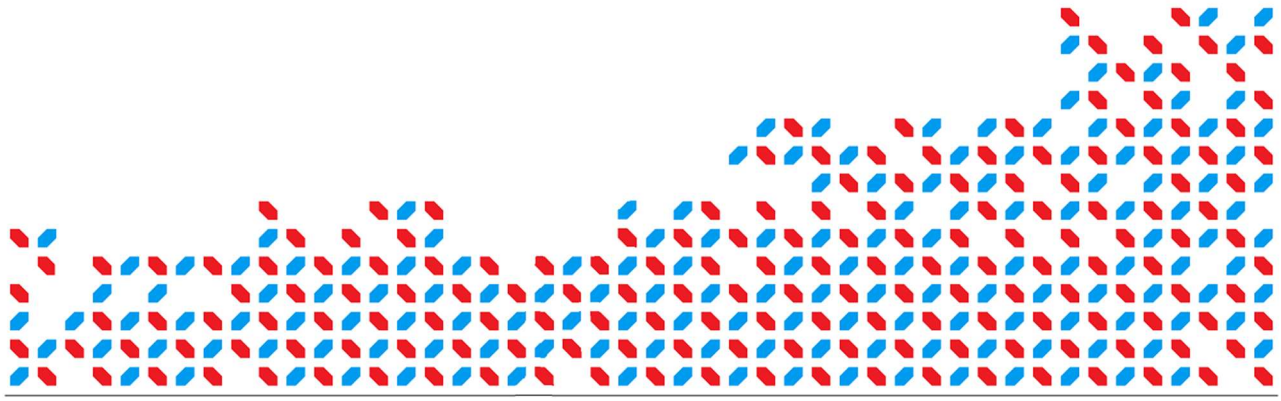
Ons Wirtschaft vu muer

Roadmap for a competitive and sustainable economy 2025

Ministry of the Economy I June 2021



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I. Introduction

Luxembourg is once again at a pivotal moment in its economic development, having successfully navigated a number of global crises, from the collapse of the steel industry in the last century between 1975 and 1985, through the global financial crisis of 2008, and now emerging from the COVID-19 pandemic-induced crisis of 2020. This ability to adapt is reflected in Luxembourg's ranking amongst the top 10 most resilient economies in the world[1].

As our country has steered successfully through different crises, it has also successfully transitioned from a largely steel manufacturing base to become the 4th most globalized economy in the world[2], one of the top two European Union financial hubs[3], a key player enabling financial connectivity along the Eurasia route[4], a country that has created the world's largest commercial satellite operator[5], a pioneering European logistics hub integrated into global supply chains, a European digital front runner[6], and a strategic European Union digital pole[7], in less than half a century.

In the past, Luxembourg has therefore already demonstrated both the energy and determination necessary to accelerate post-crisis into a new economic model to drive future economic growth and prosperity. The Luxembourg economy is now gearing up to do so again following the COVID-19 pandemic.

This document proposes a vision and path forward, a Roadmap for a Competitive and Sustainable Economy, for the Grand Duchy of Luxembourg in the coming years. This explains the title "Ons Wirtschaft vu muer" (our economy of tomorrow). It addresses the industrial innovation policies, regulation, financial instruments and actions necessary to support the rapid emergence of a competitive, resilient and sustainable economy in Luxembourg. It sets out a number of Pilot Actions over the short and medium term that both address the need to implement immediate recovery measures for the economy whilst at the same time accelerating the economy in a strategic direction for the future.

1 Luxembourg is ranked as the 7th most resilient economy in the world, 2020 FM Global Resilience Index

[2] ETH Zürich's KOF Globalisation Index, 2019.

[3] Global Financial Centres Index 24, the New Financial International Financial Centre's Index, as well as the Global Green Finance Index (GGFI).

[4] Approximately 80% of European assets invested in Mainland China are Luxembourg funds. Luxembourg is equally the largest listing centre for Dim Sum bonds outside Asia.

[5] Created in 1985, the Luxembourg government-supported SES (Société Européenne des Satellites) is today the world's largest commercial satellite operator.

[6] Digitising Europe, The Boston Consulting Group, 2016.

[7] Luxembourg is ranked number 2 in the EU in digital connectivity in the EU DESI index. It has the highest density of Tier IV data centres in Europe. Luxembourg is the "Digital Pole", the "Digital Connectivity Hub" of the European Commission and now hosts the Digital IT arm of the European Commission (DIGIT), along with several Directorates from the Commission's Directorate General for Communications Networks, Content and Technology.

This Roadmap for a Competitive and Sustainable Economy also takes note of, and leverages, the joint efforts of the European Council, the European Commission and other European institutions, to chart a comprehensive European recovery plan[8]. The Roadmap, through its design, also integrates measures to address key European Union and Luxembourg ambitions: the transition towards climate neutrality by 2050, global leadership of the digital revolution in an increasingly digitised economy and society[9], and the implementation of the 2030 Agenda. It is the belief of the Ministry of the Economy that the Green transition and the Digital transformation can play a central and prioritised role, both in relaunching our economy and in best positioning Luxembourg for the future.

Finally,"Ons Wirtschaft vu muer" is cognizant that the world has changed beyond all recognition since the global financial crisis of 2008. Our world today is far more complex and competitive, as well as more vulnerable, than before, and is changing at unprecedented pace. The COVID-19 pandemic of 2020 rendered visible some of the challenges arising from current global Megatrends (see Appendix I), in particular geo-economic and geo-technical elements. For example, the complexity of global supply chains that need seamless logistics operations to function properly coupled with the lack of appreciation of the importance of flexible and resilient strategic value chains in the overall economic resilience of advanced economies. This Roadmap therefore also takes into account insights from current global Megatrends and proposes specific measures to both better anticipate some of the challenges that might confront our economy, and position Luxembourg to take advantage of future opportunities in the coming years in key identified strategic sectors.

Although this roadmap is focused on Luxembourg, the scale of the challenges to be faced and the opportunities to be seized require a solidarity-based and cooperative approach with the Greater Region, the Benelux countries and Europe. The Covid-19 pandemic reminds us of the importance of solidarity and cooperation, which are built over the long term and essential in times of crisis.

Reflecting these principles, "Ons Wirtschaft vu muer" is built around six key pillars to fast-track and drive the development of a competitive, resilient and sustainable economy in Luxembourg poised for future opportunities:

[8] A Roadmap for Recovery: Towards a more resilient, sustainable and fair Europe, www.consilium.europa.eu, 21-04-2020.

[9] "Political guidelines for the next Commission (2019-2024) – A Union that strives for more: My agenda for Europe", Political Guidelines of European President Von der Leyen, 2019.

- *Building block 1: Accelerating across all key sectors the digitalized economy for societal benefit*
- *Building block 2: Driving the digitally enabled circular economy transition*
- *Building block 3: Developing resilient strategic value chains*
- *Building block 4: Enabling a secure and trusted data-economy transformation*
- *Building block 5: Ensuring a sustainable digital transition*
- *Building block 6: Providing a supportive investment environment and instruments to achieve competitive sustainability*

In summary, this document provides a roadmap including a comprehensive set of actions that will boost productivity across the entire Luxembourg economy.

II. Background EU context:

The European Council, in its meeting on 23 April 2020, approved *"A Roadmap for Recovery: Towards a more resilient, sustainable and fair Europe"*, to provide a coherent framework for joint action towards overcoming the crisis and moving forward[6]. In response, the Commission presented at the end of May 2020 a very wide-ranging package combining the future Multiannual Financial Framework (MMF 2021-2027) and a specific Recovery effort under Next Generation EU (NGEU), adopted by the European Council on 21 July, 2020[10].

The conclusions of the Special European Council, 17-21 July, 2020, highlighted the central and prioritised role of the Green transition and Digital transformation in relaunching the European economy. It therefore deepened focus on the two key overriding European Union ambitions and priorities, the transition towards climate neutrality by 2050 and global leadership of the digital revolution in an increasingly digitised economy and society. In addition, both the roadmap and subsequent Council conclusions emphasized the importance of strategic autonomy and that strategic value chains be re-established in Europe.

The European Council recovery plan builds on the series of strategies and action plans published by the von der Leyen Commission over the past year. These include:

- The European Green Deal communication[11]
- A new Circular Economy Action Plan for a More Competitive Europe[12]
- The Strategy on Shaping Europe's Digital Future[13]
- A European Strategy for Data[14]
- A New Industrial Strategy for Europe[15]
- An SME Strategy for a Sustainable and Digital Europe[16]
- The European Data Governance Act[17]
- The Intellectual Property Action Plan to support recovery and resilience in the European Union[18]

The following section presents an overview of the vision guiding the development of the Roadmap. The six key building blocks are presented along with short-term Pilot

[10] www.consilium.europa.eu/media/45109/210720-euco-final-conclusions-en.pdf
[11] The European Green Deal COM (2019) 640
[12] A new Circular Economy Action Plan for a Cleaner and More Competitive Europe COM (2020) 98
[13] The Strategy on Shaping Europe's Digital Future COM (2020) 67
[14] A European Strategy for Data COM (2020) 66
[15] A New Industrial Strategy for Europe COM (2020) 102
[16] An SME Strategy for a Sustainable and Digital Europe COM (2020) 103
[17] The European data Governance Act COM(2020) 767 final
[18] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Making the most of the EU's innovative potential: An intellectual property action plan to support the EU's recovery and resilience COM(2020) 760 final

actions to drive an immediate stimulus into key strategic sectors, and a series of medium-term Pilot actions assuring synergy with and leveraging from European Commission innovation, incentive and recovery initiatives.

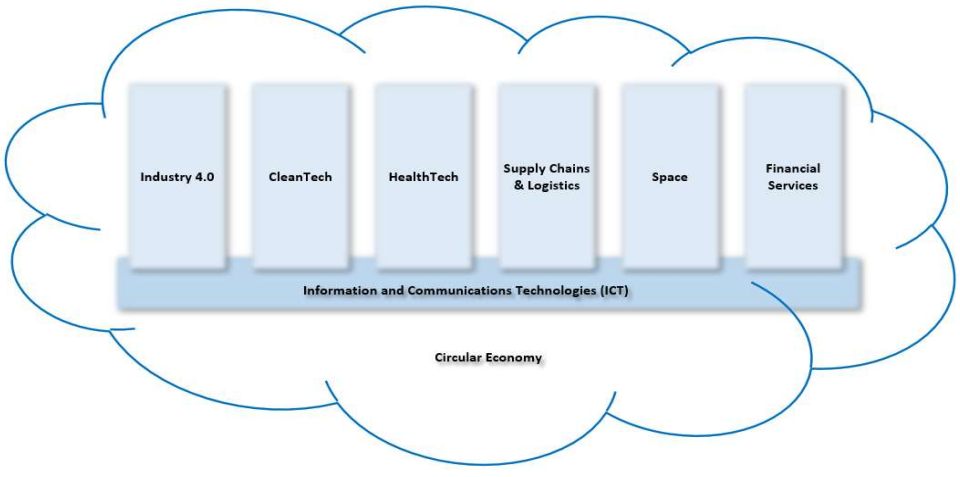
III. Luxembourg vision and path forward

The Ministry of the Economy's Roadmap is based on a vision of a Luxembourg economy that is:

- competitively sustainable
- a European leader in the full digitalisation of key strategic sectors
- the European leader in using digitally enabled solutions for the circular and resilient economy transition
- the European leader in ensuring the security and trust of the data-driven economy transformation in a complex geopolitical environment
- a leading European logistics hub embedded in global supply chains
- a lead actor in developing resilient and low-carbon strategic value chains within Europe
- the first European Union member state to align and translate the twin Union goals of climate neutrality by 2050 and global leadership of the digital revolution into a single roadmap.

> The overall goal of this Roadmap for a Competitive and Sustainable Economy is to propose a direction forward and paths of action for Luxembourg to achieve the above vision, and in so doing, accelerate the relaunch of a sustainable, resilient and competitive economy fit for the future.

The current government programme, within the framework of the remit of the Ministry of the Economy focuses on seven priority sectors: Industry 4.0, Clean Tech (including Circularity and Smart Mobility), Health Tech, Supply Chains and Logistics, Information and Communication Technologies (ICT), Space, and Financial Services (from the data economy perspective) as shown below:



”Ons Wirtschaft vu muer” is constructed around six building blocks to relaunch the economy and accelerate the economic transition in the above key sectors:

Three vertical initiatives address targeted sectors and industries:

- *Building block 1: Accelerating the digitalized economy for societal benefit*
- *Building block 2: Driving the digitally enabled circular economy transition*
- *Building block 3: Developing resilient strategic value chains*

Three horizontal initiatives cross-cut all sectors and underpin Blocks 1-3:

- *Building block 4: Enabling a secure and trusted data-economy transformation*

- *Building block 5: Ensuring a sustainable digital transition*
- *Building block 6: Provide a supportive investment environment and instruments to achieve competitive sustainability*

This Roadmap builds on the existing National Data-driven Innovation Economy strategy[19], the strategy on Artificial Intelligence[20], the strategy for a circular economy Luxembourg[21], the National Research and Innovation Strategy[22] and on certain elements of the 3rd National Plan for Sustainable Development (NPSD)[23] and the National Energy and Climate Plan (PNEC)[24]. It is in alignment with the European Council Roadmap for Recovery and leverages the European Commission policy initiatives on the Green Deal, the Circular Economy Action Plan, Shaping Europe's Digital Future and the New Industry Strategy for Europe. It contributes to the implementation of the United Nations 2030 Agenda, it also clearly addresses future challenges posed by current Megatrends and their potential impact on the Luxembourg economy, enabling a holistic response for the economy. In this context, and in view of a number of cross-cutting issues and projects -- also impacting the financial sector -- the Ministry of the Economy will cooperate closely with the Ministry of Finance, in order to fully take into account the importance of the financial centre for Luxembourg's economic development as well as the inter-connectivity between economic sectors.

This roadmap takes into account that the national Intellectual Property policy contributes to preserve and strengthen technological innovation. Intellectual Property assists determine the market value and competitiveness of Luxembourg-based companies[25]. The importance of intangible assets, such as trademarks, designs or

[19] The data-driven innovation strategy for the development of a trusted and sustainable economy in Luxembourg, May 2019, Ministry of the Economy, The Government of the Grand Duchy of Luxembourg

[20] Strategy on artificial intelligence, a strategic vision for Luxembourg, May 2019, Digital Luxembourg, Government of the Grand Duchy of Luxembourg

[21] Strategy for a circular economy Luxembourg, February 2021, Ministry of Economy, Ministry of the Environment, Climate and Sustainable Development, Ministry of Energy and Spatial Planning, Government of the Grand Duchy of Luxembourg

[22] National Research and Innovation Strategy, February 2020, Ministry of Higher Education and Research, Government of the Grand Duchy of Luxembourg

[23] 3rd National Plan for Sustainable Development, July 2018, Ministry of the Economy, Ministry of the Environment, Climate and Sustainable Development, Government of the Grand Duchy of Luxembourg

[24] Integrated National Energy and Climate Plan, December 2019, Ministry of the Economy, Ministry of the Environment, Climate and Sustainable Development, Ministry of Energy and Spatial Planning, Government of the Grand Duchy of Luxembourg

[25] 45% of Luxembourg's GDP is generated by companies making intensive use of intellectual property. They are also responsible for 38% of the jobs created in the Grand Duchy.
Source : EUIPO Observatory: IP contribution study
euipo.europa.eu/ohimportal/en/web/observatory/home

models, patents, copyrights and neighbouring rights, is constantly increasing. Intellectual Property must be one of the essential elements to help businesses grow, create jobs, protect and develop what makes them unique and competitive.

IV. Ons Wirtschaft vu muer: six key building blocks

Building block 1: Accelerating the digitalized economy for societal benefit

Digital technologies and platforms are already transforming the lives of our citizens, the way they work, and how they communicate and do business as they become ever more integrated across all sectors of our society. During the COVID-19 crisis, services provided by digital online platforms allowed our citizens to remote work from their homes, to order delivery of essential food supplies, to teleconsult with medical doctors, to allow medical staff to telemonitor their health status, and, in particular, to simply remain connected. The Ministry of the Economy fully recognises the importance of these platforms and gives them special attention (building block 4, the data economy).

The surge in e-commerce will most certainly continue in the recovery phase following the economic crisis caused by the COVID-19 pandemic as many retailers that were not fully engaged in online sales prior to the crisis have now seen the benefit of this additional sales channel. Although Luxembourg initiatives such as Corona.letzshop and Letzshop marketplace were successful, logistics players had the challenging task of dealing with last-mile delivery. The end of the crisis will require further reflection on how to digitally optimise last-mile delivery in urban areas.

There is also a renewed interest in, and urgency for intelligent transportation systems (ITS) based on digital technologies, addressing post COVID-19 shared mobility and public transport concerns. The ongoing health crisis is likely to accelerate the deployment of autonomous vehicles (AVs), with an overriding objective to keep transport drivers and operators safe from the virus. In the near future, AVs coupled with robotic assistance will reduce barriers for people with disabilities or the elderly to travel safely, while making it possible to observe social distancing rules.

Finally, at a broader level, digitally enabled space-based systems are revolutionizing the emergency crisis response capabilities of governments and supranational organisations. The SATMED initiative (https://satmed.com/mission) is a high quality e-health platform that is open, easy to use, readily available and accessible anywhere. It is the medical arm of emergency.lu, the Luxembourg disaster recovery communications platform created to improve the rapid-response capabilities of rescue teams in areas hit by severe catastrophes.

The ongoing digitally enabled transformation of our economy [26] and of health technologies, mobility and the retail sector to address our most pressing societal challenges is happening at a scale and speed that will bring immense opportunities for growth and jobs in Luxembourg.

[26] "Digitizing Europe", The Boston Consulting Group, May 2016

The first building block of the Roadmap is therefore to ensure that Luxembourg, and in particular its industrial fabric, is best positioned to participate in and accelerate the inclusive and sustainable digital transformation of key sectors such as health technologies, mobility, retail and space, beneficial for our resident and working populations as well as our fellow EU citizens. Investing in digital technologies and capacities, digital solutions and digital infrastructure to address our most important future societal needs and challenges will help the government contribute to creating jobs and growth, and allow Luxembourg to gain a first-mover advantage in the global digitally enabled race to recovery. It will also help make us more resilient and less dependent by diversifying our key supply chains to ensure more local, regional and European content and by protecting biodiversity and ecosystem services.

Key actions include:

Health technologies: accelerate the development and deployment of “best in class” digital infrastructures, platforms and tools among healthcare players. The joint initiatives by the ministers of Health and Social Security linked to the establishment of the Gesondheetsdësch and the definition of a national eHealth strategy already reflect this objective. By putting cybersecurity at the heart of the development of these infrastructures, Luxembourg will be able to position itself as a leader in terms of trust in its health data ecosystem, enabling the creation of a "Health Data Hub". The Ministry of the Economy will actively participate in the development of proposals that will form the basis for the establishment of the Health Data Hub by the Ministry of Health and the CNS.

The Ministry of the Economy will link this Health Data Hub to a national data exchange platform that it plans to set up. This will provide a strategic tool for positioning Luxembourg as an attractive location for clinical researchers as well as being a unique test bed for the benefit/cost assessment of digital and data-enabled health technologies and solutions developed locally, or from abroad and seeking to enter the European market.

Mobility and Intelligent Transport Systems: Luxembourg has already positioned itself as a living laboratory for intelligent mobility. This is thanks to numerous projects related to intelligent mobility such as the “Cross Border Test Bed” between Luxembourg, France, Germany and Belgium, the “Data Task Force” and the Mobility Innovation Campus in Bissen, as well as excellent connections to European and international private and public players.

Connected and autonomous vehicles currently in development and/or pre-deployment can only be truly exploited by combining the elements of connectivity and cooperation. These vehicles must constantly exchange information with their environment and other road users as well as with remote service providers, who will take care of optimizing flows, reducing the impact on the environment and increasing user comfort. The ongoing digitalisation of the mobility and ITS sector therefore

requires not only digital technologies in smart vehicles, but also ITS platforms within public infrastructure ensuring connectivity and cooperation[27].

In this context, the Ministry of the Economy will continue to bring together private and public players in pilot projects that integrate the key technologies required to create an innovation-friendly ecosystem. These initiatives will be carried out in close collaboration with the Ministry of Mobility and Public Works.

Retail and logistics: The Ministry of the Economy will explore options to optimize last-mile deliveries in urban cities leveraging new technologies to share transport in particular with a view to reducing emissions and resource consumption.

Space data and information market: The Ministry of the Economy will explore the development of a space data and information market place. This will build on European digitalisation initiatives (Collaborative Ground Segments and Copernicus Data Information Access Services, etc.), the Luxembourg Space Agency Data Center at the national level, and leveraging ongoing data-economy initiatives such as the National HPC facility for computation performance and processing capabilities. The objective is to create a favourable environment for the developers of services and applications in areas including the environment, health and transportation.

Other data-rich sectors such as energy and agriculture are also seen as having considerable potential to feed into the national data exchange platform.

Building block 2: Driving the digitally enabled circular economy transition

The Luxembourg Government has long recognized the "connectivity Megatrend" and the importance and potential of general-purpose digital technologies (AI, HPC and Internet of Things (IoT)...) to accelerate the digitalisation-enabled transformation of its existing industry and support the emergence of a Luxembourg data-driven economy. In 2019 this was translated into a data-economy innovation strategy, in close alignment with European Union digital initiatives.

Equally, the Ministry has recognized the potential of digitalisation and connectivity enabled by digital technologies to make products, processes and services circular, to monitor and protect the environment by decoupling emissions and resource consumption from economic activities, and to optimize the way in which energy is used. The Ministry has already supported a number of industrial and logistics projects in these fields - from digitally enabled, resource-efficient 3D additive manufacturing to the use of innovative space technologies for environmental monitoring , the big-data enabled Luxembourg Circularity Dataset Initiative and the Product Circularity Data Sheet (www.pcds.lu).

[27] An appropriate legal basis would also be required.

The second building block of ”Ons Wirtschaft vu muer” is to accelerate the digitally enabled transformation of the Luxembourg economy and, in particular, its industrial fabric so as to underpin our emerging circular economy initiatives and open new opportunities quickly for Luxembourg companies across our strategic sectors.

In line with the European Commission’s new Circular Economy Action Plan, published in March 2020, and our internal reflections on a Luxembourg sustainable product policy framework, specific digitally enabled circular economy-related initiatives in priority economy sectors could include:

- Accelerating the adoption of digital technologies such as IoT and AI in production processes for enhanced sustainability
- Enabling a sustainable construction industry environment leveraging BIM and other approaches
- Digitally enabled design of sustainable products
- Circular business models based on digital technologies such as the performance economy
- Promoting the use of digital technologies for tracking, tracing and mapping of resources
- Leveraging the “Circularity Dataset Initiative” project launched by the Ministry of the Economy and developing the “Product Circularity Data Sheet” (www.pcds.lu) as well as the processes and standards necessary for its implementation.

In parallel, a unique opportunity exists to accompany this digitalisation-enabled circular economy transition in industry by launching an IoT investment programme in the public sector, with the aim of equipping public infrastructure with IoT and connecting them in order to collect reliable circular economy-related data that can be aggregated at a national level to manage efficiently the national stock of materials[16]. This data can then be used by national and local authorities, as well as to set up test beds in order to validate new technologies emerging from start-ups for the digitally enabled circular economy.

Building block 3: Developing resilient and sustainable strategic value chains

The COVID-19 pandemic caused significant disruption to manufacturing industries and their supply chain networks. Large and small companies across Europe and Luxembourg felt the impact of materials shortages in their supply networks and had to take informed decisions to ensure business operations continuity. At the same time, European citizens observed at first hand the impact of offshored manufacturing capacity on the availability of critical medical equipment, pharmaceutical supplies and even items as mundane as plastic gloves. Many companies were unprepared to mitigate the disruption caused by COVID-19 due to the limited visibility in their supply chains that could have helped them to better assess key risks across their operations. The COVID-19 crisis demonstrated the importance of uninterrupted logistics

operations and the need to implement flexible and resilient strategic value chains as part of the overall economic resilience of advanced economies.

The ongoing digitally enabled transformation of the Luxembourg economy, the focus of Roadmap building blocks 1 and 2, provides a previously unimaginable opportunity to implement a post-COVID-19 recovery programme to ensure resilience in industrial manufacturing, supply chains and logistics sectors by contributing to the country's environmental targets. It also provides a very significant opportunity to reshore/attract industry to Luxembourg, building on the country's digital reputation and the possibility of having a "manufacturing licence" customized for use within the European Union. This also reflects an appreciation of the ongoing impacts of a geopolitical Megatrend towards a strong regionalization of capacity and capability.

Through this approach, Luxembourg will leverage the fact that the application of advanced digital technologies and systems to every facet of the manufacturing process is currently reshaping modern manufacturing. This digitalisation of manufacturing is changing the way in which products are designed (e.g. high-performance computing – high-powered computer aided design and engineering software, digital twins), fabricated (3D printing, industrial robotics, machine learning, machine-to-machine communications), used, operated, and serviced post-sale. Similarly, digitalisation is transforming the operations, processes, and energy footprint of factories and the management of manufacturing supply chains and their related logistics operations (smart logistics using wireless connectivity, IoT, advanced sensor technologies, cloud computing and data analytics). Supply chains are increasingly characterized by a high degree of cyber-physical interconnection, enabled by sensors that collect big data for predictive analytics supporting real-time decisions to optimize supply chain performance[28].

This digitalisation of manufacturing and with it, the possibility for endless customization, opens up the potential for developing new strategic value chains and/or reshoring industry. The Roadmap will focus particular attention on fostering European and regional collaborations to ensure greater resilience along these strategic value chains in priority economy sectors.

The recent crisis not only highlighted the complexity of global interconnected supply chains, but also exposed the vulnerabilities of the just-in-time production model to unexpected disruptions. As a response to supply chain risk mitigation, support of automation of operations, implementation of digital technologies to increase process efficiency, and reshoring certain critical production can also be considered.

The resilience of support logistics operations and supply chain management should also be addressed. Increasing end-to-end supply chain visibility will allow companies to manage daily and exceptional uncertainties when connecting supply to demand. Predictive data analytics solutions based on big data coupled with IoT and AI will

[28] WEF White paper "Supply Chain 4.0. Global Practices and Lessons Learned for Latin America and the Caribbean"

support timely and confident decision-making to mitigate risks. Knowledge addressing how to forecast demand, predict disruptive unforeseen events, and take informed decisions on how to react will thus become a strategic asset for companies.

In parallel, a second opportunity emerges in the development of these new strategic value chains. Namely, the value chains in place today are to a considerable degree unsustainable. Responsibility for the ecological impact of a product quickly passes from one actor to another and the end products often fall well short of a design through which their components or materials can be returned to the economy in a circular fashion. Optimization of efficiency is often only performed in any given isolated manufacturing stage. At the level of the product's entire life cycle, the lack of economic and ecological efficiency tends to be considerable and can only be addressed through closer collaboration throughout the value chain. There is thus the opportunity to set up circular value chains and take advantage of the beneficial spin-offs concerning competitiveness, resource productivity, resilience, employment and positive ecological impacts. Circular value chains are also less dependent on raw material imports, meaning they are more resilient, especially in times of crisis.

> This convergence of digital technologies with traditional manufacturing, in synergy with a circular economy strategy for our value chains, will enable our Luxembourg industry to recast the landscape of competitive sustainable manufacturing and local value chains.

Immediate initiatives for post COVID-19 sustainable industrial manufacturing and strategic value chains will, at a generic level, include support for establishing regional industrial production and value chains, leveraging digitally enabled production technologies such as 3D printing, across strategic economic sectors.

In the healthcare sector, a particular opportunity exists to strengthen the local industrial value chain in the field of molecular diagnostics. This will be detailed further in the summary of Pilot 4.

Furthermore, it will be essential for strategic supply chains such as that of healthcare to increase visibility by implementing an approach to mitigate risk in the supply chain.

We need to raise awareness among companies to develop robust risk management processes in their supply chains, and support (where needed) the development of business continuity plans.

Finally, the Ministry will explore other regional opportunities to establish new value chains, such as those arising from the Cross Border Test Bed for Connected and Autonomous Driving (CAD) addressed in Building block 1.

The work carried out by the Research COVID-19 task force on supply chains and logistics has the potential to provide a mapping of the value and supply chains of different sectors of the economy, at the national, regional, European and global levels. This tool will allow for a more targeted identification of actors that could create a more sustainable value chain.

Building block 4: Enabling a secure and trusted data-economy transformation

The emerging “Data-driven economy” constitutes both an opportunity and a competitive challenge. The opportunities will fall predominately to those nations that are best prepared and equipped to compete digitally. Digital data, digital infrastructure and digital knowledge are now considered as strategic economic and competitive assets in all advanced nations, and must be protected. To do this, Luxembourg must become more sovereign in terms of the products and services implemented, equip itself with regulators to guide it, and strengthen confidence in these technologies, promote skills and generally increase digital resilience.

In addressing the need for a digital transformation that is secure for both Luxembourg industry and citizens, Luxembourg will focus on SMEs.

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  Luxembourg is building its transformation towards a data economy on the principles of "Sovereignty", "Trust" and "Resilience".

  The implementation of these three requirements will be carried out in particular through participation in the following two initiatives:

- Creation of a national data exchange platform to position the country among the pioneers of the data economy. The COVID-19 crisis has shown the importance of data, technological blocks linked to data management and digital collaboration to quickly provide healthcare, economic and social responses. Luxembourg has many advantages in terms of developing new economic activities and a new societal model around the exchange and processing of data. The idea is to complement this ecosystem with a national data exchange platform, a transversal, multi-sector and highly secure platform guaranteeing a very high level of protection of privacy, intellectual property and trade secrets. This platform will be implemented as a pilot action (see pilot 1).

- The overriding imperatives of sovereignty and trust will be ensured by the creation of a Luxembourg "secure open cloud" compatible with the Gaia-X initiative and the European federated cloud initiative in terms of interoperability, compatibility and trust. The Luxembourg cloud will be configured to become a key component of the GAIA-X validated infrastructure ecosystem while also being connected to

the European cloud ecosystem. It will be based on *open source* technology to increase its resilience and independence from monopolies and reduce the risk of political or commercial blackmail. The Luxembourg cloud will be implemented as a pilot action (see pilot)

In parallel, the COVID-19 crisis has shown the importance of the resilience of IT structures. We must draw conclusions from this crisis and invest more in the resilience of our essential digital services and ICT infrastructures. Opportunities to be addressed include the projects aimed at strengthening the infrastructure for ultra-high-speed connectivity such as FTTH (fibre to the home), CATV (DOCSIS 3.x - hybrid fibre and cable TV network and, FTTB (fibre to the businesses) – these projects must move faster and possibly integrate secure broadband Wi-Fi or 5G Fixed Wireless Access (FWA) solutions if there are connection problems for the last mile. This development will be at the heart of the review of the ultra-high-speed strategy being developed by the Media and Communications Department of the Ministry of State.

The Luxembourg government will also continue its efforts to develop and implement an ultra-secure communication infrastructure based on quantum technology, closely involving the scientific community and private players.

Building block 5: Ensuring an energy-efficient and sustainable digital transition

It is important for our citizens and industries to realise that digitalisation will not, in and of itself, lead to greater sustainability. In fact, direct and indirect environmental impacts (rebound effects) related to the growing use of digital are constantly underestimated, due to the virtual "invisibility" of digital devices and related infrastructures. The reality is that increasingly massive investments in digital technologies have contributed to a net increase of digitalized sectors' carbon footprint. The trend for the past ten years is towards an increasingly energy-gulping digital world and the scarcity of rare materials, in particular rare metals. We thus need a digitalisation plan that is sustainable while being at the same time energy-efficient, based on the principle that digitisation does not necessarily entail dematerialisation.

The rapid digitalisation of industry and society has led to a rapid increase of the ICT direct energy footprint. This direct footprint has been increasing by 9% per year. Compared to 2010, the direct energy consumption generated by one euro invested in digital technologies has increased by 37%. The energy intensity of the ICT sector is growing by 4% per year, in stark contrast to the trend in global GDP energy intensity, which is declining by 1.8% per year. The explosion of video uses (Skype, Zoom, streaming, etc.) and the increased consumption of digital equipment that is renewed are the main drivers of this inflation. Today approximately 10% of the planet's energy is consumed by the energy requirements of the cloud and related Information and Communication Technology (ICT) infrastructure.

From a Luxembourg perspective, with the acceleration of digitally enabled solutions for a sustainable and circular economy, a rapid growth and build-out of the digital environment is anticipated across all key Luxembourg strategic sectors, which could potentially lead to a significant increase in the state's environmental footprint.

This fifth building block is therefore designed to accompany the digitalisation and transformation of the Luxembourg economy addressed in building blocks 1, 2 and 4, whilst, at the same time, taking all steps necessary to ensure a fair and sustainable transition. This will open up new opportunities for our industry and associated support sectors.

Initiatives around sustainable digitalisation could include:

- Supporting energy-efficiency manufacturing pilots to reflect reduced-energy environmental ambitions
- Supporting the development of digital tools to enable stakeholders to assess the environmental impact of digital infrastructure choices
- Supporting "lean data" initiatives, implementing smart solutions to reduce "unnecessary" data flows and storage and related impacts.

Building block 6: Ensuring a coherent sustainable investment strategy and instruments to achieve competitive sustainability

The sixth and final building block of the Roadmap designed in coordination with the Ministry of Finance and the Ministry of the Environment, Climate and Sustainable Development is to ensure that our ambition is accompanied by a sustainable investment strategy and instruments, including public procurement, to achieve rapid impact and long-term competitive sustainability.

The newly formed Luxembourg Sustainable Finance Initiative[29] under the Ministry of Finance and the Ministry of the Environment, Climate and Sustainable Development is noteworthy is this respect.

Additional initiatives in this area could include:

- Incentivizing existing industry investment programmes towards a smart, high value-added, resource-efficient economy creating quality jobs
- Investing in innovative start-ups
- Implementing sustainable investment strategies and funds to support sustainable, i.e. energy and resource efficient, digitisation (in collaboration with the Ministry of Finance and the Ministry of the Environment, Climate and Sustainable Development) and in support of the fifth building block above.

[29] lsfi.lu

The establishment of a public initiative with the objective of investing directly in the capital of innovative start-ups, scale-ups and SMEs would accelerate the development of sectors defined as strategic for the economic diversification of Luxembourg.

- Continuing the success story of the Luxembourg Future Fund and broadening its missions, in particular in initiatives addressing competitive sustainability.
- Providing a tax exemption for research-related activities and for private investments in innovative start-ups: this could significantly increase the volume of capital coming from business angels and help provide support in the economic recovery phase after the COVID-19 crisis. It is important that such a device includes not only direct investment, but also indirect investment through dedicated funds. A number of European countries have already implemented similar measures.
- Improving the awareness of companies with regard to the challenges of Intellectual Property.
- Exploring the appropriate regulatory environment for the digitization of business processes.
- Contributing to the Commission's launch of a green tech investment initiative to pool funding from the EU, Member States and the private sector to increase access to equity finance for our innovative SMEs and start-ups that develop and adopt green tech solutions.

The six "Ons Wirtschaft vu muer" implementation building blocks constitute a comprehensive range of potential industrial innovation policies, necessary regulation, financial instruments and above all concrete actions necessary to accelerate a rapid economic recovery phase and support the emergence of a new competitive, resilient and sustainable economy in Luxembourg.

Pilot actions

Short term: Six specific, short-term actionable Pilot actions have been identified that will provide an immediate stimulus into both the data-driven economy and the emerging circular economy sectors.

These short-term Pilot actions will be supported through the "Fit4Resilience" programme of Luxinnovation designed to provide Luxembourg SMEs and large companies with a strategic assessment to facilitate their post-COVID-19 repositioning, as well as the Fit4Circularity programme, aiming at establishing circular value chains by federating and supporting their stakeholders. The analysis takes into account changes in the company's ecosystem, customer and consumer behaviour, and supply chains.

Pilot 1: Luxembourg Data Exchange Service Platform

High-quality data is needed to improve business processes, foster innovation, and improve governance and regulation. Data is mostly hidden in closed proprietary silos, useless for the owner and the community. For this reason, the Luxembourg government will foster the creation of interoperability standards and interoperable services within the Luxembourg open and secure cloud, and help companies to actively participate in the data-driven economy.

The platform will provide guidance for the secure processing of personal data, IP rights and trade secrets during all phases of the data economy value chain. The data platform will also provide steward services pointing to either valuable datasets or specific algorithms and AI training kits. Innovative services such as secure data access brokerage will be provided. This service helps data owners to generate profits from their data by giving controlled access to sanitised and anonymised data extracts without any risk of infringing privacy laws, IP rights or revealing trade secrets. More importantly, this service will make data available for better regulation and governance as well as for innovation and research.

In preparation for this, the Luxembourg Government is in the process of identifying key use cases that will accelerate the development of the platform.

Pilot 2: Smart industrial zones

The 2017 study to develop a methodology for circular "zones d'activités économiques (ZAE)" identified several issues that companies in ZAEs are facing. These include mobility, logistics, soil, water and energy management, and sharing infrastructure. Existing ZAEs were not designed to function as an ecosystem. Promising approaches

like those of Windhof or Salzbaach have shown to be successful in eliminating some of the issues.

Building on existing infrastructure, IoT and ICT solutions can help to connect the dots to turn ZAEs into cooperative and efficient organisms and attractive working areas. Investing in smart ZAEs will support their efforts to become circular, increase the tenants' competitiveness and strengthen their position, if they belong to a multinational group.

Existing, as well as developing areas like the Mobility Innovation Campus in Bissen, could profit from these investments and, if well managed, synergies in and between ZAEs could become apparent and available for exploitation.

The next steps include confirmation of the most urgent pain points through a quick survey, and subsequently developing an investment plan and deploying solutions to develop smart ZAEs.

Pilot 3: Product Circularity Data Sheet

Driven by the Ministry of the Economy and supported by major international industry leaders, the Circularity Dataset Initiative[30] developed the "Product Circularity Data Sheet" (PCDS), aimed at establishing an official standard for communicating data on the circular economy properties of a product.

The PCDS is a basic source of verifiable data. It can be used to establish how circular a product is, and inform about the circular path it was designed and manufactured for. The PCDS offers a standardized format with trustworthy data without the scoring or ranking of these aspects.

The PCDS is a threefold system:

- A data template containing standardized and trustworthy statements on the product circularity
- A third-party verification process to validate the content of the PCDS (audit system)
- A standardized data exchange protocol based on decentralized data storage (IT system)

It has three objectives:

- Provide basic data on a product's circularity to all relevant stakeholders

[30] Detailed information is available at www.pcds.lu

- Improve the sharing efficiency of circularity data across supply chains
- Encourage the improvement of product performance in terms of circularity

The project is currently in phase 2 of its development:

Source: +impaKT

The Ministry, together with expert consultants, steers and encourages several working groups gathering 50 companies from more than 12 countries actively working on the continuous development of the PCDS.

Phase 2 will deliver:

- A Minimum Viable Product of the PCDS system that will support the scale-up to a larger market and its adoption as a “de facto” industry standard
- A layout of the governance system that will support the future development of the whole PCDS system as a standalone initiative
- Continuous development of international recognition for the PCDS

In parallel, the Ministry of the Economy is in the process of establishing a dedicated working committee at the International Organization for Standardization (ISO) to convert the PCDS into an ISO Standard.

Pilot 4: Regional strategic value chain in Medical Diagnostics

In the health technologies sector, a particular opportunity exists to strengthen the local industrial value chain in the field of molecular diagnostics. For example, by capitalizing on the presence of actors such as ABL, private labs, LIH, IBBL, LNS, Fast-Track Diagnostics / Siemens Healthineers to constitute a value chain "from innovation to the market" based on a strong positioning in terms of digitalisation and regulatory capacities, with the ultimate objective of generating a sustainable supply chain in terms of diagnostics.

The Ministry will explore the creation of a virtual incubator to:

- Stimulate local innovation in digital and molecular diagnostics - in particular by attracting and encouraging collaboration with foreign start-ups through FNR PPP projects, the Fit4Start programme and new tools to be implemented to encourage them to invest in innovation in our territory
- Prepare the placement on the European market of local or international innovations (outside the EU) through regulatory advice - from day 1
- Foster the implementation of early economic modelling practices in order to evaluate the cost-effectiveness of digital and molecular diagnostics solutions
- Position Luxembourg as an attractive ecosystem for rapid entry into the European market of innovations in molecular and digital diagnostics

Pilot 5: Digital Procurement

In the quest to source essential medical supplies across the world, expertise in supply chain and procurement operations have shown to be critical for implementing an uninterrupted supply of medical masks, ventilators and other medical essentials. Finding alternative product sources and flagging them as reliable were among the main challenges at the start of the pandemic. Implementing agile procurement operations systems will also help drive resilience in challenging times. Sustainability and fairness of products will also need to be considered. The Ministry of the Economy has concluded an agreement with the University of Luxembourg to establish a chair in Digital Procurement to accelerate capacity and capability in this critical field.

Pilot 6: Luxembourg Secure Open Cloud

The outstanding physical infrastructure of Luxembourg in terms of data centres, international connectivity and broadband penetration, the availability of human skills and services, the reputation of the Luxembourg Government and the existence of specialised laws in the domain of dematerialisation and conservation make Luxembourg a first-class candidate for the creation of a truly open but highly secure cloud.

The lead in the “Luxembourg Secure Open Cloud” initiative should be taken by the private sector; the role of the Government will consist in applying existing support mechanisms in order to ensure successful outcomes.

The experience of the COVID-19 crisis has shown that the cloud should be accessible for all businesses, especially SMEs. Based upon services and tools the Luxembourg and European ICT ecosystem can provide, it will provide all the advantages of the

European legal framework in terms of privacy protection[31], IP and trust[32] guarantees, and will become a trusted partner for citizens, SMEs and companies throughout the European Digital Single Market.

The Luxembourg Secure Open Cloud will be compatible with the Gaia-X initiative and the European Federated Cloud initiatives in terms of interoperability, compatibility and trust. The Luxembourg cloud will be configured to become a key component of the GAIA-X validated infrastructure ecosystem while also being connected to the European cloud ecosystem.It will be based upon *open source* technology to increase resilience and independence from monopolists and reduce the risk of political or commercial blackmail.

The Luxembourg Secure Open Cloud will act as a competence centre and help companies, particularly SMEs, to become more resilient, flexible and open. Services like e-signature platforms and archiving services will be made available within the cloud to foster true e-business relations, links to local or regional e-shops will be integrated, with all elements secured by strong authentication services provided by local companies. Thin clients from local providers will be made available to substantially reduce the energy footprint for ICT in companies and take full advantage of the synergies provided by the cloud.

Pilot actions (medium term): A second series of Pilot Actions will be launched to *connect with and leverage* specific European Commission policy initiatives related to the Green Deal, Shaping Europe's Digital Future and the New Industry Strategy.

The five selected medium-term impact Pilots are:

Pilot medium-term 1: Accelerate Luxembourg industry participation in world-class digitalisation transformation initiatives through participation in the European Commission's Key Digital Technologies (KDT) Joint Undertaking (JU) programme.

(In support of Building Block 1).

Luxembourg is a full participating state (PS) member of the current Electronic Components and Systems for European Leadership (ECSEL) JU. The future KDT programme, the follow-on to ECSEL, will focus on maintaining and developing strong design and production capacities in essential digital technologies such as micro- and nano-electronics, microsystems, photonics, software and cyber-physical systems and

[31] General Data Protection Regulation
[32] eIDAS regulation and the EU cybersecurity act

their integration, as well as advanced materials for these applications, for a competitive EU.

The KDT programme will provide the opportunity for Luxembourg industry to access key European value chains and participate in industry consortia shaping future opportunities across a range of sectors including automotive and aeronautics, manufacturing and energy, defence and security.

Pilot medium-term 2: Develop, by 2025, *a European Digital Innovation Hub (EDIH*), of scale and size, to accelerate the widespread digital transformation of Luxembourg industry leveraging support from the European Commission's *Digital Europe EDIH programme*.

(In support of Building Block 1).

The overall objective of the European Commission EDIH programme is to stimulate a broad uptake by industry (in particular SMEs and midcaps) and public sector organisations across Europe of Artificial Intelligence, High-Performance Computing (HPC) and Cybersecurity as well as other digital technologies. The EDIH should function as a one-stop shop that helps companies respond dynamically to current and future digital challenges and become more competitive. The Digital Europe Programme will increase the capacities of the selected hubs to cover activities with a clear European added value through networking the hubs and promoting the transfer of expertise.

The Ministry of the Economy will co-fund along with the European Commission the selected EDIH in Luxembourg, which will focus on accelerating the uptake of general purpose digital technologies and solutions, and enable the digital transformation of SMEs across key strategic sectors of the Luxembourg economy and, where appropriate, the Greater Region.

Pilot medium-term 3: Develop and support Luxembourg industry and public authorities' participation in the *Digital Europe "European Cloud" and "Cybersecurity" initiatives.*

(In support of Building Block 4)

Focused on building a competitive data and knowledge economy in Europe, "The European Cloud Initiative" aims to strengthen Europe's position in data-driven innovation, improve its competitiveness, and help create a Digital Single Market in Europe. Luxembourg is a co-signatory of the European Cloud Declaration[33], the joint declaration by 25 EU Member States on building the next-generation cloud in Europe.

[33] Declaration on "Building the next generation cloud for businesses and the public sector in the EU", 15 October 2020.

This initiative will provide Luxembourg industry, public research actors and its public authorities with a world-class data infrastructure to store and manage data; high-speed connectivity to transport data; and ever more powerful High-Performance Computing to process data.

To support future industry investment in critical cloud infrastructure and services, the Ministry of the Economy is a founding member of the "Important Project of Common European Interest on Cloud Infrastructure and Services" (IPCEI-CIS) currently under development by several Member States.

In parallel, the Ministry of the Economy through its Cybersecurity directorate will support Luxembourg industry participation in the wide range of future European initiatives including cybersecurity RDI in Horizon Europe, where cybersecurity is part of the 'Civil Security for Society' cluster. This RDI programme will drive towards strengthening Luxembourg cybersecurity industrial capacities and increase our strategic autonomy with regard to foreign technologies.

Cybersecurity also requires a resilient critical digital infrastructure. The Luxembourg Roadmap also aims to fully utilise all support in the upcoming Digital Europe Programme for cybersecurity capacity and the wide deployment of cybersecurity infrastructures and tools across Luxembourg - for industry and public administrations.

Pilot medium-term 4: Develop and support *digital technologies "Testing & Experimentation Facilities" for Luxembourg industry* with the *Digital Europe Testing & Experimentation Facilities programme.*

(In support of Building Blocks 1, 2, 3 and 4)

A key step in terms of bringing technology to market relates to experimenting and testing state-of-the art technology in real-world environments. Reflecting this, the Ministry of the Economy already supports "test beds", as detailed in the national data-driven innovation economy strategy published in 2019. In 2021, the European Commission under the Digital Europe Programme will support the establishment of world-leading testing and experimentation sites for AI-powered products and services in essential sectors such as health, agri-food, smart cities and smart manufacturing or finance, as well as in other areas of public interest throughout Europe.

The Ministry of the Economy will explore both the creation of Testing & Experimentation Facilities in Luxembourg, whilst also supporting Luxembourg industry participation in new world-leading testing and experimentation sites across Europe for AI-powered products and services.

Pilot medium-term 5: Position and support Luxembourg industry within the emerging European Commission *Hydrogen Initiatives.*

(In support of Building Block 2)

Hydrogen can be used as a feedstock, a fuel or as energy carrier and storage, and has many possible applications across the industry, transport, power and building sectors. Most importantly, it does not emit CO_2 or virtually any air pollution when used. It thus offers a solution to decarbonise industrial processes and economic sectors where reducing carbon emissions is both urgent and hard to achieve.

The Commission adopted on 8 July, 2020 a new dedicated strategy on hydrogen[34] in Europe, which will explore the potential of clean hydrogen to help the process of decarbonising the EU economy in a cost-effective way, in line with the 2050 climate-neutrality goal set out in the European Green Deal. The strategy brings together different strands of action, from research and innovation regarding production and infrastructure to the international dimension of hydrogen use.

The Luxembourg Government will finalise its own national hydrogen strategy in 2021. In parallel, the Ministry of the Economy will play an active role in the European Hydrogen Industry Alliance and will explore the potential to support Luxembourg industry ambitions in this sector through a Commission-facilitated *Important Project of Common European interest (IPCEI).*

[34] A hydrogen strategy for a climate-neutral Europe COM (2020) 301 final

V. Conclusions:

Luxembourg emerged from the world crisis of 2008 as the fourth most globalized economy in the world, one of the top two European Union financial hubs, a key player enabling financial connectivity along the Eurasia route, a leading logistics hub integrated in global supply chains, a European digital front-runner and a strategic European Union digital pole. Our country is now ideally positioned to *accelerate* its economic transition out of COVID-19 and the associated economic crisis of 2020, leveraging the fact that the Green transition and the Digital transformation will play a central role in relaunching and modernizing our economy and those of our European partners.

This document, coordinated by the Ministry of the Economy, proposes a vision and path forward, a post-COVID-19 Roadmap for a Competitive and Sustainable Economy for the Grand Duchy of Luxembourg. It addresses the immediate industrial innovation policies, regulation, financial instruments and concrete actions necessary to support the rapid emergence of a competitive, resilient and sustainable economy in Luxembourg. This comprehensive response comprises six building blocks:

Building block 1: Accelerating the digitalized economy for societal benefit
Building block 2: Driving the digitally enabled circular economy transition
Building block 3: Developing resilient strategic value chains
Building block 4: Enabling a secure and trusted data-economy transformation
Building block 5: Ensuring a sustainable digital transition
Building block 6: Providing a supportive investment environment and instruments to achieve competitive sustainability

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The "Ons Wirtschaft vu muer" – Roadmap for a Competitive and Sustainable Economy – of the Ministry of the Economy will ensure that Luxembourg continues to become the most progressive and attractive digital and data-economy environment within the European Union, whilst also positioning itself as a future European leader in the sustainable Green transition, future-proofing the economy in the face of strong headwinds and global megatrends.

This Roadmap simultaneously presents both immediate opportunities for our companies to accelerate out of the recent crisis whilst positioning the economy and Grand Duchy for future economic prosperity. In parallel, the Roadmap, by also focusing resources on addressing our most pressing societal challenges in sectors ranging from health technologies to mobility and security, ensures a citizen-centric response.

A first set of six immediately actionable Pilot actions provide significant opportunities for a rapid strategic support stimulus into the Luxembourg industrial fabric. A second set of five medium-term Pilot initiatives *connect* and *reinforce* actions within the Roadmap building blocks with key European Commission initiatives and support.

Annex 1. Megatrends context:

The world today is far more complex and competitive than even a decade before, and is changing at an unprecedented pace. However, clear global trends are evident and to some extent frame the paths of action that Luxembourg can take to accelerate forward from the COVID-19 pandemic that began in early 2020.

These global trends are often termed Megatrends, and are the subject of considerable reflection and analysis[35] [36]. Not all Megatrends are of importance to Luxembourg and indeed many are outside the remit of this Roadmap. The objective in this section is to review the global Megatrends that matter most to the Luxembourg economy, extrapolate insights from these Megatrends, and anticipate the challenges and opportunities that might affect our economy in the coming decade.

Three of the Megatrends that have the greatest potential to affect Luxembourg and its economic growth trajectory over the next decade are Digitalisation & Connectivity; Climate change and Environment; and Geopolitics.

Megatrend 1: Digitalisation & Connectivity

Digital technologies, the Internet of Things and digital platforms are transforming the lives of our citizens, the way they work and how they communicate and do business, as they become ever more integrated across all sectors of our society. This digitalisation is enabling and driving new levels of connectivity. By 2030, the number of devices connected to the internet will reach 125 billion, up from 31 billion today (2020). In particular, over the course of the next ten years to 2030, this digitalisation and connectivity trend will accelerate, permeate and significantly impact all our key economic sectors.

Potential impact: This digital transformation is happening at a scale and speed that brings immense opportunities for innovation, growth and jobs in Luxembourg. However, "Digitalisation" constitutes both an opportunity and a competitive challenge. The opportunities will present themselves predominately to those nations that are best prepared and equipped to compete digitally. In short, as we enter the third decade of the 21st century, digital data, digital infrastructure and digital knowledge are considered to be strategic economic and competitive assets in all advanced nations.

Megatrend 2: Climate change and Environment

The second Megatrend that will affect Luxembourg is climate change, and a set of interconnected environmental-related transformation issues. Climate-driven changes

[35] Global Trends to 2030: Challenges and Choices for Europe
[36] European Parliament, Global Trends to 2035

are happening far faster than previously thought, bringing an inevitable impact on both our social and economic futures. Over the past decade, these climatic impacts have caused regional systemic disruptions to supply chains, physical infrastructure and society. As a result, global, regional and national responses have now commenced.

Potential impact: The European Commission 2050 climate neutrality objective, enshrined in legislation, poses significant challenges and opportunities for many sectors of the Luxembourg economy. For example, the transition to climate neutrality will require the deployment of innovative technologies and infrastructure, such as smart grids, hydrogen networks and carbon capture, energy storage, and also new circular economy business models, newly-developed products and new recycling strategies.

Megatrend 3: Geopolitics

The third Megatrend is the increasingly uncertain geopolitical future. For many decades, the international order was based on a globalizing world, international trade, and cross-border flows of labour and capital. However, significant and increasingly visible differences in societal values, trust, trade flows and in industrial policy are now spurring regionalization and, in some cases, protectionism. This Megatrend has been accelerated by the COVID-19 pandemic, which has highlighted the fragility of global supply chains and strategic cross-border flows.

Potential impact: The Luxembourg economy is one of the most open in the world, while, at the same time, Luxembourg is tightly integrated into the European Union. Geopolitics will increasingly shape the landscape in which our economy develops and within which our companies operate. There are many examples that highlight the potential disruption arising from this Megatrend. One is the realization that technological decoupling between the USA and China is already affecting digital infrastructure policies and options across European Union member states. A second is the potential impact on Luxembourg-based companies arising from the ongoing rivalry between the European Union and the USA for future digital economy platforms, content and commerce, and the proposal this year for a European directive on a digital services tax on revenues resulting from the provision of certain digital services.

The above insights inform and guide decisions on specific actions addressing the industrial innovation policies, regulation, financial instruments and actions necessary to support the rapid emergence of a competitive, resilient and sustainable economy in Luxembourg.