SustAIn Liv Work

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Executive Summary

This report outlines the Research and Innovation (R&I) Agenda for the SustAInLivWork Centre of Excellence (CoE) in Lithuania. The document is written during the launching phase of the project to help assess the current capabilities of the partner institutions, analyse objectives for the vision of the CoE, and provide opportunities to develop R&I activity in the future.

Each partner institution has provided a summary of information on current areas of research excellence, capacities, and innovation activities. These have been analyzed in comparison with data from the advanced partners of the project, to identify overall strengths and areas for development. This information has then been analyzed with respect to the overall objectives of the CoE, thereby providing a picture of current gaps in the current R&I provisions.

The gaps are identified across the four thematic focus areas of the CoE (manufacturing, transport, energy, and health), and have been categorized across three key areas of activity: technology, commercial, and society. Additional reflections have led to the proposal of key opportunities and research priority areas for the CoE to focus on.

The final section of this report sets out implementation guidelines and a timeline of future deliverables in relation to implementing research and innovation activities. This includes milestones and monitoring framework suggestions, along with a discussion on key ethical and regulatory considerations. Key questions for consideration in preparation for future R&I-related deliverables are highlighted based on the findings of this report. A fundamental theme throughout this work is the fast and changing nature of R&I within AI technology research. The future direction and agenda of the CoE must therefore be agile and adaptable based on the emergence of new technologies and societal trends.

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Glossary

AI	Artificial Intelligence
B2B	Business to Business
BSc	Bachelor of Science
CEA	Comparative Expert Assessment
CERN	European Organization for Nuclear Research
CIVIT	Centre for Immersive Visual Technologies
CLARIN	Common Language Resources and Technology Infrastructure
CoE	Centre of Excellence
CPU	Central Processing Unit
CSC	IT Centre for Science
DAC	LSMU Data Analytics Centre
DIH	Digital Innovation Hub
DASHH	Data Science in Hamburg - Helmholtz Graduate School for the Structure of Matter
EC	European Commission
EGI	European Grid Infrastructure
EU	European Union
EuroHPC	European High-Performance Computing
FCCI	Finnish Computing Competence Infrastructure
ForLab	Research Laboratories Microelectronics Germany
GB	Gigabyte
GDPR	General Data Protection Regulation
GPU	Graphics Processing Unit
HDD	Hard Disk Drive
HELIOS	Hamburg Electronics Lab for Integration of Optoelectronical Systems
HIAS	Hamburg Institute of Advanced Studies
HIPAA	Health Insurance Portability and Accountability Act
HOOU	Hamburg Open Online University
HPC	High-Performance Computing
HVAC	Heating, Ventilation, Air Conditioning
LitGrid-HPC	Lithuanian GRID and High-Performance Computing Network
LUMI	Large Unified Modern Infrastructure
ICT	Information and Communication Technology
I^3	Interdisziplinarität und Innovation in den Ingenieurwissenschaften
INSO	Intelligent Society Platform
IoT	Internet of Things
IP	Intellectual Property
IT	Information Technology
IWM	Intelligent Working Machines
KPI	Key Performance Indicator
MES	Manufacturing Execution Systems
ML	Machine Learning
MSc	Master of Science
PhD	Doctor of Philosophy

RAM	Random Access Memory
R&D	Research and Development
R&D&I	Research, Development, and Innovation
R&I	Research and Innovation
RGs	Research Groups
S3	Lithuanian Smart Specialisation Strategy
SDG	Sustainable Development Goals
SITTI	Institute of Digital Resources and Interdisciplinary Research
SME	Small Medium Enterprise
SO	Specific Objective
SP	Study Program
SRA	Strategic Research Agenda
SSD	Solid-State Drive
TB	Terabyte
TCSC	Tampere Centre for Scientific Computing
TIAS	Tampere Institute for Advanced Study
TLCC	Transport and Logistics Competence Centre
TRL	Technology Readiness Level
TUHH-RZ	TUHH Computer Center
USD	US Dollar
vCPU	Virtual CPU
VR/AR	Virtual / Augmented Reality
WP	Work Package
XAI	eXplainable Artificial Intelligence

1 Introduction

SustAInLivWork CoE AI Joint R&I Agenda (hereinafter — Joint R&I Agenda) outlines the research and innovation roadmap focussed on Artificial Intelligence (AI) technologies for the Centre of Excellence (CoE) which is to be established in Lithuania as part of the SustAInLivWork project. Since AI technologies and their applications can be quite diverse and wide-ranging, research and innovation (R&I) within AI requires interdisciplinary and intersectoral efforts and competencies. Such requirements for future interdisciplinary and intersectoral R&I initiatives are usually, systematically identified and described within strategic research agendas.

The "Joint Strategic Research Agenda (SRA)" for the European Union's (EU) Networks of Excellence Centres in AI and Robotics[1] and the Strategic Research & Innovation Roadmap of Trustworthy AI[2] are examples of such research agendas. Accordingly, the main objective of this Joint R&I Agenda, is to recommend an implementation roadmap for R&I initiatives related to AI technologies for the SustAInLivWork CoE, based on the existing, unique, and complementary competencies, expertise, and capacities of the partners and beneficiaries involved in the SustAInLivWork project.

SustAInLivWork CoE AI Joint R&I Agenda is project deliverable D2.1 which belongs to Work Package No. 2 (hereinafter — WP2) "Scientific excellence and education activities' development and research", wherein the objective is to build scientific excellence for AI by mobilizing highly qualified researchers through international collaborations. Accordingly, WP2 aims to generate valuable research outcomes (patents, scientific publications, technical reviews, etc.), increase scientific outreach, and maximize the impact of R&I on society, the environment, and the economy. Thus, D2.1 is a deliverable and outcome of Task 2.1 – AI Joint R&I Agenda, which aims to develop an R&I agenda based on a development map of the research excellence, expertise, and capacities of the CoE.

Deliverable D2.1 is developed based on a systematic mapping of the *research* (strategy, excellence, capacity, and infrastructure) and *innovation* (output, services, and digital innovation hubs) competencies of the following 6 (six) partners involved in this project: Kaunas University of Technology (KTU), Vilnius Gediminas Technical University (VILNIUS TECH), Vytautas Magnus University (VMU), Lithuanian University of Health Science (LSMU), Tampere University (TAU) as an advanced partner, and Hamburg University of Technology (TUHH) as an advanced partner.

This systematic mapping is further divided into 4 (four) thematic application areas for AI described within the SustAInLivWork Project: Innovative manufacturing technologies (hereinafter — Manufacturing); Healthy living, Green Energy, and Transport. Based on the mapping results, D2.1 analyses R&I gaps and strengths among the six partners and provides recommendations for future R&I topics, initiatives, and collaborations, categorized by time horizon (short-, medium-, and long-term) and priority.

1.1 Scope of Deliverable D2.1

The scope of D2.1 is briefly illustrated in Figure 1. According to Deliverable D6.1[3] from WP6 of the SustAInLivWork project, the outcomes and recommendations from D2.1, as part of Task 2.1 –AI Joint R&I Agenda, will be used as an input to the following tasks from WP2 and WP3: Task 2.2 –

[1] Heintz, F. & Montgomery, J. (2024). *Joint Strategic Research Agenda (SRA)*. Available from: https://www.vision4ai.eu/sra/
[2] Milano, M., Schoenauer, M., Heintz, F. (2022). *Strategic Research & Innovation Roadmap of Trustworthy AI*. Available from: https://tailor-network.eu/research-overview/strategic-research-and-innovation-roadmap/
[3] Deliverable 6.1- Project Management Plan, SustAInLivWork

Establishment and Operation of the AI Research HUB; Task 2.3 – AI-relevant Data Platform; Task 2.4 – SustAInLivWork CoE Scientific Excellence and Educational Programmes Roadmap from WP2; and Task 3.3 – Services Package from WP3. Task 2.2 will create detailed research project roadmaps for key areas - Manufacturing, Healthy Living, Green Energy, and Transport. It will also define the roles and expected contributions of CoE partners based on D2.1 recommendations. Task 2.3 will serve as a foundation for data collection, sharing, and integration across thematic areas, ensuring that the CoE partners can effectively collaborate and leverage data-driven insights to align with the strategic priorities outlined in D2.1. Task 2.4 will outline a comprehensive roadmap to ensure educational and scientific excellence. Task 3.3 will develop a service package tailored for business and industry organizations, public bodies, and other stakeholders. Moreover, Task 1.2 – CoE Development Strategy sets out the long-term strategic directions for the CoE, which is to be revised periodically, every 24 months. Specific actions for the tasks and deliverables of different WPs which depend on the outcomes/recommendations of D2.1 can be found in Section 4.2.

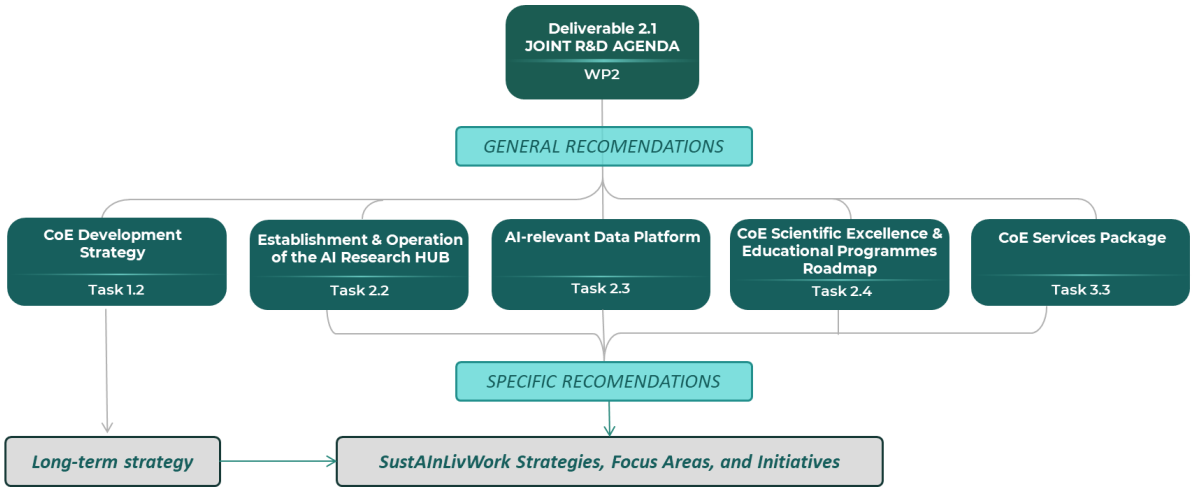


Figure 1. *Scope of D2.1- Joint R&I Agenda*

As the deliverables of Task 1.2, Task 2.2, Task 2.3, Task 2.4, and Task 3.3 are expected to outline the specific complementarity and contributions of the SustAInLivWork CoE partner institutions, the scope of Deliverable D2.1 – Joint R&I Agenda, is focused on providing a high-level overview and general recommendations for the CoE. Accordingly, D2.1, which develops recommendations for the future R&D&I strategies, topics, and initiatives, is primarily meant for the Lithuanian research partners (KTU, VILNIUS TECH, VMU, and LSMU) within the SustAInLivWork project.

Leadership and responsibilities: Tampere University has taken the lead in developing Deliverable D2.1, overseeing data collection and analysis, including systematic mapping and gap analysis, of R&I data from SustAInLivWork project partners.

Partners contributions: Hamburg University of Technology and the Lithuanian partners contributed by providing the necessary input data and collaborating with TAU in the joint development of D2.1.

Advisory Board input: The Advisory Board of the SustAInLivWork project reviewed an early draft of D2.1 and provided expert feedback to enhance its scope and quality.

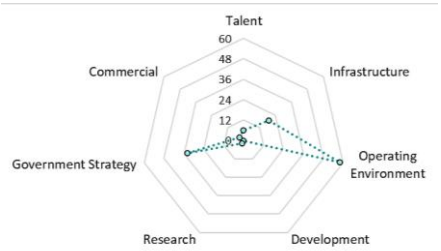
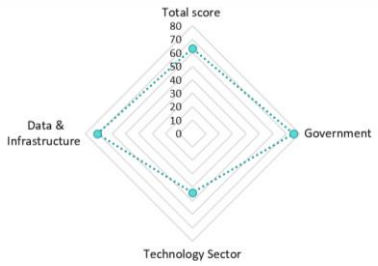
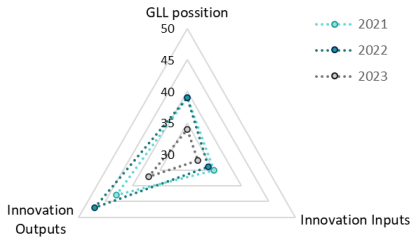
Accordingly, this Joint R&I Agenda is a collective effort of the SustAInLivWork project consortium and represents our current (2nd half of 2024) understanding and associated future projections of the evolution of AI-related research, innovation, technologies, and applications.

1.2 Bridging the Gaps in AI, Open Data and Sustainable Growth in Lithuania

Globally, AI is expected to have a big impact on global GDP by 2030, contributing nearly $15.7T, mainly driven by productivity gains due to robotisation and automation of processes, a labour force that will be assisted/augmented by AI technologies, and personalised high-quality products/services enhanced by AI[4]. Lithuania's AI operating environment, government strategies, and infrastructure are rated above average, showcasing strong AI readiness and maturity on global and regional scales (see Table 1). However, significant gaps remain in talent development, research, commercialization, and innovation creation, highlighting that Lithuania excels more in applying existing technologies rather than creating new ones. In the 2024 *Global Startup Ecosystem Index*, Lithuania ranks 16th globally and 2nd in Central and Eastern Europe, with Vilnius leading in cybersecurity (71st globally) and Kaunas excelling in **Medtech** (189th globally, ranked 19th in its sector). While Lithuania's startup ecosystem demonstrates strong growth, with $173.5M in funding in 2023, challenges in sustaining momentum and reducing fragmentation persist.

Lithuania has also taken leadership in open data readiness, being among the leaders in implementing the **High-Value Datasets** (HVD) regulation effective in June 2024 (see Table 1). However, unlike most EU Member States, Lithuania lacks systematic support for assisting data providers in publishing datasets, which limits the full utilization of open data potential.

Table 1. *The position of Lithuania in the world AI market*

46	Lithuania ranks 46th in the *Tortoise Global AI* Index 2024, which evaluates countries based on their artificial intelligence capabilities across various indicators. The index assesses AI capacity using 122 indicators gathered from 24 public and private data sources and 83 governments[5], distributed across seven sub-pillars. Among the Baltic states, Estonia ranks 12th, Latvia 70th, and Lithuania holds second place regionally.	
35	According to the *Government AI Readiness* Index 2023 by Oxford Insights[6], which highlights the main findings for each of the pillars and provides insights into global trends in the AI governance landscape, Lithuania ranks 35th with a total score of 63.33. Latvia ranks 48th, and Estonia ranks 17th. In the 2024 rating, Lithuania is noted as the third country in Eastern Europe (after the Czech Republic and Estonia) with an increased index score of 67.80.	
34	Lithuania ranks 34th among the 132 economies featured in the *Global Innovation Index* (GII) 2023[7], which evaluates countries based on their innovation capabilities through approximately 80 indicators categorized into innovation inputs and outputs. Lithuania's ranking reflects its performance in both areas. This year, Lithuania ranks 32nd in innovation inputs and 37th in innovation outputs, both higher than last year.	

[4] PWC. (2017). https://www.pwc.com/gx/en/issues/artificial-intelligence/publications/artificial-intelligence-study.html
[5] The Global AI Index - Tortoise Media
[6] Government AI Readiness Index - Oxford Insights
[7] Lithuania ranking in the Global Innovation Index 2023 https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2023/lt.pdf

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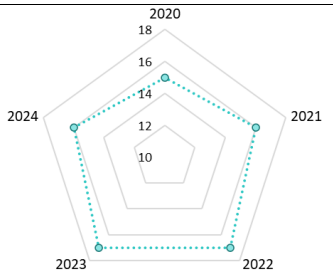
Despite its small population, Lithuania thrives as a startup hub with a unique foreign policy voice and a strong ecosystem. Relatively low living costs and skilled developers attract foreign entrepreneurs, while key players like Go Vilnius and KTU foster innovation and talent. Notably, Lithuania is the only Baltic country with two cities in the top 200. StartupBlink's[8] latest index highlights this progress, ranking Lithuania 16th globally.



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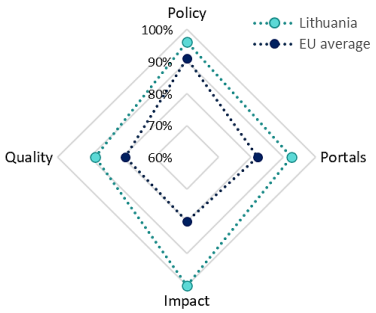
The *Open Data Maturity* assessment measures European countries' progress in promoting and reusing public sector information. It evaluates national policies, portal features, metadata quality, and reuse initiatives[9]. The distribution of composite maturity scores is skewed towards higher scores, with clusters categorized as *Trendsetters* (94–100%), including ***Lithuania***, Cyprus, Estonia, Italy, Czechia, Spain, Ireland, Slovakia, Ukraine, and Poland; Fast-trackers (83–90%), Followers (74–80%), and Beginners (15–69%).



Despite significant efforts by Lithuanian AI policymakers and implementers to address recurring challenges in innovation development, there remains a lack of consolidated and updated knowledge about the specific obstacles within Lithuania's AI ecosystem (see Table 2). The *2024 Lithuanian AI Governance Forum*, featuring some of the most experienced and qualified members of Lithuania's AI ecosystem – including AI Developers Team Lead and SustAInLivWork Project Coordinator Prof. Dr. Agne Paulauskaite-Taraseviciene, and AI Deployers Team Lead and President of the Lithuanian Association of AI Assoc. Prof. Dr. Linas Petkevicius – highlighted key concerns regarding long-term innovation development and regulation, with a focus on the impact of the EU AI Act on AI progress in the country.

Table 2. *The main challenges in building a sustainable AI Ecosystem in Lithuania*

Collaboration Challenges: • Lack of awareness regarding Lithuania's strategic AI priorities. • Fragmentation within the AI ecosystem. • Insufficient information on organizational compliance with EU AI regulations. • Risk of inconsistencies in AI regulations within the EU or with international counterparts.	**Educational Challenges:** • Lack of information about AI benefits and risks. • Low average level of AI literacy. • Gender imbalance among AI specialists.
Regulatory Challenges (EU AI act): • Insufficient clarity on executing AI oversight functions. • Uncertainty regarding practical organizational alignment with AI regulations. • Shortage of accredited institutions and information about their benefits. • Unclear principles for ensuring transparency and bias prevention in AI data and outputs.	**Innovation Support Challenges:** • Absence of a central institutional leader in the AI ecosystem. • Lack of nationally approved and recognized strategic AI priorities. • Uncertainty about the effectiveness of AI solutions. • Insufficient financial resources. • Poor-quality private data and insufficient state data resources • Lack of digitized Lithuanian language resources suitable for AI solution development.

[8] Startup Ecosystem of Lithuania | Startupblink
[9] Open Data in Europe 2023 | data.europa.eu

These challenges underscore the need for a coordinated approach, such as establishing the CoE SustAInLivWork, to address fragmentation, enhance open data accessibility, and drive faster breakthroughs in AI innovations. The CoE will enable Lithuania to build a stronger foundation for AI innovation, foster closer cooperation and fully exploit its potential to lead the way in emerging technologies.

1.3 AI Ecosystem and Applications in Key Sectors for Lithuania's Growth

According to the ***Lithuanian AI Strategy***[10], Lithuania has an active AI community. In the industry community within Lithuania, a vast majority of the organisations, which are small and medium sized (SME) organisations, focus on AI technologies within Business to Business (B2B) product delivery, covering a wide range of industries: Development & Information Technology, Data, Security, Human Resources, Internet of Things (IoT), Computer Vision, Research, Language Processing, AR/VR, Analytics and Insights, Advanced Targeting, Agriculture, Medical Imaging and Biometrics. R&D financing for AI projects are predominantly public sector investments, for both, academia and industry.

The Lithuanian AI Strategy makes 6 (six) major principles for future AI initiatives in Lithuania:

1. **Ethical & legal** core **principles** for the development and use of AI;
2. A break down of Lithuania's position in the **AI ecosystem**;
3. Integration of AI systems across all **economic sectors**;
4. National development of **skills and competencies** needed for a future with AI;
5. Growth of AI R&D;
6. A responsible and efficient approach to **data.**

Key industry sectors in Lithuania with significant potential for AI impact include manufacturing (the largest economic sector), agriculture, healthcare, transportation, and energy.
According, ***Lithuanian Artificial Intelligence Technology Development Action Plan 2023–2026***[11] aims to establish the necessary conditions for advancing AI in Lithuania by fostering ecosystem growth and driving innovation. It outlines three key tasks and tools for their achievement (see Table 3).

Table 3. *Key tasks defined in Lithuanian AI Technology Development Action Plan*

(1) Improving the foundational conditions for AI technology ecosystem development.	(2) Promoting AI adoption and usage across all economic sectors.	(3) Creating an environment conducive to high-tech AI innovations.
Tools for achieving tasks:		
• Develop robust **data preparation** capabilities • Enable **HPC** utilization for scalable AI applications; • Support **talent growth** & attraction; • Facilitate access to investment and grants for AI development; • Develop a collaboration framework for **AI Ecosystem stakeholders.**	• Encourage **private sector** investment; • Promote AI adoption in **public Sector.** • Develop a catalogue of core AI components and their suppliers to facilitate faster **adoption** and better **awareness.**	• Foster long-term **international collaboration** among AI solution developers. • Promote **multi-disciplinary partnerships** for comprehensive AI development. • Remove barriers to ICT innovation.

[10] Lithuanian AI strategy document. https://eimin.lrv.lt/uploads/eimin/documents/files/DI_strategija_ENG(1).pdf
[11] https://data.kurklt.lt/wp-content/uploads/2023/04/DI-pletros-veiksmu-planas.pdf

The ***strategic guidelines of Lithuania's AI Governance Model*** include the following recommendations:

1. Improve **AI skills** and education for all country citizens.
2. Strengthen the national **R&D ecosystem** in the field of AI.
3. Promote the adoption, development, and use of AI across all economic activities, including the **private and public sectors**.
4. Foster national and international **collaboration** in AI and enhance opportunities for cooperation.
5. Develop an **ethical and legal framework for sustainable** and **transparent** AI development.
6. Establish a responsible and efficient **data ecosystem**.

The guidelines aim to position Lithuania as a European leader in the development and application of ***high-risk AI solutions***, oversight and compliance evaluation, and the safe use of general-purpose AI.

Similarly, other initiatives such as the ***Lithuanian National Progress Program 2021-2030***[12] focuses on key thematic areas such as: *Smart Society* — Improving tertiary education levels among young people, improving the global ranking of Lithuanian universities, reducing income inequalities and inefficiencies within healthcare, and improving the participation of adults in education programs; *Smart Economy* – Improving collaboration between universities and industry, improving the rankings of Lithuania within global and EU innovation indices, increasing the R&D expenditure by industry, attracting foreign direct investment, and increasing the number of patents; *Clean Environment* – Improving energy efficiency and reducing energy consumption; and *Smart Governance* – Improving the quality of regulations, reducing corruption and streamlining bureaucratic processes by using digitalisation.

Additionally, the ***Lithuanian Smart Specialisation Strategy (S3)***[13] aims to identify and prioritize areas that have the greatest potential to drive economic growth and competitiveness, considering current and projected scientific and business capabilities, as well as major national and global challenges and trends. These priority areas are also emphasized in terms of funding allocation. It identifies 6 priority R&D&I development areas with associated action plans for each development area (see Table 4).

Table 4. *R&D&I development priority areas denoted by S3.*

Priority area:	
1. Energy and sustainable environment;	4. New production processes, materials & technologies;
2. Inclusive and creative society;	5. Health technologies and biotechnologies;
3. Agro-innovation and food technologies;	6. Transport, logistics, information & communication technologies.

The global AI market is projected to grow at a CAGR of 36.6% from 2024 to 2030, driven by continuous R&I across industries like automotive, healthcare, retail, finance, and manufacturing. The healthcare sector is expected to lead by 2030, with use cases such as robot-assisted surgery and computer vision based automatic diagnosis. In banking, financial services and insurance sector, AI supports risk assessment and regulatory technologies, while in retail, it enhances the shopping experience. AI's role in data analytics, entertainment, and advertising continues to grow, driven by the increasing volume of digital data. Other key industries leveraging AI include transportation, and agriculture. The AI market's dominant TOP sectors vary based on region, regulations, strategic priorities, etc. In the EU, key sectors include healthcare, manufacturing, energy, transport, environment, and agriculture (see Table 5).

[12] https://2014.esinvesticijos.lt/uploads/main/documents/files/Post%202020/2_%20LRVK_NPP.pdf
[13] Government of the Republic of Lithuania. (2013). *Smart Specialization.* https://smsm.lrv.lt/en/sector-activities/science-1/smart-specialization/

Table 5. *AI dominant sector defined in Lithuanian strategies, recommendations, and EU strategic plans*

	Sectors								
	Manufacturing	Health	Energy	Transport	Agriculture	Cybersecurity and Defense	Environment	Finance	Advanced Materials
Lithuanian AI Tech Development Action Plan 2023 –2026	✓	✓	✓	✓	✓	✓			
Lithuanian AI Strategy 2019	✓	✓	✓	✓	✓				
AI governance model: Lithuania 2023 – 2024	✓	✓	✓	✓	✓				
S3 R&D&I priority topics	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU AI Plan 2024[14]	✓	✓	✓	✓	✓		✓		

Health, Agriculture and **Environment** sectors are combined into one under the concept of **"One Health"** which emphasizes the interconnectedness of human, animal, and environmental health (see Figure 2). It is defined as an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. This definition is supported by multiple organizations, including the *World Health Organization*[15], the *Food and Agriculture Organization*[16] and the *Centers for Disease Control and Prevention*[17].

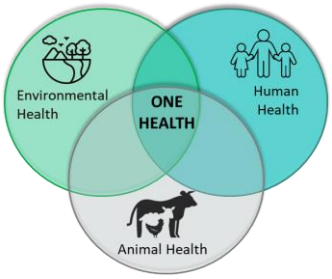


Figure 2. "*One Health" concept*

Based on the recommendations of the *Lithuanian S3*, *Lithuanian National Progress Plan 2021-2030*, *Lithuanian AI Strategy*, *Lithuania's AI Governance Model* and a preliminary review of the research excellence, expertise, and capacities of the 6 partners involved in the SustAInLivWork Project, the CoE focuses on the following four areas: **Manufacturing**, **Health**, **Energy**, and **Transport.**

The establishment of the CoE for AI, i.e., **AI** for **sust**ainable **liv**ing and **work**ing (SustAInLivWork) – addresses critical gaps by fostering R&D and innovation, creating a foundation for responsible and efficient AI development, improving AI-related skills and competencies within the Lithuanian workforce, supporting talent growth and attraction in the AI field, and promoting the adoption and use of AI across all economic activities, including key sectors.

The SustAInLivWork project's *Description of Action,* annexed to its grant agreement, outlines three primary challenges in Lithuania:

[14] Special report 08/2024: EU Artificial intelligence ambition – Stronger governance and increased, more focused investment essential going forward https://www.eca.europa.eu/en/publications?ref=sr-2024-08
[15] World Health Organization One Health
[16] https://www.fao.org/one-health/en/
[17] One Health concept. https://www.cdc.gov/one-health/about/index.html

(1) **Talent and R&D Investment:** A research system that struggles to attract skilled talent.; Insufficient corporate and business investment in research and development (R&D), as identified in an OECD report[18] from 2021 and also reiterated in an EU report[19] from 2023;
(2) **R&D spending:** R&D expenditure in Lithuania was 1.05% of GDP in 2023[20], stagnating since 2013, and this is far below the Lithuanian government's target (1.5 %) [21] as well as half of the EU average (2.26 %), as reported in 2023;
(3) **Sectoral Innovation Gaps:** Shortage of R&D and innovation solutions within four key sectors where AI development would have the greatest economic impact in Lithuania: manufacturing, energy, health, and transport sectors.

The SustAInLivWork project also outlines four overarching specific objectives (SO).

- **SO1**: To set-up and operate the SustAInLivWork CoE with a long-lasting mindset to ensure long-term self-sustainability and AI innovations.
- **SO2:** To conduct research on sustainable AI, and to educate stakeholders about the benefits of sustainable AI approaches and capabilities. SO2 relates to WP2 and is highly relevant to D2.1.
- **SO3**: To become a driver of change in AI solutions for sustainable living and working within societies from an international perspective.
- **SO4**: To create a Lithuanian AI cluster to foster transitions towards sustainability, with a particular focus on the S3 priorities areas.

This CoE will act as a lighthouse with far-reaching scientific, economic, and societal impact, thereby strengthening R&I, nationally and internationally, through a nurtured and curated collaboration between national partners and advanced international partners (TAU and TUHH). Accordingly, the vision of the SustAInLivWork CoE is to enhance Lithuania's proficiency in developing AI-driven solutions for sustainable living and working practices within Lithuania, the pan-Baltic region, and beyond. This will be achieved by creating and encouraging the adoption of cutting-edge AI technologies and sustainability approaches, drawing from the expertise of advanced partners.

Accordingly, based on these SOs, this deliverable D2.1, attempts to provide recommendations to achieve the following key outcomes via the activities of the CoE: To Increase the scientific capabilities of the Lithuanian partners of the CoE by enabling them to successfully apply for competitive research funding both within the EU and globally; To enable strengthened, multidisciplinary, and mutually benefitting collaboration between internationally renowned scientific institutions and the Lithuanian partners of SustAInLivWork CoE; To develop and promote new research strands within relevant domains and applications of AI; To develop and enhance the R&I capacities and the uptake of advanced technologies within Lithuania; Finally, to enhance innovation and integration of planned processes, services, and products of the CoE.

[18] OECD. (2021). *Improving effectiveness of Lithuania's innovation policy*. OECD Science, Technology & Industry Policy Papers, No. 123. https://doi.org/10.1787/a8fec2ee-en
[19] European Commission. *Lithuania: 2023 Country Report*. https://economy-finance.ec.europa.eu/system/files/2023-05/LT_SWD_2023_615_en.pdf
[20] R&D expenditure - Statistics Explained
[21] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, (2021) *European innovation scoreboard 2021*. Publications Office of the European Union. https://data.europa.eu/doi/10.2873/725879

The recommendations of D2.1 curated towards the abovementioned SOs and associated key outcomes, will enable the CoE to fulfil the Key Performance Indicators (KPIs) set out in the *Description of Actions* of the project, in a timely manner. This will have wide-ranging impacts within the Lithuanian society, its AI ecosystem, as well as within the future development of policy documents.

1.4 Contribution to Sustainable Development Goals

The SustAInLivWork CoE also contributes to the following sustainable development goals (SDGs)[22]:

Goal 3. Healthy lives and well-being by creating advancing health technologies and promoting preventive healthcare develop. Since one of the key sectors is health, CoE is aiming to deploy AI-powered tools for early detection, diagnosis, and monitoring of diseases (e.g., cancer, cardiovascular diseases) using computer vision, biometrics, and advanced analytics. Integrate AI into healthcare systems to deliver personalized treatments based on individual genetic, environmental, and lifestyle factors. Use AI to enhance medical imaging techniques, making diagnostic processes faster, more accurate. Moreover, promote a healthier environment within "One Health" concept, using AI to monitor environmental factors affecting health of humans and animals.

Goal 4 & 5. Quality education and **Gender Equality** by creating new training programs (in native and English languages) for continuous learning, focusing on skills required for the evolving job market, particularly in AI and technology-related fields. By promoting equitable and accessible high-quality education, wherein gender dimensions within education are considered throughout the project to promote equality and eliminate gender biases. Additionally, AI is utilized to analyze gender disparities across sectors, providing policymakers with insights to develop effective gender-responsive strategies.

Goal 8 & 9 – Decent Work & Economic Growth and **Industry, Innovation, and Infrastructure**, wherein the research outputs from CoE will be implemented within the four key sectors. The collaboration of Lithuanian partners with the advanced partners will enable an exchange of experiences as well as the synthesis of new research strands within AI, which will also enhance the execution of national and international reforms. Moreover, the impacts of SustAInLivWork will extend beyond merely streamlining technological processes or boosting returns on R&I investments, by advancing the *National Climate Change Agenda*, while also upholding the 'do no significant harm' principle. Such a broad approach also ensures that the goals and priorities of the EU Cohesion Policy[23] are achievable;

Goal 13 – **Climate Action**, by developing new business models aimed at reducing CO_2 emissions and facilitating climate-resilient agriculture, while promoting a renewable energy transition, thereby enabling compliance with the expected outcomes of the *EU Green Deal*[24]. Using AI, there is a need to optimize energy grids, manage energy storage, and efficiently integrate renewable energy sources such as wind, solar, and hydropower. AI systems can also be deployed to monitor and reduce carbon emissions in agriculture and transportation through real-time analytics.

[22] United Nations. (2015). *Sustainable Development: The 17 Goals.* Available from: https://sdgs.un.org/goals
[23] European Commission. (2023). *Report on the outcome of 2021-2027 cohesion policy programming.* Available from: https://ec.europa.eu/regional_policy/information-sources/publications/reports/2023/report-on-the-outcome-of-2021-2027-cohesion-policy-programming_en
[24] European Council. (2019). *European Green Deal.* Available from: https://www.consilium.europa.eu/en/policies/green-deal/

2 Mapping Research Excellence and Capacities

The research mapping has been done to identify the current strategies, areas of excellence, and capabilities for research and innovation across the SustAInLivWork partner institutions. This information will then be compared to the objectives for the CoE, identifying strengths to be exploited and potential areas for improvement to achieve the project objectives. The research mapping exercise is performed across the following key themes:

1. **Research:** Strategy, Excellence, Capacity & Infrastructure
2. **Innovation:** Output, Services, Digital Innovation Hubs (DIHs)

Partner institutions conducted a self-assessment of their R&I activities, coordinated by TAU, using a standardized document. Key data on research strategy, excellence, and innovation outputs are detailed in Annexes 1-6. TAU summarized and analysed the information, providing an overview of R&I capabilities to support the CoE.

2.1 Research Strategy

Each Partner institution has its own overarching structure and strategy for research activity. These are briefly summarised in the following text and graphics to give context to the institutions. More details on research activity related to the CoE themes and use of AI are presented in the subsequent subsections.

TAU focuses on multidisciplinary research that crosses the boundaries of science, specifically in the areas of health, technology, and society. Research missions include fostering a just and participatory society, promoting the health and welfare of people of all ages, developing safe living and working environments that are resource-efficient, and ensuring socially responsible digitalisation and transformation of work. TAU's research strategy is visualised in Figure 3.

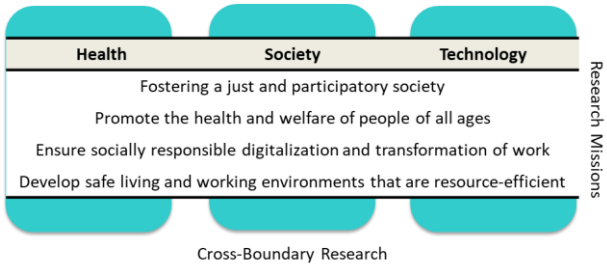


Figure 3. *TAU research strategy overview.*

TUHH focuses on 'Technology for Humanity'. Its research is organised into five research fields (Advanced Materials & Bioprocesses; Aviation & Maritime Technologies; Cyber-Physical & Medical Systems; Environmental & Energy Systems; Logistics, Mobility & Infrastructure), representing the research focus and comprising nine research clusters. TUHH is a member of ECIU and UNU-HUB. TUHH's research strategy is visualised in Figure 4.

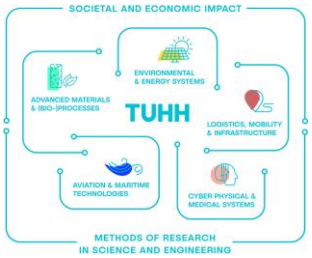


Figure 4. *TUHH research strategy overview. (TUHH: Research Organisation)*

KTU has a research strategy with three key areas of activity: Transformation of Industry; Digital Transformation; Smart Cities and Resilient Communities. Research, Development, and Innovation (R&D&I) activities are developed in two broad areas: Technologies for Sustainable Future, and Sustainable Sociocultural Development. The first area includes engineering related to AI, robotics, biomedical, electrical, mechanical, transportation, construction, sustainable energy, etc. The second area includes architecture, urban activities, cultural heritage, educational environments, financial technologies, innovation management and entrepreneurship, digital media, culture, etc. KTU's research strategy is visualised in ***Figure 5***.

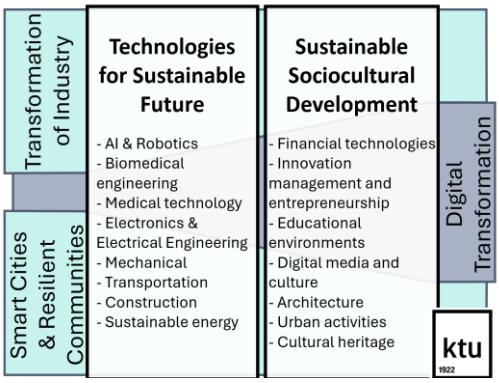


Figure 5. *KTU research strategy overview*

VMU has five Scientific Research areas (Humanities, Social Sciences, Natural Sciences, Technological Sciences, and Agricultural Sciences) and Arts, with 8 prioritised research and arts fields. The prioritised research field of Smart Technologies covers two topics related to SustAInLivWork: Artificial Intelligence and Digitalization Systems, and Security, Reliability and Risk Analysis Methods. VMU's research strategy is visualised in ***Figure*** .

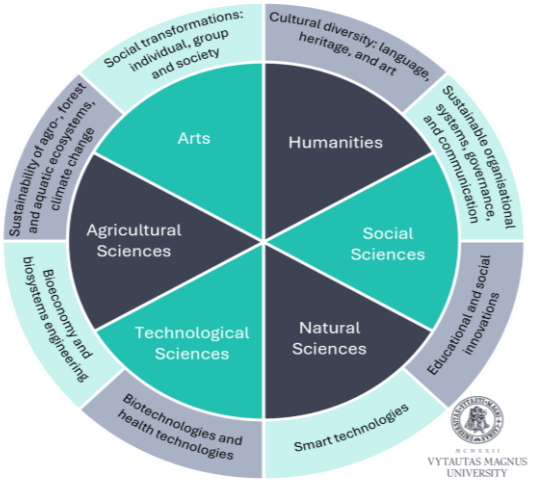


Figure 6. *VMU research strategy overview*

VILNIUS TECH works in 7 (seven) research focus areas, of which 6 are related to the SustAInLivWork project: Sustainable Building; Environmental and Energy Technologies; Sustainable Transport, Mechatronics, Information and Communication Technologies, and Fundamental Research on Materials and Processes. Seven faculties are working in these areas and have the potential to contribute to all SustAInLivWork project thematic areas. Vilnius Tech's research strategy is visualised in Figure 7.

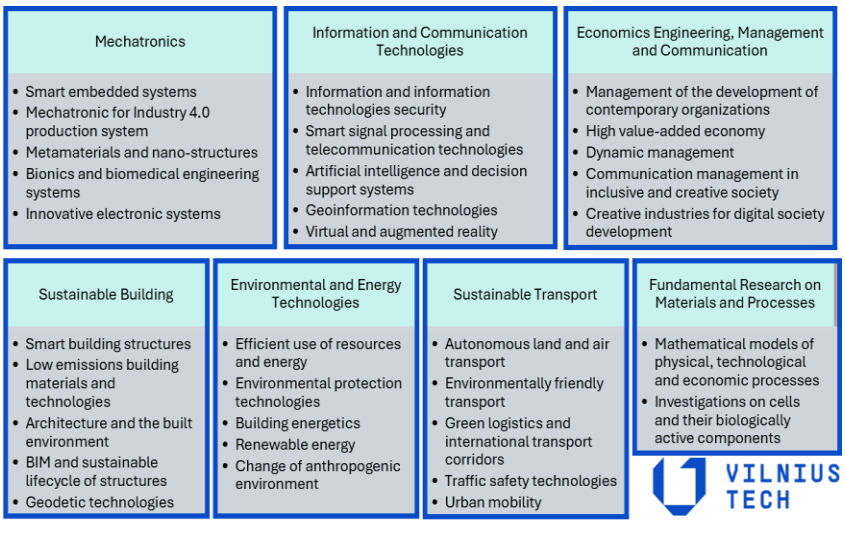


Figure 7. *VILNIUS TECH research strategy overview.*

LSMU focuses on research and experimental development in Medical and Health Sciences, Natural Sciences, and Agricultural Sciences. LSMU is valuable for its activities in medical imaging, clinical data collection, background experience in precise management of data collection and analysis, and providing valuable labelled datasets based on expert knowledge. LSMU's research strategy is visualised in Figure 8.

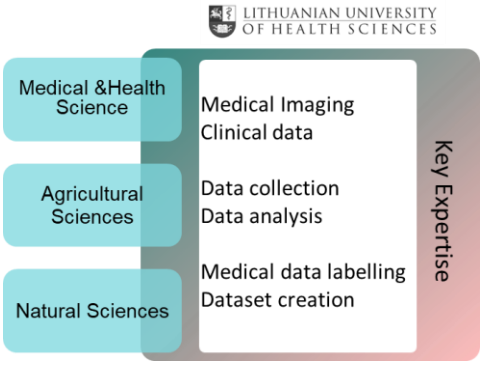


Figure 8. *LSMU research strategy overview*

2.2 Research Excellence in AI related fields

TAU has received funding from the Research Council of Finland (former Academy of Finland) to expedite strategy-based research profiling in Finnish universities to improve the quality of research. The grants received are for Intelligent machines; Circular economy; Intelligent Society Platform (INSO); TAU imaging research platform; System-on-Chip and Wireless Technology for Intelligent Machines.

The Finnish Doctoral Program Network in AI launched in 2024 to build a world-class PhD program with quality supervision, mobility, and multi-disciplinarity as integral parts. The Intelligent Working Machines (IWM) doctoral program educates new generations of professionals to the PhD level with multidisciplinary engineering knowledge needed for intelligent machinery development. The doctoral training connects academic research excellence with relevant industrial research and development challenges and accelerates industrial renewal in the machine industry.

Additional research groups include the Platform of Excellence in Mobile Work Machines, Centre of Excellence in Generic Intelligent Machines Research (2008–2013), and Tampere Institute for Advanced Study (TIAS). TAU conducts an international assessment of all research at regular intervals. The first research assessment exercise (TAU RAE 2022) was done as an international peer review in two phases.

TUHH research field 'Cyber-Physical & Medical Systems' contains activities on AI in healthcare. A recent initiative to foster innovative research has been the I³ program[25] ("Interdisciplinary und Innovation in den Ingenieurwissenschaften" / interdisciplinarity and innovation in engineering), with two funded I³ labs focusing on healthcare, i.e., focusing on model-based machine learning for soft tissue analysis and interface research. The research initiative 'Machine Learning in Engineering' represents the broad spectrum of AI methods studied and applied at TUHH. A recent research focus is engineering to face climate change with the Climate Informed Engineering research group.

TUHH operates a graduate academy for all PhD students and participates in DASHH (Data Science in Hamburg HELMHOLTZ Graduate School for the Structure of Matter) which offers a doctoral program focussing on AI and data science. Another joint initiative in Hamburg is the Hamburg Research Academy, which supports PhD and entry-level researchers at all member institutions, including TUHH.

The Centre for Teaching and Learning at TUHH and the Hamburg Open Online University (HOOU) foster teaching activities, including outreach and virtual classes on AI. TUHH is a member of ahoi-digital, an alliance of universities focusing on computer science education and research. Collaboration

[25] TUHH: I3 Program

among Hamburg metropolitan research institutions is also coordinated through the PIERplus initiative. The Hamburg Institute of Advanced Studies (HIAS) provides a broader platform for scientific collaboration.

KTU has 5 relevant research groups: Artificial Intelligence and Image Processing Methods in Multimedia; Internet-of-Things and Services; Multimodal Human-Computer Interactions; Multidisciplinary Models; Semantics and Knowledge-Based Engineering of Information Systems.

KTU has a growing number of research projects related to AI solutions in all the SustAInLivWork thematic areas, however, most are national and focused on the health sector. Examples include pose estimation, hydromorphology of rivers, speech enhancement for laryngeal cancer patients, improving public health, and diagnosis of neonatal brain injury.

KTU has multiple study programs (SP) in AI, including 1st cycle SP on Informatics, 1st cycle SP on AI, and 2nd cycle SP on AI in Computer Science. The 1st cycle SP on AI provides competencies enabling the development of AI-based computer systems. The 2nd cycle AI SP provides knowledge of modern AI methods, data processing, optimisation and other fundamental sciences based on computing, systems analysis, and mathematical models. The SKILLed AI Talent Academy provides career competencies in AI, life skills, and financial benefits for KTU Bachelor students.

A joint doctoral program on informatics is run with VMU and Vilnius Tech (coordinated by KTU). Students investigate the fields of data analysis, signal and image analysis, simulation modelling, computational intelligence, physically-based behaviour, development and analysis of general dynamic models, cryptography algorithms, etc.

VMU focuses on applications of Statistics, Machine Learning (ML), and AI. Research focuses on the application of AI in five key domains.

The AI and language technologies in healthcare domain includes a large range of topics such as AI and statistics for digital phenotyping, modelling and AI in neuroinformatics, genetic data analysis, cardiovascular disorder prediction, and anonymisation of healthcare records. The other domains are AI and statistical models for energy load and usage balancing; Signals fusion for environment surveillance; Language technologies for information space analysis; and Predictive maintenance, e.g., identification of issues in IT infrastructure, and applications of predictive maintenance in wind power generation.

VMU participates in a joint doctoral school with KTU and Vilnius Tech, led by KTU. The main dissertation topics are research and application of AI in medicine, language technologies, etc.

Vilnius Tech has AI-focused research strengths across all the SustAInLivWork thematic areas, e.g.: Manufacturing - cybersecurity solutions; Energy - renewable energy forecasting, predictive maintenance, monitoring and control of HVAC systems; Transport - road condition monitoring, thermal imaging for road safety, vision-based human activity recognition, driver interaction with autonomous vehicles, 5G hardware for public transport; Health - human skeleton motion tracking, biomedical signal analysis for Parkinson disease patient monitoring, migraine detection, chronic pain monitoring, gait analysis.

Research is conducted in various institutes and faculties, including the Antanas Gustaitis Aviation Institute and the Faculties of Civil, Environmental, Electronics, Fundamental Sciences, Mechanics and Transport Engineering. Various EU-funded projects have focused on using AI methods, particularly for railway and vehicle dynamics analysis.

Vilnius Tech has doctoral programs alone or in collaboration with other institutions in 12 fields of science across 4 areas: Humanities, Natural Sciences, Social Sciences, and Technological Sciences. AI is used across multiple programs, while AI development is mostly in Informatics, Electrical and Electronic Engineering. Key AI technology development includes virtual try-on solutions; deep-fake video identification; video depersonalisation; audio depersonalisation; voice detection; landmine detection; and radio wave analysis-based drone detection and identification.

The Comparative Expert Assessment (CEA) of Research and Development Activities is organised by the Research Council of Lithuania and evaluated by international experts. The CEA is conducted every five years and used to allocate part of the basic state funding for R&D.

LSMU specialises in activities around AI in healthcare. There are four main research institutes, each with various specialised laboratories. The Institute of Cardiology conducts research in basic and clinical cardiology and population-based cardiovascular epidemiological studies. The Institute of Endocrinology carries out basic, clinical, and epidemiological studies on endocrine system diseases. The Institute provides a scientific basis for PhD studies and develops the scientific qualifications of teaching staff.

The Institute of Neuroscience researches neuroscience and behavioural medicine. The Institute has a hospital (Palanga Clinic) where treatment/rehabilitation programs are provided for patients with cardiovascular diseases and stress-related disorders. The Institute of Animal Science conducts animal science research in agricultural sciences. The Institute develops innovations on an experimental basis to provide competitiveness and sustainability of animal production, trains highly qualified specialists, and preserves and upholds farm animal breeds and the biodiversity of genetic resources.

Additionally, LSMU has nine faculty institutes: Institutes of Anatomy, Pharmaceutical Technologies, Physiology and Pharmacology, Animal Husbandry Technologies, Microbiology and Virology, Oncology, Health Research and Digestive System Research.

Doctoral studies are in 10 scientific fields across the areas of Natural, Medical and Health, and Agricultural Sciences. Two of these fields are closely related to AI: Medicine and Public Health. During PhD studies, health data and images collected are used to solve scientific problems.

Conclusion on Research Excellence Findings

Key strengths are shown in medical research by VMU, KTU, and especially LSMU. This area of expertise presents an excellent opportunity to focus on applying AI technologies to the existing areas of research. This research will benefit from the advanced resources and collaborations across the partner institutions, made possible through the CoE. VMU and KTU additionally have a strong focus on AI research in language analysis, databases, and tools, which may present further opportunities for innovation.

VILNIUS TECH shows a broad range of research topics, with strengths in energy and transportation research. The descriptions show limited manufacturing and industry-focused research across the Lithuanian partner institutions, especially compared to the advanced partners. Key investment in the expertise and facilities required to bolster the research areas of manufacturing, transport, and green energy is a prime focus for the CoE. ***Figure 9*** summarises the findings across the Lithuanian partner

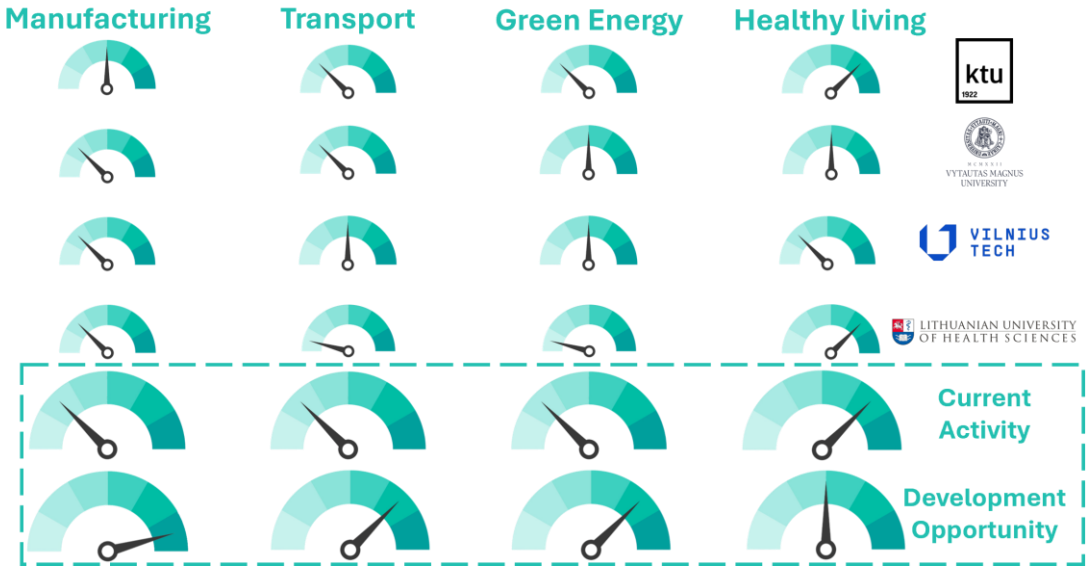


Figure 9. *Summary evaluation of current research activity and potential opportunity concerning the SustAInLivWork research themes*

institutions.

Increasing the number of doctoral researchers in a range of fields is important to raise the quality and quantity of AI research. For this to be effective, BSc and MSc programs should equip students with fundamental AI research and innovation skills. Highly skilled graduates will enable the adoption of new technology into industry and will have the skills necessary to continue an academic career.

2.3 Research Capacity

TAU hosts several advanced research labs. Robolab allows students and researchers to experiment with robotic equipment, offering industrial manipulators, mobile robots, sensors, and processing platforms. The HRC pilotline supports Human-Robot Collaboration in manufacturing, enabling hands-on learning and prototyping in a pre-commercial "test before invest" environment. The mobile machines test ground is designed for off-road machinery and robotics research, featuring over 10 instrumented machines and a 4000 m² test area with diverse surfaces, excavation area, and slopes up to 18 degrees.

The Centre for Immersive Visual Technologies (CIVIT) provides facilities and expertise for visual content creation, advanced displays, spatial measurements, and user experience research, serving students, researchers, and companies.

Tampere Centre for Scientific Computing (TCSC) provides computational resources, with a Linux cluster, Narvi, offering high-speed connections, large data storage, and Graphics Processing Units (GPUs). TCSC is part of the Finnish Computing Competence Infrastructure (FCCI), which integrates computational resources across Finnish universities. FCCI supports data-intensive research, AI, and HPC, linking universities to national and European computational resources (Tier-1 and Tier-0) like CSC (IT Center for Science) and European High-Performance Computing (EuroHPC). It serves a wide range of disciplines, including science and the arts.

TUHH research infrastructure is largely operated by the research institutes. This includes lab space and equipment like machines and robots, etc., as well as living labs and larger scale infrastructure, e.g., the ForLab HELIOS for microelectronics and photonics. Various workshops and the WorkINGLab provide space and infrastructure for rapid prototyping.

The HPC cluster at TUHH-RZ consists of 200 compute nodes, several login nodes and a parallel storage system with a capacity of 300TB. All in all, about 8700 CPU (Central Processing Unit) cores, 70 TB RAM and dedicated GPU servers are available for compute-intensive workloads. Researchers at TUHH can also access the infrastructure at the House of Computing and Data Science in Hamburg.

KTU has a variety of infrastructure for AI solution development, with dedicated hardware available in research centres such as M-lab, AI centre, Centre of Real-Time Computer Systems, Biomedical Engineering Institute, Virtual and Augmented Reality Technology Laboratory, etc. These centres provide access to diagnostic and measurement technologies, smart environments, IT solutions, and sustainable development technologies, with descriptions and resources available online.

The KTU AI Centre offers HPC services, featuring powerful resources such as 5 Dell PowerEdge R7525 servers (AMD EPYC 7452 32-Core Processor, 512GB RAM, NVIDIA A100 GPUs). Researchers can access Jupyter Notebooks with Python, R, ROOT C++, and packages like TensorFlow-GPU and MXNet, with expansion options.

KTU also connects to the Lithuanian GRID and High-Performance Computing Network (LitGrid-HPC), a national infrastructure providing advanced computing capabilities. LitGrid-HPC is integrated with the European Grid Infrastructure (EGI) and Euro-HPC. KTU is part of the CERN-LT consortium, granting its researchers access to CERN's (European Organization for Nuclear Research) cloud computing resources for cutting-edge research.

VMU collaborates on research in computational linguistics with the Faculty of Humanities, utilising the Computer Linguistics Centre resources, including virtual machines and AI-based language tools. VMU is part of CLARIN, a European Research Infrastructure Consortium providing open digital language resources and analysis tools for social sciences and humanities researchers worldwide.

Most of VMU's specialised equipment is mobile and can be used in various spaces, including the Computer Networking Laboratory and Smart Systems Laboratory. The Multimedia Specialised Laboratories include the Multimedia Laboratory, the Photography Studio, the Audiovisual Technology Laboratory, the Augmented Reality Laboratory, and 3D Modelling, featuring technologies like 3D scanning, virtual reality, bio-signal recording tools, and holographic displays.

AI computation needs are supported by the SITTI Research Institute's computing cluster, which consists of 192 vCPUs (virtual CPU), 576GB RAM, 12 GPUs, 6TB SSD (Solid-State Drive) and 14TB disk storage. This infrastructure enables parallel computations and resource reservation for researchers. Additional computational resources include 480 vCPUs, 3136GB RAM, and 98TB HDD (Hard Disk Drive), accessed via VMU's cloud infrastructure for distributed research tasks.

VILNIUS TECH offers a range of centres for research activities. The Sustainability HUB promotes sustainability culture and competencies, and advocates for change in society's behaviour. The HUB has areas for data modelling, eco-design, and sustainable consumption experimental demonstration. The Aerospace Data Centre investigates the adaptation of unmanned aircraft payloads. The "LinkMenų fabrikas" innovation and creativity centre offers a workspace for students and researchers, with access available for industry professionals to accelerate R&D innovations. There are also facilities frequently used by Vilnius Tech VR and AR Competence Centre researchers and volunteers.

The Digital Defence Competence Centre aims to improve cybersecurity, tackle disinformation issues, and improve resilience to cyber and information attacks. The Cybersecurity Competency Centre is under development and will dedicate attention to AI applications in cybersecurity, providing the required infrastructure for research and development.

The Transport and Logistics Competence Centre (TLCC) conducts international-level research on sustainable transport, participates in international and national projects, and applies the acquired knowledge and skills in the Faculty of Transport Engineering. The Laboratory of Building Energy and Microclimate Systems conducts research and knowledge dissemination across various aspects of renewable energy and energy efficiency and provides mobile indoor climate laboratory services.

Computing resources available include the HPC cluster VANAGAS; OpenStack cloud computing services; Cloud storage services; and Computing resources for AI model training (12 nodes with a single GPU for AI training). Additional infrastructure will be available at the beginning of 2025 after an investment of over €500k.

LSMU research infrastructure is largely operated by the research institutes previously mentioned. Additionally, LSMU is a member and active partner of 2 "science valleys" in Lithuania, which serve as clusters between science, education, and business, in dedicated areas.

- Santaka Valley focuses on measurement technologies, materials for high technologies, and ICT. It serves as a one-stop shop for interactions between businesses and universities.
- Nemunas Valley focuses on scientific, technological and infrastructure R&D in the agricultural, forest and food sectors. It strives to commercialise scientific results, transfer technologies, and establish new, knowledge-intensive economic entities. Cooperation with researchers, science and study institutions is key to increasing competitiveness in the international market.

LSMU Data Analytics Centre (DAC) conducts fundamental and applied research on health data to help and advice researchers and scientists at the University and University Hospitals on data analytics and tools for analysis. Services provided include tools, infrastructure, and recommendations in research data management and reuse, and health data-based scientific research.

HPC infrastructure comprises 6 nodes with a total of 224 cores, 891GB RAM, 300TB storage, and GPU computing with NVIDIA A100 as mainstream 80GB and four NVIDIA 4080. Researchers at LSMU can also access the infrastructure at the State Data Agency of Lithuania.

Conclusion on Research Capacity Findings

The CoE institutions show a good level of capacity for research with various key equipment available. Most labs focus on providing small-scale equipment that can be used as a tool, e.g. VR, 3D printing, 3D scanning, etc. Consideration should be given to dedicated lab space with investment into specific research

areas requiring specialised equipment, e.g. robotics, manufacturing, surgery, prosthetics and rehabilitation, power systems, etc. Local HPC facilities with limited scale currently exist at the partner institutions. Preliminary additional plans have been developed under Task 1.5: "SustAInLivWork CoE Infrastructure development", with further updates in the coming months. The requirements for modern AI developments change constantly. Regular reviews and planning must be done to ensure investment is made early enough to meet future needs.

There is a current lack of ability to share resources between institutions, both within the CoE and externally. In relation to AI development, this is particularly relevant to compute resources, datasets, processing pipelines, and models. How this will be managed is a key focus of Task 2.3: "AI-relevant data platform". Current examples of similar shared resources include TAU's access to supercomputer LUMI (Large Unified Modern Infrastructure), of particular note due to its sustainable operations through renewable energy use and heat management.

2.4 Innovation

High levels of innovation competencies increase the translation of research from academia to industry. This is essential for adopting technology into commercial settings where social, economic, and environmental benefits can be realised. Innovation services and initiatives promote the collaboration between research and commercial settings. This improves both, academic research, with new ideas and impactful research opportunities, and smooths the translation of research into industry, achieving social, economic, and environmental benefits. TAU and TUHH offer significant numbers of services and initiatives, summarised in **Error! Reference source not found.**, to aid collaboration &communication between research and commercial partners, as well as to promote innovative research.

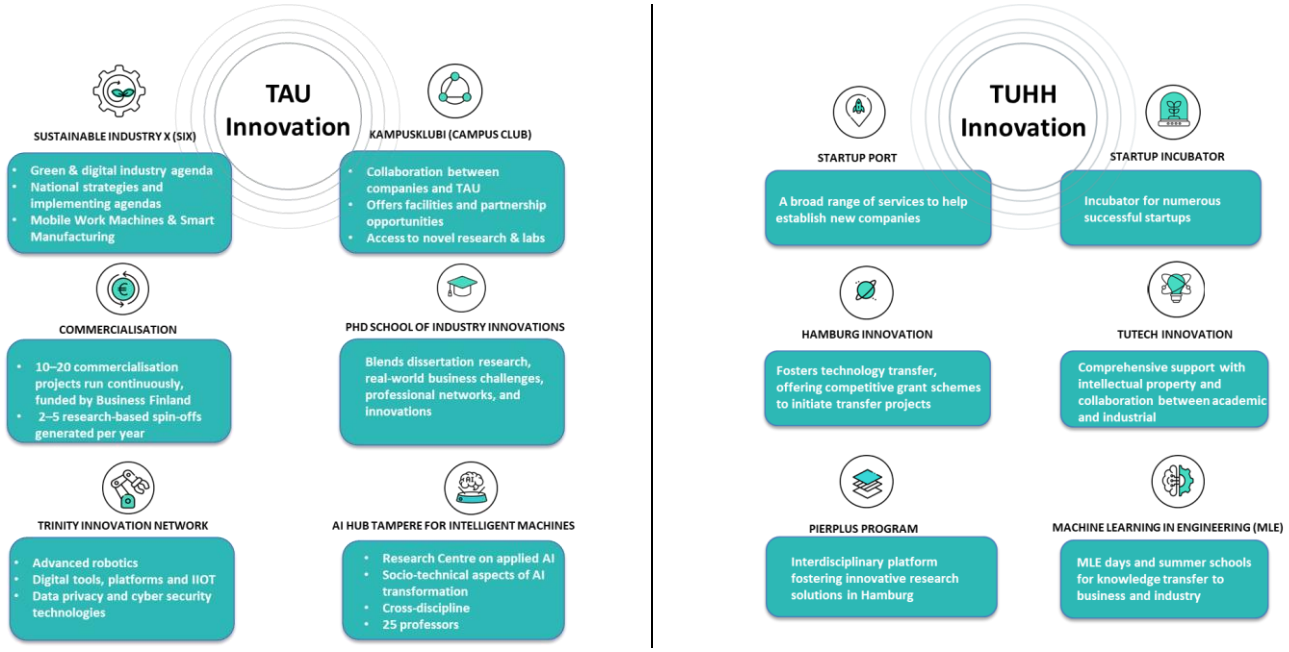


Figure 10. *Summary of innovation activities at advanced partners (TAU and TUHH)*

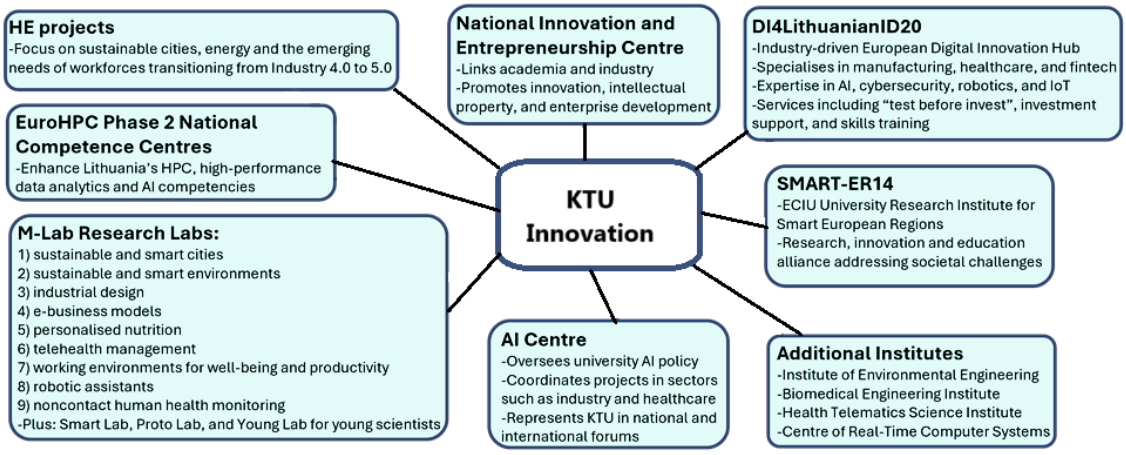
The innovation activities and service types of the advanced partners TAU and TUHH can be grouped into the following key categories, as also shown in Figure 11:

KTU offers many services focused on technical aspects of industrial collaboration (E.g. access to research facilities, technical expertise, etc). The other CoE partners have a limited variety and depth of services to promote innovative research and to link with external organisations. Providing innovation services across the CoE is vital to ensure bidirectional collaboration between academia and business. These technical services should also be met with expertise, services and networks associated with 'soft' skills needed for collaboration, e.g. support services for spinouts, education and outreach programs, knowledge-sharing networks and hubs across academia, industry, and government. The CoE partners have a strong background in innovative research projects which can be further built on through innovation services and collaborations to realise the full social and economic benefits. Further specification and development of these services will be done in future work packages, namely D3.1 – "SustAInLivWork Joint Tech-transfer and knowledge valorisation Agenda & framework"[26] and D3.4 –

Startups	Collaborations	Policy, Strategy and Agenda	Education & Outreach
• Services to facilitate startups from university research • Key to bridging TRL gaps • Access to R&D facilities and space • Services to help with e.g. IP, grants, management, etc	• Collaborate with existing companies on research • Conduct research on behalf of partners • Academics working as consultants for companies • Provide facilities for 'test-before-invest'	• Work with government, industry, research & education providers • Work on policy development and implementation • Facilitate spreading of advanced tech to industry	• Provide education and outreach across all ages and demographics • Inspire future research and adoption of tech • Increase acceptance of AI tech in industry and society

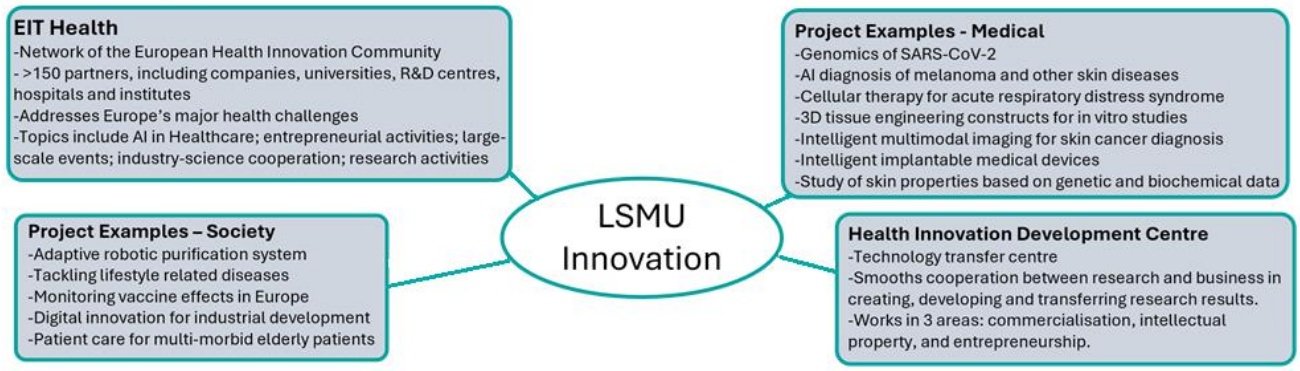
Figure 11. *Summary of innovation activity and service types*

"AI start-ups acceleration guidelines for sustainable living and working"[27]. Figure 12,**Error! Reference source not found.** summarises the innovation activities of the Lithuanian CoE partner institutions.

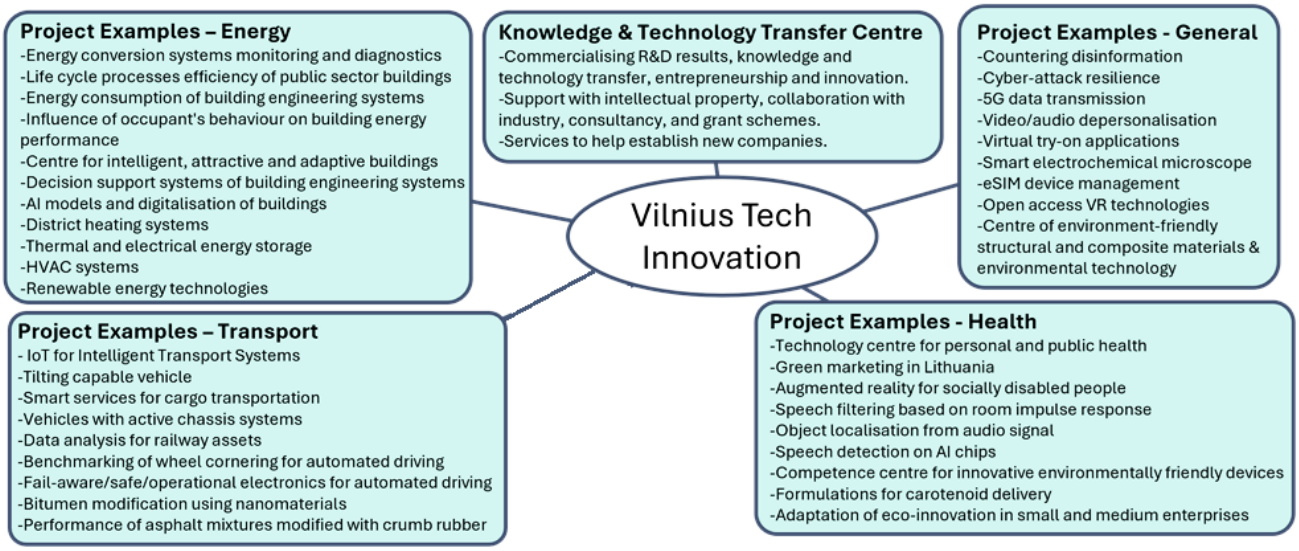


a) KTU innovation

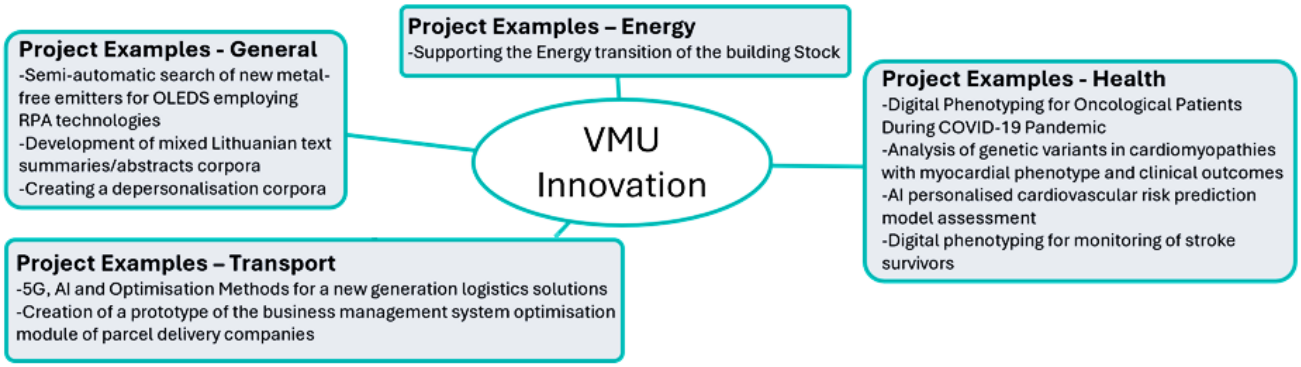
[26] D3.1 – "SustAInLivWork Joint Tech-transfer and knowledge valorisation Agenda & framework", M24, TAU
[27] D3.4 – "AI start-ups acceleration guidelines for sustainable living and working", M30, KTU



b) LSMU innovation



c) Vilnius Tech innovation



d) VMU innovation

Figure 12. *Summary of innovation activities at partner institutions (KTU, LSMU, Vilnius Tech and VMU).*

2.5 Research Facilities

Performing successful, innovative research requires appropriate facilities and equipment. Reporting from CoE partner institutes indicates a lack of high-quality resources and core research technology in

dedicated spaces. A detailed investigation into the research facility requirements of the CoE has been undertaken under D1.4 - Infrastructure Development Plan[28], which includes further information on current equipment and infrastructure along with proposed key investments.

Additional resources to support cutting-edge research are required beyond core technology, as illustrated in Figure below. AI research requires considerable computing infrastructure including high-speed data networks, HPC capabilities, significant data storage, and access to specialised software requiring licencing. Support services including prototyping equipment and associated floor space, and specialised technicians and support staff, allow for research to be streamlined. Driving high-impact innovation requires methods for industry to access research environments and collaborate with academics effectively. Managing space and resources effectively is therefore vital to making the best use of the investments made.

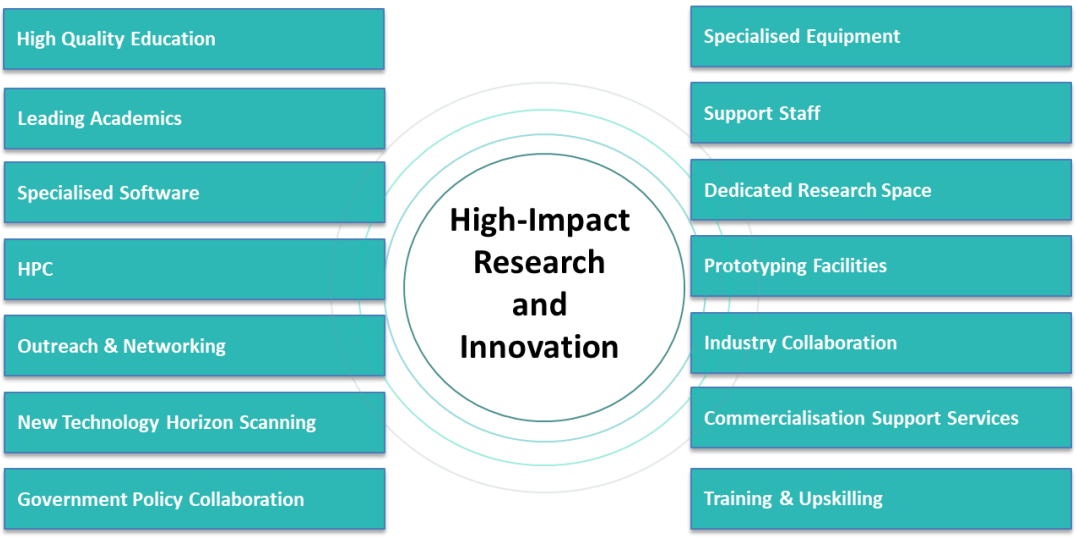


Figure 13. *Impactful research and innovation analysis requirements*

The current and future data needs of the partner institutions and CoE must be considered when developing the data storage and management systems. The institutions already have significant and valuable datasets, for example on language processing and medical data. How and where data is stored and accessed will be influenced by technological factors, as well as legal, ethical, and security considerations, see Section 5. Task 2.3 will consider these aspects further under the "AI-relevant data platform"[29].

[28] D1.4 – "Infrastructure Development Plan", 24.08.2024, KTU
[29] D2.3 – "AI-Relevant Data Platform", M36, Vilnius Tech

3 Strategic Objectives and Alignment

3.1 Defining Strategic Research Objectives

Analysis of the project proposal, newest Lithuanian strategic documents and guidelines and description of the action documents provides greater insight into the goals, ambitions and most important research objectives of the CoE. This analysis highlights various key objectives that may be summarised into the following points:

Table 6. *Key objectives summarised from the SustAInLivWork*

No.	Objective description	Key factors*	KTU	VMU	Vilnius Tech	LSMU	TAU	TUHH
1.	Develop intelligent solutions tailored to key sectors (METH) , driving economic growth and innovation.	T, C	✓	✓	✓	✓	✓	✓
2.	Offer cutting-edge AI infrastructure solutions, featuring HPC systems, to accelerate efficient AI development, deployment, and scaling	T, C	✓		✓			✓
3.	Develop advanced XAI technologies providing robust and stable multi-modal explanations	T	✓				✓	✓
4.	Develop sustainable AI approaches and drive their adoption in commercial applications	T, C	✓	✓	✓	✓	✓	✓
5.	Promote the creation of ethical AI frameworks that ensure fairness, accountability, and transparency across all application	T, C, S	✓	✓	✓	✓	✓	✓
6.	Create international standards for health data annotation, anonymization, and secure sharing	T, S	✓		✓	✓		✓
7.	Design and curate high-quality datasets in key sectors (METH) to support AI researches and accelerate the development of XAI solutions	T, C	✓	✓	✓	✓	✓	✓
8.	Establish infrastructure to test and validate AI solutions, offering early adopters a reliable environment to assess performance before investment (test-before-invest).	T, C, S	✓		✓	✓	✓	✓
9.	Become a certifying authority in assessing high-risk AI systems in compliance with the EU AI Act.	T, C, S	✓		✓	✓	✓	✓
10.	Provide guidance and support to political authorities to advance AI adoption in key sectors	S	✓	✓	✓	✓		
11.	Promote AI accessibility and education to drive awareness, understanding, and adoption of best practices across citizens, businesses, and government.	S, C	✓	✓	✓		✓	
12.	Offer AI tools to promote sustainability and active citizen involvement	S	✓	✓	✓	✓	✓	

*Key Factors: **T** for Technology, **C** for Commercial, **S** for Society

These considerations will guide the analysis of the research and innovation gaps within the current framework of the CoE partner institutions. This will lead to the identification of opportunities for R&I where meaningful impact may be achieved in line with the CoE ambitions.

Next, in Table 7, across the overarching themes of **technology**, **commercial,** and **society** focussed activities:

Table 7. *Summary of R&I gaps across key themes of Technology, Commercial and Societal activities*

Technology	**Manufacturing**	The partner institutions show limited AI-related manufacturing R&I activities. There is a significant gap to be exploited in researching technology that can be integrated into existing manufacturing settings with a high return on investment.
	Healthcare	Partner institutions show a strong research pedigree in healthcare and related society-based technologies. The key gap to focus on is how AI can be applied to existing areas of research. Furthermore, challenges around data acquisition, certification, privacy, explainability, and sustainability will need to be tackled. Identification of specific areas to focus on for high-quality research should be done, in line with EU SDG and S3 priority areas.
	Green Energy	Currently limited sustainable energy research. Existing R&I focuses on built environment efficiency and energy systems, maintenance prediction and decision systems. Given that sustainability is a focus of Lithuania and EU research strategy, this is a significant area for development.
	Transport	There is a large gap in research around transport-based AI technology. Vilnius Tech shows some projects looking into aspects of rail and road transport using AI. There is significant scope for breadth and depth of research in the transport sector, and in particular, a focus on innovation into commercial and sustainable opportunities.
Commercial	Commercial activities among the CoE partners are lacking in various areas. KTU has a good selection of commercialisation services to help facilitate technology transfer, collaboration, startups, etc. Similar services should be developed for the CoE, focussed on the thematic areas and available to all Lithuanian partners. LSMU has strong ties with healthcare research implementation through the Palanga Clinic. Collaborations and avenues for trialling healthcare research in real settings is a core benefit which would be a distinguishing strength of the CoE. The adoption of technology in clinical and societal settings does, however, present challenges around the requirements for industrial partnerships and certifications, which require further investigation.	
Society	Education, training and outreach are core to the success of the CoE vision. Significant steps are already in place, such as university education programmes focused on AI technology and collaborations on projects with other European partners. Further work is needed to raise awareness of the AI agenda across the wider public. Improved education for both children and adults on AI technology will help smooth the transition to a society highly integrated with AI safely and ethically.	

3.2 Opportunities for AI Research & Innovation

Key R&I opportunities identified are presented below. These are based on comparing the current strengths and capabilities of the CoE partners, the objectives of the CoE and the current gaps. Opportunities consider balancing areas where there is potential for growth with the realistic need for some existing expertise to succeed in achieving impactful results.

Technology

Manufacturing: Researching AI for manufacturing has strong potential for commercialisation in Lithuania. A key objective of the SustAInLivWork project is to implement advanced technology across industrial settings, thereby realising economic benefits. Targeted R&I activities should be done for specific manufacturing sectors core to the Lithuanian economy. Adopting advanced AI technology into SMEs should be seen as a prime opportunity. These companies often have very limited existing

technology, hence minimal investment requirements in automating processes can lead to significant benefits. A key blocker to SMEs in adopting such technology is that they lack the resources to research viable solutions coupled with a risk of not achieving a return on their investment. The CoE is ideally suited to provide expertise, guidance, "test-before-invest" services, and training. The exact offering will be developed in Task 3.3 as the "SustAInLivWork services package"[30].

Healthcare: The strong, existing healthcare technology research presents a leading opportunity for the CoE to focus on. Building on the variety of existing research activities, there is a need to identify and foster focus areas, both, from a technological and clinical perspective, and to develop a strategy for how the CoE can become an internationally visible institution in this field. This requires consolidating the areas of expertise to determine specific sub-areas to focus on. For example, the CoE partner institutions show strength in imaging for diagnostics, speech and language tools, and applications in cardiology. The advanced level of research and existing integration with government and medical practices also present a strong opportunity for high innovation. The CoE may help Lithuania to advance the integration of AI healthcare technologies into society.

Sustainable Energy: There is currently very limited research across the institutions on sustainable energy topics. Although this represents a significant opportunity for advancement, it is important to consider what achievable goals can realistically be set. To have high impact, the specific beneficiaries of research activities should be identified, for example, companies using a particular energy generation technology. The existing research is primarily focused on energy-efficient buildings and infrastructure maintenance by Vilnius Tech and VMU. A potential avenue for investigation is the energy consumption, implementation requirements, and maintenance needs of advanced AI technologies when integrated into, for example, manufacturing and healthcare settings. This link to other research sectors presents a strong case for high-impact collaborations.

Transport: Minimal existing R&I activities exist for transport technology. Vilnius Tech leads the developments with various road and rail focused research activities. Similar to the energy sector, consideration should be given to how the research activities will impact the Lithuanian economy and society. To have the greatest impact, specific analysis should be done to understand the transport sector in the country and identify avenues for R&I that will benefit the economy, society, and sustainability.

Commercial

The commercialisation objectives are focused on transferring research into real-world settings. As described under Technology, the manufacturing theme is particularly well suited to this, given the existing research base and links with industry. Healthcare also presents a good opportunity but is challenging due to data privacy concerns and stringent requirements for certification. Therefore, the focus should be on developing exchange platforms to facilitate the transition of AI technology from research to companies already working on healthcare solutions. For energy and transport, focused research may need more careful planning to yield effective results. In any case, the commercial developments require strong links with industry. Examples of activities to build networks with external commercial entities include:

[30] D3.3 – "SustAInLivWork services package", M26, KTU

- Services offered to industry e.g. test-before-invest environments, training services, networking and education events[31].
- Collaborative research opportunities[32].
- Strong links with university students through promotion and facilitation of internships, student projects on real scenarios from industry, and networking events[33].
- Clear services and pathways to navigate the commercialisation of technology research[34, 35].

Society

Many CoE R&I objectives related to societal matters are overarching themes that should be considered across all research activities. These include topics such as eXplainable AI, sustainable AI, and ethical considerations. The CoE should have clear guidelines for researchers and collaborators on the use of AI in their projects, similar to the ethical reviews that take place when experiments with human subjects take place. Developing such a clear framework and review process would be a strong beacon to other institutions for managing advanced AI in society. Concrete development will be reported in D4.3[36] and D4.4[37], however, despite the deliverables being due later in the project timeline, consideration should be given early on to help shape the operations of the CoE.

Further work on disseminating resources, results and outreach to the public is also a key focus of the CoE. Public engagement through education programs and outreach events will help ensure acceptance and understanding of AI technology, smoothing the transition to high-tech solutions across different sectors.

The strategic guidelines of the AI governance model identified different sectors where AI development would have the greatest economic impact in Lithuania: **manufacturing, health, agriculture, transport, and energy**. Consequently, the CoE prioritises these sectors as they align closely with its objectives and Lithuania's strategic goals. Research and innovation priority areas of SustAInLivWork are listed below:

Research Area: One Health solutions.[38]

Priority P1: Creating Open and Collaborative Standards for Health Data Annotation and Sharing

This priority addresses a critical need for standardized methodologies to annotate, store, and share health data. A significant barrier to effective data sharing is the variability in coding systems between member states. The Nordic-Baltic initiative emphasizes the need for cross-country collaboration in health data, which is crucial for achieving advanced interoperability in healthcare services[39]. This ensures interoperability, fosters international collaboration, and accelerates research and innovation

[31] D3.3 – "SustAInLivWork services package", M26, KTU
[32] D2.2 – "AI Research HUB map", M20, KTU
[33] D2.4 – "Scientific excellence and educational programmes Roadmap", M24, TAU
[34] D3.1 – "SustAInLivWork Joint Tech-transfer and knowledge valorisation Agenda & framework", M24, TAU
[35] D3.4 – "AI start-ups acceleration guidelines for sustainable living and working", M30, KTU
[36] D4.3 – "Guidelines on responsible deployment of AI", M60, TUHH
[37] D4.4 – "Recommendations for improving Lithuanian S3 and AI strategy", M66, KTU
[38] The healthy living focus area is impactful due to its crucial role in shaping the health and nutrition of humans and animals, and its contribution to environmental sustainability. All priorities support SDG 2 (Zero Hunger), SDG 3 (Good Health & Well-Being), and SDG 12 (Responsible Consumption & Production).
[39] https://pub.norden.org/temanord2023-542/4-findings-of-work-package-2-use-of-health-services-in-another-nordic-or-baltic-country-.html

in healthcare. This includes working closely with healthcare institutions and regulators to ensure compliance with privacy regulations such as GDPR and the Health Insurance Portability and Accountability Act (HIPAA), as well as fostering international partnerships to develop open-source annotated datasets to advance AI research in healthcare.

Priority P2: Remote Health Monitoring Ensuring Timely Intervention & Personalised Care

The establishment of remote health monitoring systems represents a significant advancement in healthcare delivery, enabling proactive management of patient health through continuous monitoring and data analysis. By combining diverse data sources, such as electronic health records, patient-reported outcomes, and other factors, holistic patient profiles can be built. This aligns with various strategic documents, research funding programmes and future health agendas[40],[41],[42] that prioritize creating tailored treatment plans in the health sector. Although remote health monitoring (telemedicine) is primarily a civilian field, AI can be effectively adapted for telehealth in the military, particularly for monitoring personnel health and providing treatment in hard-to-reach areas or at military bases.

Priority P3: Cancer Early Detection and Diagnosis

Europe's Beating Cancer Plan[43] aims to turn the tide against cancer and serves as another stepping stone toward a strong European Health Union and a more secure, better-prepared, and resilient EU. One of its key tasks is improving the early detection of cancer. Therefore, there is a crucial need to develop AI analysis methods to diagnose cancer types using various imaging techniques, such as mammograms, CT scans, and MRIs, enabling faster detection with improved accuracy. AI methods will also integrate multiple sources of information, such as health records, lifestyle data, and genetics, to provide more reliable and earlier detection. Additionally, AI models should deliver explainable results, allowing clinicians to verify findings and interpret the results more effectively.

Research Area: Innovative Manufacturing Technologies

Priority P1: Predictive Maintenance

AI algorithms can use large amounts of data from sensors and other IoT devices embedded within manufacturing machines to detect and predict failures before they occur. Using real-time operational and historical data from machines, ML models can analyse patterns within the data and predict faults/failures before they occur, along with prescribing solutions and actionable insights for proactive preventive maintenance. By reducing the need for reactive maintenance and optimising resource allocations, AI-based predictive maintenance enables improved efficiency and reliability of manufacturing technologies. Additionally, AI-based predictive maintenance can also be used to reduce Scope 1 and Scope 3 emissions[44].

Priority P2: Anomaly detection

[40] https://data.kurklt.lt/wp-content/uploads/2024/03/Dirbtinio-intelekto-valdysenos-modelis.-Strategines-gaires.pdf
[41] Personalised medicine - European Commission
[42] Survey: Shaping the Future of Personalised Prevention in Healthcare - European Partnership for Personalised Medicine - EP PerMed
[43] A cancer plan for Europe - European Commission
[44] https://www.nationalgrid.com/stories/energy-explained/what-are-scope-1-2-3-carbon-emissions

AI-powered anomaly detection can identify irregularities in manufacturing processes, ensuring quality control and preventing defects. This can enhance product quality and reduce waste. By combining different techniques, more accurate and versatile anomaly detection systems can be developed[45]. Improving AI techniques for learning from unlabelled data is a key challenge for adaptability to real-world manufacturing scenarios[46]. For use in fast-paced manufacturing environments, reliable, accurate predictions with low latency are required[47]. Developing explainable AI tools is key to helping operators understand and interpret the outputs of anomaly detection systems[47]. Additional research is needed into methods to integrate AI-based anomaly detection systems into existing manufacturing systems for improved operational efficiency.

Priority P3: AI-powered robotics

Integrating AI with robotics can enhance automation in manufacturing, improving precision and efficiency. AI tools can help robots perform complex tasks, adapt to changes, and work alongside humans safely. There is significant scope for research in various areas, such as enabling robots to learn through interaction with the world, vision recognition of complex parts in real environments, and human intention recognition. Enhancing robots with advanced AI perception, decision-making, and control methods will help them adapt to new manufacturing settings, increasing production efficiency and reducing workers' physical and mental load.

Priority P4: AI-Powered Quality Assurance

AI can automate quality assurance processes by analysing product data to detect defects and ensure compliance with standards. This can improve product quality and reduce the need for manual inspections. Recognition of complex and subtle defects is challenging; hence the use of AI models can help with recognition accuracy[48]. Developing AI models that can run efficiently on edge devices, enabling faster real-time defect detection and decision-making on the production line are key AI research avenues[49]. Research and development of AI algorithms that can predict potential quality issues before they occur, thereby enabling proactive interventions, is a further opportunity[50], along with improving AI-driven root cause analysis to identify the underlying causes of quality issues[48].

Research Area: Green Energy

Priority P1: Predictive Analytics for Energy Generation

AI can optimise energy generation by predicting demand and adjusting production accordingly. This can improve efficiency and reduce waste in energy production. AI-driven grid management systems can better balance the intermittent nature of renewable sources with energy demand, ensuring grid stability and efficiency. Creating AI algorithms to optimise the deployment and operation of energy storage solutions, and determining optimal charging and discharging times based on predicted supply and demand, is critical for increasingly distributed energy systems[51]. AI systems that can analyse sensor data from energy equipment to detect anomalies and predict potential issues before they occur

[45] https://www.appliedai.de/en/insights/anomaly-detection-manufacturing
[46] https://www.rapidinnovation.io/post/ai-in-anomaly-detection-for-businesses
[47] https://www.leewayhertz.com/ai-in-anomaly-detection/
[48] https://www.hso.com/blog/enhancing-product-quality-and-reliability-with-ai-for-manufacturing-quality-control
[49] https://metrology.news/leveraging-ai-for-enhanced-quality-control-in-manufacturing/
[50] https://www.datategy.net/2024/11/25/how-ai-transforms-quality-control-in-modern-manufacturing/
[51] https://www.gep.com/blog/mind/artificial-intelligence-accelerating-clean-energy-transition

can help provide more reliable infrastructure. Advanced AI methods can generate scenarios for predicting greenhouse gas emissions and model the impacts of different energy strategies on climate change, helping reduce the environmental impact of energy generation and enabling energy companies to set realistic emission targets and track progress towards sustainability goals[51].

Priority P2: Intelligent Energy Storage Solutions

AI can enhance energy storage solutions by optimising the charging and discharging schedules. This can improve the efficiency and lifespan of energy storage systems and help balance supply and demand in energy systems. Key developments include AI models that optimise the deployment and operation of energy storage solutions, determining optimal charging and discharging times[52]. Further creating AI systems that can integrate renewable energy sources with energy storage technologies for efficient energy management[52] will help provide a more efficient and reliable energy network.

Priority P3: Renewable Energy Forecasting

AI can improve the accuracy of renewable energy forecasts, enhancing the reliability and stability of renewable energy systems This will help integrate renewable sources into the energy grid more effectively. Developing more sophisticated machine learning algorithms will improve the accuracy of renewable energy output predictions, particularly for wind and solar power[53]. This includes creating AI models that can integrate multiple data sources, such as satellite imagery, ground sensors, and weather stations, to provide more precise forecasts of renewable energy generation[Error! Bookmark not defined.,53].

Priority P4: Enhancing the use of AI for developing energy-efficient, sustainable buildings

AI can optimise building design and operation to improve energy efficiency and sustainability. Developing advanced AI-driven building management systems can optimise energy usage in commercial and residential buildings[52]. This includes the creation of AI systems that control HVAC systems, lighting and energy management based on occupancy and environmental factors[54]. These developments will help reduce the energy consumption and environmental impact of buildings.

Research Area: Transport

Priority P1: Sustainable Urban Planning

AI can support sustainable urban planning by analysing traffic patterns, land use, and environmental impact data. This can help design more efficient, liveable, and environmentally friendly cities. Focusing on transport, AI algorithms can be developed to analyse traffic flows, predict congestion, and suggest optimal routes to reduce emissions and travel times[55]. AI can analyse urban data and suggest eco-friendly transportation networks that reduce congestion and emissions. The placement and management of electric vehicle charging infrastructure could also be optimised using AI systems[55].

Priority P2: Information & Services (I&S) Solutions for Public Transport

[52] https://www.fdmgroup.com/news-insights/ai-in-energy-sector/
[53] https://www.kyotutechnology.com/the-role-of-ai-in-optimizing-renewable-energy-production/
[54] https://www.energymonitor.ai/interviews/in-conversation-how-ai-can-optimise-energy-use-and-aid-the-green-transition/
[55] https://sustainabilitylinkedin.com/ai-driven-strategies-for-sustainable-urban-development-in-smart-cities/

AI can enhance public transport systems by optimising routes, schedules, and operations. This can improve service quality, reduce costs, and encourage more people to use public transport. For example, user experience can be improved through AI algorithms that provide real-time, personalised travel information to passengers, including accurate arrival times, route changes, and service disruptions[56]. Improved route planning can be achieved through AI systems that analyse multimodal transport systems (e.g., buses, trams, bicycles, etc.), demand forecasting, historical data analysis and real-time inputs[57].

Accessibility can be enhanced through AI-powered multilingual communication systems, such as Project Luna, which uses AI to translate information into sign language for deaf and hard-of-hearing passengers[58]. Additionally, AI-driven smart ticketing systems can streamline the user experience and optimise fare management. Dynamic pricing models using AI to adjust fares based on demand, time of day, and other factors, can maximise revenue for public transport operators while ensuring fairness[56]. Implementing AI-powered video analytics for real-time monitoring of public transport vehicles and stations will enhance passenger safety and security[56].

Priority P3: AI-Powered Predictive Maintenance for Transport Infrastructure and Vehicles

AI can predict maintenance needs for transport infrastructure and vehicles, reducing downtime and improving safety. This can enhance the reliability and efficiency of transport systems. Research is needed to develop sophisticated AI algorithms to analyse diverse data sources, including sensor data, historical maintenance records, and environmental factors. Incorporating emerging sensor technologies, such as IoT devices, into existing transport infrastructure will help enhance the data available. AI systems for real-time vehicle and infrastructure health monitoring enable immediate intervention when issues arise. Developing AI-driven decision support tools will help provide actionable recommendations to maintenance crews and fleet managers to optimise resource allocation and maintenance scheduling.

3.3 Collaboration

Multidisciplinary internal and external collaboration is key to many modern advancements and fundamental to the aims of the CoE. Collaborations allow for the development of new technologies in new areas, and the potential impact on society to be realised. Many existing research environments struggle to facilitate collaborations for modern research, hence the new CoE presents an opportunity to design structures and systems into the operating methods which enhance collaborative opportunity. Managing the collaborative nature of research between the partner institutions, across the four thematic areas and within specific research topics may be challenging. Consideration should be given to how this can be facilitated, e.g. through networking events, seminars, expertise and resource databases, and working environments that promote interactions between colleagues.

Particularly relevant initially are the collaborations with other research institutions. This includes the advanced partners, TAU and TUHH, and other research ecosystems such as DIHs. Building and strengthening networks can lead to higher impact R&I, with greater benefits to society in Lithuania.

[56] https://attractgroup.com/blog/ai-in-public-transport/
[57] https://praxie.com/ai-driven-efficiency-in-public-transportation-systems/
[58] https://www.rtinsights.com/transforming-public-transit-with-ai-and-machine-learning/

Opportunities that promote these collaborations include master's internships at different institutions, doctoral placements, collaborations on research projects and grant applications.

4 Planning, Execution and Monitoring

4.1 Timeline and Milestones

Developing R&I goals and milestones will ensure that the CoE maintains momentum and maximises impact. Indicative goals over short, medium and long-term timespans are given below, in line with the launching, growth and self-sustainability phases of the overall project[59].

Short Term (0–24 Months):

- Key Research Areas: Identification within overarching CoE themes.
- Infrastructure and Equipment: Requirements identified and implemented.
- Personnel Hiring: Recruitment of research, technical, administrative, and innovation staff.
- Innovation Services: Implementation and promotion for visibility and accessibility.

Medium Term (24–72 Months):

- Core Research: Conduct and publish datasets, tools, and papers.
- Networking: Attend and organise conferences, seminars, and summer schools.
- Education Portfolio: Develop AI programs at BSc, MSc, and doctoral levels.
- Industry Collaboration: Engage in technology transfer and test-before-invest programs.
- Outreach Activities: Collaborate with government, businesses, schools, and the public to foster AI adoption.

Long Term (72+ Months):

- Research Growth: Invest in cutting-edge technologies and global collaborations.
- Industry Partnerships: Continue regular collaborative projects.
- Startups: Support successful ventures based on CoE research.
- Education and Outreach: Embed within society with regular reviews to ensure relevance.

4.2 Agenda for Future R&I Activities

According to the Description of the Action[60], the following deliverables related to this R&I Agenda will be developed over the coming months. The descriptions below highlight the key information that will be presented in each deliverable. Open questions to be answered in preparation for the outputs identified through the preparation of this report are highlighted from the perspective of research and innovation activities. The institution responsible for each deliverable is indicated who will organise the necessary discussions to answer the questions and produce the deliverables.

M20 – D2.2 – "AI Research HUB map" - KTU: The Research HUB map will give details of the four research groups (RGs) within the CoE. Consideration should be given to the partner institutions' research strengths and current limitations identified in this report. The research map should ensure a focus on maintaining alignment with Lithuania's S3 priorities and aims of the CoE. The creation of the RGs will enable specific multi-disciplinary collaborative research projects to be identified and developed.

Key Questions: -Who will be in each RG, and what will the organisational structure be?
-What are the specific areas of focus the RGs will initially target?
-What will the management, reporting and evaluation structures be for the RGs?

[59] SustAInLivWork Annex 1 – Description of the Action (Part B)
[60] D2.2 – "AI Research HUB Map", M20, KTU

-What facilities currently exist and what additional requirements does the RG have?

M24 – D1.2 – "SustAInLivWork CoE Development Strategy" - KTU: Strategic document outlining the direction of the CoE. The creation of the research groups will provide a basis on which to shape the future strategic areas of focus for the CoE. Given the dynamic nature of AI research and the new CoE, the deliverable will be updated in M54 and M72.

Key Questions: -What strategic research directions have been identified from the RGs?
-How will the RGs continue to grow and drive innovative research?
-How will the CoE organisation facilitate collaborative, cross-disciplinary research?

M24 – D2.4 – "Scientific Excellence and Educational Programmes Roadmap" - TAU: The outreach and education provisions of the CoE are further key to its success. D2.4 will provide details on how these will be developed considering the creation of the RGs, identification of key research projects, infrastructure and research developments.

Key Questions: -What educational programmes will be provided through the CoE?
-How and who will manage and deliver these educational programmes?
-How can scientific excellence best practices be promoted throughout the partner institutions?
-Given the creation of RGs and research focus areas, what educational requirements are there to ensure academic excellence?

M24 – D3.1 – "Joint Tech-transfer and knowledge valorisation Agenda & framework" - TAU: As identified in this R&I Agenda, the provision of high-quality services and frameworks to bridge the gaps between research and commercial endeavours is key to innovative, impactful activity. Building off the findings of this report, D3.1 will create a detailed plan for the Tech-Transfer, Impact and Knowledge Valorisation HUB.

Key Questions: -What tech-transfer, impact, and knowledge valorisation services will be available through the CoE?
-How will these services be organised, managed and run?
-What methods will help bridge the gap between research and industry, and how will this be monitored and reported?

M26 – D3.3 – "SustAInLivWork services package" - KTU: The services package is available to business companies, industry, public bodies, etc. The services offered to external organisations will be highly linked to the innovation services and organisations detailed in D3.1. The services will also change over time, with updates to the services package made yearly (M36, M48, M60, M72).

Key Questions: -What services will be offered to external organisations and who will run them?
-How will the services provided benefit the CoE and external organisations?
-What funding model will be used for the services?
-How will these services be advertised to relevant organisations?

M36 – D2.3 – "AI-relevant data platform" – Vilnius Tech: The data platform will provide access to high-quality (labelled) data, software, code, algorithms, etc that will enable efficient research into AI and the development of solutions to cutting-edge problems. The requirements and architecture will be further detailed with input from the RGs considering the nature of research projects and the direction of future activity. This will be updated in M72 to ensure the platform is current with technological advancements.

Key Questions: -What hardware requirements are there for the platform?

-How will data be organised and managed for efficient access and use by members of the CoE?
-Who will be responsible for maintaining, organising, updating and organising training on the data platform?

4.3 Monitoring and Evaluation Framework

Monitoring of research and innovation progress is key to meeting the goals of the CoE. Evaluation must be done in the context of the wider AI R&I research and policy landscape. Analysing the current R&I progress and agenda with reference to the external factors listed below will enable the CoE to maintain relevance and focus. It is initially proposed reviews should be performed every 6 months until month 72, after which annual reviews may be more appropriate. Research projects, capacity and infrastructure developments, and innovation activities aligned with the four themes outlined in Figure 11 should be clearly identified and comprehensively reported.

5 Ethical and Regulatory Considerations

5.1 AI Ethics and Regulatory Standards

Awareness and adherence to key legal, regulatory and strategy frameworks during the planning and execution of R&I activities is fundamental to ensuring high-impact and compliant endeavours. Figure 15 illustrates the levels of consideration needed to be given to planning R&I activity, ensuring legal compliance, upholding the best possible standards, and developing work in line with the goals of the CoE, Lithuania and the EU.

Figure 14. *Illustration of the requirement to operate at the intersection between legal, best practice and strategic policy*

Table 8 details specific policies for consideration throughout the development of AI technologies. This non-exhaustive list gives an overview of some of the core requirements and considerations for R&I activities in the CoE. Having dedicated services and personnel helps to ensure technical and research staff have up-to-date awareness of current policy which helps facilitate high-impact research. This is a complex and ever-changing field with the fast development of new AI technologies.

As discussed in Section 3.2, developing the new CoE presents the opportunity for novel, innovative approaches to managing the complex needs of AI research. This can be a strong contribution to the wider development of AI research and will help enable the CoE to actively participate in the future development of regulations, strategies and policies. Various partner institutions lack an AI strategy document to guide researchers in the *use of* and *research into* AI technology. Developing a strategy for the CoE will also benefit partner institutions as a model on which to base their own strategies.

Table 8. *Key regulatory and strategy policies to adhere to when developing R&I activities*

Current Global AI Research Landscape	AI research and innovation is a fast-changing field. Over the subsequent years, the direction of research and resource requirements will change. Maintaining vigilance and proactivity in updating guidance, standards and procedures is essential.
The AI Data Robotics Association (ADRA)	In May 2023 ADRA released the "Strategic Orientation towards an AI, Data and Robotics Roadmap 2025-2027"[61]. It summarises Adra's strategic position and offers recommendations for upcoming EU work programs in the AI, Data, and Robotics fields.

[61] https://adr-association.eu/sites/default/files/2024-04/ADRA-roadmap-May2023_PostConsultationVersion.pdf

CoE Overall Objectives[62]	The progress of R&I must be viewed relative to the objectives of the CoE to ensure actions are towards the CoE goals.
EU Sustainable Development Goals[63]	All R&I activities should be assessed in relation to the SDGs to ensure best practices are maintained, and the research has a meaningful impact on society.
Lithuanian S3 Priorities[64]	The S3 priorities, or other subsequent national policy directing AI research, should be considered to ensure the maximal impact of R&I across activities. Future policy should also be developed in conjunction with the CoE to ensure it is fit for purpose.
Lithuanian AI Regulation[65]	National regulations must always be adhered to and where relevant be influenced by the latest R&I findings and best practices.
Finland AI Strategy Report	In November 2020, Finland launched an updated AI strategy: the Artificial Intelligence 4.0 Programme[66]. It promotes the development and introduction of AI and other digital technologies in companies, focusing on SMEs from several industrial and service sectors.
AI Strategy of the German Federal Government	The Federal Government adopted its Artificial Intelligence Strategy on 15 November 2018. An update was made in 2020[67]. Priorities include technical expertise, research, transfer and application, the regulatory framework and society.
EU AI Strategy and Regulation[68]	EU regulation and strategy concerning AI technology is a fast-changing field. Actively participating in the development and discussions around such regulations (e.g. the EU AI Act) will help build networks of collaboration and ensure best practices are adhered to.
EC guidelines on R&I knowledge valorisation[69]	In August 2022 the EC published guidelines on how to increase the social and economic value of research results, aligning policy principles and measures for policymakers to maximise the transformation of R&I results into solutions that benefit society.
General Data Protection Regulation (GDPR)[70]	The SustAInLivWork CoE R&I activities will require collecting, storing and processing large amounts of data, some of which are personal. Compliance with GDPR rules is therefore essential.
IP and Copyright Considerations	Developing new techniques, technologies and datasets in collaboration with various partner organisations will require careful planning as to who owns and has access to outcomes and who will receive benefits. Further developments are to be done in D3.2[71].

5.2 Research Integrity Standards

In parallel with maintaining AI ethical standards, research best practices must be adhered to, ensuring high-quality, ethical research and dissemination is conducted. Examples of good research integrity include conducting high-quality, scientific research, publishing in reputable, peer-reviewed channels, avoiding predatory channels, and adopting open science best practices. The advanced partners will assist with cultivating an environment of high research integrity through actions such as providing guidance and guidelines on reputable publication channels. Further guidance on research integrity standards is available from The European Code of Conduct for Research Integrity[72].

[62] Horizon Europe Proposal 101059903-2, "SustAInLivWork", 08.09.2022
[63] https://international-partnerships.ec.europa.eu/policies/sustainable-development-goals_en
[64] Smart specialization - Švietimo, mokslo ir sporto ministerija
[65] Lithuania AI Strategy Report - European Commission
[66] https://tem.fi/en/-/artificial-intelligence-4.0-programme-to-speed-up-digitalisation-of-business
[67] https://www.ki-strategie-deutschland.de/files/downloads/Fortschreibung_KI-Strategie_engl.pdf
[68] EU AI Act: first regulation on artificial intelligence | Topics | European Parliament
[69] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2022:391:FIN
[70] General Data Protection Regulation (GDPR) – Legal Text
[71] D3.2 – "SustAInLivWork IP protection strategy", M30, KTU
[72] The European Code of Conduct for Research Integrity - ALLEA

6 Concluding Remarks

This research and innovation agenda has set out key information for the continued successful development of the SustAInLivWork CoE. Initial data gathering and analysis from the partner institutions provided valuable information on the current strategies and capabilities of the partner institutions, as well as the advanced partners, which serves as additional inspiration for further developments at the CoE.

Analysis of the R&I goals of the CoE and the current capabilities has allowed for the proposal of key R&I opportunities. These technical, commercial, and societal opportunities are across the four CoE themes of manufacturing, green energy, transport, and healthy living. These opportunities have been identified to have the greatest economic impact in Lithuania, and, consequently, the CoE prioritises these sectors as they align closely with its objectives and Lithuania's strategic goals.

Based on the findings of this report, further detail on future R&I related deliverables has been given along with key questions requiring answers in preparation of the future deliverables. Guidelines on planning, execution, and regulatory considerations have been provided. A key takeaway from these, however, is the fast-paced change of R&I within AI, and the need for the CoE to be agile and adapt to a dynamically changing landscape. Regular reviews are strongly suggested to ensure that the direction of activities is fit for purpose, cutting-edge, and sustainable.

Annex 1. Data collection from CoE partners – TAU

Research strategy: https://www.tuni.fi/en/research/research-tampere-university

At Tampere University (TAU), multidisciplinary research is conducted across the boundaries of fields of science. More specifically, TAU strength lies in research in the fields of health, technology and society. The topics TAU Centres of Excellence (CoEs) study range from body-on-chip research to game cultures.

The missions of TAU research include fostering a just and participatory society, promoting the health and welfare of people at all ages, developing safe living and working environments that are resource efficient, and ensuring socially responsible digitalisation and transformation of work.

Research Excellence
Profiling areas
The Academy of Finland grants competitive funding, referred to as Profi, to Finnish universities to support their efforts to build stronger research profiles. The goal of this funding is to expedite the strategy-based research profiling of Finnish universities and improve the quality of research. Tampere University has received more than €40 million of funding in the first six Profi calls launched by the Academy of Finland. PROFI1 (2015-2019): Intelligent machines PROFI2 (2016-2020): Intelligent machines PROFI4 (2018-2022): Circular Economy PROFI4 (2018-2022): The Intelligent Society Platform (INSO), https://www.tuni.fi/en/research/intelligent-society-platform-inso PROFI6 (2021-2026): TAU imaging research platform, https://projects.tuni.fi/imaging-platform/ PROFI7 (2023-2028): System-on-Chip and Wireless Technology for Intelligent Machines, https://www.tuni.fi/en/research/profi-7-system-chip-and-wireless-technology-intelligent-machines
Doctoral education pilots
The **Finnish Doctoral Program Network in Artificial Intelligence** launched in 2024 to build a world-class PhD program with quality supervision, mobility, and multi-disciplinarity as integral parts. The program is a joint effort of ten Finnish universities and will educate 100 new PhDs in artificial intelligence research. Finland's Ministry of Education and Culture has granted 25.5 million EUR to support the program. The PhD students joining the program will benefit from: • Ability to do fully-funded, curiosity-driven research with high-quality supervision from experienced researchers • Multidisciplinary environment with experts both in fundamental machine learning research as well as several application areas • Built-in collaboration opportunities with industry • Support for international mobility periods and links to top international partners, through e.g., ELLIS AI network of excellence • Possibility to attend summer schools, research seminars, workshops and networking events • Access to high-end infrastructure, career training and support services
Doctoral program on Intelligent Working Machines (8 positions to TAU)
The IWM doctoral program educates new generations of professionals to the PhD level with multidisciplinary engineering knowledge needed for intelligent machinery development. The doctoral training connects academic research excellence with a relevant industrial research and development challenges and accelerate industrial renewal in the machine industry. The IWM doctoral program collects the leading departments and research groups in Finland. In the program there are 31 positions in five Finnish universities: Aalto University, Lappeenranta-Lahti University of Technology, Tampere University, University of Oulu, and University of Turku. www.tuni.fi/iwm
Other
Platform of Excellence in Mobile Work Machines, https://www.tuni.fi/en/research/platform-excellence-mobile-work-machines
Centre of Excellence in Generic Intelligent Machines Research (2008–2013)
Tampere Institute for Advanced Study, https://research.tuni.fi/tampere-ias/
Research Assessment Evaluation

We conduct an international assessment of all our research at regular intervals. The first research assessment exercise of our new university (TAU RAE 2022) was carried out as an international peer-review in two phases. Download TAU RAE 2022 assessment report (pdf)

Research Capacity
Research infrastructure ENS
Robolab Tampere https://research.tuni.fi/robolabtampere/, offers a place for students and researchers to work with robotic equipment and experiment without major restrictions. Robots and related technology are for example industrial manipulators, mobile robots, a multitude of sensors and different processing platforms. The learning environment differs from FabLabs and other learning/teaching factory environments in such way that the lab is available 24/7 to all students interested in robotics.
HRC pilotline, https://research.tuni.fi/hrc-pilotline/ is Piloting environment for Human-Robot Collaboration in Manufacturing and pre-commercial ('test before invest') production and prototyping environment that enables learning through experimentation in new product, process and related-service development.
Mobile machines test ground provides excellent facilities for field off-road machinery and robotics research, as the campus area includes a test ground and has over 10 instrumented mobile machines. Our closed 4000 m² test ground has a working area for excavating, different surfaces ranging from gravel to asphalt, and a hill with three different slopes ranging up to about 18 degrees.
IHA has a rapid development and prototyping environment for building novel systems (powertrain and working hydraulics) and control technologies, which is used to test and demonstrate functionality and control algorithms in mobile machines. We can measure on real time emissions, fuel and energy consumption (electric) of the machines during the work. https://research.tuni.fi/iha/facilities/mobile-laboratory/
Research infrastructure ITC
CIVIT - Centre for Immersive Visual Technologies is a research infrastructure unit at Tampere University that provides facilities and expertise in the sectors of visual content creation and representation of visual data, advanced displays, spatial measurements and processing, and user experience. https://civit.fi/ Services are for students, researchers and companies. CIVIT facilities and equipment can be used in different research projects, experiments and thesis work.
Computing infrastructure
Tampere Centre for Scientific Computing – TCSC, https://www.tuni.fi/en/research/tampere-center-scientific-computing-tcsc Tampere Centre for Scientific Computing (TCSC) operates the research infrastructure for computational science at Tampere University (TAU). TCSC's computational resources consist nowadays from Linux cluster called Narvi. It features fast Infiniband connection between compute-nodes for MPI-connection and a few hundred TB's of storage space for data. Different GPU's are also available for cuda optimized code. TCSC is part of Finnish Computing Competence Infrastructure (FCCI).
Finnish Computing Competence Infrastructure (FCCI) provides Finnish universities with Tier-2 computational and data storage resources that heterogeneously support each university's specific research activities and thus the national profiling of the universities. FCCI integrates these capacities into a single entity that is coordinated through centralized maintenance and integrated into national Tier-1 (CSC) and Tier-0 (EuroHPC, LUMI/CSC, PRACE) computational resources. FCCI supports, e.g., data-intensive research, artificial intelligence, and high-performance computing, and its User Groups cover both science and art.

Innovation
R&I projects and initiatives
AI HUB & AI ecosystem, https://tampere.ai/ai-hub-tampere-en/ AI Hub Tampere is a research centre dedicated to applied artificial intelligence hosted by Tampere University and funded by public instruments. Backed by a coalition of 25 professors combining multiple disciplines, AI Hub explores the diverse socio-technical aspects of AI transformation.
Sustainable Industry X - SIX https://www.six.fi/ SIX is Finnish, industry driven initiative shaping and implementing next-gen green and digital industry agenda in practise. In a nutshell SIX is kind of a toolbox: it provides essential tools for forming joint agenda from national level strategies and implementing agenda in industry driven way. It practice it forms continuous industry driven implementation chain from strategic level to factory floors and products. The main themes of SIX are Mobile Work Machines and Smart Manufacturing
TRINITY Innovation Network, https://trinityrobotics.eu TRINITY has created a network of multidisciplinary and synergistic local digital innovation hubs (DIHs) composed of research centres, companies, and university groups that covered a wide range of topics that could contribute to agile

production; robotics, digitalization and cybersecurity. The Innovation network continues as joined effort between the EC and all DIHs: https://www.robotics-portal.eu/Agile-Manufacturing/about
Doctoral School of Industry Innovations (DSII), https://www.dsii.fi DSII represents a unique combination of dissertation research, real-world business challenges, professional networks and innovations. DSII's doctoral students conduct their research at the University and in the premises of partner companies.
Innovation services
Commercial exploitation of research results. This means, for example, transferring inventions created in collaborative research projects with cooperation companies for the benefit of society. We have 10-20 active commercialization projects financed by Business Finland running continuously. Additionally, TAU generate 2–5 research-based spin-off companies every year. https://www.tuni.fi/en/services-and-collaboration/our-services-for-companies-and-communities/innovation-services-and-commercialization-research-results-at-tampere-university
Kampusklubi, https://www.kampusklubi.fi/ Kampusklubi (Campus club) creates and deepens cooperation between companies and the university through the club's activities, flexible facilities and cooperation models. Companies can join the Kampusklubi as members.

Annex 2. Data collection from CoE partners – TUHH

Research strategy: TUHH has a focus on 'Technology for Humanity'. Its research is organized in five research fields (Advanced Materials & Bio-Processes, Aviation & Maritime Technologies, Cyber Physical & Medical Systems, Environmental & Energy Systems, Logistics, Mobility & Infrastructure) which represent the research focus and comprise of nine research clusters. Institutes from different fields of engineering follow joint research interests by joining the respective clusters. TUHH is a member of ECIU and a UNU-HUB.

Research excellence
Profiling areas (related to SustAInLivWork)
The research fields as outlined above, with 'Cyber Physical & Medical Systems' bundling activities on AI in healthcare. A recent initiative to foster innovative research at TUHH has been the I³ program ("Interdisziplinarität und Innovation in den Ingenieurwissenschaften" / interdisciplinarity and innovation in engineering), with two funded I³ labs focusing on healthcare (model-based machine learning for soft tissue modelling in medicine, interdisciplinary competence centre for interface research). The research initiative 'Machine Learning in Engineering' (https://www.mle.hamburg/) represents the broad spectrum of AI methods studied and applied at TUHH. A recent research focus at TUHH is engineering to face climate change (https://www.tuhh.de/cie/about) and related collaborative research projects, e.g., 'Climate Informed Engineering' research group and on 'SMART Reactors for Future Process Engineering' (DFG CRC).
Doctoral programs
TUHH operates a graduate academy for all PhD students. Furthermore, TUHH participates in the DASHH (Data Science in Hamburg HELMHOLTZ Graduate School for the structure of matter, https://www.dashh.org/index_eng.html), which focuses on AI and data science in the context of DESY (Deutsches Elektronen-Synchrotron) and offers a separate doctoral program. Another joint initiative in Hamburg is the Hamburg Research Academy (https://www.hra-hamburg.de/en/ueber-uns/mitgliedshochschulen.html), which supports PhD and entry level researchers at all member institutions, including TUHH.
Other
The Centre for Teaching and Learning at TUHH and the Hamburg Open Online University (HOOU, HOOU https://portal.hoou.de/) foster teaching activities, including outreach and classes on AI. TUHH is a member of ahoi-digital, an alliance of universities with a focus on computer science education and research. Collaboration among Hamburg metropolitan research institutions is also coordinated through the PIERplus initiative (https://www.pier-plus.de/en/ueber-uns.html). An even broader platform for scientific collaboration is provided by the Hamburg Institute of Advanced Studies (HIAS, https://hias-hamburg.de/).

Research capacity
Research infrastructure related to SustAInLivWork
At TUHH, research infrastructure is largely operated by the research institutes. This includes lab space and equipment like machines and robots, etc., as well as living labs and larger scale infrastructure, e.g., the FORLAB Helios (https://www.tuhh.de/mst/en/research/forlab-helios) for microelectronics and photonics. Various workshops and the WorkINGLab provide space and infrastructure for rapid prototyping.
Computing infrastructure related to SustAInLivWork
The HPC cluster (https://www.tuhh.de/rzt/en/services/hpc) at TUHH-RZ consists of 200 compute nodes, several login nodes and a parallel storage system with a capacity of 300TB. All in all, about 8700 CPU cores, 50 TByte RAM and some GPUs are available for compute intensive workloads. Researchers at TUHH can also access the infrastructure at the House of Computing and Data Science (https://www.hcds.uni-hamburg.de/).

Innovation
R&I projects and initiatives related to SustAInLivWork
Projects and initiatives listed above typically also foster innovation, e.g., MLE, Startup Port, TuTech. TUHH has been an incubator for numerous successful start-ups (https://www.tuhh.de/tuhh/en/research-and-transfer/knowledge-and-technology-transfer)
Innovation services
TuTech (https://tutech.de/) is the agency affiliated with TUHH which provides comprehensive support with intellectual property and collaboration between academic and industrial partners. Similarly, Hamburg Innovation

(https://hamburginnovation.de/) fosters technology transfer, offering competitive grant schemes to initiate transfer projects. The Startup Port at TUHH (https://www.tuhh.de/startupport/en/welcome-1-1) provides a broad range of services to help establish new companies.

Annex 3. Data collection from CoE partners – KTU

Research strategy: The University's Strategy 2021–2025[1] confirms the priorities of R&D&I activities, which are especially important for the viability of the country and its knowledge-based sustainable economic, social and cultural development: (1) Transformation of Industry; (2) Digital Transformation; (3) Smart Cities and Resilient Communities. At the KTU, R&D&I activities are developed in two broad areas, **Technologies for Sustainable Future** and **Sustainable Sociocultural Development**. The first area includes artificial intelligence and robotics, biomedical engineering and medical technologies, diagnostic technologies; electronics and electrical engineering; mechanical and transportation engineering; construction technologies; sustainable energy, etc. The second area includes architecture, urban activities and cultural heritage, educational environments and technologies; financial technologies; innovation management and entrepreneurship, digital media and culture and etc.

KTU is integrating the United Nations sustainable development goals (17 SDG) in all areas of its activity and has the **Sustainable Development Guidelines** 2021-2025[2] with provided values, strategic objectives and success criteria.

Research excellence
Profiling areas related to SustAInLivWork
The University conducts research in areas related to SustAInLivWork and develops new technologies, products, and processes. KTU has a number of research institutes[3] and research groups those are responsible for developments innovations in relevant fields with the focus on sustainability and AI technologies. KTU has 5 AI technologies-relevant research groups[4] including Artificial Intelligence and Image Processing Methods in Multimedia (12 investigators); Internet-of-Things and Services (8 investigators); Multimodal Human-Computer Interactions (7 investigators); Multidisciplinary Models (21 investigators); Semantics and Knowledge-Based Engineering of Information Systems (19 investigators). The top research topics in these groups highlights explainable AI (XAI) algorithms, computer vision and biomedical signals analysis for healthcare, combined approaches to physical behaviour simulation based on PDEs and AI algorithms, etc. The University has a growing number of research projects each year related to the development and application of AI solutions in 4 core sectors, but most of them are national and focused on the health sector: "Deep learning-based architecture for humanoid pose (skeletal) estimation from partial depth data" (2024- 20263)[5]; "Development of combined physical behaviour and artificial intelligence models to determine hydro morphology of rivers by indirect measurements" (2023 -2026)[6]; "Development of artificial intelligence-based automated voice and speech enhancement algorithms for patients after laryngeal cancer surgery" (2023 -2026)[7]; "Biological Feedback Measurement and Analysis Technology Centre for Strengthening Personal and Public Health" (Bio-MAC) (2020- 2023)[8]; "Smart Gerontechnology for Healthy Ageing" (iGeronTech) (2016-2018)[9]; "Maximising impact of multidisciplinary research in early diagnosis of neonatal brain injury (AI-4-NICU)", (2021-2025)[10].
Study programmes The University has two 1st cycle and one 2nd cycle study programmes (SP) in AI field of study, focusing on the aspects of informatics (the 1st cycle SP Informatics) and the application of artificial intelligence technologies (1st cycle SP **Artificial Intelligence** and 2nd cycle SP **Artificial Intelligence in Computer Science**). The aim of the 1st cycle SP Artificial Intelligence is to provide competences that enable the development of AI-based computer systems with a particular focus on data processing and analysis, machine learning, image and speech recognition, and the socio-economic aspects of AI applications. The aim of the 2nd cycle SP **Artificial Intelligence in Computer Science** is to provide knowledge of modern artificial intelligence methods, data processing, optimization and other fundamental sciences based on computing, systems analysis and mathematical models; to develop skills to independently perform research work and develop artificial intelligence and general informatics models, applying them to computer vision, semantic text analysis, content generation and other applications in computer science and related fields. **SKILLed AI** - Talent Academy providing with career competencies in the field of AI, wide-ranging life skills and financial benefits for KTU Bachelor students. **PhD Programmes:** Informatics - joint doctoral studies with Vytautas Magnus University and Vilnius Gediminas Technical University (coordinating institution: Kaunas University of Technology). Informatics is the field of science based on Computer Science and Computational Science. Doctoral students investigate the research fields of data analysis,

signal and image analysis, simulation modelling, computational intelligence, physically-based behaviour, development and analysis of general dynamic models, cryptography algorithms, etc.

Research capacity
Research infrastructure related to SustAInLivWork
KTU has variety of infrastructure required to develop AI solutions. Dedicated hardware is available in KTU research centres, such as **M-lab**, **AI centre**, **Centre of Real Time Computer Systems**, **Biomedical Engineering Institute, Virtual and Augmented Reality Technology Laboratory**, etc. Featured research equipment including diagnostic and measurement technologies, smart environments and information technology, technologies for sustainable development and energy are provided in online, including all descriptions and possible services[11].
Computing infrastructure related to SustAInLivWork
KTU AI Centre provides the High-Performance Computing (HPC) solution[12] services for researchers of UoA. HPC resources used: 5 servers Dell PowerEdge R7525 (AMD EPYC 7452 32-Core Processor / 2350 MHz; 512GB RAM; NVIDIA GA100 [A100 PCIe 40GB], 2x450GB SSD; 2x 25Gbps LAN MT27800 Family [ConnectX-5] (2x100GBps [ConnectX-6]). IT infrastructure used for AI tasks includes access to the Jupyter Notebook environment (by using https://ai-notebook.ktu.edu/hub/spawn), which includes Python, R, ROOT C++, basic Python packages such as tensorflow-gpu, mxnet-cu112, the possibility to expand as needed is provided; resources used: 1 x NVIDIA A100 40GB and 2 x AMD EPYC 7452 32-Core Processor.
KTU Researchers have access "**Lithuanian GRID and High-Performance Computing Network**"[13] (LitGrid-HPC). LitGrid-HPC is a national research infrastructure that comprehensively and efficiently provides users with the necessary computing capabilities and related services for demanding high-performance computing solutions. It is connected to the international European distributed computing infrastructure EGI (European Grid Infrastructure-advanced computing for research and Euro-HPC). The University participates in the European Organisation for Nuclear Research (CERN) as a member of the CERN-LT consortium. KTU researchers – registered CERN users have access to the CERN cloud computing resources

Innovation
R&I projects and initiatives related to SustAInLivWork
"Horizon 2020" project **"The ECIU University Research Institute for Smart European Regions (SMART-ER[14])"** is a research, innovation and education strong alliance, enabling all member universities to jointly address complex societal challenges under the framework of the UN SDG11 (Sustainable cities and communities).
HE project **"GreenIn Cities" (2024 -2027)[15]** will develop a Sustainable Renaturing Toolbox for governance and decision-making processes compatible with the targets and indicators outlined in the Global and European sustainable goals, as well as with the existing municipal and regional planning strategies.
HE project **"Boosting Research for a Smart and Carbon Neutral Built Environment with Digital Twins (SmartWins)" (2022-2025)[16].** The concept of the SmartWins project is to form a network between KTU and leading institutions in the field of energy and sustainability assessment of buildings with the use of Industry 4.0 practices related research and innovation management, for know-how transfer and development of a long-term research collaboration.
HE project **"Bridging Risks to an Inclusive Digital and Green future by Enhancing workforce Skills for industry 5.0 (BRIDGES 5.0)" (2023 – 2026)[17].** Quantitatively map how jobs are transforming and what new green and digital jobs are emerging in the 4th Industrial Revolution; and qualitatively understand Industry 5.0 requirements (human- and socio-centric, sustainable and resilience) for these jobs and company practices.
EU project **"National Competence Centres in the framework of EuroHPC Phase 2 (EuroCC2)"** (2023 -2025)[18]. The aim of the project is to strengthen the competencies of high-performance computing (HPC), high performance data analytics (HPDA) and Artificial Intelligence (AI) in Lithuania, to promote their use in the industrial sector and research, and to develop interdisciplinary cooperation opportunities among universities, companies and government institutions.
Innovation services
KTU National Innovation and Entrepreneurship Centre (NIEC)[19] is a link between science and business, ensuring a smooth mutual cooperation, commercialisation of the latest innovations developed at the University, protection of intellectual property and development of newly established enterprises. Connections to non-academic stakeholders and Types of collaborations: Our services encompass a wide range of collaborative efforts between academia and industry, designed to advance research, education, and practical applications. These services include research partnerships, consultancy and expert services, internships and student placements, sponsored research and funding, knowledge transfer and technology licensing, training and professional development, infrastructure sharing, curriculum development, spin-offs, and competitions and challenges.

The laboratory centre **"Centre for Experimental and Prototyping Laboratories in Physical and Technological Sciences** – **M-Lab"** started in 2021. The centre houses nine thematic research-experimental laboratories: sustainable and smart cities, sustainable and smart environments, industrial design, e-business models, personalised nutrition, telehealth management, working environments for individual well-being and productivity, robotic assistants and noncontact human health monitoring, as well as a Smart Lab, a Proto Lab, and a Young Lab for young scientists.
DI4LithuanianID[20] - industry need driven European Digital Innovation Hub (EDIH) of Central and Western Lithuania consists of 14 partners, coordinated by KTU, operating throughout Lithuania and representing different areas of competence and experience. Consortium is operating in 5 sectors: Manufacturing, Public Sector, Healthcare & Biotechnologies, ICT and Fintech. EDIHs key competences are Artificial Intelligence (AI) and Cybersecurity (CS) in the fields of Big data, Automated BMS & WMS, Smart Sensors, Robotics, IoT/IoIT, Automation, VR/AR, Automatic reporting. Service packages of EDIG: Test before invest; Support to find investment; Ecosystem building & Networking; Skills &training services.
The KTU AI Centre[21] is responsible for University policies development and activities coordination related to AI development, including the creation and integrate AI solutions that allow to solving different problems in industry, medicine, and the public sector, non-formal education, and the representation of the University in national and international organisations and working parties.
The Institute of Environmental Engineering[22] focuses on a preventive approach towards environmental issues related to industrial development. The Institute is not only involved in cutting-edge research but also trains highly qualified specialists for sustainable industry.
Biomedical Engineering Institute[23] is competitive on national and international level in the field of biomedical engineering, such as biomedical electronics, sensors, wearing systems, ultrasound diagnostics, deep biomedical signals and image processing.
Health Telematics Science Institute[24] develops radically innovative non-invasive industrial and physiological measurements and process monitoring technologies.
Centre of Real Time Computer Systems (CRTCS)[25] performs applied leading research on smart environments and Internet of Things and Services (IoT&S). Centre cooperates with Aalborg University, London City University, Technical University of Denmark, Darmstadt University and their research centres. It maintains contacts with companies Siemens, Philips, Advantech, Analog Devices, Texas Instruments, Microsoft, Intermedix. Since the year 2000, Centre performs research on smart homes. Methods, algorithms and technologies, created by the scientists of CRTCS, enable implementation of innovative systems of smart environments, smart systems and IoT, as well as home systems with services designed for them

Annex 4. Data collection from CoE partners – VMU

Research strategy: Scientific research at VMU is carried out in five science areas (Humanities, Social Sciences, Natural Sciences, Technological Sciences and Agricultural Sciences) and Arts regarding the 8 prioritized research and arts fields approved by the Senate: Social transformations: individual, group and society; Cultural diversity: language, heritage, and art; Educational and social innovations; Sustainable organisational systems, governance, and communication; Smart technologies; Biotechnologies and health technologies; Bioeconomy and biosystems engineering; Sustainability of agro-, forest and aquatic ecosystems, climate change. Prioritized research field Smart technologies covers two topics related to SustaInLivWork: Artificial Intelligence and Digitalization Systems, and Security, Reliability and Risk Analysis Methods.

Research excellence
Profiling areas related to SustAInLivWork
Applications of Statistical, Machine Learning (ML), and AI. Research focuses on the application of AI in different domains: AI and language technologies in healthcare Application of AI and statistical methods for digital phenotyping, e.g. identification of health issues using passive smart devices data (SmartOut project). Statistical modelling and application of AI in neuroinformatics. Application of statistical and AI methods for genetic data analysis and cardiovascular disorders detection and prediction. Cardiovascular risk score development using diverse short-term and longitudinal parameters. Anonymization of healthcare data records. AI and statistical models for energy load and usage balancing Signals fusion for environment surveillance (radar, video, thermal). Language technologies for information space analysis. Predictive maintenance, e.g., identification of issues in IT infrastructure, applications of predictive maintenance in wind power generation.
Doctoral
VMU participates in joint doctoral school with Kaunas University of Technology (KTU) and VILNIUS TECH, led by KTU. Main dissertations topics are research and application of AI in medicine, language technologies, etc.

Research capacity
Research infrastructure related to SustAInLivWork
Interdisciplinary research in computer linguistics/language technology area is conducted in collaboration with the Faculty of Humanities, using the hardware resources as well as linguistic databases of the Computer Linguistics Centre. It consists of a number of virtual machines hosting infrastructure data, components and a website (acting as a graphical user interface). Corpora and DB repository includes Corpora of Contemporary Lithuanian, both written and spoken language, DBs of collocations, and morphemes, Dictionaries of nominal phrases, and pronunciation; tools: text search system, machine translation system, hate speech recogniser https://hatespeech.vdu.lt; search system for social media in vectorised text (Fasttext) https://fasttext.vdu.lt, Colloc - Fixed Compound Identifier, automatic accentuation tool, morphological annotator, tokeniser, to mention a few. CLARIN is a European Research Infrastructure Consortium that aims to provide researchers in the social sciences and humanities in Europe and around the world with open and reliable dissemination of and access to digital language resources and their analysis tools on a single platform, with common standards for the development of language resources and long-term data storage (https://clarin.eu). Most of the specialised equipment used by VMU IF is mobile and can be used both in specialised laboratories (Computer Networking Laboratory, Smart Systems Laboratory), and in other study or research rooms as required. The specialised stationary and mobile equipment is located in the Multimedia Specialised Laboratories: the Multimedia Laboratory, the Photography Studio, the Audiovisual Technology Laboratory, the Augmented Reality Laboratory and the 3D Modelling Laboratory. The Multimedia Laboratory has 3D scanning hardware and software, virtual reality equipment with stationary and mobile VR support, bio-signal recording tools, a holographic display, tablets and smart devices, etc. The specific research needs of artificial intelligence and deep learning computing are currently met by the computing cluster of the SITTI Research Institute, which consists of 6 interconnected physical servers with a total of 192 vCPUs, 576GB of RAM, 12 GPUs (12GB of RAM each on the Nvidia Pascal architecture), a 6TB SSD for virtual machines, and a 14TB disk

storage for data. This cluster is used by researchers to run parallel computations on all servers (via openGrid) or to pre-reserve the CPU/GPU/RAM resources of individual servers.
Computing infrastructure related to SustAInLivWork
Computational resources, serving laboratory and researcher workplaces include server resources of 480 vCPU, 3136GB RAM, 98TB HDD, accessed via university cloud infrastructure. Cloud laboratory system, supporting virtualization, parallel and distributed computations is used for research needs.

Innovation
R&I projects and initiatives related to SustAInLivWork
5G, AI and Optimization Methods for a New generation logistics solutions, 08-004-K-0006, coordinator: prof. dr. Ričardas Krikštolaitis, period: 2024.01.01-2025.12.31. SHERLOCK - Supporting the Energy transition of the building Stock, 101105629, coordinator: prof. dr. Ričardas Krikštolaitis, period: 2023.09.01-2026.08.31. Semi-automatic search of new metal-free emitters for OLEDS employing RPA technologies, VDU-S-834, period: 2023.04.11-2023.12.31 Application of Digital Phenotyping for Oncological Patients Monitoring During COVID-19 Pandemy, 13.1.1-LMT-L-718-05-0011, coordinator: prof. Tomas Krilavičius, period: 2021.12.01-2023.08.31. Creation of a prototype of the business management system optimization module of parcel delivery companies, 08-006-K-0002, coordinator: prof. Tomas Krilavičius, period: 2024.01.04-2025.06.04. Analysis of relationship between genetic variants in cardiomyopathies with myocardial phenotype and clinical outcomes, coordinator: prof. dr. Ričardas Krikštolaitis, partner: Lithuanian University of Health Sciences, not funded. Artificial intelligence-based personalized cardiovascular risk prediction model assessment, coordinator: prof. dr. Ričardas Krikštolaitis, not funded. Digital phenotyping for monitoring of stroke survivors, coordinator: prof. dr. Ričardas Krikštolaitis, partner: Lithuanian University of Health Sciences, not funded. Development of mixed Lithuanian text summaries/abstracts corpora (for training automatic deep learning-based systems), 02-101-K, 2024 09 – 2026 04 Creating a depersonalisation (anonymization) corpora, 02-100-K, 2024 09 – 2026 04

Annex 5. Data collection from CoE partners – VILNIUS TECH

Research strategy: VILNIUS TECH is working in 7 research focus areas, of them 6 are related to the project: 1) Sustainable building, which covers: smart building structures, low emissions building materials and technologies, architecture and the built environment, BIM and sustainable lifecycle of structures, geodetic technologies. 2) Environmental and energy technologies, which covers: efficient use of resources and energy, environmental protection technologies, building energetics, renewable energy, change of anthropogenic environment). 3) Sustainable transport, which covers: Autonomous land and air transport, Environmentally friendly transport, Green logistics and international transport corridors, Traffic safety technologies, Urban mobility. 4) Mechatronics, which covers: Smart embedded systems, Mechatronic for Industry 4.0 production system, Metamaterials and nano-structures, Bionics and biomedical engineering systems, Innovative electronic systems. 5) Information and communication technologies, which covers: Information and information technologies security, Smart signal processing and telecommunication technologies, Artificial intelligence and decision support systems, Geoinformation technologies, Virtual and augmented reality. 6) Fundamental research on materials and processes, which covers: Mathematical models of physical, technological and economic processes, Investigations on cells and their biologically active components. 7 faculties are working in these areas and have a potential to contribute to all project thematic areas.

Research excellence
Profiling areas related to SustAInLivWork
MANUFACTURING (cybersecurity solutions); ENERGY (AI based renewable energy production forecasting, including wind farms and solar plants; predictive maintenance solutions; AI based monitoring and control of HVAC systems); TRANSPORT (AI based road condition monitoring; AI based thermal imaging analysis for road safety; vision based human activity recognition; driver interaction with different levels of autonomous vehicle control systems; 5G hardware solutions for public transport); HEALTH (Human skeleton motion tracking, biomedical signal analysis for Parkinson disease patient monitoring, migraine detection, chronic pain monitoring, human gait analysis)
From the perspective of university faculties and research units, the profiling areas could be grouped as follows: Antanas Gustaitis Aviation Institute research is mostly oriented on aviation, ranging from an unmanned aerial vehicle (UAV) to satellite technologies. The experience in environment analysis (using different sensors, image processing) will contribute to all project thematic areas. Faculty of Civil Engineering research is closely related to the sustainability in civil engineering area, concerning materials, structures, affect to nature and human, etc. Therefore, the faculty will contribute to manufacturing, health and transport thematic areas of the project. Faculty of Environmental Engineering main research areas include sustainable building, environmental and energy technologies. Environment is analysed both from the productivity as well as human perspective, therefore the faculty will contribute to all project thematic areas. Faculty or Electronics research areas are mostly oriented on the development and optimization of different devices and systems, which significantly contribute to the enhancement of technological competitiveness. The long-term experience in development of AI based electronics systems, orientation on advanced electrical and electronic engineering will allow the faculty to contribute to manufacturing, energy and transport thematic areas of the project. Faculty or Fundamental Sciences research activities carried out at the faculty characterized by interdisciplinary, as the faculty combines the computer science, mathematics, bioengineering and physics research areas. The faculty will contribute to all project thematic areas, but mostly on health and transport. Faculty of Mechanics is doing research in the areas of energy and sustainable environment; new production processes, materials and technologies. The orientation to biomechanics, rather than just mechanics will allow the faculty to contribute to all thematic areas of the project. Faculty of Transport Engineering faculty research includes different aspects of modern transports and logistics. Without the contribution in transport thematic area of the project, the faculty will contribute to manufacturing and health thematic areas too. Deep learning based virtual point tracking for real-time target-less dynamic displacement measurement in railway applications; and visual measurement system for wheel–rail lateral position evaluation. The research was funded by the EU under H2020: https://www.ait.ac.at/en/research-topics/structural-dynamics-and-assessment/projects/assets4rail/. Feasibility of a Neural Network-Based virtual sensor for vehicle unsprung mass relative velocity estimation; and an analysis of the impact on vehicle dynamic response and driving comfort. The research was funded by the EU under H2020.

Doctoral programs
VILNIUS TECH alone or together with other academic and research institutions has been granted license to organize doctoral studies in 12 fields of science: Humanities: • History and Theory of Arts Natural Sciences: • Informatics Social Sciences: • Management • Economics • Communication and Information Technological Sciences: • Electrical and Electronic Engineering • Civil Engineering • Transport Engineering • Environmental Engineering • Informatics Engineering • Materials Engineering • Mechanical Engineering The AI technologies are used in multiple of them, while its solutions are developed mostly in **Informatics Engineering, Electrical and Electronic Engineering and Informatics** fields.
Other
AI based virtual try-on solutions; deep-fake video identification; video depersonalization; audio depersonalization; voice activity detection in noisy environment; development of mine detection systems for civil purpose; radio wave analysis-based drone detection and identification systems
Research Assessment Evaluation
The Comparative Expert Assessment (CEA) of Research and Development Activities conducted by Lithuanian universities and research institutes is organized by the Research Council of Lithuania and evaluated by international experts. The CEA is conducted every five years, and the results are used to allocate part of the basic state funding for R&D. For the purposes of the CEA, Institutions or their respective units are evaluated according to three criteria: quality (weighting factor 0.65), economic and social impact (weighting factor 0.2), and development potential (weighting factor 0.15). The most recent CEA was conducted in 2023, covering the period from 2018 to 2022. The CEA reports can be found at: https://lmt.lrv.lt/en/science-quality/comparative-expert-assessment-of-research-and-development-activities/

Research capacity
Research infrastructure related to SustAInLivWork
1. VILNIUS TECH Sustainability HUB (https://vilniustech.lt/sustainability-hub/get-to-know-the-sustainability-hub/laboratories-and-workshop-spaces/364418?lang=2) - to promote sustainability culture, develop sustainability competencies and advocate for change in society's behaviour. The HUB has the data modelling area, eco design area, sustainable consumption experimental demonstration area. 2. Aerospace Data Centre - adaptation of unmanned aircraft payload. 3. Innovation and creativity centre "LinkMenų fabrikas" - a unique and workspace for students, researchers and a well-organized access for industry professionals for accelerating R&D based innovations. There is also a list of facilities available that are frequently used by VGTU VR and AR competence centre researchers and volunteers. 4. Digital Defence Competence Centre - It aims to tackle the problem of cybersecurity and its relation to tackling disinformation issues and improve the resilience of our societies, our public institutions and our infrastructure to the threat of ever-growing cyber and information attacks. 5. Transport and Logistics Competence Centre (TLCC): The aim of TLCC: to carry out international level research in the field of sustainable transport, to participate in international and national projects, to apply the acquired knowledge and skills in the study process of the Faculty of Transport Engineering. 6. The Laboratory of Building Energy and Microclimate Systems (https://vilniustech.lt/environmental-engineering/departments/department-of-building-energetics/laboratories/laboratory-of-building-energy-and-microclimate-systems/63194) - to provide energy efficiency research and knowledge dissemination, particularly in the following areas: renewable energy for heating and cooling, efficient energy use in buildings, thermodynamic efficiency and life cycle

assessment of energy systems, simulation and design of energy supply and consumption systems for urban modules, and to provide mobile indoor climate laboratory services. 7. Cybersecurity competency center is under development, planning to dedicate higher attention to AI application in cybersecurity, providing the needed infrastructure for such solutions research and development.
Computing infrastructure related to SustAInLivWork
Cluster VANAGAS (http://vanagas.vgtu.lt); OpenStack cloud computing services; Cloud storage services (talpykla.vgtu.lt); Computing resources for AI model training (12 nodes with dingle GPU for AI training, additional current and powerful professional infrastructure solutions will be available in the beginning of year 2025 with investments of more than 500k Eur).

Innovation
R&I projects and initiatives related to SustAInLivWork
Running:
AI-based platforms for countering foreign mis-/disinformation during elections (AICP-FIMI). No 05-001-01-05-06/12-001-01-03-01 "Implementing mission-driven science and innovation programmes". 985,982.28 EUR.
Automated system for hybrid threat detection and attribution (HIPSTer). No 05-001-01-05-06/12-001-01-03-01 "Implementing mission-driven science and innovation programmes". 3,005,680.12 Eur
Self-learning smart buildings equipped to tackle cyber threats (AFFECTS). No 05-001-01-05-06/12-001-01-03-01 "Implementing mission-driven science and innovation programmes". 698,546.78 EUR
Comprehensive cybersecurity management solution for FinTech industry participants (CyberFiRD). No 05-001-01-05-06/12-001-01-03-01 "Implementing mission-driven science and innovation programmes". 1,279,314.55 EUR.
Innovative 5G data transmission modules with video surveillance and data depersonalization for mobile machines and rail transport. No. 08-004-K-0023, 4,063,211.80 EUR.
Artificial Intelligence-Based Twinning of Eyeglasses Under Limited 2D Image Data for Virtual Try-On Applications (AI-TEVIA). No. P-ITP-24-28. 285,814 EUR
Finished:
Industrial Internet methods for electrical energy conversion systems monitoring and diagnostics – EMONDI. (Research Council of Lithuania, Baltic Research Programme, Project contract No S-BMT-21-5 (LT08-2-LMT-K-01-040)), 2021–2023.
Design and Research of Internet of Things (IoT) Framework Model and Tools for Intelligent Transport Systems, No. 01.2.2-LMT-K-718-01-0054, 2017-2021, 564 536.06 EUR.
Innovative transport: the creation of a vehicle capable of tilting, No. 01.2.1-LVPA-K-856-01-0054, 2020-2023, 1 040 465.87 / 90 358.32 EUR.
Smart Scanning Electrochemical Microscope (SMART-SECM), No. 01.2.2-LMT-K-718-03-0063, 2020-2023, 549 975.74 EUR.
Smart eSIM device management platform, No. 01.2.1-LVPA-K-856-01-0109, 2020-2022, 1 264 073.25 EUR.
Provision of context-aware smart services for the operational management of cargo transportation (KAIPTOKSTV), No. 01.2.2-LMT-K-718-03-0030, 2020-2023, 211 032.81 EUR.
Open Access Platform for Virtual Reality Technologies (EU Structural Funds 01.2.2-CPVA-K-703-02), 2018–2021.
Transport
Smaller projects: *Innovative engineering of ground vehicles with integrated active chassis systems.* *Shift2Rail actions: Measuring, Monitoring and Data Handling for Railway Assets; Bridges,* *Tunnels, Tracks and Safety Systems.* *Benchmarking of Wheel Corner Concepts Towards Optimal Comfort by Automated Driving.* *Enhanced Physical Internet-Compatible Earth-friendly freight Transportation answer Institution.* *Advancing fail-aware, fail-safe, and fail-operational electronic components, systems, and architectures for highly and fully automated driving to make future mobility safer, more efficient, affordable, and end-user acceptable" (AUTODRIVE) project aims for the design of (i) fail-aware (self-diagnostics), (ii) fail-safe, (iii) fail-operational (HW and SW redundancy) electronic components and systems architecture that enable the introduction of automated driving in all car categories.* *Analysis of bitumen modification using nano materials to prolong the whole service-life of asphalt.* *Delivering context-aware smart services for operational management of freight transport.* *Research in physical and mechanical performance of asphalt mixtures modified with crumb rubber by using a dry method.*

Formulation of an artificial intelligence-based method for the identification and reintegration of alternative camera groups in a three-dimensional structure into a basic 3D structure, development and testing of numerical models using synthetic data.
Health
Biological Feedback Measurement and Analysis Technology Centre for Personal and Public Health –Bio-MAC. (EU Structural Funds 1.2.2-CPVA-K-703-03-0022. 2020–2022), 2020–2023.
Smaller projects: *Green Marketing in Lithuania: Critical Evaluation and Development Potential.* *Integrated augmented reality research for socially disabled people (blind and partially sighted).* *Centre of Environment-Friendly Structural and Composite Materials and Environmental Technology.* *Development of a speech signal filtering method based on room impulse response prediction.* *Development of a feature extraction method for object localization from an audio signal in an echo environment.* *Development and application of speech detection method to artificial intelligence chips.* *Development and design competence centre for innovative environmentally friendly devices.* *New formulations for carotenoid delivery.* *The Drivers and Barriers for Adaptation of Eco-Innovation in Small and Medium Enterprises on the road toward Circular Economy.*
Energy
Development of measures for increasing the efficiency of the life cycle processes of public buildings sector by applying Building Information Modelling (BIM-LT project), 2020-2023. Project funded from EU structural funds.
Development of innovative expert systems for maintenance, monitoring and forecasting the energy consumption of building engineering systems. Project funded by Innovation Agency.
Survey on buildings life cycle buildings energy performance gap influenced by occupant`s behaviour (PerfoGap), funded by Research Council of Lithuania, 2019-2022.
Competence Centre for Intelligent, Attractive and Adaptive Buildings - SAVAS. Project funded by Central Project Management Agency. 2018-2021.
Energy related projects required specific competences on the development of innovative multicriteria Decision Support Systems (DSS) for planning, design, monitoring, forecasting and maintenance of building engineering systems and their energy consumption, also application of AI-based models and deep expertise on digitalisation of buildings. The researchers participating in the project are also working on other energy related topics, such as district heating systems, thermal and electrical energy storage, HVAC systems, renewable energy technologies, etc.
Innovation services
Knowledge and technology transfer centre (KTTC) - is a hub for the commercialization of R&D results, knowledge and technology transfer, innovative entrepreneurship and promotion of innovation culture. KTTC (https://vilniustech.lt/349263) is the centre which provides comprehensive support with intellectual property and collaboration between academic and industrial partners, fosters technology transfer, offering consultancy, support and facilitation to competitive grant schemes to initiate transfer projects. Also provides a broad range of services to help establish new companies.

Annex 6. Data collection from CoE partners – LSMU

Research strategy: https://lsmu.lt/en/research-and-innovations/strategic-directions-of-research/
Research and experimental development in the fields of medical and health sciences, natural sciences and agricultural sciences are traditionally developed at the Lithuanian University of Health Sciences (LSMU). The University is valuable for its activities in medical imaging, clinical data collection and experience background required for precise management of data collection and analysis, providing valuable labelled datasets based on expert knowledge.

Research excellence
Profiling areas
Lithuanian University of Health Sciences specializes in activities on AI in healthcare. There are four main research institutes in the University: • Institute of Cardiology conducts research in basic and clinical cardiology, as well as population-based cardiovascular epidemiological studies. Research is carried out in 10 research laboratories: Laboratory of Cardiac Pathology, Automation Laboratory for Cardiology Examinations, Laboratory of Clinical Cardiology, Laboratory of Cell Culture, Laboratory of Membrane Biophysics, Laboratory of Molecular Cardiology, Laboratory of Population Studies, Laboratory of Preclinical Research for Medicinal Products, Laboratory of Drug Targets Histopathology, Laboratory of Cell Communication. • Institute of Endocrinology - was established to carry out basic, clinical and epidemiological studies of diseases of the endocrine system at the international and national level, to provide a scientific basis for the third-level (PhD) studies, and to develop the scientific qualifications of the teaching staff. The LUHS Institute of Endocrinology has two laboratories: the Diabetes Laboratory and the General Endocrinology Laboratory. • Institute of Neuroscience - scientists working at the Institute are involved in basic, applied, and clinical research in various areas of neuroscience and behavioural medicine. There are nine Departments (Research Laboratories) at the Neuroscience Institute: Laboratory of Biochemistry, Biophysics and Bioinformatics, Neurophysiology, Molecular Neurooncology, Molecular Neurobiology, Toxicology, Ophthalmology, Behavioural Medicine, and Laboratory for Research of Pharmacological Regulation of Pathological Processes and Drug Metabolism. The Institute has a hospital the Palanga Clinic where rehabilitation programmes for patients with cardiovascular diseases (after myocardial infarction, cardio surgery, coronary artery bypass grafting, pacemaker implantation, etc.) and treatment/rehabilitation for patients with stress-related disorders (depression, anxiety, post-traumatic stress, chronic pain, fatigue and sleep disorders) are provided. • Institute of Animal Science - was established for the fundamental and applied research in animal science on international and national level in the field of agricultural sciences. The Institute develops innovations on experimental basis to provide competitiveness and sustainability of animal production, participates in training of the specialists of the highest qualifications, preserves and upholds national farm animal breeds and the biodiversity of genetic resources. In addition, in LSMU has nine faculty institutes: Institute of Anatomy, Institute of Pharmaceutical Technologies, Institute of Physiology and Pharmacology, Institute of Animal Husbandry Technologies, Institute of Microbiology and Virology, Institute of Oncology, Health Research Institute and Digestive System Research Institute.
Doctoral programs https://lsmu.lt/en/admission/doctoral-studies/#requirements-for-applicants-to-doctoral-studies
The aim of the doctoral studies at the LSMU is to train researchers of the highest competence in the areas of Natural, Medical and Health, and Agricultural sciences, to carry out research and experimental development independently and to solve scientific problems. LSMU offers doctoral studies in 10 equivalent scientific fields. Two of them are the most closely related to AI: Medicine and Public Health. During doctoral studies, collected health data and images are used to solve scientific problems.

Research capacity
Research infrastructure related to SustAInLivWork
At LSMU, research infrastructure is largely operated by the research institutes mentioned above. Additionally, LSMU is a member and active partner of 2 integrated centres of science, studies and business - "Santaka" and "Nemunas" valleys:

- **Santaka Valley** is one of the five "science valleys" in Lithuania, which serve as clusters between science, education and business, in dedicated areas. Santaka focuses on measurement technologies, materials for high technologies, and ICT. It serves as a one-stop-shop for interactions between businesses and universities.
- **Nemunas Valley** is one of the five "science valleys" in Lithuania. It is a modern R&D and related infrastructure for general scientific research, studies and technological development needs of Lithuanian agricultural, forest and food sectors, commercialization of scientific results, transfer of technologies, establishment of new, knowledge-intensive economy entities, creating conditions for agricultural, forest and food companies which are knowledge-intensive, cooperating with science and studies institutions, groups of researchers and increasing competitiveness of Lithuanian agricultural, forest and food sciences and technologies in the international market.

LSMU Data Analytics Centre (DAC) – the aim of the centre is to conduct fundamental and applied research on health data, to help and advice researchers and scientists of the University and University Hospitals on issues of data analytics and tools used for analysis, to offer tools, infrastructure and recommendations in the areas of research data management and reuse, and to carry out commissioned, health data-based, scientific research.

Computing infrastructure related to SustAInLivWork

HPC: 6 nodes with total of: 224 computing cores with 891GB ram + 300TB storage + GPU computing with A100 as mainstream 80GB and 4080 x 4.
Researchers at LSMU can also access the infrastructure at the State Data Agency of Lithuania (https://vda.lrv.lt/en/)

Innovation

R&I projects and initiatives related to SustAInLivWork

- Digital Innovation for Lithuanian Industrial Development (DI4 LITHUANIAN ID), No. 101083434, H2020, 2022-2025. LSMU – partner, 3241752,24 Eu;
- Evaluation of a patient-centred biopsychosocial blended collaborative care pathway for the treatment of multi-morbid elderly patients – ESCAPE, No. 945377, H2020, 2021 – 2025, LSMU – partner, 6 101 206,20 Eur.
- Genomics of SARS-CoV-2: a tool for determining the rate of viral evolution and modelling the clinical and immune response (evoCOVID), No 13.1.1-LMT-K-718-05-0023, 2014-2020 Operational Programme for the European Union Funds Investments in Lithuanian, 2021 – 2023, LSMU – coordinator, 299.477,17 Eur;
- Applied technology of automatic analysis of artificial intelligence images for diagnosis of melanoma and other skin diseases (DIVAT-SMARTPHONE), No. 13.1.1-LMT-K-718-05-0024, 2014-2020 Operational Programme for the European Union Funds Investments in Lithuanian, LSMU – coordinator, 299.961,94 Eur;
- Development of an innovative cellular therapy prototype for the treatment of acute respiratory distress syndrome caused by the SARS-CoV-2 virus (REGEN), No. 13.1.1-LMT-K-718-05-0007, 2014-2020 Operational Programme for the European Union Funds Investments in Lithuanian, LSMU – coordinator, 279 402,16 Eur;
- Hybrid 3D tissue engineering constructs for in vitro studies, No. 09.3.3-LMT-K-712-19-0181, SF, 2020-2022, LSMU-coordinator, 85 008,28 Eur;
- Intelligent Multimodal Imaging System for Skin Cancer Diagnosis (SmartVisSolution), No. 01.2.1-LVPA-K-856-01-0087, SF, 2020-2023, LSMU- partner, 726 424,77 Eur;
- Development of intelligent implantable medical devices with diagnostic and therapeutic functionality, No. S-J05-LVPA-K-03-0101, SF, 2019-2021, LSMU- partner, 2 029 711,31 Eur;
- Development of a MySkin study of basic skin properties based on genetic and biochemical data and an algorithm for predicting skin weaknesses, No. S-J05-LVPA-K-04-0127, SF, 2019-2021, LSMU- partner, 271 469,69 Eur;
- Development of adaptive robotic purification system RoboChrom, No. 01.2.2-MITA-K-702-06-0018, SF, 2020-2021, LSMU- partner, 99 344,00 Eur.HBM4EU European Human Biomonitoring Initiative, No 733032, 2017-2021, H2020, LSMU – partner, 74 169 889,74 Eur
- BaltCityPrevention project: Baltic cities tackle lifestyle related diseases, Interreg Baltic Sea Region Programme 2014 – 2020, 2017-2020, 2 705 000 Eur
- I-MOVE+ Integrated Monitoring of Vaccines Effects in Europe: a platform to measure and compare effectiveness and impact of influenza and pneumococccal vaccines and vaccination strategies in the elderly, No 634446, H2020, LSMU – partner, 7 520 005 Eur.

Innovation services

Health Innovation Development Centre a technology transfer centre, whose main goal is to seek smooth cooperation between research and business in creating, developing and transferring research results. The Centre works in three main areas: commercialization, intellectual property protection, and building a culture of entrepreneurship.
https://lsmu.lt/en/cooperation-of-science-and-business/

EIT Health. LSMU is the coordinator of the EIT Health project in Lithuania, which is a unique network of the European Health Innovation Community with over 150 partners, including major companies, universities, R&D centres, hospitals and institutes. This collaboration helps to address Europe's major health challenges. Some of last year's main topic is AI in Healthcare sector going thought activities in the field of education; activities to provide support to entrepreneurial talents, start-ups and spin-offs; activities in organizing large-scale events; activities to support industry – science dialogue and cooperation; activities in the field of research.