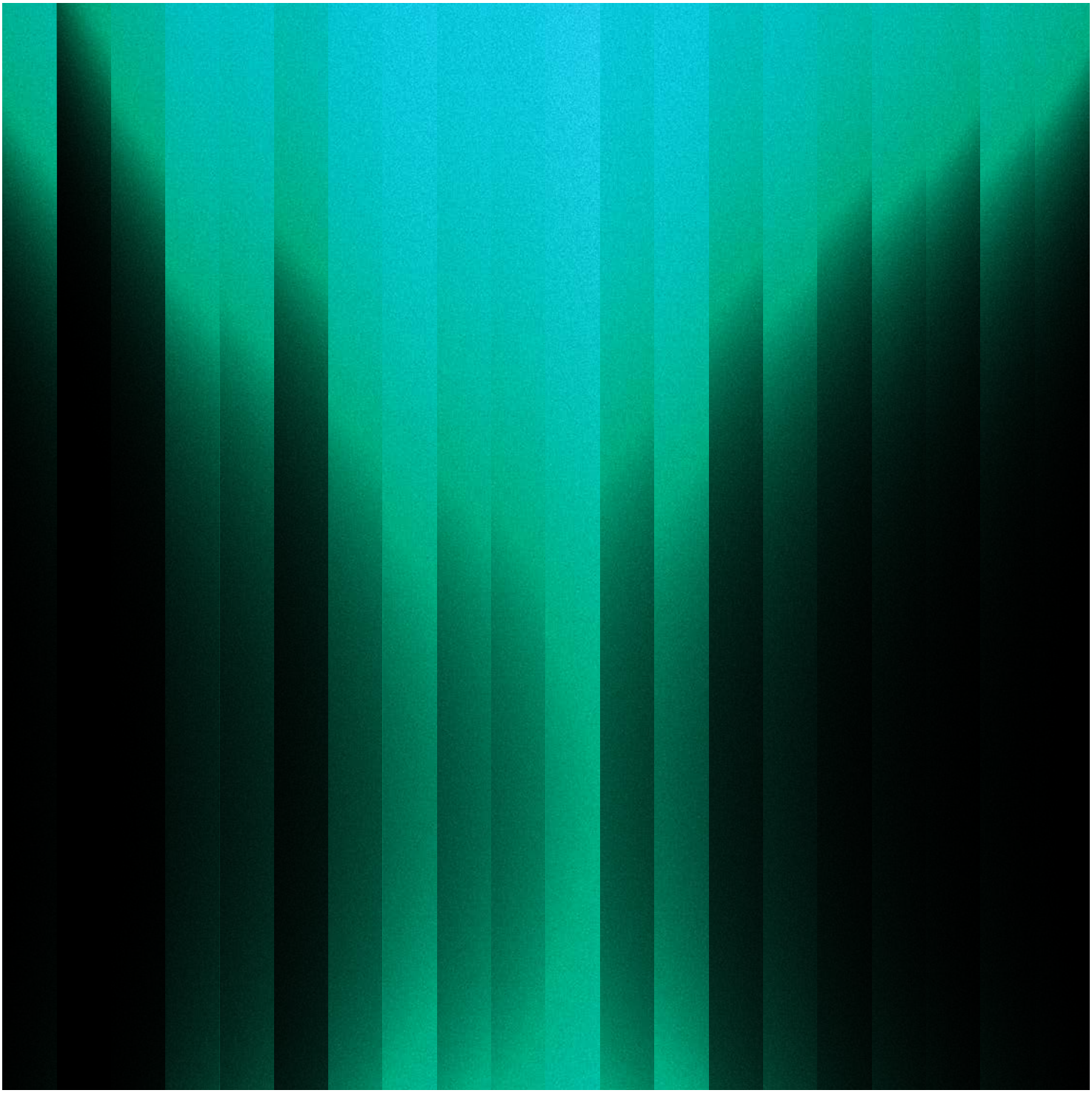

Accelerating digital sovereignty 2030

Luxembourg's Data Strategy

THE GOVERNMENT
OF THE GRAND DUCHY OF LUXEMBOURG

Accelerating digital sovereignty 2030

Luxembourg's Data Strategy

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Forewords

Luc Frieden

“Innovation is the driving force of human progress and, consequently, of economic and social development. Thanks to the ambitious and coherent vision defined in these strategies, as well as the flagship projects identified, the government will transform Luxembourg into an international centre of reference for the sovereign and secure valorisation of data. We aspire to create an agile centre, founded on trust and transparency, where private and public actors collaborate to put innovation at the service of humanity – European-style innovation, with a Luxembourgish touch!”

Stéphanie Obertin

“National strategies on data, AI, and quantum technologies are the result of excellent collaboration between ministries, public research stakeholders, the private sector, and civil society. The three strategies place humans at the centre of our digital transformation and inspire common ambitions and shared actions to create a dynamic, resilient, and inclusive ecosystem capable of responding to current and future challenges.

The valorisation of data is at the heart of our vision, enabling informed decision-making, the design of judicious policies, and the delivery of effective public services while establishing the foundation for AI and quantum technologies.”

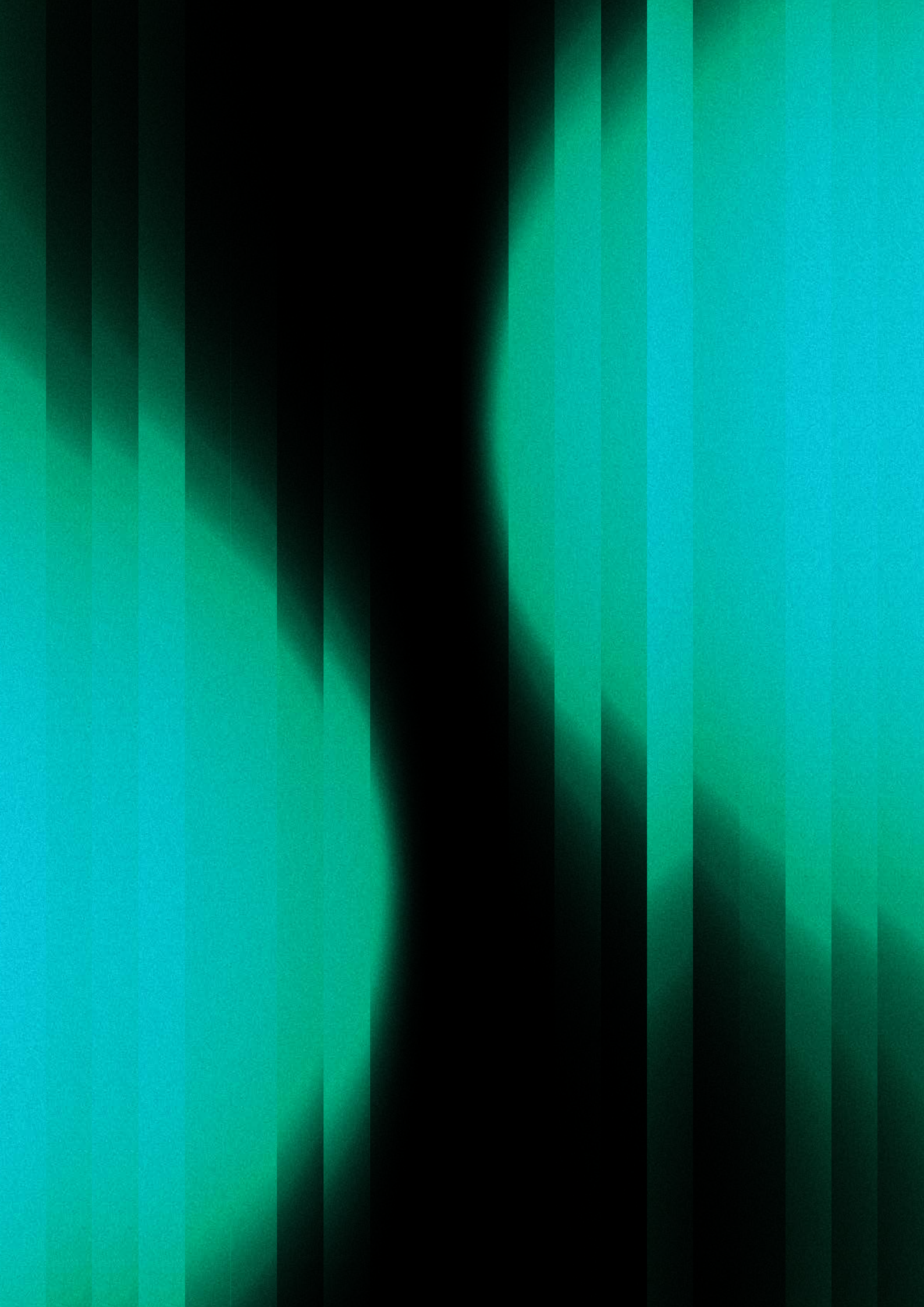
Elisabeth Margue

“Prioritising adoption – this is the principle that guided us in drafting the ambitions and actions regarding AI, whether through the multiplier effect of digital public administration or within Luxembourg’s key sectors such as finance or health. Each company, each person will have a different journey in increasing their AI expertise. Everyone will be able to rely on the great strengths of our country: connectivity, computational resources, and digital skills. Additionally, by adding regulations that accelerate innovation, Luxembourg truly has a strong card to play within the European Union. Let’s be as ambitious as we can be!”

Lex Delles

“Digitalisation is no longer an option: it is an absolute necessity for any business that wishes to gain productivity and remain competitive in an increasingly rapidly evolving environment. This is why Luxembourg is investing in cutting-edge digital infrastructure while facilitating access through the provision of services adapted to the needs of businesses and research. With the future quantum computer MeluXina-Q and the future supercomputer MeluXina-AI placed at the heart of the national AI Factory, we offer businesses of all sizes a favourable framework for innovation to concretely accelerate their digitalisation.

By implementing a digital strategy built around three fundamental pillars - data, AI, and quantum technologies - we are giving ourselves the means to strengthen our digital sovereignty, guarantee our long-term competitiveness, and consolidate the resilience of our economy in an increasingly digitalised world.”



Accelerating digital sovereignty 2030

Luxembourg's ambition in data, artificial intelligence and quantum technologies

As part of the 2023-2028 coalition agreement, the government has committed to promoting innovation with the aim of keeping Luxembourg at the forefront of new technologies and digital advancement. In this context, **data, artificial intelligence (AI), and quantum technologies** constitute the **three areas** that Luxembourg aims to advance in order to continue stimulating its economy, improve the quality of life of its citizens, strengthen its digital and technological sovereignty, and contribute to the digital sovereignty of the European Union.

Since the publication of "**The Data-Driven Strategy for the Development of a Trusted and Sustainable Economy in Luxembourg**" and "**Artificial Intelligence: A Strategic Vision for Luxembourg**" in 2019, as well as the "**Ons Wirtschaft vu Muer**" strategy presented in 2021, technological evolution and its impact on our daily lives has substantially changed. With the rapid popularity of new AI tools in 2023 and the growing importance of data and its valorisation, a review of government strategies became necessary. In parallel, a technological evolution that is certainly less mature but no less fundamental, namely that of quantum technologies, has also rapidly gained momentum. It is therefore opportune, even urgent, to position the country for the next technological era, particularly through the adoption of innovative and high-impact solutions by 2030, thanks to the implementation of dedicated and additional budgets.

Luxembourg focuses on data, AI, and quantum technologies to strengthen its digital sovereignty and remain at the forefront of innovation.

Organisational approach

The government has invited **the Ministry of State (ME), the Ministry for Research and Higher Education (MESR), the Ministry of the Economy (MECO) and the Ministry for Digitalisation (MinDigital)** to identify complementarities and opportunities through national and international initiatives. To benefit from synergies and achieve ambitious objectives by 2030, a **holistic approach** has been adopted by these ministries, while ensuring the participation, from the initial preparations during workshops, thematic meetings and working groups, of representatives from civil society, private and public sectors, as well as experts from Luxembourg's public research. The **monitoring of the strategy implementation** according to its three axes relies on a transversal approach involving the entire government.

For the sake of general coherence, the three priority axes are addressed in **three dedicated documents**. Each document includes an **identical common section** that highlights the shared ambitions and synergy between the three axes, followed by a specific section for each: **data, AI, and quantum technologies.** It is this entire **strategic corpus** that constitutes the national ambition aimed at **accelerating the digital sovereignty of the Grand Duchy by 2030**.

Strategic vision

By 2030, Luxembourg aspires to become a country of digital and technological innovation centred on people, agility, sustainability and international collaboration. To achieve this, the Grand Duchy is determined to stimulate its digital ecosystem to make it increasingly innovative, dynamic, and agile. To ensure coherence, inclusivity, and collaboration within this ecosystem, both public and private sectors - including research and development - will be heavily involved. Built upon international openness, proven economic dynamism, and unparalleled and highly reliable digital infrastructure, the national ambitions regarding data valorisation, AI, and quantum technologies aim to consolidate Luxembourg's character as a European pioneer in digital transition, capable of serving as a model and benefiting from the advantages offered by digital technologies. The vision aims to support digital sovereignty, technological and economic progress, and to promote citizens' well-being.

This common vision for the **strategic corpus** is based on the conviction that digital and technological innovation is essential to ensure the country's competitiveness and future prosperity. Building on its unique advantages such as **cutting-edge sovereign infrastructure** and **the agility of a country of limited size**, Luxembourg will position itself as a leader in the field of high value-added applications in highly regulated sectors and thus offers true complementarity and added value on the European and global stage.

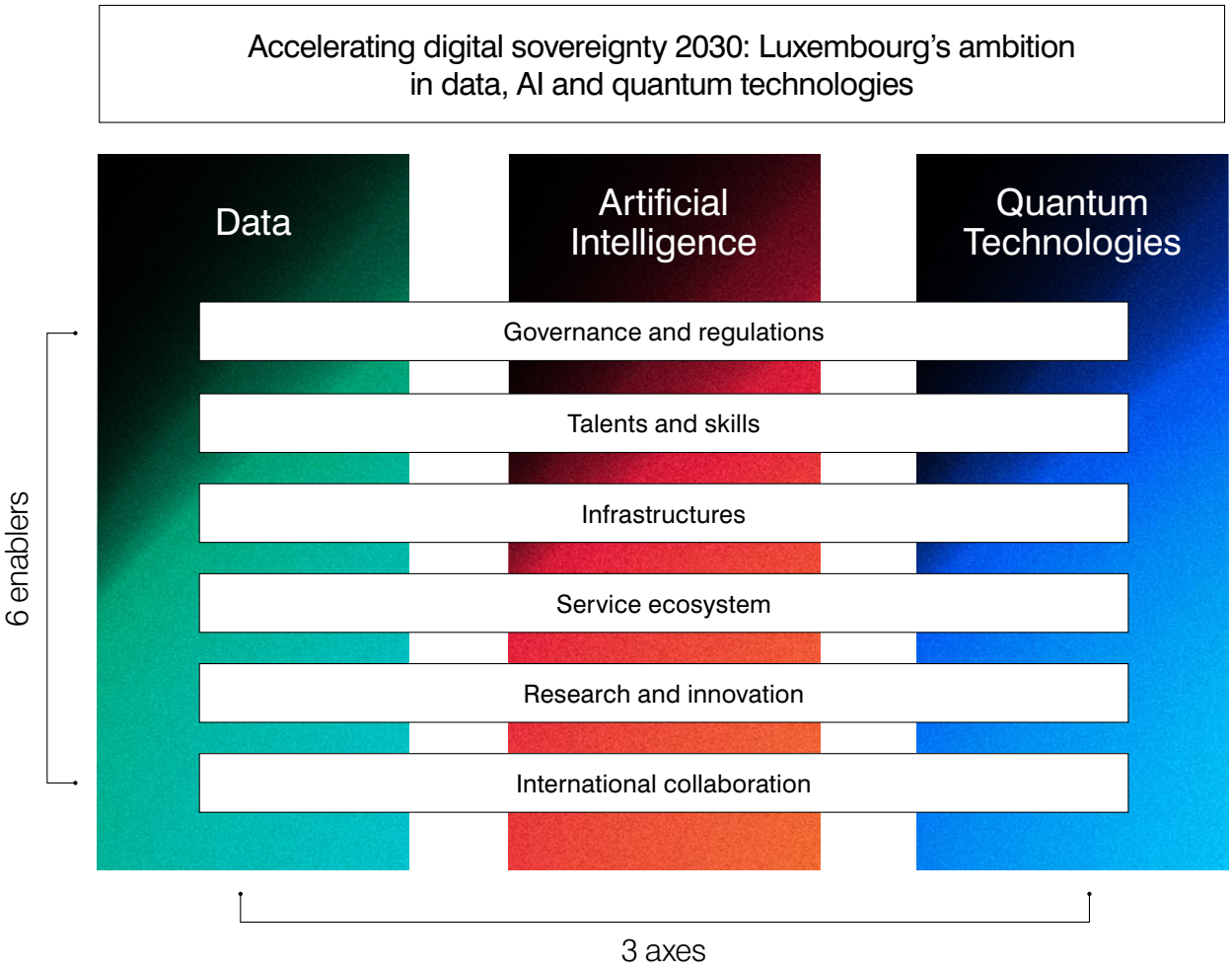
These strategies have been developed to position Luxembourg at the forefront of a future where technology is an essential driver of economic growth and citizens' well-being while ensuring the country's digital sovereignty.

A unified approach: leveraging interactions between data, AI and quantum technologies

Data represents the raw material of digital innovation, artificial intelligence allows value to be extracted from it, and quantum technologies promise to push the current limits of information processing, security, and analysis. To unleash their full potential, these three strategies should not be approached in isolation but rather as complementary components of an interactive technological ecosystem.

An integrated approach also allows for **greater sharing of infrastructure** (for example cloud, HPC (high-performance computing) and quantum computing) and **human and financial resources**. These interactions strengthen the country's ability to develop more powerful, safer technological solutions that are better adapted to tomorrow's challenges, particularly in key sectors such as the public sector, finance, cybersecurity, health, culture or space.

The common thread through each of the different documents is provided by **six transversal enablers**. The advantage of this articulation is to avoid a siloed approach and to facilitate synergies. It allows both a thematic reading (by vertical axis) and a pragmatic one (by horizontal action) of Luxembourg's various ambitions in terms of digital technology.



Six action enablers common to the three strategic development axes

The enablers for building a coherent digital ecosystem are as follows:

- Establish and promote governance means and regulations to encourage the use and reuse of data, as well as accelerate the adoption of AI and quantum technologies while guaranteeing data security and protection, infrastructure sovereignty, and reliability of software creation;
- Develop and attract the necessary skills and talents to strengthen national competitiveness, innovate and work in the field of digital technologies, and enhance digital literacy at the societal level;
- Continue to deploy cutting-edge infrastructure adapted to evolving national needs, both public and private, in terms of connectivity and computing;
- Offer a complete range of specialised services to support the dissemination and adoption of data culture and new digital technologies within society and the economy, particularly by offering more efficient and personalised public services, thus reducing the administrative burden for citizens and businesses;
- Stimulate agile research and innovation, at both public and private levels, to solve complex societal challenges;
- Contribute to international initiatives in the field of data, AI, and quantum technologies to promote digital sovereignty and European values.

Implementation of strategies: integrated dynamics and flagship projects

The operationalisation of the strategy will rely on a **set of flagship projects** translating concrete sectoral ambitions into strategic domains such as finance, health, culture, space, education, skills, cybersecurity, energy, mobility, and the optimisation of legislative and administrative processes. This approach will stimulate the digital and innovation ecosystem in Luxembourg through the adoption of innovative and high-impact solutions. To this end, dedicated budgets will also be established to meet the needs expressed by the consulted stakeholders.

This dynamic is supported by integrated governance and dedicated structures such as the **Deep Tech Lab** (see below) and the **collaborative Data, AI, and Quantum Factory platforms** (see below), true catalysts for innovation and coordination.

Flagship projects in key sectors will boost innovation in Luxembourg, supported by dedicated budgets and integrated governance.

Luxembourg's strategic assets for succeeding in its digital transition

Over the past decades, the government has committed to developing cutting-edge infrastructures and has continuously engaged in international initiatives and collaborations. Luxembourg already has a few key elements to assert itself as a digital pioneer on an international scale:

- Luxembourg has the highest density of **"Tier IV" data centres** in Europe. These data centres guarantee the highest level of resilience in terms of electricity, water, and connectivity supply while ensuring a very high level of physical security. Thanks to this security level, these data centres can host highly critical data storage and processing infrastructures.

- Luxembourg is an active and recognised member of AISBL **Gaia-X**, a European initiative aimed at creating an **open, secure, and sovereign data infrastructure** to promote the interoperability of data or cloud services while respecting European standards. Luxembourg plays an important role with a Luxembourgish representative sitting on the board of directors and having leadership of the health ecosystem within this same association.

- Operational since 2023, the **Luxembourg National Data Service (LNDS)** facilitates value creation from secondary use of data for both public and private partners and supports the sharing and reuse of public sector data in a reliable manner. Its approach, unique in Europe, aims to offer a complete range of data-related services (management, access, cataloguing, Ethical, Legal, and Social Issues (ELSI) assessment, pseudonymisation and anonymisation, etc.) in an intersectoral and centralised way to accelerate data exploitation in Luxembourg.

- Luxembourg positions itself as a European leader in digital connectivity, with **high-speed Internet infrastructure** and **5G coverage** that far exceed the EU average.

- Luxembourg is one of the first EU Member States selected to host a supercomputer as part of the EuroHPC network. Operational since 2021, the **HPC MeluXina** was designed in particular to process AI computational tasks. In 2023, MeluXina processed 35% of all EuroHPC AI projects, highlighting its key role in advancing AI in Europe. At the national level, its computing hours are increasingly being used to develop AI applications for a growing number of companies, including startups.

- Luxembourg is among the first seven Member States to have signed in 2019 a declaration on the development and deployment of a European quantum communication infrastructure, the

EuroQCI. From this declaration was born the national initiative **LuxQCI** which aims to create an experimental laboratory for quantum communications, to develop and implement a quantum communications network at the national level in order to interconnect it with the quantum communications networks of other European Union Member States, thus creating the EuroQCI. The development of the national ecosystem in the field of quantum communications is another key objective of the LuxQCI initiative.

Far from being established achievements, these assets must be continuously developed so that Luxembourg can accelerate its digital sovereignty and remain at the forefront of digital technologies and meet national and international needs.

Fostering innovation and creation

Intellectual property has become an economic issue that must be considered to ensure the growth of innovative, creative, and economic actors. It must therefore be integrated in a transversal and strategic manner in the initiatives of the various ministerial departments and in the sectors of the economy and culture, particularly in the context of AI, quantum technologies, and data, so that creative and innovative efforts result in competitive advantages that will ultimately benefit society, the economy, and Luxembourgish culture.

Luxembourg has established a fully developed legal and regulatory framework in the field of intellectual property. This legislative framework helps ensure Luxembourg's position among the leaders in innovation. Luxembourg will continue to engage in discussions and developments in this area at the European and international levels.

It should be emphasised that in the context of the sustainability of the knowledge economy, access to content should not be considered solely in a dematerialised manner. In this regard, and to sustainably guarantee Luxembourg's sovereignty, it is essential to ensure that intellectual resources and access to knowledge are not solely dependent on external operators and their digital resources.

These various elements will help maintain Luxembourg's position at the forefront of knowledge-based and innovative economies, which are guarantees of competitiveness and growth.

Becoming and remaining a key player in the digital ecosystem

The key arguments highlighted below, drawn from the strategies, emphasise specific actions that will contribute to positioning Luxembourg as a key player in the European digital ecosystem:

- Luxembourg will establish centralised data governance to ensure data reuse and exchange in a trusted environment. To facilitate relations with citizens in their administrative procedures, the government is also planning a solid and coherent framework for data exchange by introducing the Once-only principle (a principle whereby a person provides data to administrations only once). To facilitate data access and reuse, while ensuring legal certainty and maintaining citizen trust, the government also aims to establish a precise framework for the reuse of data held by the public sector (G2B) by both public and private actors. It specifically provides for:
  - authorised purposes for which data access and reuse are permitted, e.g., for training, testing, and evaluating algorithms and AI solutions;
  - rigorous control of rules through the intervention of the Government Commissioner for Data Protection with the State (CGPD), acting as the Data Authority in charge of

Luxembourg establishes itself as a European digital hub with a strategy focused on data, AI, and quantum technologies.

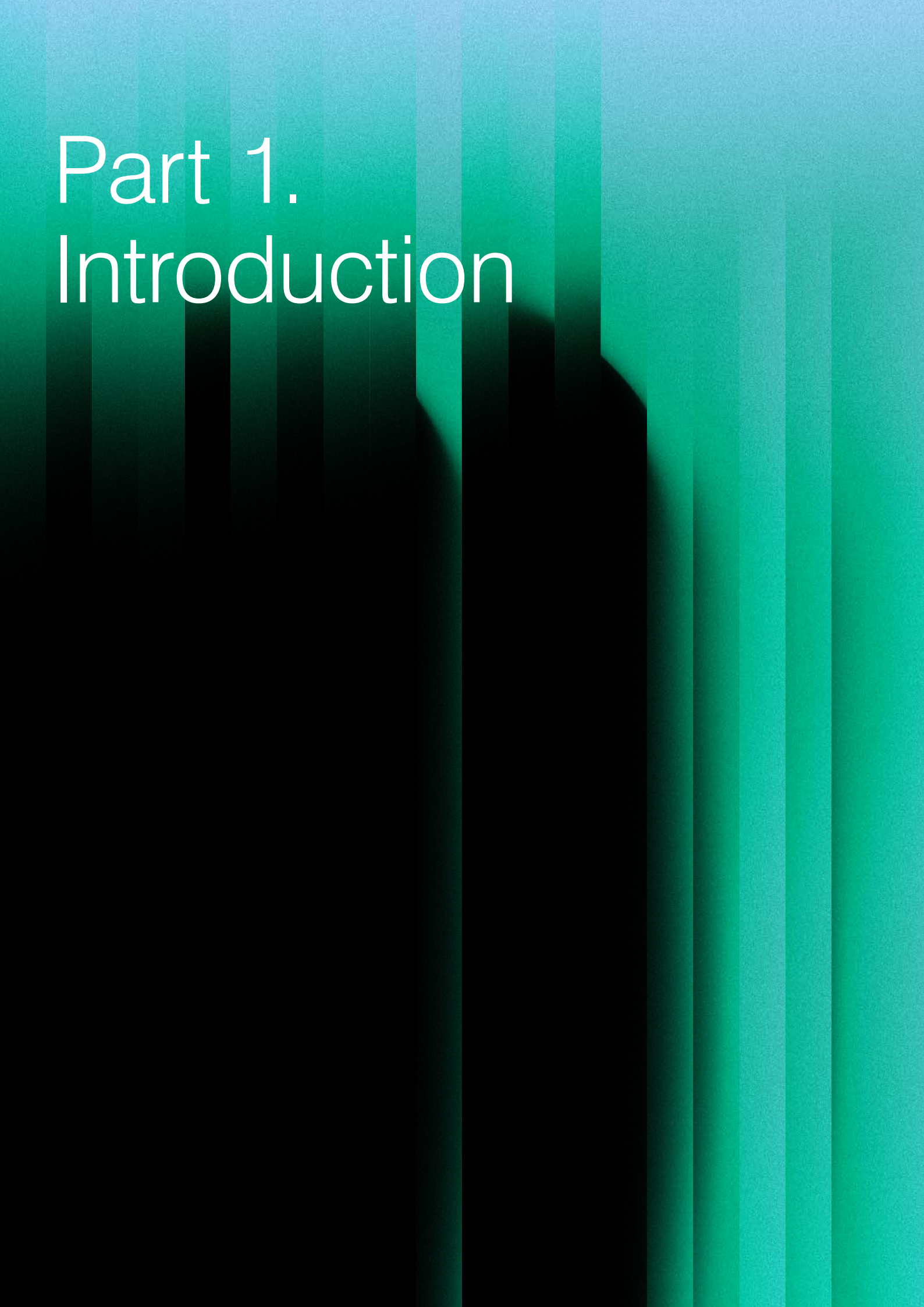
authorising data access and reuse based on a specific request by the re-user;

- the fact that data access and reuse take place in a secure processing environment set up by the CGPD and managed by the State Information Technology Centre (CTIE);
- the fact that data is anonymised, pseudonymised, or aggregated (if necessary by a trusted third party) prior to being made available.

- The network of AI Factories will facilitate access to large volumes of data and pool expertise at a European scale. Additionally, Luxembourg will be able to rely on its new MeluXina-AI supercomputer to further accelerate the development of its already dynamic and agile digital ecosystem. The national AI Factory, with its centre in Belval, will constitute a one-stop shop increasing the visibility of available initiatives and offerings, and providing access to essential resources to accelerate AI development in Luxembourg, while promoting collaboration, knowledge exchange, and inter- and intra-sectoral synergies.
- The new MeluXina-AI supercomputer will be integrated with sovereign cloud solutions and Tier IV data centres in a computing continuum. This will offer flexibility, robustness, and security in terms of data protection and IP necessary for applications in highly regulated domains.
- To attract and advance the talents and skills necessary for developing a thriving AI ecosystem, Luxembourg will adopt an agile, sectoral, and inclusive approach, combining pedagogical innovation and close industry-academia collaborations, while capitalising on MeluXina-AI. Luxembourg will equip itself with an advanced AI-based tool to anticipate skills needs in order to align training with labour market developments. To position the country as a model in Europe for equitable access to AI skills, Luxembourg will seek to find a good balance between developing elite talent and the broad inclusion of citizens.
- In order to drive the rapid application of AI in the key economic sector of finance, a major project will be implemented to explore the potential of AI-based use cases. In the same spirit, the health sector is complementing its digital strategy with a major project that uses AI to improve patient medication care, thus driving the application of AI with the aim of making medicine more personalised.
- The Deep Tech Lab (DTL) aims to promote the economic valorisation of Deep Tech research activities in Luxembourg. Its goal is to facilitate interactions between the academic and economic worlds. To achieve this, it encourages the creation of public-private partnerships, the development of spin-offs, and the commercialisation of licenses. Furthermore, the DTL will allow Luxembourg to become a hub that attracts, retains, and develops talent in the field of Deep Tech technologies, to guarantee national sovereignty and realise national ambitions in the areas of data, AI, and quantum technologies. It will usefully complement the existing solutions in Luxembourg to stimulate research, innovation, and entrepreneurship, thereby supporting the activities of this ecosystem as a whole.Additionally, the DTL will constitute a dynamic scientific and technological environment where researchers and engineers can focus on providing innovative and concrete solutions, particularly in the fields of data, AI, and quantum technologies, in line with the ambitions defined in Luxembourg's strategies. Its ultimate goal will be to promote high-level research, both public and private, to address societal and industrial challenges with high added value. Both bottom-up and top-down approaches will be used to identify and address research questions and high-impact innovation areas.
- To prepare for cyber threats in the quantum era, Luxembourg aims to accelerate the transition to post-quantum cryptography and deploy quantum communication networks integrated with the European EuroQCI initiative. This includes support for test beds for secure terrestrial and satellite networks, as well as promoting concrete use cases. The space component, with the development of a QKD satellite, is one of the country's strategic priorities. These efforts will contribute to strengthening national cybersecurity and defence capabilities, in line with its long-term priorities in terms of digital sovereignty, cybersecurity, and space technologies.
- The integration of the MeluXina-Q quantum computer into the existing MeluXina HPC infrastructure and the future coupling with MeluXina-AI allows for intelligent distribution of computational tasks between different architectures, thus optimising the use of available resources. This configuration will create a centre of computing excellence, where the advanced capabilities of classical and AI-specialised supercomputers are enhanced by the unique assets of quantum computers.

All of these strengths and key arguments will allow Luxembourg to present itself as a centre of competence and a true European hub at the cutting edge of digital technology.

Part 1. Introduction



Luxembourg's Data Strategy

1. About this document

Luxembourg's national data strategy covers the first of three strategic axes of the programme **"Accelerating digital sovereignty 2030"**. Together with the strategies on artificial intelligence and quantum technologies, it presents a holistic and cohesive vision of the ambitions and specific actions aimed to maximise the valorisation of data in Luxembourg, and thus, to contribute to the shared vision of this programme.

In line with the strategic vision outlined below and the guiding principles that derive from it, the national data strategy defines – for each of these six enablers – Luxembourg's ambition for 2030, as well as the specific actions to achieve them.

2. Participative methodology

This strategy is the **result of close collaboration with a wide range of key stakeholders** from civil society, the private and public sectors and research. This participatory and co-creation process took place in various formats, including meetings of the High Committee for Digital Transformation, collaborative workshops or bilateral discussions. At each stage, stakeholders were encouraged to share their needs, highlight the challenges they face and raise questions. In addition to the expertise of Luxembourg's public sector in data valorisation, the feedback from these stakeholders helped develop the vision, guiding principles, ambitions and specific actions explained below.

3. General approach

Data and its impact on the creation of an ecosystem

As data is the key element of this strategy, it is important to provide a definition of the term. Data, including personal data, is **anything that can be communicated, analysed or processed** (whether by an individual, a computer or other automated means) **to derive information**. It can be raw or processed and is used in a variety of contexts, ranging from scientific research to commercial operations.

Data is useful to make informed decisions, identify trends or adopt an analytical approach. Data can be qualitative (descriptive) or quantitative (numerical), originate from various sources and be stored in databases, spreadsheets or other digital formats, and processed using software tools and algorithms.

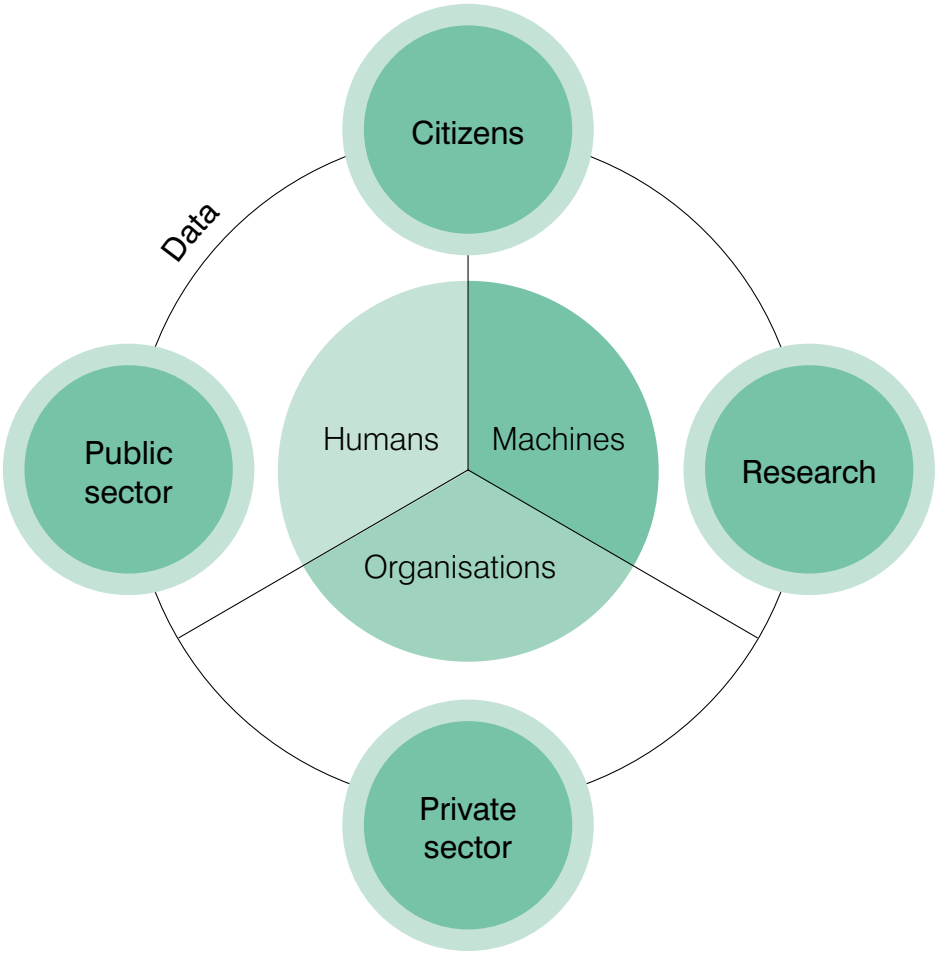
This strategy aims to establish a consistent and comprehensive framework for the management, use and valorisation of data throughout the country and at international level. This holistic approach covers all key sectors of Luxembourg society: the private sector, where data serves as a driver of innovation and economic growth; the public sector, which seeks to improve its policies, services and governance through the smart use of data; the research sector, which will benefit from privileged access to data for to advance science and innovation; and citizens, who will benefit from greater transparency, enhanced products and services, and stronger protection of their personal data, while being encouraged to participate actively in the digital economy.

In the digital age, **data comes from a multitude of diverse and complementary sources**. People constantly generate data through their daily interactions, such as social media posts, online purchases, internet searches or electronic communications. Objects, such as environmental sensors measuring air quality, medical devices monitoring vital signs, smart meters recording energy consumption or connected vehicles collecting data about their use and environment, generate an even more substantial volume of data.

Meanwhile, organisations constitute a third major data source, e.g. companies that catalogue their business transactions, public institutions that archive administrative documents, healthcare facilities that document medical records, research bodies that compile scientific results, etc. The convergence of all these sources creates an extraordinarily rich data ecosystem, and their interconnection and analysis offer revolutionary perspectives.

The convergence of all these sources creates an extraordinarily rich data ecosystem, and their interconnection and analysis offer revolutionary perspectives.

In terms of scope, this strategy adopts a balanced approach that recognises the diversity of data types and uses. On the one hand, it actively promotes the publication and use of **open data**, whose access, sharing and use are free for everyone, to stimulate innovation, research and governmental transparency. On the other



hand, it establishes a robust framework for the management of **protected data**, ensuring its responsible and secure use in respect of individuals' privacy and the legitimate interests of organisations, while facilitating its controlled sharing. This dual function enables Luxembourg to maximise the socio-economic value of data while preserving digital sovereignty, confidentiality and security, which are essential pillars for building trust in the national digital ecosystem.

Data, a strategic element serving people and innovation

In a world of constant and accelerated digital transformation, **data is not merely a technological resource, it is also a fundamental resource that should be used to benefit people**. When used responsibly, data can improve the quality of life for all fellow citizens, encourage social inclusion and address major societal challenges. This strategy puts people at the heart of the data economy by ensuring that the use of data benefits citizens, businesses and institutions.

Luxembourg has adopted a proactive and responsible approach regarding critical challenges such as the fragmentation of data ecosystems, concerns regarding digital sovereignty and privacy protection, and the concentration of power in the hands of a few technological actors. The task at hand not only involves supporting global digital evolution, but also actively shaping it by creating a framework that ensures balance between innovation, security and respect for fundamental rights.

The **ambition of this strategy** is to:

- **put people at the heart of data use** by guaranteeing the concepts of transparency and ethics as well as individuals' control of their own information;
- **stimulate innovation and competitiveness** by facilitating access to top-quality data for research stakeholders and businesses, while respecting fundamental rights;
- **strengthen Luxembourg's digital sovereignty** by developing independent standards and infrastructures to preserve its strategic autonomy;
- **create a sustainable and inclusive data economy** where the value generated by data benefits society as a whole.

Data is far more than just a technological or economic tool: it forms the foundation of collective intelligence, more informed decision-making and digital transformation for the common good. Throughout this strategy, Luxembourg commits to being a driving force for a more innovative future rather than remaining passive in the face of digital developments.

Harness the potential of data

Data is omnipresent in the digital world. It must be treated as a **primary resource** that has enormous potential, particularly when it comes to decision-making, designing effective policies, developing products and providing efficient, top-quality public and private services. Data also serves as a **raw material** for a broad array of technologies, such as artificial intelligence (AI), which are playing an increasingly prominent role in our everyday lives.

As such, data is a valuable source of wealth for citizens, businesses and policy makers because it helps them better understand socio-economic and environmental challenges. It enables more precise and effective planning of necessary actions to be taken and facilitates to develop innovative products and solutions. The value of data therefore lies in its use, reuse and analysis, ideally of high quality and in large volumes.

Luxembourg would like to bring together a data ecosystem and become an attractive and internationally recognised hub of excellence for data.

The valorisation of data in both the public and private sectors hinges on the **generation of high-quality, reliable and easy-to-use data, as well as compliance with guiding principles, such as the FAIR principle**, which stands for **F**indability, **A**ccessibility, **I**nteroperability and **R**euse of data; **the protection of individuals, their data and their fundamental rights**; and a **focus on human well-being**.

In order to fully harness the potential of data, a centralised form of governance ensuring access to and reuse of public sector data is being established at the level of a competent public entity pursuant to Regulation (EU) 2022/868 on European data governance[1] (DGA) and other relevant sector-specific regulations, such as Regulation (EU) 2025/327 on the European Health Data Space[2] (EHDS). By establishing an authorisation approach through a centralised and specialised body responsible for granting access and reuse to eligible public and private entities, **Luxembourg ensures a favourable and consistent framework for data valorisation in a trusted environment**, accessible to the eligible public and private sector actors. This body will substantially enhance data exchange in strict compliance with Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data[3]

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[1] Regulation (EU) 2022/868 on European data governance and amending Regulation (EU) 2018/1724 (Data Governance Act)

[2] Regulation (EU) 2025/327 on the European Health Data Space and amending Directive 2011/24/EU and Regulation (EU) 2024/2847

[3] Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC

(GDPR), as well as respecting copyright and related rights, the protection of trade secrets and banking secrecy. To do so, it will provide secure data exchange and processing infrastructures, using trusted third-party services where necessary.

Furthermore, a body providing catalogues of available data within the public and private sector and in common European data spaces has been established. It also provides guidance to any entities that wish to make their datasets interoperable.

Towards a data-driven society: challenges and perspectives for Luxembourg

The national data strategy is part of a datafication context, i.e. the societal and economic transformation driven by data, and it follows in the footsteps of national and international initiatives and strategies aimed at leveraging the benefits of this transformation.

One of the indicators of this new reality is the emergence of new technologies that increasingly rely on the use of data. These technologies can either generate massive amounts of data (e.g. the Internet of Things - IOT) or process large volumes of data to conduct analyses and extract information (e.g. artificial intelligence - AI).

In recent years it has become possible to collect data on a continuous basis, which makes it possible to respond rapidly and take decisions in real time. Moreover, data collected directly from connected devices is more granular, enabling deeper insights into processes. Although this data presents new challenges due to its volume and decentralised nature, it also holds untapped potential to find new solutions to complex problems.

The production, storage and transfer of data between service providers have already become more accessible, thus giving rise to new social-economic and technological opportunities.

The Luxembourg Government aims to establish a comprehensive framework - ranging from regulations to essential services - to seize emerging opportunities and encourage all stakeholders of Luxembourg's ecosystem to follow suit. This initiative builds on the Data-driven innovation strategy for the development of a trusted and sustainable economy in Luxembourg.

Luxembourg, a digital pioneer

A reflection on the data ecosystem must necessarily take place in the context of the actions already undertaken by Luxembourg to follow up on the 2022 recommendations on digital government, published by the Organisation for Economic Co-operation and Development (OECD) regarding digital government, as well as the context of the European Data Strategy published by the European Commission. It is therefore aimed at both the private and public sectors, as well as research.

In its pioneering role, Luxembourg also attaches great importance to the creation of national versions of common European data spaces and the participation in international initiatives such as Gaia-X. The strategy aims to **make the descriptions of the datasets** contained in common European data spaces **accessible to a wide audience** and to **simplify the access and reuse of data** by the public, private and research sectors **by setting up a single authorisation entity**.

As such, Luxembourg and its international partners can capitalise on synergies in the governance of common European data spaces dedicated to topics such as health, cybersecurity, mobility or energy, all thanks to the creation of a single authorisation entity, the publication of centralised data catalogues and the promotion of interoperable standards. Moreover, the governance system establishes the entities capable of responding to the specific needs of each sector while ensuring the (technical, semantic, legal and organisational) interoperability and the security of the shared data. This interconnected ecosystem will ultimately make it easier to implement advanced technologies, particularly artificial intelligence, by providing access to big, diversified and high-quality data, while guaranteeing the protection of users' rights.

By adopting harmonised data management and valorisation practices that promote innovation, interoperability and security, **this strategy also contributes to European ambitions to build a robust and resilient digital economy**. This involves developing advanced digital infrastructures, providing support to a skilled data workforce and encouraging the transparency and accessibility of data while complying with European data protection and privacy standards. Luxembourg is therefore actively contributing towards a more digital, competitive and inclusive Europe.

Existing national data management and valorisation initiatives

As part of our considerations to create an extensive data valorisation framework, **Luxembourg can draw on the momentum and drive of the national strategies and initiatives already in place**.

- On 1st March 2019, in response to a growing demand for interaction between the services that use data, the Government Council adopted the National Interoperability Framework (NIF) developed by the Ministry for Digitalisation. The NIF provides a general framework as well as a governance system that enables and facilitates a higher level of interoperability between public sector entities.

- Through its activities in the field of emerging technologies, the Ministry for Digitalisation wants to raise awareness amongst ministries and administrations of innovations that could provide solutions to the challenges our society is facing. To do so, the Ministry for Digitalisation introduced the Tech-in-GOV call for projects. Furthermore, the GovTech Lab, a joint initiative by the Ministry for Digitalisation and the Government IT Centre (Centre des technologies de l'information de l'État - CTIE), also launches calls for solutions, combining technologies used within the public sector and open innovation to accelerate the development and improvement of digital public services.
- The Open Data Strategy, established by the Information and Press Service (SIP) and approved by the Government Council on 7th December 2022, supports Luxembourg's programme to implement open data principles. The continued availability of public sector data in the form of open data, whenever legally possible, is an integral part of public sector data valorisation within a trusted environment.
- The National Research and Innovation Strategy implemented by the Ministry of Research and Higher Education, which establishes the framework for the development of the research ecosystem, is closely linked to optimal data management and use.
- The Data-Driven Innovation Strategy for the Development of a Trusted and Sustainable Economy in Luxembourg, implemented by the Ministry of the Economy, targets the private sector to strengthen a sustainable and reliable economy in Luxembourg through increased use of data.
- Luxembourg's National Cybersecurity Strategy, developed under the coordination of the High Commission for National Protection (HCPN), aims to boost the Grand Duchy's digital resilience to cyber threats. This strategy is essential for the development of a reliable digital economy.
- The open cybersecurity data space established by the Luxembourg House of Cybersecurity will be fed by both public and private Security Operations Centres (SOCs). It will encourage the development of autonomous protection tools for small and medium-sized enterprises (SMEs).
- The National Space Strategy recognises the potential of space data for a broad range of applications beyond the space industry and highlights Luxembourg's active involvement in international discussions on space exploration and sustainable use. Luxembourg is also taking steps to establish a robust national regulatory framework, including, for example, a proposed act on sensitive high-resolution earth observation data.
- The Space Defence Strategy highlights a plan to support intentional initiatives which aim to integrate data from public and private sources to enable continuous Earth monitoring and rapid access to imagery where necessary. In addition, the strategy also highlights the importance of protecting the data sent to and from satellites in orbit.
- Lastly, the Luxembourg National Data Service's (LNDS) economic interest group was created by the Luxembourg Government to assist in the implementation of strategies combining research, innovation and digitalisation through the provision of reliable data services. The LNDS aims to create value for public sector organisations as well as for private sector and research stakeholders through the reuse of data from the public sector and from common European data spaces. Through its services, it seeks to facilitate data discovery, improve data quality, enrich data content, secure data processing, manage data life cycles, protect the confidentiality of data subjects and strengthen processing capabilities.

Towards a pragmatic national regulatory approach

The use, reuse and analysis of data for the purpose of enhancing their value is already based on a robust and ever-expanding regulatory framework. This framework specifically addresses data governance, the protection of fundamental rights, the use and reuse of public sector data, data intermediaries between private sector stakeholders, data security, data interoperability, the provision of data related to connected products, the provision of non-personal data held by the private sector for the benefit of the public sector in exceptional circumstances, facilitating the change of data processing services and the development of data interoperability standards.

The Government has decided that the governance established within the context of Regulation (EU) 2022/868 on European data governance (DGA) will be reproduced for all common European data spaces with the aim of simplifying access to data catalogues contained within the respective data spaces for potential users and accelerating access requests. Within the scope of the Data Act, Luxembourg seeks to establish governance in line with the regulation on European data governance and the digital space in general and supports the creation of a single European data market.

Regarding the use, reuse and analysis of data for the purpose of maximising its value, the regulatory framework that Luxembourg intends to implement will be expanded in the coming years, particularly through the adoption of European regulations on common European data spaces.

The European Commission is considering adopting additional European regulations to specifically regulate

the common European data spaces, of which there are 14[4] to date. The first of these texts is Regulation (EU) 2025/327 on the European Health Data Space, which constitutes a dedicated framework for health data (*lex specialis*), specifying the rules set out by the Data Governance Act (*lex generalis*).

Regulatory fragmentation in the implementation of the 14 different legal regimes governing the access and reuse of sector-specific data – applying simultaneously and complementing each other – is likely to complicate the access to and reuse of data and potentially their data valorisation.

To prevent such outcomes, Luxembourg recommends adopting **a harmonised authorisation approach through a centralised and specialist body responsible for granting access and reuse** to eligible public and private entities.

This national data strategy aims to support all stakeholders of the data ecosystem by advocating for a pragmatic national regulatory approach and by developing a single procedure for data access and reuse across the sectors covered by the common European data spaces. As such, stakeholders of the data ecosystem can benefit from increased legal certainty to generate added value from data. By focusing on the digital transformation of the country, Luxembourg aims to implement cutting-edge infrastructure, boost the efficiency and proactiveness of public services and encourage innovation in the private sector.

Through effective data governance: the importance of data valorisation in a trusted environment

The foundations of the pragmatic national regulatory approach have been laid by the Luxembourg Government as part of its efforts to maximise the value of data in a trusted environment.

The Luxembourg Government has given new momentum to the reuse of data in Luxembourg by proposing a legal framework for the provision, use and reuse of data within the scope of the Data Governance Act and by establishing the Once Only principle, which aims to reduce the redundancy in information exchange between citizens and public administrations to simplify procedures and thereby reduce the administrative burden on citizens and businesses.

The governance established therein aims to serve as a model plan for managing data exchange and the creation of common data spaces across the various sectors of the Luxembourg ecosystem. The Government Council confirmed this centralised approach by affirming its intention to establish in Luxembourg a single procedure and governance system for data access and reuse across all future common European data spaces.

The national data strategy also aims to turn this data governance – focused on maximising the value of data – into a driver of digital competitiveness in Luxembourg. It does so by guaranteeing its attractiveness and competitiveness nationally and internationally as a data hub, through the uniqueness and user-friendliness of access and processing procedures across sectors.

By creating this data valorisation framework, the Government wishes to position Luxembourg as a key player in a data-driven economy, where exchanges can take place seamlessly and securely, all while strengthening cooperation between stakeholders within the European Union.

[4] Namely: agriculture, cultural heritage, energy, finance, Green Deal, health, language, production, media, mobility, public administration, research & innovation, skills and tourism.

4. Strategic vision

To fully harness the opportunities that data can offer, Luxembourg is creating an attractive, efficient, sovereign and secure socio-economic environment for all public and private stakeholders as well as for citizens. Through the judicious use of data, Luxembourg facilitates informed and effective decision-making, promotes innovation and research by leveraging and maximising the value of data – thereby stimulating the data economy – and makes administrative processes more efficient and user-friendly. Internationally, Luxembourg aims to become a European data hub for reliable, high quality and easily exploitable data. Luxembourg commits to promoting transparent access and respectful use of data while safeguarding their security and protection in line with the European values. Ensuring the well-being of the citizens and the contribution to a more sustainable world are at the heart of this data strategy.

Ensure an attractive, efficient, sovereign, and secure data environment

To achieve this vision, the Luxembourg Government takes on the role of a pioneer in data management, establishing **a centralised governance that will simplify the access, use and reuse of public sector data**. **This facilitation applies to public and private entities at both the national and international level**. The positive effects of this governance will benefit the public and private sector as well as research, and will be manifested in the adoption of new regulations, standards, interoperable technologies and efficient and exemplary operational procedures. In doing so, it becomes the guarantor of an attractive, efficient, sovereign and secure data environment.

- **Attractive**, as findability, accessibility, interoperability and reusability of data in Luxembourg is at the core of its data ecosystem. The stakeholders are therefore not only immersed in an existing data culture or benefit from potential partners at their level of data knowledge, but also have easy access to data and a promising starting position to add value to data.
- **Efficient**, as Luxembourg is setting up a centralised governance whose mechanisms and procedures are reused to meet the requirements of national and European regulations. On the one hand, the stakeholders of Luxembourg's data ecosystem can therefore take advantage of uniform procedures, ranging from access requests for the reuse of public sector data to the participation in common European data spaces. On the other hand, it draws on a transversal governance leaving each stakeholder in the public sector data ecosystem the freedom to address the specificities of their own domain.
- **Sovereign and secure,** as the Government aims to implement pragmatic regulation and clean solutions to address the opportunities and challenges of a dynamic and evolving data ecosystem. The idea, as described in the vision, is to move forward without sacrificing either security or data protection.

The aforementioned determination and efforts will ultimately **lead the Government to create a Data Factory**, supervised by the Ministry for Digitalisation. The objective of this Data Factory is to support private and public sector entities as well as scientific research professionals to implement this national data strategy.

The *Data Factory* aims to develop an ecosystem for data valorisation based on the provision and reuse of ready-to-use information, enabling the creation of accessible and interoperable data products and services.

Thus, the ***Data Factory*** represents a collaboration of stakeholders that particularly facilitates:

- **collaboration** between the main stakeholders of the national data strategy and the various national initiatives contributing to its implementation;
- **providing information on resources and services** in the context of data valorisation;
- **providing information on the activities of** the *AI Factory*, the *Quantum Factory* and other initiatives contributing to a digital innovation chain;
- **national and international promotion of the** data valorisation **ecosystem**;
- **consulting services** on the implementation of the national data strategy.

Empower citizens to maximise the value of their own data

The benefits of an attractive, efficient, sovereign and secure data environment have tangible impacts on Luxembourg citizens. An advanced and dynamic data culture within the professional sphere influences society as a whole, contributing to the **development of a robust and effective data culture shared across Luxembourg's social fabric**. This establishes a solid foundation for a **broader public understanding of the opportunities and challenges related to data sharing**

and use by the public, as well as for more effective and controlled management of their own data. New needs must be addressed by a diverse range of economic actors, offering new products and services that genuinely enhance the connection between citizens and their data.

Design data-driven policies

Luxembourg is shaping its future with ambition, equitably with the public interest at heart and, at the forefront of ecological challenges. To this end, it **enhances its understanding of opportunities and challenges by using available data**, either directly or by combining it with data from other public sector stakeholders, and in special cases defined by law, from private sector stakeholders[5]. This data helps to establish informed and evidence-based political and entrepreneurial initiatives, and to assess them on an ongoing basis to make any necessary adjustments.

Luxembourg intends to encourage:

- **the development of strategies, policies and initiatives** while enriching the expertise and the information directly available to decision-makers with the information contained in the data;
- **informed decision-making** by analysing the data available; and
- the **measurement of its policies', decisions' and initiatives' impact**, and to subsequently adjust them as and where necessary.

Provide simple, fast and efficient public services

The use and valorisation of data help to improve and **optimise public services in regard to reducing the administrative burden on citizens, businesses and government officials**. Ministries and public authorities ensure the necessary data is shared to fulfil their responsibilities and **proactively offer services to assist citizens and businesses** in their endeavours, while respecting privacy. This **approach strengthens guiding principles such as the Once Only principle**. This also implies the removal of unnecessary procedures, thereby **promoting administrative simplification**. In the future, within an efficient data ecosystem, it is conceivable that - with the explicit consent of the individuals or entities involved - data from the private or research sector could be used to improve public processes.

Improving administrative services directly benefits citizens and businesses alike and goes hand in hand with both a new data culture and its associated skills, making Luxembourg an attractive partner in any data-related project.

Create data-driven innovation and added value

Luxembourg aims to **create a data ecosystem which favours innovation and the creation of added value**. An ecosystem stimulating knowledge creation provides solutions to numerous current and future challenges faced by society. More specifically, it aims to **boost the competitiveness of Luxembourgish businesses**, both at national and international level, and supports their ability to **attract the talent** required for their proper development. It encourages a spirit of initiative, thereby ensuring the diversification of the economy and the development of pioneering sectors.

The envisioned data ecosystem encompasses comprehensive, interoperable, and interconnected data services for both the public and private sectors, representing significant progress in data valorisation. This includes facilitating and regulating access to data, improving data quality, management and security, enhancing data processing capabilities, generating synthetic data, anonymisation and pseudonymisation, as well as considering the ethical, legal and social implications of working with data. All these services aim to create added value by using and reusing data, including public sector data, within a trusted environment.

The *Data Factory* mentioned above seeks to facilitate the creation of this data ecosystem. It brings together a wide range of stakeholders offering data processing services and directs data project owners to the right actors or creates synergies between them with a view to optimising the value derived from the use of data within a specific project.

Establish a hub of excellence in terms of data

Luxembourg aims to **strengthen its position as a leading example of a data-driven digital nation**. It aims to create comprehensive, high-quality datasets and ensure they are accessible, governed by robust and effective mechanisms. In key sectors like space and finance, Luxembourg seeks to produce high-volume, strategic datasets while prioritising quality.

In addition to making its own data accessible, **Luxembourg takes on the role of bridging the gap to datasets from other countries and fostering a robust data ecosystem through international partnerships**. To achieve this, Luxembourg is enhancing its data expertise, governance and knowledge regarding the

[5] Regulation (EU) 2023/2854 on harmonised rules on fair access to and use of data and amending Regulation (EU) 2017/2394 and Directive (EU) 2020/1828 (Data Act)

provision of national data, as well as understanding the governance and access conditions in other nations. Given its geopolitical context, Luxembourg prioritises cross-border data flows. It collaborates with EU Member States and other strategic partner countries to establish legal and technical frameworks, ensuring that data is exchanged securely and responsibly.

Luxembourg also continues to invest in talent recruitment and training programmes to strengthen skills and enable the retraining of the existing workforce in all data-related fields. To sum up, it encourages collaboration between academia, industry and public services through various measures, promoting the country as an attractive destination for national and international talent.

5. Guiding principles

A human centred approach

Luxembourg is ambitiously shaping its future in an equitable manner with the public interest at its core and leading the way in addressing ecological challenges. The **importance of the human element in these considerations is paramoun**t. People's needs and requirements must be considered from the onset of any data valorisation process and should underline all decisions made, policies formulated, and products or services designed.

To place people in the centre of these considerations and maximise the potential of data, Luxembourg provides individuals with a framework to access their own data generated by the Internet of Things, or to voluntarily share their personal data held by public sector organisations for altruistic purposes.

Protection of individuals and data

In Luxembourg, all data processing must comply with the fundamental rights guaranteed by the Constitution, the Charter of Fundamental Rights of the European Union and the European Convention on Human Rights.

Data must be processed in a way that data protection requirements are met, particularly in terms of data transparency, accuracy and security.

Data valorisation

With a view of optimising the valorisation of the data within its ecosystem, Luxembourg promotes **FAIR** data, i.e. **F**indable, **A**ccessible, **I**nteroperable and **R**eusable.

- **Findable:** an overview of the data in the ecosystem through one or more data catalogues enhances its visibility, ensures transparency and easier identification, and encourages its use.

  Simultaneously, a data ecosystem has to establish transparency not only in regard to the collection, processing and use of public sector data, but also to the role of data in decision-making, the delivery of products, services or even decisions.

- **Accessible:** data has to be accessible in line with the current legal framework to enable reuse by third parties, encourage the creation of added value and drive innovation. By proactively and systematically providing access to the data from the Luxembourg ecosystem in a standardised way, stakeholders can allow administrations, citizens, researchers, businesses and organisations to use data to improve the services they provide to citizens, conclude informed decisions, innovate and take part in the democratic process.

  Data accessibility follows the principle of openness by default. Any data produced should, by default and within the limits of the applicable legal and regulatory framework, be considered open data. Any derogation from this principle must be justified.

- **Interoperable:** applications and systems have to be able to exchange data in a secure, standardised, automatic or even proactive way, without being constrained by organisational silos. Collaboration between organisations has to be encouraged such as information exchanges, creating added value for citizens, businesses and organisations.

- **Reusable:** data-holding organisations ensure that their data is easily reusable by clearly specifying the conditions for subsequent processing or reuse, by providing detailed information on the data's origin and the context of its collection, and by aligning with semantic and technical standards shared across the ecosystem.

All collected data must be in a **digital format by default**. Any data which, in the spirit of inclusion and accessibility, is collected in a non-digital format, must subsequently be digitised.

In line with optimising the use of the information and knowledge intrinsic to data, its accessibility in a machine-readable format is the the overarching aim.

Part 2. Enablers

Six enablers for action

This national data strategy sets out clear ambitions and actions, structured around six enablers, to be implemented by 2030. To realise the Government's vision and **make Luxembourg's data ecosystem an enabling framework for the public sector, research, and national and international businesses** supporting the country's innovation and growth through the responsible use of data.

The Data Factory will offer invaluable support to stakeholders engaged in a variety of the actions to follow. Its goal is to develop an ecosystem for data valorisation, centred on the provision and reuse of ready-to-use information, thereby enabling the creation of accessible and interoperable data services and products.

1. Governance and regulations
2. Talents and skills
3. Infrastructures
4. Services ecosystem
5. Research, development and innovation
6. International collaboration

1. Governance and regulations

Ambition: establish data governance

To achieve the vision set out in this strategy, a clear, structured and transversal governance is needed to provide all stakeholders with an overview of the potentially accessible data. A unified and simple access procedure, secure data processing environments, anonymisation and pseudonymisation services, and simple and clear interaction with experts throughout the value chain will be offered.

By implementing this data governance, the Government will ensure that the public, private and research sectors can fully leverage the information contained in data from the public sector and common European data spaces.

› **Action 1:** A centralised governance - Luxembourg Government's unique approach as a catalyst for innovation and enabler for digital competitiveness

The Luxembourg Government is implementing a centralised, unique and effective data governance to manage access to public sector data and to common European data spaces. This initiative aims to unite various data ecosystem stakeholders to optimise processes, drive innovation and enhance digital competitiveness, all while adhering to standards for data access, processing, and reuse.

This centralised data governance is based on four main pillars:

- A **single information point** is placed under the authority of the Ministry for Digitalisation from which all interested parties can use a data catalogue to find out what datasets exist and how to access them, including the conditions and procedures involved.
- A single **data authority**, the Government Commission for Data Protection of the State (Commissariat du Gouvernement à la protection des données auprès de l'État - CGPD), grants or denies access to and use of public sector data and the common European data spaces through a harmonised and unified access request procedure based on legal criteria.
- CTIE provides a **secure data processing environment and related tools** for processing data previously authorised by the CGPD. If necessary, this can be done with the involvement of a trusted third party for data anonymisation, pseudonymisation and aggregation.
- The LNDS **assists** all entities in accessing the common European data spaces in preparing access and reuse requests to be submitted to the data authority.

› Action 2: Standardise data access conditions

Access to public sector data is defined by national governance procedures, standards and policies which are aimed at maximising the value of data while safeguarding it from any misuse.

As mentioned in the previous paragraphs, **a centralised, unique and efficient governance ensures that access procedures for data from the public sector and common European data spaces, as well as their respective secure processing environments, are synergistic and standardised**. This high level of standardisation from both legal and organisational perspectives enables stakeholders within the data ecosystem to quickly learn and fully understand the procedures for requesting access to this data, allowing them to optimise their own workflows and internal processes accordingly.

The private sector can leverage the standardised procedures and access conditions of the public sector to establish its own framework for data access. This results in a data ecosystem that facilitates access and potential reuse of all types of data within a framework that is both efficient and secure.

Introducing a register of successful data sharing cases within Luxembourg's data ecosystem facilitates the dissemination of information about relevant access procedures and conditions. This could guide ecosystem stakeholders in their approaches and inspire the creation of initial standards that emerge organically, eventually leading to the adoption of effective and proven standards across the entire ecosystem.

The adoption of such standards would also address intrinsic matters, such as ethical and moral considerations. These values could be embedded in standards governing data reuse and access conditions, applying to the entire ecosystem. For example, the European Code of Conduct for Research Integrity requires that researchers, institutions and research organisations ensure, among other things, that data access is as open as possible and as restricted as necessary, and that they are transparent about the access arrangements and procedures for obtaining usage permissions.

› Action 3: Define authentic sources

To boost confidence in the accessibility and sharing of data, a **common approach for defining authentic sources** is required among data ecosystem stakeholders, particularly within the public sector. The definition of authentic sources is based on several key elements: identifying authentic data and the sources that contain it, accepting responsibilities for maintenance, updates and access, standardising data descriptions, and implementing technical standards. These elements are essential to ensure that data is shared effectively and efficiently, thereby achieving the objectives of the current strategy.

In addition to proactively identifying authentic sources with the responsible entities, the Ministry for Digitalisation will consult the future Once Only protocol register to identify the authentic source of the data.

› Action 4: Define interoperable standards

The **definition of organisational, legal, semantic and technical standards** (e.g. APIs) **or structural standards** (such as data formats) **is essential for accelerating, streamlining, and facilitating data sharing**. Developing common definitions and meanings for semantic data structures, like data dictionaries, ensures that available data is used without misunderstandings, significantly reducing the risk of incorrect analyses. Implementing a national strategy for creating unique and persistent identifiers for all public sector datasets will simplify data identification and ensure consistent tracking of its origin throughout its lifecycle.

These standardisation efforts will form the cornerstone for data exchanges between the public and private sectors as provided for by law. They will ensure that the data exchanged can be understood clearly, assimilated effectively and used by the country and society at large. This need for interoperability, which has been embedded in Luxembourg's National Interoperability Framework since 2019, is increasingly reflected in EU legal texts. The European Union views this as a fundamental condition for the implementation of its European Data Strategy, and more specifically its common European data spaces.

Furthermore, a national standard, DCAT-AP-LU, will be recommended to describe the data, forming a Luxembourgish extension to DCAT-AP, a standard for information sharing about catalogues containing dataset and data service descriptions in Europe. This will ensure the interoperability of national and European catalogues.

› Action 5: Establish a public sector identification framework that improves data protection

The "matricule" or national identification number is the unique identifier for individuals in Luxembourg. It is also often used by the private sector to carry out identity matching.

Although the national identification number is simple and effective, it gives away information about the person in question, such as their date of birth. It must therefore be protected because of its unique characteristics. Furthermore, its collection is only justified in a limited number of cases provided for by law.

Other solutions now need to be explored, such as the management of identifiers, to establish unique links between different datasets without openly displaying information about the individuals to whom they relate.

2. Talents and skills

Ambition: Foster a data-driven society and strengthening digital skills

Luxembourg's ambition to strengthen data-related skills and abilities requires **a multi-dimensional approach**. To speed up the adoption of data technologies, it is essential to nurture not only the technical skills needed to manage and analyse data but also the analytical and legal skills needed to understand and exploit the potential that data withholds. Moreover, to ensure that data is used responsibly and in an optimal manner, it is crucial that not only employees at all organisational levels, but also citizens, receive appropriate training.

To achieve this objective, Luxembourg is looking to develop data-related skills and to foster a genuine data culture at all levels of society. This requires the implementation of approaches that match the various skills profiles. Luxembourg has identified three such key profiles:

- **Data experts:** Developers of data solutions possessing in-depth technical knowledge, who design algorithms, train and fine-tune models, build data pipelines and integrate those models into products. This group includes, amongst others, data engineers and data scientists. They are the main innovators in the field of data. It is crucial that they have access to adequate infrastructure, specialised technical training and ongoing support enabling them to develop state-of-the-art solutions.

  Supported by a second group of data experts in legal and regulatory matters, the work of this primary group is embedded in a framework of pragmatic, unifying norms governing data innovation.

- **Data practitioners:** These professionals understand the concepts around data and implement and maintain data systems in their respective areas, even though they do not themselves build data pipelines. This category comprises business analysts, business developers, project managers, IT support, legal experts, data stewards and the like. For them, it is essential that they have the training needed for their specific fields, that awareness of data is being raised and opportunities to exchange with others are provided.

- **Citizens:** All citizens who use applications and pre-built data solutions (e.g. decision-support tools, chatbots, predictive analyses, etc.) to improve their everyday lives, and all those affected by data-driven decisions, policies, products or services. It is important for them to know how those applications and solutions use data, both personal and non-personal, to enable them to derive the greatest possible benefit from these and to ensure a responsible data use. This includes basic training about data functionalities, best practices for using data tools and raising awareness of the legal implications and data security.

To meet these profiles, Luxembourg is planning actions in a variety of areas, including **attracting and retaining talent, education, vocational training and awareness-raising**. These efforts will be carried out in collaboration with universities, schools, research institutions and training providers. By focusing on those areas and taking advantage of partnerships, Luxembourg aims to build a robust data ecosystem that supports sustainable growth and development.

The full potential of data can only be achieved if we succeed in creating a genuine data culture within Luxembourg's society. A willingness and ability to understand how to use and share data and in the process to question ideas and procedures should be instilled in citizens, public sector employees and businesses through the sharing of successes, best practices and challenges met and overcome.

This process of raising awareness, as well as the use of the tools needed to promote such a data culture, fall within the responsibilities of the ministries and administrations, research institutions and businesses, in addition to the various transversal and centralised efforts needing to be made.

However, merely creating a general data culture is not enough; it is also crucial to develop data experts such as data analysts, data stewards, specialised legal experts and others, of whom there is currently a shortage in Luxembourg. To do this, it is necessary to establish advanced training programmes and professional development initiatives aimed at instilling and fostering these specialist skills. The University, the research centres and businesses must work together to provide opportunities for continuous training, internships and mentoring programmes that will enable professionals to hone their

skills and deepen their knowledge and to keep up to date with technological advances.

At the same time, it is essential to raise awareness amongst citizens of the importance of data, ideally from an early age, and to encourage them to pursue careers in that field. This can be done through tailored educational programmes, practical workshops, awareness-raising campaigns and partnerships with schools aimed at integrating data skills in school curricula. By investing in education and training at all levels, Luxembourg can create a data culture and develop high-level expertise to support innovation and the country's competitiveness in the long run.

By focusing on these two aspects – general data culture and the development of expert skills – Luxembourg will be able to build a robust, dynamic data ecosystem capable of meeting current and future needs and supporting sustainable growth and development.

› Action 6: Establish data literacy

One of the main missions of this strategy must be to ensure digital inclusion, in other words, the process aimed at making digital technology accessible to each individual and providing everyone with the skills and especially the data literacy, that are to serve as the enabler of people's social and economic inclusion. Luxembourg's ambition is to include all its citizens in society's digital transformation and thereby to counter the digital divide that might otherwise cause it to fragment. Data must be seen not as a threat or a burden, but as an opportunity for everyone. Accordingly, when drawing up the new National Digital Inclusion Plan, dedicated attention will be paid to its data component, to develop and provide the citizens of Luxembourg with relevant training courses and events.

Reinforcing data literacy in civil society

Data culture plays an important role in civic involvement. To take part in today's society, geared as it is towards data and algorithms, Luxembourg's citizens must be able to benefit from a more in-depth understanding of data, related technologies and the impact they have. Acquiring the necessary skills from an early age is crucial if one is to manage and access not only one's own data but also data from multiple other sources, such as the open data platform or various media. Accessing, navigating and critically evaluating public sector data will enable the country's residents to participate in the process of formulating policies the results of which often affect them directly. Moreover, there needs to be a high level of public understanding of the advantages offered by data and data sharing, and a correspondingly high level of trust and interest in both collaboration and involvement. To achieve this, the results of data-driven research need to be publicly available and accessible. Interested members of the public should be able to take part in the data processing and resulting decision-making related to the secondary use of public data (including the use of public sector data to train AI systems) and to benefit from the results of such reuse.

Reinforcing data literacy in the public sector

In addition to the efforts needed to develop a data culture, it is important to create a culture of reuse of public data amongst public sector employees, to demystify the subject of data, to proactively tackle the challenges surrounding the monetisation of data, security, confidentiality, anonymisation and pseudonymisation of sensitive data, and to establish responsible data management practices. Luxembourg will do this through a series of awareness-raising campaigns and events, such as the annual *Data Summit Luxembourg*, underlining the potential for creating and deriving value from public sector data, as well as calls for challenges and hackathons.

Reinforcing data literacy in education

The Ministry of Education, Children and Youth (MENJE) is putting in place initiatives to strengthen data literacy at all educational levels, to prepare young people for a digital future. This includes tailored educational programmes, practical workshops and partnerships with schools aimed at integrating data skills in school curricula.

› Action 7: Create a network of public sector employees to ensure vertical governance

The central governance body (transversal governance) **must be able to rely on a network of agents** (vertical governance) who are familiar with public sector data and are experts in their respective fields – the previously defined data practitioners. Consequently, it is necessary that each public entity should have one or more employees responsible for data-related matters (e.g. data stewards). The latter must have an in-depth knowledge of the data generated or used in the business processes of their ministry or administration, and must ensure the confidentiality, quality and potential for the use of such data within the public sector.

These employees are charged with the implementation of the strategy (e.g. verifying that the relevant standards are properly applied in projects, maintaining the data inventory, etc.). They actively contribute to the creation and maintenance of knowledge and the data culture, as well as the periodic review of the strategy.

› Action 8: Attract and retain data skills

When it comes to human resources and the recruitment of talented personnel, **Luxembourg must become a go-to employer for data professionals of every specialisation**, by offering them a culture and a paradigm enabling the realisation of their data-related projects and the development of their careers. In concrete terms, the attractiveness of Luxembourg as an employer valorising data is built around the visibility of data projects, bringing true added value to society and pushing back the technological frontiers through innovative ideas. Consequently, Luxembourg intends to proactively communicate the progress achieved in valorising data by showcasing innovative projects.

Luxembourg will build the skills needed to implement actions, through data scientists and engineers who contribute to turning the above vision into a reality. One of the measures will be the creation of the Deep Tech Lab, a magnet for attracting, retaining and developing talent around *deep tech* technologies in Luxembourg. It is essential, therefore, that Luxembourg should strive to nurture and strengthen, within the public and private sectors, all aspects of knowledge and know-how relating directly or indirectly to data and data processing. Data experts will also play a highly important role in the context of the skills required for the development of artificial intelligence and quantum technologies in Luxembourg.

Develop continuing training programmes for the private sector

The National Centre for Continuing Vocational Training (Centre national de formation professionnelle continue – CNFPC), plays a key role in the development of data skills. The CNFPC is currently offering a Data Analyst programme aimed at employed and self-employed individuals, as well as managers, focusing primarily on non-IT professionals. In collaboration with the National Employment Agency (Agence pour le développement de l'emploi – ADEM), a version of this programme is also available for jobseekers, including, amongst other things, the necessary soft skills, thus increasing their employability.

The CNFPC is also looking to offer a training programme for data scientists, that includes machine learning modules (supervised and unsupervised learning) and a mathematics refresher module. Each training course contains a small-scale project as a practical application of the acquired skills.

The Digital Learning Hub (DLH), launched in May 2022, plays a crucial role in reducing the digital skills gap in Luxembourg. The DLH offers specialist courses in several IT-related fields, including data. These courses are open to all adult citizens and are designed to help them retrain or improve their skills to meet the needs of the labour market.

The LNDS is also developing specific training on basic subjects such as responsible and secure data use, including data protection, the legal framework surrounding the development of artificial intelligence and data governance.

Support initial and continuing university training and research

The University of Luxembourg is looking to expand the range of initial and continuing education it offers in the field of digital transformation and data management and analysis, to support upskilling and reskilling in Luxembourg. As a first step, the University of Luxembourg Competence Centre (ULCC) is considering the introduction of a continuing education university certificate in data management rooted in the research carried out at the University in that field. If this proves successful, this continuing education programme may lead to the organisation of an initial education programme (bachelor's and/or master's) by including an important interdisciplinary component regarding the diverse skills that future data management specialists will be required to master. Such a course would be supplementary to the existing Master in Data Science.

The University of Luxembourg's Institute for Digital Ethics (ULIDE) encourages and supports the integration of the principles of ethics, transparency and sustainability in the courses linked to AI, to prepare students for the responsible navigation of the societal implications of AI.

These coordinated actions are designed to create a robust and dynamic data ecosystem in Luxembourg that is capable of meeting current and future challenges and supporting sustainable growth and development.

Create training programmes for public sector employees

To encourage the development of a data culture within the public sector, and to promote reskilling and potentially upskilling within government entities, as well as the creation of a Digital Academy, the Ministry for Digitalisation will support the National Institute for Public Administration (Institut national d'administration publique – INAP) and propose a range of training courses dedicated to public sector employees.

To strengthen public administrations, initiatives such as communities of practice, networking and mentorship projects aimed at developing the skills of public sector employees will be implemented to ensure that improving digital and data skills is considered a priority.

To provide effective support for innovation within Luxembourg's public administrations, targeted programmes are essential, so that employees are provided with the required knowledge and skills concerning data and AI. By building on the INAP's

existing training and development initiatives, the Government will prioritise specific learning pathways focused on AI, tailored to the role and level of responsibility of the employee.

Those programmes may include:

- training relating to data and the sources on which artificial intelligence systems are based: data literacy, data valorisation and data science;
- specialised training in AI, providing basic and advanced knowledge about AI applications in the public sector; and
- AI modules in leadership training courses, designed for middle and senior managers, to enable them to manage teams efficiently, make informed decisions and have a strategic vision within a public administration in which digitisation and AI are becoming increasingly present.

This effort supplements Luxembourg's wider digital strategy and will strengthen the Government's ability to drive and implement AI-based innovations in all sectors, thereby fostering services that are more efficient, transparent and citizen-centric.

A data culture training programme has been specially designed for public sector employees. In accordance with the OECD's recommendation regarding the creation of communities of practice, which favours among others, a bottom-up approach to sharing best practices and identifying common challenges, the LNDS has set up and is maintaining and developing its national community of data management practices.

New communities of practice may include those dedicated to the challenges and opportunities of using AI (including generative AI) in the public sector and should provide a forum for dialogue not only within the public sector but also between representatives of academia, civil society and the private sector.

3. Infrastructures

Ambition: Develop state-of-the-art infrastructures

To turn the vision in this data strategy into reality, it is important to **develop state-of-the-art infrastructures making it possible to work with data on a small and large scale in all sectors**. Infrastructure development is based around two main axes.

The **first** of these is **aimed at establishing a safe, secure and resilient digital environment**. That objective requires the creation of reliable platforms guaranteeing the integrity of the collection, storage, transfer and use of data. It goes hand in hand with the installation of robust cybersecurity frameworks to protect systems and users.

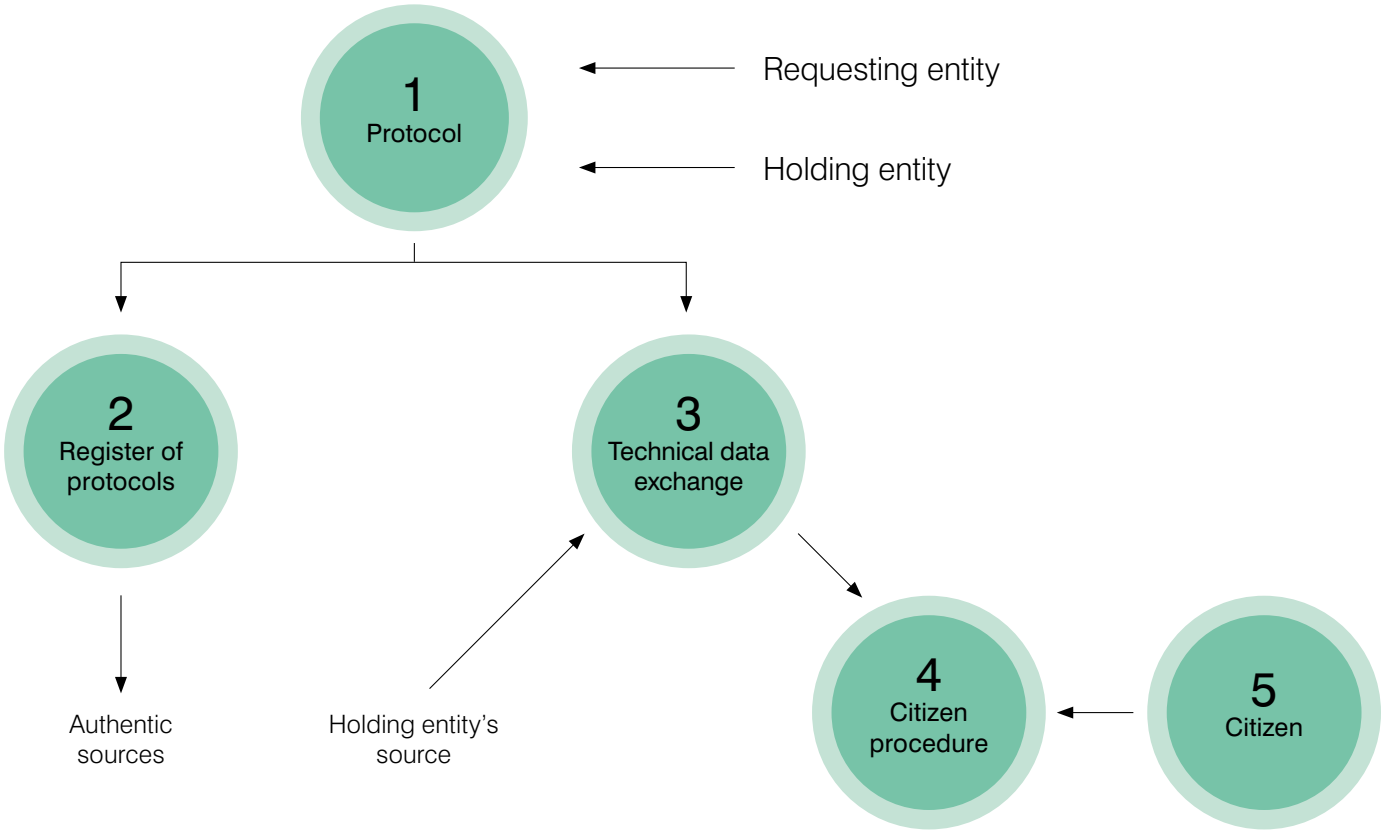
The **second** one is focused on the **performance and durability of infrastructures**. This approach involves a significant strengthening of infrastructures such as the cloud, which is essential to support actors dealing with large volumes of data. Likewise, the roll-out of high-speed connectivity across the country is a major priority for guaranteeing fair access to digital services. At the same time, the development of state-of-the-art computing capabilities will make it possible to meet the needs of emerging technologies. The strategy also provides for the creation of data centres combining optimal security and respect for stringent environmental standards to ensure a sustainable future.

› **Action 9:** Develop the IT infrastructures needed for public sector data valorisation

To **facilitate the flow of data to optimise data valorisation**, the Government will provide **public sector data exchange infrastructures**. In general terms, a distinction may usefully be drawn in this connection between two different types of infrastructure:

- An infrastructure that meets future obligations by complying with the Once Only principle. The personal data affected are those contained in sources that are authentic, identified, described and structured in a standardised manner. Those data are obtained by public entities from other public entities, ideally through centralised and standardised technical interfaces. The aim being to reduce the barriers to the implementation of the Once Only principle and to optimise the processes linked to it.
- An infrastructure for the further processing of data by public entities (either by the entity that already holds the data, or one or more other public entities) and for access to, and the reuse of, personal or non-personal data by users of public sector services, including public research centres and the private sector.

Both infrastructures benefit from the creation of a public sector data catalogue, as referred to earlier on in this strategy.



Procedural flow relating to the once-only principle.

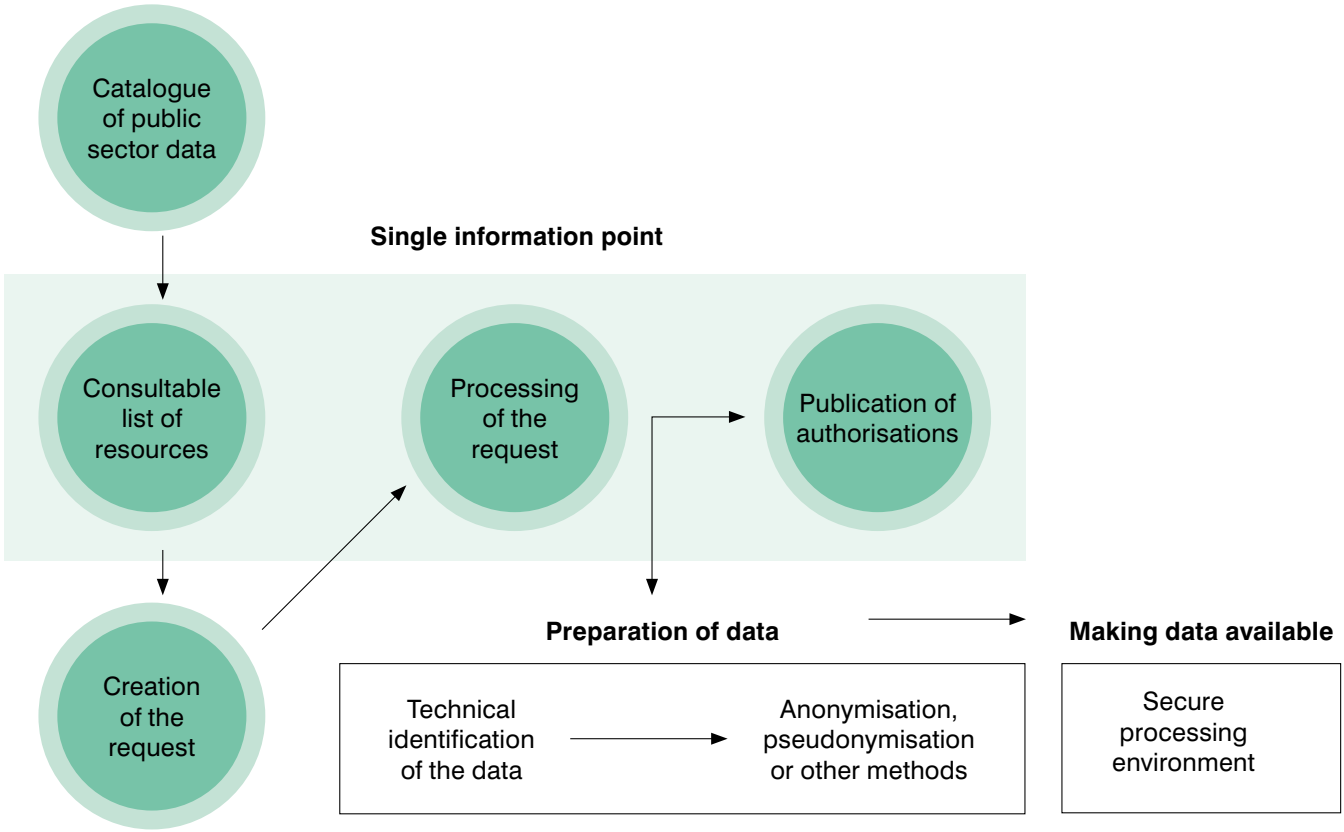
Within the framework of the Once Only principle, the objective of the infrastructure is henceforth to refrain from collecting the data needed for an application or declaration from the citizens if the data in question already exists within the public sector. In such circumstances, the public entities are required to exchange those data directly between them, and to resort to the citizen only if the data is not yet available within the public sector. Within that framework, each type of data exchange is formalised in a protocol signed between the requesting entity and that holding the data. The data authority receives and thereafter publishes all the Once Only protocols and keeps a register of them. A technical exchange of data between public entities, done on a centralised and standardised basis, is then put in place. The Ministry for Digitalisation uses the register of Once Only protocols to identify any authentic sources. Citizens may check whether the data are correct and, where they are not, may demand that they be rectified.

In the context of subsequent processing and access to and reuse of data, solutions will enable requesting parties to identify relevant data and to submit a specific, standardised request for access to the data in question. The information contained in that access request will be used by the data governance stakeholders to assess both aspects of data protection and technical feasibility, and, if the request is granted, to enact the preliminary mechanisms with respect to anonymisation, pseudonymisation, aggregation, or any other methods of disclosure control. Finally, the data are made available in a secure processing environment for the sole authorised purpose granted to the request made by the data reuser.

Thus, the data may not be downloaded and must be analysed directly from within the secure processing environment, which will therefore need to provide the tools required for analysing the data. The source codes for the data analysis, and those giving the extraction and anonymisation procedure for the data, can be archived and made publicly accessible, to ensure transparency of processing and reproducibility. A summary detailing the methods and results may also be provided to the manager of the infrastructure supporting the reuse of the data, to compile a catalogue of results.

› Action 10: Encourage the use of IT infrastructures for private sector data valorisation

The private sector must be able to use data to innovate, create or improve new products and services and optimise its internal processes. Bearing this in mind, if the Government is putting in place an



Procedural flow relating to subsequent processing or reuse of data.

infrastructure and processes for the valorisation of public sector data, then it is equally important that data sharing and processing, and the necessary infrastructures, should likewise be encouraged in the private sector and in research.

For several reasons there is a crucial need for using digital infrastructures in the private sector in order to valorise data:

- **Extend the Once Only principle to the private sector:** within the limits of the legal framework, the public sector can benefit from authentic data emanating from the private sector, since this will help it to further improve its administrative processes and procedures. In respect of the same conditions, the private sector can in turn benefit from authentic data emanating from the public sector, thereby facilitating the commercial and administrative processes linked to the respective activities of stakeholders.
- **Informed decision-making and policy creation by the public sector with the help of private sector data:** conditional access to private sector data will enable the public sector to make more informed decisions and to develop sound public policies, in compliance with the legislation in force and with the cooperation of the private sector.
- **Bring citizens and their own data closer:** this infrastructure will make it possible to develop new products and services, offering citizens improved access to, and giving them a better understanding of, their own data. This will strengthen their control, transparency and trust.
- **Innovation and increased competitiveness of the national economy:** the use of public sector data by the private sector and research, and data exchanges between companies, will stimulate innovation and increase the competitiveness of the national economy. This must not, however, result in data security and protection being compromised in any way. Therefore, a secure environment for the processing of data between national and international actors will continue to safeguard the confidentiality and security of information.
- **A magnet for data innovators and the promotion of Luxembourg as centre of excellence in data:** this infrastructure is designed to bring together innovation of all kinds and to create added value in, with and around data. It will simplify exchanges, with the aim of making Luxembourg an attractive destination for innovative actors and talents in data, placing it at the centre of all European exchanges and considerations regarding data.

› Action 11: Ensure an adequate level of supply in terms of storage and computing capacity

Luxembourg is planning a significant expansion of its cloud services, data centres and computing power, with a view to creating an evolving infrastructure. This strategy is aimed at **developing sovereign and hybrid cloud solutions for national and European data ecosystems, while strengthening the country's role as a digital hub** thanks to the increased availability, security and sustainability of its data centres. By consolidating its national computing capabilities, Luxembourg will support research, innovation and AI, thereby ensuring its competitiveness in the high-intensity data sectors, while strengthening the reliability, sovereignty and cybersecurity of the data infrastructure in conformity with the national and European regulatory frameworks.

Cloud computing is removing the barriers often linked to data sharing in a compartmentalised world, by creating inclusive spaces for efficient data collaboration. In such shared secure and trusted environments, users can access data from authentic sources and thereby engage in more efficient high-quality processing.

When it comes to providing adequate solutions to the challenges posed by the data ecosystem, the cloud is the go-to solution, because it offers shorter time make resources available and greater agility. The projects and applications needed for the implementation of the data ecosystem are thus able to evolve more rapidly from the stage of the initial idea to that of the final solution, while remaining capable of being scalable to meet the evolving needs of said ecosystem.

Cloud computing removes the barriers often associated with sharing data in a siloed world by creating inclusive spaces for effective collaboration on data.

Such adaptability or flexibility becomes especially important once the solution has rolled out. The scalability of a cloud environment is unmatched and allows rapid adjustments to be made to the size of a project, considering its specific characteristics. Thus, the cloud helps a project to grow, thanks to optimised use of the resources and time available.

By using cloud services, small and medium-sized enterprises can reduce licencing and resource costs. Such companies may also benefit from the skills of cloud providers in terms of availability, maintenance, updates, backups and cybersecurity.

As mentioned in the action about IT infrastructures needed for data exchanges, it will also be necessary to allow the use of state-of-the-art data analysis tools within the secure processing environment. Interconnection with the Meluxina, MeluXina-AI and MeluxinaQ supercomputers will be possible.

4. Services ecosystem

Ambition: Data valorisation in a trusted environment

To foster data valorisation in a trusted environment, **Luxembourg makes sure that data is easy to find, accessible, interoperable and reusable, and that it meets the highest quality standards**, thereby leading to an optimisation of public services, the making of informed decision and sound policies, the stimulation of innovation, increased competitiveness of the national economy, and the development and attraction of the talents needed.

› Action 12: Support data discovery and intermediation services

Data discovery and intermediation services will be developed and offered to potential users as a means of supporting them in identifying their data needs. This will facilitate networking between data users and suppliers. Data discovery will include the creation and maintenance of a knowledge base bringing together information from existing catalogues, registers and other data sources originating from the public and private sectors, as well as international entities.

The intermediation service will support relationships between potential users and suppliers and will facilitate discussions, the matching of needs and conditions

for reuse. For data holders, these services may also serve as catalysts for innovation events such as data hackathons, during which innovators are called upon to solve problems which the data holders are unable to solve at that stage or which fall outside the scope of their main activities.

The objective of these services is to **bring about a considerable decrease in the time needed for research and to lower the obstacles in identifying datasets that are suitable** for innovative projects.

› Action 13: Compile catalogues of data and data products

The **catalogue of public sector data accessible to all stakeholders** must enable them to search, via metadata, through **existing public sector data, including open data**, and to **request access to that data rather than going through a new phase of data collection**. This would be contrary to the objectives of the present strategy, data quality criteria and the Once Only principle. To further promote the use of existing public sector data, part of the data from that catalogue, particularly those to which the rules on data governance apply, are accessible to research organisations and the private sector. They may request their reuse within a specific and defined scope.

The catalogue of public sector data is being drawn up under the coordination of the Ministry for Digitalisation. It goes without saying that the sharing of data is done in strict compliance with the above-mentioned principles of security, fundamental rights and data protection.

However, such sharing must not be limited to raw data. Any data product created within the public sector, for example a register of products or a register of algorithms or source code must be made available. Moreover, any reuse of data for the purposes of scientific research will also need, as a minimum requirement, to lead on to a description of the methods used and the results obtained (even where these are negative) and, ideally, to a peer-reviewed article in a scientific publication. Such descriptions or articles will also have to be referenced as data products in the data catalogue. The publication of other products, such as source code, through official distribution channels or repositories will also be strongly encouraged, to highlight all the elements in the value chain.

A catalogue of private sector data will also be drawn up and the private sector actors are being encouraged to describe their data in that catalogue.

Lastly, various indicators will be established to monitor the number of projects using the catalogued data and data products.

› Action 14: Identify and instil responsibility in data users, to ensure data reliability

The **reliability of public and private sector data is a basic and prerequisite** to the successful achievement of the objectives of the present strategy. While each ministry and administration are responsible for maintaining the quality of their own data, this data must meet quality standards defined across the board for the whole of Luxembourg's public sector and must also satisfy European requirements. Although transversal standards must be defined in a centralised manner, this cannot and must not be done without feedback from ministries and administrations which already manage data with quality standards meeting the requirements outlined in this document.

› Action 15: Support in relation to data access requests

Requesting access to controlled sensitive data can be a complicated process necessitating a lot of resources and constitutes an obstacle to the reuse of data. The LNDS may serve as a point of entry for such a request, whether the data in question is listed in the national data catalogue or not. **Any organisation interested in reusing controlled public sector data may have recourse to the support offered by the LNDS**, with a view to discussing its data needs and obtaining assistance with the process and the concrete formulation of the request.

› Action 16: Develop systems to manage identifiers and pseudonyms

To improve confidence in data sharing and at the same time make data more useful, it is necessary to **put in place a central system that combines identifier matching and pseudonymisation**. The linking of items of information originating from different sources makes it possible to create an enriched dataset, but this can only be done if a procedure for identifier matching is used to link records relating to the same entity in different datasets. At the same time, pseudonymisation is replacing identifiers (for example, a person's social security number or name) with pseudonyms (new identifiers which hide the identity of individuals), thereby reducing the risk of direct identification of said individuals within a dataset. These two techniques must be seen as complementary, since it is important to ensure that all records for the same individual or entity are linked under the same pseudonym.

Such a national Identifier-matching and Pseudonym Management Service (IPMS) is now in place, and on that platform, all pseudonymised data associated with the same data subject can be linked, even where the datasets were held and pseudonymised by different

controllers. This data flow is crucial for sectors such as health research, in which patient data (personal data to be de-identified) emanate from a variety of different medical or other institutions (e.g. the Clinnova project) or from social care services. Indeed, pseudonymisation often constitutes an effective protection measure for the purposes of complying with the data protection legislation.

› Action 17: Create and develop anonymisation management systems

Data anonymisation is essential to protect privacy while at the same time enabling data to be used, shared and analysed. **Through the development of robust anonymisation management systems and the provision of anonymisation services, personal data can be transformed in such a way that they can no longer be associated with specific individuals, thereby guaranteeing confidentiality.** Unlike pseudonymisation, which replaces direct identifiers with pseudonyms but still potentially allows the data subject to be re-identified, anonymisation irreversibly removes or modifies the information, thereby guaranteeing a higher level of confidentiality. Moreover, anonymisation facilitates collaboration between different stakeholders, such as research institutions, businesses and government entities, by enabling them to access valuable data without compromising the confidentiality of the persons concerned. These considerations also apply, by extension, to non-personal protected data, such as data relating to business confidentiality, the protection of intellectual property rights, statistical confidentiality and national security.

› Action 18: Facilitate the generation of synthetic data

Synthetic data is artificial data generated from a model driven by original data which reproduce their inherent characteristics and structure. The power of synthetic data lies in the fact that **global statistics and the interconnections between data can be preserved, while reducing the risk of breach of confidentiality** and the burden of legal compliance involved in the sharing and processing of real personal or private data.

Recent years have seen the launch of government and data ecosystem initiatives encouraging the experimentation with and analysis of synthetic data. For example, a synthetic data factory has been set up to generate population data from publicly available datasets. Likewise, other projects exist which explore ways of merging different synthetic datasets to evaluate their usefulness. The results obtained from the various projects are promising and provide new perspectives for the use of synthetic data.

Luxembourg encourages and supports the creation and adoption of such supplementary initiatives in areas of national importance such as health, finance, cybersecurity, space, mobility and energy.

› Action 19: Develop data extraction, enrichment and fusion services

To use data to their full potential and make them more valuable for decision-making, it is often useful to merge data originating from a variety of sources. This is especially important in the public sector, where information may be spread across several different administrations, frequently involving data silos with combined information that cannot be accessed for analysis and the formulation of policies. It follows that **the integration of data into a single, unified view represents a critical step**. To guarantee data protection, this process must respect the principles of data minimisation laid down by the GDPR. At the same time, if a dataset is not complete or is obsolete, it is not useful and must be “enriched” – in other words, improved by the addition of supplementary information to the existing information to improve the quality of the data or to create a more complete and more detailed picture. **Luxembourg offers data extraction, enrichment and fusion services** to help organisations extract data from identified data sources, combine them into a single dataset by mapping the recordings, and enrich them as necessary.

› Action 20: Develop data quality and curation services

Efficient data reuse depends largely on the quality of the data concerned. Data which is well structured, consistent and well documented is easy to reuse and combine with other data. Unfortunately, many organisations find it difficult to collect data in a structured and consistent way, giving rise to datasets containing large quantities of unstructured information and missing or inconsistent values, thus impeding analysis, combination and reuse of the data concerned.

Luxembourg offers **data quality and curation services to help organisations improve the quality of their data** by retroactively transforming existing datasets and rationalising the processes for collecting primary data. Approaches such as data standardisation, the implementation of controlled vocabularies and the adoption of standards promoting interoperability are used to improve quality and organise data.

› Action 21: Support for data management and organisation

Organisations that rely on data for their activities require efficient data management to maximise its usefulness. Limited internal resources and a tendency to rely on standardised solutions that are often unsuitable for specific needs hinder effective data management.

Luxembourg offers **structured methodological support services for data management and governance**. These services are designed to **help organisations in Luxembourg develop their capabilities** in those areas. Organisations can benefit from tailored solutions throughout the data life cycle. These solutions include the development of strategies, processes and policies, training and workshops, and the customisation of tools.

› Action 22: ELSI expert service for data governance

The regulatory framework governing the reuse of public sector data must protect the rights and freedoms of data subjects while introducing restrictions only when truly necessary and proportionate to the reuse objectives pursued. To meet this need and to navigate this complexity, the LNDS offers **ELSI (ethical, legal and social implications) data governance services** to its government partners to support them in developing new legislation.

This **service is being extended to the private sector**, as businesses need support in developing policies and procedures to ensure responsible data collection, storage, use, archiving, deletion and sharing. Guidelines will be created and shared to help organisations comply with the GDPR, including the requirements of "data protection by design and by default", establishing data protection safeguards, and addressing other ELSI concerns such as the ethical and legal aspects of data collection and sharing.

The need for a data impact assessment tool will be evaluated and could be developed to help organisations assess and mitigate privacy risks associated to their data projects. This will become especially relevant when data is linked from multiple sources to gain new insights.

› Action 23: Develop best practice guides and key data quality indicators

To ensure a high level of data quality, it is important to be transparent about the data life cycle, and in particular about data obsolescence, to prevent potential users from using outdated data to make decisions.

Enhancing transparency of available data through a comprehensive data catalogue reduces the number of data instances, thereby improving data quality. This approach prevents the proliferation of multiple data sources that contain identical data with varying quality levels.

Data quality is directly affected by data collection practices. To achieve optimal data quality from the collection phase onwards, defining quality governance, including the roles and responsibilities, is the most crucial step. The team implementing quality governance must be equipped with the right tools and methods for collecting data and subsequently monitoring quality. Furthermore, the data collection staff must have adequate training in data culture, data quality and the FAIR principles, as well as the specific domain (e.g. healthcare), to ensure that the data collected is as accurate, complete and consistent as possible. Making data FAIR from the outset makes it easy to find, access, understand and reuse.

Consequently, in the cataloguing process, every data item created is linked with metadata (e.g. legal basis, description, date of creation, distribution), so that data consumers can assess the relevance of the data within the framework of their own analysis. It is therefore important to streamline the data creation and collection process to benefit from this rigor at all levels of the data processing process.

The use of data quality indicators (KPIs) allows us to measure the quality of available data and, in addition, to carry out periodic audits.

The value of data may fluctuate depending on the situation of the country, society and future developments. An **indicator of the impact of particular data at a given point in time** (data impact score) allows, where necessary, to focus the public sector resources and workforce on a dataset having a high momentary value, thereby maximising its benefits in solving challenges associated with that situation or its future developments.

To monitor and continuously improve data governance, it is essential to establish metrics for its key areas: data, human resources, processes and technology. This will include measuring completeness and accuracy rates, indicators relating to national data catalogues (such as the number of datasets and their engagement rate), data access metrics (e.g. authorisation time), indicators of conformity, interoperability, service efficiency and diversity, as well as performance indicators relating to the sharing of knowledge and development of skills.

For open data, the percentage of datasets held by the public sector and made publicly accessible is a good indicator to measure. For protected data, it is possible to track the evolution of the number of datasets available in the catalogues, the volume of access requests and the authorisation rate.

Luxembourg adopts a systemic approach integrating quantitative metrics and qualitative considerations. The maturity of data governance can be assessed using existing benchmarks: the level of literacy and data awareness can be measured by surveys and workshops; data security and confidentiality can be analysed via audits; user satisfaction (e.g. that of users of the data catalogue or data project stakeholders) should be evaluated through interviews and questionnaires.

Using all these indicators, it will be possible to highlight the strengths of the country's data governance efforts and to identify the priority areas for improvement.

› Action 24: Data advisory services

As a part of its digital transformation and its strategic vision of technological excellence, Luxembourg is developing an innovative national system of advisory services in relation to data projects. That initiative is designed to **create a comprehensive and dynamic support ecosystem that will assist all economic and institutional sectors in the country in their drive to get the most out of data**. The system will offer a wide range of integrated services covering the entire data journey, from the collection of data to their exploitation, while ensuring respect for the fundamental principles of trust, security and governance. The **services will be designed to be modular and adaptable to the specific needs of each sector**, whether in the fields of finance, technology, research, healthcare or public services. The objective is to **position Luxembourg as a centre of excellence in responsible data management and valorisation**, by providing economic and institutional actors with high-quality support throughout the course of their digital transformation.

› Action 25: Establish a national framework and solutions for the right to benefit from data

To harness the opportunities of bringing citizens closer to their own data following the entry into force of the Data Act[6], the Government is developing a regulatory framework and solutions designed to **ensure that every citizen can benefit from the data that concerns them**[7]. Simple analysis and valorisation tools will be created to help citizens understand the potential value of their data and leverage it, for example, through opportunities to participate in innovative projects.

To ensure the effective implementation of this action, close collaboration is being established with ministries, data protection experts, representatives of civil society, the private sector and research. This framework will meet European privacy standards and is based on transparency and security standards defined at national level.

5. Research, development and innovation

Ambition: Stimulate research and promote innovation based on high-quality data

Luxembourg aspires to **create a dynamic research ecosystem based on data excellence**, by establishing a robust national infrastructure that guarantees the reproducibility and reuse of research data. This ambition allows the Grand Duchy to guarantee its digital sovereignty by locally storing the data generated by its researchers and to establish a framework of incentives for their conservation within Luxembourg. At the same time, the country is committed to **developing data spaces that promote sharing and collaboration between the various stakeholders in the ecosystem**, while establishing formal recognition and valorisation mechanisms to encourage researchers to share their data in accordance with the FAIR principles, considering these contributions as scientific products in their own right, deserving of recognition and rewards in the evaluation of scientific careers.

› Action 26: Promote data excellence in research

Luxembourg's national research ecosystem continues to generate vast amounts of publicly funded data, which constitute an asset with the potential to drive innovation, economic growth and societal progress. For those reasons, Luxembourg should **commit to ensuring the sovereignty, preservation and sharing of research data and information generated by scientific research**.

Luxembourg aims to become a centre of excellence in the field of research data, by adopting and promoting the principles and best practices of FAIR data and research data management (RDM) throughout the research life cycle. To benefit its economy and society, Luxembourg's research data should be findable, accessible and reusable.

Regarding the sustainability of research data, Luxembourg is aiming at solutions that promote the sovereignty of the country's research data, the long-term reproducibility of research results, and their reuse in future research. These solutions must increase researchers' options regarding the sustainability of their data and their research results, enabling them to respect the policies of research institutions and fund providers alike.

Building on this strategy, the implementation of a framework promoting the sharing and funding of best practices for research data management should be considered in order to support the sharing and reuse of research data and to promote measures to make publicly funded research data accessible in accordance with the FAIR principle.

› Action 27: Establish national sovereignty for Luxembourg's research data

To ensure the national sovereignty of Luxembourg's research data, and thus to ensure that Luxembourg can collect, store and use the research data generated within its borders, it is essential to **develop a robust national infrastructure enabling the secure conservation of research data**. At the same time, connections will be established with European and international research data infrastructures to foster the development of the national skills and capabilities, notably with RDA, EOSC, OpenAIRE, the ERIC infrastructures and infrastructures specific to certain disciplines such as ELIXIR and EATRIS.

To strengthen this sovereignty, it is important to ensure that locally produced and stored data is internationally discoverable and that it can, where necessary, be accessed and reused in compliance with the applicable regulatory framework. Consulting services will be offered, along with services for the joint solution development. The establishment of national and institutional indicators and dashboards will be supported to monitor research data activity and results over time and across disciplines. Lastly, an assessment of the national research data landscape will be carried out and a research data framework established.

› Action 28: Create strategic data spaces

Luxembourg encourages the **creation and use of data spaces** between stakeholders in the same or different sectors, who come together to **promote data sharing within this ecosystem and thereby create real added value**. A data space provides a clear structure for this purpose, allowing participants to share, exchange and collaborate on data with greater efficiency and in compliance with applicable norms and standards.

By actively sharing its governance processes, and the semantic and technical standards used for its participation in European data spaces, the Luxembourg Government contributes to the federation of data spaces and generates significant potential for interoperability between the common European data spaces and the intra- and intersectoral spaces created at the initiative of the stakeholders in the Luxembourg ecosystem.

A concrete example of this could be a data space governing linguistic data to promote Luxembourgish as a national language. To that end, the Government has implemented a strategy to develop and standardise the language, while encouraging its everyday use. The linguistic data generated by the public sector (text, audio, audiovisual) represent a valuable asset for improving public services and an important element for implementing data and AI strategies. The *Zenter fir d'Lëtzebuerger Sprooch* (ZLS) develops publicly accessible linguistic tools such as *D'Sproochmaschin*, which amongst other things enables automatic voice recognition, text-to-speech conversion and the generation of audio content in Luxembourgish.

However, Luxembourgish remains an under-resourced language, with little quality data available for the development of linguistic models[6]. The Common European Language Data Space[7] will help solve this problem, but will need time to gain momentum. The Government should therefore invest in various initiatives, such as digitising existing Luxembourgish documents, developing Luxembourgish online platforms, encouraging collaboration between researchers and language technology communities and further developing linguistic technologies and tools, in particular through adopting automatic translation tools.

› Action 29: Encourage and reward data sharing in the research

Luxembourg is looking to prioritise the recognition of data contributions as scientific products in their own right. This framework will **establish formal citation mechanisms for Luxembourgish research datasets**, ensuring that the researchers receive due credit for their work. Research bodies will be encouraged to integrate data management practices in their evaluation criteria for career advancement and funding decisions, with an emphasis on Open Science principles. This strategy encourages the development of consistent evaluation standards that recognise researchers who have integrated systematic data sharing in their scientific methods. To further encourage excellence, initiatives such as the awarding of national prizes for data research[8, 9] could be used to reward exceptional contributions to the data ecosystem and promote best practices throughout the scientific community.

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6 European Language Equality – Report on Luxembourgish Language

7 European Language Data Space - European Commission

8 The Dutch Data Prize - Researchdata

9 Ouvrir la Science - The Open Science Research Data Awards

6. International collaboration

Ambition: Develop and promote Luxembourg as a centre of excellence in data

Luxembourg's aim is to **serve as a central hub for international data exchange and a centre of excellence for data-driven innovation and creation of value**. While at the international level, given its size, it is often unable to compete in terms of data volume, Luxembourg relies on its expertise in the field of data and its **central and efficient data governance** to facilitate and accelerate access to data and thus, the **valorisation of data in a trusted environment**. In practical terms, Luxembourg aims to offer conditional access to national and international data by facilitating interconnection between stakeholders from different countries, while building a solid reputation for data security and protection. To this end, it advocates the right balance between data openness and data security. In addition to the technical solutions needed to achieve this ambition, Luxembourg is developing legal instruments to simplify international data processing. In this regard, its small size is a real asset, allowing Luxembourg to quickly create a new legal framework, which is an advantage in the absence of international legislation. International institutions based in Luxembourg are thus able to operate under national laws while facilitating international cooperation. To that end, the conditions for access and reuse will be aligned with the procedures and designations established under the rules on data valorisation, in particular Regulation (EU) 2022/868 on European data governance.

Furthermore, Luxembourg's expertise in the field of data is also demonstrated through its active participation in European Union initiatives, the development of bilateral and multilateral partnerships, its contribution to the development of international standards, and the sharing of best practices with partner countries.

The ambition to be an international data pioneer is also reflected the LNDS' strategy, which actively contributes to a growing number of international projects and initiatives, such as the International Data Space Association, FIWARE, Big Data Value Association, DataLeaders, EIT Health and MyData Global. Luxembourg also plays a key role in the Gaia-X initiative, which aims to develop a federated and secure European data infrastructure. The LNDS, the official national hub of Gaia-X in Luxembourg, contributes to this objective by promoting the transparency, controllability, portability and interoperability of data and services. It provides support for all organisations based in Luxembourg – startups, public sector and research centres – in their exploration of using or creating of a truly sovereign cloud service based on European values.

Another example of the international efforts in regards of data flow in which Luxembourg is actively participating is Clinnova, an international precision medicine project launched in 2023 by Luxembourg, France, Germany and Switzerland. With the objective of supporting therapeutic decision-making through data federation, standardisation and interoperability, the cross-border data exchange will speed up translational research into the causes of disease, which may have an impact on patient care. In the healthcare sector, Luxembourg is at the forefront of genomic research, providing data and resources to scientists worldwide through its participation in the ELIXIR network (in which it is represented by the LNDS) and the Luxembourg Centre for Systems Biomedicine (LCSB).

Furthermore, as a country with a lesser-used national language, Luxembourg has long been committed to advancing reliable, inclusive and compliant language technologies while preserving Europe's linguistic diversity and cultural richness, with a particular emphasis on language data in Luxembourgish and other European languages. In December 2024, Luxembourg, as a member of the Alliance for Language Technologies (ALT-EDIC), a European digital infrastructure consortium, represented by the Luxembourg Institute of Science and Technology (LIST) (in collaboration with the University of Luxembourg and 70 ALT-EDIC partners and with the support of the Ministry of State – Department of Media, Connectivity and Digital Policy - SMC and the Ministry of Culture), was awarded the prestigious project LLMs4EU, financed by the Digital Europe programme. This project, which will begin in 2025, aims to develop specialised LLMs (large language models) to meet the specific needs of different fields, including the public sector and European businesses, and to position Luxembourg as a hub for reliable and human-centred language technologies, and AI research and innovation.

Lastly, Luxembourg hosts two e-embassies (Estonia and Monaco), responsible for protecting those countries' sensitive data, which testifies to its commitment to cybersecurity, digital sovereignty and resilience, as well as its strategic vision in the development of international collaborations. Luxembourg is open to working with the new concept of "data embassies" and is at the forefront when it comes to ensuring a continuous digital future.

› Action 30: Implement the regulation laying down measures for a high level of public sector interoperability across the Union

The regulation (EU) 2024/903 establishing measures for a high level of public sector interoperability across the European Union[11] represents a major step towards meeting the expectations of citizen and businesses regarding **simple and efficient cross-border public services**. Through its implementation, Luxembourg has expanded the bases created by the European Interoperability Framework (EIF) and the National Interoperability Framework (NIF) for improved cooperation between the administrations of the different Member States as well as the respective national levels.

The national data strategy is designed to **fully integrate the principles of interoperability** to ensure smooth data exchanges and efficient cooperation at national and cross-border levels. The objective is to create a common framework for the reuse of data and its services, while supporting innovation and cooperation between sectors.

This is based on an approach structured around the NIF's four levels of interoperability: organisational, legal, technical and semantic. It takes shape in the catalogues of interoperable products, the interoperability action plans, and in the case of cross-border IT projects, the mandatory interoperability assessment. It is based on European and national governance in relation to interoperability, such as the Interoperable Europe Board and Luxembourg's national and sectoral interoperability committees. Together, the stakeholders in this interoperability governance guarantee effective coordination and collective mobilisation of expertise, thereby ensuring consistent and sustainable implementation of interoperability principles and requirements on a national and international level.

In the context of Luxembourg's ELIXIR node, the co-developed and now operates, along with other nodes, the FAIR Cookbook for researchers in the field of life sciences and is committed to improving data interoperability across the EU. Since 2021, ELIXIR Luxembourg has co-developed two key resources in the field of life sciences data management: the RDMKit and the FAIR Cookbook. Luxembourg actively contributes to the ELIXIR Research Data Management community as well as to the ELIXIR Interoperability Platform for the development of data management best practices and guidelines contributing to the interoperability of life sciences data.

Luxembourg, represented by the LNDS, is one of 16 members of the EOSC-ENTRUST providers' forum, designed to create a European network of trusted research environments for sensitive data and to promote European interoperability through the joint development of a common model federated data access and analysis. The project began in 2024 and will continue until 2027. Luxembourg, as a member of this working group, will contribute to the interoperability of services in trusted research environments and will take part in the co-development of modular services and common processes.

The country participates in various international initiatives promoting data interoperability - for example, eSanté, Luxembourg's national agency for exchanging and sharing medical data, is committed to facilitating the exchange of clinical data at both national and international levels. To achieve this objective, the agency plays an active part in European discussions on standardisation and is a member of SNOMED International. In addition, Luxembourg has been at the forefront of implementation of the cross-border use of electronic patient summaries, thanks to its participation in European projects such as Trillium Bridge and the digital health services infrastructure.

In January 2025, Luxembourg joined forces with six EU Member States in the European Commission's new initiative INVEST (INTeroperability Vision in Europe - Strategy Timeplan). This project is designed to help the Member States implement the Interoperable Europe Act and, as a result, provide better cross-border digital public services.

These examples show Luxembourg's commitment and leadership in contributing to better cross-border collaboration and digital governance. Luxembourg will continue to support such initiatives.

› Action 31: Contribute to the European Single Digital Gateway

To **make the European Union's single market a reality for citizen and businesses**, Luxembourg is actively contributing to the implementation of the European Single Digital Gateway[12] and, more specifically in the context of data, to the Once Only Technical System. Within cross-border administrative procedures, this interoperable technological solution facilitates the flow of information and data between relevant administrations at the explicit request of the natural or legal person concerned.

To meet the requirements of the regulation, Luxembourg will adapt the digital portal MyGuichet.lu, through which citizen and businesses will be able to

[11] Regulation (EU) 2024/903 laying down measures for a high level of public sector interoperability across the Union (Interoperable Europe Act)

[12] Regulation (EU) 2018/1724 establishing a single digital gateway to provide access to information, to procedures and to assistance and problem-solving services and amending Regulation (EU) 1024/2012

retrieve their own data and transmit them to another European Union Member State via the Once Only Technical System as part of a digital cross-border administrative procedures. At the same time, the MyGuichet.lu platform will expand its capabilities to accommodate evidence, information, or data from other Member States in digital administrative procedures.

As such, the Once Only Technical System and all its related works represent a tangible **implementation of the national and cross-border Once Only principle** for all citizens and businesses.

› Action 32: Develop a digital identity wallet

Luxembourg is actively taking part in the development of the European Digital Identity Wallet (EUDIW), in accordance with Regulation (EU) 2024/1183 amending Regulation (EU) 910/2014 as regards establishing the European Digital Identity Framework (eIDAS 2.0).[13]

By the end of 2026, each EU Member State must offer at least one European wallet solution. These must satisfy the requirements laid down in the eIDAS2 regulation, which have been drafted with a view to **achieving interoperability** between these solutions. Luxembourg has based its solution on a code base provided by the European Commission and is investing resources to work on configuring this code base so that the final product also meets the national needs.

Future users of an EUDIW will find that it **simplifies their daily life**: they will be able to store verifiable attestations in this mobile application and present them (in full or in part) to any entity that needs to view them. **Users will retain control over their data**, with the guarantee that their transactions cannot be traced or interlinked. The European Digital Identity Wallet will also enable them to sign documents using a qualified electronic signature, free by default, and activated from the mobile application.

Finally, it should be noted that Luxembourg is participating in the European pilot project POTENTIAL (PilOTs for EuropeaN digiTal Identity wALlet, 2023-2025). This project is aimed at creating the bases for tests on the initial prototypes of different wallets, focusing on specific use cases. Luxembourg is involved in four of those use cases, namely government digital services, opening a bank account, the digital driving licence and, lastly, the qualified electronic signatures. In Luxembourg as elsewhere, the lessons learned from this pilot project will be invaluable for the development of the various final products.

› Action 33: Join and host common European data spaces

Luxembourg's commitment to creating and contributing to common European data spaces has recently been demonstrated by the launch of Dataspace4Health, a collaborative project involving key stakeholders from the Luxembourg healthcare sector, aimed at creating a secure and interoperable health data space in compliance with the Gaia X norms. In the field of genomics, Luxembourg is a signatory to the European 1+Million Genomes (1+MG) initiative, which aims to enable personalised medicine by providing secure cross-border access to high-quality genomic data and to bring about their integration with related health data. Luxembourg is a **core member of the European Genomic Data Infrastructure project**, which is working to deploy a secure data sharing infrastructure for the 1+MG initiative and to establish a sustainable and evolving data governance body for genomic data in Europe, using tools such as the European Digital Infrastructure Consortium (EDIC) and other suitable frameworks. Luxembourg is expected to host the future Genome EDIC, which will be a new entity set up to make Europe's genomic data infrastructure operational and to turn the vision defined by the 1+MG initiative into reality. Hosting that cutting-edge infrastructure will position Luxembourg as a pioneer in the digital sector.

Luxembourg considers cybersecurity data not only as key to national security and defence, protecting critical infrastructure and safeguarding its citizens' data, but also as a factor of democratic and economic success. Thus, the national Computer Security Incident Response Team (CSIRT) holds important data regarding threats and is now preparing to publish them in an open and groundbreaking cybersecurity data space. This data space will be accessible to those with a legitimate interest, particularly SMEs and start-ups, to foster the development of AI-based cybersecurity solutions. Luxembourg is already operating the internationally recognised MISP project, an open-source platform for sharing data about threats, thereby demonstrating that Luxembourg companies are ready and willing to contribute to a collaborative project for the common good. Furthermore, that data space will play a crucial role in promoting cross-border collaboration, supported by Luxembourg's research, development and innovation programmes (RDI), as the development of AI-based security solutions can benefit not only Luxembourg but of the entire European cybersecurity ecosystem.

Finally, to act as a national gateway to wealth of data in the European research area, national organisations such as the LNDS have begun the process towards becoming a node of the EOSC Federation.

[13] Regulation (EU) 2024/1183 amending Regulation (EU) No 910/2014 as regards establishing the European Digital Identity Framework

Part 3.
Flagship projects

Public administration: Luxembourg's legal Large Language Model (4LM)

The 4LM project aims to develop a Large Language Model (LLM) specialised in Luxembourgish legal texts. A domain-specific LLM will enhance efficiency in the legal and regulatory domain, benefiting governmental institutions, legal professionals, the judiciary and companies. The public will also gain access to AI tools like chatbots and automatic translation, improving access to legal information. Companies will be provided with AI-driven tools that will help them in their efforts to be compliant with an ever-growing body of legal and regulatory constraints, thus increasing their productivity through an AI-driven automatisation of compliance processes.

This project aligns with Luxembourg's digital transformation goals, reinforcing its position in AI-driven governance and legal innovation.

The context of the 4LM project centres around the development and deployment of a Large Language Model (LLM) specifically tailored for legislative legal and regulatory processes in Luxembourg. This project is situated at the intersection of AI innovation, digital transformation, and public administration modernisation. It aligns with national and European strategies to improve digital governance while addressing critical societal, economic, and security challenges.

Below is a detailed breakdown of the context:

For the general public:

- Improve understanding, accessibility and inclusiveness of legislation.
- Make legislative texts currently in force available in as many languages as possible to meet the needs of a multicultural and multilingual audience.
- Produce "understandable" summaries for citizens (Einfach Sprooch).

For government administration and legal professionals:

- Identify legislative needs and LLM use cases, especially for drafting and compliance with European laws.
- Train a Luxembourgish LLM for precise legislative text interpretation.
- Ensure interoperability with government digital platforms to enhance cooperation.

For companies:

Companies are increasingly seeking ways to navigate the growing regulatory requirements at both the national and European levels. Ensuring compliance can be complex, particularly for SMEs, and may impact productivity. The 4LM project aims to provide a solution by developing specialised AI-driven tools designed to streamline and automate compliance processes, helping businesses meet their obligations more efficiently and effectively.

Finance: The AI Experience Centre at the LHoFT

Luxembourg is a leading European financial centre, with strategic priorities focused on digital transformation, innovation, and sustainability. However, the adoption of advanced technologies such as AI remains nascent across many institutions. The AI Experience Centre addresses this by lowering barriers to experimentation and adoption, helping financial institutions to understand and integrate AI in secure and sovereign conditions.

The LHoFT's plays a key role in Luxembourg's financial services ecosystem. Its catalysing effect happens by boosting early adoption of cutting-edge technology. The LHoFT has chosen to play this role through the design of the AI Experience Centre, a physical experience inside LHoFT's growing office footprint at the heart of Luxembourg City. It will activate and engage the finance sector in AI, ensuring the financial centre's future competitiveness and helping to cement Luxembourg as a leading hub for digital finance innovation, showcasing state-of-the-art technologies that meet global financial challenges.

LuxProvide contributes its state-of-the-art MeluXina supercomputer and expertise in high-performance computing, essential for handling extensive datasets and executing sophisticated AI models. The LHoFT Foundation brings its extensive network within the FinTech ecosystem and its understanding of financial regulations and market dynamics. This unique combination ensures that the AI Experience Centre will be both technologically advanced and finely attuned to the specific challenges, needs and opportunities of the financial sector.

Its concept is shaped through the following goals:

- **Demonstrate AI's potential in finance.** Display how AI can be leveraged to improve financial services by enhancing decision-making processes, increasing operational efficiency, and providing superior risk management solutions.
- **Facilitate technological innovation and adoption.** Accelerate the adoption of AI technologies within Luxembourg's financial sector by providing hands-on experiences, demonstrations, and success stories.
- **Enhance collaboration between technology and finance.** Encourage and strengthen the collaboration between tech providers, financial institutions, and regulatory bodies by creating an environment that fosters dialogue and partnership.
- **Educate and train industry professionals.** Develop and deliver educational programmes and workshops that train financial sector professionals on the latest AI technologies and their applications.

It is designed to evolve in close alignment with the government's AI Factory programme, acting as both an intake mechanism and a market engagement interface for AI solutions emerging from the national innovation pipeline. By exposing financial institutions to real-world AI applications and facilitating experimentation, the Centre will help identify viable, scalable use cases that may be further industrialised within the AI Factory framework. Conversely, it will showcase outputs from the AI Factory, creating a public-facing demonstrator of Luxembourg's AI innovation capabilities.

Precision medicine: AI readiness for precision medicine

Luxembourg will advance its digital health strategy by integrating AI and data-driven approaches to support precision medicine with the aim of moving healthcare from a reactive model focused on treating diseases to a proactive system that leverages genomic and clinical data. The transformation will rely on a continuous feedback loop of research, deployment, and fine-tuning, emphasising key areas such as clinical data integration, robust infrastructure, skilled personnel, legal compliance, and active citizen engagement. Drawing on insights from the past 15 years of significant investments in biomedical research, clinical trials, and large-scale health data initiatives, Luxembourg will prioritise these areas to enhance interoperability and support evidence-based decision-making.

The project will serve as a catalyst for this evolution by developing the necessary infrastructure, along with AI-driven tools to match treatments to individual patients. This effort will build on several key initiatives such as the 1+Million Genomes project/Genome EDIC, the European Health Data Space (EHDS) and initiatives that aim at reducing all preventable deaths from cancer and neurodegenerative diseases. Additionally, it will leverage current national expertise in AI-driven multimodal analysis, which personalises treatments for conditions such as multiple sclerosis, rheumatoid arthritis, cancer and neurodegenerative diseases embodying the "right drug for the right patient" philosophy. Scaling these efforts beyond research will require addressing significant challenges in data governance, interoperability, market access pathways and public engagement. The flagship will expand this focus on complex cancer cases and neurodegenerative diseases with an ambitious aim of minimising unnecessary deaths through prevention, early detection, and tailored therapies. Precision medicine will demand vast amounts of data, and as a small country, Luxembourg will benefit greatly from integrating into pan-European efforts.

The 1+Million Genomes Initiative, supported by EU projects, will seek to create a formal data space for collecting, curating, and sharing data in Europe to enable new research and personalised, genome-based healthcare. In 2025, a new legal entity, the Genome EDIC will take over the core operations of the 1+MG initiative, and Luxembourg will be well-positioned to serve as its host.

The AI in Health flagship will be built on a comprehensive health data strategy and AI readiness framework that spans the entire patient journey, with AI continuously improving through clinical feedback. Luxembourg's advanced digital infrastructure, including the MeluXina supercomputer and the forthcoming MeluXina-Q quantum computer, will support AI research in fields like genomics, cancer, neurodegenerative diseases and drug discovery. Additionally, the AI Factory will accelerate development, enhancing the pace of innovation.

This approach will deliver a clear benefit:

- **It will improve patient outcomes and support healthcare providers by streamlining decision-making and workflows, aided by tools such as AI scribes for standardised data entry.**

Nevertheless, challenges in data governance, interoperability, market access pathways and public engagement will need to be resolved to scale these efforts effectively. The EHDS regulation will foster structured health data exchange across Europe, aligning with Luxembourg's pan-European objectives. Through these strategic investments, Luxembourg will aim to position itself as a leader in AI-driven healthcare innovation.

Labour market: AI-powered skills insights

Luxembourg faces specific challenges in leveraging skills data due to its diverse, multilingual, and highly dynamic labour market. The OECD Skills Strategy[14] highlighted critical gaps in the quality of existing skills data in Luxembourg, including incomplete data (e.g., limited to Luxembourg residents), incorrect data (e.g., errors in occupations reported to social security), outdated data (e.g., surveys conducted only every few years), insufficient detail (e.g., data on occupation categories and not detailed skills), and lack of interoperability (different classifications used between administrations).

These challenges mean that it is currently impossible to say how many people work in which occupation in Luxembourg, let alone what skills are missing or predicting future trends. However, these challenges present significant opportunities for innovation by leveraging AI technologies. ADEM, the national employment agency, seeks to use AI to improve our understanding of Luxembourg's skills needs and shortages.

Those insights can be used to:

- Guide citizens (including youth) to occupations with high prospects.
- Guide citizens (including youth) to courses in order to acquire skills that will be needed on the labour market.
- Show opportunities for upskilling and reskilling between different occupations.
- Help employers in their recruitment efforts.
- Assess relevance of education/training offer in Luxembourg and identify missing offers.
- Provide financial incentives (e.g., training vouchers) focused on skills that are in high need or shortage.
- Focus talent attraction efforts on regions and profiles that can address the national skills shortages.
- Compare detailed skills data with that of the Greater Region or other countries to identify opportunities for collaboration.

This initiative aligns with Luxembourg's strategic goals of fostering a future-ready labour force, addressing skills shortages, and supporting evidence-based policymaking. By leveraging AI technologies, the project aims to create a comprehensive and dynamic skills data ecosystem that benefits individuals, employers, and policymakers, ultimately contributing to economic growth and social cohesion.

[14] Luxembourg Government, OECD Skills Strategy: Recommendations for Improving Skills in Luxembourg, 02/2023

Education: A sovereign AI chatbot for education

Luxembourg's strategic vision for AI adoption emphasises responsible technology use, robust data governance, and strong privacy guarantees. In the education sector, multiple curricula exist for diverse tracks, grade levels, and linguistic contexts—creating complexity for teachers, policymakers, and other stakeholders. Current digital repositories are often static and fragmented, making it difficult to gain a holistic, real-time view of the curriculum landscape.

By building a dynamic, locally hosted database and coupling it with AI-driven tools, this flagship project aligns with Luxembourg's national AI strategy and data sovereignty goals. The solution not only streamlines curriculum exploration and planning but also enables future-proofed, learner-centred pedagogical approaches. Ultimately, it ensures that innovation goes hand in hand with the preservation of core values, such as privacy, autonomy, and equitable access to educational opportunities.

This flagship initiative aims to revolutionise how teachers, school administrators, policymakers, and students interact with Luxembourg's vast educational curricula by creating a locally hosted AI-driven platform. The core objective is to build a multidimensional database containing all curricula in Luxembourg's school system—fully interconnected and continuously updatable—and then layer on intelligent search capabilities and a Large Language Model (LLM)-powered chatbot.

Key ambitions include:

- **Sovereign data management:** Host the entire solution on Luxembourg-based servers to ensure data protection, privacy, and compliance with national and EU regulations.
- **Dynamic curriculum repository:** Develop a robust, multidimensional curricular database that allows easy updates, deep interconnections, and granular insights into educational pathways.
- **Empowered educators and policymakers:** Provide modular "widgets" and search functionalities, enabling users to discover cross-curricular links, identify transversal topics, and inform policy decisions.
- **AI-enhanced teaching and learning:** Leverage LLM technology to generate tailored lesson plans, differentiation strategies for mixed-ability classrooms, student support plans, and more.
- **Scalable capacity building:** Offer training and Continuous Professional Development (CPD) for educators, so they can utilise the new platform effectively and responsibly, fostering a culture of AI literacy across the educational landscape.

Through this project, Luxembourg positions itself at the forefront of educational innovation, showcasing how sovereign, ethically governed AI solutions can transform curriculum management and classroom practice while respecting data protection and human-centric values.

Mobility: Movement AI 1.0

AI Move 1.0 proposes an innovative approach to better understand mobility needs in the Grand Duchy. This will allow policymakers to target public investment into mobility services and infrastructure even more effectively. By streamlining data governance procedures and leveraging AI, AI Move 1.0 will bring together fragmented data sources, bolster their quality and accelerate their processing and interpretation. This will lead to improved data availability in the field of mobility, with the certainty that those data are fit for purpose, providing the insights policy makers require.

This initiative is a direct response to the need expressed by the coalition agreement 2023-2028 to strengthen the Observatoire digital de la Mobilité (OdM). Accompanying that reinforcement by AI will multiply the benefits for the government's mobility policy and the wider Luxembourgish mobility ecosystem. This project will roughly touch one eighth of the government's expense budget (13% of the budget 2023 allocated to the Ministry of Mobility and Public Works (MMTP)) as well as the investments into mobility by businesses and households.

Through better availability of high-quality data on mobility, AI move 1.0 unlocks the following benefits:

- **Social:** AI methods allow to dig deeper into existing and yet to be created mobility data, leading to a deeper understanding of the mobility needs of the people. Better knowledge of what needs to meet allows even more effective aiming of investments and to further improve access to mobility.
- **Economic:** there already is a strong demand for high quality mobility data. AI move will widen that scope and strengthen the community of mobility data producers and consumers in Luxembourg. This will create a fertile breeding ground for innovation.
- **Environmental:** accelerated meeting of modal split targets to less polluting means of transport can reap secondary environmental benefits.
- **Collaboration and synergies:** AI Move 1.0 aligns with European "intelligent transport systems" and mobility data space initiatives, fostering cross-border cooperation. As an example of how this is happening already, OdM's LuxMobil is carried out in close coordination with our French, Belgian and German neighbours to produce a unique international view on cross-border mobility.

Within this ecosystem, AI Move 1.0 places particular emphasis on public data producers. They constitute the main pillar of Luxembourg's mobility data landscape, simply because they provide by far the largest share of mobility services and infrastructures in the country. This focus does not diminish the contributions and importance of other actors in the ecosystem. AI Move 1.0 is conceived as an initial, foundational step—hence its name. It recognises that even the most sophisticated analytics require a robust and reliable data foundation, and that public data make up a large chunk of that foundation. As this foundation takes shape, new opportunities may emerge. Research institutions and private enterprises might lead the development of advanced analytics or contribute new kinds of data, either in direct contribution to OdM's central mission or in pursuit of their own initiatives.

Cybersecurity: Democratising cybersecurity

Cybersecurity threat intelligence data is seldomly shared and mostly stays in proprietary feeds. Such data is thus not available for innovation, thus strengthening the position of oligopolistic cybersecurity vendors. As a result, unaffordable prices leave SMEs (representing > 95% of the EU economy) vulnerable, posing significant risks to supply chains and economic stability. To strengthen economic resilience, SMEs therefore require access to affordable security solutions defending them against the ever-evolving threat landscape.

An effective way to address this market failure is to **open the cybersecurity data economy**. Today's data economy relies extensively on cloud infrastructures. Therefore, Luxembourg participates in the IPCEI Next Generation Cloud Infrastructure and Services (IPCEI-CIS) and its contribution will materialise through the macro project CLoud and dAta SecUrity reSource cENter (CLAUSEN), creating the first **Open Cybersecurity Data Space** (OCDS) in Europe. Such a data space fosters synergies by facilitating the collection and exchange of cybersecurity-related data like threat intelligence, vulnerabilities, and efficiency of protective measures. Furthermore, it nurtures AI Factories with cybersecurity data, which is indispensable for the creation of new autonomous cybersecurity tools that SMEs can afford.

As faster and more sophisticated cyber threats need quicker and more effective responses, the ambition of the present flagship project is to further support the cybersecurity ecosystem with AI, applied on vast amounts of raw and contextualised cybersecurity data. The aim is to enhance the readiness of all stakeholders by equipping them with the necessary knowledge and tools to handle cyber threats.

- **As a primary focus**, the project aims to gain a deeper understanding of adversaries by utilising existing threat intelligence gathering tools, and by shaping the collected raw data with the help of AI into threat intelligence. The integration of this data will enable quicker analysis of malicious behaviours and the processing of larger volumes of such activities. The resulting intelligence will be made available to the cybersecurity community, to law enforcement agencies, and to judicial authorities to support their efforts in identifying and combating cyber threats and securing companies and citizens. Finally, the gathered threat intelligence will be aggregated with the help of AI into cyber weather reports, which, among other benefits, increases the accuracy of risk management and improves the resilience of the Luxembourg economy.
- **A secondary focus** of the project aims at strengthening governance, risk, and compliance for SMEs. New risk information, including metrics, risk scenarios and mitigation techniques related to the adoption of new AI technologies, will be provided to the private sector. Moreover, the use of new and continuously updated models will democratise governance and risk management by providing easy-to-use AI-powered human interfaces. This will enable proactive and safe integration of AI into governance platforms to improve the accuracy of risk treatment decisions and investments. SMEs will be supported in their compliance journey by offering a platform that helps them design and implement tailored information security policies, procedures, and guidelines.
- **A third focus** lies on managing risks that accompany the emerging technologies. Those cover inherent vulnerabilities of AI systems, and the quantum threat for cryptography. To address these challenges, the Luxembourg ecosystem needs guidance, testing infrastructure and tools to adopt post-quantum cryptography (PQC), and mechanisms to evaluate AI implementations, models and machine learning processes.

Energy: Enhancing Luxembourg's energy transition through near-real-time data integration

As Luxembourg progresses through the energy transition and shifts to a decentralised and a decarbonised energy system, its management becomes increasingly complex as new dynamics appear through an increasing number of producer-consumers, renewable sources, electrical assets and energy carriers.

The present project aims to establish a foundation for tackling challenges such as grid limitations, data expansion, volatile prices, fluctuating consumption, congestions, and multi-energy vectors in the next phase of the energy transition through applying a paradigm shift in how the country manages its energy system: near-real-time operation of the future Luxembourgish energy system.

The approach aims to position Luxembourg as a showcase of a small but efficient and digitalised energy system. An affordable, sustainable and secure energy system (i.e., regulated and non-regulated) will be guaranteed while unlocking the necessary system flexibility, reliability, and market adaptability. The vision is to enhance Luxembourg's energy system by harnessing the capabilities of AI, making it more robust, secure, resilient, and environmentally sustainable while ensuring affordable energy for all.

To achieve this objective, the following aspects will be covered:

- **Harnessing near-real-time energy data:** Gathering and utilising the vast amount of near-real-time data generated from various energy sources (e.g., electricity, gas, heat, and hydrogen) to create a highly optimised, economically viable, and sustainably driven energy management system. Existing data flow interactions will be mapped, and new ones created while ensuring harmonisation and cybersecurity.
- **Leveraging advanced computing and AI:** Developing AI-driven support tools that enable the near-real-time operation of the energy system. For example, fault detection, asset predictive maintenance, grid reconfiguration, multi energy vector monitoring, explicit real time dynamic tariffs, solar and wind optimisation, vehicle to Grid. Establishing an AI model sandbox for energy allowing developers and researchers to test the performance and behaviour of AI models, evaluate the trustworthiness of different AI algorithms, identify and mitigate potential risks and biases, and test regulatory compliance.
- **Developing near-real-time and bidirectional communication:** Implementing bidirectional communication channels to acquire data, monitor and optimally control energy system assets in near-real-time.

The expected broader impact of the initiative covers a multitude of aspects. Economically, the integration of AI-driven decision-making aims to reduce operational costs and create new market opportunities. Environmentally, operating in near-real time will allow Luxembourg to make energy decisions with the adequate balance of affordability, sustainability and supply security and resilience. By dynamically balancing supply and demand and optimising renewable energy production, storage and consumption, the present project will directly contribute to the country's climate goals. Socially, active citizen participation is empowered, enabling consumers to engage with energy markets, adjust consumption based on dynamic pricing, and benefit from demand response programmes. As a result, energy literacy is improved.

Climate science: Regional Digital Twin Climate Change

The rising economic impact of climate change underscores the urgency for innovative resilience solutions. As risks grow, the predictive risk analytics market is set to expand from $22 billion in 2019 to $55 billion by 2027.[15] The Regional Digital Twin Climate Change (RDTCC) project has the ambition to address this need by providing advanced climate services and risk management solutions for energy, finance, agriculture, and public services. The project will leverage data, AI, HPC, sovereign cloud, and EU platform interoperability to develop a comprehensive climate services portfolio.

Its main objectives are:

- Enhance resilience to climate change for government bodies and critical industries
- Advance AI algorithms for predictive and risk management applications
- Establish Luxembourg as a global leader in digital twin technology and climate services

The initiative will build on favourable European and national contexts, in alignment with Destination Earth (DestinE), an ambitious European initiative to develop a highly accurate digital replica of the Earth for monitoring, simulating, and predicting climate and environmental changes. It will leverage and pursue LSA- and ESA-initiated activities such as the 2024 Luxembourg Flood Digital Twin prototype and the 2025 RDTCC Architecture study and use cases. This strategic approach lays the groundwork for industrial development starting in 2026.

By leveraging the expertise and technological advancements developed through the Space Hub of the Luxembourg AI Factory, the RDTCC will apply AI and HPC to optimise regional climate impact assessments, enabling precise risk analysis and decision-making. The system integrates satellite imagery, local in-situ measurements, topographic maps, and auxiliary regional data, automatically ingesting and processing them by using MeluXina(-AI) and hosting capabilities on Luxembourg sovereign cloud solutions. A key feature is its interoperability with DestinE, which provides the global climate scenarios that the RDTCC will refine into high-resolution and region-specific models.

The project will further **enhance multi-sectoral climate services, delivering AI-driven predictive models and scenario simulations** tailored for energy, financial services, and digital infrastructure, and will support sector-specific digital twins such as those for energy and transport, ensuring a cohesive and scalable digital ecosystem. Additionally, AI-powered tools, including virtual assistants and advanced search functions, will enable real-time insights and efficient data retrieval, empowering businesses and policymakers to anticipate and mitigate risks.

The consortium is composed of key Luxembourgish actors in AI, Cloud, and HPC such as research centres, academics, private companies, European AI Factories and other national agencies having relevant expertise/ needs and confirming interest to take part to the project.

[15] Fortune Business Insights, Risk Analytics Market Size to Touch USD 54.95 Billion by 2027 (23.06.2020)

Space: Sustainability in Space

Space technologies and applications play a crucial role in our daily lives from enabling GPS navigation, weather forecasting, to global communications. Due to the increasing number of satellites launched, space is becoming crowded; therefore, to continue benefiting from space technologies, ensuring a sustainable space is a must. Luxembourg's position in the Space Sector is well established with large, stabilised operators, an extended ecosystem of startups and SMEs as well as a legal framework for space activities.

The present project will tackle complex problems related to space sustainability in different phases:

- **Space Situational Awareness (SSA):** Improve SSA through the development of AI-based tools for object identification, manoeuvre optimisation and collision risk avoidance. The use of Earth-based observations and radars in combination with space-based data is foreseen. In the SSA-context, the development of SSA data curation capabilities ranging from collection, aggregation over error detection, bias estimation to standardisation and archiving is encouraged. Further, the creation of SSA databases to be hosted on a sovereign cloud infrastructure and a SSA marketplace will be explored.
- **Satellite Health:** Enhance spacecraft maintenance. AI is expected to become a game-changer in analysing satellite health by using ML, predictive analytics, and anomaly detection. AI could monitor satellite telemetry data in real time and detect anomalies that could indicate sensor malfunctions, communication issues, deviations from patterns, unexpected energy consumption or attitude control problems. AI could potentially flag the need for actions (predictive maintenance) from historical telemetry, from environmental factors such as space weather, or from previous anomalous behaviours.
- **On-board autonomy and In-Orbit-Servicing:** Improve sustainability in space by allowing to (i) plan efficient routes and make real-time decisions for space missions as well as (ii) extend spacecraft life, reuse modules, and de-orbit objects that cannot manoeuvre to graveyard. AI will play a crucial role in IOS by enabling autonomous, precise, and efficient operations for repairing, refuelling, relocating, and deorbiting satellites. This involves computer vision, edge computing and machine learning for real-time object recognition. Robotic control may be used to execute dedicated operations that cannot depend on the latency that human oversight would require.
- **In-Space Manufacturing:** This phase will set the cornerstone for a future in-space economy. Advancements of 3D printing, in-space assembly, reuse of debris and edge computing in space are foreseen.

The realisation of the present project, significantly driven by initiatives from private companies, will involve the launch of three calls for projects, covering the first three phases of the 'Sustainability in Space' initiative. These calls are expected to encourage industrial R&D projects in the domains of 'AI for Space Situational Awareness', 'AI for Satellite Health' and 'AI for on-board autonomy, for In-Orbit-Servicing' through attractive financial aid intensities.

Cultural heritage: A strategic framework for integrating AI into Luxembourg's cultural sector

Cultural institutions ensure an essential balance between technological progress and human values. The flagship project *Intelligent Heritage* aims to position Luxembourg's cultural sector as both a consumer and actor in the development of AI solutions, by establishing the appropriate policy framework.

AI opens up unprecedented perspectives: connecting disparate collections through intelligent metadata, detecting patterns in multilingual archives, or making vast sets of historical data accessible. The project aims to bridge the digital divide between major institutions and local archives through scalable AI tools, shared technical infrastructure, and knowledge transfer mechanisms. Sections dedicated to ethics, protection of creation, innovative tools, inclusion, and public engagement will strengthen critical thinking and promote digital sovereignty at the national level. By leveraging AI capabilities, we will democratise access to Luxembourg's multilingual heritage, strengthen the links between citizens and collective memory, and make the country a leader in AI-enhanced heritage management, in line with the national AI strategy.

Context:

Since a survey conducted in 2018 by the Ministry of Culture, the Luxembourg cultural heritage sector has shown varying levels of digital maturity. The LuxTIME project has deepened this diagnosis by proposing a decentralised consortium to structure research activities. This flagship project, recognised for its strategic relevance, aims to address the challenges and seize the opportunities related to AI in the cultural field.

Here are the objectives of the project:

- **Strengthen the archives and collections:** Support cultural institutions in the qualitative and sustainable management of their data, while enhancing their interoperability. In a data-driven economy, it is important to recognise these skills and expertise as crucial strategic assets.
- **Facilitate research and development:** Improve the internal processes of heritage institutions and offer innovative user-centred services. The associated projects facilitate intelligent research, metadata enrichment, semantic links, and multilingual access.
- **Establish an ethical framework:** Create transparent legal frameworks to ensure that AI innovation respects the rights of creators. Support the GLAM sector (Galleries, Libraries, Archives and Museums) by establishing an ethical framework conducive to responsible and sustainable innovation.
- **Raise awareness and train the public:** Position the State as a strategic catalyst for innovation in the cultural sector through the creation of internal experimentation spaces, targeted awareness and training actions for small GLAM institutions.
- **Implement a collaborative governance model:** Establish a flexible and adaptive governance model that can evolve with the needs of stakeholders and the rapid pace of AI advancements, while ensuring strategic coherence and fostering innovation.

Part 4.
Conclusion

Luxembourg is staking its claim to be a digital pioneer in Europe, with a clear view to reinforcing its digital sovereignty by 2030. By integrating the national data strategy with those on artificial intelligence and quantum technology, the Grand Duchy is creating an attractive, effective, sovereign and secure ecosystem, benefiting citizens, researchers as well as the public and private sectors. This human-centred approach aims to bring citizens closer to their own data, empowering them to use it while strengthening its protection.

Centralised data governance plays a fundamental role in this digital transformation by ensuring the coherence of initiatives and facilitating the reuse of public sector data. This structure will enable the Government to effectively address societal challenges by relying on data-driven decisions, while developing simpler, faster and more efficient public services for citizens.

By optimising access to data, investing in cutting-edge infrastructure and nurturing the necessary talent, Luxembourg is stimulating innovation and value creation in the national economy. This ambitious strategy is positioning the country as a centre of data excellence within Europe, a preferred destination for innovative companies and a partner of choice for cross-border data initiatives, thereby helping to shape Europe's digital future.

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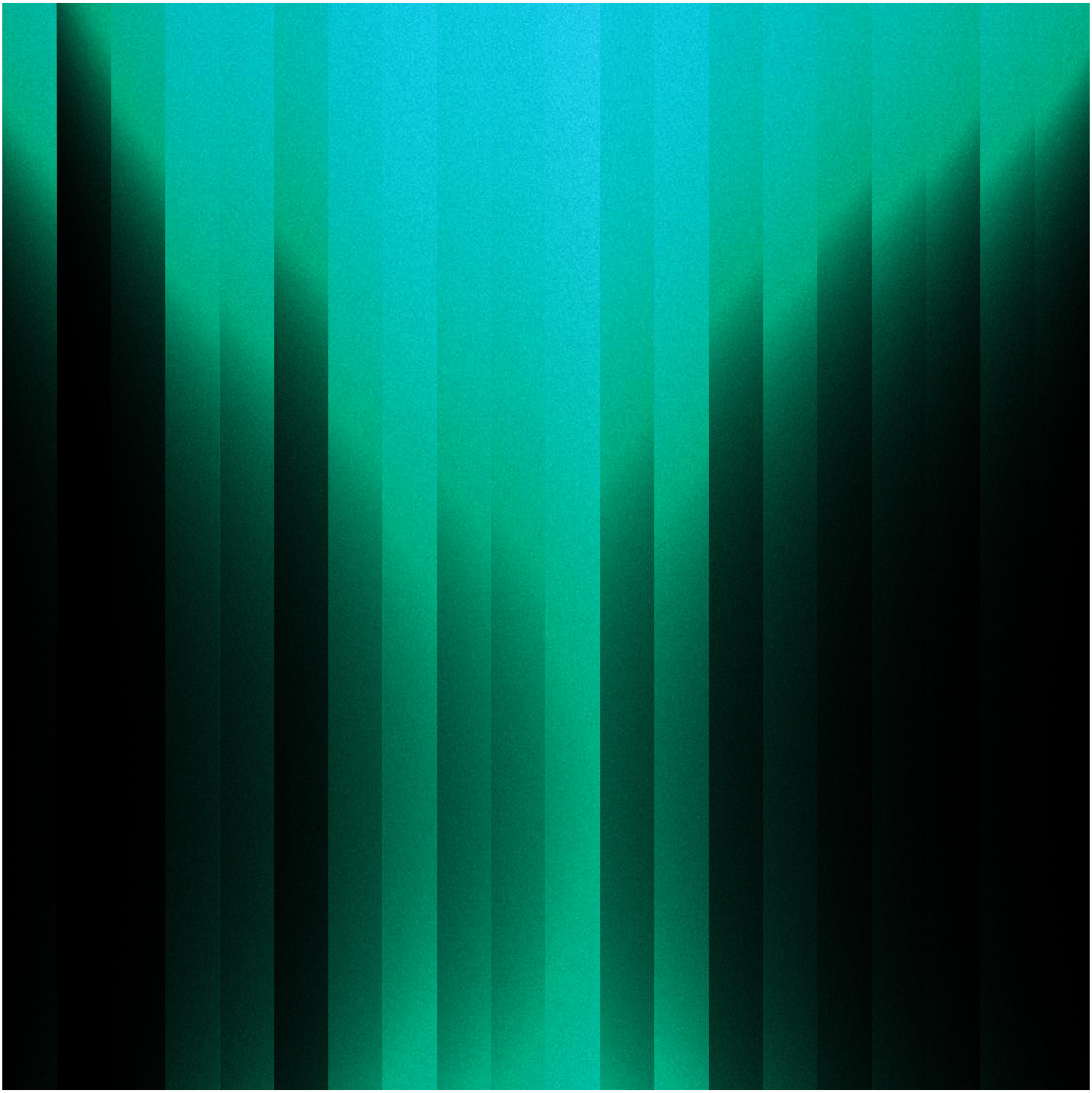

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