Economy

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Introduction

Situated in the centre of Europe and bordered by two major powers, France and Germany, the small Grand Duchy of Luxembourg (with a total area of just 2,586 sq km and, in January 2019 a population of 613,894 inhabitants, according to official estimates, of whom 47.5% were foreigners—184 different nationalities)—a multicultural, multilingual and cross-border area *par excellence*—has always sought to maintain an openness to its neighbours, both for reasons of security and to give itself access to larger markets. The fact that the country did not have its own currency increased this need for openness and made monetary policy a key factor for integration.

In the 19th century Luxembourg was part of the German customs and trade union (Zollverein). Following the First World War, the country embarked on a process of economic and monetary integration with Belgium via the Belgium-Luxembourg Economic Union (initially set up in 1921 and regularly extended over the ensuing decades). It also played a driving role in the economic and political rapprochement of Belgium, the Netherlands and Luxembourg in the Benelux Economic Union (established in 1944 and restyled as the Benelux Union in 2008). Following the Second World War, it was ultimately with the European project that these integration efforts began to bear fruit and take on a new dimension. Luxembourg was one of the six founding members of the European Coal and Steel Community (ECSC) and the European Economic Community (EEC); in 1952 the country

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became the workplace and one of the permanent seats of the institutions of the European Community (EC, later European Union—EU), and it played a pioneering role in the establishment of Economic and Monetary Union (EMU).

In political terms, European integration and multilateral co-operation enabled Luxembourg to become an equal partner in the decision-making processes and leadership of European organizations. In economic terms, these features gave the country the tools it needed to forge a development model that could underpin the creative growth of its social market economy, while preserving the majority of its vital interests—particularly the steel industry and the financial centre—over the long term. With a gross domestic product (GDP) growth rate of 2.6% in 2018—higher than 2017 (2.3%), but lower than 2016 (3.1%)—and an average annual growth rate of 3.4% between 1996 and 2019, the highest GDP per caput among the Organisation for Economic Co-operation and Development (OECD) member states, a level of material well-being more than 37% above the European average, an unemployment rate of 5.5% and sound public finances, Luxembourg is currently one of the most politically stable, innovative and prosperous countries in the world. Its strong fiscal position is well illustrated by a longstanding AAA credit rating and a significant accumulation of government financial assets. This essay will endeavour to explain how Luxembourg managed to achieve this; its current strengths and weaknesses; and its future challenges in an increasingly globalized, competitive international environment.

From an Agrarian Economy to a Knowledge-driven Economy

Beginning in the 20th century, Luxembourg experienced several periods of transition. The largely agriculture-based economy became industrialized, driven by a powerful steel industry which remained the dominant sector from the immediate post-Second World War years to the mid-1970s. The country had a considerable competitive advantage in this respect owing to iron ore deposits in Luxembourg itself and in the neighbouring French region of Lorraine. The industrial flagship was Aciéries Réunies de Burbach-Eich-Dudelange (ARBED), founded in 1911, which developed its production in Europe and established a global network of sales outlets. Between 1953 and 1968 the steel industry contributed approximately 25% of the country's GDP growth, while steel production represented 50% of its added industrial value. Over the same period, the nominal wage grew by 29.3%. The improvement in living standards led to the emergence of the middle class and to an increase in urbanization. The Government improved the social security regime and extended it to all workers, thus helping to close the gap in social equality, raise living standards further and boost social cohesion in the country over the long term. The asymmetry between steel output (e.g. 6.4m. metric tons of steel in 1974) and national requirements (approximately 5% of this output) meant that Luxembourg had to export its steel production, which made the country entirely dependent on the international economic climate. Most of Luxembourg's steel went to the EEC. Membership of the Community organizations had a positive impact on the country, multiplying its wealth and boosting living standards. At the same time, the contrast between Luxembourg's thriving steel industry and its small population prompted it to look beyond its borders to augment its workforce. This resulted in several waves of immigration, especially from Italy at the turn of the 20th century and from Portugal in the late 1960s. The discrepancy between the required and available capital in the country meant that it needed to tap into foreign capital. Luxembourg also looked abroad for expertise.

Even as the steel industry reached its peak, the Government set about exploring possibilities for economic diversification, introducing a suitable legislative framework with the establishment of the Board of Industrial Development in 1959, the adoption of the framework law on economic expansion in 1962 and the creation of the Société Nationale de Crédit et d'Investissement (SNCI) in 1980. It managed to attract major multinational companies in other manufacturing sectors (glass, chemicals and plastics) and in the service industry (trade, tourism and public administration). Most of the new companies that came to the country were from the USA, such as Goodyear, DuPont de Nemours and Guardian. Nevertheless, 60% of foreign direct investment into Luxembourg was from its neighbours, Germany and Belgium. The early 1970s saw the rise of a new growth sector for Luxembourg: the international financial centre. This was the result of action taken by the Government as well as several external factors, including the interest equalization tax introduced by the USA in 1963 and the

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German securities transfer tax (*Kuponsteuer*) introduced in 1965. US capital and German banks were attracted to Luxembourg. Germany was the main investor in the banking sector, with 53% of all investments. The country would also become a 'laboratory' for the single European currency, one of the architects of which was Pierre Werner (Prime Minister of Luxembourg in 1959–74 and again in 1979–84, and Chairman of the expert committee that drafted the 1970 Werner Report, which formed the basis of EMU). The Luxembourg Stock Exchange (LuxSE), Kredietbank SA Luxembourgeoise, the Banque Internationale à Luxembourg, the Banque et Caisse d'Epargne de l'Etat, Luxembourg (the latter two recognized as systemically important banks in the country) and Cedel (which became Clearstream Banking in 1999) also played a major role.

In 1974 the steel industry began to decline, marking the end of the 'Trente Glorieuses'. Luxembourg was forced to implement considerable structural changes and embarked on its second major transition, from an industrial economy to a service economy based on the financial sector. This was reflected by fundamental changes in the structure of the country's economic value added. Between 1970 and 2016 the share of industry contracted sharply, from 47% to 7.3%, while the share of the steel industry shrank from 28% to 2%. The share of industry in total employment contracted from 33% in 1970 to 7.8% in 2016, but increased to 9.2% in 2018. Expressed in absolute figures, this downward trend—from 45,800 worker in 1970 to 32,700 in 2016 and 41,100 in 2018—is less pronounced. The weight of agriculture in the economy also fell considerably, representing just 0.3% of GDP and 1% of total employment in 2018. From the mid-1980s the country's economic growth accelerated, driven by its financial centre, whose contribution to GDP currently stands at around 36%. In 1998 the financial industry employed approximately 20,000 people (some 10% of the working population), generating 20% of GDP and directly providing between 30% and 40% of the country's public revenue. An indirect impact of this sector has been the development of business in related specialist areas, including information technology, data processing, intellectual property, legal and accounting expertise, training and business services. From 1985 to 2017 average annual GDP growth was twice as much as that of neighbouring countries and of the member states of the EC/EU.

Luxembourg is an export-intensive economy and the trade deficit is a recurrent characteristic. Between 1988 and 2019 the balance of trade averaged −€340m., reaching an all-time high trade deficit of €30m. in February 1988 and a record low of −€1,060m. in September 2012. In May 2019 the trade deficit rose to €592.1m., up slightly from the €580.6m. recorded in May 2018.

The share of foreign trade in Luxembourg's GDP is currently higher than 30%. EU countries are by far the country's largest trading partner, accounting for about 85% of exports and 87% of imports. Its three main trading partners are Germany, France and Belgium; its top customer is Germany (more than 27%) and its leading supplier is Belgium (nearly 36%). Luxembourg mainly exports iron and steel, chemical and rubber products, glass, electrical and electronic equipment, and financial services, its most profitable export. The country remains dependent on imports of energy (mineral fuels and oil) and most of its consumer goods. Luxembourg has successfully diversified its exports outside the EU, and the country is now developing trade relations with countries in Asia and the Middle East. Luxembourg has managed to establish itself as a hub for international trade, and this contributes significantly to the country's economic activity and domestic employment. Although in 1970 exports of goods represented more than twice the value of exports of services, the growth of the service sector has led to a reversal of this situation: nowadays Luxembourg exports more services than goods.

The expansion of the financial industry resulted in the emergence of a new phenomenon in Luxembourg: in order to meet its workforce requirements, the country turned to cross-border workers. This new development was made possible only by labour mobility, the discrepancy in unemployment rates between Luxembourg and its neighbours, and a positive wage differential. In 1998 cross-border workers made up one-third of the country's workforce. Of the total workforce, 55% were non-Luxembourgers. Concerted state intervention (in the form of investing to boost productivity, controlling mass unemployment by introducing community projects, activating the ECSC's aid mechanisms and developing a productive synergy with Belgium) and the spectacular growth of the financial sector enabled the country to avoid a painful socioeconomic crisis. Political leaders improved the legislative and institutional infrastructure underpinning the financial centre in three

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main areas: implementing international regulations; setting low taxes; and establishing strict rules on banking secrecy. The leaders explored possibilities for further economic diversification in innovative, competitive areas such as audiovisual technologies and communications satellites, as reflected in companies such as the Compagnie Luxembourgeoise de Télédiffusion and the Société Européenne des Satellites (SES). SES is now the world's leading satellite operator, reaching 99% of the global population. As regards the steel industry, in 2001 ARBED merged with Usinor and Aceralia, thus creating Arcelor, which in turn merged with Mittal Steel in 2006. ArcelorMittal, which has its headquarters in Luxembourg, is currently the world's largest steel producer.

To reconcile economic interests and social stability, the Government opted for a proactive social policy, with key measures including an automatic wage indexation mechanism based on increases in the cost of living (1965), the 40-hour working week (1975), a guaranteed minimum income (1986) and the expansion of the health care system. Labour relations were strengthened. In 1977, during the steel crisis, a Consultative Tripartite Committee (comprising the Government, employers and the unions) was established, acting as a shock absorber for both sides of industry. The Committee formed the basis of the Luxembourg social model, which relies on democracy, social solidarity and consensus to underpin social and economic development.

In 2007, during the emergence of the 'sub-prime' mortgage crisis stemming from low-income borrowers' inability to meet repayment obligations on lending, Luxembourg had the EU's largest banking sector and was a highly specialized, widely diversified global financial centre (with investment funds, insurance companies and banks, most of which were branches of foreign-based establishments). Since Luxembourg's economy was strongly driven by this sector, the potential vulnerabilities were considerable. In 2008 the financial sector contributed 29% of the country's GDP, 12% of jobs and 20% of total tax revenues—a significantly higher proportion than in any other OECD country. The global financial crisis resulted in a decrease of 20% on the aggregated balance sheet of Luxembourg's banks and a decline in GDP of 5.4%. The contraction of the financial sector led to a fall in tax revenues, which raised the risk of a long-term impact on the sustainability of the generous Luxembourg social security system, placed under growing pressure by an ageing population.

Another long-term problem was the country's ongoing structural unemployment, despite a rise in the overall employment rate. In 2015 GDP strongly increased by 4.9%, returning to its pre-crisis level (during 2000–07 GDP rose by roughly 4.7% per annum). The Government bailed out two major cross-border banks, Dexia and Fortis, which were experiencing serious difficulties; both required recapitalization equivalent to 6% of GDP. However, government aid, in the form of guarantees and injections of capital, was less extensive than in other OECD countries. Three small Icelandic banks were placed under the legal administration of the Commission de Surveillance du Secteur Financier (CSSF—Financial Sector Supervisory Commission). All these problems, which were caused by cross-border issues, were resolved without severe difficulties, and contagion to other establishments in the financial centre was avoided. Although Luxembourg fared better than its partners in the eurozone, the crisis had a lasting effect on the country's competitive advantage, particularly because it had to align its financial regulations with European and international initiatives, such as budget constraints, prudential supervision and increased transparency.

To guarantee its future position in a competitive globalized environment, the country faced a major strategic challenge: it had to diversify its economy by focusing on state-of-the-art fields with high added value, while preserving the competitiveness of the financial sector. Luxembourg continued to prioritize innovation as the main driver of smart, sustainable and inclusive growth, embarking on its third major transition—from a financial economy to a knowledge-driven economy.

The New Government and its Main Objectives 2018–23

Following the general election held on 14 October 2018, the governing coalition comprising the Demokratesch Partei (DP—Democratic Party), the Lëtzebuerger Sozialistesch Arbechterpartei (LSAP—Socialist Workers' Party of Luxembourg) and Déi Gréng (The Greens) remained in power under Xavier Bettel of the DP and was sworn in on 5 December.

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The Government's programme, the 'Declaration on the government programme 2018–2023', described by the Prime Minister as 'social, liberal and eco-friendly', reflects an approach based on 'justice, sustainability and social cohesion, while promoting the country's competitiveness'. The main priorities are the protection of resources, the preservation and strengthening of quality of life, and a clear commitment to diversity, multilingualism, history and the Luxembourgish language. Areas for action also include the implementation of a family-friendly policy and a more equitable distribution of the results of shared societal efforts, as well as the consolidation of a strong social state. Finally, there is a focus on the diversification of the economy, digitalization and investment in mobility and infrastructure.

The Government's approach is in accordance with the parameters set by the EU's Stability and Growth Pact (SGP), the Europe 2020 strategy and the requirements for the completion of EMU, as well as the measures introduced during the European Semester (the evaluation and co-ordination of medium-term economic and fiscal policy in the eurozone). The annual National Reform Programme, the Stability and Growth Programme for five-year periods (with the latest version covering 2016–20) and the National Action Plan for Employment have been continued. An independent body, the National Council of Public Finance, was established in 2018 to monitor Luxembourg's public finances and evaluate medium-term economic and budget forecasts. The Government has introduced the principle of 'zero-based budgeting' (whereby all expenses must be justified in terms of political priorities) and a series of 250 measures (the 'Zukunftspak') to reduce the structural public deficit, with the aim of maintaining a structural balance of 0.5% of GDP by the end of the Government's term. Social dialogue has also been stepped up within the Standing Committee for Work and Employment and the Economic Committee (Comité de Conjoncture).

Significant Social Policy Proposals

A number of significant plans for reform in the area of social policy have been put forward by the new Government. A reduction in working time has been put forward, of two days per year, by increasing the minimum statutory leave allowance by one extra day and introducing a new public holiday, Europe Day, on 9 May. The Government also plans to introduce more flexibility to working time and organization. Also, an increase in the minimum wage (salaire social minimum) of €100 net per month. This measure, which came into force on 1 July 2019 (retroactive to 1 January), increases the minimum wage to €2,507.70 per month. The approximately 60,000 employees receiving this amount were therefore given an additional €600 lump sum to cover the period from January to July. In the space of 20 years the minimum wage has risen constantly, with a total increase of €1,345 over that time. Further, a higher general cost-of-living allowance, designed to serve as a means of tackling in-work poverty.

In terms of employment, measures include support for job seekers and those involved in social and professional activation measures with the social inclusion income. Recipients of the previous guaranteed minimum income are automatically entitled to social inclusion income. As of 1 July 2019 the monthly social inclusion benefit stands at €733.13 per adult and €227.73 per child (increased by €67.27 for single-parent families). The Government is also extending the system of services in kind for poor families: in addition to free textbooks and child care, they can use drop-in centres free of charge during school hours. Also, a change in the indexation of family allowances, which (unlike salaries, pensions and other social transfers) have not been indexed to living costs since 2006. A new indexation mechanism will be introduced by the end of the parliamentary term, i.e. by 2023.

Changes to the health care third-party payer system have also been put forward. Currently, patients pay the full cost of doctors' fees and are subsequently reimbursed by the National Health Fund (Caisse Nationale de Santé—CNS). The third-party payer principle applies only in some cases (for social reasons), as well as for prescription drugs. After a successful petition to parliament calling for a generalized third-party payer principle, a technical solution was put forward in January 2019; the new system is to be operational within three years. Health care costs for patients under the age of 18 are entirely refunded.

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Relieving Tension in the Housing Market

Housing represents a major challenge for the Luxembourg economy and the country's competitiveness: real estate prices are being driven up because there is not enough supply to meet the continued high demand. The government programme 2018–23 sets out a series of measures, primarily large-scale investment in social housing and affordable housing which will be owned by the Government or local authorities; a new 'Housing Pact 2.0' between the Government and local authorities to give as many residents as possible access to public housing; increasing the state guarantee for those purchasing their first property; and increasing the current €20,000 tax credit to which each individual is entitled for registration fees. The Government is also keen to widen the availability of affordable accommodation for students and promote intergenerational cohabitation. Favourable tax measures offer indirect but valuable support for those struggling to pay high accommodation costs.

Towards a 'Tax Neutrality' System by 2023

The Government is aiming to introduce a single tax scale by 2023, regardless of marital status. The aim is to 'guarantee a taxation model that is neutral in terms of people's way of life'. The process began with the 2017 tax reform, which provided for the possibility of separate taxation for married couples. The single tax system will prevent individuals from being disadvantaged if their situation changes during their lifetime. Households with children will continue to enjoy tax breaks, which will also take into account other family or social criteria.

Supporting the Energy Transition: Sustainable Mobility and Free Public Transport

The Déi Gréng Minister of Land Use Planning, and of Energy, Claude Turmes, has spearheaded Luxembourg's energy transition strategy for the replacement of fossil fuels with renewable energy sources. As part of efforts to reduce plastic waste, plastic bags and all unnecessary packaging will be banned. From December 2020 the use of glyphosate will be prohibited, and by 2025 20% of Luxembourg's farms will produce exclusively organic products. The Government has taken a highly critical stance on nuclear energy, calling for the closure of the nuclear power stations in Tihange and Doel in Belgium and Cattenom in France, all of which are considered by Luxembourg to be a safety hazard.

The Government has drawn up a national mobility plan with a strong environmental component. Priority investments include the tram linking the Cloche d'Or industrial area (on the outskirts of Luxembourg City) and the airport, as well as a high-speed tram between Luxembourg City and Esch-sur-Alzette. To improve the quality of the environment, especially in urbanized areas, the emphasis will be on electromobility. The Climate and Energy Fund will offer subsidies to companies that reduce their environmental impact via employer mobility. These measures also reflect Luxembourg's commitment to tackling human-induced climate change: the country was a signatory of the Paris Agreement on climate change in 2016.

On 1 March 2020 all buses, trams and trains will become free of charge in Luxembourg. This measure has been described as an environmentally and socially friendly measure that will strengthen the country's attractiveness—although the Government does not expect the number of public transport users to increase. A number of priority investments to target the quality (i.e. punctuality and reliability) of public transport are also planned.

A World Leader in the Digital Economy

Another major priority for the new Bettel Government is to diversify the economy by developing new sectors and pillars, and one ambition is to make Luxembourg a world leader in the digital sector. The country will be among the first to adopt a 5G strategy. Another focus area is the development of a national strategy for artificial intelligence. Further measures to support diversification and

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competitiveness include freezing the subscription tax on investment funds for the next five years and reducing corporation tax by 1% from 1 January 2019.

Current Situation and Outlook

At late 2019, Luxembourg has clearly confirmed the steadily increasing trend of the previous five years by returning to its excellent pre-crisis levels of growth, thereby consolidating its status as one of the world's most competitive economies. The World Economic Forum's *Global Competitiveness Report 2018* ranked Luxembourg in eighth place in the EU and in 19th place at international level (out of 140 countries) in terms of competitiveness and medium- and long-term growth potential , and placed it first in terms of macroeconomic stability and technological readiness, second for international investment, fourth in terms of international trade and eighth for overall institutional framework and productivity. Taking these indicators as a basis, the Luxembourg Observatory for Competitiveness (ODC) ranked the country seventh for economic aspects, first for the social dimension and ninth in environmental terms. However, this ranking of first place in Europe for its social system may be found to be lacking in substance in the medium and long term if Luxembourg's economic performances fail to keep pace. Luxembourg came fifth on the 2018 Digital Transformation Scoreboard, the European Commission's annual analysis to assess how much progress has been made by EU countries in integrating digital technologies. There follows a summary of the main characteristics of the Luxembourg economy and the challenges facing it.

Keeping on Course at a Turbulent Time

Since 2017, against the backdrop of an eventful international geopolitical context, the overall economic situation has shown a general improvement and the major economies seem to have embarked on a stable, long-term recovery, even though some uncertainties remain. After achieving growth of 4.2% in 2016 (measured at 2010 prices), Luxembourg's real GDP grew by only 2.3% in 2017 and by 2.6% in 2018. According to the Institut National de la Statisique et des Etudes Economiques (STATEC), the country's economy should maintain the same level in 2019 and reach 3.8% in 2020. (The International Monetary Fund predicts figures of 3.5% in 2019 and 3.3% in 2020, and the European Commission 2.5% and 2.6%, respectively.) This economic rebound can partly be attributed to exports from financial services, which should benefit from the predicted rise in the Euro Stoxx 50 stock market index for the eurozone. After 2020 growth should stabilize at approximately 3%. The growth rate nevertheless exceeded the eurozone average of 2.2% in 2018, and the country represents a benchmark in terms of sustainable qualitative growth. It is worth noting that in 2018, unlike the two previous years, eurozone growth was overtaken by the US economy (which saw growth of 2.9%), but was significantly higher than that of Brazil (1.1%) and similar to the Russian Federation (2.3%), although it is progressing at a slower rate than the economies of the People's Republic of China (4%) and India (7%).

Although private investment has remained weak (except for goods transport, environmental and health technologies, the satellite industry and, more recently, space resource exploration), public investment has been boosted by major projects in three broad areas: mobility, green transport and environmental protection; research and intellectual assets based around the University of Luxembourg; and infrastructure and innovative industries (information and communication technology—ICT, energy and logistics), the showcase for which is the Belval development cluster on the France–Luxembourg border. There have been substantial investments in mobility, with a number of large-scale projects (rail, road and air transport, tram and urban transport). For the period 2013–18 rail transport received €1,600m., compared with €1,360m. from 2003–13. In 2013 the Fonds des Routes (Highways Fund) received €180m. in investments, compared with more than €340m. of expenses for 2018. As the new government investment cycle gets under way, public investment may slow in 2019. Nevertheless, the public investment-to-GDP ratio is expected to remain stable at around 4.0% of GDP, among the highest in the EU. Focusing investments on fostering digitalization and innovation, improving housing supply and sustainable transport infrastructure, and stimulating skills development would improve economic resilience and strengthen Luxembourg's long-term potential growth.

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Inflation in consumer prices fell to 2.0% in 2018 from 2.1% in 2017, slightly above the eurozone average of 1.8%. Inflation was sustained mainly by oil price movements. At the same time, domestic price pressures, including from past wage increases, are set to reassert their influence and headline inflation should increase from 1.6% in 2019 to 1.8% in 2020. The introduction of free public transport in March 2020 is expected to lower inflation (by 0.2%, according to STATEC estimates). Under the impact of the automatic indexation of wages applied on 1 January 2017, average salaries increased by 1.9% in 2018 and were predicted to increase by 2.7% in 2019. Following the wage indexation planned for the end of 2019, two more indexations should take place in 2023. Excluding the automatic indexation mechanism, salaries have increased by more than 1% a year, largely as a result of tax reform, the fall in unemployment, general improvements to the employment market and the expected rebound in productivity, which should also support household consumption. However, estimates suggest that salary increases will fall to close to zero by 2023.

Strengthening the Assets and Transparency of the Financial Industry

Representing 25% of GDP, 11% of employment and 21% of fiscal revenues in 2018, the financial industry continues to drive Luxembourg's economy and to serve as a catalyst for qualitative growth. With its unparalleled range of services, well developed financial infrastructure and considerable expertise, Luxembourg is a global financial hub. In the context of the United Kingdom's decision to leave the EU (known as Brexit—as voted for in the referendum of 23 June 2016), Luxembourg has continued to interest foreign investors. It is currently the leading European centre for investment funds (the country is ranked second at international level, behind the USA) with net assets under management of €4,404,900m., managed by 3,871 investment funds in 13,548 portfolios and traded in more than 70 countries (figures from May 2019). The LuxSE lists more than 35,000 securities in 59 currencies from approximately 2,300 issuers; 26% of all bonds listed in the EU are listed on the LuxSE, including sovereign bonds from 17 EU member states. The country houses the European Investment Bank and the European Investment Fund, investing roughly €80,000m. per year in the European and global economy.

Luxembourg is also the first-placed centre for private banking in the eurozone and the largest reinsurance centre in Europe. At 1 July 2019 it was home to 131 banks from 28 countries (with assets of €815,484m. compared with €773,834m. the previous year, a rise of 10.54%), which employ some 50,000 professionals (81% non-Luxembourgers). Given the considerable number of foreign banks in Luxembourg, the degree of internationalization of its financial centre (96.5%) is the highest in Europe.

In the last few years, new banks from third countries have established their European hubs in Luxembourg, including the seven largest Chinese banks. In addition, many international banking groups are establishing centres of excellence in Luxembourg, either in private banking, fund administration, custodian services or treasury management, or as booking centres for international loans.

During 2007–17, the financial sector recorded annual average growth of 3.7% and the workforce increased with the addition of 7,500 new jobs. Growth in the financial centre represented an increase of €300m. for the government budget in terms of direct taxes levied, which rose from €1,400m. to €1,700m.

Although growth in the eurozone financial sector overall was higher than in Luxembourg in terms of volume, Luxembourg performed better in terms of value and employment. The value added of the financial sector in the eurozone fell by 0.2% in volume and 0.5% in value (as opposed to a fall of 3.3% and a rise of 1.9%, respectively, in Luxembourg). At a time when many restructuring programmes are being implemented, European employment in the field decreased by 0.9%, while in Luxembourg it rose by 2.8%. The drop in value added of Luxembourg's financial sector can mainly be attributed to the fact that banks have had to increase their expenses to adapt to the growing digitalization and regulation of the industry, and thus the increase in their income was lower than hoped. Since costs have increased more than revenues, bank profitability has fallen (overall net profit

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dropped by 3.2% in 2018 compared with 2017). The rising prices of financial services as a result of stock market valuations have also had a negative impact on growth in the volume of funds, which has ultimately affected GDP. Luxembourg's market share in the value added of the eurozone financial sector nevertheless continued to grow, reaching 3% in 2017. The country is in first place in terms of investment funds, with a 33% market share.

Luxembourg has embarked on reforms to increase transparency in line with the most important regulations agreed at international level, including the automatic exchange of tax information for individuals in line with the Foreign Account Tax Compliance Act, in force since July 2015, and the end of banking secrecy pursuant to the OECD Common Reporting Standard. Also worth noting are the forthcoming law transposing the EU Anti-Tax Avoidance Directive, the establishment of the Multilateral Convention to Implement Tax Treaty Related Measures to Prevent BEPS and the international working groups tackling harmful tax competition. These will be enhanced by the Directive on Administrative Co-operation 5 (DAC 5) on access to anti-money-laundering information collected by tax authorities as well as DAC 6 on transparency rules for intermediaries, and by the General Data Protection Regulation, which came into force in May 2018. Luxembourg must implement the DAC 6 into domestic law before the end of 2019, with reporting duties from mid-2020. With the legislation of January 2019 establishing a Register of Beneficial Owners for Luxembourg-registered entities, the country has strengthened its legislation on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing, in accordance with EU directives.

The attractiveness of Luxembourg as a financial centre is liable to be affected by the process of tax and financial harmonization at EU and OECD level and the new regulatory environment: namely, the three pillars of Banking Union (the Single Supervisory Mechanism, the Single Resolution Mechanism and the European deposit guarantee scheme) and the liquidity regulation provided under the Basel III agreement. To offset this risk, the country is pursuing the diversification and specialization of its financial industry. Luxembourg's investment fund industry benefits from EU passports under the regulatory framework provided by the Undertakings for Collective Investment in Transferable Securities Directive and the Alternative Investment Fund Managers Directive. These enable Luxembourg to offer investment funds to other EU countries which remain under the supervision of the European Central Bank/CSSF. The Systemic Risk Committee (SRC) will closely monitor the links between banks and the fund industry as well as developments in the housing market. The Banque Centrale du Luxembourg (BCL) serves as the Secretariat to the SRC.

Pursuing an Agenda of Innovative Sustainable Finance

Since 2017, Luxembourg's financial centre has been at the forefront of developing initiatives and financial instruments that are specifically designed to support sustainable finance. It has a limited but highly skilled, responsive and committed number of stakeholders, and flexible and short decision-making processes. These conditions mean that the country currently benefits from a first-mover advantage in sustainable finance initiatives. As a platform for international finance, Luxembourg's financial sector can also have an important multiplier effect by committing to sustainable finance.

Through its involvement in a number of initiatives at international and EU level, Luxembourg has the potential to drive the political agenda for sustainable development: it is a member of the International Network of Financial Centres for Sustainability; the BCL is a member of the Central Banks and Supervisors Network for Greening the Financial System; the Luxembourg Government is actively engaged in discussions at EU level as a member of the EU Member States Expert Group on Sustainable Finance; the LuxSE actively contributes to various working groups at EU level, such as the EU Technical Expert Group on Sustainable Finance, and also chairs the United Nations (UN) Sustainable Stock Exchanges Initiative's Green Finance Advisory Committee; and the Luxembourg Bankers' Association chairs the working group on incentives and disincentives for sustainable finance in the European Banking Federation .

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In 2018 the labelling agency for sustainable financial projects (LuxFLAG), created in 2006, was involved in the technical group for convergence of green labels. In 2017 LuxFLAG launched a green bond label; in that year 49% of the total global volume of green bonds were listed on the Luxembourg Green Exchange (LGX). With 151 green bonds worth €72,890m., the LGX is currently the world's first and only platform for the listing of sustainable, social and green securities. In 2017 the Government signed an agreement with the retail banks in the financial centre on zero-interest 'climate bank' lending, the 'Klimabank' initiative. It is also worth noting that Luxembourg and the European Investment Bank (EIB) have launched an innovative climate finance platform, with the aim of encouraging investment in projects with a strong impact in combating climate change, in accordance with the international commitments entered into under the Paris Agreement.

Luxembourg increasingly plays the role of a gateway to and from China. Chinese banks in Luxembourg not only serve China-based clients (enabling them to invest in Europe), but also provide European clients with the expertise and opportunity to invest in China. The LuxSE's Chinese domestic Green Bond Channel bridges the information gap between Chinese issuers and international investors. Green bonds listed on the Shanghai Stock Exchange can be traded via existing channels, and co-operation with the LuxSE focuses on providing exhaustive information in English to offshore investors. As of May 2018 23 green bonds from Chinese issuers were displayed on the Luxembourg Green Exchange (LGX), representing 13% of all the green bonds displayed on the platform. Luxembourg has therefore consolidated its position as a European hub for the internationalization of the Chinese currency, the renminbi (RMB—as shown by the arrival of the seven leading Chinese banks in Luxembourg). At the end of 2018 the LuxSE listed 122 Dim Sum bonds; it is the European leader for bond listings in RMB and in second place at global level (20% market share), behind Hong Kong. With a market share of 50% for European High Yield Bonds, the LuxSE is the leading exchange for this type of security. Luxembourg is also the leading financial centre for Islamic finance outside Muslim countries, demonstrating its expertise by becoming the first country to issue a sovereign *sukuk* (Islamic bond) in euros.

Luxembourg's early development of outstanding expertise in microfinance in the 2000s provided the foundation for its development of impact finance and sustainable finance in general. Some 31 microfinance funds accounting for 50% of all global Microfinance Investment Vehicles are currently based in Luxembourg. The country has been a driving force for the creation of internationally recognized networks such as the Inclusive Finance Network and the European Microfinance Platform.

Luxembourg has also witnessed a broad spectrum of financial technology (FinTech) activities, driven by the integration of social, mobile, analytics and cloud technologies and supported by an innovation-friendly and responsive financial regulator. Leading international players in the payments sector, such as PayPal, Amazon Payments and Six Payment Services, have chosen Luxembourg as their hub to serve the entire EU market. In Luxembourg, they leverage a regulatory framework of payment licences to passport their services across the EU and draw on the country's supportive FinTech ecosystem and state-of-the-art information technology infrastructure. As a testament to Luxembourg's thriving FinTech environment, a number of home-grown Luxembourg payment service providers have been successfully acquired in recent years. These include Digicash and Paycash (which now operates as Mercedes Pay). The FinTech ecosystem, which in 2018 had around 150 companies, two-thirds of which were set up in the previous four years, has since seen the addition of several others, which have come to Luxembourg from Europe, China, Japan, the USA and Africa.

Luxembourg has developed structures in the area of financial technology transfer. The Luxembourg House of Financial Technology, set up in 2017, has proved to be a successful national platform for those involved in the digitalization of financial services. The House of Training (Agence de Transfert de Technologie Financière) was founded in 1999 with the aim of co-funding training programmes worldwide, mostly in 40 developing countries, in the areas of cybersecurity, financial structures and sustainable development. Several groups of companies have developed projects based on blockchain (cryptocurrency) technology, especially in the area of investment funds. The CSSF has taken a proactive approach to ensuring the effective regulation of FinTech developments. Since Luxembourg is mostly involved in cross-border activities, regulatory technology provides a major opportunity for

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the country and could particularly contribute in two areas: technological innovation can be applied to or used in regulation and by regulators to improve efficiency and transparency; and technology can also assist financial institutions in complying with regulatory requirements.

Luxembourg and (a No-Deal) Brexit

The exit of the UK from the EU will have a strong impact on Luxembourg, especially if there is a so-called no-deal Brexit. A study published by the credit rating agency Standard & Poor's in March 2019 on the basis of a 'Brexit Sensitivity Index' demonstrated that Luxembourg, together with Ireland and the Netherlands, was among the most vulnerable countries. This indicator takes into account exports of goods and services to the UK, bidirectional migration, links between the financial sector and British counterparts, and foreign direct investment in the UK. Economic links between Luxembourg and the UK are particularly close. The British market is Luxembourg's second largest export market for services (with 16% of market share and a total value approximately seven times that of exports of goods), and its fifth largest for goods (with 4% of market share). The situation is less clear in terms of financial services, where Luxembourg has a negative trade balance (22% of market share in imports compared with 18% in exports). This negative balance has been largely offset in recent years by non-financial trade with the UK, including business services and internet-based commerce. The UK has a strong presence in the financial sector: of 131 banks, four are British. Investment funds from the UK represent approximately €600,000m., or 17.2% of the total net assets of the financial centre (behind the USA with 20.5% of assets). The UK represents almost 17% of the value of Luxembourg's investments abroad and 15% of the total of investments by non-residents in Luxembourg.

As of 1 January 2019 more than 7,148 British citizens were living in Luxembourg (approximately 1.2% of Luxembourg's total population), making the British community the seventh largest international community in Luxembourg, with 1,382 citizens holding dual British–Luxembourgish citizenship. In 2018 70% of British nationals in Luxembourg stated that they were planning to apply for Luxembourgish nationality following the Brexit decision. Some 2,000 Luxembourgers currently live in the UK, including 1,200 students. The Luxembourg Government published its national preparations for Brexit in January 2019, with two possible scenarios: deal or no-deal. British nationals will be able to stay in Luxembourg with the same rights as EU citizens for a transitional period of one year after the date of withdrawal, and those resident for five or more years may apply for permanent residency. Luxembourg has tabled legislation to guarantee the recognition of professional qualifications for certain professions (particularly in the health care sector) in the event of a no-deal Brexit. British teaching staff at international schools and British employees at the BCL or in the civil service will also be protected, and there will be protections for customers of the financial centre and for air traffic rights (the 'fifth freedom' governing international air travel allows aircraft to pick up or drop off passengers or freight originating in or heading to any country), given that there are nine daily passenger flights between Luxembourg and London, in addition to Cargolux freight traffic. STATEC has forecast a 4% fall in the country's imports of financial services from the UK (amounting to €350m.). By 2020 there is likely to be a 2.5% fall in the value added of the financial sector and a 1% reduction in Luxembourg's GDP, with the loss of 1,600 jobs, one-third of which will be in the financial sector.

Luxembourg is an attractive option for companies post-Brexit, especially if the UK loses the EU 'passport', a mechanism that enables banking and financial establishments to carry out their activities across the European Economic Area. In this competition for relocation among Europe's major financial centres, Luxembourg looks set to be the favourite. Its main assets are its stable political and economic environment; its global reputation for investment funds and wealth management; its central position in the eurozone; and the professional approach of its regulator. There are, however, obstacles associated with the size of the country (its market infrastructures are limited) and the high real estate price, and it does not always have the same level of attractiveness as other larger centres.

By April 2019 over 66 companies, most of them operating in insurance and fund management, had already confirmed their move to Luxembourg, a relatively high number compared with other EU countries. One-half of these are asset managers and the other half are a mix of banks, insurers and

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payment service providers. The question for UK firms is often not whether to move out of the UK, but rather how much substance to allocate to their Luxembourg-based operations to be run in symbiosis with London-based functions. Looking ahead, Luxembourg's role as a global fund centre is set to continue growing, buoyed in part by the intention of 23 leading international asset managers and private equity firms to move existing activities to Luxembourg after Brexit. While Luxembourg has long been a key EU hub for cross-border life insurance and reinsurance, the non-life sector has also been significantly bolstered by the arrival of 11 global insurers, which have chosen to set up their post-Brexit EU headquarters in Luxembourg. Most of these insurers have already started operating with their new licences, which contributed to growth in premium income in Luxembourg's non-life sector of more than 23% over the first nine months of 2018. However, Luxembourg fears a 'lose-lose' Brexit despite financial sector gains.

It remains to be seen how Brexit will affect value added and employment in Luxembourg. STATEC stated that approximately 500 direct jobs in asset management alone were created in 2018 as a result of relocations, twice as many as in 2017. Brexit relocations should create about 3,000 new financial centre jobs in Luxembourg by the end of 2019.

Balanced Public Finances

Luxembourg's public finances are in very good shape and are fully compliant with all EU SGP criteria. Over the medium term the overall budget situation has improved, strengthening competitiveness, enhancing living standards and boosting trust in the economy. The situation of public finances in 2018 was mainly characterized by investment spending, which, despite its already high level, was set to increase by 7.0% in 2019. This is in line with the Government's desire not only to make up for delays but also to prepare the country's infrastructure for future challenges. Public investment priorities include education for children, housing and public transport. The Government will also increase investment in sport, culture and public safety.

For the eighth consecutive year the country's public finances recorded a surplus, which in 2018 stood at 2.4% of GDP (compared with 1.5% in 2017), or €773m. The state budget averaged 1.9% of GDP from 1995 until 2018, reaching an all-time high of 6% of GDP in 2001 and a record low of –1.3% of GDP in 2004. The public administration balance for 2018 is being revised upwards by €314m., or 0.5% of GDP, compared with the figure in the 2018 budget. The public administration balance is €647m., which represents a decrease of €211m. compared with 2017. This development can particularly be attributed to the delayed impact of the 2017 tax reform, as well as the fact that only part of the impact of the 2017 outperformance of corporate income taxes was felt in 2018. The government deficit therefore increased from €220m. in 2017 to €587m. in 2018. Nevertheless, this represents a more favourable balance than the one projected in the 2018 budget, which was still forecasting a deficit of €890m. In local government, the surplus rose from €81m. to €194m. The social security surplus increased slightly, from €996m. to €1,040m. Despite the fact that Luxembourg's fiscal position is among the strongest in the EU, long-term fiscal sustainability concerns remain given the projected increase in costs due to an ageing population. Forecasts suggest a gradual improvement in the central government balance over the next few years; it should reach a deficit of €1,696m. by 2021 (2.5% of GDP).

The country has managed to maintain its low level of public debt as well as a significant budgetary safety margin with respect to the Maastricht deficit reference value of 3% of GDP, demonstrating the Government's commitment to sound fiscal policies. Luxembourg's government debt continues to be among the lowest in Europe. It reached 21.4% of GDP in 2018, four times lower than the eurozone average of 86.1%. From 2018 onwards, the level of public debt relative to GDP should continue its downward trajectory to reach 18.8% of GDP by 2022, the lowest level since 2011. It is well below the 30% of GDP threshold set in the 2013 government programme.

After three years of strong growth, investments increased by 14.5% in 2017 and 9.3% in 2018, reaching a record level of 4.0% of GDP. This increase is likely to continue, with growth set to reach an average of 4.7% of GDP in the period 2020–22. The tax reform which came into force in 2017

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involves a significant reduction in personal taxation and also in corporate income tax, with the aim of boosting the purchasing power of households (which, in 2018, was 32% above the European average). To encourage equality and social cohesion in line with the traditional Luxembourg social model, this tax reform protects people on low incomes, single parents with dependent children, those just embarking on their working lives and the middle class. These measures, in synergy with the social component of the government programme 2018–23 will have a negative impact on the budget, ranging from 0.7% to 1.7% of GDP in 2018 (as predicted by STATEC and the BCL). However, the reform is expected to result in a broadly balanced fiscal position over the medium term.

Recent changes to tax legislation, to strengthen investment and innovation and improve the competitiveness of firms, include: lowering the income tax rate for local authorities (from 21% to 19% for the 2017 tax year, then down to 18% for 2018 and 17% for 2019); increasing the rate of investment tax credit (from 12% to 13% for overall investment, together with an increase in the scope of application for innovative fields such as software and electric cars); and introducing a special tax regime for intellectual property (exemption of 80% of net eligible revenue, adjusted and compensated). With the lowest debt-to-GDP ratio in Europe and strong economic foundations, Luxembourg is the only eurozone country apart from Germany to have been awarded an AAA credit rating by all the major financial ratings agencies—a major asset for the country. The main challenges facing Luxembourg are the rising costs of an ageing population—among the highest in the eurozone—as well as the introduction of measures designed to standardize financial practices.

Strengths and Weaknesses of a Highly Specific Employment Market

Luxembourg's employment market reflects the dynamic international environment that characterizes the country. In 2018, however, job creation slowed in most sectors, with the notable exception of the financial and construction industries. Since August 2014 the unemployment rate has fallen significantly, passing below the 7% barrier in March 2015 and reaching 6.0% in March 2017, 5.7% in March 2018 and 5.1% in January 2019. With 5.9% year-over-year growth, business services continued to make the strongest contribution to employment growth in spring 2018, led by accounting activities, agency work and the cleaning industry. They were followed by construction (with growth of 4.0%), health and social services (3.6%) and financial and insurance activities (2.9%). The dynamics in the financial sector are variable, from the management of investment and pension funds (with growth of 6.7% in the second quarter) to financial holding companies (known as SOPARFI, 11.2%). This may be partly linked to the Anti-Tax Avoidance Directive that came into force on 1 January 2019, which requires the significant consolidation of Luxembourg's SOPARFI structures. Jobs created as a result of the relocation of financial activities affected by Brexit represented one-quarter of net job creations in the financial sector in 2018. It is also worth noting that several global industrial groups are based in Luxembourg (such as ArcelorMittal, Goodyear, Guardian and Dupont), as well as communications giants (leading broadcaster RTL Group, and the Société Européenne des Satellites—SES, the world's leading provider of communications and television broadcasting services) and multinationals in the digital economy (Skype, iTunes, PayPal, eBay and Amazon.com).

At the end of the first quarter of 2019, Luxembourg had 431,462 employees, 233,801 of whom were residents and 197,661 cross-border workers. The paid workforce is composed as follows: 45% cross-border workers (one-half of whom are French, followed by Germans and Belgians), 27% Luxembourgers, 24% EU nationals and 4% third-country nationals. Weak labour market outcomes for low-skilled workers, older workers and, to a lesser extent, women remain an important policy challenge. Regardless of strong economic growth and innovative measures taken by the national employment agency, youth unemployment (people under 30) remains high, at 14.6% in June 2019. This indicator averaged 10.67% from 1983 to 2019, reaching an all-time high of 22.7% in September 2014 and a record low of 2.7% in April 1991.

Luxembourg has a highly qualified workforce: the percentage of 30–34-year-olds with a higher education qualification stood at 54.3% in 2018, one of the highest rates in Europe. The country is therefore not too far from its 2020 target of 66% (higher than the Europe-wide target of 40%). Two-thirds of jobs created in Luxembourg are aimed at higher education graduates, a trend that was

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confirmed by the 2014–15 reform of the government-funded grant scheme for students in higher education, which was also extended in 2017 to the children of cross-border workers. Secondary education remains a cause for concern: basic skills outcomes are lower than the EU average, and this performance worsened between 2012 and 2018. According to the OECD PISA rankings, out of 52 countries, Luxembourg is 28th, behind neighbouring countries Germany (12th), Belgium (21st) and France (27th). These results can be attributed primarily to the socioeconomic difficulties encountered by pupils (50% of 15-year-old pupils are immigrants), but also to the challenge posed by the trilingual approach of the Luxembourg school system. The reform of fundamental education (the first nine years of schooling) began to be implemented from the start of the 2017 academic year. Adapting teaching and professional training to meet the needs of the employment market remains a major challenge. Since 2018 the final package of measures in the secondary school reform has been implemented, with the aim of diversifying the range of subjects available by giving teachers more freedom and introducing several structures and mechanisms to improve support for pupils with specific and special needs within the regular school system.

Luxembourg is coping well with the influx of refugees, which includes minors applying for international protection. In 2017 the authorities recorded 2,322 requests for asylum, compared with 2,035 in 2016 and 2,447 in 2015—a record year. Most were from Syria (368 people), ahead of Eritrea, Morocco and Serbia. Under the EU's relocation programme, the country also welcomed 577 migrants via Greece and Italy. A total of 1,152 people were awarded refugee status. On average, it took 7.5 months for each individual concerned to receive a response to their request. Building on past experience, the authorities prefer to accommodate families with children, which are considered easier to integrate over time. To help enrol refugees in schools, training programmes and language classes, the authorities have made an appeal for retired teachers to return to work. Special measures have been taken to create welcome classes in primary and secondary schools focused on learning the language of instruction. These are also available to young adults. Poverty and social exclusion (affecting 19% of the total population) are among the lowest in the EU. High real estate prices are one of the main causes of social exclusion. Social transfers play a vital role in overcoming poverty, especially in view of increasing wage inequalities.

A Competitive Business Environment in the Digital Era

After several years of mixed performances, Luxembourg's business environment has experienced a marked improvement since 2016, driven to a large extent by increased economic efficiency and competitiveness, reforms introduced by the Government and a more positive sentiment among business circles. In 2018 there were 35,113 companies in Luxembourg, 1,380 more than in 2017 (an increase of 4.1%), with almost one-quarter involved in trade, 22.4% in specialist, scientific and technical activities, and 11.87% in the construction industry. Some 29.8% of companies are based in Luxembourg City and the surrounding area. The proportion of financial, insurance and reinsurance services is just 3.9%, but these serve as the driving force of the economy in terms of value added. This sector was likely to continue to grow in 2019, and the positive impact of Brexit (especially company relocations) should soon become apparent. Some 93% of Luxembourg companies had fewer than 20 employees in 2018, and those with more than 250 employees represented just 0.5% of the country's economic fabric. Small and medium-sized enterprises (SMEs—those with fewer than 250 employees) represented 99.6% of all the country's companies, employing some 210,000 people (68.1% of the active population) and contributing 69.8% to the economic value added. Since 2016 Luxembourg's strong position in international comparisons and benchmarks has helped to boost its image in the business community as a dynamic, open economy that is conducive to the development of growth projects. It should also be noted that in 2018 1,195 companies filed for bankruptcy, 30% more than the figure of 935 in 2017. The number of companies more than five years old entering insolvency in 2018 represented 78.2% of all company collapses.

The main stakeholders (Chambers of Commerce, Trades, Crafts, Tourism, Hospitality, etc.) have worked alongside the Government within a high-level committee to boost SMEs and entrepreneurship. In February 2019 Luxembourg announced its fifth National Action Plan to support SMEs, which consolidates the measures introduced by the fourth plan in March 2016, especially with

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effective, innovative instruments such as the SNCI, the secure interactive platform guichet.lu, through which individuals and companies can carry out administrative procedures online, the business inventory (cadastre du commerce) and the launch of LëtzShop. The plan also includes new strategies to help SMEs access additional funding for the digital transition and introduces a ‘second-chance entrepreneurship’ scheme, which gives bankrupt entrepreneurs another chance after a failed business venture. In July 2018 the Chamber of Deputies adopted a new financial aid scheme for SMEs. The budget of €89m. for the period 2018–22 (an increase of 27% over the previous five years) is designed to foster entrepreneurship, develop smart regulation, promote the growth of the labour market, facilitate access to finance, set up a more innovation-friendly business environment and help SMEs to enter international markets.

The European Commission’s latest Digital Economy and Society Index (DESI 2019) places Luxembourg in sixth position in the EU for the integration of digital technology by companies. Compared with 2017, Luxembourg has gained 16 places, largely because the multidisciplinary ‘Digital Lëtzebuerg’ initiative has begun to bear fruit. Launched in 2014 by the Government together with private, public and academic stakeholders, this strategy aims to make a ‘positive digital transformation’ based on five priorities: skills, policy, infrastructure, ecosystem and government. In December 2017 the Government adopted the Research and Innovation Smart Specialization Strategy, focusing on various priority sectors (industry, environmental technologies, health technologies, logistics, information and communications technology—ICT and space). Considerable progress in digitalization has been made in terms of policy, at government level (including administrative bodies) and within education, but the introduction of digital technologies in companies remains a challenge. In 2018 the Ministry of the Economy and its partners launched a scheme for the digitalization of SMEs. In connection with the ‘third industrial revolution’ (see below), such programmes are helping to boost the efficacy of the ‘Pakt PRO Artisanat’ and ‘Pakt PRO Commerce’ initiatives introduced by the Government in 2017. At the same time, by participating in programmes and networks at European level and with its neighbours, the country’s economic stakeholders have been able to defend Luxembourg’s specific interests and make better use of the opportunities provided by the single market.

In May 2019 the new Luxembourg Government published the country’s new digital strategy based around artificial intelligence, which it identified as its ‘main strategic tool’. ICT is central to these measures, which focus on strengthening the digital infrastructure, supporting companies with the integration of innovative digital technologies and creating a favourable legal and financial framework. The main avenues for action are ‘industry 4.0’, big data production and storage, logistics, eco-technologies, health technologies, the space industry and financial services.

Although Luxembourg excels in areas such as contract enforcement, cross-border trade and building permit acquisition, and the country is the European leader in terms of arbitration and business conflict management, there is still scope for improvement with regard to its management practices and access to some independent professions such as law, architecture, engineering and health care, and it needs to open up its network industries (e.g. postal services and telecommunications) to competition, since the service providers in these sectors are still entirely state-owned.

Space as a New Opportunity

Since Luxembourg joined the European Space Agency (ESA) in 2005, the country’s space industry—which particularly draws on its experience as a world leader in satellite communications—has grown steadily. Luxembourg has tripled its budget for space technology over the past five years, and this sector plays a major role in the country’s economy, representing 1.82% of GDP, with approximately 1,000 jobs and more than 40 companies (including the satellite operators SES and Intelsat, and three government-funded organizations).

The Luxembourg Space Agency was set up in 2017, together with a dedicated investment fund of €200m. To date, eight new companies have been established, one-half of them under the flagship initiative SpaceResources.lu. Launched in 2016, this programme has successfully positioned

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Luxembourg as a pioneer in the exploration and use of space resources. Luxembourg's government has become a shareholder of Planetary Resources, investing €25m. in direct capital and recreating the same public-private partnership model established in 1985 with SES, of which the Government holds nearly 17% of the capital. The Luxembourg Space Cluster, which fosters innovation, technological co-operation and synergy between networks of private and public stakeholders in the field, is at the forefront of the series of clusters for creativity and innovation set up in Luxembourg. The EIB is also involved in the project, together with the ESA, which will offer guidance via its European Investment Advisory Hub.

Luxembourg is globally recognized for its ambition in this field and is one of the main players in the commercial space sector, which has also enabled it to attract companies from other sectors of the space industry such as telecommunications and Earth Observation. In 2018 the Ministry of the Economy held the first Mining Space Summit, attended by stakeholders from the space sector and the mining industry with the aim of launching scientific, technological and financial co-operation. The country also hosted the Space Forum, Asteroid Day and NewSpace Europe. In 2018 around 30 new projects were implemented in connection with programmes run by the ESA and the national space programme LuxIMPULSE. Luxembourg is set to play a key role in the EU Space Programme for 2021–27. Luxembourgers have also been appointed as Vice-Chairman of the ESA Council and Chair of the ESA's Joint Board on Communication Satellite Programmes. In June 2018 the ESA announced that it was setting up a European Space Education Resources Office for Luxembourg, in a bid to support the national education system in teaching people about space. In Luxembourg, this task will be carried out by the Luxembourg Science Center, which will join a network of some 15 ESA member states already active in this field.

From the start of the 2019/2020 academic year, the University of Luxembourg is offering an Interdisciplinary Space Master's degree focusing on the space industry, which will train engineers in robotics, autonomous systems and artificial intelligence, as well as providing a grounding in business development. This new study programme—which is markedly different from Master's programmes offered at other universities—reflects the Luxembourg Government's objective to become Europe's hub for new space activities, in particular in the field of the exploration and use of space resources.

In connection with the SpaceResources.lu initiative, international co-operation has been furthered by the signing of co-operation agreements with other countries and exchanges to create a favourable regulatory framework for commercial space activities. In 2018 new agreements were signed with China, Poland and the Czech Republic (Czechia), following on from those concluded with Portugal, Japan and the United Arab Emirates. The agreement with China includes co-operation with the Chinese Academy of Sciences' National Space Science Center, with the aim of creating a space exploration laboratory in Luxembourg. In May 2019 Luxembourg and the USA signed a memorandum of understanding that will serve significantly to deepen co-operation in the field of space by facilitating space research, exploration, development and use, not only by the two countries' Governments but also by research institutes and private-sector space companies. Luxembourg has also been involved in UN activities in the area of space, and it participated in the high-level International Space Exploration Forum (ISEF2). On the margins of this forum, an agreement was signed between the University of Luxembourg and Tohoku University in Japan to strengthen co-operation in the field of robotics and autonomous systems.

Making a Success of the 'Third Industrial Revolution' in a Data-driven Economy

Luxembourg is pursuing a transition towards a new industrial model. A strategic study on the 'third industrial revolution', commissioned by the Government was released in 2016. The study encourages the transition to a new industrial model based on the convergence of ICT, renewable energy and new transport methods, via a participatory, collaborative approach. Targeted areas include increasing energy efficiency, developing a high-performance computing infrastructure and setting up technology platforms for co-located industry and university researchers working on common cross-cutting issues. This role of Luxembourg as a laboratory for a knowledge-based, sharing economy further boosts the country's image as a 'smart nation'.

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Since late 2016, a collective process has been initiated and effective cross-sector governance has been introduced, enabling socioeconomic stakeholders to collaborate within nine different platforms (energy, mobility, construction, food, industry, finance, smart economy, circular economy and the prosumer and social model), meeting regularly to discuss and take decisions in these areas. This has led to a new type of convergence between industry, energy and digital technology, shaped by environmental concerns, and therefore to a new socioeconomic model for Luxembourg. Under the Europe 2020 strategy, the country has set itself ambitious national objectives for 'smart, sustainable and inclusive' growth and has identified innovation as its driving force. The consolidation of a knowledge-based economy has become a major political priority. In 2018–19 topics for debate included public procurement, regulation and taxation, raising awareness of the circular economy, and new products, services and circular business models, resulting in the announcement of a number of 'circular' measures in the 2018–23 coalition agreement, particularly driven by Déi Gréng.

The strategy roadmap focuses on nine priority objectives, on which progress has been made as follows: development of a national energy internet (80%); smart, sustainable, circular and zero-energy districts (80%); promotion of the circular economy by public contracts (80%); gradual introduction of mobility as a service (80%); promotion of electromobility and of no-emission technologies for personal vehicles (80%); technological platforms jointly developed for industry and public research (25%); the Luxembourg Sustainable Development Finance Platform (50%); sustainable food production (25%); and implementation of a high-performance computing (HPC) infrastructure (80%).

Digital transformation is happening at a scale and speed that brings immense opportunities for innovation, growth and jobs in Luxembourg. The vision of data usage as central to economic and social development (a 'data-driven economy') is reflected in the 'Digital Lëtzebuerg' strategy, which aims to turn Luxembourg into a 'smart green digital nation'. This strategy consolidates ICT as a field of excellence for the economy and encourages the creation of start-ups in the areas of e-commerce, digital content, cloud computing, big data and e-skills. Particular efforts are being made to digitize government services in a move towards greater transparency and access to information. The investments made in digital infrastructure in recent years have placed Luxembourg second within the EU in terms of connectivity, a position which will undoubtedly be consolidated by the Government's '5G strategy for Luxembourg'. In parallel, a new strategic vision on artificial intelligence will further support the country's ambition to be one of the most advanced digital societies in the world. Also noteworthy is the agreement announced in 2018 between the European Patent Office (EPO) and Luxembourg for the externalization of the EPO's data centres. This decision was fuelled by the need to protect the 'inviolability' of the EPO's archives, a right guaranteed by its immunity at European level.

Luxembourg has been chosen to host the headquarters of the future multi-billion-euro European Commission EuroHPC Joint Undertaking. The Meluxina supercomputer, with a calculating power of 10 petaflops (10,000,000,000m. operations per second) and a cost of €30.4m., will be hosted, operated and marketed at the LuxConnect data centre in Bissen, and powered exclusively by green energy produced in part by KioWatt, a co-generation plant fuelled by scrap wood. Meluxina is scheduled to become operational in 2020. It will facilitate the digital transition of the economy and will be used for applications in the areas of research, personalized medicine and eHealth projects, as well as for the needs of companies (SMEs and start-ups) and the financial centre. The name 'Meluxina' is derived from the legend of Luxembourg's founder Count Siegfried and the mythical figure of Melusina, and is visually linked with the nation-branding signature 'LuXembourg—let's make it happen'.

Between 2000 and 2018 investment in public research increased more than fivefold, with one of the Government's key projects being the Cité des Sciences in Belval, which is home to another hub of research and knowledge, the University of Luxembourg, as well as the country's main funding institutions for research and development, the National Research Fund (FNR) and Luxinnovation. This multidisciplinary, multisector platform houses nearly all of the country's higher education, research and innovation activities, together with innovative private companies such as the Technoport and the House of BioHealth. The country plans to build an attractive digital health ecosystem during

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2019–23, with the aim of accelerating the transition in Luxembourg from a public research-driven to a business-driven innovative biomedical ecosystem.

Luxembourg is therefore consolidating its growth by investing in the intangible dimension of productivity: education, research and innovation. The diversification of the economy involves identifying niche skills and specializing in high-value-added activities such as technology-intensive industries and knowledge-intensive services, especially in the fields of computer science, intellectual property, consultancy, telecommunications, logistics and infrastructures.

Given its specific characteristics, Luxembourg faces a considerable strategic challenge if it is to guarantee its future in a globalized economic and energy environment. It needs to diversify its economy while safeguarding the competitiveness of its financial sector and the long-term sustainability of the Luxembourg social model, characterized by a high standard of living, high employment and a good level of social cohesion. The country's ageing population and the related welfare expenditure could jeopardize the long-term viability of its public finances. Luxembourg's first place at social level according to the new system of indicators established by the ODC is a significant achievement. But if it is to preserve these social gains, it must ensure that they are fully compatible with the country's economic performance, in other words its competitiveness and productivity. If not, in the medium and long term, this social system, considered as the best in Europe, may be found to be lacking in substance. The ODC indicators show that the country's macroeconomic performances are strong (in terms of government debt and GDP growth rate). However, it is lagging behind in terms of cost competitiveness (last place for the 'profitability of non-financial corporations' indicator) and non-cost competitiveness ('R&D spending' and indicators related to entrepreneurship). It is therefore important to work on these essential drivers that will enable Luxembourg to move from a model of extensive growth, based on improvements in employment and GDP, to a model of qualitative growth, mainly fuelled by gains in productivity.

Conclusion

Luxembourg's economy has come a long way since the Second World War, especially in recent years. The once bipolar agricultural/industrial society has become a competitive society largely based on knowledge-intensive services, characterized by high-performing human capital, political stability, prosperity and a strong welfare system. Among the key growth factors for Luxembourg, five can be identified as particularly important: the country's integration into larger economic areas; the systematic development of infrastructures; a permanently available workforce (through migration and cross-border workers); the existence of growth niches and high-value-added economic diversification; and a high level of social protection. The country's proactive political leadership, a source of long-term continuity, has turned exogenous challenges into opportunities, integrating them into a creative economic policy. Within Luxembourg's long-term strategic vision, the economy has been the main area on which political platforms have converged, underpinned by two pillars: a balanced approach and a culture based on consensus and peaceful labour relations. The 'Luxembourg consultation model' and Luxembourg's specific brand of social stability largely reflect this: agreement is reached between the 'social partners' (within the Tripartite and the Economic and Social Council) before legislation is adopted by the Chamber of Deputies, thereby creating an environment conducive to social solidarity where any potential disagreements can be identified and resolved in advance. The country has consolidated its national identity by opening itself up to the international community. Looking to the future, if Luxembourg is to safeguard its welfare state and boost competitiveness, it will have to tackle three recurrent issues: an ageing population, unemployment (especially among young people and over the long term) and the sustainability of the social security system.

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