



VTT Technical Research Centre of Finland

Towards a Single Knowledge Transfer (KT) Strategy for the Łukasiewicz Research Network

Lehenkari, Janne; Olesiak, Małgorzata; Peczek, Tadeusz; Oksanen, Juha; Dönitz, Ewa; Loikkanen, Torsti; Sarvaranta, Leena; Popper, Rafael

Published: 02/09/2022

Document Version
Publisher's final version

[Link to publication](#)

Please cite the original version:

Lehenkari, J., Olesiak, M., Peczek, T., Oksanen, J., Dönitz, E., Loikkanen, T., Sarvaranta, L., & Popper, R. (2022). Towards a Single Knowledge Transfer (KT) Strategy for the Łukasiewicz Research Network. Łukasiewicz Research Network.

VTT
<https://www.vttresearch.com>

VTT Technical Research Centre of Finland Ltd
P.O. box 1000
FI-02044 VTT
Finland

By using VTT Research Information Portal you are bound by the following Terms & Conditions.

I have read and I understand the following statement:

This document is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of this document is not permitted, except duplication for research use or educational purposes in electronic or print form. You must obtain permission for any other use. Electronic or print copies may not be offered for sale.



Report:
**Towards a Single Knowledge
Transfer [KT] Strategy for the
Łukasiewicz Research Network**

Authors:

Janne Lehenkari, Małgorzata Olesiak, Tadeusz Pęczek,
Juha Oksanen, Ewa Dönitz, Torsti Loikkanen,
Leena Sarvaranta & Rafael Popper

Knowledge Transfer Strategy

Table of Contents

Executive summary 4

Introduction 6

KT Strategy Pillar 1: Knowledge valorisation.....10

 COMMERCIALISATION OF IP12

 Measures by 202412

 Measures by 202713

 SPIN-OFF CREATION.....14

 Measures by 202414

 Measures by 202715

KT Strategy Pillar 2: Knowledge co-creation16

 COLLABORATIVE RESEARCH18

 Measures by 202418

 Measures by 202719

 CONTRACT RESEARCH.....20

 Measures by 202420

 Measures by 202721

KT Strategy Pillar 3: Knowledge sharing.....22

 NETWORKING AND EVENTS24

 Measures by 202424

 Measures by 202725

 PROFESSIONAL DEVELOPMENT26

 Measures by 202426

 Measures by 202727

Conclusion.....28

References.....30

Annex 1: High-level options for the strategy32

Annex 2: Stakeholder survey.....34

Annex 3: Project team and authors.....37

 VTT TEAM37

 ISI FRAUNHOFER TEAM.....37

 EPRD TEAM38

 AARC TEAM.....39

 CFI TEAM39

Annex 4: Acknowledgments..... 40

The photos used in the publication come from Envato Elements and the archives of the Łukasiewicz Research Network.

This report was prepared with funding by the European Union via the Structural Reform Support Programme and in cooperation with the Directorate General for Structural Reform Support of the European Commission. The views expressed in this report are those of the consultants, and can in no way be taken to reflect the official opinion of the European Union.



Executive summary

This report presents a proposal for a single knowledge transfer (KT) strategy for Łukasiewicz Research Network (Łukasiewicz). It builds on the previous work conducted in the 1KTS4Łukasiewicz project, including the review of European best practices of KT and SWOT (strengths, weaknesses, opportunities and threats) analysis of Łukasiewicz’s KT activities in the Polish context. The proposal for the KT Strategy aims at fulfilling the broader goals of Łukasiewicz while taking into account the differences between individual Łukasiewicz Institutes. For this purpose, we have adopted a broad-based and cross-cutting approach for the KT Strategy and consider strategic objectives and concrete measures for improving KT channels under three KT pillars:

- 1) **Knowledge valorisation:** Commercialisation of research knowledge into marketable solutions.
- 2) **Knowledge co-creation:** Creation and transfer of research knowledge in contract-based collaboration.
- 3) **Knowledge sharing:** Informal sharing of knowledge through various channels.

Each KT pillar is subdivided into two focus areas in our review. The focus areas and strategic objectives for the KT pillars are presented in Table 1 below. All together thirty measures for improving KT channels are considered by elaborating the opportunities, capabilities required, expected impact and Łukasiewicz’s strengths regarding each measure.

Table 1. The focus areas and strategic objectives for KT under three KT pillars.

KT pillar	Strategic objective
1. Knowledge valorisation Focus areas: <ul style="list-style-type: none">– Commercialisation of IP– Spin-off creation	Łukasiewicz should search for improved knowledge transfer via commercialisation of IP and spin-off creation in relevant fields, while paying attention to the extra benefits that patenting and spin-off activities can produce in terms of credibility, industrial connections and professional development.
2. Knowledge co-creation Focus areas: <ul style="list-style-type: none">– Collaborative research– Contract research	Łukasiewicz should take a proactive role in knowledge co-creation by mobilizing experts in Horizon Europe preparations, for instance, and enforcing the utility of its research offering by investing in business training, promotion of services and customer impact assessment.
3. Knowledge sharing Focus areas: <ul style="list-style-type: none">– Networking and events– Professional development	Łukasiewicz should improve the conditions for knowledge sharing by supporting international and business networking with dedicated measures , such as a networking strategy, while enhancing the staff’s capabilities and opportunities to engage in these activities via professional development.

For the focus area of **commercialisation of IP**, we suggest open IPR training for researchers, establishment of an expert IPR organisation, and knowledge exchange with domestic centres for technology transfer as key support measures to be taken in the immediate future (by 2024). In case of **spin-off creation**, the corresponding measures are entrepreneurial competence development for researchers, spin-off support with minimum bureaucracy for researchers, and involving people with a business profile in spin-off projects.

Regarding the focus area of **collaborative research**, we suggest mobilization of experts in EU project activities, a joint funding model (public and private funding) run by Łukasiewicz, and ecosystems approach in regional collaboration as key support measures to be taken by 2024. The corresponding measures for **contract research** are promotion and communication of research services to enterprises, training employees to adapt to business culture, and a customer impact survey.

Concerning the focus area of **networking and events**, we propose the support measures of international networking and training on European research programmes, rewarding of international research collaboration, and cross-organisational networking strategy in the immediate future. For **professional development**, the corresponding measures are supporting outward researcher mobility, English training, and training on the online communications platforms.

We recommend that the following cross-cutting issues are taken into consideration when the KT support measures for each focus area are being implemented:

- **Internationalisation:** While the international dimension is evident in case of many measures proposed, it can be fostered in case of all measures, e.g. by using English language in key documents.
- **Sustainability:** Paying attention to sustainability and responsibility of Human Resources (HR) policies, customer collaboration and overall KT activities creates a sound basis for future development.
- **Business creation:** Opportunities for business creation are potentially present in all KT activities and ensuring that Łukasiewicz creates value for its customers should be a guiding principle in all collaborations and knowledge exchanges.

In the next phase of the 1KTS4Łukasiewicz project, the key enabling actions, financial and human resources, critical steps and key performance indicators for each KT measure presented in this document are further elaborated and reported in Deliverable 5, Plan for Implementation.



Introduction

In this report, we present a proposal for a single knowledge transfer (KT) strategy for Łukasiewicz Research Network (Łukasiewicz). It builds on the previous work conducted in the 1KTS4Łukasiewicz project, including the analysis of gaps and needs, critical issues and best practices of KT (Popper et al. 2021), as well as the SWOT (strengths, weaknesses, opportunities and threats) analysis and generation of high-level strategic options for the KT Strategy (Suominen et al. 2022). The KT Strategy proposed in this document aims at fulfilling the broader goals of Łukasiewicz while taking into account the differences between individual Łukasiewicz Institutes.

Research and Technology organisations (RTOs), such as Łukasiewicz, have a public mandate to support society and the economy by advancing the use and commercialisation of research and technology. KT channels are crucial for RTOs for fulfilling this mandate and creating impact and value for and with the users of knowledge (see Figure 1). The proposed KT Strategy aims at guiding Łukasiewicz to manage its KT channels comprehensively and systematically by ensuring that appropriate and well-functioning support measures are in place for fostering the knowledge flow at all levels. Furthermore, the proposed KT Strategy aims at assisting Łukasiewicz to diminish the risk of duplication of efforts and coordination shortcomings in KT while creating more transparency and easier access to the R&D offering of Łukasiewicz for external stakeholders (e.g. industry).

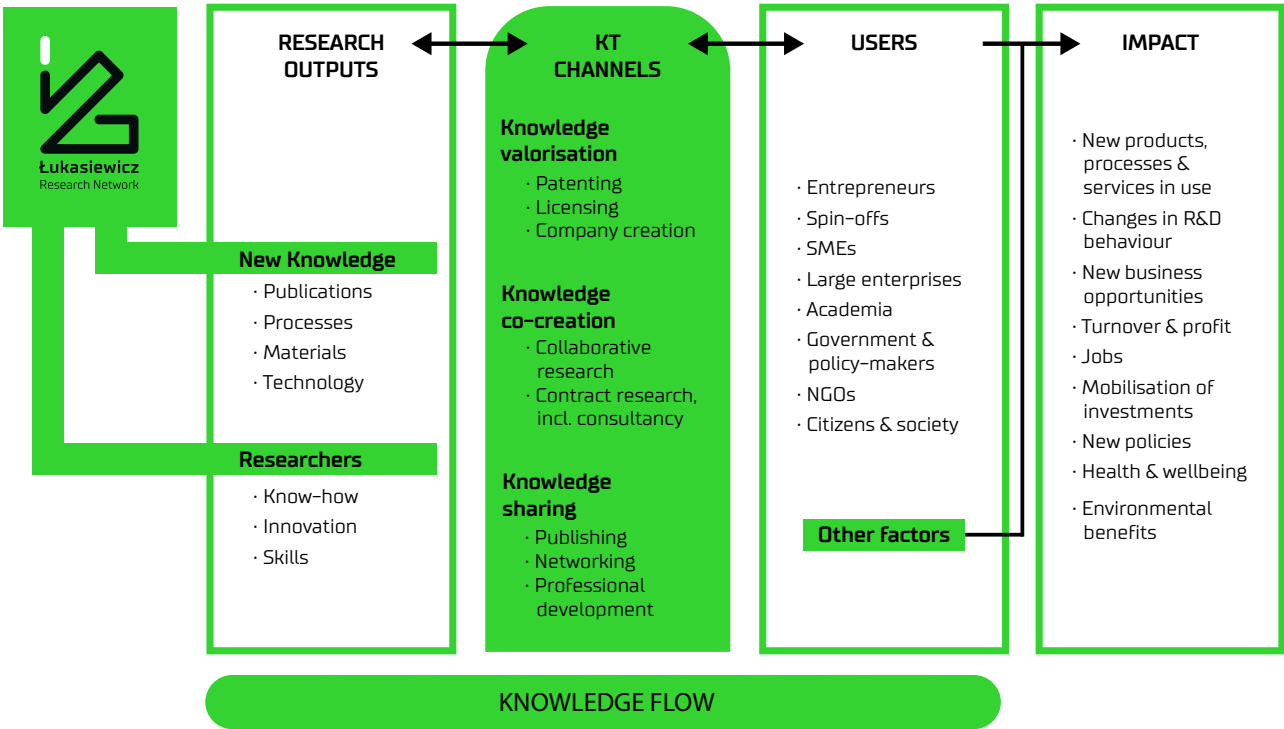


Figure 1. From research to impact via KT channels. Adapted from Campbell et al. 2020; cf. Holı et al. 2008.

Commercialisation of research results (knowledge valorisation), e.g. through licensing, is a well-recognised but only one KT channel that is relevant for RTOs. Depending on the discipline and industry in question, other KT channels may prove equally or more important to RTOs and other public research performers. As a point of comparison, the UK university system generated more than 60% of its KT income through contract research and collaborative research, whereas the share of IPR revenue was only 5% in the period 2015–2019 (Ulrichsen 2020). In case of RTOs, Fraunhofer (Germany) stands out in terms of the volume and income coming from licensing activities, but, nevertheless, the IPR revenue was only 4% (€99M) of the total turnover of Fraunhofer in 2020 (Fraunhofer 2021). These examples point out the need for a broad-based consideration of KT channels without favouring one type of KT channel – commercialisation of research results, in particular – over others.

In addition to the broad-based approach on the KT channels, it is also important to consider the bi-directional character of KT. The bi-directional character of KT means that knowledge flows in both ways from RTOs to the users of knowledge and vice versa (cf. Siegel et al. 2003; Kutvonen et al. 2013). The bi-directional KT is beneficial for RTOs in multiple ways. For example, acquiring critical knowledge from industry is highly valuable for researchers as it can open an array of research avenues that would not have emerged otherwise (D’Este & Patel 2007).

The previous analysis of the 1KTS4Łukasiewicz project (Popper et al. 2021) highlighted many positive elements of the Polish innovation system for the KT activities of Łukasiewicz, such as the supportive legal framework (e.g. tax incentives), the size of knowledge-intensive services exports, and the access to European RDI (Research, Development & Innovation) and business development programmes (see Figure 2). Concerning Łukasiewicz’s own strengths, the new KT measures, such as the Challenges System, provide promising avenues for KT activities within and outside Łukasiewicz. Also, the strong competence of employees, high-quality research infra and well-working connections to industry can be highlighted as strengths of Łukasiewicz’s KT activities.

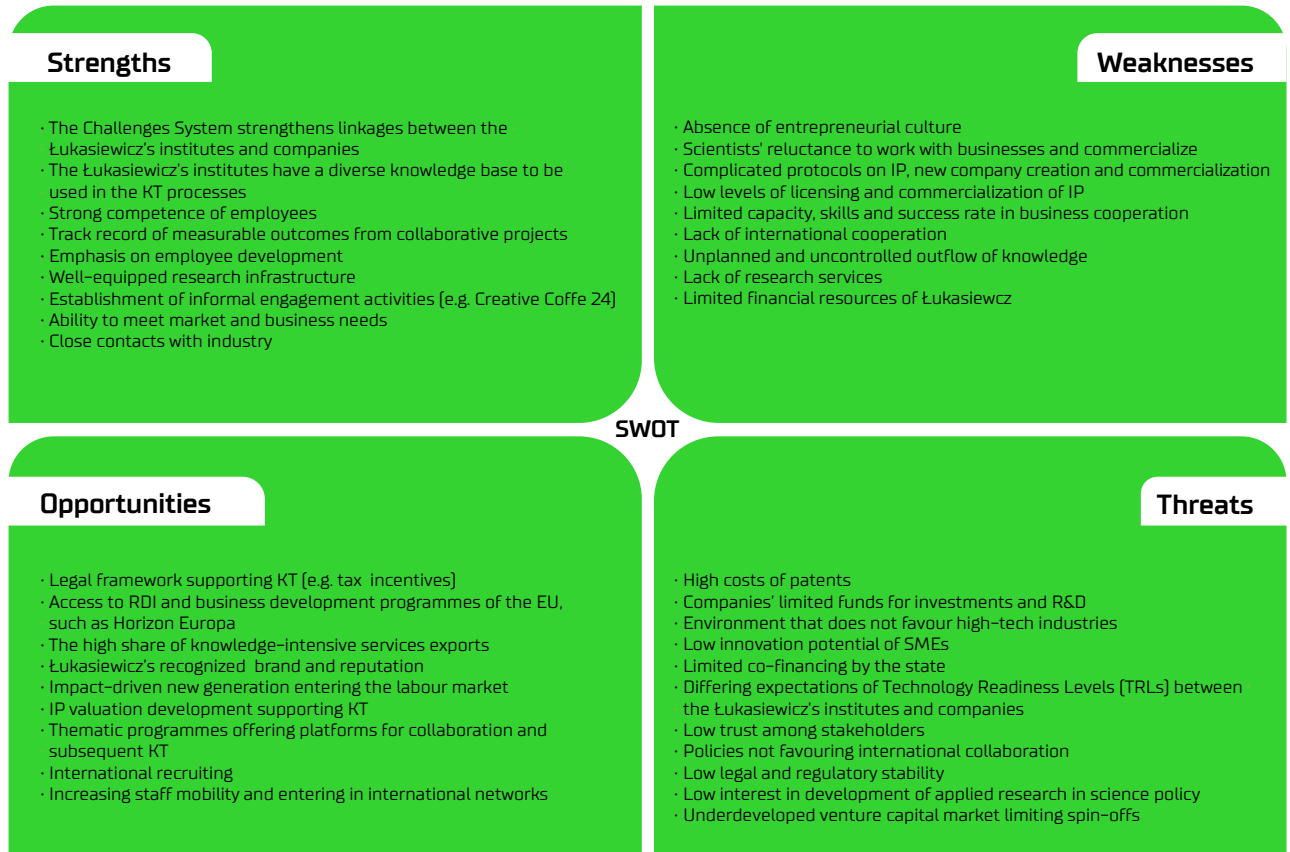


Figure 2. SWOT analysis of the Łukasiewicz’s KT activities. Based on Popper et al. 2021.

Despite the excellent development in many of the core aspects of KT, there are still factors that may impede the positive development. Concerning system-level threats, it should be noted that the Polish innovation system does not seem to favour high-tech industries, and firms – particularly SMEs – have a low potential to innovate and invest in R&D. In addition, financial restraints affect many aspects of KT activities negatively, including the issues of hight costs of patenting, underdeveloped venture capital market, and limited co-financing of R&D by the state. Within Łukasiewicz, there are problems related to the absence of entrepreneurial culture, complicated protocols on IP and new company creation, and lack of international collaboration. All in all, overcoming the problems and fully exploiting the strengths and opportunities affecting KT will require persistent and determined work from Łukasiewicz and strong support from the key stakeholders, such as the Ministries concerned.

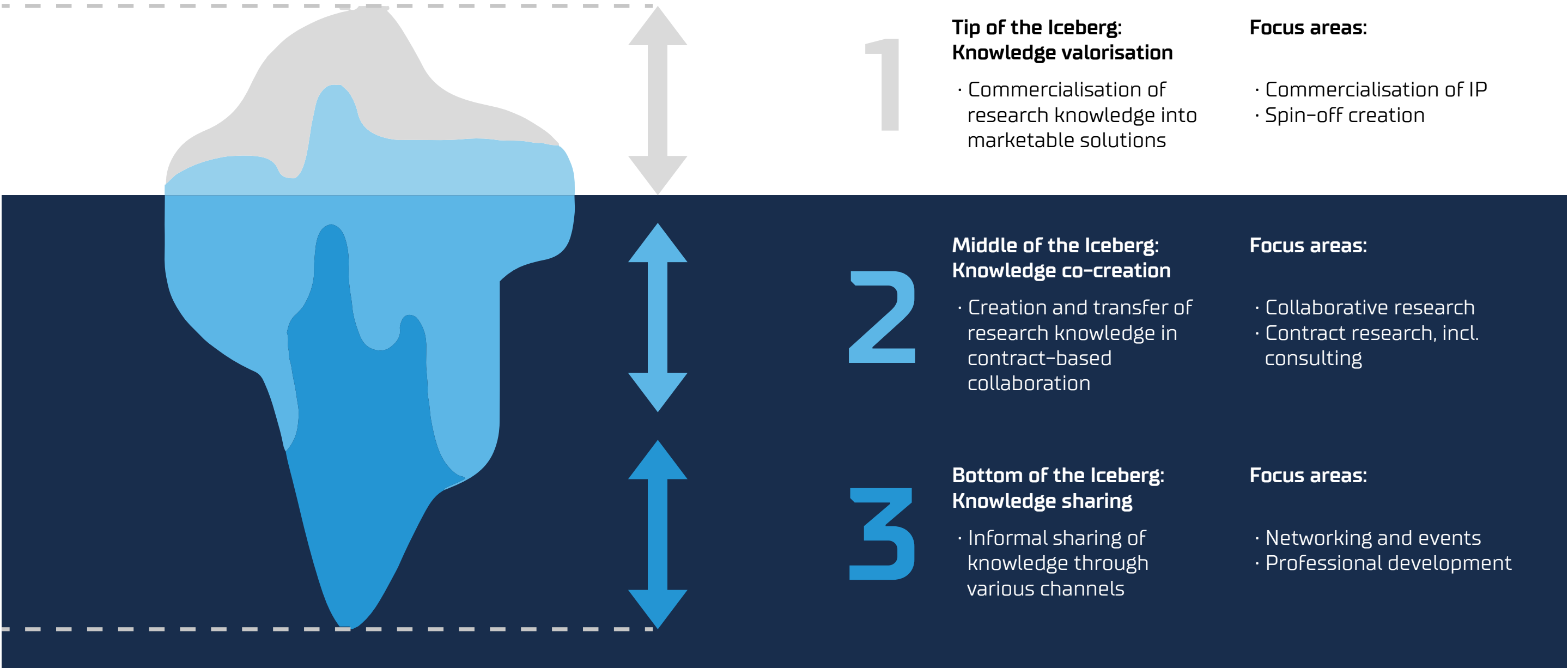
In this report, we have adopted a broad-based and cross-cutting approach for the KT Strategy (Figure 3). We will consider thirty measures for improving KT channels under three KT pillars: 1) Knowledge valorisation, 2) Knowledge co-creation, and 3) Knowledge sharing. Each pillar is subdivided into two focus areas in our review. For each measure, we consider the opportunities it offers, capabilities required, expected impact and Łukasiewicz's strengths.¹

The prioritization of the measures – achievement is targeted either by 2024 or 2027 – is based on the stakeholder survey that was participated by all the Łukasiewicz Institutes in the spring of 2022 (see Annex 2 for survey details). In addition, the results of the stakeholder consultation with the Łukasiewicz management board (Warsaw, May 13th 2022) have been taken into account.

In the following chapters, the measures for supporting and improving KT channels under the three pillars of KT are addressed in detail. Also, the strategic objectives for each pillar of KT are put forward. A summary and discussion on the cross-cutting issues of internationalisation, sustainability and business creation are provided in Conclusion.



Figure 3. The “Iceberg” approach on the KT Strategy: Broad-based and cross-cutting improvement of two-way KT channels.



¹ The high-level options for the KT Strategy [enabling discovery, willingness to share and acquire knowledge, and absorptive capacity] elaborated by 1KT54Łukasiewicz project previously [Suominen et al. 2022] were used as background information when the measures were formulated. The high-level options for the KT Strategy are presented in Annex 1.



KT Strategy Pillar 1: Knowledge valorisation

Knowledge valorisation refers to commercialisation of research knowledge into marketable solutions. In the case of public research performers, the commercialisation of research knowledge usually takes place either through 1) licensing or selling IP (patents, trademarks and copyrights) or 2) creation of deep-tech spin-off companies, that is, academic entrepreneurship. In order to foster knowledge valorisation, many universities and RTOs have established versatile in-house support services, such as Technology Transfer Offices (TTOs), incubators and accelerators, or collaborate closely with external service providers.

Since the US Bayh-Dole Act of 1980, strong IP protection for the results of publicly-funded R&D has been seen as essential for accelerating their commercialization and the realization of economic benefits (cf. Kutvonen et al. 2013). Especially, the role of patents has been seen as critical for knowledge valorisation since patent protection enables the private investments that are many times needed to bring a knowledge-based innovation to market (EPO 2020, 10). The commercialisation of patents does not always mean selling or licensing individual patents but public research performers may choose to pool their patents with other parties and, thus, create international patent pools that generate license income worldwide, such as the Fraunhofer's audio and video encoding patent pool (Fraunhofer 2021, 22).

The role of spin-off creation – the establishment of spin-off companies by researchers to commercialise research results – has gained more and more attention in research and innovation policy (cf. Clarysse et al. 2011; Hayter et al. 2018). Usually, spin-off creation demands higher involvement and commitment from the participating researchers in comparison to selling or licensing patents (Oxford University Innovation 2014). Many RTOs have founded incubator services that enable the full-time engagement of researchers with spin-off activities, such as VTT's LaunchPad and TNO's Tech Transfer Program.

In principle, knowledge transfer can take place with minimal involvement of a researcher when a TTO licenses or sells a patent to a client for financial reward. However, this rarely occurs in practice and researcher's involvement is usually needed during the whole licensing process for giving support, answering the questions and considering the improvements over the patented technology (Oxford University Innovation 2014). In this sense, the licensing process can be a highly bi-directional knowledge transfer activity, in which the researcher gets first-hand knowledge on the industrial and business requirements of the client. In case of spin-off creation, there are good opportunities for bi-directional knowledge transfer, as well, since spin-off activities usually take place within the premises of the host organisation.

The main limitation of knowledge transfer via patenting is that patenting is highly relevant only in selected disciplines and industries. For example, over half of the world's university patents are filed in the area of chemistry, including biotech and pharmaceuticals (Fisch et al. 2015). Concerning RTOs, Fraunhofer stands out in terms of the volume and income coming from licensing activities. Fraunhofer's IPR revenue was 4% (€99M) of the total turnover in 2020 (Fraunhofer 2021). For other RTOs, licensing plays a less significant role. For example, both at TNO and VTT, the income from IP has been circa 1% (€3M–€6M) of the total turnover in recent years (TNO 2020; VTT 2022). However, the financial figures do not give the whole picture when the importance of patenting and spin-off activities is considered. First, in some domains, such as biotech and life sciences, the presence of patent protection is a requirement for any business collaboration. Second, patents can play a vital role in achieving other research-related benefits, such as gaining reputation and credibility among academic and industry-related communities (D'Este & Perkmann 2011).

Based on the discussion above and the research and consultations conducted in the 1KTS4Łukasiewicz project, we propose the following strategic objective for the knowledge valorization of Łukasiewicz:

STRATEGIC OBJECTIVE FOR KNOWLEDGE VALORISATION

ŁUKASIEWICZ should search for improved knowledge transfer via commercialisation of IP and spin-off creation in relevant fields, while paying attention to the extra benefits that patenting and spin-off activities can produce in terms of credibility, industrial connections and professional development.

Next, the high-priority measures that are needed in the immediate future (by 2024) for achieving this strategic objective are described in detail in the focus areas of commercialisation of IP and spin-off creation. The selection of the high-priority measures is based on the results of the stakeholder survey that was participated by all the Łukasiewicz Institutes in the spring of 2022. These are followed by other measures, which were not given as high priority in the survey. However, these other measures are still important for the broad-based improvement of knowledge valorisation through patenting and spin-off activities in the near future (by 2027) according to the best practices and literature reviews conducted in this study.





Measures by 2024

Open intellectual property rights [IPR] training for researcher

Łukasiewicz should provide open training in research commercialisation and IPR issues for researchers on an ongoing basis.	
Why?	IPR training improves researchers' capabilities to create and manage IPR allowing them to get recognition and protection for the novel knowledge and solutions they produce. For Łukasiewicz, improved IPR management practices among its employees entail both proofs of excellence of research and new ways to generate income. By keeping IPR training open for all and lowering the threshold or even encouraging (as part of career development) to take part in the training, the benefits of improved IPR management practices are maximised within Łukasiewicz.
How?	The design of IPR training courses and related training modules requires considerable and up-to-date expertise of IPR management. In case of RTOs, IPR managers working at the operational level have this level of expertise in most cases. The actual IPR training can be implemented as training modules on an online learning platform that is easy to access at any time and place. For example, VTT (Finland) provides 7 interactive training modules on IPR for its employees on its Opinet learning platform. Each module has a specific topic concerning IPR and takes about 30–45 minutes to complete.
Expected impact	Improved IPR management skills increase the utilisation of research results and are an important part of well-working industrial collaboration.
Łukasiewicz's strengths	Currently, the Łukasiewicz staff entering commercialisation activities receive free of charge support from the Łukasiewicz legal advisers for IPR protection and management.

Establishing an expert IPR organisation

Łukasiewicz should establish an expert organisation consisting of IPR professionals and experienced researchers to define a common IPR strategy, rewarding model and required management practices, including IPR training provision.	
Why?	An expert organisation consisting of IPR specialists and experienced researchers can define and implement a common IPR strategy that improves the overall IPR management across Łukasiewicz.
How?	The expert IPR organisation must be capable to create an IPR strategy. For example, the IPR strategy of VTT (Finland) includes 1) creation of IP plans for the relevant technology areas, 2) selection of IPR protection and commercialisation approaches for key technologies, and 3) selection of new inventions and advances as key technologies.
Expected impact	Improved IPR management via the support of an expert IPR organisation improves business collaboration by better utilization and diffusion of research results.
Łukasiewicz's strengths	Almost all the Łukasiewicz Institutes have administrative and legal units dedicated to IPR or external legal support. Establishment of an expert IPR organization at the network level would be feasible.

Knowledge exchange with domestic centres for technology transfer for learning purposes

Łukasiewicz should exchange experiences and best practices with domestic centres for technology transfer for mutual learning and benefit.	
Why?	More than 70 Polish universities and research organisations are participating in The Polish Association of Centers for Technology Transfer (PACTT), which offers good opportunities to exchange experiences over IPR management and related issues (https://pactt.pl/).
How?	An action plan to collaborate within PACTT is needed.
Expected impact	Benchmarking with and learning from other organisations can be used for development of IPR management capabilities in Łukasiewicz.
Łukasiewicz's strengths	Łukasiewicz is well placed to benefit from national collaboration with centres for technology transfer. Most of the Łukasiewicz Institutes, laboratories and individual scientists have broad-based cooperation with universities, including double affiliations.

Measures by 2027

Standardized IP protocol

When implementing the IPR strategy, Łukasiewicz should ensure that a standardized IP protocol is in place and applied by all institutes, including model agreements, guides and practical support for business collaboration. Also, information analysis tools, such as patent and innovation landscapes, should be readily available.	
Why?	A standardised IP protocol ensures uniform and efficient IPR management across the Łukasiewicz.
How?	Preparation of model agreements and practical guides, as well as provision of practical support is needed. For example, see the IP protocol of Knowledge Transfer Ireland (https://www.knowledgetransferireland.com). In addition, information analysis tools are needed, e.g., for creating innovation landscapes that contain patent analyses and market studies enabling comparison of different patent portfolios with each other and identification of potential clients, competitors and partners.
Expected impact	The uniform and efficient IPR management enables a smooth and transparent business collaboration and increases the potential leverage from utilization of research results.
Łukasiewicz's strengths	Almost all the Łukasiewicz Institutes have administrative and legal units dedicated to IPR or legal support, which supports the introduction of a common IP protocol.

Contacting international venture capital investors for co-investment models

To valorise IP effectively, Łukasiewicz should establish direct contacts with international venture capital investors, including the European Investment Bank and other business actors interested in knowledge valorisation.	
Why?	Commercialisation of deep tech (technology solutions based on substantial scientific or engineering challenges that require long-term R&D work) requires active collaboration, risk-taking and critical mass, including search for co-investment models with international venture capital investors.
How?	An action plan to collaborate with international venture capital investors is needed. For instance, TNO (Netherlands) has recently started a close collaboration with a private venture-building accelerator, HighTechXL (https://www.hightechxl.com/). For another example, see Voima Ventures private equity fund that is participated by VTT (Finland) and European Investment Fund (https://voimaventures.com/).
Expected impact	Collaboration with international venture capital investors creates possibilities to create co-investment and other funding models to support the utilization of research results, especially in up-scaling of solutions based on deep tech.
Łukasiewicz's strengths	The internationalisation plans of Łukasiewicz include efforts to contact venture capital investors abroad.





Measures by 2024

Entrepreneurial competence development for researchers

Researchers entering spin-off projects should get support in terms of entrepreneurial competence development, including individual and shared development targets.	
Why?	Researchers entering spin-off activities benefit from entrepreneurial competence development that helps them to advance business plans, market analyses and roadmaps for commercialisation. It is known that the success of a spin-off firm is dependent on how well the team behind it works together. Therefore it is also important that the entire spin-off team and its individual members identify their strengths and areas for improvement in terms of entrepreneurial competence development.
How?	Entrepreneurial competence development requires an external facilitator that helps the spin-off team to discuss, draft and monitor the team's shared development targets concerning entrepreneurial competence development. For example, at VTT (Finland), the entrepreneurial competence development is run by an incubation team consisting of 7 full-time professionals.
Expected impact	The success rate of spin-off companies is improved if spin-off teams work together well and know their strengths and areas needing improvement.
Łukasiewicz's strengths	Łukasiewicz has recently implemented a new talent management system aiming at increasing the technical and business skills of researchers.

Spin-off support with minimum bureaucracy for researchers

Researchers should be able to get broad-based spin-off support with one application, including support in business and IPR development, project financing and networking services.	
Why?	Minimal bureaucracy lowers the threshold to enter spin-off activities. A one-stop-shop approach in spin-off services shortens the lead-in time for viable ideas and project preparation can start from day one.
How?	Spin-off support should include team building and development mechanisms, a need-based programme structure that reacts according to the needs of the projects, market interaction right from the start, as well as standardised and transparent documentation. For example, see Fraunhofer's AHEAD programme (https://www.ahead.fraunhofer.de/en.html).
Expected impact	By lowering the threshold to enter spin-off activities and shortening the lead-in time, commercialisation of research results is speeded up.
Łukasiewicz's strengths	Łukasiewicz has established a dedicated programme to support spin-off company creation (Accelerator). Also, there is close cooperation between business and legal experts within Łukasiewicz.

Involving people with a business profile in spin-off projects

Spin-off teams should always include people with a business profile, even from outside the host organisation.	
Why?	In order to improve the success rate of spin-off companies, it is necessary to include both technological and business profiles in spin-off teams. Since not all the researchers possess the required business skills, teams can be supplemented with business experts even outside the host organisation when needed.
How?	Versatile connections to the business ecosystem of relevance are required for contacting people with suitable business profiles to be invited to enter spin-off teams. Contacts with former spin-off or start-up entrepreneurs can prove valuable, in particular. According to the experiences gained by Tecnalia Ventures, which is the spin-off service provider of Tecnalia (Spain), knowing the right people requires long-term involvement and connections within the business ecosystem, including smart investors, such as VC firms.
Expected impact	Versatile involvement and connections within the business ecosystem fosters an improved success rate of spin-off companies.
Łukasiewicz's strengths	There are new IT tools to support and attract cooperation across the teams and Łukasiewicz Institutes (e.g. Challenge solver). There is also dedicated support for business-oriented scientists in IPR protection and management.

Measures by 2027

On-site mentorship and support

Łukasiewicz should provide on-site mentorship and support for spin-off projects and thus pay attention to the physical proximity of participating people.	
Why?	When a spin-off project is moving to the proof-of-concept stage (from an idea to a business model), a set of specialized skills and their integration is needed, to which on-site mentorship and support can contribute.
How?	Mentoring is needed to integrate specific scientific and technological knowledge with skills in marketing, science-based start-ups, IPR management, etc. already during the proof-of-concept stage. For example, INESC TEC's (Portugal) LET-in pre-incubation services are run by 3 full-time experts together with a network of technological and business mentors who are involved in projects on an occasional basis.
Expected impact	The increased number of spin-off projects passing the proof-of-concept phase with mentoring help increase the commercialisation of research results.
Łukasiewicz's strengths	There is close cooperation between business and legal experts within Łukasiewicz, which supports mentoring activities.

Comprehensive technology transfer and entrepreneurship programme

Łukasiewicz should establish a comprehensive technology transfer and entrepreneurship programme with the objective of helping researcher-driven spin-off projects to become market- and investment-ready within a maximum of two years.	
Why?	In order to promote technology transfer, entrepreneurship and engagement in new ventures on a large scale, a comprehensive and well-targeted tech transfer and entrepreneurship programme is needed.
How?	A comprehensive tech transfer and entrepreneurship programme requires considerable resources. For example, Fraunhofer's AHEAD programme has an annual budget of €9M.
Expected impact	The increased number and success rate of spin-off companies improve the commercialisation of research results.
Łukasiewicz's strengths	Łukasiewicz has already established a dedicated programme to support spin-off creation (Accelerator).





KT Strategy Pillar 2: Knowledge co-creation

Knowledge co-creation refers to the creation and transfer of research knowledge in contract-based collaboration with the industry and other external actors (cf. Kutvonen et al. 2013). Two focus areas can be distinguished in knowledge co-creation: 1) collaborative research, and 2) contract research (including consulting). Collaborative research is carried out through formal collaborative arrangements aimed at cooperation on R&D projects (D'Este & Perkmann 2011). Usually, the content of collaborative research is pre-competitive and, thus, these projects can get public support from European or national public research programmes. Concerning IP, the typical arrangement is that the ownership of the results and IP generated is shared between the participants of the collaborative research project. For instance, in Horizon Europe, the shared ownership is defined in the joint ownership agreement as part of the consortium agreement or separately.²

Contract research is commissioned by the firm and the research work is usually more applied and commercially focused than in the case of collaborative research (D'Este & Perkmann 2011). Public subsidies are not usually available for contract research due to its commercial focus, except for the various innovation voucher funding schemes dedicated to SMEs. The innovation vouchers are available in many European countries, and, for instance, in Finland, an SME can get EUR 5,000 for buying research and innovation services for its product and service development.

In contract research, the results and IP generated are usually owned by the commissioning firm. Consulting is a specific case of contract research. It refers to advisory services provided by individual researchers to their clients on commercial terms (Perkmann & Walsh 2008).

Knowledge co-creation is a more common activity for researchers in many disciplines in comparison to the commercialisation of IP and spin-off creation that were addressed earlier. In the UK, for instance, about half of UK researchers in the physical and engineering sciences are engaged in knowledge co-creation, while only 12% - 22% are engaged in the commercialisation of IP and spin-off creation respectively (D'Este & Perkmann 2011; cf. Perkmann et al. 2021).

While their significance is widely acknowledged, collaborative and contract research are a much less studied area than the commercialisation of IP and spin-off creation in terms of KT (cf. Perkmann et al. 2013). It has been noticed, however, that knowledge co-creation is a highly bi-directional KT activity as knowledge flows in both ways from industry to academia and vice versa. Interaction with industry practitioners exposes researchers to a wide range of technological problems and needs identified by industry, which opens an array of research avenues that would not have emerged for researchers otherwise (D'Este & Patel 2007).

The importance of collaborative and contract research for RTOs is high in terms of research volume and funding. For instance, the EU programmes for research and innovation, which are the key funding sources for European RTOs, mainly fund collaborative research and the presence of industry and other stakeholders in the EU research consortiums is usually required. Concerning contract research of RTOs, the income from the business sector (excluding licensing fees) can be used as an instructive indicator. In the case of Fraunhofer, the income from the business sector was 25,1% of the total turnover in 2020 (€662M) (Fraunhofer 2021). For TNO and VTT, the figures were 16,5% (€92M) and 26,4% (€67M) respectively (TNO 2020; VTT 2022).

² See https://intellectual-property-helpdesk.ec.europa.eu/ip-eu-funded-projects_en.

³ See <https://www.businessfinland.fi/en/for-finnish-customers/services/funding/research-and-development/innovation-voucher>.

⁴ See <https://aineetonansainta.fi/wp-content/uploads/2019/05/EU-IPR-Guide-IP-and-Contracts.pdf>.

Following the discussion above and the research and consultations conducted in the 1KTS4Łukasiewicz project, we propose the following strategic objective for the knowledge co-creation of Łukasiewicz:

STRATEGIC OBJECTIVE FOR KNOWLEDGE CO-CREATION

ŁUKASIEWICZ should take a proactive role in knowledge co-creation by mobilizing experts in Horizon Europe preparations, for instance, and enforce the utility of its research offering by investing in business training, promotion of services and customer impact assessment.

Next, similarly to the previous section, the high-priority measures that are needed in the immediate future (by 2024) for achieving this strategic objective are described in detail in the focus areas of collaborative research and contract research. The selection of the high-priority measures is based on the results of the stakeholder survey that was participated by all the Łukasiewicz Institutes in the spring of 2022. These are followed by other measures, which were not given as high priority in the survey. However, these other measures are still important for the broad-based improvement of knowledge valorisation through collaborative and contract research activities in the long run (by 2027) according to the best practices and literature reviews conducted in this study.





Collaborative research

Measures by 2024

Mobilization of experts in EU project activities

Horizon Europe activities should be enhanced by mapping domain experts and their contact networks and mobilising them towards various EU initiatives, European Partnerships in particular.	
Why?	Łukasiewicz institutes can take a leading role in internationalising of the Polish Science and Innovation System. Not only should the Łukasiewicz Institutes be involved in the EU project activities but also their industrial partners and other local actors should be brought in whenever they can provide complementary competencies.
How?	Horizon Europe funding is based on high-quality and complementary competencies present in the project consortium, a sound impact offer, and a credible project implementation capability. Experts need to reach out for the key positions in the European Partnerships. For this to happen, Łukasiewicz Institutes need to secure a dedicated networking and travel budget for experts. Łukasiewicz Institutes also need to provide professional financial, administrative and contractual support for EU project planning, preparation and execution.
Expected impact	By increasing its EU activities, Łukasiewicz can contribute positively to the Poland's revenues from EU programmes.
Łukasiewicz's strengths	Łukasiewicz has a wide regional presence in Poland, which is a unique asset for developing local knowledge and innovation hubs. Łukasiewicz already has a group of trusted partners for applying domestic research and innovation funds. Łukasiewicz is member of EARTO, which offers accelerated opportunities for collaboration with the key European RTOs and door-openings towards European Partnerships.

A joint funding model (public and private funding) run by Łukasiewicz

In situations when current public funding mechanisms are not meeting the real need in practice, Łukasiewicz should initiate a joint funding model (combining public and private funding) to enable application-driven research projects that are of core interest to Łukasiewicz and its partner companies.	
Why?	A joint funding model can be used as a tool to pool funding and continue or initiate application-driven projects, which require large resources while no other public funding resources are available. The objectives of the joint funding model can be aligned with Łukasiewicz's core strategy and the needs and interests of the participating companies.
How?	When initiating a jointly-funded project, legal aspects become critical from the onset (IPR and state-aid rules). Also, the presence of in-house domain experts is important for the projects to be attractive and meaningful for the companies to join. For instance, at VTT (Finland), the Shared Benefit (SB) project model has been utilized to fund research activity, which brings together VTT and at least 3 business partners to innovate and research on a shared topic. In the SB project, the participating companies provide 70% of funding, while a maximum of 30% of funding is provided by VTT.
Expected impact	When other funding mechanisms are limited, the joint funding model ensures continuity and progression of research that is of core interest to Łukasiewicz and its partners.
Łukasiewicz's strengths	Łukasiewicz's project organisation and support activities enable the development of a joint funding model provided that the preconditions related to financing and regulation are taken care of.

Ecosystems approach in regional collaboration

Łukasiewicz should apply the ecosystems approach in regional collaboration in order to build common activities and trust between researchers and regional actors.	
Why?	Łukasiewicz can actively contribute to regional innovation ecosystems through collaborative research projects with companies, universities and other regional actors. Especially, regional business collaboration creates possibilities for Łukasiewicz to identify local industry needs and build trust with business partners, which is necessary for long-term engagements and knowledge transfer in value chains.
How?	To make the best use of regional business collaboration, the RTO has to operate on multiple levels. Based on the experiences gained by INESC TEC (Portugal) in the implementation of its Innovation Ecosystem approach, the capability of acting at the different levels – European, national and regional – allows the alignment of research and innovation strategies and agendas, as well as the utilization of multiple support programmes and funding instruments (e.g. under Horizon Europe). This requires a mid- to long-term activity that calls for persistence and significant investments in terms of human resources. For its five core market areas, INESC TEC has hired a coordinator and a business developer for each.
Expected impact	Through regional business collaboration, the RTO can take a leading role in the green and digital transition of the region, among others.
Łukasiewicz's strengths	Łukasiewicz has a wide regional presence in Poland, which is a unique asset for developing local knowledge and innovation hubs. Łukasiewicz already has a group of trusted partners for applying domestic research and innovation funds. The broad and well-designed Łukasiewicz campaign to promote science and Network successes in newspapers and other public media has proven successful. Recently, Łukasiewicz has been involved in numerous public activities in cooperation with Polish businesses related to COVID-19, such as the development of post-Covid treatment methods and the design of special medical masks.

Collaborative research

Measures by 2027

Building a brand identity

Łukasiewicz should build a brand identity to strengthen its position as a preferred partner that combines scientific and technological expertise with forward-looking industrial knowledge and societal responsibility.	
Why?	A strong brand identity will enable Łukasiewicz to start contributing to future policies design and have an influence on the development of the operational research and innovation environment, together with public and private actors.
How?	A key success factor of brand identity is the achievement of the defined objectives in the successful projects with industrial and public partners. For instance, AIT (Austria) has built its brand identity as an "Ingenious partner" through its business model that combines technological competence and expertise, systems expertise, the application of scientific methods and high-quality research infrastructure, complemented by thorough industry and market knowledge and close relationships with clients.
Expected impact	Branding is a necessary asset in making the Łukasiewicz's forward-looking vision to become true. Branding is a useful asset for enhancing financial resilience. It is also important for attracting talents.
Łukasiewicz's strengths	The key strength is the specialised research staff in many fields of science and technology, and advanced and interdisciplinary research work. Research, testing and quality control is performed in accredited laboratories.

Surveys and market analyses of industries

Łukasiewicz should conduct surveys and market analyses of strategically relevant industries in domestic and international markets regularly.	
Why?	Surveys and market analyses are needed for creating forward-looking industrial and market knowledge, which is essential for building a brand identity as a preferred partner.
How?	Processing of business and market information can be enhanced by a dedicated knowledge services unit. For instance, at VTT (Finland), knowledge services are provided by a team of experts (6 FTEs). These knowledge services include market research reports and industry information, company information, business news and customized information analysis (e.g. innovation landscapes).
Expected impact	With forward-looking industrial and market knowledge, Łukasiewicz can attract business and public sector clients.
Łukasiewicz's strengths	Łukasiewicz Institutes meet entrepreneurs, exchange knowledge and receive information about their research needs. Innovatorium – periodical annual event designed as an opportunity for meeting public bodies, scientists, businesses and private equity – provides opportunities for information gathering, potential cooperation and new projects.





Contract research

Measures by 2024

Promotion and communication of research services to enterprises

Łukasiewicz should strengthen its promotion and communication activities on research services to enterprises, including SMEs.

Why?	Promotion activities strengthen the awareness on Łukasiewicz's research offering, business references, IPR assets, networks, and skilled and motivated staff among the business clients.
How?	Effective promotion of research services requires sales and customer personnel who can perform active contacting and long-term engagement with business clients. For instance, at VTT (Finland) each research area (80-100 researchers) has a sales lead who promotes research services to business clients.
Expected impact	Increased awareness of Łukasiewicz's offering among business clients can increase the number of industrial contracts.
Łukasiewicz's strengths	The Łukasiewicz Institutes present the scientific achievements at seminars, conferences, workshops and training courses. Employees are active in industry organizations. Joint activities are initiated with industry on a constant basis, e.g. applications for joint research and development projects.

Training employees to adapt to business culture

In order to smoothen the business collaboration, Łukasiewicz should train employees to get entrepreneurial and business skills.

Why?	Especially in the case of SMEs, building trust and enhancing good collaboration requires transparency and adaptation to business culture, objectives and operations. Adapting to business culture is a key to smooth and efficient collaboration.
How?	Training on technology management, innovation cycle, project management and innovation strategy is required. As an example, at Tecnalia (Spain), researchers participating in the Orainn SME contract research programme get training on these issues, as well as support from legal affairs for contractual matters, etc. In the Orainn programme, collaboration with an SME can last one year.
Expected impact	Smooth collaboration and creation of trust can lead to long-term partnerships with businesses.
Łukasiewicz's strengths	By 2020, over 80 Łukasiewicz researchers have been qualified by Ministry of Education and Science with industrial PhDs achieved in cooperation with selected companies. An additional aim was training researchers on business-science cooperation and management.

Customer impact survey

Łukasiewicz should conduct a customer impact survey on a regular basis for business clients to support development of contract research services.

Why?	Customer impact surveys are needed to clarify the results and effectiveness of Łukasiewicz's project activities from the customer's point of view. The customer impact survey provides increased understanding of Łukasiewicz's added value for the customer and helps to develop contract research services.
How?	Customer impact surveys can be outsourced to specialized market research companies. For instance, at VTT (Finland), a customer impact survey is conducted every few years to study the effectiveness of VTT's project activities and VTT's added value for reaching the project targets. In addition, issues related to the competitive environment and general rating of VTT services are addressed in the customer impact survey.
Expected impact	Improved strategic management and delivery of contract research services with the help of a customer impact survey can increase the number of industrial contracts.
Łukasiewicz's strengths	The "Challenges" as a new system of cooperation with business is part of monitoring and evaluating business R&D activities.

Contract research

Measures by 2027

Rewarding of customer work

Łukasiewicz should recognize successful business collaboration to make customer work more visible, e.g. by giving a reward for the best customer project annually.

Why?	By rewarding researchers and teams for exceptional customer work, Łukasiewicz recognises customer work and supports customer-centric culture.
How?	A rewarding process requires the creation of an application and evaluation procedure, communications activities and a budget for prizes. For instance, at VTT (Finland), the Customer Excellence Reward is given three times per year in three categories. Usually, the whole participating team is rewarded instead of single individuals.
Expected impact	A more customer-centric culture can lead to increased sales volume and profitability.
Łukasiewicz's strengths	There are long-term, productive partnerships between Łukasiewicz and key enterprises.

Streamlining contract research services

Łukasiewicz should streamline contract research services by providing standardized terms of reference documents, agreement templates and pricelists (daily rates).

Why?	Standardized terms of reference documents, agreement templates and pricelists of daily rates make the research services offering of Łukasiewicz more transparent and unified from the customer's point of view. They decrease the transaction costs of contract research services and support offering fast-track services for strategic business partners.
How?	Streamlining contract research services is enabled by creating a commercial operations unit. As an example, at VTT (Finland), Customer Operations unit is serving whole VTT with dozens of sales and account leads.
Expected impact	More efficient contract research services can increase the number of industrial contracts.
Łukasiewicz's strengths	The Łukasiewicz Institutes have internal, well-standardised protocols in the field of knowledge management and technology transfer policy.





KT Strategy Pillar 3: Knowledge sharing

Knowledge sharing refers to the informal sharing of knowledge through various channels, such as networking, conferencing, researcher mobility, teaching and training, as well as problem-solving activities of various kinds [Kutvonen et al. 2013]. Also, publications can be included in the informal, non-contractual forms of knowledge sharing. However, we are not addressing academic publishing more closely here since it is a researcher-driven activity that is less likely to require management intervention via strategic guidance. In this section we address knowledge sharing from the point of view of two focus areas: 1) networking and events, and 2) professional development.

Concerning networking and events, international networking and business networking are of particular interest from the point of view of knowledge transfer strategy. International networking can be supported by organising international networking events, for instance. Business networking can be supported via a cross-organisational networking strategy, through which the connections with the key companies and stakeholders are maintained and enhanced. Professional development, on the other hand, can be improved via training activities and dedicated measures for enhancing researcher mobility, such as supporting short-term visits to foreign research organisations.

The importance of informal knowledge sharing is high for knowledge transfer, and it has been regarded equally or even more important than the formal forms of knowledge transfer in some domains [Siegel et al. 2003; D'Este & Patel 2007]. For instance, the US R&D managers working in the manufacturing industry reported that the key channels of knowledge transfer with academia were publications, public conferences and meetings, informal information exchange, and consulting [Cohen et al. 2002; cf. Bekkers & Bodas Freitas 2008].

It should be noted that the importance of informal knowledge sharing channels differs significantly from industry to industry and from one country to another [Kutvonen et al. 2013; Perkmann et al. 2021]. Publications and participating in conferences are important in a small number of science-based industries, such as biotech and pharmaceuticals, and moderately important in a wide range of manufacturing sectors. Researcher mobility is essential not only in biotech but also in various fields of engineering, chemistry and ICT. [Bekkers & Bodas Freitas 2008; Cohen et al. 2002].

Also, the researchers' motivations for engaging in knowledge sharing activities with external actors vary from country to country. For instance, professional recognition and intellectual pursuit were identified as key motivational factors for scientists' collaborative engagements in the UK [Lam 2011], while engagement with third parties because it makes a difference for society predicts academic engagement in Italy, in addition to the possibility to obtain research funding [Iorio et al. 2017; cf. Perkmann et al. 2021].

The bi-directional character of informal knowledge sharing – knowledge flows in both ways from industry to academia and vice versa – has been confirmed in numerous studies [Siegel et al. 2003; D'Este & Patel 2007; Link et al. 2007; cf. Perkmann et al. 2021]. There are, however, few studies that analyse the transfer of knowledge assets from industry to academia via informal knowledge sharing [for an exception, see D'Este and Patel 2007; cf. Battistella et al. 2016].

RTOs are engaged in informal knowledge sharing activities in multiple ways, and policies and programmes supporting, e.g., researcher mobility and strategic international networking are in place [Faunhofer 2021]. However, information concerning outcomes or scale of these activities are not reported in annual reports [cf. TNO 2020; VTT 2022; Fraunhofer 2021].

On the basis of the discussion above and the research and consultations conducted in the IKTS4Łukasiewicz project, we propose the following strategic objective for the knowledge sharing of Łukasiewicz:

STRATEGIC OBJECTIVE FOR KNOWLEDGE SHARING

ŁUKASIEWICZ should improve the conditions for knowledge sharing by supporting international and business networking with dedicated measures, such as a networking strategy, while enhancing the staff's capabilities and opportunities to engage in these activities via professional development.

Next, like in the previous sections, the high-priority measures that are needed in the immediate future (by 2024) for achieving this strategic objective are described in detail in the focus areas of networking and events and professional development. The selection of the high-priority measures is based on the results of the stakeholder survey that was participated by all the Łukasiewicz Institutes in the spring of 2022. These are followed by other measures, which were not given as high priority in the survey. Nevertheless, these other measures are still important for the broad-based improvement of knowledge sharing through networking and events and professional development in the near future (by 2027) according to the research conducted in this study.





Measures by 2024

International networking and training on European research programmes

In connection to Horizon Europe project preparations, Łukasiewicz should participate in international networking activities and organise training for researchers and managers participating in grant writing processes.	
Why?	International networking is a prerequisite for building competitive consortia needed for succeeding in Horizon Europe calls. Free resources, such as the EU Partner search tool, are not sufficient. Therefore, specific support is needed for effective networking, on-site meetings and especially for contributing to the technology/industry-relevant European Partnerships.
How?	Both working time and funding for travel expenses are needed for effective networking and making benefit from European Partnerships. According to the experiences gained at VTT (Finland) on EU project preparations, networking activities should have clear targets and ownership related to specific clusters, calls and proposals.
Expected impact	By building competitive consortia via international networking, the success rate of Horizon Europe proposals can be improved.
Łukasiewicz's strengths	Many Łukasiewicz Institutes participate in international networking events. Łukasiewicz is a member of EARTO and a partner in EIT KICs (Climate, Urban Mobility, Raw Materials and Health). These experiences lay a fair basis for starting to reach to the next level.

Rewarding of international research collaboration

Researchers and teams carrying out high-profile and effective international research collaboration should be rewarded.	
Why?	High-level international research collaboration, such as coordinating a Horizon Europe project preparation and execution, is an extremely demanding task that can be encouraged with rewarding measures.
How?	The line management, with the help of HR, can conduct a rewarding process provided that a rewarding budget is available. For instance, at VTT (Finland), excellent preparations of high-quality proposals for Horizon Europe are rewarded with recognition awards two times per year along with other exceptional researcher activities contributing to VTT's impact and excellence.
Expected impact	Rewarding measures motivate and guide the personnel to goal-oriented activity in international research collaboration.
Łukasiewicz's strengths	Over 80 employees of Łukasiewicz have participated in the researcher exchange programmes in Poland and abroad. In order to continue international cooperation and researcher mobility despite the COVID limitations, Łukasiewicz has introduced an ICT tool to support knowledge exchange.

Cross-organisational networking strategy

Łukasiewicz should establish a mechanism to support cross-organisational networking, through which Łukasiewicz maintains and enhances connections with the key companies and stakeholders in its core sectors.	
Why?	Through a specific mechanism, Łukasiewicz ensures that it is connected with relevant companies and stakeholders across Łukasiewicz's core sectors. Moreover, Łukasiewicz can take a proactive role in its networking activities and participate in important initiatives and openings right from the start without lagging behind, e.g. by organising sector-specific workshops with enterprises combined with training on upcoming opportunities in Horizon Europe.
How?	Implementing a mechanism for cross-organisational networking requires that resources are available for networking and follow-up of activities is in place. For instance, TecNALIA (Spain) provides its staff with 1-4 working hours per week for networking.
Expected impact	Łukasiewicz's strong position in networks, initiatives and forums enhances knowledge transfer and creation of collaboration opportunities, including contract research.
Łukasiewicz's strengths	Łukasiewicz has simplified its offering with the objective of a clear presentation of benefits for business. The Łukasiewicz Institutes are members of many national and international cooperation networks, such as associations, councils, committees and clusters.

Measures by 2027

Thematic groups

For the sake of effective coordination and resource pooling, Łukasiewicz should support Thematic groups that gather research units together to exchange information on topical research issues across disciplinary and organisational boundaries.	
Why?	Thematic groups coordinate work of related research fields within Łukasiewicz, pool essential resources in core disciplines, and present a unified image of Łukasiewicz in the marketplace. Thus, Thematic groups are not only for internal coordination and information sharing but also to build brand image to external actors.
How?	If Thematic groups are supposed to take an agenda-setting role that is recognised at the national level, significant resources are needed. For instance, Fraunhofer (Germany) provides support for seven thematic groups that have their own offices with 3-4 employees, including a managing director and a press officer.
Expected impact	Thematic groups are a vehicle to join forces, share information and be visible in a selected domain.
Łukasiewicz's strengths	The Research Groups of Łukasiewicz are a source of contacts and give the opportunity to inform others about projects, events, and possibilities of taking action in various fields. The discussion panels of Research Groups and the Technology Assessment Centre are places where knowledge is most actively exchanged within Łukasiewicz by representatives of various Łukasiewicz Institutes. "Creative Coffee" meetings where the Łukasiewicz Institutes' representatives conduct presentations also provide opportunities for sharing experiences.





Professional development

Measures by 2024

Supporting outward researcher mobility

Łukasiewicz should support researchers and other experts to visit foreign research organisations for a minimum of two weeks, participate in international PhD and Postdoctoral programmes and networks, including Marie Skłodowska-Curie Fellowships, and apply for international double affiliations.

Why?	The growth of Łukasiewicz's operations on an international scale requires international experience, and, therefore, the international mobility of researchers is highly valuable.
How?	Besides funding, international mobility requires a great deal of practical arrangements, especially in case of researchers with families. At VTT (Finland), a mobility HR team coordinates international assignments and makes all the necessary arrangements. The team helps to prepare a budget on the basis of information available and assists with the practical arrangements required in preparation for an international assignment.
Expected impact	International researcher mobility increases knowledge transfer, contact networks and ability to work in multinational settings, among others.
Łukasiewicz's strengths	Researcher exchanges and internships are promoted at Łukasiewicz, including those financed by the National Science Centre projects. To promote researcher mobility, each Łukasiewicz Institute has planned minimum limits for such activities in Poland and internationally.

English training

Łukasiewicz should provide training in English, including academic and business English, as well as communications skills.

Why?	Ability to use spoken and written English in academic and business contexts is a prerequisite for international collaboration.
How?	English training courses are provided by language training service providers. At VTT (Finland), language training is available when there is a clear work-based need. Private lessons are offered only for employees going to international assignments.
Expected impact	Using spoken and written English efficiently enhances capabilities for international collaboration both in academic and business contexts.
Łukasiewicz's strengths	The Łukasiewicz Institutes have units (e.g. Centres of Knowledge Transfer) that organise training courses, both on-site and online. English training is the most common element of internal researchers' education programmes provided by Łukasiewicz.

Training on the online communications platforms

Łukasiewicz should provide training on the use of online communications platforms and tools for project managers, especially in case of large research projects with dozens of partners.

Why?	Large-scale industrial research projects can be participated by more than fifty companies, and, therefore, traditional communications tools are not sufficient for effective communications and information sharing activities. With the help of online platforms, partner firms can learn about the upcoming project activities, such as test runs, in a detailed and timely manner, which helps them to participate in and contribute to the project activities.
How?	Multiple online communication platforms are available in the market. For instance, VTT (Finland) uses Microsoft Teams Planner as a project management, time management and information board for disseminating information, engaging participation, and organizing events and meetings with the industry.
Expected impact	By using customized online platforms, Łukasiewicz enhances its cooperation and knowledge sharing activities with partner companies with an aim of developing, up-scaling, demonstrating and valorizing Łukasiewicz's innovations and technological advancements in industry collaboration.
Łukasiewicz's strengths	The Łukasiewicz Institutes have units (e.g., Centres of Knowledge Transfer) which offer a wide variety of training courses.

Professional development

Measures by 2027

Internal PhD programme

Łukasiewicz should establish an internal PhD programme supporting junior researchers to get access to research infrastructure, scientific supervision, networking and qualification opportunities.

Why?	For young researchers, an internal PhD programme is a cornerstone in their career development since it allows them to enhance scientific and professional knowledge and experience, in addition to the successful completion of their PhD theses. When the work of PhD students is integrated into Łukasiewicz's projects, it increases the research excellence of Łukasiewicz.
How?	An internal PhD programme requires a budget for the salaries of candidates and coordination support. At AIT (Austria), 200 national and international PhD students are supported annually in close collaboration with universities through an internal PhD Programme. AIT's HR department coordinates the programme (one FTE coordinator). The PhD contracts have a duration of three years.
Expected impact	The research excellence of Łukasiewicz increases with the PhD studies that are closely connected to the research projects carried out in Łukasiewicz.
Łukasiewicz's strengths	Łukasiewicz already supports and encourages its researchers to participate in the industrial PhD programmes implemented in cooperation with universities or polytechnics.

Supporting inward researcher mobility

For effective knowledge sharing, Łukasiewicz should provide support for inward researcher mobility, that is, a foreign researcher visiting Łukasiewicz for a minimum of two weeks.

Why?	Short-term visits are a low-threshold way to increase international collaboration and knowledge transfer.
How?	To make a visit mutually productive, personnel resources should be made available for hosting and guidance. Even if the salary and travel expenses of the visiting researcher are provided by the sending organisation, there are still overhead costs to be covered.
Expected impact	Increased international collaboration contributes to the enhancement of research excellence at Łukasiewicz.
Łukasiewicz's strengths	Researcher exchanges and internships are promoted at Łukasiewicz, including those financed by the National Science Centre projects. Each Łukasiewicz Institute has its own annual mobility goals. Łukasiewicz is member of EARTO and researcher mobility can be enhanced bilaterally with other RTOs.

Talent acquisition and management

Łukasiewicz should develop a human resources management (HRM) plan for talent acquisition and management in order to respond to the need of highly-skilled workforce both in high-profile research and business development.

Why?	Talent acquisition and management is an ongoing strategy to find and retain top talents for positions that are crucial for knowledge transfer activities in Łukasiewicz and require specific skills, such as business development.
How?	For talent acquisition and management, an HRM plan, which identifies talent needs, enhances talent supply and manages in-house talent (e.g. through talent development programmes) is needed. In order to improve talent acquisition, a recruitment bonus can be paid. At VTT (Finland), a recruitment bonus is paid for an employee if the hired person communicates in the beginning of the recruitment process that he or she found out about the job from the VTT employee in question.
Expected impact	Top talents in key positions enhance knowledge transfer both in high-profile research, such as Horizon Europe projects, and business development.
Łukasiewicz's strengths	Łukasiewicz has highly-skilled employees with contact networks that ease talent acquisition and management.

Conclusion

In this report, we presented a proposal for the KT strategy for Łukasiewicz, including strategic objectives and concrete support measures under the three KT pillars: 1) Knowledge valorisation, 2) Knowledge co-creation, and 3) Knowledge sharing. Each pillar was subdivided into two focus areas in our review. For each measure, we considered the opportunities it offers, capabilities required, expected impact and Łukasiewicz's strengths. A summary of all measures is provided in Table 2 below.

Pillar	Focus area	Measures by 2024	Measures by 2027
1. Knowledge valorisation	Commercialisation of IP	<ul style="list-style-type: none">· Open intellectual property rights (IPR) training for researchers· Establishing an expert IPR organisation· Knowledge exchange with domestic centres for technology transfer for learning purposes	<ul style="list-style-type: none">· Standardized IP protocol· Contacting international venture capital investors for co-investment models
	Spin-off creation	<ul style="list-style-type: none">· Entrepreneurial competence development for researchers· Spin-off support with minimum bureaucracy for researchers· Involving people with a business profile in spin-off projects	<ul style="list-style-type: none">· On-site mentorship and support· Comprehensive technology transfer and entrepreneurship programme
2. Knowledge co-creation	Collaborative research	<ul style="list-style-type: none">· Mobilization of experts in EU project activities· A joint funding model (public and private funding) run by Łukasiewicz· Ecosystems approach in regional collaboration	<ul style="list-style-type: none">· Building a brand identity· Surveys and market analyses of industries
	Contract research	<ul style="list-style-type: none">· Promotion and communication of research services to enterprises· Training employees to adapt to business culture· Customer impact survey	<ul style="list-style-type: none">· Rewarding of customer work· Streamlining contract research services
3. Knowledge sharing	Networking and events	<ul style="list-style-type: none">· International networking and training on European research programmes· Rewarding of international re-search collaboration· Cross-organisational networking strategy	<ul style="list-style-type: none">· Thematic groups
	Professional development	<ul style="list-style-type: none">· Supporting outward researcher mobility· English training· Training on the online communications platforms	<ul style="list-style-type: none">· Internal PhD programme· Supporting inward researcher mobility· Talent acquisition and management

Table 2. A summary table.

For the first KT pillar, knowledge valorisation, we proposed the strategic objective of improving knowledge transfer via commercialisation of IP and spin-off creation in relevant fields, while paying attention to the extra benefits that patenting and spin-off activities can produce in terms of credibility, industrial connections and professional development. The proposed support measures for knowledge valorisation were addressed under the focus areas of commercialisation of IP and spin-off creation.

Concerning commercialisation of IP, we suggested open IPR training for researchers, establishment of an expert IPR organisation, and knowledge exchange with domestic centres for technology transfer as key support measures to be taken in the immediate future (by 2024). In case of spin-off creation, the corresponding measures were entrepreneurial competence development for researchers, spin-off support with minimum bureaucracy for researchers, and involving people with a business profile in spin-off projects.

Regarding the second KT pillar, knowledge co-creation, we suggested that the strategic objective should be that Łukasiewicz takes a proactive role in knowledge co-creation by mobilizing experts in Horizon Europe preparations, for instance, and enforces the utility of its research offering by investing in business training, promotion of services and customer impact assessment. The proposed support measures for knowledge co-creation were addressed under the focus areas of collaborative research and contract research.

For collaborative research, we suggested mobilization of experts in EU project activities, a joint funding model (public and private funding) run by Łukasiewicz, and ecosystems approach in regional collaboration as key support measures to be taken in the immediate future. The corresponding measures for contract research were promotion and communication of research services to enterprises, training employees to adapt to business culture, and customer impact survey.

Finally, for the third KT pillar, knowledge sharing, we proposed that the strategic objective should be that Łukasiewicz improves the conditions for knowledge sharing by supporting international and business networking with dedicated measures, such as a networking strategy, while enhancing the staff's capabilities and opportunities to engage in these activities via professional development. The support measures for knowledge sharing were addressed under the focus areas of networking and events and professional development.

Concerning networking and events, we proposed the support measures of international networking and training on European research programmes, rewarding of international research collaboration, and cross-organisational networking strategy in the immediate future. For professional development, the corresponding measures were supporting outward researcher mobility, English training, and training on the online communications platforms.

There are three cross-cutting issues that should be borne in mind when KT support measures for each focus area are being implemented. First, fostering internationalisation should be given a special attention. The international dimension is evident in case of many measures, such as mobilization of experts in EU project activities and outward researcher mobility. It should be noted, however, that internationalisation can be fostered in case of all measures. For instance, by using English language in key documents and playing a bridging role between domestic and foreign stakeholders, Łukasiewicz can support international dimension of each measure as part of everyday work.

The second cross-cutting issues deserving attention in the implementation of KT support measures is sustainability. Sustainability can be improved on many levels. Within Łukasiewicz, KT activities require thriving professionals, which call for sustainable HR policies, including active caring of wellbeing, diversity and fair treatment of personnel. Sustainable HR policies also concern management practices that should be transparent and foreseeable for employees. In customer collaboration, sustainability does not only mean providing technological solutions enhancing sustainable development for customers but also organisational models and approaches promoting responsibility. Regarding the overall sustainability, the review of how Łukasiewicz's activities and research choices contribute to Sustainable Development Goals (SDGs) is worth considering.

The third cross-cutting issue is business creation. While it is the core dimension of spin-off creation and the driving force of commercialisation of IP, it is potentially present in case of all KT activities. For instance, collaborative research, such as a Horizon Europe project, should develop competencies and connections that can lead to customer projects or IP development at later stages creating new business or expanding existing business activities of partnering firms. The key aspect of business creation is what value Łukasiewicz can offer to its customers. In many cases, research excellence and capabilities that have been maintained and developed over a long period of time are key to value creation and forming a unique selling point of Łukasiewicz.

In the next phase of the 1KTS4Łukasiewicz project, the key enabling actions, financial and human resources, critical steps and key performance indicators for each KT measure presented in this document are further elaborated and reported in Deliverable 5, Plan for Implementation.

References

Battistella, C., De Toni, A. F., & Pillon, R. [2016]. Inter-organisational technology/knowledge transfer: a framework from critical literature review. *The Journal of Technology Transfer*, 41(5), 1195–1234.

Bekkers, R. & Bodas Freitas, I.M. [2008]. Analysing Knowledge Transfer Channels between Universities and Industry: To What degree do Sectors also Matter? *Research Policy*, 37 (10), 1837–1853.

Campbell, A., Cavalade, C., Haunold, C., Karanikic, P., Piccaluga, A., & Dinnetz, M. [2020]. Knowledge transfer metrics. Towards a European-wide set of harmonised indicators, Karlsson Dinnetz, M.(Ed.). Available: <https://publications.jrc.ec.europa.eu/repository/bitstream/JRC120716/kjna30218enn.pdf>.

Clarysse, B., Tartari, V., & Salter, A. [2011]. The impact of entrepreneurial capacity, experience and organizational support on academic entrepreneurship. *Research Policy*, 40(8), 1084–1093.

D'Este, P., & Patel, P. [2007]. University–industry linkages in the UK: What are the factors underlying the variety of interactions with industry? *Research policy*, 36(9), 1295–1313.

D'Este, P. & Perkmann, M. [2011]. Why do academics engage with industry? The entrepreneurial university and individual motivations. *The Journal of Technology Transfer*, 36(3), 316–339.

EPO [2020]. Valorisation of scientific results Patent commercialisation scoreboard: European universities and public research organisations. Available: <https://www.epo.org/service-support/publications.html?pubid=221#tab3>.

Fraunhofer[2021]. AnnualReport2020. Available: <https://www.fraunhofer.de/en/media-center/publications/fraunhofer-annual-report.html>.

Hayter, C. S., Nelson, A. J., Zayed, S., & O'Connor, A. C. [2018]. Conceptualizing academic entrepreneurship ecosystems: A review, analysis and extension of the literature. *The Journal of Technology Transfer*, 43(4), 1039–1082.

Holi, M. T., Wickramasinghe, R., & van Leeuwen, M. [2008]. Metrics for the evaluation of knowledge transfer activities at universities. Cambridge: Library House. Available: https://ec.europa.eu/invest-in-research/pdf/download_en/library_house_2008_unico.pdf.

Iorio, R., Labory, S., & Rentocchini, F. [2017]. The importance of pro-social behaviour for the breadth and depth of knowledge transfer activities: An analysis of Italian academic scientists. *Research Policy*, 46(2), 497–509.

Kutvonen, A., Lehenkari, J., Kautonen, M., Savitskaya, I., Tuunainen, J., & Muhonen, R. [2013]. University–industry collaboration and knowledge transfer in the open innovation framework. In *University–industry interaction conference: Challenges and solutions for fostering entrepreneurial universities and collaborative innovation* (pp. 694–710). Available: https://www.researchgate.net/publication/265227439_University-Industry_Collaboration_and_Knowledge_Transfer_in_the_Open_Innovation_Framework.

Link, A.N., Siegel, D.S. and Bozeman, B. [2007]. An Empirical Analysis of the Propensity of Academics to Engage in Informal University Technology Transfer, *Industrial and Corporate Change*, 16 (4), 641–655.

Oxford University Innovation [2014]. Spin-out versus Licence. Available: <https://innovation.ox.ac.uk/wp-content/uploads/2014/10/Licence-or-Spin-article.pdf>.

Perkmann, M., Salandra, R., Tartari, V., McKelvey, M., & Hughes, A. [2021]. Academic engagement: A review of the literature 2011–2019. *Research Policy*, 50(1), 104114.

Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'este, P., ... & Sobrero, M. [2013]. Academic engagement and commercialisation: A review of the literature on university–industry relations. *Research policy*, 42(2), 423–442.

Perkmann, M., & Walsh, K. [2008]. Engaging the scholar: Three forms of academic consulting and their impact on universities and industry. *Research Policy*, 37(10), 1884–1891.

Popper, R., Bhatia, R., Myllyoja, J., Lehenkari, J., Bäck, A., Stahlecker, T., ...& Holmes, N. [2021]. Fostering Knowledge Transfer in Poland, Europe and the World. Deliverable 2. Report to the IKTS4Łukasiewicz project on “A single knowledge transfer strategy for institutes of the Łukasiewicz Research Network Poland”. Available: <https://cris.vtt.fi/en/publications/fostering-knowledge-transfer-in-poland-europe-and-the-world>.

Siegel, D. S., Waldman, D., & Link, A. [2003]. Assessing the impact of organizational practices on the relative productivity of university technology transfer offices: an exploratory study. *Research policy*, 32(1), 27–48.

Suominen, A., Bhatia, R., & Myllyoja, J. [2022]. High level options for the Strategy. Task 4.1 outcome. Internal report to the IKTS4Łukasiewicz project on “A single knowledge transfer strategy for institutes of the Łukasiewicz Poland”.

TNO [2020]. Annual report 2019. Available: <https://www.tno.nl/en/annualreport2019/>.

Ulrichsen, T. C. [2020]. Assessing the Gross Additional Impacts of the Higher Education Innovation Fund (HEIF) An update for the period 2015/16–2018/19. Available: https://www.ifm.eng.cam.ac.uk/uploads/UCI/knowledgehub/documents/2020_Ulrichsen_Assessing_Impacts_of_HEIF.pdf.

VTT [2022]. Annual report 2021. Available (in Finnish): https://www.vttresearch.com/sites/default/files/2022-03/vtt_vuosikertomus_2021.pdf.

Annex 1: High-level options for the strategy

Table 1. Summary of key objectives and key initiatives based on the high-level strategic options (Suominen et al. 2022).

Key objectives

Enabling discovery	Willingness to share	Willingness to acquire	Absorptive capacity
<ul style="list-style-type: none"> Identifying existing knowledge Creating a portfolio approach to knowledge creation Unification of terms and conditions of licensing Unified policies to enhance commercialisation Improving access to knowledge Improving market analysis and foresight Improving access to and impact of business insight in evaluating commercialization potential Enhancing entrepreneurial culture Creating basis for culture of trust 	<ul style="list-style-type: none"> Increase openness and transparency of knowledge Developing researcher career pathways to include more diverse opportunities Attracting talent to non-tradition KT focused roles Mapping strategic research areas and ensuring resourcing. Increase capability and motivation to take part in KT activity 	<ul style="list-style-type: none"> Increasing market of knowledge Increasing the abilities to gather market insight and communication Creating feedback loop from market insight to strategy Streamlining IPR and licensing regulations Increasing access to and training on using market information for researchers Enhancing collaborative / co-creative research projects Increasing networking and strategic communications with companies 	<ul style="list-style-type: none"> Increase alignment of shared mutual local goals To increase SMEs capabilities for understanding benefits of co-operating with an RTO Increase core markets understanding of absorptive capacity Improve customer driven conceptualization Improve expertise driven communication in project actualization Increase transparent sharing of data, knowledge, and expertise for mutual good Embedding STI activities as a part of societal framing and work for improving the quality of life of all citizens

Key initiatives

<ul style="list-style-type: none"> Improving knowledge management procedures. Creating a strategic technology roadmap for knowledge creation Creating unified guidelines for immaterial property rights management and licensing. Creating a shared access point to codified knowledge created within the Network Technology update newsletters Strategic selection/participation in networks & events Launching a unit for market intelligence and foresight Creating networking database of local / regional / national industry associations. Identifying key investors operating in deep tech space relevant for the Network Increasing entrepreneurial bootcamp activity Increasing engagement between researchers and business stakeholders 	<ul style="list-style-type: none"> Guidelines for open and transparent sharing of information SHRM to include roles aligned with KT strategy Talent acquisition plan for roles aligned with KT strategy Strategic research KT mapping including: Articulating benefits from KT Upskilling and motivational schema from researchers 	<ul style="list-style-type: none"> Promoting the benefits of knowledge transfer to target industries Conducting extensive market analysis Reflecting market analysis on Łukasiewicz research agendas / programmes Communication of research results to external partners Creating unified guidelines for immaterial property rights management and licensing. Developing market analysis and foresight capabilities helps to recognize potentials and needs for knowledge utilization. Creating lower threshold collaboration access with industry via collaborative agreements 	<ul style="list-style-type: none"> Establishing co-creation programme with SMEs to define feasible, collaborative strategies to boost local R&D activities. Establish a research program to support innovation management capability in core target market. Design a customer operations unit to address voice of the customer, service design and research as a service approaches for the benefit of the customer Initiate strategic partnerships as platforms for sharing and developing knowledge and skills Initiate impact assessment to contextualizing research in wider societal frames Boosting impact communication; including popularization of science to affect general attitudes
--	--	--	---

Annex 2: Stakeholder survey

The 1KTS4Łukasiewicz project conducted an online stakeholder survey between 18.2.2022–24.3.2022. The aim of the survey was to gather stakeholder views on the Łukasiewicz's knowledge transfer strategy and prioritization. There were three respondent groups in the survey: 1) management, 2) research team leaders and 3) research support personnel (e.g. HR) of the Łukasiewicz Institutes (see figure below). The survey questionnaire was sent to 252 respondents and there were 94 responses, which gives the response rate of 37%. All the Łukasiewicz Institutes participated in the survey.

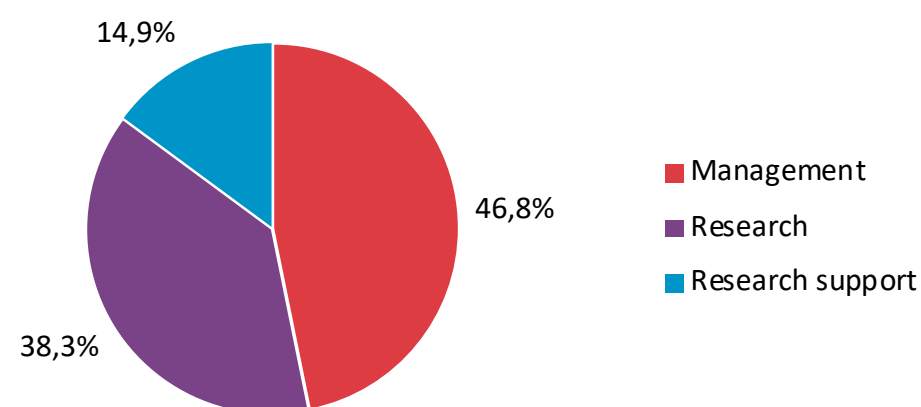


Figure 1. Survey respondent groups (n=94).

The survey questionnaire consisted of the assessment of fifty statements on knowledge transfer measures that were divided into three sections:

1. Knowledge valorisation (commercialization of IP and spin-off creation)
2. Knowledge co-creation (collaborative research and contract research)
3. Knowledge sharing (networking & events and professional development)

The assessment of the statements, which took place on the Likert scale from 1 to 5, considered four criteria: a) agreement, b) priority, c) research excellence and d) business impact. At the end of the survey, there were four open-ended questions on how to increase revenue and funding via KT measures. All the answers to open-ended questions were reviewed and utilized in the stakeholder consultation that took place on May 13th 2022 in Centrum Łukasiewicz, Warsaw, together with the management of the Łukasiewicz Institutes.

In the figures below, respondents' overall agreement with all the statements of the survey is presented in bar charts.

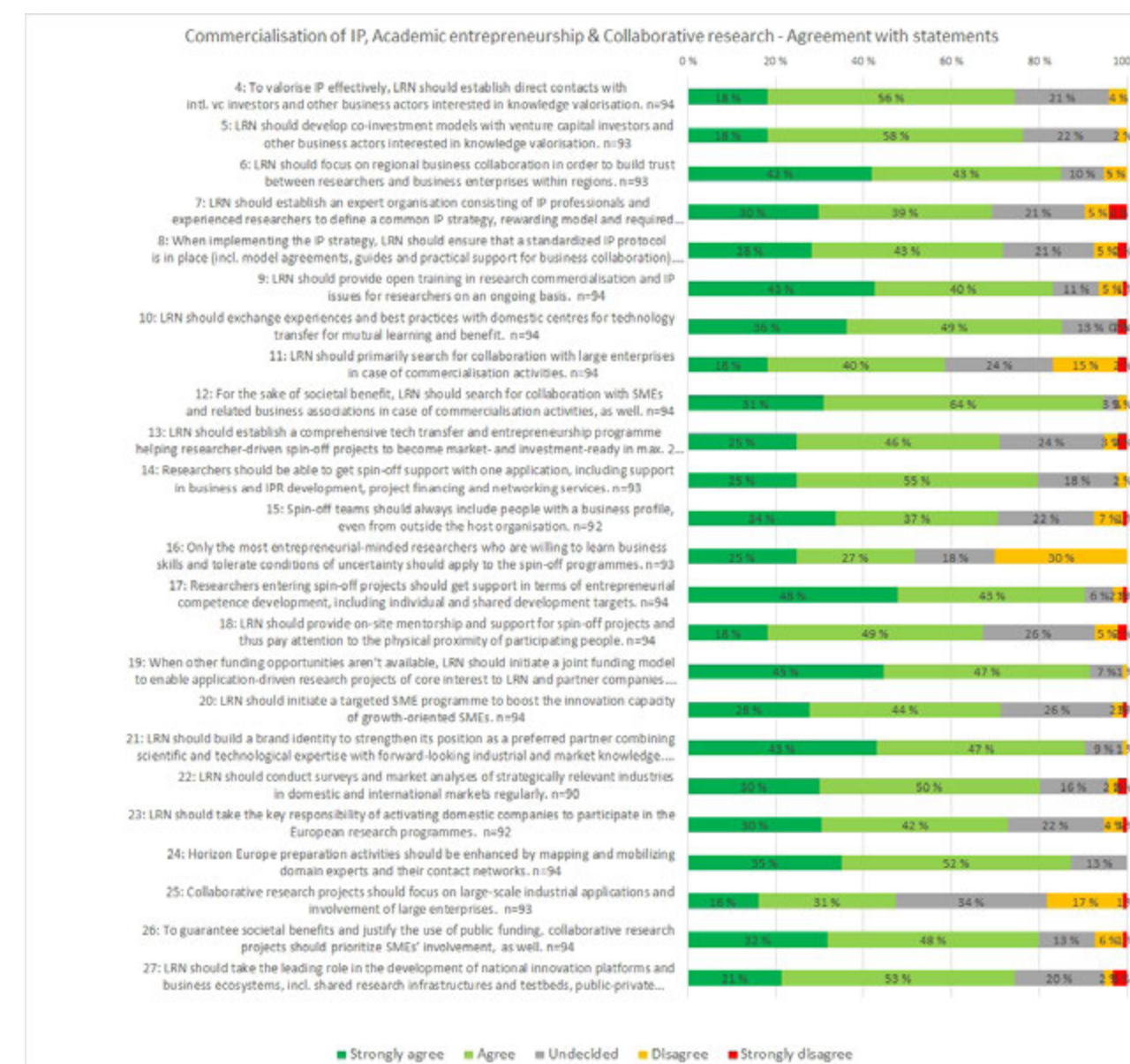


Figure 2. Respondents' agreement with the statements concerning commercialisation of IP, spin-off creation and collaborative research.

Annex 3: Project team and authors

VTT Team

Janne Lehenkari (PhD, Adult Educ.) is a senior scientist at VTT Technical Research Centre of Finland. He has over 20 years of experience in innovation research, impact assessment and policy work. Currently, Lehenkari is an expert in an Evaluation Study of the European Framework Programmes for Research and Innovation for a Resilient Europe (EC, DG RTD). In 2019–2021, Lehenkari was a work package leader in an Impact Assessment Study for Assessing the Impact Pathways of IA/RIA SC5 Projects Through the Use of Portfolio Analysis (EC, DG RTD). In 2018–2019, Lehenkari was an expert in a feasibility study for Technical Expertise on Best Practices from Other Countries in the Context of Upcoming Establishment of the New Polish Łukasiewicz (EC, SRSP).

Jouko Myllyoja (M. Sc. Marketing, M. Sc. Environmental engineering, BA) works as a senior scientist at VTT Technical Research Centre of Finland. Myllyoja shares particular interest towards methodological development of foresight – futures knowledge creation through participatory activities and actions in particular. His responsibilities have covered conducting foresight projects in various substance areas. His thematic fields of interests concern e.g. innovation ecosystems, organizational development and futures of work. His international assignments have covered projects, such as Cybersecurity Awareness and Knowledge Systemic High-level Application (Horizon 2020) and Policy instruments and Incentives for Circular Economy (EIT).

Juha Oksanen (MSSc) is a senior research scientist at VTT Technical Research Centre of Finland with 25 years of experience in research, technology and innovation policy. He participates in research and evaluation projects related to innovation, innovation process and innovation policy at sub-national, national and international level. Oksanen's key areas of expertise include evaluation and impact assessment, qualitative research methods in social sciences, and design and implementation of surveys.

ISI Fraunhofer Team

Ewa J. Dönitz (PhD) has been a senior researcher in the Competence Centre Foresight at the Fraunhofer Institute for Systems and Innovation Research ISI since 2009. She is Coordinator of the Business Unit Foresight for Strategy Development. She is an expert in scenario development and supports colleagues across the Institute in developing scenarios in various thematic areas and leads national and European Foresight projects. Her research is focussing on the whole range of Foresight methods in particular scenarios, visions and roadmaps and its application for underpinning strategy building and innovation processes. Since June 2013, she has been a coordinator of the Business Unit Foresight for Strategy Development. She teaches innovation and project management at the Femtec Berlin. Since 2011 she has been a lecturer for the futures research methodology at the University of Kassel and Karlsruhe Institute of Technology. After having studied economics at the Oskar Lange Economics Academy in Wrocław (Poland) and economics at the University of Bremen, she worked as a research associate at the Institute for Project Management and Innovation (IPMI) at the University of Bremen and received her PhD with a thesis on advancing the scenario methodology.

Thomas Stahlecker (PhD) studied economic geography, international technical and economic cooperation and business administration at the Technical University of Aachen (RWTH Aachen). In 1998 he received his master's degree, in 2005 his doctoral degree. Between 1999 and 2000 he was employed as a researcher at the Center of Technology Assessment in Baden-Wuerttemberg. Since May 2000 he has been working at the Fraunhofer Institute for Systems and Innovation Research ISI in Karlsruhe as a senior researcher and project manager in the Competence Center 'Policy – Industry – Innovation'. Since 2007 he is the coordinator of the business area 'Regional Innovation Systems'. His current fields of interest are regional economic theory, regional technology oriented development, regional innovation and technology indicators, evaluation of policy programmes, innovation and technology policy.

Andrea Zenker (PhD) worked as trainee and technical assistant at the Lower Saxony Forest Tree Breeding Station in Staufenberg-Escherode, before she studied Geography and Modern Languages at the University of Gießen and the Université de Besançon. In 1996, she received her diploma in Geography from the University of Gießen. She then worked as consultant for Desktop Mapping at GRIT in Werne. In 1997, she joined the Fraunhofer Institute for Systems and Innovation Research ISI Karlsruhe where she works as researcher and

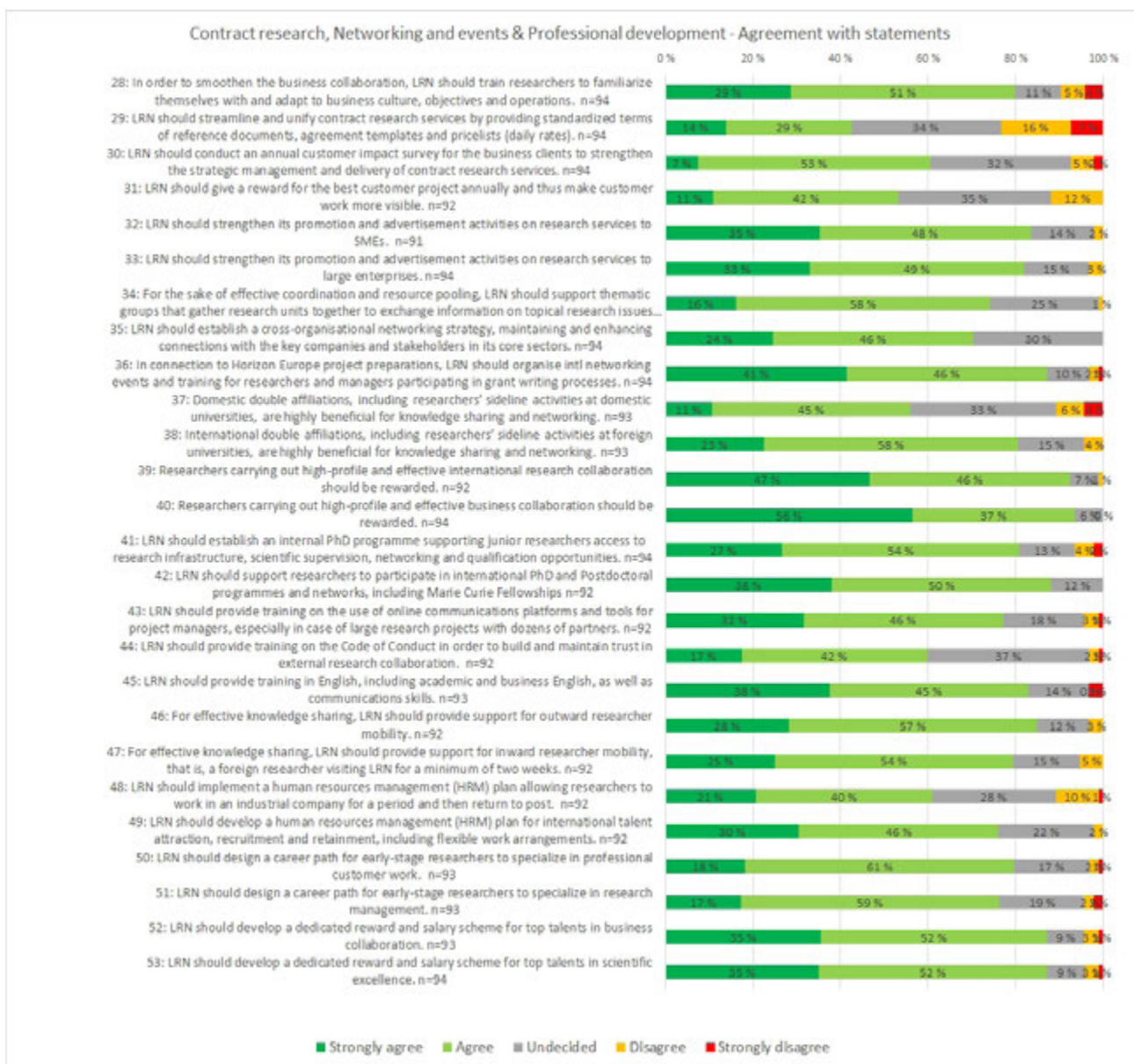


Figure 3. Respondents' agreement with the statements concerning contract research, networking and events, and professional development.

project manager in the Competence Center 'Policy – Industry – Innovation'. In 2007 she was awarded her doctoral degree in Geography from the Université de Strasbourg [then Université Louis Pasteur]. Her research interests are in regional innovation, methodological questions in innovation research, knowledge, creativity and innovation, and comparative aspects of innovation in France and in Germany.

Hendrik Hansmeier studied geography at the University of Marburg, where he received his Bachelor's degree in 2016, and economic geography at the University of Hanover and the Jagiellonian University of Kraków, finishing with a Master's degree in 2018. During his master's studies, he was employed at the German Centre for Higher Education Research and Science Studies as a research assistant, in the research area 'Educational Careers and Graduate Employment'. In February 2019, he joined the Fraunhofer Institute for Systems and Innovation Research ISI in Karlsruhe and since that time has been working as a researcher in the Competence Center Policy and Society, in the Business Unit Regional Innovation Systems. His current research interests include analyses of the emergence, diffusion and impact of knowledge and innovation on the regional level, the design and implementation of regional innovation and technology policies, as well as methodological aspects of regional innovation research.

EPRD Team

Małgorzata Olesiak, Director of EPRD Research and Evaluation Department, participated in numerous research projects as EPRD Project Director (since 2005) and expert/ evaluator (since 2007). She has extensive experience in analysis, including evaluation and data collection [conducting interviews, surveys, elaboration of case studies] in the field of innovation, R&D and technology transfer ["Analysis of knowledge-intensive sectors in the region of Mazowsze in the context of smart specialization", "Cooperative relations between companies with foreign capital shares and domestic companies – a result of the diffusion of knowledge and innovation (spillover effects)", "Legal support in implementation activities for ERDF R&D projects in Poland"]. Małgorzata has been Country Team Leader in the project "Mainstreaming Climate Change into CSF-Funds 2014-2020". She coordinated and conducted quality control activities in a number of projects in the area of innovation funded by the Ministry for Foreign Affairs of Finland. Ms Olesiak possesses good analytical and report writing skills. Recently she has been engaged as Project Director in the DG Research and Innovation "Study on fostering industrial talents in research at European level".

Tadeusz Peczek holds a master's degree in Agriculture and Agricultural Mechanisation. He is the owner and President of the Board of EPRD and acts as a senior adviser in the area of regional development, partnership building, R&D, knowledge transfer, agri-products market structures, and SME development. During the last 20 years, by performing the post of the Project Director, he has been responsible for the management and monitoring of over 50 projects financed by the EU and other international agencies in Poland and abroad. As the founder of EPRD, from 1995 he supervised the company activities aimed at supporting regional and local development, with particular focus on assisting self-governments in obtaining external funds for investments, elaborating local development plans and establishing their spatial policy. From 2000 he was involved in the preparation and implementation of projects financed under structural funds (in Poland) and pre-accession funds. Mr. Pęczek has in-depth knowledge of EU Cohesion Policy issues, structural funds and EU pre-accession instruments, particularly PHARE and SAPARD procedures as well as an extensive experience in the area of rural and urban development. He has a proven knowledge and experience in creation of cooperation platforms linking business and science and providing assistance to research institutions in knowledge transfer, including conclusion of the cooperation agreement between EPRD and Center for Pre-Clinical and Technological Research (CePT), the largest biomedical and biotechnological initiative in Central and Eastern Europe.

Anna Gajek holds a master's degree in environmental protection. He is the coowner and Vice President of the Board of EPRD and acts as a senior adviser in the area of regional development and environmental issues in relation to investment and infrastructure projects. She has knowledge with large infrastructure projects for public and private clients realized at municipal, regional and national level. From 2000 she was involved in the preparation and implementation of projects financed under pre-accession funds and structural funds (in Poland). She was responsible for the management of team of experts in preparation of application to national and international funds (Structural and Cohesion Funds, EEA Grants, Norway Grants, Swiss Contribution). She was responsible for the management of team of expert in preparation Environmental Impact Assessments (EIA). She has experience with multi-functional development of the regions and environmental protection at local and regional level, preparation of regional and local studies on spatial planning, preparation of socio – economic development strategies. Her expertise includes the partnership building, creation and development of small and medium enterprises. She has knowledge in the field of innovation and technology transfer. Anna

has proven knowledge and experience in creation of cooperation platforms linking business and science and providing assistance to research institutions in knowledge transfer, including relevant support provided to the Institute of Environmental Protection and the New Chemical Syntheses Institute.

Monika Mańkowska holds master's degree in Romance Philology (French and Italian) at Maria Curie-Skłodowska University and a Post-Graduate at the UNESCO Chair for Translation Studies and Intercultural Communication at Jagiellonian University (French and Italian). Monika is an efficient senior manager with over 6-year experience in managing EU and other international donors assistance projects and more than 10 years of working experience in the areas of marketing and communication. She has a solid track record of supervising projects and supporting the events organisation as well as event management (workshops, conferences, clusters and hubs, fairs). As examples of the projects successfully managed by Monika we can give TA – DEAR for EU members states and multinational framework contract – Joint Programming, where she coordinated the work of event organiser and involved herself as event coordinator. She has been in charge of quality assurance in our backstopping services for projects in Europe but also in Africa. Through these experiences she has gained in-depth knowledge about the EU approach and regulations governing the logistics of EC events. Moreover, the preparation of events being closely related to the communication strategy and marketing materials requires excellent knowledge of the Communication and Visibility Manual prepared by the EC.

Agnieszka Naudeer holds master's degree in sociology and law at John Paul II University. Agnieszka works as an assistant with over 3 years of experience in supporting management of international projects and over 3 years' experience in the areas of education management. Before joining EPRD she worked in the education sector. She has a track record of supervising projects and supporting the events organisation as well as event management (live webinars, workshops, fairs). She is a co-founder of a Saturday school in England where she was responsible for the legal issues as well as the School Improvement Plan. Since she joined EPRD, she has been working as an evaluation assistant.

AARC Team

Nicholas Holmes is an Associate Director at AARC. He holds a 1st class honours Postgraduate Diploma in Management Practice from the Smurfit Graduate Business School, a MSc. in Business and Entrepreneurship, and a Bachelors' in Engineering from Trinity College Dublin. Nicholas is primarily involved in the quality assurance and management of a range European Union projects focused on Digitalization, Research & Innovation, and the EU Green Deal. He is an experienced project manager, having worked on a wide range of projects across the EU and internationally since 2009.

CFI Team

Rafael Popper (PhD) is Director of the Łukasiewicz – Centre for Foresight and Internationalisation (CFI). Dr. Popper is also Scientific and Foresight Advisor at the Łukasiewicz Research Network in Poland, Founder and Director of Futures Diamond Ltd in the United Kingdom, Director of Executive Education in Foresight at the Manchester Institute of Innovation Research (MIOIR) of the University of Manchester in the UK, and Adjunct Professor in Futures Studies, Foresight and Innovation Management at the Finland Futures Research Centre of the University of Turku in Finland.

Torsti Loikkanen is Scientific and Foresight Advisor at the Centre for Foresight and Internationalisation (CFI) of the Łukasiewicz Research Network in Poland. He worked as Principal Research Scientist in VTT Technical Research of Finland Ltd from 1987 until 2016, and since then in Sapar Oy/Ltd, a consulting company in industrial innovation, foresight, and innovation policy studies.

Leena Sarvaranta (PhD Tech, EMBA) is EU Affairs Advisor at the Centre for Foresight and Internationalisation (CFI) of the Łukasiewicz Research Network in Poland. She was employed by VTT Technical Research Centre of Finland until 2021, with several research and management positions over the years. Her work as Head of EU Affairs (2007-2021) was to guide VTT towards European collaboration.

Annex 4: Acknowledgments

We would like to acknowledge Dr. Rafael Popper's role in leading the project proposal writing and designing the methodology and process for the project. In addition to Rafael Popper, we thank Torsti Loikkanen and Leena Sarvaranta from the Łukasiewicz – Centre for Foresight and Internationalisation (CFI) for their contributions to this report.



Ignacy Łukasiewicz
1822-1882

The patron of the Polish research network is Ignacy Łukasiewicz, born 1822 in Zaduszniki, a Polish pharmacist, entrepreneur, community activist, patriot, philanthropist, and the inventor of the kerosene lamp. In 1852, together with his colleague Jan Zeh, he used a scientific method to distil the world's first oil. A year after that breakthrough, the first kerosene lamp was lit up. It may now be hard to imagine the magnitude of his discovery, but the brightness of Łukasiewicz's kerosene lamp was equivalent to the light provided by some 10 to 15 candles. In partnership with Tytus Trzeciecki, he opened the first ever oil mine in Bóbrka near Krosno in 1854. In 1856, he founded the world's first oil distillery in Ulaszowice near Jasło, which is still in operation today. He donated part of his income to charity, for to Łukasiewicz people were as important as science and scientific progress.





Łukasiewicz
Research Network