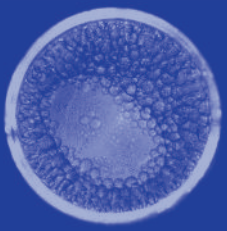
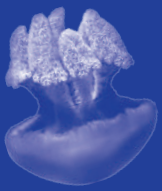
World Congress of Latvian Scientists

research Latvia
Value Through Knowledge

The 5th World Congress of Latvian Scientists "Research Latvia"







State of the Art

Green Transition | Digital Transformation | Science Impact

2023

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I. GREEN TRANSITION

Climate change, sustainable, secure and affordable energy and food supply, circular use of material resources, and preservation of environmental biodiversity are among the most pressing global challenges today. Most of the areas defined in the EU Green Deal (Fig. 1) are tightly linked to the use of resources and energy. Society needs to understand how we will meet our long-term energy and food supply needs while reaching climate neutrality and maintaining competitiveness in the "green economy". Latvia will have to handle available energy and biological resources wisely to ensure prosperity based on the principles of a sustainable economy.

1. GREEN ENERGY

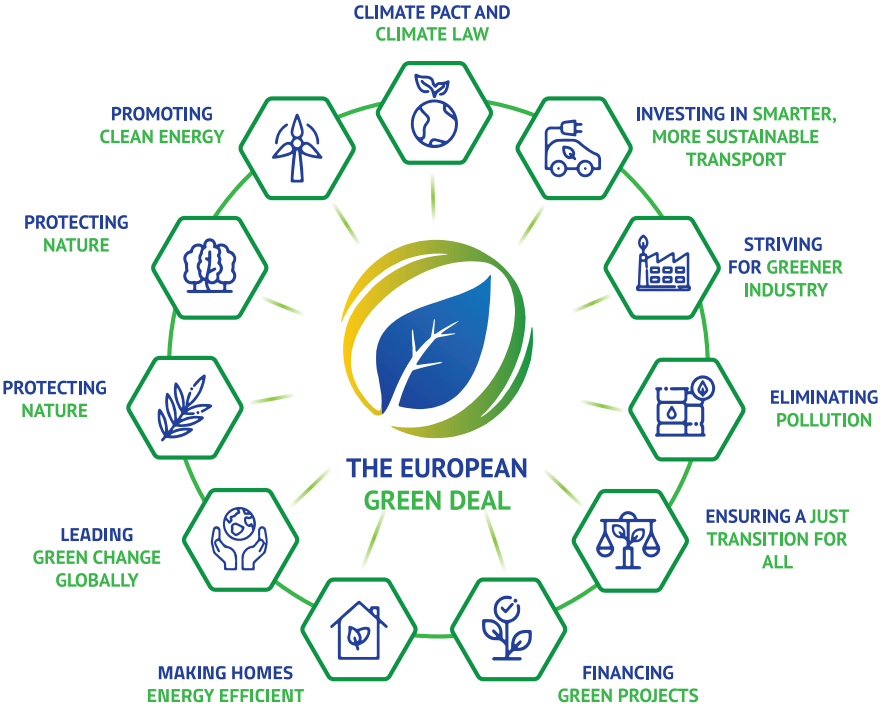


Figure 1. *EU Green Deal Content (https://euinasean.eu/eu-green-deal/)*

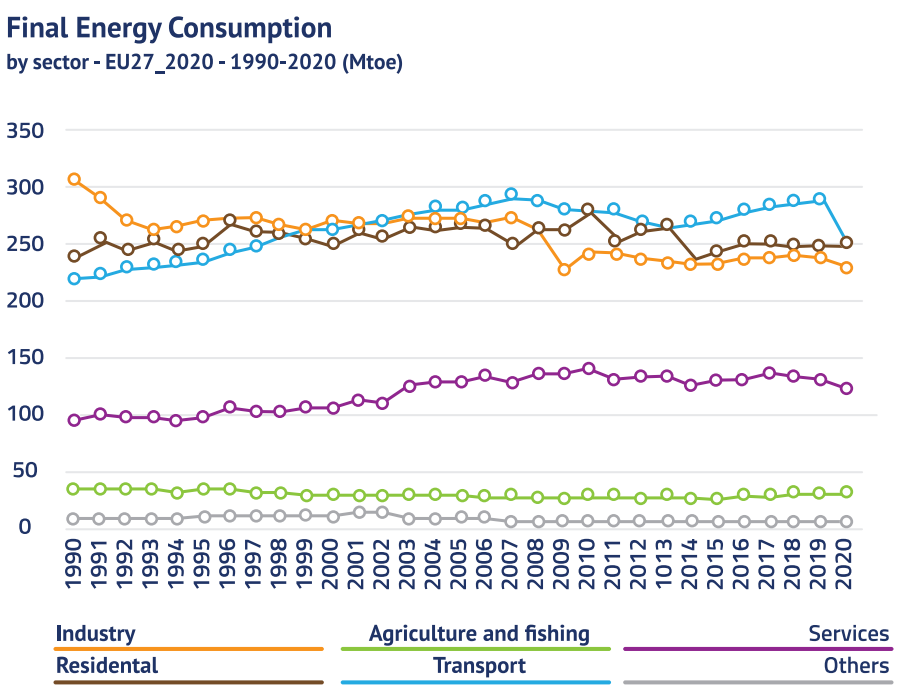


Figure 2. Final energy consumption by sector in EU27 countries during 1990-2020, Mtoe [source: EU energy in figures, Statistical pocketbook 2022, Luxembourg: Publications Office of the EU, 2022]

In the energy sector, it is paramount to develop **smart energy systems** where renewable energy technologies, combined with digital solutions, comprehensive energy efficiency improvements and changes in consumption patterns, allow for a sustainable response to society's energy and mobility needs. This requires extensive research and development of solar and wind energy technologies, novel electronic control systems and electricity grids, energy storage technologies, electrification of the heating and transport sectors, and production of "green hydrogen" and synthetic fuels.

Besides new technologies, the energy transformation requires **social and institutional changes**, i.e., the introduction of new business models and principles of market operation, the adaptation of the regulatory environment, and changes in public perception and knowledge. Examples include widespread acceptance of solar and wind energy, their integration into the environment andagriculture, the advancement of electric vehicles, and significant improvements in energy efficiency.

The residential sector, with a 28% share in 2020, remains the second largest final energy consumer in EU27 countries (Fig. 2). For Latvia, the share in 2020 was over 29%, and residents are the primary final energy consumer. **Therefore, improving the energy efficiency of the buildings in the residential sector is of utmost importance for the Green Transition.** In addition, it is equally essential to develop self-generation and flexible consumption ready to adapt to renewable energy flows.

2. BIOECONOMY

The overarching aim of the European Green Deal is to reach net-zero greenhouse gas emissions within the EU and deliver a pollution-free environment by 2050. Research in the bioeconomy can significantly impact the solution to these challenges. The EU Bioeconomy strategy is concentrated on five goals:

- ensuring food and nutrition security;
- managing natural resources sustainably;
- reducing dependence on non-renewable, unsustainable resources;
- limiting and adapting to climate change;
- strengthening European competitiveness and creating jobs.

Greening measures in agricultural production cover three of the goals mentioned above and are increasingly being introduced to foster the implementation of environment- and climate-friendly farming practices. The investigations on the most effective measures to reduce pesticide use, increase biological fixing of atmospheric nitrogen, increase soil microbiological activity, and biological carbon sequestration are among the topicalities of applied science.

Smart and sustainable use of existing bioresources ensures the economic independence of a country. However, to utilise novel technologies and solutions, we must be aware of currently available resources and their potential. Therefore **recognition of existing biodiversity** and its role in the development of the bioeconomy is considered one of the keystones in the Green Transition of the economy. Securing biodiversity is a strategic objective to ensure that natural resources are available in the long run. Municipalities and public regulatory bodies are involved at all stages and levels of the biodiversity management process – monitoring, resource allocation, design and implementation of echanisms, ensuring access through vertical and horizontal cooperation, and linking with agendas in other areas. Furthermore, the diversification and introduction of biotechnological approaches in utilising bioresources are boosting the circular economy.

The technological solutions of **food production and processing** directly influence its quality and safety for consumers. Therefore fortified food and modern protein sources, including insect-based food, are the topicalities of food production. Moreover, investigations on the biochemical composition and physical properties of food raw materials give new perspectives in ensuring a healthy diet for consumers. In recent years, earthworms and insects were processed into food, as well as

unprecedented vegetarian combinations were manufactured in Latvia. The extraction and use of seaweed extracts in food products are also being explored. In general, the development of improved and novel foods is one of the central fields of bioeconomy.

All bioeconomy branches are tightly connected with smart technologies and digital solutions, which requires multidisciplinary research teams and environments to foster efficiency and precision in technological processes.

3. SCIENCE FOR GREENER LATVIA

The diversity and richness of Latvian green capital assets provide abundant opportunities for Green Transition breakthroughs in science, economy and governance. Currently, the most promising are various bioeconomy research agendas concerning horticulture, forestry, animal husbandry, and biotechnologies like the production of bioethanol and different non-timber forestry products. Given the low population density and orientation towards producing high-added value goods, sustainable and innovative rural development stands out among priorities. Bioeconomy research in Latvia is led by comparatively large research organisations like Latvia University of Life Sciences and Technologies, Latvian State Research Institutes Silava (forestry) and BIOR (food safety, animal health and environment).

The energy sector benefits from ongoing research into **renewables and energy storage technologies** and a wide range of investigations related to energy and housing, like energy-efficient building practices, thermal insulation, and new heating methods. Sustainable innovations are fostered by discovering new materials and active integration of digital technologies from industrial electronics and remote sensing systems to artificial intelligence. The leading research organisation in the field is Riga Technical University.

Green Transition is a comprehensive social process which necessitates a change of habits in the general population, transformation of business practices, and radical orientation towards an evidence-based policy of government institutions. It would be impossible to achieve without extensive input from various disciplines of social sciences, tight cooperation with non-governmental organisations, and involvement of communities through citizen science and other practices. The emerging field of Environmental Humanities has a leverage of understanding long-standing cultural factors influencing the efficient implementation of Green Transition.

Latvian scientists have the advantage of scientific excellence, flexibility and extensive practice of dynamic cooperation. The relatively small number of researchers has resulted in the proliferation of individual competencies and thus increased opportunities for participation in multiple networks and advancing interdisciplinary research projects. Consulting boards of various government ministries and other organisations frequently benefit from the expertise of

researchers, and participation in international research networks like EUVRIN, EFRIN or ECPGR extends **our impact on policymaking at the EU level.**

DURING THE CONGRESS

The 5th World Congress of Latvian Scientists addresses two primary missions: the smart utilisation of resources in the context of the Green Transition and the promotion of safe and sustainable energy practices.

The first mission aims to identify viable pathways for transforming Latvian society towards a sustainable economy and lifestyle, premised on smart governance and bioresource management as critical principles for ensuring the country's safety and prosperity. Congress participants will analyze the challenges and opportunities presented by the European Green Deal, as well as delve into specific parameters of Latvian agricultural production and concerns related to food safety, contamination, and packaging. Urgent issues to be examined during the Congress include the impact of global warming on global and local agricultural production, the consequences of industrial forestry, and the advanced utilization of microorganisms as a biotechnological resource.

The second mission of the congress will explore issues related to the safe and sustainable use of energy in all stages of production and consumption. While the general objective of the green energy transition is to shift towards climate-smart technologies from climate-blind ones, the recent Russian war in Ukraine has demonstrated the critical importance of energy independence and decentralized grid systems. In this light, presenters and discussants will explore diverse issues, such as energy-efficient thermal insulation of buildings, the next generation of thermonuclear synthesis, future solar panels, and electric vehicles.

II. DIGITAL TRANSFORMATION

Digitalization has been an uncontested driver of change in all scientific fields over the past decade. At the same time, a comprehensive digital transformation of society and economy is one of the main conditions for Latvia's international competitiveness and an important aspect of national security. Effective use of digital technologies makes it possible to multiply the added value created by companies, optimize the work of organizations, and significantly improve governance.

Access to digital technologies, skills and resources today equates to access to knowledge. The Internet provides an inexhaustible range of information sources and machine learning algorithms open new horizons of knowledge. Digital transformation is simultaneously experienced not only by technology, but also by people. The transition from the physical world to digital reality occurs in more and more areas of life. Access to information and new knowledge also changes our judgment and ability to cooperate, our identities, and the structure of society.

The future society will consist of seamless cooperation and interaction of information and communication technologies. The advancement of wireless communication, the nteraction of the digital and physical worlds, digital learning technologies and the computing continuum are and will be major vectors of change. **Both sides – technology and its users – are becoming equally important**. Artificial intelligence, high-performance computing and comprehensive cybersecurity solutions created by scientists must be closely followed by the improvement of digital skills throughout society and the active use of digital technologies in everyday life, business and public administration.

If an increasing number of people have access to equivalent technologies and necessary skills for their use, additional factors such as **creative problem-solving, international regulation, societal resilience, and environmental sustainability** become increasingly important. Only human creativity, collective responsibility, and visionary action will determine the direction in which big data, artificial intelligence, quantum computing and other technologies will take the world and society.

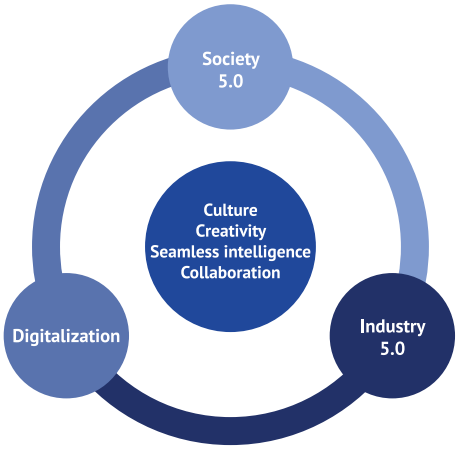


Image: Society 5.0 – Japan's plan for comprehensive societal transformation in the world where the digital and physical dimensions are increasingly overlapping

1. THE ROLE OF SCIENCE IN DIGITAL TRANSFORMATION

The current digital technologies are the result of decades of worldwide research. **At the same time, the speed of digital transformation is constantly increasing**. According to the so-called Moore's law, the number of transistors in an integrated circuit has doubled about every two years since 1970. Mobile internet and touchscreens have become a natural part of everyday life in less than a generation. Last year, artificial intelligence modules like DALL-E and ChatGTP became freely available to the general public, causing an equal amount of excitement and concern. The latest technologies enable digitization an automation of more and more areas that were considered exclusive to the human mind.

Besides developing new digital solutions, the science is tasked to make them transparent and sustainable for increasing the public good. Otherwise, there is a significant risk of the formation of **"digital asbestos"** – just like the once popular thermal insulation material, which over time was revealed to be dangerous for the surrounding environment and human health.

Digital technologies have fundamentally changed natural sciences and medicine, economics and education, creating stunning innovations and novel subdisciplines. At the same time, digitalization has become a dimension, which can be observed in all areas of scientific activity. Therefore, one of the most important tasks of the scientific community is interdisciplinary cooperation in order to purposefully direct these changes and use the opportunities provided by technology as efficiently as possible.

The importance of an interdisciplinary approach to digital transformation is perfectly illustrated also **by some of the most impressive recent achievements of Latvian Scientists**. Modris Greitāns at the Institute of Electronics and Computer Sciences has created a smart robot with advanced abilities of seeing, feeling and understanding human gestures. Tālis Juhna and Agris Ņikitenko at the Riga Technical University have developed safe technological solutions for protection against Covid-19 in healthcare and other high-risk areas, while Sanita Reinsone at the Institute of Literature, Folklore and Art of the University of Latvia is laying the foundations for a new Latvian digital humanities ecosystem. Under the leadership of Professor Andris Ambainis from the Faculty of Computer Science of the University of Latvia, Latvia has become one of the European leaders in the scientific development of quantum computing.

Effective digital transformation also requires close cooperation between science, public administration and entrepreneurs. A good example is solutions to some recent crises, such as the COVID-19 digital certificate jointly developed by ZZ Dats and subcontractors, or the monitoring and automated mass verification of sanctions lists developed by Lursoft IT.

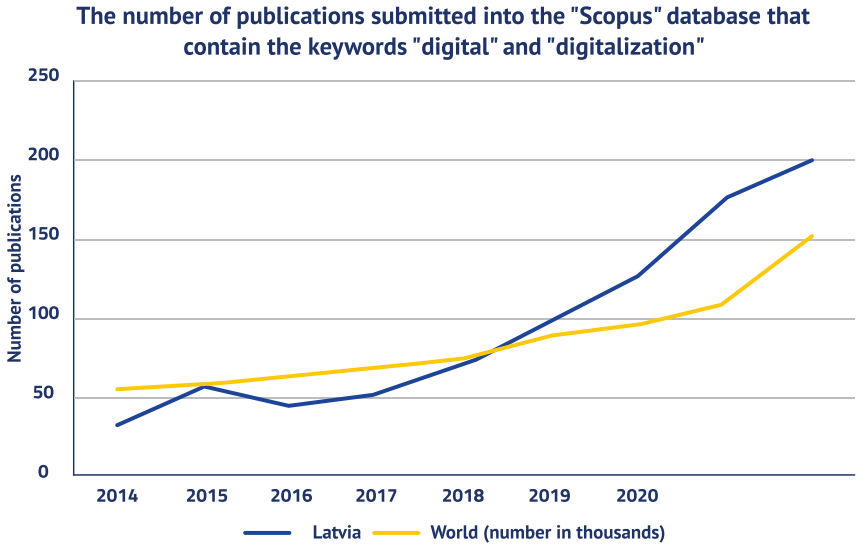


Image: *Statistics of indexed scientific publications. The number of studies in the field of digitization is rapidly growing, and relatively even faster growth can be observed in Latvia than in the world as a whole.*

Finally, **digital transformation is also at the heart of the Open Science movement**. The principles of Open Science require that the results of research (e.g., publications, data) should be as open as possible or available to the public, and the access can be limited only in case of well-founded necessity. The availability of scientific results effectively promotes innovation, increases the impact of science and helps develop cooperation between science, state administration and entrepreneurs. Therefore, Open Science is also one of the main principles in the science policy of the European Union.

2. DURING THE CONGRESS

In order to discuss issues of digital transformation at the 5th World Congress of Latvian Scientists, we have formulated three missions:

- digital globalization – the most important directions of development, leading Latvian scientists and research projects;
- digitalization and the people – opportunities and challenges created by digitalization in Latvian society and culture;
- digital democracy – the digital future of democracy in Latvia and new opportunities for the existence of a democratic state.

The central inquiry driving the mission of digital globalization pertains to **the ways in which digitalization contributes to the advancement of science, industry, and education**. This topic will be thoroughly examined in collaboration with colleagues from the European Commission, within the frameworks of Industry 5.0 and Society 5.0. We emphasize the crucial importance of adopting a human-centered and sustainable approach as the foundation of future digital transformation. Simultaneously, we will delve into the utilization of artificial intelligence in interdisciplinary research fields, including material science, linguistics, and medicine. As a demonstration of the rapid growth of digitalization in the field of education, the Congress will host **an exhibition** featuring educational technologies developed by Latvian scientists and practitioners.

Our second mission revolves around the question of **how digitalization affects society and culture**. Throughout the discussions, representatives from diverse disciplines will explore mutually beneficial digital interventions within Latvian culture, emphasizing positive future scenarios. We will analyze the interconnected relationship between technology and society. Researchers specializing in information and communication technology (ICT) will outline the most significant developments in digital technology for Latvia in the near future, while representatives from the social and humanities domains will reflect upon the importance of these technologies in promoting the common good. The Congress will outline the potential of digital components in establishing **Latvian culture as a global brand**. Concurrently, representatives from the humanities will discuss the digitalization of Latvian cultural heritage and ongoing processes of cultural

production, while ICT researchers will examine the most suitable technologies for such endeavors.

The core question guiding the digital democracy mission is **how digitalization assists in constructing a democratic Latvia**. Researchers from various fields will elucidate the opportunities afforded by digitalization for increased public participation in policymaking and governance, while also highlighting potential risks and challenges related to cyber security. In the era of hybrid warfare, digital transformation constitutes a vital aspect of national defence, raising concerns about the security of technological ecosystems and the media literacy of society.

Technological advancements carry inherent **risks to societal resilience**, and the prevalence of data capitalism widens the digital divide both between nations and within societies. Furthermore, the rapid progress of artificial intelligence necessitates the expedited **development of regulations** at the international, national, and organizational levels to mitigate political, economic, ethical, and existential threats.

III. SCIENCE IMPACT

The ultimate value of science lies in its impact. Nevertheless, while scientific discoveries have shaped our entire world and how we interact with it, measuring or predicting the impact of specific research projects remains challenging. Often, the impact of research builds up over decades or even centuries, and it is difficult to trace the impact back to a single starting point. As a result, scientific research always necessitates long-term vision and trust built on ongoing education and communication efforts with society.

The discourse on impact revolves around the key distinction between direct or scientific impact and indirect or social and economic impact. The direct impact is expressed in contribution to improving existing knowledge and creating new scientific knowledge. Yet many national science assessment programs and funding agencies emphasise dissemination and impact evaluation, particularly beyond academia.

1. DIMENSIONS OF IMPACT

The impact of science spans a broad range of fields and subfields, each with its unique contribution to society. At its core, science generates new knowledge, allowing us to understand the world around us better. When this knowledge reaches decision-makers and government officials, it can inform new guidelines and laws, ultimately shaping our society.

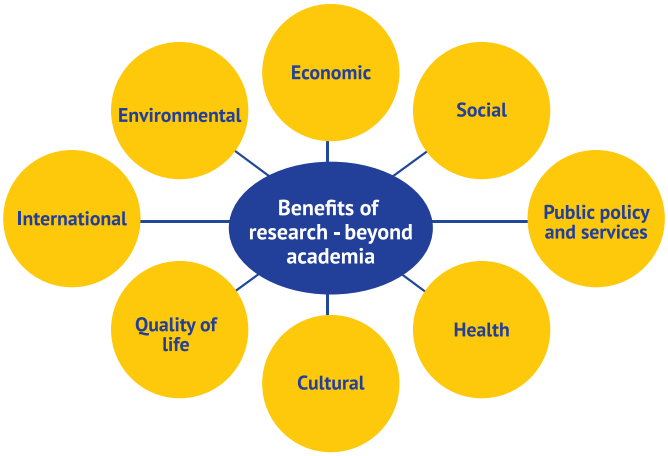


Fig. 1 *Impact beyond academia*

In economics, scientific discoveries and the application of scientific methods drive **innovation,** creating new businesses and contributing to cost savings and revenue growth. Science also plays a critical role in **environmental awareness** and action, including climate research, the mapping of genetic diversity, and habitat conservation.

In our daily lives, we benefit from research related to **medicine and well-being**, which has improved our overall health and quality of life. Additionally, science has the unique **ability to influence long-term societal values, attitudes, and beliefs**. For example, many modern democratic principles, **human rights**, and labour laws we take for granted today originated from prolonged debates in human and social sciences.

It is also well understood that science and innovation are neither linear nor completely predictable. Unexpected outcomes, positive or negative, can also result. In order to understand the true outcomes and impacts of science, the scholarly and policy community must be open to thinking about them more broadly. As we face an increasingly uncertain future, the importance of scientific inquiry cannot be overstated. By pushing the boundaries of what is known and exploring uncharted territories, science holds the key to **preparing us for the future**.

Measuring impact is notoriously difficult. Hence, many funders and systems still use publication-based proxies such as the Impact Factor or citation counts – which reflect a rather narrow scope of impact, i.e. usefulness for knowledge production in academia. A more nuanced way of assessing impact is through narrative-based case studies or by looking at tangible outcomes – impact evidence – that can be recorded and reported via impact trackers or impact modules within university systems. However, qualitative assessment yet cannot be automated and therefore is much more resource-intensive, kin to the peer-review practice. As a result, evidencing and measuring impact is still a controversial and fast-developing area, likely to comprise a mix of quantitative indicators and qualitative reviews in different proportions.

The impact of scientific research is possible only through effective communication and knowledge transfer. Although there are many channels through which research finds its way into the more extensive information ecosystem, most are invisible. One notable exception is the indexing of research articles and patents, which allows us to trace the connections between the two. In addition to these visible routes, the broader intellectual information system includes a wide range of sources, such as newspapers, blogs, professional magazines, continuing education programs, professional news websites, policy reports, and more. To maximise the impact of scientific research, it is crucial for scientists to actively engage in communication efforts and represent their views in various media, particularly on socially polarising issues, as demonstrated during the COVID-19 pandemic.

Furthermore, there is a need to develop more opportunities for **collaboration between researchers**, businesses, and policymakers to ensure that scientific expertise is utilised to its full potential. Science has become increasingly public in recent years, with universities and research institutes actively promoting their successes on their web pages and through various media channels.

2. THE IMPACT OF SCIENCE IN LATVIA

Despite being significantly underfunded in national research, Latvian scientists substantially contribute to the country's identity, security, and global competitiveness. **Society relies on scientists as a source of information and knowledge experts**. However, there is a lack of easily accessible and understandable information about ongoing research in one centralised location that would provide a clear understanding of Latvia's most impactful research projects, actors, and institutions.

Planning documents can be useful tools to gauge progress toward long-term goals. Sciences, Technology Development and Innovation Guidelines is a medium-term policy planning document in Latvia that defines the science and policy for the period 2021–2027, setting out the guiding principles, objectives, priorities, lines of action and tasks to be performed, and ensuring the continuity of these policies.

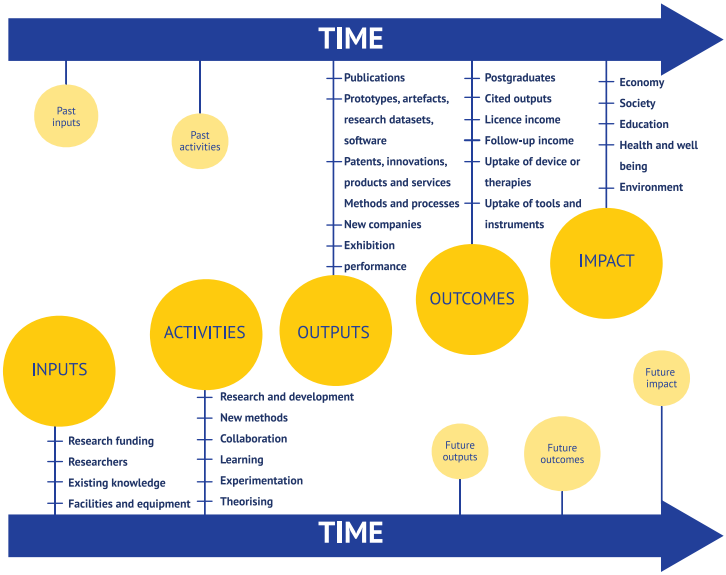
An essential step towards purposeful management of scientific impact at the national level has recently been taken by conducting a comprehensive study of science communication target audiences in Latvia[1]. Researchers affiliated with Vidzeme University of Applied Sciences identified the following **five priority target audiences**:

- **scientists** - to achieve active, qualified, and coordinated participation of the broadest possible circle of scientists and institutions in science communication and popularisation.;
- political and business **decision-makers and influencers** - to increase support for research and development by advancing critical decisions and laws, directly supporting science and science communication in the public space, and advocating for building the knowledge society;
- **active entrepreneurs** - to deepen their understanding of science and its benefits, to intensify the interaction of fundamental science and applied innovations, and to increase their desire and readiness to participate in events organised by scientific institutions while transferring part of their dynamic culture to the academic environment;
- **youth** - to envision science and research as a possible career path and encourage the early acquisition of knowledge, skills, and abilities necessary for high-quality studies.
- socially active and scientific **Latvian diaspora** - to demonstrate the performance and competitiveness of Latvian scientists, thereby increasing the international capacities and networks of Latvian science.

It is widely agreed that the most effective way to achieve impact is through stakeholder engagement throughout the lifecycle of a project. By targeting these specific audiences, Latvian scientists can effectively communicate their research findings and contributions to a broader audience, garner support from decision-makers, inspire future generations, and enhance the reputation and competitiveness of Latvian science on the global stage. As such, **pursuing impactful science is a collaborative effort**, with scientists and their communication liaisons helping relevant audiences discover, connect with, understand, apply, and advocate for research.

Despite the vital role of scientists in Latvian society as a source of information and knowledge experts, **the communication landscape of science in Latvia is somewhat fragmented.** Although academic presses, journals, websites, and social media accounts of research organisations are available, the leading actor in translating and popularising scientific knowledge is the Public Broadcasting of Latvia (PBL), a state-funded conglomerate of online, radio and television channels. Latvian scientists regularly feature in dedicated **broadcasts of Latvian Radio channels 1 and 6 (NABA)**. PBL's united **news portal, lsm.lv**, provides science-related multimedia content in both English and Latvian. Similarly, the largest private news portal, Delfi.lv, features a dedicated science section, while labsoflatvia.com publishes stories about innovations and technologies. Several **television broadcasts** regularly tackle themes related to the environment and history. For a time, Latvian audiences were addressed through several dedicated science podcasts, which unfortunately are inactive today.

The global franchise of *Illustrated Science* leads science communication in printed media. While it is an excellent channel that addresses children and the general audience, the monthly content is dominated by translations of foreign material. The Latvian Academy of Science publishes the **annual list of scientific achievements**. An obvious vehicle for science communication is a range of dedicated events, such as the Scientific Cafeteria at the University of Latvia, the international Researchers' Night, the Nature Concert Hall initiative, the LAMPA festival for conversations and art/science events organised by the RIXC centre. Currently, the youngest stakeholders of future scientific endeavours are addressed **by popular science centres** like Laboratorium.lv, Futurimo Rīga at Riga Technical University, and VIZIUM in Ventspils. A space science centre is soon to be opened in Cēsis.



Source: Achieving Future Research Impact: Guidance for Preparation. Impact Oriented Interdisciplinary Research (IIRG) Programme. Research Clusters University of Malaya May 2019.

Science communication efforts in Latvia primarily address the current and future impact areas of the most recent research initiatives. However, especially at the state investment and policy level, it is of the utmost importance to recognise the impact of fundamental research in the long term. The current state of the art of Latvian science provides several excellent examples to illustrate the payoff of such long-term investments. For example, the advancement of molecular biology and genomics as far back as the late socialist era allowed Latvia to be at the forefront of COVID-19 pandemic monitoring, epidemiology studies, and applications to healthcare in 2020. Similarly, the simultaneous development of computer science in the 1980s has been a precursor to building a sizable software industry and Digital Humanities expertise in the recent decade.

3. DURING THE CONGRESS

The 5th World Congress of Latvian Scientists aims to explore the impact of science in Latvia across three main areas: the advancement of the economy, the growth of skills, and the improvement of general well-being.

Two keynote lectures and a discussion will set the conceptual framework for measuring and conceptual issues related to scientific impacts in Latvia. The presenters will explore the types of impacts science has on regions, countries, and communities regarding improving national economies, workforce skills, security, health, the environment, and overall societal well-being. The congress will also explore how to design more appropriate R&D and innovation indicators aligned with the sustainable development goals of Latvia 2030.

The second area of focus is the career in science, academic regeneration, and how young scientists view the impact of science. Proficient scientists from the diaspora will exchange their career experiences in science, followed by a discussion directed towards understanding the role of science impact for young scientists.

The third area of focus is centred around the concept of science that sells. Investing in science is critical for a country's economic transformation and future development. However, science investment in Latvia is still insufficient. 0.71% of the GDP invested in Latvian science is only one-third of the EU average. A keynote presentation will demonstrate science funding and academic regeneration in Estonia, followed by a panel discussion on how to have more successful start-ups in Latvia. The congress will explore ways to invest better in science, manage science businesses more successfully, and aim for new companies and spin-offs where researchers can implement their inventions and discoveries in life and realise them in Latvia rather than selling patents abroad.

Overall, the 5th World Congress of Latvian Scientists provides a platform for discussing the impact of science in Latvia across various sectors, from the economy to the environment and society. By exploring the potential impact of science and technology on sustainable development goals, academic regeneration, and start-up culture, the congress aims to encourage the investment and promotion of science in Latvia for the long-term benefit of the country

Traditional approaches to research, communication, and evaluation have created barriers between science and those who stand to benefit from it. We can positionourselves to tackle the rising global challenges by reducing these barriers. Likewise, researchers must develop new skills and capabilities to demonstrate their ability to create impact, which may become central to career progression and institutional reputation.

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[1]Science communication target audiences in Latvia. Vidzeme University of Applied Sciences (2021). Funded by ERDF through the Ministry of Education and Science of Latvia.
Final report: https://www.izm.gov.lv/lv/media/13361/download

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Ministry of Education and Science Republic of Latvia

NATIONAL DEVELOPMENT PLAN 2020

EUROPEAN UNION
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INVESTING IN YOUR FUTURE

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