



THE **IMAGINE - INNOVATE - CONNECT** FUTURE WORKSHOP

2023 Edition White Paper



IN PARTNERSHIP WITH

LUXEMBOURG
INSTITUTE OF SCIENCE
AND TECHNOLOGY





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MyConnectivity G.I.E.

MyConnectivity G.I.E. was founded in 2022 by the Department of Media, Connectivity and Digital Policy of the Ministry of State and the national internet exchange LU-CIX Management G.I.E. with the aim to further advance Luxembourg in digitalisation and connectivity, ensuring that everyone living and working in Luxembourg has real-time access to future-proof ultra-high-speed connectivity.

With the launch of the national strategies on 5G (in 2018) and on ultra-high-speed broadband connectivity (in 2021), the Grand-Duchy of Luxembourg has created a favourable framework for development.

Established as an economic interest group (G.I.E.), MyConnectivity is the main interface for public and private players, an information centre and a platform, for expertise and advice on connectivity and its implementation in Luxembourg.

MyConnectivity is a center of expertise and thought leader, actively cultivating and nurturing a telecoms-related ecosystem featuring all relevant stakeholders. The G.I.E. aims to educate and sensitize diverse audiences, and support technical progress in Luxembourg.

MyConnectivity organises its efforts around three main objectives

- Increasing the adoption of VHCN (Very High Capacity Networks),
- Supporting private and public organisations in the deployment of new infrastructures to achieve 100% coverage, in the most time, cost and labour efficient way, and
- Ensuring proper consumer education in the telecommunication sector, for better awareness and protection.



The Future Workshop

Our future will be a connected future, there's no doubt about it. Digital connectivity is both a response to, and a catalyst for the evolution of our society.

With a first edition of the Future Workshop, MyConnectivity explores forthcoming societal and technical developments that are already on the horizon, to ascertain what the next steps in connectivity could be.

In partnership with the [Luxembourg Institute of Science and Technology \(LIST\)](#), MyConnectivity embarked on this journey, to bring together experts, talents, forward-thinkers and dreamers, who could help shape the landscape of communication infrastructures in Luxembourg. The goal was to gather experts and students, and to imagine

scenarios, to spark innovation and to share a vision on future connectivity developments, by triggering conversations about possible futures and outcomes!

The project positions itself at the crossroads of innovation, connectivity, education, digital transformation, science and technology, as it brings together a multi-faceted audience and expertise. A bi-annual event serving as a new platform to shape and build a more connected Luxembourg for tomorrow uniting the past, present and future.

The goal is to involve experts and students and to imagine solutions, to spark innovation and to share a vision that paves the way for a more connected, vibrant and digital future for Luxembourg.

The Future Workshop serves multiple objectives

- To discuss visions for the future,
- Understand the importance of digital connectivity,
- Analyze trends that might influence outcomes, and
- Welcome fresh ideas from both experts and the audience.

An inspiring launch to kick-start the process

Global futurist **Rohit Talwar** was invited by MyConnectivity to give a keynote talk on the future of connectivity and related technologies during the launch event on 14th of December 2023, at the European Convention Center Luxembourg. In front of 170 guests, Rohit eloquently took the audience on a journey into the future, describing what everyday life might look like. Envisioning a future where AI, utilizing sensors on your body, collects data to anticipate ones' desires and actions. For example: "an autonomous car with pre-selected meals awaits, while an induced dream helps you sleep through the flight." Rohit crafted a tailored holiday experience for the audience, including potential itineraries, costs and business models to pay for related costs.



Although this description of a possible day in the future carries connotations of science fiction, the technologies and business models discussed are already available or soon to be released, predicting a 20 to 50 trillion-dollar industry. This prompts contemplation on the transformational impact on telecommunications infrastructure, as this future will unfold in the next five years.

A typical workday for a young professional leveraging multiple AI-powered tools for learning, data analysis, content creation, and even dating was also illustrated. The rapid evolution of AI, with tools approaching artificial general intelligence (AGI) capabilities, highlights how tech corporations are driving this evolution to increase their valuation.

The challenges organizations face in adapting to the speed of technological advancements and the need for rapid learning and adaptation occur at both individual and institutional levels. An immersive future, with affordable multi-sensory headsets, will become more prevalent in the market.

Key takeaways

Shift in the conversation about Metaverses

1

Even before Facebook, users - primarily teenagers who understood the economics of buying virtual goods - were already engaging in metaverses through platforms like World of Warcraft, Minecraft, etc. Now, it is being used in practical, more functional ways, like architects demonstrating designs to clients without needing physical visits.

Explosion of data

2

Data generation is increasing exponentially, with estimates suggesting a staggering increase of 23 times from 2020 to 2030, reaching a yottabyte (10^{24} bytes) scale. Accommodating such volumes requires new storage solutions beyond current hard drives, like helium-cooled drives or potentially DNA digital data storage, which could store all data created on Earth on just one kilogram of DNA.

Data handling revolution

3

Rethinking data storage methods, using tokens to retrieve underlying email conversations instead of transmitting entire histories, has significant implications for data management, transmission, and storage location.

Security challenges

4

Beyond conventional data security concerns, AI-generated realistic videos/images and misinformation pose new security challenges. Trust becomes crucial for governments and corporations, impacting their performance and societal trust.

Country differentiation

5

Countries mastering data management, security, and technological education may stand out, affecting their global positioning and contributions.

Connectivity challenges

6

The number of internet-connected devices is expected to surge, possibly reaching a trillion by 2030-2035, demanding reconsideration of communication infrastructure and services for seamless connectivity.



Key takeaways

Smart implants and communication

7

Implants and direct communication between individuals and devices are burgeoning as industries invest in embedded services, revolutionizing how we interact with technology.

Smart money and financial control

8

Digital money is becoming more intelligent, allowing fine-grained control over every cent digitally, leading to potential innovations in financial management and eliminating intermediary service providers.

Learning and healthcare

9

Micro-personalized learning, AI-enabled healthcare monitoring, and even culinary experiences tailored by AI are becoming realities, transforming how we learn and access services.

Future leadership requirements

10

To adapt to these changes, leaders must continuously learn, innovate, emphasize foresight, and be ready to redesign processes and structures for a technology-enabled world.

Adaptability and humor

11

Being adaptable, continually learning, and maintaining a sense of humor are vital in navigating this unpredictable future and fostering resilience in teams and organizations.

The full keynote speech is available here

<https://myco.lu/4czNLTB>



Insights about the future of communication infrastructures

The panelists' discussions covered technological challenges, such as security and infrastructure, as well as the human aspect, including education and adaptation. The panelists highlighted the need for integrating advanced technologies with legacy systems, addressing the generational gap in technology adoption, and reframing knowledge transfer paradigms to harness the potential of emerging technologies effectively.

The full expert panel discussion

<https://myco.lu/3xyQXzQ>



Dr. Carlo Duprel

Head of Industry Partnerships and Technology Transfer Office
SnT

Dr. Carlo Duprel highlighted the complexity of ensuring security and resilience in communication infrastructure. He pointed to the various layers involved in ensuring security, including regulations, network operators, companies, and technology. He mentioned increasing threats in the age of IoT (Internet of Things) and the importance of securing both external and internal systems. He emphasized the human element as the weakest link in communication security and stressed the need for educating people about risks and protection measures. Dr. Carlo Duprel encouraged collaborative efforts across government, regulators, operators, users, and research to maintain progress in connectivity, stressing the need to keep innovating.

Dr. Sébastien Faye addressed the challenges related to the current generation of mobile network technologies, specifically 5G. These challenges include the need to implement more business cases, starting with the deployment of private 5G networks, and finding complementarity with fibre networks to address coverage issues. He highlighted the need to accommodate the increasing amount of data and the necessity to design networks that can handle this growth. Dr. Sébastien Faye emphasised 6G as an evolution of communication systems, focusing on the integration of AI into networks, making them more autonomous and adaptable to various demands, not just limited to telecommunications.



Dr. Sébastien Faye
6G Technology & Innovation
Line Manager
LIST



Jean Pierre Choffray
Vice President, Systems Engineering
SES

Jean-Pierre Choffray talked about the significance of satellite communications for global coverage. He mentioned various types of communications, including human-to-human, machine-to-human, and machine-to-machine, and underlined the need for higher data throughput and speed, especially in remote locations, and the integration of satellites with terrestrial networks, accentuating how both systems complement each other.





Prof. Eric Tschirhart

Professor, Special Advisor to the rector, for UNIVERSEH | European University and Université de la Grande Région University of Luxembourg

Prof. Eric Tschirhart highlighted the limitations of human senses in acquiring knowledge compared to the vast amount of data generated by technology. He suggested there is a clear need to reframe knowledge transfer paradigms to adapt to current technological advancements and the importance of timely education and knowledge transfer. Prof. Eric Tschirhart also pointed out the aggregation of human intelligence into AI, inviting people to interact with technology to understand its output better.



Jeanette Kæseler Mortensen

Business Designer and Futurist
EGGS Design

Jeanette K. Mortensen spoke about the challenges faced by traditional industries, like oil and gas, in adopting new technologies due to legacy systems and a lack of trust in data-driven decision-making. She addressed the generational gap in technology adoption and the need for AI, data governance, and effective communication to enable innovation and data utilisation. Jeanette K. Mortensen mentioned the tendency to underestimate technology's long-term impacts. She stressed the importance of ethical considerations in technological development.

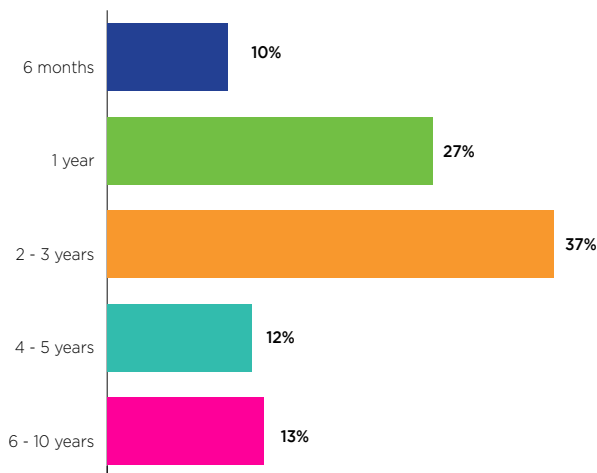


A very interactive and engaged audience

Before concluding the event, the audience participated in various polls to gather opinions and insights on the most promising areas of opportunities for the future.

What is the most important time horizon for you to focus on when planning for the future in your organisation?

☰ Multiple Choice Poll 📄 67 Votes 👤 67 Participants



When strategizing for the future within their organizations, the majority of the participants, prioritize shorter planning cycles, concentrating on roadmaps spanning from 6 months to 3 years (74% of the votes).

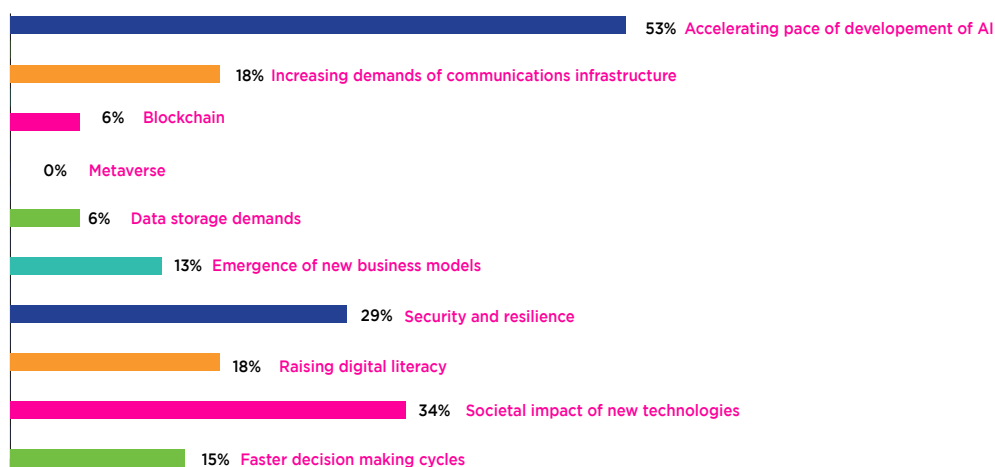
The biggest bulk of the participants emphasized a 2-3-year horizon (37% of the votes) when planning for the future in their respective organisations.



Of the topics covered today, which two are likely to have the biggest impact on your organisation in the next 12 months and 3 years?

Multiple Choice Poll 68 Votes 68 Participants

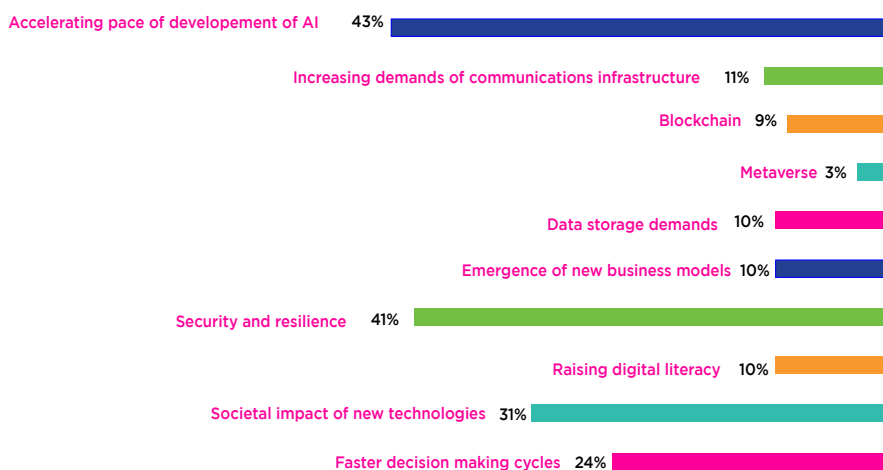
12 Months



Among the discussed topics, participants identified AI development (53%) as the area expected to have the most significant impact on their organization in the next 12 months, trailed by the societal impact of new technologies (34%) and concerns regarding security and resilience (29%).

3 years

Multiple Choice Poll 70 Votes 70 Participants

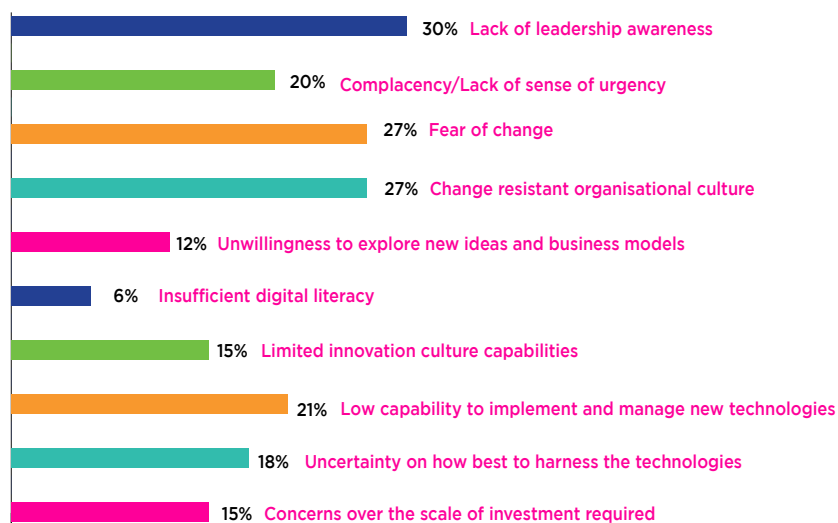


Looking ahead three years, AI remained the top choice (43%) for expected impact on their organization, closely followed by security and resilience (41%), with concerns regarding the societal impact of new technologies following at (31%).

What do you see as the two biggest barriers and two biggest potential opportunities in responding to these developments for your organisation?

☰ Multiple Choice Poll 📄 66 Votes 👤 66 Participants

Barriers



In terms of obstacles stopping organizational development, participants highlighted a lack of leadership awareness (30%), followed closely by both fear of change (27%) and an organizational culture resistant to change (27%).

☰ Multiple Choice Poll 📄 70 Votes 👤 70 Participants

Opportunities



Participants identified the most significant opportunities for their organization as establishing a deep innovation culture and capabilities across the organization (39%), closely followed by expediting the development of new products and services (33%), and integrating a robust, future-focused, innovative, and delivery-oriented technology function.

A showcase of innovation

The launch conference of the Future Workshop not only provided a fertile ground for discussions, it also showcased concrete research projects linked to connectivity. Together with the LIST as project partner, 6 demo booths were set-up to invite the audience to get a closer look at future communication networks.

BOOTH #1: PRIVATE AND OPEN 5G NETWORKS, TOWARDS 6G

Future communication networks promise to come with greater capacity and flexibility, in response to a need for digitalisation that is predicted to be massive and affecting many sectors. This will come with an increasingly dense and complex infrastructure for service providers to manage and understand. In this context, it is essential to implement new architectures that are energy-efficient and capable of self-management, using advanced artificial intelligence and optimisation techniques.



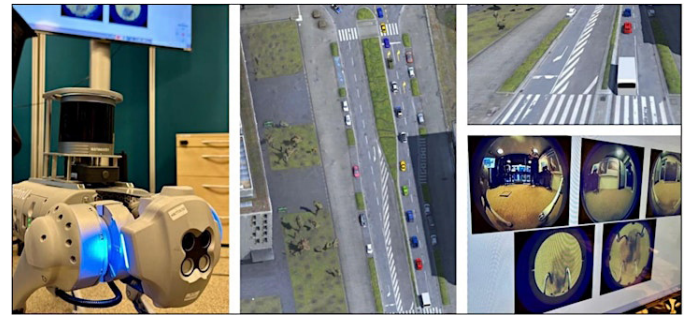
At the same time, it is essential to make these architectures more open and propose new approaches to companies, which break away from conventional models.

This booth featured an open 5G SA network, i.e., one that is typically used in the world of R&D to experiment new algorithms, methods and services. Research trends were also presented, with concrete examples using 6G as a case study.

A showcase of innovation

BOOTH #2: CONNECTED AND AUTOMATED MOBILITY

Connected and autonomous mobility is promised to be of major interest in the years to come, making transport more efficient and secure. However, with the exception of a few pilot projects in Europe, or very specific use cases, it will still be years before we see fleets of these vehicles on the road with full autonomy (i.e., SAE level 5). There is therefore a constant need to anticipate the evolution of mobility patterns, and their relationship with the mobility infrastructure - which implies advanced connectivity.



This booth presented local and European initiatives addressing this topic. More specifically, it focussed on COMBO, a project underway with the Société nationale des chemins de fer Luxembourgeois (CFL) and co-funded by the Luxembourg National Research Fund (FNR), which aims to anticipate the use of connected and autonomous shuttles. To this end, a robot dog, equipped with sensors similar to those on a real shuttle, was present and interconnected with a simulation interface with a view to testing scenarios before deploying them in reality. The robot dog was remote controlled via a mechanism set up by LIST and Proximus Luxembourg.

A showcase of innovation

BOOTH #3: CONNECTIVITY FOR INDUSTRIAL NETWORKS

Time-Sensitive Networking (TSN) is a set of standards and technologies developed to enhance the capabilities of Ethernet networks in order to support time-sensitive and deterministic communication for industrial automation and other applications. TSN aims to provide precise and predictable network behaviour, which is essential in industries where real-time data and control are critical, such as manufacturing, automotive, and telecommunications.

TSN is increasingly important in the Industrial Internet of Things (IIoT) and Industry 4.0, where machines, robots, and other devices need to communicate and coordinate with high precision. By providing deterministic and time-sensitive communication over Ethernet, TSN helps improve the reliability and efficiency of industrial processes and critical applications.

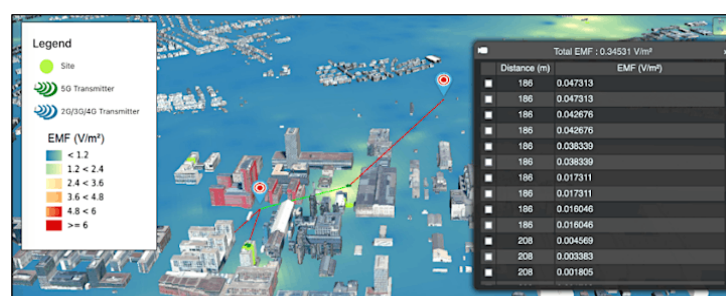


The purpose of this demo was to showcase the key features of TSN technology, such as time synchronisation, quality of service, scheduled traffic, and deterministic communication. It demonstrated TSN's ability to ensure that critical data packets are delivered on time and with low latency, even in the presence of network congestion.

A showcase of innovation

BOOTH #4: EMF EXPOSURE AND PUBLIC AWARENESS

The deployment of new generations of wireless networks is always a source of fear for the general public. In particular, exposure to electromagnetic fields (EMF) is a major concern, as well as a factor slowing down the deployment of new antenna technologies. This is also a challenge for telecom operators and regulators, as each country has its own rules and exposure limits. Often, a compromise has to be found, although it is not always optimal. This situation is set to intensify in the future, with ever denser infrastructures.



This booth will present the 5G-EMIT platform as well as some elements of the 5G-PLANET project, both co-funded by the Department of Media, Connectivity and Digital Policy of the Luxembourg Government. A national observatory of EMFs for radio frequency sites was presented, created with the support of the Environment Agency, and with measurements and conclusions presented from more than two years of research in Luxembourg on 5G. Visual elements were used to help communicate these results and explain to the audience the tools made available for the general public.

A showcase of innovation

BOOTH #5: IOT-BASED WASTE MANAGEMENT & BLOCKCHAIN

With our waste production predicted to increase by 70% by 2050, waste collection and management activities are essential. Yet this sector still lacks the tools to benefit from better optimisation. Connectivity and automation are seen as key elements there. Further down the line, special cases involving the management and transport of hazardous industrial waste could benefit from technologies such as blockchain to ensure that the collected waste is traceable.



This booth focussed on projects exploring the use of IoT, Low Power Wide Area Network (LPWAN) and technologies such as Blockchain to digitalise the waste sector. The demo presented, featured robot trucks and miniature bins equipped with ultrasonic sensors - to best showcase what is happening or could happen in reality. An AI-based platform was presented, as well as case studies from Luxembourg and Europe. This demo also showed how Blockchain can be used to improve the traceability of collected waste and act as an incentive in the process to promote the selective sorting of waste.

A showcase of innovation

BOOTH #6: IOT, 5G, AND SATELLITE FOR SMART AGRICULTURE

Agriculture is one of the verticals that is expected to highly benefit from the adoption and integration of Internet of Things (IoT), with 5G, and other communication and computing (cloud, edge, AI/ML) technologies. Moreover, space-assets, like satellite communication (SATCOM) and Earth Observation (EO), properly combined with IoT, and 5G can offer advanced services for precision agriculture. In particular, satellite networks come into play, as a key enabler for seamless IoT connectivity, when terrestrial networks are not available, like in rural remote areas.



This booth focussed on connectivity solutions and network infrastructures for agriculture, aimed at empowering rural communities.

Two demos were presented. The first one showed an application for crop and droughts monitoring, developed in the Lux5GCloud project. The app relies on the acquisition of complementary EO and IoT (sensors and camera) data, and the use of LoRaWAN and 5G networks. The second demo presented the LORSAT testbed, developed in the FNR LORSAT project. The testbed integrates real LoRa prototype devices and gateways with a satellite emulator. It showcased the implementation of scheduling and synchronization techniques for satellite IoT networks.

More information about these projects on www.list.lu



Future-driven innovation process to foster new ideas

"We cannot solve our problems with the same thinking we used, when we created them" - Albert Einstein

Future-driven innovation is innovation generated through the analysis of trends. It is an innovation tool that stress tests the existing business model or generates new business models and product innovations that are the future.

That is why we need to listen to younger generations and empower them to strengthen a sense of agency in terms of impacting the future. We need to learn from less tainted minds, whose mindsets are less bound by yesterday's way of finding solutions.

With this at the forefront of our minds, MyConnectivity kickstarted the future-driven innovation process in the shape of a 1-day hackathon, which took place at the House of Startups in Luxembourg-city, on 28th of February 2024.

The process was facilitated by EGGs Design and Art Square Lab, and 18 registered students and lifelong learners, from the University of Luxembourg, Lifelong Learning, Université de Liège, Luxembourg Tech School, Lycée Guillaume Kroll, Lënster Lycée, and Athénée de Luxembourg, took part.

During the hackathon, the participants formed 5 groups and were given the challenge to develop their vision of a future connected Luxembourg. Their point of departure was the "Now" with an outlook to what connectivity could help achieve by 2030.

5 groups and their ideas:

- **BRIGHT FUTURE**, with their vision for a fully connected smart home.
- **STAR** with their veggie drone project.
- **SKYSHARE** exploring the possibilities within shared storage solutions.
- **ERUDITO** introducing groundbreaking VI glasses designed to aid visually impaired individuals.
- **TECHSANITY**, reducing garbage within smart cities.

More information about the hackathon:
<https://myconnectivity.lu/the-future-workshop-student-coaching-and-hackathon/>



Over the course of 4 months, nearly 20 lifelong learners, aged between 16 and 50, crafted future-driven innovation concept ideas, and benefitted from 5 hours of free individual coaching and mentoring under the guidance of Piotr Gawel from Art Square Lab.

Besides this support, the purpose of the Future Workshop was also to connect industry players with brilliant young minds. As philosopher Eric Hoffer puts it: “In times of change, the learners will inherit the world, while the knowers will be beautifully equipped for a world that no longer exists”.

To foster further inspiration whilst envisioning creative concepts to enhance connectivity in Luxembourg 2030, two site visits were organised for the participating students.

On the 15th of April the students experienced a two-hour guided tour, led by Luc Vandenabeele and Dr. Sébastien Faye, of the Luxembourg Institute of Science and Technology at their offices in Belval.

The visit provided a comprehensive insight into cutting-edge technologies and innovations, showcasing a range of projects, including data visualisation tools for smart cities, an exploration of their connectivity lab, and an interactive walk with a robotic dog. Additionally, the group learned about advancements in healthy ageing and observed a presentation on LIST's collaboration with the Luxembourg National Data Service (LNDS), unifying visual representation of synthetic data derived from Statec's population statistics.

Further highlights included discussions on methods to optimize traffic flows, electric vehicle charging, grid utilisation, logistics, and strategies to reduce emissions and carbon footprints. A very insightful couple of hours which provided just a glimpse into the diverse activities at LIST and their significant contributions to the science and technology landscape in Luxembourg and beyond, highlighting their role in driving innovation and research development within the region.

On the 8th of May the students also had the chance to get a behind the scenes look at SES, headquartered in Betzdorf. The visit included an informative presentation on the history and activities of SES. The Luxembourgish satellite telecommunications network provider is a global leader in satellite communications, covering 99% of the world's population. They currently operate 51 Geostationary satellites (GEO) and 20 Medium Earth Orbit satellites (MEO), with 7 more MEO satellites set to be launched.

An outdoor excursion to view the impressive satellite dishes and an exclusive look into the control room, providing a behind-the-scenes perspective on their operations, concluded the tour in Betzdorf.



Getting ready for the final pitch

The coaching and the exchanges with industry experts led to the student's final pitch preparation session at the House of Startups on the 12th of June. This session served as the last rehearsal before the main event, where participants had the opportunity to present their ideas to a panel of jury members. The panel included Dr. Sébastien Faye from the LIST, Philippe Linster, CEO of the House of Startups Luxembourg, and Arnit Dey, a student and TEDx speaker. The assessment focused on the clarity, innovation potential, market readiness, and connectivity relevance of each project.

Four groups were given the green light and thereby earned the chance to present their projects at the first edition of the Nexus2050 Luxembourg conference during the "the Future of Connectivity in Luxembourg" side-event organised by MyConnectivity. Set for the 26th of June, Bright Future, Star, SkyShare and Erudito will pitch in front of an audience of 150 professionals, offering a prominent platform to further showcase their ideas.





Conclusion

Looking ahead, the trajectory and findings outlined by the Future Workshop suggest a dynamic and interconnected future where digital infrastructure will underpin all aspects of life and work. AI is set to revolutionize industries, providing unprecedented levels of efficiency and personalization. As data generation continues to explode, innovative storage and management solutions will be critical, potentially leveraging breakthroughs like DNA storage.

Security will remain a top priority, with advanced measures needed to safeguard against increasingly sophisticated cyber threats. The integration of satellite and terrestrial networks will ensure comprehensive coverage, enabling connectivity even in the most remote areas. Smart implants and direct communication technologies will blur the lines between humans and machines, creating new possibilities for healthcare, communication, and beyond.

Organizational leaders will need to foster a culture of continuous learning and adaptability, preparing their teams to thrive amidst rapid technological change. By embracing future-driven innovation processes and involving younger generations in decision-making, Luxembourg can cultivate a forward-thinking mindset that not only anticipates but actively shapes the future. The student's vision of a better-connected Luxembourg by 2030 brought fresh and interesting ideas to light and it will be interesting to monitor their further development and evolution.

Overall, the work initiated at this year's Future Workshop sets a foundation for ongoing dialogue and development. With sustained commitment and collaborative effort, the vision of a fully connected, vibrant, and technologically advanced society remain the objectives of MyConnectivity to shoulder Luxembourg in emerging as a leader in digital connectivity, setting benchmarks for other nations to follow. By including and listening to the younger generations and empowering them to help shape the future of connectivity, we aim to keep fostering this dialogue and collaborations to build a connected future with all stakeholder.

We would like to thank all the participating stakeholders in making this first edition a reality and we look forward to building on these findings for our second edition of the Future Workshop.



myconnectivity.lu

If you would also like to become part of the conversation and help pave the way for a more connected, vibrant and digital future for Luxembourg, then let's connect.



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