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Data for health



FOCUS

On the road to personalised medicine

AT HOME IN LUXEMBOURG

Entering the European market with ease



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CROSSROADS

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- **6** On the road to personalised medicine
- **10** Accessing the European healthtech market
- 12 Data-driven research with patient impact
- **14** Smart solutions for a healthy future
- **16** From innovation to healthcare
- **18** Capturing patient feedback the innovative way



20 Start-up corner



22 News



26 At home in Luxembourg

28 Entering the European market with ease



34 Company portrait

Ferrero: Local partnerships, international reach



36 Culture & lifestyle

The centenary Gëlle Fra



38 International CEO

Lokdeep Singh (Talkwalker)

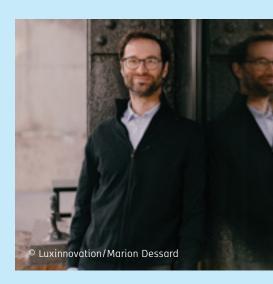


40 Business info



Why choose Luxembourg?

Scan





Technology and digitalisation are revolutionising healthcare across the world. Digital innovations are impacting all aspects of the health sector, from prevention to care delivery and the functioning of hospitals. As all radical transformations, this leads to challenges, but also to new opportunities to improve people's lives, while also generating economic value.

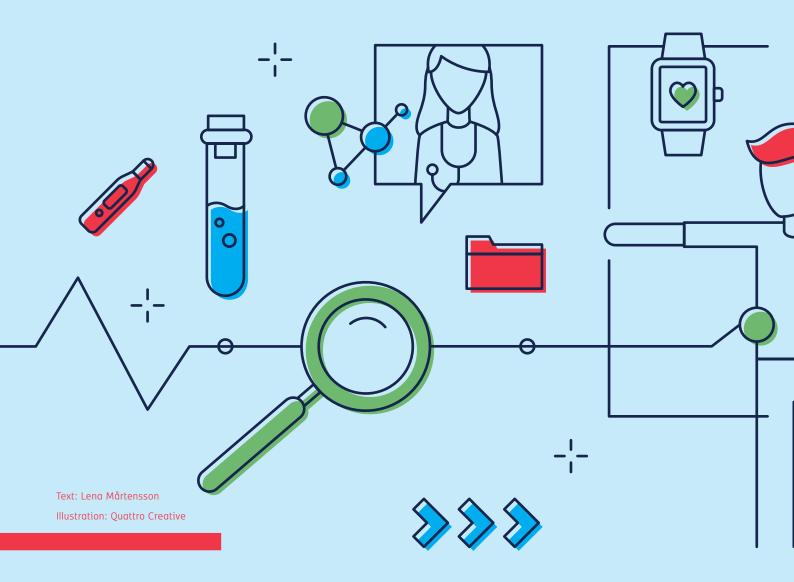
This edition of Crossroads Magazine showcases Luxembourg's unique model for embracing new opportunities in healthcare and building a strong ecosystem where innovative health technology companies — in particular those with a digital focus — can flourish and grow in the European and global markets. Enjoy, and if you wish to know more, you are more than welcome to get in touch with us.

Jean-Philippe Arié

Cluster Manager – HealthTech, Luxinnovation

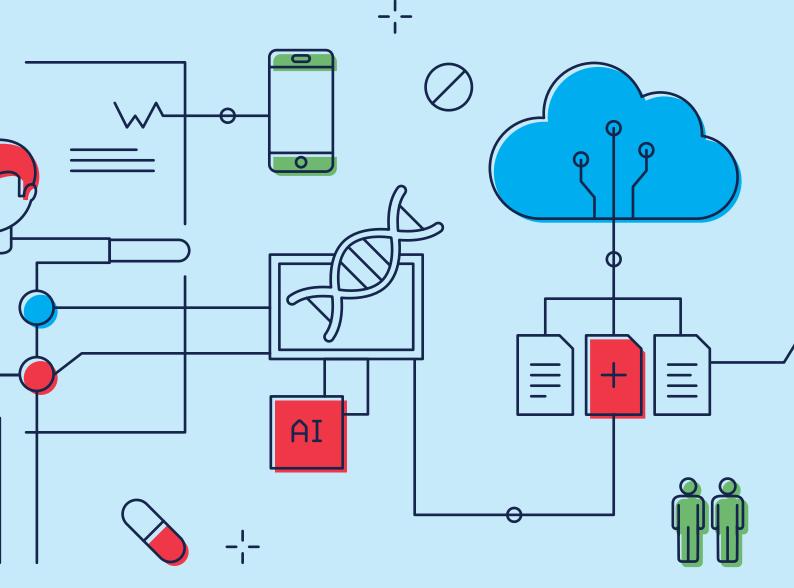


Data for health



The use of data is revolutionising healthcare. Knowledge generated from patient data analyses enables personalised medicine - also referred to as precision medicine which implies tailoring medical intervention based on their predicted response to a specific treatment. It makes healthcare more efficient and enables a whole new level of preventive medicine.

Over the past years, Luxembourg has continuously been building a comprehensive ecosystem where innovative healthtech companies can flourish, interact with public research and hospitals and tailor their offering to the requirements and regulations of the EU market. These efforts have one overarching objective: to have a real impact on the welfare of people.









On the road to personalised medicine

In 2008, the Luxembourg government launched its Sciences and Health Technologies Action Plan to diversify its economy, nurture health technology innovation and stimulate the shift towards personalised medicine. Fifteen uears later, the country is home to internationally renowned biomedical research centres and a growing community of healthtech companies focusing, in particular, on digital health, digital medical devices and in vitro diagnostics.

The importance of healthcare innovation can hardly be overestimated: it can improve patient care, enhance population health, decrease healthcare costs and, at the same time, generate economic value. "The ambitions behind Luxembourg's decision to develop this sector was to stimulate economic diversification while also advancing personalised medicine – a field that was still in its infancy in 2008," says Françoise Liners, Director Health Technologies at the Luxembourg Ministry of the Economy. Since then, the country has worked to build a comprehensive ecosystem where healthtech companies can flourish, systematically adding one piece of the puzzle after another.

A foundation of research excellence

The first step was to create a pool of excellence in biomedical research. The Luxembourg Centre for Systems Biomedicine (LCSB) was created in 2009 as part of the University of Luxembourg, and has since gained a strong international reputation for its research on neurodegenerative diseases. The Integrated BioBank of Luxembourg (IBBL), set up around the same time, has become a centre of excellence in biospecimen science and data generation and is today part of the Luxembourg Institute of Health's (LIH) precision medicine research centre.

As the focus on personalised medicine matured, it became increasingly clear that data was at the very heart of the matter. "Data-driven decisions about the most appropriate treatment for each patient are today at the core of healthcare," Dr Liners points out. "Computational biology was a key activity at the LCSB from the very beginning, and when national innovation agency Luxinnovation carried out its first mapping of the Luxembourg healthtech sector in 2018, we saw that the number of companies with a digital focus had constantly increased in parallel to the development of the biomedical research institutions."

The strength of the existing company base, coupled with Luxembourg's well-developed data ecosystem and general

















emphasis on data-driven innovation, drove the current focus on digital health, digital medical devices and in vitro diagnostics. "These three fields are at the heart of personalised medicine as they enable the development of data-based decision support tools as well as new types of diagnostic tests," says Carole Brückler, Head of Digital Health Technologies at the Ministry of the Economy. "They also complement the strong biotechnology and biopharma industries established in neighbouring Belgium, France and Germany, or in Switzerland and the United Kingdom."

Facilitating healthtech market access

The focus is now on developing the young and growing healthtech business community and to attract international companies bringing healthtech innovations that Luxembourg can nurture and benefit from. "Luxembourg should become a natural choice for companies wanting to gain European market access for their digital medical devices. To achieve that, we have developed a set of initiatives that address and answer specific company needs," says Dr Liners.

The range of tools includes acceleration programme Fit 4 Start HealthTech, which helps start-ups align their operational plans with the regulatory requirements for their medical devices in the European market, and Fit 4 Innovation HealthTech Market, which introduces start-ups and SMEs to the regulatory expertise needed to obtain CE marking for selling their medical devices in the EU.

A further programme, the Joint Call HealthTech, addresses companies' need for clinical investigations in order to demonstrate the performance, safety, cost efficiency and patient benefits of their devices. "In 2021, the Ministry of the Economy, the Luxembourg National Research Fund and Luxinnovation launched the first joint call for collaborative clinical investigation projects involving companies, research organisations and hospitals," says Dr Brückler. The second edition, launched in 2023 with additional funding from the Directorate of Health. demonstrates the broad support for these developments.

The impact of digitalisation

In order to tailor their products to patient needs and the EU market, companies also need to understand the impact they will have on the healthcare system. "Digital medical devices can completely change the relationship between healthcare professionals and patients," states Dr Liners. "They allow patients to be partners in their own health management, and can facilitate the application of preventive and care measures. They can also bring considerable efficiency gains and free up time for healthcare professionals to focus on their patients. The projects cofinanced through the joint calls offer patients and healthcare professionals an opportunity to use and try new digital health innovations, and provide companies with precious insights into how their tools are received and perform."

To advance the understanding of the medical benefits, structural and procedural changes, and the social acceptance of digital healthcare services, the LCSB, the LIH and the dMed research clinic of Luxembourg hospital CHL have created a Digital Medicine Group funded by the FNR as a PEARL Professorship. Headed by Professor Jochen Klucken, who holds the Chair of Digital Medicine at the University of Luxembourg, the group aims to understand how patientcentred, personalised healthcare technologies can be tailored



to patients needs and integrated into existing healthcare structures and procedures. High quality patient data is also at the core of Luxembourg's forward-looking patient cohort strategy, crystallised in the international CLINNOVA project led by the LIH which lays the foundation for artificial intelligence-enabled innovation in medicine. Luxembourg is thus at the forefront of the efforts to develop a European federated health data space enabling innovation and patient-centric care.

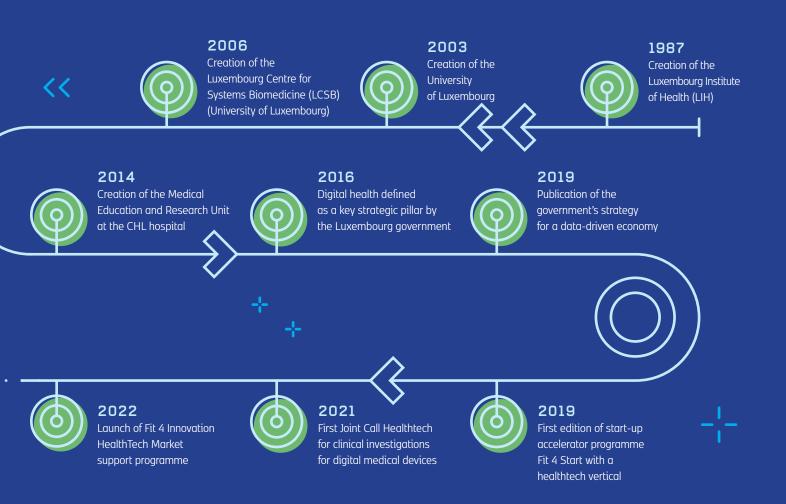
centre servicing the south of Luxembourg and the nearby City of Sciences that hosts the University of Luxembourg and several other research institutes, the campus will be a geographical bridge between research, innovation and the medical sector. "Some LIH and LCSB departments are already located in the House of BioHealth, and the campus will continue to foster this closeness between researchers and entrepreneurs," Dr Brückler continues.

A campus for health

Another essential block in the ecosystem building is a physical hosting infrastructure adapted to the needs of healthtech companies. In 2015, the House of BioHealth opened its doors, offering over 17,000 m² of office and lab space to both established and start-up companies. "It has all the necessary permissions for wet labs, which is a considerable advantage for resident companies," Dr Brückler underlines. The next step is the construction of the HE:AL Campus dedicated to health and life science innovation. Located between the House of BioHealth, a future major hospital

Future ambitions

Luxembourg's future plans for growing the healthtech sector include the creation of a medicine agency and a fund leveraging private investments in the field, as well as support for companies seeking to make their digital medical devices eligible for reimbursement. "With the progress made these last years on building our healthtech ecosystem, international companies show an increasing interest in Luxembourg," confirms Dr Liners. "This shows that the country is becoming an attractive location for healthtech companies looking for an enabling ecosystem to enter the European market."





Accessing the European healthteck market

Healthtech



Each healthtech company is basically getting tailor-made support.

Healthtech solutions are subject to rather complex regulatory requirements guaranteeing health standards and protection in the EU. Luxembourg's national innovation agency Luxinnovation manages a range of initiatives aimed at supporting healthtech companies from strategy development to European market access.

Luxinnovation is a central player in Luxembourg's innovation landscape, supporting start-ups and SMEs as well as large international groups in their R&D and innovation activities. In collaboration with the Ministry of the Economy, the agency runs several programmes supporting healthtech firms.

From start-up acceleration to obtaining CE marking

One of them is the internationally renowned start-up acceleration programme Fit 4 Start, which offers start-ups from Luxembourg and abroad coaching, seed funding and access to key networks that can help them succeed with their market launch and growth. Since 2018, it includes a specific track for healthtech companies. "The Fit 4 Start coaches help start-ups acquire an understanding of the European market and build their business strategies in the most efficient way," says Anne Meunier, Senior Advisor – Healthtech. The programme also gives them insights into medical device, data protection and other regulations that they need to comply with, so that they can take these into account in their early technology development.



As a next step, the agency has launched Fit 4 Innovation – HealthTech Market to help companies developing digital medical devices obtain the CE marking that is compulsory for commercialisation in the EU. "Receiving the CE marking is a complex process, and many young companies are not capable of defining a clear roadmap for getting there on their own. We give them access to experienced experts from across Europe and beyond that take them through all the steps from defining the class of their medical device to developing a quality management system, conducting the clinical validation, and preparing technical documentation as well as post-market surveillance," explains Dr Meunier.

Finding the right partners

The clinical validation cannot be done by companies on their own, so the Ministry of the Economy, the Luxembourg National Research Fund and Luxinnovation have launched a joint call for clinical investigation projects involving companies, research centres and hospitals. Luxinnovation notably contributes with a matchmaking platform that helps companies find the right project partners.

"Bringing the national healthtech ecosystem together and connecting companies with the partners that can help them move forward is an important part of our everyday work," says Luxinnovation Healthtech Advisor Lauriane Chuzeville. "In addition, we also collaborate with clusters abroad, such as EIT Health and Medical Valley in Germany, to work on strategic topics."

In May 2023, Luxinnovation, together with Medical Valley and its digital health application centre DMAC, EIT Health

and the Enterprise European Network, organised the first European Digital Healthtech Hub Conference. The event brought together companies, decision makers, researchers, investors and other experts from 15 countries as well as European Commission representatives to discuss funding solutions, business models and clinical validation approaches that facilitate the market access of digital health technologies.

A tailor-made approach

The added value of these instruments is confirmed by Luxinnovation's Head of International Business Development – Heathtech, Régis Ciré. Since joining the agency in spring 2023, the former entrepreneur has been amazed by the number of international healthtech companies interested in using Luxembourg as their European base and testbed for launching their products on the European market.

"Luxembourg is a good place for non-European companies that do not yet know the market here," he points out.
"As the size of the ecosystem is limited, we know all players very well. We can listen to the needs and expectations of companies and connect them with the right people. There are also initiatives such as the recently organised Luxembourg Healthcare Week to create bridges between businesses and medical professions. Each healthtech company is basically getting tailor-made support."

Text: Lena Mårtensson Photos: Michel Brumat









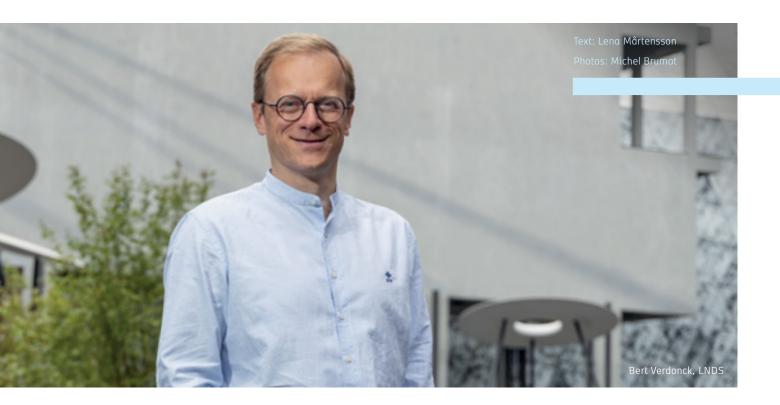


The access to standardised, highquality biomedical and digital health data is crucial for translational research centre Luxembourg Institute of Health (LIH). Together with national and international partners, and supported by the innovative Luxembourg National Data Service (LNDS), the LIH is part of a pioneering European partnership around standardised, quality-controlled health data, which enables research with real patient impact.

With immune-related diseases and cancer as its main application areas, the Luxembourg Institute of Health specialises in the development of precision medicine. "Our aim is to be able to define the right treatment track for the right patient," says CEO Ulf Nehrbass.

To reach this goal, the availability of clean, interoperable data - biomedical data derived from blood and tissue samples, for example, but increasingly also digitally captured data - is essential, and the LIH is involved in several projects using data from patient cohorts. "However, biomedical data can have strong variations due to small differences in how biological samples were taken and manipulated,





of precision medicine for treatment decisions through data federation, standardisation, and interoperability. "The clinical centres involved make huge efforts to ensure that samples are taken in exactly the same fashion," explains Professor Nehrbass. "All samples are shipped to the Integrated BioBank of Luxembourg (IBBL) for processing, and then forwarded to the project partner in charge of that specific type of samples. The data generated is highly standardised and fed into a federated data space."

While this approach is crucial for facilitating high-quality cross-border studies, it is also key to unleashing the power of artificial intelligence (AI) in health. "Training AI algorithms on retrospective, non-structured data has proven to be very difficult. They need to be developed based on clean and structured data sets. Once that is done, they become capable of providing relevant insights also from older, unstructured data."

Secure processing environments

Professor Nehrbass' vision is to make this data available for both public and private sector research. However, this is a delicate issue as health data is highly sensitive and protected by strict European data privacy regulations.

This is where the Luxembourg National Data Service (LNDS) comes in. "Our role is to provide services that enable value

creation from public sector data. We also facilitate the sharing and reuse of data for public and private data partners in a way that fully respects privacy and other regulations," explains Bert Verdonck, CEO of the young organisation created in late 2022 that is also a CLINNOVA partner. "We have a quite unique transversal approach, targeting all sectors, but as health data is particularly sensitive, it is a good and challenging focus point."

The LNDS is developing solutions for providing access to sensitive data in a restrictive manner and under certain conditions. The intention is to give access through secure processing environments which would allow researchers to do the agreed research only and obtain results without extracting the actual data. The organisation also offers services to help clean and standardise data. "Our ultimate objective is to make it possible to do research on larger volumes of data much faster and much faster than today," says Mr Verdonck. "Sometimes it can take researchers a year or more just to get the permission to use the necessary data. We aim to reduce this to less than a month."

This coordinated effort is much appreciated by Professor Nehrbass. "Our high-quality databases will enable us to use AI in a fast, affordable way and identify new healthcare solutions that will fit the medical systems of the next 5-10 years."















Smart solutions for a healthy future

Andreas Kremer, Co-founder & Managing Director, ITTM

Actionable data

How do you innovate in the healthtech space?

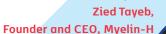
ITTM is a leading provider of data management and data flow optimisation solutions for pre-clinical and clinical trials. Our scope has also extended to digital healthcare and realworld data integration, with the goal to enhance data quality and accessibility, enabling a federated data analysis. This approach ensures that data remains distributed while being used in a coordinated, shared, robust and secure manner.

What type of data do you deal with?

Our focus is on a wide range of data types encompassing variables that provide insights on an individual's health behaviours, from medical to consumer-grade information, that help clinicians better understand the root causes of health issues. This includes among others medical imaging, data from physiotherapy devices, wellness and sports applications. A project on Parkinson's patients, for instance, involves diverse disciplines, and hence various data sources. This collective information plays a pivotal role in both diagnosis and treatment.

How do you benefit from the data and innovation ecosystem in Luxembourg?

We are a spin-off from the Luxembourg Centre for Systems Biomedicine, which is part of the University of Luxembourg. Our datacentre partner is the European Business Reliance Centre in Luxembourg. We just collaborated with the Luxembourg Institute of Health (LIH) on a real-world data project involving the cancer registry. Together with LIH, we also co-founded the Luxembourg node of the Observational Health Data Sciences and Informatics.



Gamified neuroscience

How do you innovate in the healthtech space?

We have developed a revolutionary neuro technology platform for remote monitoring of brain disorders starting with multiple sclerosis (MS). We have gamified neuroscience as we call it. Patients play brief cognitive games, and we stimulate the brain in different ways and observe how it reacts to these stimuli. Thereafter. we process the data and translate it into what we call "digital biomarkers" to help physicians, hospitals and pharmaceutical companies effectively manage and monitor MS at any time and from anywhere.

What type of data do you deal with?

Essentially, we amass data that provides a holistic view of the entire body, spanning from brain functions down to lower limb activities. We capture various biosignals and work with primarily medical data, for example, EEG readings that capture brain activity in a non-intrusive manner, speech patterns, EMG signals that reflect muscle activity and IMU records of body movements.

How do you benefit from the data and innovation ecosystem in Luxembourg?

Currently, we are working with ecosystem players like the Luxembourg Institute of Science and Technology (LIST) on a cybersecurity solution for physicians. We have also received a lot of support from Luxinnovation, the Ministry of the Economy and the Luxembourg National Research Fund (FNR). We have an industrial fellowship with the University of Luxembourg, and we recently submitted a proposal with one of the main Luxembourg hospitals.

Dermot Doyle, CEO and Co-Founder, Dynaccurate

Semantic interoperability

How do you innovate in the healthtech space?

Dynaccurate harmonises health data at source.

Today, health data is documented in slightly different ways. While the information is generally accurate, discrepancies in wording and terminology pose problems for patients, doctors and researchers.

For patients, their data from one system cannot be read or understood by another system. For doctors, it is not possible to get a rapid summary of how the patient has been treated historically or at another facility. For researchers, it is not possible to review a mass of data across different systems or sites, due to a lack of harmonisation.

These problems are all solved if the data is structured in a machine-readable way. The technical term for this is "semantic interoperability", which implies preserving the meaning of words across different systems. This is what our technology does.

What type of data do you deal with?

Our focus is health data, and we are very advanced in medication data. We have applied our technology in health, but we have barely scratched the surface of its vast potential. Semantic interoperability needs exist across all the life sciences, law, defence, engineering etc.

How do you benefit from the data and innovation ecosystem in Luxembourg?

For research partnerships in the academic sector, we have plenty of opportunities, thanks to our relationship with the Luxembourg Institute of Science and Technology. But there is still work to be done around medication data in Luxembourg.



Texts: Abigail Okorodus



Digital twin

How do you innovate in the healthtech space?

MDSIM seeks to improve patient quality of life and reduce reoperation rates using an innovative medical software solution that creates a digital twin of the patient. Surgeons employ this tool in advance to strategically plan and enhance surgical procedures via computer modelling and simulations. This is a prime example of cross-industry innovation, where a well-established technology from other sectors is adapted for the intricate and unique context of healthcare.

What type of data do you deal with?

We need medical image data such as CT scans and MRIs to build a digital twin of the patient's geometry. Data is essential for training our AI model to automatically identify and comprehend aspects like spine anatomy, the biomechanical properties, and also for the model's resolution and validation. Given the sensitive nature of healthtech, it is imperative that data is anonymised to prevent loss or compromise. Compliance with GDPR laws and cybersecurity protocols are within our purview.

How do you benefit from the data and innovation ecosystem in Luxembourg?

We just signed a data agreement with the Hôpitaux Robert Schuman in Luxembourg. We are being supported by Luxinnovation to set up an R&D project. We engage with supercomputer MeluXina for high-performance computing and cloud infrastructure access. Our Scientific Advisory Board includes a University of Luxembourg professor, and we have plans to collaborate with the LIH during the clinical validation phase.

















Digital innovations are taking medical interventions to new levels of precision and personalisation, but all new ideas do not provide real added value. We spoke to Luxembourg-born, internationally renowned orthopaedic surgeon and scientist Romain Seil about his work to develop and implement new digital tools in clinical practice while ensuring that patient needs remain at the very centre.

Digitalisation impacts virtually all aspects of medical practice. "It includes everything from patient information and remote consultations to the use of digital technologies such as augmented reality and robotics," comments Romain Seil, who heads the Division of Neurosciences and Musculoskeletal Diseases at the Centre Hospitalier Luxembourg (CHL), Luxembourg's first academic teaching hospital.

Simulation and augmented reality

A specialist of knee surgery and sports traumatology and renowned for doing arthroscopic surgery at a very high clinical and scientific level, Professor Seil has been confronted with digitalisation for many years and remains passionate about pushing the boundaries further. "Today, I use augmented reality when doing knee arthroplasty surgery. I'm still evaluating the tool, but I can already see that it allows me to do less invasive operations but with a higher degree of precision and personalisation."

In the context of an EU-funded project, he has also been working with Swiss company VirtaMed on the development of a simulator for arthroscopic surgery, in particular for meniscal repairs. "In medical education, surgical simulation can be very useful to fill the gap between theoretical teaching and practice on actual patients. It also helps doctors become proficient on very specific and difficult types of surgery."

"A very open but critical mind"

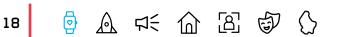
Professor Seil also talks about how new and more sophisticated diagnostic techniques are made feasible with tools such as Luxembourg's brand new cone beam CT scan, which makes it possible to do imaging of the lower extremities with the patient in a standing position. "With the help of artificial intelligence, we will also be able to predict the course of arthritis in knees based on simple radiographs," he predicts.

However, he still urges some caution. "You need to have a very open but critical mind when dealing with these types of new technologies: every innovation does not mean progress, and the theoretical advantages do not always translate into reality. The usefulness of each solution, and the surgeons' level of acceptance, need to be confirmed in clinical practice. We also have to be very careful about keeping the patient at the centre of what we do. No digital tool can replace listening to and observing the patients and doing clinical examinations."

The need for solid medical data

Patient data analysis is another field that is strongly supported by digitalisation. In 2010, Professor Seil and some of his colleagues at the CHL initiated the creation of a quite unique database that today includes data on over 3,000 severely knee-







Capturing patient feedback the innovative way



Pharma research companies are constantly faced with the challenge of processing huge quantities of patient data that are complex to gather and often of mediocre quality. Using AI-powered voice analysis and digital interaction, Luxembourg tech company Softbrik can capture much more patient intelligence of far better quality, while significantly reducing the time and costs of clinical studies.

Gathering feedback from customers is fundamental for most companies – but few clients enjoy filling out long questionnaires. "Many people find it much easier to talk than to type," says Romit Choudhury, Softbrik's COO and co-founder. The company has therefore developed a tool that captures voice messages and turns the resulting audio streams into texts. Machine learning algorithms analyse the emotions transmitted by each respondent and detect key insights, which makes the evaluation of the feedback quick and efficient at scale.

Understanding patient feedback

Just as Softbrik had finalised a first version of its tool, intended for the telecommunications market, the COVID-19 pandemic broke out. The team realised that they could help doctors who were overloaded with patient calls. Supported by Luxembourg's StartupVsCovid19 programme launched in spring 2020, it redesigned its tool for messages left by early-stage COVID patients, using artificial intelligence to help doctors detect the most urgent calls and identify patients speaking about similar symptoms. "This started our journey into understanding patient feedback," recalls Mr Choudhury.

With this first experience in the healthcare field as a basis, the company saw that it could make a real difference in the field of clinical studies involving data from thousands of patients. "Traditionally, patients are asked to provide the initial batch of data during their first visit to the clinic, and then follow up at their next visit three months later or so. However, when people who have just learnt that they are severely ill are presented with a 30-page questionnaire, the quality of their answers will reflect their level of shock. Analysts have to deal with a lot of 'data noise'."

A complete digital journey

With Softbrik's digital solution, patients will instead be asked to provide only the most essential input on an iPad or similar device via a mix of multiple selection questions, ratings, emojis and even voice messages. "The emojis work the best – people love them, and the smiling icons bring down their level of stress," Mr Choudhury points out. A week later, when their shock has hopefully abated a little, they will receive an automatic notification on their phones to provide a next set of answers from the comfort of their home.

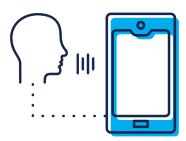
Healthcare teams can also give patients a health card with a QR code to physically remind them to give timely feedback.

The digital journey will continue with regular, digital feedback provided by the patients on their state of health. Biostatisticians are supported by AI-powered dashboards. "Our AI tools understand what the patients are talking about – their reactions to the medicine, their sleep cycle, etc. – and can extract information about the context, their mood and so on."

More data, less time and costs

The tool is already in use by pharma companies and hospitals in Switzerland, Germany and Belgium, and discussions with some US healthcare companies are under way. "Our clinical projects pass the ethical validation of the best pharmaceutical companies like Novartis, and we have proven that we can collect up to 25 times more patient intelligence while reducing the time needed for studies by 50-60% and budgets by millions of euros," explains Mr Choudhury.

The focus is now on scaling and growing the team. The company is exploring cooperation opportunities with the University of Luxembourg and the Luxembourg Institute of Health, and Mr Choudhury is very active in the start-up community. "We are a close-knit group of founders, almost like Silicon Valley in the early 90s, and the government is extremely supportive. Our diversity is our strength: if I want to do a version of my tool in, say, Amharic, I can easily find 20 Ethiopian people in Luxembourg to test it. This is a unique advantage for companies targeting the international markets."



Text: Lena Mårtensson Photo:Michel Brumat

Start-up corner



A roadmap for Luxembourg's start-up ecosystem

The Luxembourg government published this summer its strategic vision for fostering a thriving and dynamic start-up ecosystem. The aim is to reach a new stage of maturity, with a particular focus on the transition of young start-ups to the scale-up level.

The 18-page publication "From Seed to Scale" that the Luxembourg government presented last June outlines the roadmap for the future development of Luxembourg's start-up ecosystem.

This document is based both on an assessment of the Luxembourg start-up ecosystem in 2022, carried out with the support of specialist consultancy company Startup Genome, and on the needs identified on the ground, following a consultation process with the main stakeholders in the ecosystem.

A new digital platform

The ambitious and participative roadmap is aimed at positioning Luxembourg as a first-class environment for entrepreneurs developing innovative projects, investors and players in the start-up ecosystem.

The high number of start-up support structures in Luxembourg is a further indicator of the evolution of the ecosystem and the interest and support of private players. Today, some 15 public and private incubators are present in Luxembourg, while business angels, venture capitalists, major corporations and advisors bring the international experience essential to the accelerated development of innovative companies.

"Compared with other ecosystems, Luxembourg's salary levels help to attract talent, as do our social benefits and pension system, which are advantageous," Minister Fayot points out. "We are also successful in attracting top researchers, thanks to the university and to our research institutes, which are at the cutting edge in certain fields, and even world pioneers."

The roadmap is also supported by a new national digital platform, developed with Dealroom. It lists all the startups present in the ecosystem, as well as real-time data on startup activity and venture capital trends in Luxembourg. It aims to facilitate connections, to improve transparency and to increase the visibility of the Luxembourg ecosystem, both locally and internationally.

We are also successful in attracting top researchers.

Franz Fayot, Minister of the Economy

Texts: Abigail Okorodus & Jean-Michel Gaudron

From Seed to Scale Five priorities

Continuing efforts to support start-ups from the very beginning – Developing existing initiatives (i.e. Fit 4 Start acceleration programme), as well as facilitating disruptive innovation through the creation of spin-offs.

A more connected, stronger and more visible national ecosystem – Setting up a partnership with the internationally renowned service provider Dealroom.

Improving access to talent for start-ups and scale-ups – Enabling start-ups to recruit more easily, particularly internationally, with attractive forms of remuneration.

Create an environment conducive to the development of scale-ups – Encouraging open innovation, strengthening support for start-ups in their journey to become scale-ups, and promoting private investment in start-ups.

A start-up ecosystem anchored at the heart of the European Union – Joining the European Startup Nations Alliance (ESNA) and aiming to be more involved in European innovation initiatives.















News

NEW LAW Facilitate the hiring of skilled labour



The law simplifies the hiring of non-EU nationals and grants family members of third-country nationals holding a residence permit access to the labour market as soon as they arrive in Luxembourg.

As in many other countries, the shortage of skilled workers is a challenge for Luxembourg's economic development. The IT sector is particularly affected, but other industries such as healthcare, engineering services, the financial sector, and various segments of the construction industry are also seeking workers. To address this issue and assist companies in hiring foreign skilled workers, the Luxembourg Ministry of Foreign and European Affairs and the Ministry of Labour and Employment have put in place a new law which came into force on 1 September 2023. The text introduces significant changes designed to simplify the hiring of third-country nationals.

Thus, family members of third-country nationals holding a Luxembourg residence permit on the basis of family

reunification are now authorised to work in Luxembourg as soon as they arrive, giving them direct access to the labour market. This amendment applies to holders of a "family member" residence permit. As a result, they no longer need to apply for a work or self-employment permit before starting a salaried or self-employed activity.

The process for obtaining a certificate allowing the hiring of third-country nationals is also being simplified. For professions on the list of professions facing significant shortages of skilled workers, the national employment agency ADEM (which establish annually this list) is now exempted from its obligation to conduct a labour market test and check for available job seekers matching the employer's requirements. For jobs not listed as highly in demand, the labour market test will still be conducted, but with shorter timeframes. ADEM will have seven working days to verify if job seekers meeting the required qualifications for the declared position are available.

More information is available on the ADEM website (www.adem.public.lu).

Texts: Jean-Michel Gaudron, Lena Mårtensson & Abigail Okorodous

RESEARCH

University of Luxembourg inaugurates fintech centre of excellence

In March 2023, the University of Luxembourg inaugurated its National Centre of Excellence in Financial Technologies (NCER-FT). "As a leading future-oriented international financial centre, Luxembourg must have a state-of-the-art research environment that can match its level of ambition," said Luxembourg Minister of Finance Yuriko Backes. "By focusing on cutting edge interdisciplinary research, the NCER-FT will play a key role in helping strengthen our fintech ecosystem to drive the digital transformation of the Luxembourg financial sector."

This interdisciplinary research approach remains rare in the world, but is essential for developing practical, sustainable solutions to the challenges of digitalisation in finance.

It will focus its research roadmap on four topics: new frontiers for digital and automated finance; regtech and compliance by design; financial inclusion; and trust and security.

FUNDING

New capital injection into Digital Tech Fund

The Digital Tech Fund invests in innovative companies created less than 7 years ago and which develop products or services that preferably already exist as a working prototype. To ensure its continuity over the next few years, the Luxembourg state is participating, together with a group of investors, in the creation of a new compartment of the fund worth €14 million at its first closing.

"The Digital Tech Fund is part of the existing financing instruments and public support measures, which help make Luxembourg a welcoming place for start-ups and attract new innovative activities," said Minister of the Economy Franz Fayot. "In addition, the fund plays an important role in identifying and helping the most promising start-ups in their international growth."

SPACE ACTIVITIES

Astroport establishes European subsidiary in Luxembourg

US-based space construction and materials manufacturing company Astroport Space Technologies has established a European subsidiary in Luxembourg. This new venture is based on a partnership with Interflight Global Europe, the European arm of another prominent American air and space company also headquartered in Luxembourg.

The company, founded in 2020 in San Antonio (Texas) has the objective of designing, deploying, and operating interplanetary landing ports to enable safe, dependable, and efficient spaceflights to the Moon, Mars and beyond. "With a focus on 'regolith works' for bulk regolith excavation and conveyance, we see Luxembourg and its thriving space entrepreneurial ecosystem as the perfect place for developing new uses and new regolith based products from stockpile accumulations of feedstock during excavation phases in our site preparation construction," said Sam Ximenes, Astroport Founder, CEO and Space Architect.

INVESTMENT

Lyten opens European HQ in Luxembourg

Lyten, a Silicon Valley pioneer of materials based on threedimensional tunable graphene, has decided to establish its European headquarters in Luxembourg. Unlike conventional lithium-ion batteries, Lyten's lithium-sulfur batteries contain no nickel, cobalt or manganese. This reduces their carbon footprint by >60% and makes electric vehicles considerably lighter, which accelerates the transition to sustainable mobility.

"Luxembourg's talented workforce, deep history of collaboration across the Europe Union, and shared values in leading the way to a more sustainable global economy make the country a prime location for Lyten to begin its expansion into Europe," Dan Cook, Lyten's CEO and co-founder, points out.















EY REPORT Luxembourg 8th most attractive European country for FDIs



According to the EY's Luxembourg Attractiveness Survey 2023, 11% of investors rank Luxembourg as one of the top three countries in Europe that are most attractive for foreign direct investment.

For the second time, professional services network EY has published a Luxembourg edition of its Attractiveness Survey. The study analyses foreign direct investment (FDI) in Europe and Luxembourg. It also includes the perceptions of attractiveness of Europe as well as of the Grand Duchy.

The number of foreign direct investment projects announced in Europe increased by a modest 1% in 2022 compared to the year before. While this is yet another step on the road to recovery from the COVID-19 pandemic, the limited progress probably reflects the economic uncertainties resulting from the war in Ukraine. Nevertheless, EY refers to it as "disappointing" as the number of projects is still lower than in 2019 and 10% below the top year of 2017.

For the second consecutive year, Luxembourg comes out as number 1 in Europe in terms of foreign direct investment projects per capita, followed by Cyprus, Spain, Portugal and Belgium. While this list, unsurprisingly, is dominated by smaller countries with a relatively limited population, France is still in 8th position.

Luxembourg's biggest growth drivers were to be found in the sectors that support the financial and industrial sectors. Investment in the digital/ IT/software services sectors tripled.

The three European countries considered as most attractive for FDI are Germany, France and the UK. Luxembourg is in 8th place. More investors plan to increase sales and marketing in Luxembourg than in the rest of Europe. "As a central spot in Europe, Luxembourg is a sensible location for firms to conduct their European expansion activities, and this may explain why so many industrial, consumer, financial, chemical, pharmaceutical and high-tech firms cited plan to increase investment in this particular business area," the report points out.

FARG

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DISPUTE RESOLUTION SERVICES

The Luxembourg Chamber of Commerce provides an alternative to court rulings on disputes which often prove to be long, expensive and unsuited to the world of business. The Luxembourg Arbitration Center provides efficient and impartial administration for national and international commercial disputes, both for individuals and private sector enterprises.

An initiative of

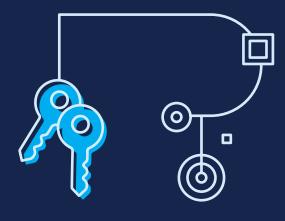
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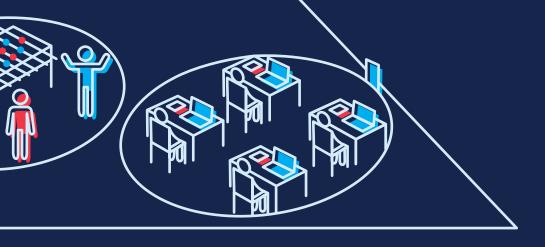
OF COMMERCE



When a company considers setting up shop abroad or expanding its operations to a new country, it considers many essential aspects to facilitate a smooth transition and ensure a favourable environment for its operations. These encompass activities like recruiting skilled personnel, adeptly navigating the regulatory landscape, and securing an optimal office space – tasks that can prove time-consuming, especially when conducted from a distant location.

Some of them start their journey by benefitting from the ready-made offer of business hosting structures. Top executives leading some of Luxembourg's many incubators, accelerators and innovation hubs, explain what the ecosystem offers and why this might just be the smartest and most cost-effective way for a soft-landing and to gain a foothold in foreign markets.





















In recent years, Luxembourg has emerged as a dynamic hub for innovation, boasting a robust ecosystem that encompasses a multitude of incubators, accelerators, specialised agencies, investors, and innovation hubs. This thriving ecosystem has played a pivotal role in nurturing and propelling numerous successful enterprises across diverse industries onto the global stage.

Many international companies opening their European offices in Luxembourg find a first home in one of the country's incubators and accelerators. Notable examples include Bitflyer, a Japanese crypto assets brokerage firm, Italian payments company Satispay, US data analytics firm Hydrosat, or space start-ups Yuri and Ispace that have constantly grown their workforces, among many others.

Incubating the future

At the heart of this entrepreneurial growth is the House of Startups, aptly referred to as the "campus of innovation". CEO Philippe Linster explains that this institution's allure lies in its comprehensive suite of services catering to a wide spectrum of players. Remarkably, over one-third of Luxembourg's 500+ startups find their home within four prominent incubators and accelerators co-located under its roof. These include the Luxembourg House of Financial Technology (LHoFT), the Luxembourg City Incubator (LCI), Le Village by CA and the International Climate Finance Accelerator (ICFA). This unique co-location fosters seamless interactions, networking opportunities, and knowledge transfer,

enriching the ecosystem. As Mr Linster puts it, "You meet people very fast, and this can be corporates, public actors, other startups and SMEs, incubators and accelerators, or funding partners. Everyone passes through this building at least once per month."

Expert guidance and mentoring

A cornerstone of this thriving ecosystem is the expert counsel and coaching available. Companies, regardless of their familiarity with Luxembourg's business landscape, receive invaluable support in rapidly establishing themselves and scaling their operations. For instance, Tomorrow Street, a collaborative venture between Vodafone and Luxembourg incubator Technoport, offers hands-on operational support to technology scale-ups and facilitates introductions across Vodafone's global network. Its Scale-Up X programme aims to select the next generation of strategic partners, offering numerous companies an opportunity to embed and scale their technology in a global company. "We work with a three-step model: scout, validation and scaling," explains CEO Kenneth Graham. "We support and guide the















Luxembourg's strategic location at the crossroads of Europe facilitates international expansion for resident companies. CEO of the LHoFT, Nasir Zubairi, highlights a general observation: the ease of access to neighbouring countries like Germany, France and Belgium. "Companies quickly become international because of the location and make-up of Luxembourg," he states. Sébastien Wiertz, General Manager of Paul Wurth InCub, which focuses on industrial innovations, emphasises the ongoing support provided to companies even after they graduate from the incubator. "We often keep monitoring the status of prototypes, make occasional investments, and share our expertise on non-technical aspects such as project management, legal, financial strategies and human resources," he recalls.

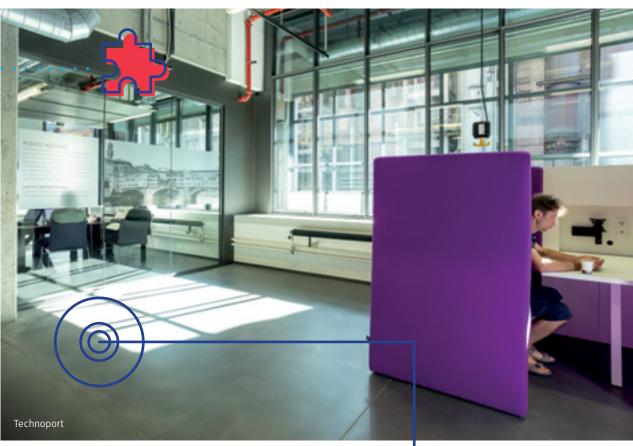
One standout success story, Site Tracker, an alumnus of Tomorrow Street, has expanded operations to ten countries while maintaining a significant presence in Luxembourg, delivering complex infrastructure management solutions primarily within the Vodafone ecosystem.













Well-equipped co-working spaces

During the early days in Luxembourg, companies often find well-equipped co-working spaces within larger firms and other establishments. The House of Startups, with nearly 6,000 square meters of space in Luxembourg City, accommodates up to 200 companies at any given time. Mr Berg notes, "Geographically speaking, you are close to the airport and railway station, and within minutes or hours, you are in other major European capitals."

Technoport, which has hosted over 170 companies, caters to a diverse range of start-ups, including spin-offs and foreign companies looking to ramp up R&D pursuits in Luxembourg. "Around 50% of our deal flow comes from foreign companies," underlines CEO Diego De Biasio, stressing its commitment to testing and implementing new concepts for the entire ecosystem. It organises and provides a space for hackathons, game jams, themed weekends, and other activities fostering innovative solutions for industry needs. Technoport also hosts industrial companies with dedicated industrial spaces in its second location in Foetz.













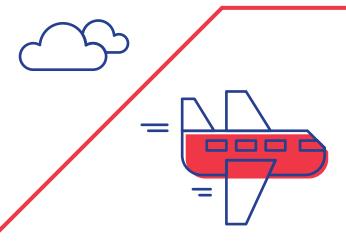




Access to key sector players

From conception to scale-up, Luxembourg's ecosystem ensures a seamless journey for start-ups. Each year, national initiatives like the Fit 4 Start accelerator attracts many promising start-ups from around the world, serving as a launchpad into Luxembourg and Europe. Mr Berg asserts, "We are here to support and put them in touch with potential clients and corporates". The close-knit community in various sectors makes it easy to get quick referrals to the appropriate structures within a heartbeat. Mr Zubairi points out the crucial role LHoFT plays in enhancing Luxembourg's competitiveness in the financial services sector, offering support like ecosystem development, knowledge sharing, training, and marketing assistance for resident companies in the field. Others, such as Neobuild, which focuses on sustainable constructions, 1535° for creative entrepreneurs, cleantech-focused Innovation Hub Dudelange, and many more, provide a targeted and well-rounded offering that facilitates easy access to key players in niche markets. "If you are looking for a European hub or headquarters, consider Luxembourg. Pay a visit and you will not be disappointed," concludes Mr Linster.





Scaling in Luxembourg: Hydrosat's success

In 2018, US company Hydrosat was accepted into the Luxembourg City Incubator (LCI). In five years, with the help of the Luxembourg innovation ecosystem, it has grown from two to 12 employees of 11 nationalities and raised more than \$26 million from investors. Its global clientele spans from Africa to Asia and the Americas.

"From the very beginning, we have been as much focused on India or Chile, as on the United States. And I think our being in Luxembourg gives us that perspective," explains Royce Dalby, President and Chairman of Hydrosat. Not only did the company successfully harness and commercialise thermal infrared imaging data from space satellites to revolutionise agriculture on Earth, but it has also developed a pipeline of potential applications that include wildfire prediction and tracking, drought forecasting, and even hydroelectric power management. "The best thing about the LCI is the learning environment. Beyond the physical facilities and convenient location, we have received invaluable support in terms of skills development. We have participated in various training programmes covering public speaking, sales, marketing and more, which have significantly enhanced our team's capabilities," he adds. The company has made Luxembourg its global headquarters for data analytics and sales operations and plans to expand its team here to 100 people by 2030. "It has been impressive to see how all the space companies work together, share information, ideas on how to recruit people, how to gain contracts from the European Space Agency... There are a lot of lessons learned by being with people in the same industry."



The best thing about the LCI is the learning environment.

Royce Dalby, Hydrosat



















The global operations of Ferrero, one of the world's biggest chocolate producing and confectionery companies, is managed from its headquarters in Luxembourg. The Grand Duchy also hosts the group's innovation centre that coordinates Ferrero's extensive R&D and open innovation activities.

When looking at boxes of Ferrero Rocher pralines, Kinder chocolates or Tic Tac mints, R&D might not be the first thing that comes to mind. Nevertheless, it plays a central role in Ferrero's activities. "Innovation and R&D is part of our DNA," confirms Fábio Mora, the group's Senior Vice President Open Innovation. "We have over 1,000 staff members around the world employed in R&D and technical functions." Their work spans over a wide range of areas: agricultural practices, biotechnology, advanced nutrition, smart packaging, protective design and advanced manufacturing solutions, to mention some examples.

Open innovation

Ferrero's global headquarters, located a stone's throw away from Luxembourg's international airport, houses the innovation centre with its laboratories and showroom where the HQ staff can test and try new innovations, in synergy with the company's innovation centres in Alba (Italy), Singapore and Chicago. "However, our main role is to provide the strategic vision for the group's R&D work and to guide our open innovation activities," Mr Mora points out.

Ferrero's objective is always to codevelop and test new technologies together with partners, including startups and SMEs, as well as big corporations, universities and scientific centres of excellence. The company's specialised scientists assess early-stage technologies and then pursue the most promising ones in cooperation with others. It currently has active collaborations with 250 R&D and innovation partners across the world.

This includes several local partnerships in Luxembourg. "Our partners here include, for example, a packaging materials solutions specialist that is an important partner for the labels we use across the world, and a major chemical company that notably specialises in sustainable chemistry used in agricultural coatings. We are also open to and working with companies in other sectors such as tyre production – a little more surprising, perhaps, as our products are very different, but we share an interest in polymers." Ferrero is also working with the government and various incubators to support the development of the start-up environment.

The centenary Gëlle Fra

From the top of her 21-metre pedestal on Place de la Constitution, she seems to be watching over Luxembourg City. The Gëlle Fra (the golden lady in Luxembourgish) is one of the country's most emblematic and poetic symbols. This statue, whose centenary was celebrated last May, was designed by the Luxembourg sculptor Claus Cito just after the First World War as a tribute to the Luxembourg soldiers who lost their lives during the Great War. Dismantled and hidden by the local population to protect her from the Nazi invaders during the Second World War, the golden lady disappeared from view for a quarter of a century, before being found, restored and rehabilitated. The influence of the Gëlle Fra is such that she was even relocated for six months to grace the Luxembourg national pavilion at the Shanghai World Expo in 2010.



Text: Jean-Michel Gaudron Photo: Shutterstock

A place for scaling quickly

Lokdeep Singh

CEO of Talkwalker From India Living in Luxembourg since 2010

"There are two main reasons why I really love Luxembourg: it is the perfect place for a young family, and a very competitive marketplace where businesses can grow. It is small enough to make it possible to test new ideas very quickly, and if they generate traction, the easy access to the EU's Single Market and a diverse set of talents makes it possible to scale them speedily in Europe. You have plenty of opportunities to develop at a fast pace.

Luxembourg's charm is made up of a combination of many different things. The country offers a unique and enticing mix of the old and the new, the modern and the traditional, and you are constantly surrounded by beautiful nature. But if I have to pick one single thing, I would say that it is the international and cosmopolitan aspects of Luxembourg that my family and I really love."



















Setting up a business in Luxembourg

Creating a company in Luxembourg involves several steps. This practical guide walks you through the process.



Why choose Luxembourg?

to watch

For more detailed information, please visit: tradeandinvest.lu/discover-why-luxembourg



1. Apply for your business permit

All businesses established in Luxembourg must acquire the necessary governmental permits. Commercial, skilled craft and industrial activities as well as certain liberal professions are subject to a business permit.



2. Define your company's legal form

Whatever the size and nature of their business, it is crucial for entrepreneurs to choose a legal form that suits their activity (sole proprietorship or company).

Contact our international network



The international network of Luxembourg Trade & Invest is fully committed to assisting you with the expansion of your business to Luxembourg and your entrance into the European markets.

Luxembourg Trade & Investment Offices

Abu Dhabi | Casablanca | New York | San Francisco Seoul | Shanghai | Taipei | Tel Aviv | Tokyo

Economic advisors and trade attachés

Ankara | Berlin | Brasilia | Brussels | London | New Delhi Paris/Marseille

Find more information about the support available for international companies considering coming to Luxembourg at tradeandinvest.lu/how-we-help



3. Handle immigration issues

Any third-country national (a person who is not an EEA or a Swiss Confederation national) planning to stay in Luxembourg for a period exceeding three months (90 days) must apply for a residence permit before entering the country.



5. Learn about taxation

Companies in Luxembourg are subject to corporate tax and have to apply value added tax (VAT) to their products and services. Individuals are taxed based on their personal situation.



4. Explore financing and support measures

Companies that establish a sustainable presence in Luxembourg can draw on several financing and support measures that help them expand their activities, develop innovative concepts and products and strengthen their competitiveness.



6. Affiliate to the social security system

All companies need to fill in an operating declaration and a declaration of start of employment to the Joint Social Security Centre, which handles the data, registration of affiliations and collection of contributions for the different insurance funds.











Luxembourg Trade & Investment Offices (LTIOs)

Connecting with strategic partners

International companies interested in exploring Luxembourg as a potential European location can count on the support of the Luxembourg Trade and Investment Offices (LTIOs). We spoke to Paul Steinmetz, Executive Director of LTIO New York, about what attracts US companies to Luxembourg and business synergies between the two countries.

What aspects of the Luxembourg economy and business climate do US companies find interesting?

CEOs of US companies based in Luxembourg often tell me that the country is an ideal gateway to Europe: it is perfectly situated within easy reach of major markets, politicians are internationally focused and business minded, and officials are very accessible.

They also appreciate that English is widely used. At the same time, as Luxembourg is very international – it closely resembles big US cities like New York – there are French and German speakers working in every office. For an American investor, it is almost as if his or her offices were located simultaneously in Luxembourg and in one or more of the larger neighbouring countries.

Paul Steinmetz, LTIO New York

Are there any aspects of life in Luxembourg that you particularly like and do not find in other countries?

Our dimension works to our advantage. Things just work better here. The government is small enough to get the job done, bankers and businesses know their clients at a deeper level, and teachers are able to give more attention to individual students. Public transport is free and well planned. Luxembourgers know both their neighbours and their politicians – who are sometimes the same people.

Impressum



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