

Commercialisation Tools in Network Research Organisations

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Abstract: The paper aims to identify which commercialisation tools (CT) are employed in network research organisations as exemplified by the Łukasiewicz Research Network, Poland. The authors analyse the state of the art by studying publications in the Web of Science database and present a longitudinal case study. The commercialisation tools identified as a result of the literature review are classified according to an original approach proposed by the authors. Then, the proposed classification is applied to indicate the commercialisation tools used in the Łukasiewicz Research Network, one of the largest recognised research networks in Europe. A longitudinal single case study is used. The data is analysed at two points in time, i.e., for periods before and after the establishment of the Łukasiewicz Research Network. Namely, the tools used by individual research institutes before and after their inclusion in the network as well as the joint use of tools by the institutes making up the network are examined. The presentation is followed by a discussion of the contexts of applying commercialisation tools in the network organisation and individual institutes. Suggested future research includes analyses of the relationship between the use of specific commercialisation tools and commercialisation effectiveness measured by means of a set of commercialisation performance indicators.

Keywords: Commercialisation, Commercialisation tools, Network research organisation, Infrastructure, Infostructure, infoculture

1. Introduction

Technological development and innovation play a highly important role in long-term economic growth. Not only the development of innovative solutions but primarily their effective market introduction are crucial. The commercialisation of research results is a key way universities and research organisations demonstrate their impact and the value they add to industry and society as a whole. Commercialisation is important for this group of organisations not so much as it generates income, but because: 1) they have a responsibility to transfer their research results into society for its benefit and 2) it increases industry engagement, which helps to find new R&D avenues, collaborators and funding, and enhance career prospects (Pesonen et al., 2008).

Commercialisation is treated as the design, development, making, and marketing of products based on new technologies to launch them in the market (Poteralska, Walasik, 2021). This is a broad approach to commercialisation that includes its subsequent stages from concept to actions aimed at a practical application in the economic activity. It converges with the approach presented in literature, which identifies the stages key to the commercial success of a new solution (Bhasin, 2023). Products, services, and new technologies are listed among such new solutions (Meredith & Shafer, 2002, Atvare et al., 2022).

The paper focuses on commercialisation by research organisations. Their role involves providing services to firms in order to support innovation and enhance industry competitiveness (Pesonen et al., 2008). Organisations that are parts of networks are special cases. Network is defined as ‘an institution facilitating innovative processes through cooperation that consists of (a) a set of measures enabling entities to realise joint projects and (b) a group of entities that creates, gains, processes, integrates, and utilises knowledge and skills for a technologically complex, economically viable, and socially acceptable innovation/change’ (Błażlak, 2010). In this paper, network is a research organisation established within a formal network which is a cluster of its parts.

The authors are interested in commercialisation tools employed in network research organisations. They are understood as tools to support the commercialisation process (Huang et al., 2018). Specialist literature uses a similar concept of activities supporting commercialisation. The authors mean commercialisation tools as sets of specific rules, practices, methods, techniques, strategies, means, platforms, and systems serving to realise the process of commercialisation. They are practical elements supporting planning, implementation, and monitoring, a kind of navigation around the technical, regulatory-organisational, business, and marketing aspects of the process.

This paper aims to identify commercialisation tools employed by network organisations like the Łukasiewicz Research Network. It is structured as follows: firstly, the research methodology is presented, including the proposed approach to the analysis of commercialisation tools, the scope of the Web of Science analysis and the assumptions for a longitudinal single case study. This is followed by an analysis of the state of the art, focusing on the identification of commercialisation support tools, and the presentation of a longitudinal case study to compare the commercialisation tools used in the Network's individual institutes before and after the formation of the Łukasiewicz Research Network. The data used in the case study came from internal reports produced within the Łukasiewicz Network and from interviews with staff in units responsible for commercialisation processes in the Łukasiewicz Research Network institutes. The paper then discusses the diversity and effectiveness of commercialisation tools. The paper is summarised with conclusions and future research directions.

2. Method

An original approach to analysing commercialisation tools is applied. Their classification is based on (1) the definition by Bressand and Distler (1995), which says a network is a set of measures (infrastructure) and rules (infostructure) that enable entities that have access to them to undertake joint projects, provided these measures are appropriate to their needs and suitable for common use (infoculture) by the network (Ziółkowska, 2019) and (2) commercialisation assessment criteria in 4 areas covering the whole activity of entities analysed, namely: a) technological, b) market, c) economic, d) legal and organisational (Belina et al, 2013, Lipkova 2016). Infrastructure is an existing set of means, i.e., equipment, technology, system, and a cooperation network operated by specific principles; infostructure is a set of principles, that is, regulations, contracts, and an established method of operation, while infoculture comprises a set of resources, good practices, attitudes, values, trust.

Our analysis began with a Web of Science review to identify tools supporting commercialisation processes. The search criteria of 'commercialisation tools' and 'activities supporting commercialisation' were applied. Tools identified by the literature and employed by various entities, including research organisations, are classified along the following dimensions: infrastructure, infostructure, and infoculture.

The review provided the starting point for examining the Łukasiewicz Research Network and its commercialisation tools. Both all the Network's institutes (22 entities as of 31.12.2023) and the Network as such were studied. The case study method was selected because it helps answer 'How?' with reference to a contemporary set of events over which the investigator has little or no control (Yin, 2014). A longitudinal single case study was used. At the initial stage, data were collected from grey literature, or internal reports generated within the Łukasiewicz Network. Data on the use of commercialisation tools are collected continuously starting from 2019, when the Łukasiewicz Research Network was created. They are collected at least once a year. For the purposes of the paper, the authors used data from reports produced in 2020 and 2024 with information for the years 2019 and 2023, respectively.

The staff of units charged with commercialisation processes (directors, managers, specialists) in the Łukasiewicz Research Network Institutes were then interviewed. Data were analysed at two points in time, i.e., for periods preceding and following the establishment of the Network, which meant examining variables for individual research institutes before and after their inclusion in the Network. The use of a longitudinal single case study enabled 1) identifying the type of commercialisation tools applied by the Network as a whole and 2) comparing the use of commercialisation tools by the individual institutes before and after the formation of the Łukasiewicz Research Network. Commercialisation tools were designated with reference to infrastructure, infostructure, and infoculture and the areas of technology, market, economy, and law and organisation.

3. State of the art

The review focused on identifying tools assisting commercialisation. To this end, the Web of Science was searched using the criteria of 'commercialisation tools' and 'activities supporting commercialisation' (Table 1).

Table 1: A selection of articles in the Web of Science

Search criteria	Web of Science	Database after reading abstracts	Final database (after reading whole papers)
Commercialisation tool (topic)	249	20	11
Activities supporting commercialisation (topic)	154	40	16
Total	402	60	27
Total – on eliminating repeated publications			26

Source: The authors.

This analysis helped to identify commercialisation tools used by various organisations developing or implementing innovative solutions, including network research organisations. The tools identified were classified with regard to 3 dimensions: infrastructure, infostructure, infoculture (Table 2).

Table 2: The classification of commercialisation tools

Tool	Description	Author
Infrastructure		
Prototyping and testing system	- Testing the readiness of technology through prototyping and tests - Products developed on campus can be built up as prototypes, then manufactured in small volumes before being transferred to a large-scale manufacturing facility	Huang et al., 2018, Youngleson & Jacobs, 2008
Structured product planning and marketing	Creating a well-structured product planning and marketing exercise for technology, including major milestones and timeframes in the operational framework	Moncada-Paternò-Castello, et al., 2003
Innovation Radar	The Innovation Radar is used as an intelligence platform providing insights on innovation activities in large collaborative projects	Napelski & Van Roy, 2021
Structured system for information compilation	Maintaining a well-structured and updated system for a regular compilation of information to disseminate to likely interested users, collaborators and industry (information on: project advancements, new projects, research results, applications, etc.)	Moncada-Paternò-Castello, et al., 2003
Tools for uncertainty management	Developing tools and procedures for uncertainty management supporting decision making already at early phases of front-end work, e.g., a tool called Opportunity Balance Matrix, an application of a known method called Potential Problem Analysis	Paasi et al., 2010
Established collaborative networks	- Virtual networks enabling greater collaboration between researchers and industry in the exchange and sale of Intellectual Property (IP) - Collaborative networks become the business ecosystem - Creating partnerships of existing or potential value network with an active role in different elements of fuzzy front end, new product development and commercialisation stages - Selecting business partners, nurturing healthy relationship with business partners, facilities and supports - Networking of appropriately skilled teams	Huang et al., 2018, Ismail et al., 2015, Cervantes & Meissner, 2014 Paasi et al., 2010, Taylor & StJohn, 2002
Open access journals	Open access journals providing a channel for diffusing scientific results and open research data initiatives making research available for further investigation or innovation	Cervantes & Meissner, 2014
Infostructure		
Standard contracts / agreements	- Introducing the Intellectual Property Framework, a set of online standard contracts to increase university-industry collaboration and research commercialisation, and the IP Toolkit - Creating standard licensing agreements often involving 'model' technology cooperation agreements that limit the potential of IP-related conflicts and disputes - Exchanging knowledge embedded in IP documents and contracts, particularly with industry	George & Tarr, 2023, Cervantes & Meissner, 2014

Tool	Description	Author
Infrastructure		
Access to information on IPR	Providing scientists with accessible information on Intellectual Property Rights (IPR)	Moncada-Paternò-Castello, et al., 2003
Formal technology transfer mechanisms	Presence of formal technology transfer mechanisms, generally positively related to commercialisation	Perkmann, et al., 2013
Promotional and testing campaigns	Promotional and testing campaign - providing enterprises with information on technical performance and requirements, alternative financing options and potential economic benefits	Moncada-Paternò-Castello, et al., 2003
Using external sources of information, including support of recognised experts	- Diffusing tailored information using the support of recognised experts - Designating and identifying an expert representative within the inventor's host institution, which has capacities to support and guide the inventor during commercialisation phases - Using external sources of information such as technology watch databases, foresight exercises, market databases and EU funding schemes that permit extending knowledge for positioning technology in the market	Moncada-Paternò-Castello, et al., 2003
Open innovation practices	Using specific open innovation practices (open innovation information exchange and open innovation collaboration) impacting commercialisation enablers of high-tech SMEs	Pustovrh et al., 2017
Developing a technology evaluation plan, including ex-ante evaluation	- Developing an evaluation plan at an early stage, analysing the economic viability and commercial potential of technology - A prospective ex-ante evaluation of the economic value of technologies	Moncada-Paternò-Castello, et al., 2003
Infoculture		
Post-Project Reviews	Reviews at a research organisation consist in bringing "multifunctional and multilevel participants together at the end of a knowledge-creating project to discuss the application and commercialisation of project results" or become the basis for innovation or further research by industry	Bout et al., 2009
Involving a set of diverse actors	- Involving all necessary actors for the successful commercialisation of technology at an early stage, namely: inventor, host institution representatives and possible interested companies. - Sharing technology opportunities with possible interested parties - Involving suppliers and manufacturers in the new product development process - Creating partnerships of companies, universities and public research institutions to use external competences for fostering innovation	Huang et al., 2018, Cervantes & Meissner, 2014, Moncada-Paternò-Castello, et al., 2003
Personal contact	Keeping repeated personal contacts and exchange of information	Cervantes & Meissner, 2014
Early linkages with industry	Establishing early linkages with industry to prevent technology supplier from developing unrealistic expectations about the market potential and success of technology transfer process	Moncada-Paternò-Castello, et al., 2003
Corporate brand and reputation	Corporate brand and reputation around efficacy based on legible measures of performance	Riep, 2019
Corporate culture	Corporate culture and the innovation culture of a company as important factors affecting uncertainties related to radical innovation development	Paasi et al., 2010
Social media	Social media fostering communication, connecting people and companies, and representing a vehicle for developing customer insights, accessing knowledge, co-creating ideas and concepts with users, and supporting new product launches	Bhimani, et al., 2019

4. Case Study

The study covers the Łukasiewicz Research Network, a network of institutes working with and for business and supporting the innovative development of Polish firms, with more than 7,000 staff, 4,500 researchers and engineers with 22 research institutes in 12 Polish cities. It is one of the largest research networks in Europe after the German Fraunhofer Gesellschaft and Finnish VTT (Technical Research Centre of Finland). Łukasiewicz's revenue is ca. EUR 400 m at present. The Łukasiewicz Network as a whole undertakes a range of actions to support commercialisation. Its flag activities include: the Challenge System (a tool to work with enterprises looking for solutions to technological or process problems), actions to expand participation in international projects (e.g. financial incentives for researchers), brand management (e.g. visual resources and contents like brand name, logo, slogans), and image actions like participation in fairs, conferences, congresses or an acceleration programme fostering the creation of spin-offs.

The longitudinal case study relates to 2 aspects:

- Designating the commercialisation tools used in the Łukasiewicz Research Network, including such dimensions as: infrastructure, infostructure, and infoculture and the following areas: technological, market, economic, legal and organisational (Table 3: columns 1-6).
- Comparison of the commercialisation tools used in the Network's particular institutes before they joined the Network and in the Network as a whole (Table 3: columns 7, 8).

Table 3: Classification of the commercialisation tools used in the Łukasiewicz Research Network addressing 4 areas of activity (columns 1-6) and indicating the tools used by Institutes before (column 7) and after joining the structure of Łukasiewicz Research Network (column 8)

No	Commercialisation tools	Technological area	Market area	Economic area	Legal and organisational area	Tools used by the individual Institutes before joining the Network	Tools used by the Institute after joining the Network
INFRASTRUCTURE							
1	Start-up and testing of the CRM customer support system in Łukasiewicz Institutes	☒	☒	☐	☐	Simple CRM systems functioned in 14% of the Institutes.	23%, the target is 100%
2	Łukasiewicz's technological range (catalogues of technological projects and of the Institutes)	☒	☒	☐	☐	100%	100%
3	Projects realised as part of subsidies aimed at commercialising results	☐	☐	☒	☒	Depending on competitions announced by intermediary units, e.g. POIR Fast Track – implementation/ commercialisation 60%	100%
4	Cockpit (aggregated management data on intellectual property, sales agreements, KPI and revenue monitoring in terms of commercialisation)	☐	☐	☒	☒	Reporting at the level of Institute directors using an excel tool – 60%	100%
5	Science and popular science, specialist or business journals issued by the Institute	☒	☒	☐	☐	23 journals, 9% Institutes have their own scientific publishing houses	No changes
INFOSTRUCTURE							
6	Rules for management of copyright and related rights and industrial property rights	☐	☐	☒	☒	18% Institutes had regulations in this area	100% - standard documents

No	Commercialisation tools	Technological area	Market area	Economic area	Legal and organisational area	Tools used by the individual Institutes before joining the Network	Tools used by the Institute after joining the Network
INFRASTRUCTURE							
7	Remuneration rules, including for sales and commercialisation	☐	☐	☒	☒	100% Institutes had remuneration rules	100% - standard principles of remuneration, including for sales / commercialisation
8	Model of indirect intellectual property commercialisation in the Łukasiewicz Research Network (guidelines)	☐	☐	☒	☒	9% Institutes had indirect commercialisation (companies)	14% Institutes had indirect commercialisation (companies)
9	Good practices of intellectual property protection and management in Łukasiewicz for authors and staff	☐	☐	☒	☒	Procedures of intellectual property management in 23% Institutes	100% - standard documents
10	Good practices for Łukasiewicz companies – key rules and processes for indirect commercialisation, preparing a legal structure for future startups and their market entry	☐	☐	☒	☒	Procedures of intellectual property management, including company foundation, in 14% Institutes	100% - standard documents
11	Preparation of standard agreements necessary for intellectual property commercialisation, e.g., joint rights to patent agreements	☐	☐	☐	☒	A variety of agreements were in place, 9% Institutes had joint rights to patent agreements	100% - standard documents
12	Sales model in Łukasiewicz - sales strategy and standards for the Łukasiewicz Network and Institutes	☐	☒	☒	☒	27% Institutes had regulations in this area	100% - standard documents
13	Production model (the project to improve effectiveness of production areas, their separation and transfer to third-party companies).	☒	☒	☒	☒	Production-related areas in 18% Institutes	The model implemented to all Institutes having production, production areas were separated and transferred to third-party companies in 5% Institutes.
INFOCULTURE							
14	Łukasiewicz Brand project (identify Łukasiewicz researchers and products, technologies and services with media potential)	☐	☒	☐	☐	18% institutes declared occasional media contacts	100% at the level of the whole Network and its Institutes
15	Conference with Polish emigre community – co-organise a regular international conference	☐	☒	☐	☐	Participation in conferences (100%), their organisation (32%)	Participation in conferences (100%), their organisation (50%)
16	Innovatorium – a regular internal event (staff integration, making and maintaining contacts with business partners)	☒	☒	☐	☐	Occasional events for the Institute's staff and business partners (50%)	100%
17	A coherent image of the whole Łukasiewicz with clients and partners	☐	☒	☒	☒	Institutes had their logotypes, websites – 100%,	Coherent image – logo, website www, stationery: 100% Institutes

No	Commercialisation tools	Technological area	Market area	Economic area	Legal and organisational area	Tools used by the individual Institutes before joining the Network	Tools used by the Institute after joining the Network
INFRASTRUCTURE							
INFRASTRUCTURE, INFOSTRUCTURE, INFOCULTURE							
18	Pimcore-based Product + Service (P+S) and intellectual property databases aggregating Łukasiewicz institutes' products, services, and intellectual property rights (infrastructure – IT system, Infostructure – data aggregation/base, infoculture – procedure/dissemination)	☒	☐	☒	☒	Excel database – 100%	Web application 100%
19	Łukasiewicz accelerator: a project supporting indirect commercialisation, or formation of startup capital companies (infrastructure – programme, Infostructure – acceleration model, infoculture – demoday)	☐	☒	☒	☒	No part in the acceleration programme, but 14% Institutes realised indirect commercialisation (companies)	100%
20	Participation in key fairs, meetings with clients, presentation of products, services, and technologies (infrastructure – a modular exhibition stand, Infostructure – data aggregation/base, infoculture – procedure/dissemination)	☒	☒	☒	☐	Individual Institutes participated in selected fairs and other events, meetings with enterprises, 100% (smaller exhibition spaces, higher costs)	100%
21	Łukasiewicz's P+S challenges – solutions to problems reported by business to be offered within 15 days (infrastructure – IT system, Infostructure – data aggregation/base/challenge hosts, infoculture – procedure/dissemination)	☒	☒	☒	☐	Offers presented at the Institute level (100%)	100%

Source: The authors

Our research implies all the CTs used by the Łukasiewicz Research Network now were operated by independent Institutes, too, though to a far lesser or more limited extent (often by a mere few of the 22 Institutes). This changed considerably after the Network's creation. Advanced infrastructure tools began to be extended to all the institutes. As far as infostructure is concerned, documents were standardised and implemented to all the institutes as guidelines (e.g., standard commercialisation rules and agreements, remuneration rules, e.g. for commercialisation, etc.). Infoculture was least affected, though the actions there relate to the crucial area of constructing the Network's coherent image and had already been undertaken by individual Institutes.

Interviews with several dozen commercialisation staff (directors, managers, specialists) of Łukasiewicz Institutes help to identify 3 groups of commercialisation tools depending on the scopes of their application:

- Basic tools – (7) CTs already used by all the Institutes before joining the Network, including product and service ranges, catalogues of technological projects completed, and a bulletin presenting the core fields of particular Institutes' activities, participation in fairs, websites, logotypes, training, remuneration rules. The changes on joining the Network standardised the regulations and layouts.
- Advanced tools – most (12) tools applied by some Institutes only. Joining the Network helped expand the range of tools, implemented to all the Institutes as guidelines (e.g. standard commercialisation rules and agreements). What is noteworthy, the larger the staff and revenue of an Institute, the longer the list of its tools.

- Specialist tools – (3) specific tools dedicated to several Institutes only. After joining the Network, their ranges were standardised only, not expanded (e.g. for Institutes running companies or production areas).

The Institutes continue reporting their needs for a continual improvement of their tools and development of their functionalities. No tools were identified used by isolated Institutes and then discontinued once the structures were formalised. Conversely, the growing numbers of tools employed by individual Institutes after joining the Network's structures, combined with rising commercialisation revenues and net profits after 1 April 2019 (Walasik, Poteralska, 2024), demonstrate their application is effective.

5. Discussion

Our state-of-the-art review helps to identify diverse commercialisation tools, most used in practice by the Łukasiewicz Research Network, the subject of this paper. The literature review failed to find a single publication, however, that would address the dimensions of infrastructure, infostructure, and infoculture at the same time. Our case study indicated this approach is possible and used in practice by the Łukasiewicz Network. The extensive ecosystem (infrastructure, infostructure, and infoculture) no doubt encourages and facilitates research. Actions involving three dimensions and becoming parts of at least 3 out of 4 areas defined acquire extra significance as tools supporting the commercialisation processes of organisations in a network. These are tools of maximum impact and thus maximum effectiveness supporting the commercialisation process. They can be described as, if not foundations of success of the network organisation discussed, certainly its strong distinguishing feature that contributes to its positive image and brand.

The diversity and effectiveness of commercialisation tools are crucial. Once the Łukasiewicz Research Network was established, the number of commercialisation tools applied by its Institutes clearly increased. What is noteworthy, the larger the staff and revenue of an Institute, the longer the list of its tools. There are of course CTs that, due to their unique operation, are dedicated to a few Institutes and their application was not expanded after they became part of the Network's structures, but standardised in most cases (e.g. for the Institutes with companies or production areas). Some CTs were utilised in independent Institutes, yet to limited extents, and then designed and implemented to all the Institutes to support the management (Cockpit, Pimcore Base), business (Łukasiewicz Challenges, Accelerator) or image (shared exhibition stand) of the Network as a whole.

Assessing the effectiveness of CT is another important aspect. The Network's formation enabled the particular Institutes to increase the numbers of their CTs and transfer of work, e.g., the accelerator or the challenge system, to the network level, which directly translated into higher profits and commercialisation revenues in the period of the Network's operation, i.e., 2019-2023. Becoming part of the Network, the individual institutes gained access to knowledge, unique resources and infrastructure, and opportunities for close and consolidated cooperation, thus building competitive advantage. Measuring the effectiveness of actions involving three dimensions: infrastructure, infostructure, and infoculture, is of special significance. It should be a key element of the Network management which not only allows for evaluating the effectiveness of actions and tools implemented but also provides foundations for an accurate setting of short- and long-term goals for both the particular institutes and the entire Network.

6. Conclusion

Based on the classification of commercialisation tools available in literature, comprising three dimensions: infrastructure, infostructure and infoculture, those employed by the Łukasiewicz Research Network are identified. Using CT brings a number of benefits, improving productiveness (automation of recurrent tasks – contact management, e-mail communication, e.g., CRM system, project management system), sales (tailor-made solutions, potential customer management – collaborative networks), and customer support (efficient responses to customer queries and personalised assistance – P+S challenge system, MStems), helps reduce errors (supply of precise data, use of tracking tools – social media, Google Analytics). Commercialisation tools are a necessary part of setting a model action path that leads to conversion of research results into market products. They not only facilitate the management of commercialisation process but also assure an ongoing information transfer and thus provide management support (impact on decision making).

The approach adopted by the authors adds a cross-cutting dimension to this discussion and foundations for more extensive research into commercialisation tools as an extremely important aspect of new technology commercialisation. The comparison of commercialisation tools of the institutes before and after inclusion in the Network is the novel element of the study. The results presented can be used for the needs of building a

commercialisation strategy. Depending on the commercialisation practices already in place in a particular organisation and the challenges it faces, a tailor-made set of commercialisation tools can be selected, taking into account the dimensions: infrastructure, infostructure, and infoculture, and the areas: technological, market, economic, legal and organisational.

Some research into the real contribution of commercialisation tools to improving effectiveness and how to measure it could be a good idea in future. Analysing which tools can be the most effective at the particular stages of the commercialisation process is another area for research.

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