is well above the EU average. Resource productivity expresses how efficiently the economy uses material resources to produce wealth. Improving resource productivity can help to minimise negative impacts on the environment and reduce dependency on volatile raw-material markets. Resource productivity is high and steadily increasing in Luxembourg; the country is ranking among the EU's best performers. In 2020, Luxembourg's resource productivity reached EUR 3.88 Purchasing Power Standard per kg.

Luxembourg's economic growth is not yet decoupled from the generation of waste. In 2020, Luxembourg's rate of municipal-waste recycling was around 52.8%, above the EU average of around 48%, and slightly above the EU's target of 50%. Significant progress has been made in the last decade in decreasing the country's landfill rate (from 52.8% in 2008 to 23.8% in 2018). However, Luxembourg's recycling performance has stagnated over the past years, and further action is needed to reach the 2025 EU target of 55%. Moreover, despite a decrease in recent years, Luxembourg had the fourth highest value of municipal-waste generation in 2018.

Luxembourg is a top performer in environmental technology. Luxembourg ranked first out of all EU countries in the 2021 Eco-Innovation Scoreboard with a total score of 171. The country is thus an eco-innovation leader. Moreover, in 4 out of 5 components of the Eco-Innovation Index of 2021, Luxembourg outperforms the EU average (in eco-innovation inputs, eco-innovation outputs, resource-efficiency outcomes and socio-economic outcomes). It performs below the EU average in the fifth component (eco-innovation activities).

Table A7.1:**Key resource efficiency indicators - Luxembourg**

SUB-POLICY AREA	2015	2016	2017	2018	2019	2020	EU27	Latest year EU 27
Circularity								
Resource Productivity (Purchasing power standard (PPS) per kilogram)	3.2	3.3	3.2	3.5	3.5	3.6	2.2	2020
Material Intensity (kg/EUR)	0.3	0.3	0.3	0.3	0.3	0.3	0.4	2020
Circular Material Use Rate (%)	9.7	7.1	10.6	10.8	10.5	13.6	12.8	2020
Material footprint (Tones/capita)	32.6	29.1	31.5	28.7	27.5	28.6	14.6	2019
Waste								
Waste generation (kg/capita, total waste)	-	17 217	-	14 828	-	-	5 234	2018
Landfilling (% of total waste treated)	-	39.0	-	23.8	-	-	38.5	2018
Recycling rate (% of municipal waste)	47.4	49.2	48.7	49.0	48.9	52.8	47.8	2020
Hazardous waste (% of municipal waste)	-	3.6	-	4.8	-	-	4.3	2018
Competitiveness								
Gross value added in environmental goods and services sector (% of GDP)	1.6	1.8	1.8	2.2	2.8	-	2.3	2019
Private investment in circular economy (% of GDP)	-	-	-	-	-	-	0.1	2018

Source: Eurostat

ANNEX 7: RESSOURCE EFFICIENCY AND PRODUCTIVITY

The Digital Economy and Society Index (DESI) monitors EU Member States' digital progress. The Digital Decade comprises four cardinal points: human capital, connectivity, integration of digital technology and digital public services ([25]). This Annex describes Luxembourg's DESI performance.

Luxembourg generally performs well on the DESI indicators related to human capital, but continues to lack ICT specialists. The country scores well above the EU average for basic digital skills and ICT specialists. Nevertheless, the lack of ICT specialists is an issue: the share of businesses reporting hard-to-fill vacancies for jobs requiring ICT specialist skills is well above the EU average (66.6% compared to 55.4%).

Luxembourg is among the EU leaders in digital connectivity. It scores considerably above the EU average and almost reaches full availability for very high capacity network coverage. However, 5G services were commercially launched only in the second half of 2020 and have reached a

Table A8.1:**Key Digital Economy and Society Indicators**

	Luxembourg			EU	EU top-performance
Human capital	**DESI 2020**	**DESI 2021**	**DESI 2022**	**DESI 2022**	**DESI 2022**
At least basic digital skills	**NA**	**NA**	**64%**	**54%**	**79%**
% individuals			2021	2021	2021
ICT specialists	**6.1%**	**6.3%**	**6.7%**	**4.5%**	**8.0%**
% individuals in employment aged 15-74	2019	2020	2021	2021	2021
Female ICT specialists	**16%**	**20%**	**20%**	**19%**	**28%**
% ICT specialists	2019	2020	2021	2021	2021
Connectivity					
Fixed Very High Capacity Network (VHCN) coverage	**92%**	**95%**	**96%**	**70%**	**100%**
% households	2019	2020	2021	2021	2021
5G coverage (*)	**NA**	**0.0%**	**12.7%**	**65.8%**	**99.7%**
% populated areas		2020	2021	2021	2021
Integration of digital technology					
SMEs with at least a basic level of digital intensity	**NA**	**NA**	**54%**	**55%**	**86%**
% SMEs			2021	2021	2021
Big data	**16%**	**19%**	**19%**	**14%**	**31%**
% enterprises	2018	2020	2020	2020	2020
Cloud	**NA**	**NA**	**29%**	**34%**	**69%**
% enterprises			2021	2021	2021
Artificial Intelligence	**NA**	**NA**	**13%**	**8%**	**24%**
% enterprises			2021	2021	2021
Digital public services					
Digital public services for citizens	**NA**	**NA**	**93**	**75**	**100**
Score (0 to 100)			2021	2021	2021
Digital public services for businesses	**NA**	**NA**	**97**	**82**	**100**
Score (0 to 100)			2021	2021	2021

(*) The 5G coverage indicator does not measure users' experience, which may be affected by a variety of factors such as the type of device used, environmental conditions, number of concurrent users and network capacity. 5G coverage refers to the percentage of populated areas as reported by operators and national regulatory authorities.
Source: Digital Economy and Society Index

([25]) 2030 Digital Compass: the European Way for the Digital Decade Communication, COM(2021) 118 final.

coverage of only 13% compared to an EU average of 66%.

Digital technologies are well integrated in business activities. Luxemburg only scores close to the EU average for small and medium sized enterprises having basic digital skills. As to the integration of advanced technologies, it scores well in AI and big data, but is lagging behind the EU average in the use of cloud services.

Luxembourg scores well in digital public services. The country performs considerably above the EU average in digital public services – both for people and businesses. The country has multiple initiatives and programmes in place, aimed to further digitalise the public sector.

This Annex provides a general overview of the performance of Luxembourg's research and innovation system. Luxembourg performs strongly in innovation according to the 2021 edition of the European Innovation Scoreboard ([26]). However, its performance remains below the EU average. Innovation suffers from underinvestment in R&D. Total R&D intensity reached 1.13% in 2020, still far below the EU average.

Luxembourg has been unable to raise its R&D intensity, notably in terms of private R&D, and science-business linkages remain weak. If unresolved, this can hinder the efforts to further diversify its economy. R&D intensity is low and declining (1.13% in 2020 compared to 1.42% in 2010), notably due to low business R&D intensity. Therefore, it remains a challenge to ensure the much-needed diversification of the economy. Luxembourg took concrete steps over the last years to develop a policy mix aimed to foster business innovation. For example, it set up the 'Fit 4' performance programmes targeting start-ups and small and medium-sized enterprises. Nevertheless, government support to business innovation still remains marginal (0.036% of GDP in 2019, compared to an EU average of 0.196%). Science-business linkages remain under-exploited, as evidenced by the low share of public expenditure on R&D financed by businesses. To tackle some of these key challenges and accelerate its transition to a data-driven economy, Luxembourg's recovery and resilience plan envisages substantial support for the development of quantum communication infrastructure, which is expected to help Luxembourg accumulate key research and innovation capabilities in this field, while providing opportunities for science-business cooperation.

Luxembourg is dependent on an always-larger highly skilled foreign labour force. The relatively small population cannot supply the labour demand of the economy. Moreover, universities offer few vocational careers and in some cases they only cover part of the course cycles. As a result, students need to complete their degrees abroad, leading to some not returning.

Table A9.1:**Key Innovation Scoreboard Indicators**

Luxembourg	2010	2015	2018	2019	2020	Compound annual growth 2010-2020	EU average
Key indicators							
R&D Intensity (GERD as % of GDP)	1.42	1.25	1.17	1.18	*1.13*	-0.7	*2.32*
Public expenditure on R&D as % of GDP	0.48	0.59	0.55	0.54	*0.52*	0.8	*0.78*
Business enterprise expenditure on R&D (BERD) as % of GDP	0.94	0.66	0.62	0.64	*0.61*	-1.1	*1.53*
Quality of the R&I system							
Scientific publications of the country within the top 10% most cited publications worldwide as % of total publications of the country	13.1	13.1	12.4	:	:	-0.7	9.9
PCT patent applications per billion GDP (in PPS)	1.5	1.6	1.5	:	:	0.8	*3.5*
Academia-business cooperation							
Public-private scientific co-publications as % of total publications	9.5	10.1	13	11.9	10.7	1.2	9.05
Public expenditure on R&D financed by business enterprise (national) as % of GDP	0.008	0.007	0.012	0.014	:	6.6	0.054
Human capital and skills availability							
New graduates in science & engineering per 1000 pop. aged 25-34	:	1.9	2.5	2.6	:	1.3	16.3
Public support for business enterprise expenditure on R&D (BERD)							
Total public sector support for BERD as % of GDP	:	*0.054*	:	*0.036*	:	-9.7	0.196
Green innovation							
Share of environment-related patents in total patent applications filed under PCT (%)	17	10.6	9	:	:	-7.6	*12.8*
Finance for innovation and Economic renewal							
Venture Capital (market statistics) as % of GDP	0.037	0.012	0.021	0.027	0.040	0.9	0.054
Employment in fast-growing enterprises in 50% most innovative sectors	3.1	4.6	6.9	6.2	:	7.9	5.5

Source: DG Research and Innovation - Common R&I Strategy and Foresight Service - Chief Economist Unit
Data: Eurostat, OECD, DG JRC, Science-Metrix (Scopus database and EPO's Patent Statistical database), Invest Europe.

([26]) 2021 European Innovation Scoreboard, Country profile: Luxembourg
https://ec.europa.eu/docsroom/documents/45924

Productivity growth is a critical driver of economic prosperity, well-being and convergence over the long run. A major source of productivity for the EU economy is a well-functioning single market, where fair and effective competition and a business friendly environment are ensured, in which small and medium enterprises (SMEs) can operate and innovate without difficulty. Businesses and industry rely heavily on robust supply chains and face bottlenecks that have a negative impact on firms' productivity levels, employment, turnover and entry/exit rates. This may affect the Member States' capacity to deliver on Europe's green and digital transformation.

Luxembourg's economy is well integrated into the single market. Up to 80% of the goods and services produced in Luxembourg are exported and the share of Luxembourg SMEs that export goods outside the EU (13.7%) is above the EU average (9.7%).

Technological integration in SME's and levels of private investment remain low compared with the high-potential. Luxembourg has launched initiatives to boost digitalisation and innovation in light of the country's ambition to transition to a data-driven economy. More than one third of businesses do not invest intensively in digital technologies or unlock the opportunities of digitalisation. Enterprises scored low in the Digital Intensity Index (38%; EU average: 41%) and SMEs are lagging behind big companies in e-commerce. In 2019, 9% of SMEs were selling online (EU average: 17.5%), against 19% of big firms (EU average: 39%).

Luxembourg's regulatory stance is generally more restrictive than most in the EU ([27]). While progress has been evident in a number of areas (notably architecture, engineering and retail sales), unnecessary restrictions persist, particularly in the legal profession. Reducing these barriers would benefit Luxembourg because it would lead to lower prices and wider consumer choice. For lawyers, restrictions are for example the obligation to join a professional organisation, the requirement to have EU citizenship and the inability to market their services. Notaries are also subject to restrictive regulations, in particular, quantitative constraints and some regulated fees. The recent reform on proportionality may be conducive for proportionality tests before the adoption of new professional regulations. Nevertheless, more direct action on existing regulations would help Luxembourg reap the economic benefits of improved competition.

Reform of Luxembourg's bankruptcy legislation has been pending approval in Parliament for more than 2 years. In this regard, a much more concerted push for the reform is needed. While some support is available to entrepreneurs for a second chance, their fear of failure is among the highest in the EU. Bankruptcy reforms would facilitate early restructuring and second chances. A more effective insolvency regime would foster entrepreneurship and help struggling firms to exit or restructure.

([27]) The Commission's restrictiveness indicator (2021) as well as the OECD product market regulation indicators (2018) show higher restrictions than EU average.

Table A10.1: **Key Single Market and Industry Indicators**

POLICY AREA	INDICATOR NAME	DESCRIPTION	2021	2020	2019	2018	2017	Growth rates	EU27 average*
HEADLINE INDICATORS									
Economic structure	Value added by source (domestic)	VA that depends on domestic intermediate inputs, % [source: OECD (TiVA), 2018]				64.83			**62.6%**
	Value added by source (EU)	VA imported from the rest of the EU, % [source: OECD (TiVA), 2018]				22.74			**19.7%**
	Value added by source (extra-EU)	% VA imported from the rest of the world, % [source: OECD (TiVA), 2018]				12.4			**17.6%**
Cost competitiveness	Producer energy price (industry)	Index (2015=100) [source: Eurostat, sts_inppd_a]	122.6	95.2	102.8	101.7	94.8	**29.3%**	**127.3**
RESILIENCE									
Shortages/supply chain disruptions	Material Shortage using survey data	Average (across sectors) of firms facing constraints, % [source: ECFIN CBS]	15	9	5	8	11	**36%**	**26%**
	Labour Shortage using survey data	Average (across sectors) of firms facing constraints, % [source: ECFIN CBS]	19	15	34	30	25	**-24%**	**14%**
	Sectoral producer prices	Average (across sectors), 2021 compared to 2020 and 2019, index [source:Eurostat]						**2.4%**	**5.4%**
Strategic dependencies	Concentration in selected raw materials	Import concentration a basket of critical raw materials, index [source: COMEXT]	0.14	0.15	0.13	0.12	0.13	**8%**	**17%**
	Installed renewables electricity capacity	Share of renewable electricity to total capacity, % [source:Eurostat, nrg_inf_epc]		69.30	64.60	59.10	58.80	**18%**	**47.8%**
Investment dynamics	Net Private investments	Change in private capital stock, net of depreciation, % GDP [source: Ameco]		1.6	3.9	4	4.2	**-61.9%**	**2.6%**
	Net Public investments	Change in public capital stock, net of depreciation, % GDP [source: Ameco]		1.8	1.1	0.2	-0.6	**-400%**	**0.4%**
SINGLE MARKET									
Single Market integration	Intra-EU trade	Ratio of Intra-EU trade to Extra-EU trade, index [source: Ameco]	3.05	2.74	2.84	2.65	2.45	**24%**	**1.59**
Professional services restrictiveness	Regulatory restrictiveness indicator	Restrictiveness of access to and exercise of regulated professions (professions with above median restrictiveness, out of the 7 professions analysed in SWD (2021)185 [source: SWD (2021)185; SWD(2016)436 final])	6				6	**0%**	**3.37**
Professional qualifications recognition	Recognition decisions w/o compensation	Professionals qualified in another EU MS applying to host MS, % over total decisions taken by host MS [source: Regulated professions database]	57						**45%**
Compliance - cooperation EC and MS	Transposition - overall	5 sub-indicators, sum of scores [source: Single Market Scoreboard]		Below average	Above average	Above average	Below average		
	Infringements - overall	4 sub-indicators, sum of scores [source: Single Market Scoreboard]		Above	On average	On average	On average		
Investment protection	Confidence in investment protection	Companies confident that their investment is protected by the law and courts of MS if something goes wrong, % of all firms surveyed [source: Flash Eurobarometer 504]	49						**56%**
BUSINESS ENVIRONMENT - SMEs									
Business demography	Bankruptcies	Index (2015=100) [source: Eurostat, sts_rb_a]	n.a.	n.a.	n.a.	n.a.	n.a.	**n.a.**	**70.1**
	Business registrations	Index (2015=100) [source: Eurostat, sts_rb_a]		110.4	151.2	140.6	125	**-11.7%**	**105.6**
Access to finance	Late payments	Share of SMEs experiencing late payments in past 6 months, % [source: SAFE]	48	50.7	50.2	n.a.	n.a.	**-4%**	**45%**
	EIF Access to finance index - Loan	Composite: SME external financing over last 6 months, index from 0 to 1 (the higher the better) [source: EIF SME Access to Finance Index]		0.65	0.71	0.54	0.28	**130.6%**	**0.56**
	EIF Access to finance index - Equity	Composite: VC/GDP, IPO/GDP, SMEs using equity, index from 0 to 1 (the higher the better) [source: EIF SME Access to Finance Index]		0.06	0.09	0.08	0.05	**19.4%**	**0.18**
	% of rejected or refused loans	SMEs whose bank loans' applications were refused or rejected, % [source: SAFE]	2.7	9.9	6.3	5	0	**n.a.**	**12.4%**
Public procurement	SME contractors	Contractors which are SMEs, % of total [source: Single Market Scoreboard]	51	51	47	48	48	**6.3%**	**63%**
	SME bids	Bids from SMEs, % of total [source: Single Market Scoreboard]	41	41	37	50	53	**-23%**	**70.8%**

(*) latest data available.

Source: See above in the table the respective source for each indicator in the column "Description".

Good administrative capacity enables economic prosperity, social progress and fairness. Public administrations at all government levels deliver crisis response, ensure the provision of public services and contribute to building resilience for the sustainable development of the EU economy.

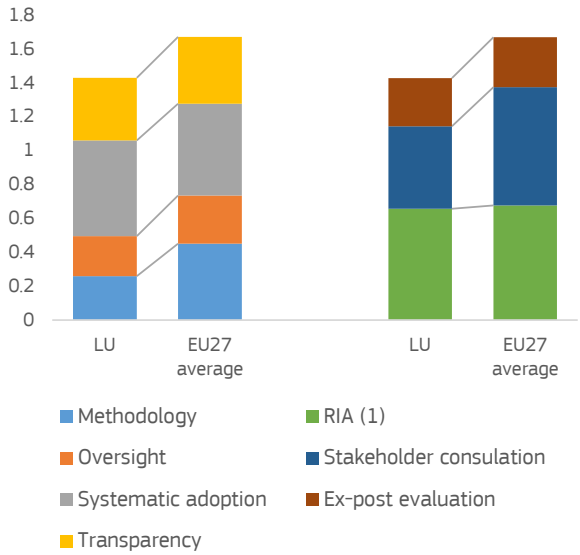
Overall, Luxembourg's public administration is one of the most effective of the EU ([28]). It has the highest trust among people of all EU countries (78%; EU average 52%) ([29]). Additionally, 87% of surveyed people indicate that the provision of public services is rather good or very good, compared to an EU average of 53%.

Graph A11.1: **Performance on open data maturity**

Source: Open Data Maturity Report 2021

The provision of open government data is behind the EU average (Graph 11.1), as is performance on indicators for public procurement and evidence-based policy making (Graph 11.2). Low provision of open data reduces the potential of information to hold institutions accountable to the people. Luxembourg's ranking in procurement indicators is explained by the relatively low share of contract notices published on Tenders Electronic Daily (TED) and the country's low score for measures to improve information quality. Evidence-based policymaking is another area with room for improvement, including for stakeholder consultation, upstream and downstream evaluation of legislation (Graph 11.2). Advance impact assessments are limited, while there are no systematic subsequent impact assessments. Furthermore, concerns have been raised, as recommendations of stakeholders in the consultation process are often not followed. ([30])

Graph A11.2: **Performance on evidence-based policy making indicators**



(1) RIA stands for Regulatory Impact Assessment
Source: OECD iREG indicators

The performance of Luxembourg's civil service management varies per indicator. The gender gap in senior civil service positions is one of the largest in the EU and is widening. However, Luxembourg performs relatively well in employees' participation in adult learning, against the backdrop of a relatively low share of public administration employees with tertiary education. Luxembourg is actively trying to address this, for example by putting in place a new recruitment procedure in 2019 and drawing up the new organisation development strategy FP2025. This proactivity yields results as the share of public administration employees with tertiary education is rising and the average age of the civil service is falling. This is in contrast to the ageing trend in most other Member States.

E-government scores are relatively good. The recent rise in the share of e-government users is encouraging as Luxembourg used to rank below

([28]) Worldwide Governance Indicators, 2020.

([29]) European Commission, *Standard Eurobarometer 95,* Spring 2021

([30]) Rule of Law Report 2021

the median in 2019 and 2020. The recovery and resilience plan aims to support the digital transition by investing in the digitalisation of public administration and people's digital skills. The ultimate goal is to improve the delivery of services and increase the effectiveness of the administration.

The justice system performs effectively. The effectiveness of civil justice keeps being high, although the length of proceedings is significantly longer at second and third instances. The number of pending civil cases is low, and a consistent clearance rate of around 100% shows that civil justice deals with its caseload effectively. The overall quality of the justice system is good, barring the limited scope of available online tools for justice. No systemic deficiencies in judicial independence have been reported. ([31])

Table A11.1:**Public administration indicators – Luxembourg**

LU	Indicator (1)	2017	2018	2019	2020	2021	EU27
E-government							
1	Share of individuals who used internet within the last year to interact with public authorities (2)	77.0	65.0	62.0	64.0	79.0	70.8
2	2021 e-government benchmark´s overall score (3)	na	na	na	na	87.1	70.9
Open government and independent fiscal institutions							
3	2021 open data maturity index	na	na	na	na	66.3	81.1
4	Scope index of fiscal Institutions	62.0	67.0	67.0	67.0	na	56.8
Educational attainment level, adult learning, gender parity and ageing							
5	Share of public administration employees with tertiary education, levels 5-8 (4)	33.7	34.5	35.4	38.5	42.9	55.3
6	Participation rate of public administration employees in adult learning (4)	20.1	22.9	22.1	16.1	18.5	18.6
7	Gender parity in senior civil service positions (5)	29.8	37.2	42.8	48.4	43.8	21.8
8	Share of public sector workers between 55 and 74 years (4)	12.1	11.6	11.7	11.0	12.1	21.3
Public financial management							
9	Medium-term budgetary framework index	0.82	0.82	0.82	0.82	na	0.72
10	Strength of fiscal rules index	0.9	0.9	0.9	0.9	na	1.5
11	Public procurement composite indicator	0.3	-3.0	1.0	-2.0	na	-0.7
Evidence-based policymaking							
12	Index of regulatory policy and governance practices in the areas of stakeholder engagement, Regulatory Impact Assessment (RIA) and downstream evaluation of legislation	1.43	na	na	1.43	na	1.7

(1) High values indicate good performance, except indicators # 7 and 8.
(2) Break in the series in 2018 and 2021.
(3) Measures the user centricity (including for cross-border services) and transparency of digital public services as well as the existence of key enablers for the provision of those services.
(4) Break in the series in 2021.
(5) Defined as the absolute value of the difference between the share of men and women in senior civil service positions.
Source: ICT use survey, Eurostat (# 1); E-government benchmark report (# 2); Open data maturity report (# 3); Fiscal Governance Database (# 4, 9, 10); Labour Force Survey, Eurostat (# 5, 6, 8), European Institute for Gender Equality (# 7), Single Market Scoreboard public procurement composite indicator (# 11); Organisation for Economic Co-operation and Development Indicators of Regulatory Policy and Governance (# 12).

([31]) For more detailed analysis of the performance of the justice system in Luxembourg, see the 2022 EU Justice Scoreboard (forthcoming) and the country chapter for Luxembourg of the Commission's 2022 Rule of Law Report (forthcoming).

ANNEX 12: EMPLOYMENT, SKILLS AND SOCIAL POLICY CHALLENGES IN LIGHT OF THE EUROPEAN PILLAR OF SOCIAL RIGHTS

The European Pillar of Social Rights provides the compass for upward convergence towards better working and living conditions in the EU. Implementing its 20 principles on equal opportunities and access to the labour market, fair working conditions, social protection and inclusion, supported by the 2030 EU headline targets on employment, skills and poverty reduction, will strengthen the EU's drive towards a digital, green and fair transition. This Annex provides an overview of Luxembourg's progress in achieving the goals under the European Pillar of Social Rights.

Table A12.1:**Social Scoreboard for Luxembourg**

Equal opportunities and access to the labour market	Early leavers from education and training (% of population aged 18-24) (2021)	9.3
	Individuals' level of digital skills (% of population 16-74) (2021)	64.0
	Youth NEET (% of total population aged 15-29) (2021)	8.8
	Gender employment gap (percentage points) (2021)	7.4
	Income quintile ratio (S80/S20) (2020)	5.0
Dynamic labour markets and fair working conditions	Employment rate (% population aged 20-64) (2021)	74.1
	Unemployment rate (% population aged 15-74) (2021)	5.3
	Long-term unemployment (% population aged 15-74) (2021)	1.8
	GDHI per capita growth (2008=100) (2020)	110.2
Social protection and inclusion	At risk of poverty or social exclusion (in %) (2020)	19.9
	At risk of poverty or social exclusion for children (in %) (2020)	24.2
	Impact of social transfers (other than pensions) on poverty reduction (% reduction of AROP) (2020)	39.4
	Disability employment gap (ratio) (2020)	22.1
	Housing cost overburden (% of population) (2020)	8.5
	Children aged less than 3 years in formal childcare (% of under 3-years-olds) (2020)	63.2
	Self-reported unmet need for medical care (% of population 16+) (2020)	0.1

Critical situation | To watch | Weak but improving | Good but to monitor | On average | Better than average | Best performers

Update of 29 April 2022. Members States are classified on the Social Scoreboard according to a statistical methodology agreed with the EMCO and SPC Committees. It looks jointly at levels and changes of the indicators in comparison with the respective EU averages and classifies Member States in seven categories. For methodological details, please consult the Joint Employment Report 2022. Due to changes in the definition of the individuals' level of digital skills in 2021, exceptionally only levels are used in the assessment of this indicator; NEET: neither in employment nor in education and training; GDHI: gross disposable household income.
Source: Eurostat

Although the labour market improved significantly in 2021, some challenges remain. Following unprecedented measures to protect employment in response to the COVID-19 crisis, the overall employment rate quickly recovered, up to 74.3% in the fourth quarter of 2021 (from 71.7% in the first quarter of 2020). Nonetheless, the employment rate remains low for some groups, notably older workers (aged 55-64) with a rate of 47.1% in the fourth quarter of 2021. This is around 14 percentage points below the EU average. The unemployment rate (ages 15-74) fell relatively sharply in 2021 (to 4.3% the fourth quarter of 2021 from a peak of 7.9% in the third quarter of 2020). Nevertheless, the increase in long-term unemployment as a percentage of the total deserves specific attention, in particular as the share of people aged 35 to 40 among long-term job-seekers has significantly risen since 2019. This trend could be linked to the mandatory registration of minimum-income recipients with the public employment service. Increased recruitment difficulties in 2021 point to growing skills mismatches in the labour market. The ongoing skills strategy, which is part of the recovery and resilience plan will help to address this challenge. EU cohesion policy funds will support measures to strengthen policies aiming for an active labour market, with a focus on young people, low-skilled people, long-term unemployed people, women and people over 45. Overall, there is scope for further progress in order for Luxembourg to help the EU in reaching its 2030 headline target on employment.

The rate of early school-leaving is relatively low but increased steadily (9.3% in 2021, below the EU average), pupils' basic skills are below the EU average and their performance is strongly linked to socio-economic status. Luxembourg's education system faces specific challenges against the background of an increasingly diverse school population (see Annex 13). In 2018, the Programme for International Student Assessment (PISA) of the Organisation for Economic Co-operation and Development showed that average skill levels are significantly lower than the respective EU averages in all three areas tested. Luxembourg had a high overall participation in adult learning over the previous four weeks in 2021 (17.9% versus 10.8% in the EU, despite a decline from 19.1% in 2019) and a rather high participation among unemployed people (34.4% in

2021 versus 12.7% in the EU). Nonetheless, low skilled people participate in learning much less (6.8%) than high skilled people (24.6%). Strengthening the quality and inclusiveness of education and training is key for Luxembourg to help the EU in reaching its 2030 headline targets on skills and on employment.

While the share of people at risk of poverty or social exclusion remains stable and below the EU average, some groups are disproportionately affected, and in-work poverty and housing-cost burden remain major challenges. The share of adults not born in the EU that are at risk of poverty or social exclusion was 35.6% in 2020, compared to 15.4% for people born in Luxembourg. Despite a slight decrease of the in-work poverty rate in 2020 (11.9% compared to 12.1% in 2019), the rate is among the highest in the EU (EU average 9%). In-work poverty is significantly higher for people not born in the EU (22.9% in 2020) than for people born in the EU (13.8%) and people born in Luxembourg (5.4%). There is thus scope for strengthened social-policy action in order for Luxembourg to help the EU in reaching its 2030 headline target on poverty reduction. To foster equal opportunities and social inclusion, Luxembourg intends to support, with the European Social Fund Plus, innovative approaches consisting of policies aiming for an active labour market and training. These approaches aim to strengthen pathways towards employment and improve cooperation with social partners, to help people join and stay on the labour market.

This Annex outlines the main challenges for Luxembourg's education and training system in light of the EU-level targets of the European Education Area strategic framework and other contextual indicators, based on the analysis from the 2021 Education and Training Monitor. Luxembourg's education and training system struggles with equity challenges that could worsen due to the pandemic. Luxembourg lags significantly behind the EU average and EU-level targets in terms of performance in reading, mathematics and science.

Participation in early childhood education and care (ECEC) is below the EU average but receives increasing support. 88.4% of children take part in ECEC from the age of 3, which is below the EU average (92.8%) and the new EU-level target of 96% set for 2030. Luxembourg has invested heavily in extending access to ECEC and non-formal day care facilities in the last 10 years, nearly tripling the number of places and doubling the availability of childminders. However, funding and qualification requirements are different in the formal from those in the non-formal ECEC sectors, which impacts on the system's quality and equity.

The rate of early school leaving has been on the rise for three years in a row, and pupils' basic skills are below the EU average and strongly linked to socio economic status. The rate of early leavers from education and training (9.3%) is below the EU average (9.7%) but for the first time surpassing the EU-level target (below 9%). Luxembourg's education system faces challenges against the background of an increasingly diverse school population. Pupils with Luxembourgish as their first language are a minority, both in primary and secondary education. In 2018, the programme for International Student Assessment (PISA) of the Organisation for Economic Co-operation and Development (OECD) showed that in Luxembourg average skill levels are significantly lower than the respective EU averages in all three areas tested. Luxembourg recorded one of the largest score gaps in reading between advantaged and disadvantaged students across EU countries. National data show that the

Table A13.1: **EU-level targets and other contextual indicators under the European Education Area strategic framework**

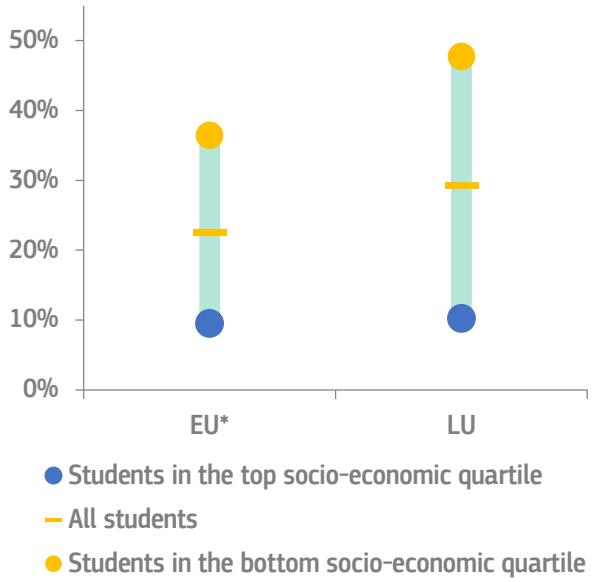
				2015		2021	
Indicator			**Target**	**Luxembourg**	**EU27**	**Luxembourg**	**EU27**
Participation in early childhood education (age 3+)			**96%**	**86.3%**	**91.9%**	**88.4%** 2019	**92.8%** 2019
Lowachieving 15-year-olds in:		**Reading**	**< 15%**	**25.6%**	**20.4%**	**29.3%** 2018	**22.5%** 2018
		Mathematics	**< 15%**	**25.8%**	**22.2%**	**27.2%** 2018	**22.9%** 2018
		Science	**< 15%**	**25.9%**	**21.1%**	**26.8%** 2018	**22.3%** 2018
Early leavers from education and training (age 18-24)	**Total**		**< 9%**	**9.3%** b	**11.0%**	**9.3%**	**9.7%**
	By gender	*Men*		10.5% b	12.5%	10.4%	11.4%
		Women		8.1% b	9.4%	8.1%	7.9%
	By degree of urbanisation	*Cities*		7.7% b, u	9.6%	9.9% u	8.7%
		Rural areas		8.9% b	12.2%	8.1%	10.0%
	By country of birth	*Born in Luxembourg*		6.9% b	10.0%	7.0%	8.5%
		EU-born		15.7% b	20.7%	:	21.4%
		Non-EU-born		: b, u	23.4%	16.4% u	21.6%
Tertiary educational attainment (age 25-34)	**Total**		**45%**	**50.3%** b	**36.5%**	**62.6%**	**41.2%**
	By gender	*Men*		45.0% b	31.2%	58.0%	35.7%
		Women		55.5% b	41.8%	67.4%	46.8%
	By degree of urbanisation	*Cities*		78.1% b	46.2%	85.7%	51.4%
		Rural areas		41.5% b	26.9%	50.2%	29.6%
	By country of birth	*Born in Luxembourg*		44.7% b	37.7%	53.5%	42.1%
		EU-born		57.5% b	32.7%	70.9%	40.7%
		Non-EU-born		51.4% b	27.0%	64.5%	34.7%
Share of school teachers (International standard classification of education 1-3) who are 50 years or over				21.1%	38.3%	21.8% 2019	38.9% 2019

Notes: The 2018 EU average on PISA reading performance does not include ES; b = break in time series, u = low reliability, : = not available; Data is not yet available for the remaining EU-level targets under the European Education Area strategic framework, covering underachievement in digital skills, exposure of vocational educational training graduates to work based learning and participation of adults in learning.

Source: Eurostat (UOE, LFS); OECD (PISA).

reading and mathematics skills of pupils with a disadvantaged non Luxembourgish or non-German language background are much poorer than the skills of their peers. Learning gaps observed in the first years of schooling remain stable or even increase during later years.

Graph A13.1: **Low achievement in reading by socio-economic status, PISA 2018**



*The EU average does not include Spain
Source: Organisation for Economic Cooperation and Development (2019), PISA 2018

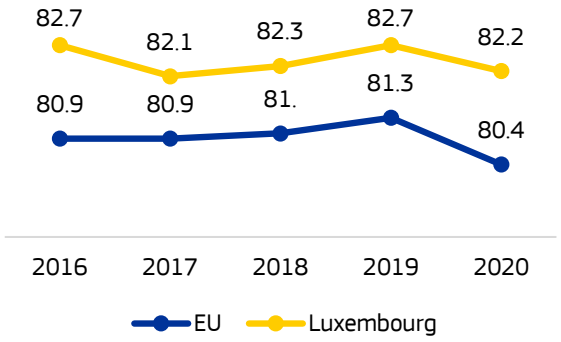
Pupils' access to academic pathways depends more on their socio-economic and linguistic background than on their school performance. Data suggest that compared to their peers, disadvantaged pupils are oriented disproportionately more often to the lowest track of secondary education (*régime préparatoire*) and less often to the highest track (*enseignement secondaire classique; ESC*) than could be expected based on their academic performance. Furthermore, pupils' study chances show a strong correlation with their linguistic background: pupils with a non-Luxembourgish- or non-German-language background access ESC much less often. The National Observatory of School Quality (ONQS) reported on the prevailing inequality based on pupils' socioeconomic and linguistic backgrounds. The way languages are taught and the way pupils are separated into different school tracks add to this inequality. The ONQS calls to develop a national curriculum better addressing the above challenges.

Tertiary education attainment and graduate employment rates are among the highest in the EU. 62.6% of the population aged 25 to 34 holds a tertiary degree, the highest rate in the EU. This is partly thanks to the high proportion of graduates in the migrant population (69.1%, compared to 53.5% of native Luxembourgers). The employment rate of recent tertiary graduates in 2021 was 87.0%, above the EU average of 84.9%, but still 7 percentage points lower than in 2019.

Luxembourg's national recovery and resilience plan (RRP) fosters skills development. Overall participation in adult learning is high (16.3%; EU average: 9.2%) but lower among low-skilled and older workers. The RRP includes investment in vocational training programmes for jobseekers and for workers placed in short-time work. These vocational training programmes are expected to help mitigate the employment impact of the COVID-19 crisis. The RRP also envisages a reform on the design of further vocational training programmes.

Especially relevant in light of the ongoing COVID-19 pandemic, resilient healthcare is a prerequisite for a sustainable economy and society. This Annex provides a snapshot of the healthcare sector in Luxembourg.

Graph A14.1: **Life expectancy at birth, years**

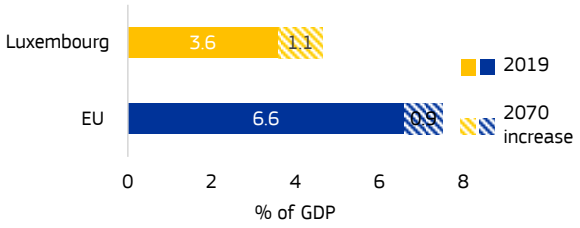


Source: Eurostat database

Life expectancy in Luxembourg is above the EU average, but fell by 6 months in 2020 due to COVID-19. As of 17 April 2022, 1.69 cumulative COVID-19 deaths per 1 000 inhabitants were reported and 382 confirmed cumulative COVID-19 cases per 1 000 inhabitants. Luxembourg fares comparatively well in avoiding deaths from treatable causes.

Health spending per person in Luxembourg is above the EU average. However, health spending relative to GDP was the lowest in the EU in 2019, although it was expected to increase more compared with the EU on average. The public share of spending on health is above the EU average. Public expenditure on health is projected to increase by 1.1 percentage points of GDP by 2070 (compared to 0.9 percentage points for the EU) ([32]).

Graph A14.2: **Projected increase in public expenditure on health-care over 2019-2070 (reference scenario)**



Source: European Commission (Directorate-General for Economic and Financial Affairs) and Ageing Working Group (Economic Policy Committee), The 2021 Ageing Report: Economic & Budgetary Projections for the EU Member States (2019-2070)

Luxembourg's health workforce strongly depends on staff who are resident in neighbouring countries, making it particularly vulnerable in crises that necessitate border closures. This concerns two thirds of nurses and one quarter of doctors practising in Luxembourg. The country also has the second lowest ratio of doctors per 1 000 inhabitants in the EU. The age structure (most physicians were over 50 in 2017) adds to this challenge.

The health strategy included in the recovery and resilience plan (RRP) aims to reduce reliance on foreign health workers. Measures in the RRP aim to make staff management more efficient investing EUR 1.2 million (1.3% of the total RRP) in telemedicine and an electronic register of health professionals. Policy action aims to improve the attractiveness of health professions for residents, implementing skills-mix approaches, expanding training opportunities and putting in place a new bachelor's programme in general medicine. New academic programmes for nurses will be launched in the coming years.

([32]) European Commission (Directorate-General for Economic and Financial Affairs) and Ageing Working Group (Economic Policy Committee), The 2021 Ageing Report: Economic & Budgetary Projections for the EU Member States (2019-2070).

Table A14.1:**Key health indicators**

	2016	2017	2018	2019	2020	EU average (latest year)
Treatable mortality per 100 000 population (mortality avoidable through optimal quality healthcare)	70.9	73.1	67.7	63.1		92.1 (2017)
Cancer mortality per 100 000 population	235.5	235.4	225.3	218.5		252.5 (2017)
Current expenditure on health, % GDP	5.2	5.3	5.3	5.4		9.9 (2019)
Public share of health expenditure, % of current health expenditure	83.6	84.0	84.1	85.0		79.5 (2018)
Spending on prevention, % of current health expenditure	2.2	2.2	2.2	2.5		2.8 (2018)
Acute care beds per 100 000 population	389.9	377.5	370.3	329.4		387.4 (2019)
Doctors per 1 000 population *	2.9	3.0	3.0			3.8 (2018)
Nurses per 1 000 population *	11.7	11.7				8.2 (2018)
Consumption of antibacterials for systemic use in the community, daily defined dose per 1 000 inhabitants per day **	21.4	20.9	20.7	19.8	14.8	14.5 (2020)

Notes: Doctors' density data refer to practising doctors in all countries except FI, EL, PT (licensed to practice) and SK (professionally active). Nurses' density data refer to practising nurses in all countries (imputation from year 2014 for FI) except IE, FR, PT, SK (professionally active) and EL (nurses working in hospitals only).
More information: https://ec.europa.eu/health/state-health-eu/country-health-profiles_en
Source: Eurostat Database; except: * Eurostat Database and OECD, ** ECDC.

The regional dimension is an important factor when assessing economic and social developments in Member States. Taking into account this dimension enables a well-calibrated and targeted policy response that fosters cohesion and ensures sustainable and resilient economic development across all regions.

Luxembourg remained the Member State with the highest national-income level per head, reaching 168% of the EU average in 2019 (in purchasing parity standards). This level reached 219% of the EU average in 2007, but has being deteriorating since the global financial crisis. Although the economy expanded at a higher pace compared with the EU average, the contribution of non-resident workers and firms to economic growth has increased even faster. This resulted in a relative deterioration of the wealth created by the resident population compared to the EU average.

The country's trade openness, financial integration in the EU and labour intensity explain this trend. In particular, the central location of Luxembourg in the EU, at the heart of the 'Greater Region', encompassing German, Belgian and French regions, enables it to attract not only commuters but also permanent residents.

Labour productivity is much higher than in the rest of the EU, at 166% of the EU average in 2018. However, it grew at a lower pace during the last decade, at an annual rate of 0.2% (against 1% at EU level). The country is considered a strong innovator.

Significant socio-economic differences between Luxembourg's various territories persist. In 2020, the unemployment rate in towns and suburbs was significantly higher, (8.8%), than in cities (5.4%) and rural areas (5.5%). Differences are very significant in terms of educational attainment. In cities, more than 76% of the population has a tertiary degree, but this share drops to 39% in towns and suburbs and to 40% in rural areas. The share of NEETs ([33]) is also higher in towns, suburbs and rural areas (Table 1).

The incidence of poverty is higher in towns and suburbs, where 22.5% of the population was at risk of poverty or social exclusion in 2020 against 16.5% in cities and 18.2% in rural areas.

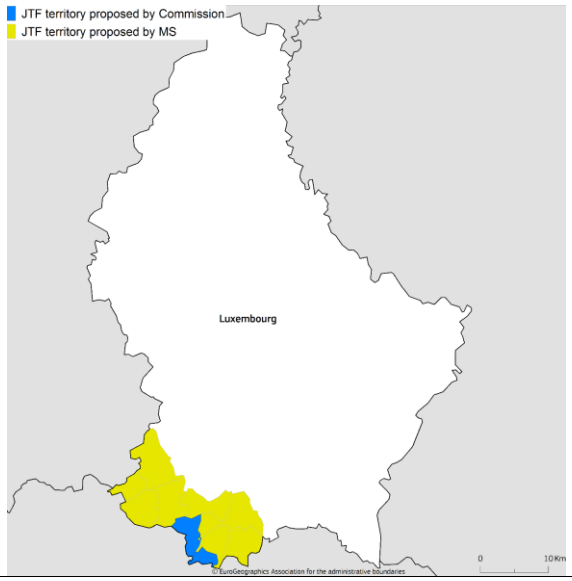
Table A15.1: **Main socio-economic indicators by degree of urbanisation, Luxembourg 2020**

Luxembourg	Unemployment rate	Population with post-secondary education	Not in education employment or training (NEET)	At risk of porverty or social exclusion (AROPE)
	% of active population	% of population aged 25-64	%	%
Cities	5.40	76.10	4.90	16.50
Towns and suburbs	8.80	39.00	10.00	22.50
Rural Areas	5.50	40.00	8.00	18.20

Source: Eurostat

Luxembourg has the highest greenhouse gas emissions per person in the EU. Transport is the main source of emissions (66% ([34]), reflecting Luxembourg's position as logistical hub and the impact of its large cross-border commuting workforce (not included in the population count). Industrial emissions are concentrated in the south of the country. The main industrial emitters are the cement industry in Rumelange and the steel industry in Esch-sur-Alzette (respectively 42% and 27% of the country's total industrial greenhouse gas emissions). The three most energy-intensive sectors are special cement, steel and glass, with the steel industry accounting for 40% of the country's power consumption.

Graph A15.1: **Territories most affected by the climate transition in Luxembourg**



Source: European Commission

([33]) NEETs are defined as young people (aged 20–34) neither in employment nor in education and training. It is measured as % of total population aged 20-34.

([34]) Statec (2020)

ANNEX 16: KEY FINANCIAL SECTOR DEVELOPMENTS

This Annex provides an overview of key developments in Luxembourg's financial sector. Luxembourg is the second-largest fund administration centre globally after the US. In 2021, the volume of Luxembourg-domiciled investment funds climbed to EUR 5.9 trillion, after growing by 17.8% in 2021. The expansion was driven largely by the economic recovery, the rise in valuations, notably in equity markets; and by a significant reallocation of savings from households and companies towards investment funds. Moreover, Luxembourg's fund industry has positioned itself as one of the favoured domiciles for sustainable investment funds in the EU.

Luxembourg is a major financial centre with global significance. Banks domiciled in Luxembourg have assets of EUR 955 billion, about 20 times the size of the economy. However, only a small part of financial institutions in Luxembourg has direct links with the domestic economy. Of the 124 banks based in Luxembourg, about 7 cater directly to domestic retail clients.

Luxembourg's banks have remained resilient in the face of the shock of the pandemic crisis. They continued to display solid capital ratios, although their profitability has weakened in the low interest rate environment. Luxembourg's non-performing loans ratio was among the lowest of the EU, at 0.6% of gross loans in the third quarter of 2021, compared to 2.2% in the euro area. On the liability side, deposits from the resident non-bank sector increased by 19% over the last 12 months.

Mortgage lending has grown rapidly in recent years, feeding back into rapidly rising real estate prices and leading to high levels of household indebtedness. The vulnerabilities continue to persist to date, despite recent borrower-based measures taken to address them. Following the 2019 European Systemic Risk Board recommendation, the local supervisor, the national financial supervisor, set a loan-to-value limit on residential mortgages and set the countercyclical buffer rate for banks at 0.50%, effective from 1 January 2021. As a result, Luxembourg was assessed as fully compliant with the ESRB recommendation. However, these measures have not dampened house-price growth significantly, resulting in further overvaluation which was affirmed by the ESRB in February 2022.

As an international financial centre, Luxembourg faces an inherent money-laundering risk. In order to address the issue a first vertical risk assessment of legal persons and arrangements was concluded in February 2022. The risk assessment exemplifies the importance of mitigating measures to reduce the risks. In this regard, Luxembourg relies on a multi-pronged

Table A16.1: **Financial soundness indicators**

	2017	2018	2019	2020	2021
Total assets of the banking sector (% of GDP)	1 784.7	1 780.6	1 853.7	1 944.8	1 990.8
Share (total assets) of the five largest bank (%)	26.2	26.3	27.7	31.6	-
Share (total assets) of domestic credit institutions (%)[1]	13.2	13.0	12.8	14.1	12.8
Financial soundness indicators:[1]					
- non-performing loans (% of total loans)	0.7	0.8	0.6	0.7	0.6
- capital adequacy ratio (%)	22.5	21.4	19.7	21.7	21.0
- return on equity (%)	5.7	5.5	5.2	4.4	5.9
NFC credit growth (year-on-year % change)	3.2	4.5	4.9	-1.6	-4.5
HH credit growth (year-on-year % change)	7.8	7.3	2.6	7.7	10.1
Cost-to-income ratio (%)[1]	56.0	59.3	62.2	61.6	61.1
Loan-to-deposit ratio (%)[1]	76.6	75.6	76.5	62.4	58.4
Central bank liquidity as % of liabilities	0.9	0.8	0.6	1.1	1.6
Private sector debt (% of GDP)	286.5	282.7	302.0	316.8	-
Long-term interest rate spread versus Bund (basis points)	22.6	16.9	13.2	9.7	1.7
Market funding ratio (%)	62.4	62.3	61.9	62.3	-
Green bond issuance (bn EUR)[2]	7.1	7.1	8.1	9.3	15.5

(1) Last data: Q3 2021.
(2) Includes issuance by supranationals such as EU.
Source: European Central Bank, Eurostat, Refinitiv

approach. As a first prong, Luxembourg is undertaking reforms to strengthen the register by granting sanctioning powers to the register of beneficial owners, so that it can obtain appropriate, accurate and up-to-date information. These reforms are well advanced. As a second prong, further improved supervision of professionals providing trust and company services is being considered. Reports of suspicions filed by these professionals have increased over time. However, not all categories of professionals report in line with the high risk exposure and some categories do not report any suspicion at all.

This Annex provides an indicator-based overview of Luxembourg's tax system. It includes information on the tax structure, i.e. the types of tax that Luxembourg derives most revenue from, the tax burden for workers, and the progressivity and redistributive effect of the tax system. It also provides information on tax collection and compliance and on the risks of aggressive tax planning.

Luxembourg's tax revenues in relation to GDP are slightly below the EU average. More than half of all tax revenue comes from the taxation of income, while some other tax bases are underused. Luxembourg's tax revenues as a share of GDP were slightly below the EU aggregate in 2020. Personal and corporate income tax revenue account for 54% of all tax revenue (36% and 18% of tax revenue in 2020, respectively). Nevertheless, this share was below the EU aggregate, as were income tax revenues as a share of GDP. Revenues from consumption and environmental taxes as a share of GDP were among the lowest in the EU. However, revenues from capital taxes as a share of GDP were the highest of all Member States. While revenues from property taxes in general were relatively high, revenues from recurrent property taxes, which are particularly conducive to growth, were among the lowest of all Member States.

Luxembourg's income tax burden is relatively low across the income distribution. The income tax wedge in 2020 was substantially lower than the EU average at various income levels, i.e. for single people at the average wage (100%) and at 50%, 67% and 167% of the average wage. Second earners at a wage level of 67% of the average wage, whose spouse earned the average wage, faced a tax wedge slightly below the EU average. However, the difference between the tax wedge of second earners at 67% of the average wage and the one of single people at the same wage level was among the highest in the EU. The tax-benefit system helped reduce inequality as measured by the Gini coefficient in 2020, but the reduction was smaller than the EU average.

Luxembourg is doing moderately well on digitalisation of the tax administration, which can help reduce tax arrears and cut compliance costs. Outstanding tax arrears have increased by 1 percentage point to 12.8% of total net revenue. This is significantly below the EU average of 31.8%, though that average is inflated by very large values in a few Member States. The Annual Report on Taxation 2021 highlights scope for improvement in the rate of tax-return e-filing ([35]). The value added tax (VAT) gap (an indicator of the effectiveness of VAT enforcement and compliance) ([36]) has been reduced in Luxembourg at 6.6%, well below the EU-wide gap of 10.5%. The effective average corporate-tax rates were well above the EU average in 2020.

Lastly, the risk of aggressive tax planning appears high in Luxembourg. First, dividends, interest and royalties (paid and received) are among the highest in the EU, and at a high level compared to the size of the economy. Second, Luxembourg has the EU's highest incoming and outgoing foreign direct investments (FDI). A large majority of this FDI (81%) is linked to special-purpose entities. These high FDI flows via special-purpose entities as a percentage of total FDI also suggest the use of Luxembourg by companies engaging in aggressive tax planning.

([35]) European Commission, Directorate-General for Taxation and Customs Union, Annual Report on Taxation 2021 : review of taxation policies in the EU Member States, Publications Office, 2021, https://data.europa.eu/doi/10.2778/294944, see section 2.1.4 Improving tax administration of the Annual Report on Taxation 2021 for further details

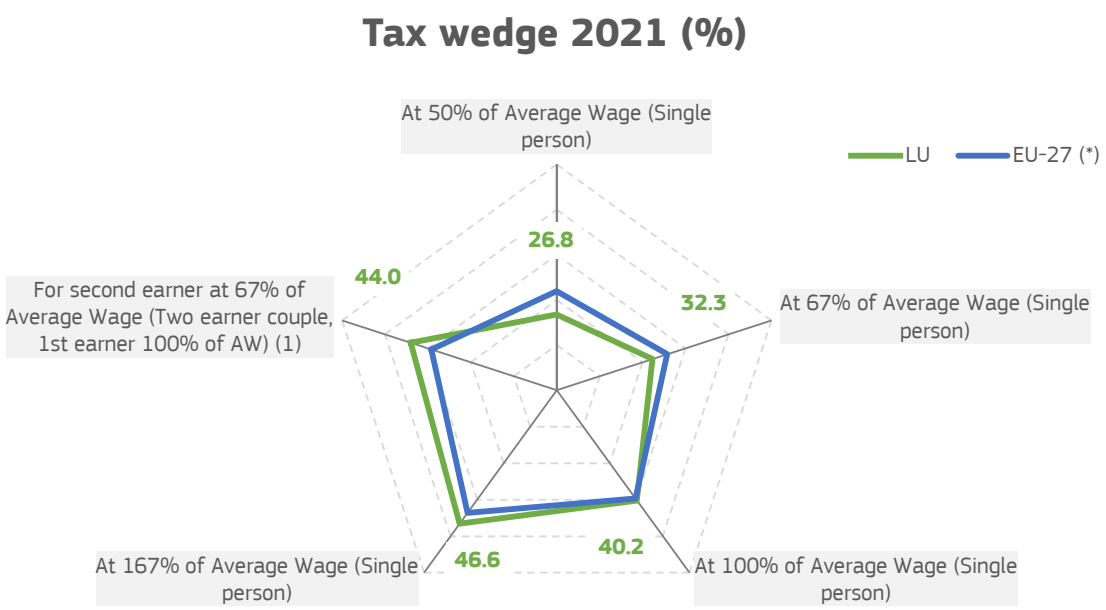
([36]) The VAT Gap is defined as the difference between the amount of VAT amount actually collected and the VAT Total Tax Liability (VTTL). The VTTL is an estimated amount of VAT that is theoretically collectable based on the VAT legislation and ancillary regulations.

Table A17.1:**Indicators on taxation**

		Luxembourg					EU-27					
		2010	2018	2019	2020	2021	2010	2018	2019	2020	2021	*Datasource*
Tax structure	Total taxes (including compulsory actual social contributions) (% of GDP)	35.7	39.3	39.5	38.5	38.1	37.9	40.1	39.9	40.1		Eurostat [gov_10a_taxag]
	Labour taxes (as % of GDP)	15.8	17.8	18.2	18.9		20.0	20.7	20.7	21.5		TAXUD, Data on Taxation
	Consumption taxes (as % of GDP)	9.9	8.7	8.9	8.3		10.8	11.1	11.1	10.8		TAXUD, Data on Taxation
	Capital taxes (as % of GDP)	10.0	12.7	12.4	11.2		7.1	8.2	8.1	7.9		TAXUD, Data on Taxation
	Total property taxes (as % of GDP)	1.0	2.5	2.4	2.5		1.9	2.2	2.2	2.3		TAXUD, Data on Taxation
	Recurrent taxes on immovable property (as % of GDP)	0.1	0.1	0.1	0.1		1.1	1.2	1.2	1.2		TAXUD, Data on Taxation
	Environmental taxes as % of GDP	2.3	1.7	1.7	1.4		2.4	2.4	2.4	2.2		TAXUD, Data on Taxation
Progressivity & fairness	Tax wedge at 50% of Average Wage (Single person) (*)	25.3	26.5	24.4	25.8	26.8	33.9	32.4	32.0	31.5	31.9	OECD
	Tax wedge at 100% of Average Wage (Single person) (*)	35.3	38.2	38.5	39.5	40.2	41.0	40.2	40.1	39.9	39.7	DG ECFIN, Tax & Benefits
	Corporate Income Tax - Effective Average Tax rates (1) (*)		24.2	23.2	23.2			19.8	19.5	19.3		DG ECFIN, Tax & Benefits
	Difference in GINI coefficient before and after taxes and cash social transfers (pensions excluded from social transfers)	9.7	6.9	5.2	6.9		8.4	7.9	7.4	8.3		Eurostat [ilc_di12] and EMPL calculations
Tax administration & compliance	Outstanding tax arrears: Total year-end tax debt (including debt considered not collectable) / total revenue (in %) (*)		11.8	12.8				31.9	31.8			OECD
	VAT Gap (% of VTTL)		8.5	6.6				11.2	10.5			DG TAXUD, VAT GAP Study
Financial Activity Risk	Dividends, Interests and Royalties (paid and received) as a share of GDP (%)		410.4	374.0	372.9			10.7	10.5			Eurostat [bop_fdi6_pos]
	FDI flows through SPEs (Special Purpose Entities), % of total FDI flows (in and out)		95.3	94.1	81.3			47.8	46.2	36.7		Eurostat [bop_fdi6_inc]

(1) Forward-looking effective tax rate (Organisation for Economic Co-operation and Development).
(*) EU-27 simple average as there is no aggregated EU-27 value.
Source: European Commission and Organisation for Economic Co-operation and Development (OECD)

Graph A17.1: **Indicators on tax wedge (1)**



The tax wedge measures the difference between the total labour cost of employing a worker and the worker's net earnings: sum of personal income taxes and employee and employer social security contributions, net of family allowances, expressed as a percentage of total labour costs (the sum of the gross wage and social security contributions paid by the employer).
(1) The second earner average tax wedge measures how much extra personal income tax (PIT) plus employee and employer social security contributions (SSCs) the family will have to pay as a result of the second earner entering employment, as a proportion of the second earner's gross earnings plus the employer SSCs due on the second earner's income. For a more detailed discussion see OECD (2016), Taxing Wages 2016, OECD Publishing, Paris. http://dx.doi.org/10.1787/tax_wages-2016-en
(*) EU-27 simple average as there is no aggregated EU-27 value.
Source: European Commission

Table A18.1:**Key economic and financial indicators**

	2004-07	2008-12	2013-18	2019	2020	2021	forecast 2022	forecast 2023
Real GDP year-on-year (y-o-y)	5.2	0.6	2.7	3.3	-1.8	6.9	2.2	2.7
Potential growth (y-o-y)	3.9	2.2	2.3	2.6	2.3	2.8	2.7	3.0
Private consumption (y-o-y)	1.8	2.4	2.6	2.5	-6.9	7.4	3.6	2.9
Public consumption (y-o-y)	1.7	3.6	2.8	3.9	7.7	4.7	3.3	2.0
Gross fixed capital formation (y-o-y)	4.4	2.8	0.3	9.8	-4.6	12.3	1.3	2.1
Exports of goods and services (y-o-y)	8.3	1.6	4.4	5.8	1.3	9.7	3.8	3.1
Imports of goods and services (y-o-y)	7.3	2.9	4.6	6.9	1.6	10.4	4.3	3.1
Contribution to GDP growth:								
Domestic demand (y-o-y)	1.8	1.9	1.4	3.1	-1.8	5.2	1.9	1.6
Inventories (y-o-y)	0.1	-0.1	0.2	0.1	0.2	-0.3	0.0	0.0
Net exports (y-o-y)	3.3	-1.3	1.1	0.2	-0.2	2.0	0.4	1.1
Contribution to potential GDP growth:								
Total labour (hours) (y-o-y)	1.9	1.3	1.6	1.1	0.7	0.8	0.9	1.2
Capital accumulation (y-o-y)	1.3	1.3	1.0	0.9	0.7	1.0	0.9	0.9
Total factor productivity (y-o-y)	0.7	-0.4	-0.3	0.6	0.9	1.0	0.8	0.8
Output gap	1.1	-1.6	-0.9	0.1	-3.9	0.0	-0.5	-0.8
Unemployment rate	4.6	4.9	6.0	5.6	6.8	5.3	5.2	5.1
GDP deflator (y-o-y)	4.1	3.8	1.7	0.6	4.3	6.8	4.0	2.1
Harmonised index of consumer prices (HICP, y-o-y)	3.2	2.7	1.1	1.6	0.0	3.5	6.8	2.3
Nominal compensation per employee (y-o-y)	4.0	2.2	2.2	1.9	0.4	5.1	4.8	3.6
Labour productivity (real, hours worked, y-o-y)	1.9	-1.1	-0.1	0.0	2.3	6.5	-1.4	0.2
Unit labour costs (ULC, whole economy, y-o-y)	2.2	4.3	2.3	2.1	4.1	1.4	5.1	3.4
Real unit labour costs (y-o-y)	-1.8	0.5	0.7	1.5	-0.2	-5.1	1.1	1.3
Real effective exchange rate (ULC, y-o-y)	1.0	2.0	1.6	-0.7	.	.	.	.
Real effective exchange rate (HICP, y-o-y)	1.1	0.1	0.5	-0.5	0.4	0.8	.	.
Net savings rate of households (net saving as percentage of net disposable income)	5.2	6.1	7.9	7.9	18.1	.	.	.
Private credit flow, consolidated (% of GDP)	40.4	5.1	11.3	19.6	44.1	.	.	.
Private sector debt, consolidated (% of GDP)	218.0	287.4	300.6	302.0	316.8	.	.	.
of which household debt, consolidated (% of GDP)	46.2	55.1	60.5	66.8	69.2	.	.	.
of which non-financial corporate debt, consolidated (% of GDP)	171.8	232.3	240.2	235.2	247.6	.	.	.
Gross non-performing debt (% of total debt instruments and total loans and advances) (2)	.	.	.	0.5	0.6	.	.	.
Corporations, net lending (+) or net borrowing (-) (% of GDP)	7.2	0.5	-0.3	-6.4	1.1	3.6	4.1	4.5
Corporations, gross operating surplus (% of GDP)	28.6	30.9	31.2	28.6	29.4	32.3	32.0	31.5
Households, net lending (+) or net borrowing (-) (% of GDP)	-0.2	0.2	0.5	0.7	5.0	1.9	0.8	-0.2
Deflated house price index (y-o-y)	8.1	1.2	4.2	8.3	13.8	.	.	.
Residential investment (% of GDP)	3.2	3.2	3.7	4.0	3.7	3.6	.	.
Current account balance (% of GDP), balance of payments	6.8	5.7	4.8	4.6	4.1	4.8	3.8	3.8
Trade balance (% of GDP), balance of payments	29.6	36.5	41.3	36.9	37.2	35.1	.	.
Terms of trade of goods and services (y-o-y)	0.0	1.1	-0.1	-0.9	1.7	1.3	-0.7	-0.1
Capital account balance (% of GDP)	0.4	-0.4	0.0	-0.1	-0.1	0.0	.	.
Net international investment position (% of GDP)	10.1	12.1	60.2	58.2	53.4	52.8	.	.
NENDI - NIIP excluding non-defaultable instruments (% of GDP) (1)	.	.	-3 429.5	-4 076.8	-4 203.4	-4 635.1	.	.
IIP liabilities excluding non-defaultable instruments (% of GDP) (1)	.	.	9 794.8	11 038.5	10 951.1	11 236.2	.	.
Export performance vs. advanced countries (% change over 5 years)	28.0	16.3	17.2	8.8	21.2	.	.	.
Export market share, goods and services (y-o-y)	4.5	-1.3	3.8	4.2	14.3	-0.2	-0.9	-1.1
Net FDI flows (% of GDP)	.	.	45.9	111.8	11.5	108.9	.	.
General government balance (% of GDP)	1.2	0.8	1.6	2.3	-3.4	0.9	-0.1	0.1
Structural budget balance (% of GDP)	.	.	2.0	2.2	-1.6	0.9	0.1	0.4
General government gross debt (% of GDP)	8.0	17.7	21.3	22.3	24.8	24.4	24.7	25.1

(1) Net international investment position - NIIP excluding direct investment and portfolio equity shares.
(2) Domestic banking groups and stand-alone banks, EU and non-EU foreign-controlled subsidiaries and EU and non-EU foreign-controlled branches.
Source: Eurostat and European Central Bank as of 2 May 2022, where available; European Commission for forecast figures (Spring forecast 2022)

This Annex assesses fiscal sustainability risks for Luxembourg over the short, medium and long term. It follows the same multi-dimensional approach as the 2021 Fiscal Sustainability Report, updated on the basis of the Commission 2022 spring forecast.

Table 1 presents the baseline debt projections. It shows the projected government debt and its breakdown into the primary balance, the snowball effect (the combined impact of interest payments and nominal GDP growth on the debt dynamics) and the stock-flow adjustment. These projections assume that no new fiscal policy measures are taken after 2023, and include the expected positive impact of investments under NextGenerationEU.

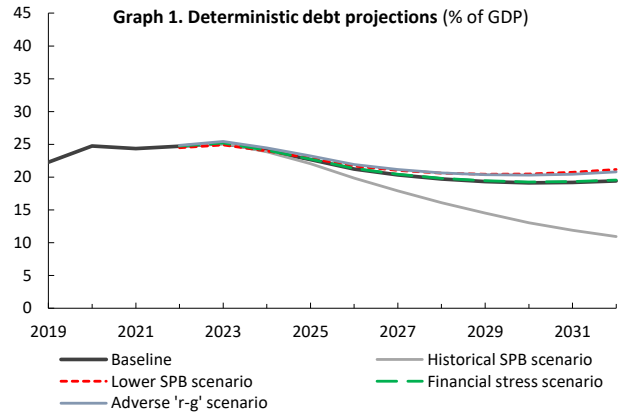
Graph 1 shows four alternative scenarios around the baseline, to illustrate the impact of changes in assumptions. The 'historical SPB' scenario assumes that the structural primary balance (SPB) gradually returns to its past average level. In the 'lower SPB' scenario, the SPB is permanently weaker than in the baseline. The 'adverse interest-growth rate' scenario assumes a less favourable snowball effect than in the baseline. In the 'financial stress' scenario, the country temporarily faces higher market interest rates in 2022.

Graph 2 shows the outcome of the stochastic projections. These projections show the impact on debt of 2 000 different shocks affecting the government's budgetary position, economic growth, interest rates and exchange rates. The cone covers 80% of all the simulated debt paths, therefore excluding tail events.

Table 2 shows the S1 and S2 fiscal sustainability indicators and their main drivers. S1 measures the consolidation effort needed to bring debt to 60% of GDP in 15 years. S2 measures the consolidation effort required to stabilise debt over an infinite horizon. The *initial budgetary position* measures the effort required to cover future interest payments, the *ageing costs* component accounts for the need to absorb the

Table A19.1:**Debt sustainability analysis for Luxembourg**

Table 1. Baseline debt projections	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Gross debt ratio (% of GDP)	**22.3**	**24.8**	**24.4**	**24.7**	**25.1**	**24.0**	**22.7**	**21.2**	**20.3**	**19.7**	**19.3**	**19.1**	**19.2**	**19.4**
Change in debt	1.4	2.5	-0.4	0.3	0.4	-1.1	-1.4	-1.4	-0.9	-0.6	-0.4	-0.2	0.0	0.2
of which														
Primary deficit	*-2.6*	*3.2*	*-1.0*	*0.0*	*-0.2*	*0.0*	*-0.1*	*-0.3*	*0.0*	*0.2*	*0.4*	*0.6*	*0.7*	*0.9*
Snowball effect	*-0.4*	*-0.3*	*-2.9*	*-1.3*	*-1.0*	*-1.1*	*-1.2*	*-1.1*	*-0.9*	*-0.8*	*-0.7*	*-0.7*	*-0.7*	*-0.7*
Stock-flow adjustment	*4.5*	*-0.4*	*3.6*	*1.7*	*1.7*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Gross financing needs (% of GDP)	3.1	7.5	2.9	3.6	3.3	1.8	1.6	1.3	1.4	1.5	1.6	1.8	1.9	2.1



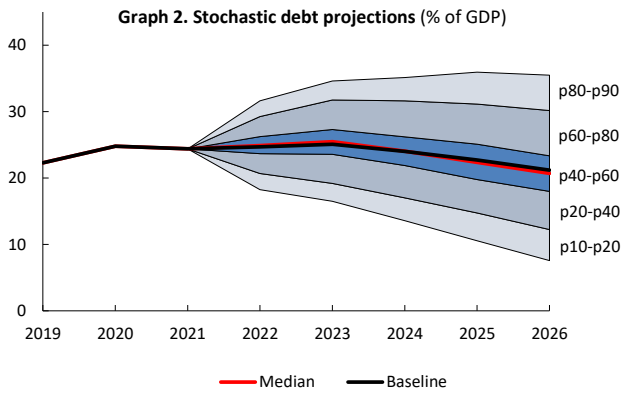


Table 2. Breakdown of the S1 and S2 sustainability gap indicators

		S1	**S2**
Overall index (pps. of GDP)		**-3.5**	**7.4**
of which			
Initial budgetary position		-2.0	-0.4
Debt requirement		-2.9	
Ageing costs		1.4	7.8
of which	*Pensions*	*1.4*	*6.1*
	Health care	*0.2*	*0.9*
	Long-term care	*0.1*	*1.3*
	Others	*-0.3*	*-0.5*

Source: European Commission

Table A19.2: **Heat map of fiscal sustainability risks for Luxembourg**

Short term	Medium term										Long term	
				Debt sustainability analysis (DSA)								
					Deterministic scenarios							
Overall (S0)	Overall (S1+DSA)	S1	Overall		Baseline	Historical SPB	Lower SPB	Adverse 'r-g'	Financial stress	Stochastic projections	S2	Overall (S2+DSA)
LOW	LOW	LOW	LOW	Overall	LOW	LOW	LOW	LOW	LOW	LOW	HIGH	HIGH
				Debt level (2032), % GDP	19	11	21	21	20			
				Debt peak year	2023	2023	2023	2023	2023			
				Fiscal consolidation space	83%	73%	86%	83%	83%			
				Probability of debt ratio exceeding in 2026 its 2021 level						36%		
				Difference between 90th and 10th percentiles (pps. GDP)						28		

(1) Debt level in 2032: green: below 60% of GDP, yellow: between 60% and 90%, red: above 90%. (2) The debt peak year indicates whether debt is projected to increase overall over the next decade. Green: debt peaks early; yellow: peak towards the middle of the projection period; red: late peak. (3) Fiscal consolidation space measures the share of past fiscal positions in the country that were more stringent than the one assumed in the baseline. Green: high value, i.e. the assumed fiscal position is plausible by historical standards and leaves room for corrective measures if needed; yellow: intermediate; red: low. (4) Probability of the debt ratio exceeding in 2026 its 2021 level: green: low probability, yellow: intermediate, red: high (also reflecting the initial debt level). (5) The difference between the 90th and 10th percentiles measures uncertainty, based on the debt distribution under 2000 different shocks. Green, yellow and red cells indicate increasing uncertainty.
Source: European Commission (for further details on the Commission's multi-dimensional approach, see the 2021 Fiscal Sustainability Report).

projected change in ageing-related public expenditure such as pensions, health care and long-term care, and the *debt requirement* measures the additional adjustment needed to reach the 60% of GDP debt target.

Finally, the heat map presents the overall fiscal sustainability risk classification (Table A19.2). The *short-term risk category* is based on the S0 indicator, an early-detection indicator of fiscal stress in the upcoming year. The *medium-term risk category* is derived from the debt sustainability analysis (DSA) and the S1 indicator. The DSA assesses risks to sustainability based on several criteria: the projected debt level in 10 years' time, the debt trajectory ('peak year'), the plausibility of fiscal assumptions and room for tighter positions if needed ('fiscal consolidation space'), the probability of debt not stabilising in the next 5 years and the size of uncertainty. The *long-term risk category* is based on the S2 indicator and the DSA.

Overall, short-term risks to fiscal sustainability are low. The Commission's early-detection indicator (S0) does not signal short-term fiscal risks (Table A19.2).

Medium-term risks to fiscal sustainability are low. Both elements of the Commission's medium-term analysis lead to this conclusion. First, the debt sustainability analysis (DSA) shows that government debt, is projected to fall from around 25% of GDP in 2022 to around 19% of GDP in 2032 in the baseline (Table 1). This debt path is rather robust to possible shocks to fiscal, macroeconomic and financial variables, as illustrated by alternative scenarios and stochastic simulations, all pointing to low risks (Table A19.1 and A19.2). Moreover, the sustainability gap indicator S1 (at -3.5 percentage points. of GDP) signals that no additional fiscal effort would be needed to reduce debt to 60% of GDP in 15 years' time (Table 2). Overall, the low risk reflects the current balanced budget and low debt, which more than compensate the projected ageing costs increase, primarily related to public pensions.

Long-term risks to fiscal sustainability are high. Over the long term, the sustainability gap indicator S2 (at 7.4 percentage points of GDP) points to high risks, leading to the overall high risk assessment. The S2 indicator suggests that, to stabilise debt over the long term, it will be necessary to address budgetary pressures stemming from population ageing, primarily related to pension and long-term care expenditure (Table 2).

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