



Practice-Based Views on Key Success Elements in University-Industry Collaborative Activities

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ABSTRACT

Research on university – industry collaboration ideologies, operations and activities for improvement of effective cooperation in industry 4.0 era. Utilizing over 65 years of experience on effective collaboration, inc. advisory notes, experiences, proven models, industry case studies and collaborators' recommendations for rich, long and successful partnerships. A five step model for cooperation is proposed: goal setting, key stakeholder analysis, legal framework definition for interaction, best practice experience analysis, and goal readjustment. Model facilitates effective interactions to achieve the set goals by adequately focusing on main issues. We contribute to the proper collaboration approaches discussions, allowing good outcome UIC. Academics and practitioners should seek specific signs, activities & outputs to avoid near term challenges in changing world. Virtual environments and metaverse collaboration are suggested to be considered as next level UIC platforms and future research is in need of extended range of interactions and novel new long-term cooperation model studies.

KEYWORDS

Co-Operation, Digitalization, DT, I4.0, Industry 4.0, Industry Partnership, Joint Effort Activity, Knowledge Transfer, Municipality, NGO, Resource Sharing, UIC, University-Industry Collaboration

The modern, digitalized, industry 4.0 era offers industry and non-governmental organizations (NGOs) many new opportunities (Happonen & Rantala, 2012) to improve and enhance their operations, work efficiency, transparency, and sustainability based on information and communication technologies (ICT) and the digital transformation of current activities (Oubrahim et al., 2023). Digitalization is also improving higher education (Hammami et al., 2015; Happonen, Santti, et al., 2020), contributing to an increase in accessibility and inclusiveness (Kovaleva et al., 2024). In the work-life environment, digitalization does add new complexities to the work content and loading, which is,

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fortunately, positively increasing employees' experience, knowledge, and skills. Still, it also pushes new requirements on them (Gobble, 2018; Happonen, Manninen, et al., 2022; Vyas-Doorgapersad, 2022). In this regard, one of the most promising ways to keep higher educational institutions (HEIs) flourishing and to innovate new business models (Happonen, Santti, et al., 2020), including shared work to solve the financing level questions in universities, is to strengthen partnerships with industries in the commercial and non-profit sectors (Happonen, Minashkina, et al., 2020) and continue working in deeper collaboration with municipalities. Moreover, collaboration should not be limited to universities' favorite areas, research and development (R&D), but should also actively develop in education and management.

Educational collaboration between universities and industry improves student knowledge related to real-world work-life requirements; enhances their skill quality; can increase inclusiveness (Kovaleva et al., 2024; Nieminen, 2022); and offers students opportunities to learn fundamental business cases and connect knowledge, skills, and abilities with the needs of the labor market (Pang et al., 2019). Modern tools allow this work to happen in physical, online (S. Li et al., 2023; Porras et al., 2021; Tang et al., 2023), and virtual environments (Usmani et al., 2024) and in traditional courses, capstone courses (Palacin-Silva et al., 2017; Tenhunen et al., 2023), and intensive educational settings, like hackathons (Porras et al., 2018) and code camps.

Currently, there is also a shift toward augmented reality and metaverse solutions, where physical and virtual groups meet simultaneously in hybrid meetings, enhancing options for trust building and the feeling of belonging to the same group (Bellini et al., 2019). Collaboration between researchers and industries boosts the chances of turning university research findings into practical products and services, innovations, and commercialization (Pudjiarti et al., 2023; Pujotomo et al., 2023). For smaller companies, especially, university–industry collaborative activities can be imperative to access resources, laboratories, tools, and expertise that are out of reach as their internal resources are commercially paid services. This reality becomes more evident closer to the start of the innovation pipeline (Happonen, Nolte, et al., 2022), where uncertainties are higher and innovation and knowledge transfer need a broader scale of inputs and more formal processes (Salmela et al., 2013), insights, and viewpoints for increased success rates. In this regard, several critical success elements have been identified in the literature. For example, networking, partnering, culture-making, and supporting are micro-practices that contribute to the success of collaborations (Zhuang & Shi, 2022). A recent study from Cirella and Murphy highlights the importance of drivers and barriers in university–industry cooperation, including connections between partners, organizational culture differences, and types of relationships (Cirella & Murphy, 2022).

Additionally, establishing trust, fear of knowledge leakage, and intellectual property agreements were identified as barriers and enablers that evolve over different phases (Lauvås & Rasmussen, 2022). Literature suggests that successful university–industry collaborations require stakeholders' attention to micro-practices, drivers, and barriers at different stages of the collaboration process. However, the studies do not provide practical actions on the collaboration level for the stakeholders to steer their collaborative operations in the most beneficial ways for all partners. Our study aims to tackle this research gap with practical insights from the authors' combined 65 years of experience with the university–industry collaboration context, mixed with recent literature and constructive feedback from our peers and industrial networks.

Our work aims to create recommendations and guidelines for cooperation and collaboration between micro, small, and medium-sized enterprises (MSMEs) and HEIs. The goal is to provide an approach for building successful collaboration, general tips for university-industry collaboration (UIC), and guidance for MSMEs and universities to support innovation and growth. The aim is to assist organizations in overcoming motivation-related, knowledge-related, capability-related, and governance-related barriers (Attia, 2015; Bruneel et al., 2010; Muscio & Vallanti, 2014; Nsanzumuhire & Groot, 2020).

The study focuses on the practical experience of researchers and academics who have over 65 years of collective experience with university–industry collaboration, covering more than 40 successful collaboration cases. They have examined and tried collaboration models, activities, and practical implementations in successful cooperation with industries and small and medium enterprises (SMEs) that have been shown to provide value for cooperating parties, surrounding regions, and municipal, governmental, or societal entities. In short, the study aims to analyze current challenges experienced in collaborations and explain practices proved by actual implementations and practical insights. The study presents specific actions that can be taken to facilitate productive collaboration between academic institutions and business sectors, adding to the current body of knowledge.

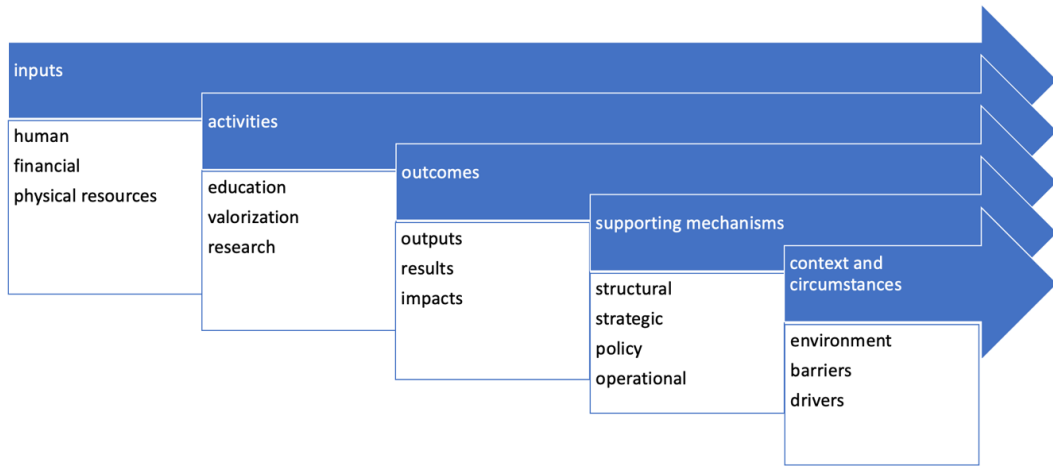
BACKGROUND

Universities not only serve as leaders in research (Dhillon et al., 2008; Gulbrandsen & Slipersæter, 2007), science, and education, but they also have a powerful influence on the development of the municipality, city, and country to which they belong (Meerman et al., 2018; Philpott et al., 2011). Their economic, social, and educational impact is essential (de Jong & Balaban, 2022; Valero & Van Reenen, 2019). This study presents multiple decades of combined industry collaboration experience in the literature findings to form a comprehensive view and model. We present practical challenges and other ways to achieve effective cooperation in the university–industry context. There is extensive practical material, and researchers pay great attention to developing collaboration models between universities, enterprises, and the government. Classical models created at the turn of the 21st century include Henry Etzkowitz’s triple helix model (Cai & Etzkowitz, 2020; Etzkowitz & Leydesdorff, 2000) and Burton Clark’s entrepreneurial university model (Clark, 1998). The triple helix model, which has absorbed the experience of entrepreneurship, is characterized by the high financial autonomy of universities and indirect control by the government.

On the contrary, Clark’s entrepreneurial university model is based on the experience of cooperation between universities and businesses. The model places the researcher in the context of a continental model of higher education with various forms of government participation. Various models have emerged to facilitate effective collaboration between these two sectors: university and industry. The triple helix model, emphasizing the interdependence of academia, industry, and government, underscores the significance of collaborative efforts among these entities in advancing innovation and regional development (Cai & Etzkowitz, 2020; Etzkowitz & Leydesdorff, 2000). The open innovation model encourages exchanging ideas and resources between organizations, promoting a culture of shared innovation and co-creation (Chesbrough, 2003). Technology transfer offices (TTOs) are critical in managing intellectual property and facilitating technology transfer from academic institutions to industrial partners (Geiger, 2005), acting as intermediaries to ensure a smooth transition from research to commercialization. Collaborative research centers (CRCs) focus on fostering long-term partnerships between universities and industries, often backed by governmental funding, to address complex challenges and stimulate breakthrough innovations (Zucker & Darby, 2007).

However, the increasing speed of knowledge renewal, the development of digitalization, and changes in the interactions between universities, businesses, and the government encourage the creation of new business models that meet modern requirements (Li, 2020; Rachinger et al., 2018). One of the most theoretically severe constructions is the concept of the ecosystem of university–business cooperation (UBC), created by a group of researchers led by Galán-Muros and Devey (Galan-Muros & Davey, 2019). This concept served as the theoretical basis for a project to analyze the state of interaction between universities and business in Europe, implemented under the auspices of the European Commission in 2016–2017 (Meerman et al., 2018). Figure 1 presents the framework of the ecosystem of university–business cooperation. The distinctive features of Galan-Muros and Devey’s approach are the maximum development of all possible types of cooperation between

Figure 1. The UBC Ecosystem Framework (for HEIs) (Note: Adapted from “The UBC ecosystem: Putting Together a Comprehensive Framework for University-Business Cooperation” by V. Galan-Muros & T. Davey, 2019, *The Journal of Technology Transfer*, 44(4), p. 1330. Copyright 2019 by Springer)



universities and commercial companies within the framework of four directions—education, research, commercialization, and management (resource sharing). The central place in the model is occupied by a step-by-step description of the cooperation process between universities and businesses, providing additional opportunities for analytics and operationalization. The key elements of the model are inputs (human, financial, and physical resources), activities (14 types of joint activities in the field of education, research, and valorization), outcomes (outputs, outcomes, and impacts), supporting mechanisms (policy, strategic, structural, and operational mechanisms), and context and circumstances (barriers, drivers, and environment) (Galan-Muros & Davey, 2019).

At the same time, there is often a shortage of crucial resources, including time (Salmela et al., 2015), personnel, finances, and information, in building relationships between universities and businesses (Kleiner-Schaefer & Schaefer, 2022; O’Dwyer et al., 2022; Rossoni et al., 2023). In such a situation, universities often respond to outside requests (Goel et al., 2017). For instance, the company approaches the university to research or develop a master’s program/course (Green, 2010; Happonen, Minashkina, et al., 2020; Maghiar, 2014; Pachura & Nitkiewicz, 2020). Insufficient attention to the UIC process can lead to problems with the perception of the benefits of cooperation and, in turn, an unwillingness to develop it in the future (Kleiner-Schaefer & Schaefer, 2022; O’Dwyer et al., 2022; Şendoğdu & Diken, 2013). According to a 2016-2017 European study of collaboration between universities and enterprises, universities and businesses are convinced that they are not benefiting from collaboration and that the other side gets more (Meerman et al., 2018).

Therefore, it will be helpful to create UIC recommendations and guidelines that would make it easier for the university to build effective collaborations with industry, focusing on key issues requiring serious attention. We tried to frame our practical experience clearly and understandably for practitioners, companies, and researchers.

METHODOLOGY

This research study presents a synthesis of practical experience and literature review to develop recommendations for a robust and sustainable industry and academic partnership. The core part of the main approach discussed consists of recommendations and guidelines collected throughout the

Table 1. Research Objectives and Research Questions

Research objective	Research question
O1: To construct recommendations and guidelines for practitioners and academics	Q1: What should universities and industries do to achieve their goals? Q1.1: What is essential for a robust relationship in UIC?
O2: To design a novel, productive UIC approach	Q2: How should robust relationships be achieved from the UIC perspective?
O3: To analyze the UIC approach for its effectiveness	Q3: What are the university and industry benefits from following these guidelines?

research practice and collaboration with industry parties. As presented in Table I, our study and our research goals for the synthesis were driven by three research objectives and related questions.

The primary sources of information for writing the article included, at the theoretical level, scientific articles, papers, and other works devoted to the problem of research and, at the practical level, the results of work with companies and industry collaborations from over 65 years of combined experience.

Existing Best Practices

UIC can take many forms depending on the partnership’s scope, intensity, and duration (Ankrah & AL-Tabbaa, 2015). For instance, contract research refers to when a university conducts a research project for an industry partner that provides the funding and defines the deliverables. Joint research involves a university and an industry partner collaborating on a project and sharing costs, risks, and benefits. Research consortia consist of multiple universities and industry partners working together on a large-scale and long-term program. Technology transfer involves a university licensing or selling its research outputs to an industry partner. Lastly, academic entrepreneurship refers to a university or its researchers obtaining industry involvement or support to create a new venture based on their research outputs; while there are great models of this form of UIC, more research is needed to determine how to increase the number of women entrepreneurs in the tech sector.

There are several current models and frameworks based on the experience of researchers and academics in UICs over the past 25 years. These include the triple helix model (Cai & Etzkowitz, 2020; Etzkowitz & Leydesdorff, 2000), the open innovation model (Chesbrough, 2003), the co-creation model (OHern & Rindfleisch, 2010; Ruoslahti, 2020), and collaborative research centers (Zucker & Darby, 2007). Each model emphasizes different aspects and approaches to UIC, but all emphasize the importance of collaboration and partnership between universities and industry. The models provide a framework for organizing and managing UIC activities. However, it is important to remember that each collaboration is unique, and the models can be adapted to meet the specific needs and goals of the partnership. It is hard for inexperienced collaborators to choose the correct model for collaboration. There are also different domains and activities inside UIC. Establishing and creating a successful university–industry collaboration requires careful planning, practical strategies, and adherence to best practices.

Other examples of UIC include innovation ecosystems and science parks. Establishing innovative ecosystems and science parks can create physical spaces where universities and industries co-locate, fostering collaboration, knowledge sharing, and innovation (Etzkowitz & Klofsten, 2005). In addition, forming joint research centers and consortia focused on specific research areas can facilitate collaboration. These entities often secure funding for collaborative projects (Zucker & Darby, 2007). Yet another example of UIC includes industry-academia fellowships and exchanges; encouraging faculty and industry professionals to participate in fellowships, sabbaticals, or exchange programs can build relationships and mutual understanding (Perkmann et al., 2013). Building vital interpersonal

relationships between university and industry partners is crucial, and regular communication and trust are critical to successful collaborations (Perkmann et al., 2013). It is also important to develop clear metrics and key performance indicators (KPIs) to measure the success and impact of collaboration efforts. This helps assess the value of the partnership (Laursen & Salter, 2006). We will cover the communication and outcome measurement recommendations in the following sections.

According to Galán-Muros and Plewa (2016), there are three UIC domains and activities: research, education, and valorization. The authors analyzed barriers and drivers in such collaborations. UIC is hard, especially when a business has no contact with the university (Giones, 2019). Therefore, models and best practices provide a valuable framework for organizing and managing UIC activities and how to collaborate properly (Greitzer et al., 2010; Rybnicek & Königsgruber, 2019; Sandberg et al., 2011). For example, Awasthy et al. (2020) proposed a framework to improve the effectiveness of the UIC. Littleton et al. (2023) investigated factors impacting the growth and success of sustainable UICs. Ankrah and AL-Tabbaa (2015) developed a conceptual process framework that connects the five primary themes: forms, motivations, formation and operationalization, enablers and inhibitors, and outcomes. Additionally, we have ongoing research about the impacts of intermediaries (Albats et al., 2022), with an analytical framework allowing knowledge professionals and stakeholders to consider how and what to change in a UIC.

University-industry collaboration approaches and models have been explored in several studies. Cheah et al. (2023) proposed a structural framework and guiding principles to integrate academic and practitioner resources and expertise as an effective mechanism for social business success. Nsanzumuhire et al. (2023) developed an integrative conceptual framework for comprehensive analysis of the university-industry collaboration context, identifying effective mechanisms for improvement. Palmieri et al. (2023) presented a joint university-business research process that enables innovation processes. Ahmed et al. (2022) proposed the academia-industry collaboration plan (AICP) design model, comprising processes, methods, and tools to establish collaboration. Manotungvorapun and Gerd Sri (2022) developed a 3-phase analytical approach and four modes to manage UIC. Cirella and Murphy (2022) identified crucial micro-practices for sustaining collaboration and innovation processes. Another proposed model identifies collaboration practices with industry and partners from the economic environment in open innovation (Samanta et al., 2022). Even though these models offer substantial benefits, including enhanced innovation, access to diverse expertise, and accelerated research and development, they are not without issues. Most models are based on theoretical literature and are somewhat limited in coverage. For example, they tend to have a limited understanding of the different collaboration contexts, do not consider the capacity of companies, or are based on a single case study. In the end, collaboration is an interaction between humans, and it should be built on clear communication and trust. Additionally, nurturing a supportive ecosystem for collaborative research and promoting a shared understanding of the benefits of industry-university partnerships can contribute to these collaborative models' continuous improvement and evolution. Still, it is somewhat confusing for a new collaborator in an industry or university to know where to start and what to do. We want to propose our approach, which helps to navigate and make the collaboration easier for both sides. The approach is easy to understand and follow, making a good start for a collaboration. Moreover, the general tips will help sustain the collaboration, leading to successful results and achieving goals.

PRACTICE-BASED VIEWS ON KEY SUCCESS ELEMENTS IN UIC ACTIVITIES

Numerous strategies have been developed for productive collaboration, as the overview of best practices in the preceding section has elaborated. However, these best practices are dispersed throughout the literature, and many authors tend to address only a single facet of cooperation, like problem-solving or technology transfer. Given the current status of research, our study aims to fill the gap by providing a generalized and simplified five-step practice-tested methodology. In this section, we present and analyze key recommendations and practical insights: a five-staged approach for robust

collaboration and grouped recommendations for better communication, a shared view of the process, teamwork, and a clear vision of the target audience and resources. The practical insights are based on a long-term partnership between personnel in HEI units and their industrial and municipal-level collaboration partners. The list has been built from the point of view of offering practitioners more realistic touch points toward UIC collaboration to understand how academics, teachers, managers, and other representatives on the HEI side might see the partnership. This should give municipal leaders, decision-makers, and SME support organizations new insight and opportunities to widen the cooperation with HEIs and companies.

First Stage

The first stage of the university-industry collaboration is understanding companies' and universities' needs and the efforts that the company and university are ready to contribute. As a company/municipal person who wants to collaborate with the university, it is advisable to consider what stakeholders need from this networking opportunity. For example, it is suitable to view the current knowledge needs of the company, where it is missing new ways to approach the knowledge gap. Alternatively, the company might have stumbled upon the research, development, and innovation (RDI) opportunity but needs more information. In short, these are beneficial ways for university contacts to help a company progress toward its information- or technology-related goals and needs (Hammami et al., 2015; Hazzi & Hammami, 2019).

Expectations for results are not discussed sufficiently at the start of the collaboration process. Too often, both parties have assumed the other's expectations for the collaboration, and they are not fulfilled. They should engage in more discussion about what the collaborators will do, what type of results are expected and within what time frame, and what sort of readiness is expected. They should also consider what resources, availability, and money will be used or available. Clarifying the boundaries of possibilities at the start will reduce complex discussions, disappointments, and lost opportunities or interest later. Sometimes, it is worth drafting official documents on the agreements and desired outcomes, which is the third stage in our approach.

In practice, the following has been noted when working in the middle ground between a company case (especially SMEs), municipal case, or seeking help in RDI and research units. Too often, people want to pass the problem on to researchers, lecturers, laboratory engineers, or students and then expect them to provide solutions with minimal input. What often goes unnoticed is that the effort should come from both sides. For instance, think about how well this would work for the company: give a challenging task to a person unfamiliar with all the intricacies of the specific process and then expect them to find solutions without any extra access to information in the company. There is a chance the person will succeed, but it will take more time and resources.

The solution to this problem is easy: more time and effort must be devoted to collaboration. However, the academic representative should be more active and ask for this collaborative work. Integrating research components into cooperation between industries and universities is paramount. This approach leverages the university's academic expertise, enabling in-depth exploration, experimentation, and innovation. By focusing on research-driven initiatives, the collaboration capitalizes on the intellectual contribution of academia to address complex challenges and yield transformative solutions beyond conventional product development. The problem is on both sides of the fence—on one side, the companies do not put enough effort into describing the problem and, on the other side, the HEI units might not demand the highest quality solutions possible. When considering solutions to a given challenge, many people are content to simply accept the first idea that comes to their minds and leave it as is. Based on long-term fieldwork experience, this is a common problem and often limits the real potential to be extracted from these UIC relationships. Unfortunately, the most straightforward ideas are those that most people have already tried and discussed together. Through the collaboration of a group of people for idea creation, it will be a challenge to identify the exact contributions of each participant. Additionally, innovation-based collaboration is not pushed as far as

possible (Parjanen, 2012; Ruoslahti, 2020). Regarding the ability to listen to outside ideas and take on feedback, industrial persons tend to get frustrated when people outside their company give them reasons why their views cannot be developed into practical solutions.

Academics and industry/municipal persons are at fault for the challenges. First, one should not get frustrated when one's idea is rejected because of this or that. Just be ready to pivot and ask from another angle, "How about this way?" The person who explains why it cannot be done is trying to save companies' time by not spending it on solutions that have already been tested and do not provide the output. However, this person should also explain how the idea could be changed to achieve the goals of the person who proposed it.

Concrete outcomes are important but not always well-remembered goals of collaboration. Previously, we mentioned how important it is to agree on what different actors will produce for their shared purposes, who is responsible for various issues, and on what timetable they will operate. It is also essential to add that these targets should be as concrete, tangible, and practically understandable as possible. Rather than just agreeing on what the targets are, partners should also explain why they are aiming for specific things and why they are vital for them, the company, or the HEI unit.

Second Stage

The second stage is to identify stakeholders. Initially, participants must consider the best personality to be a join point. On the academic side, assigning the most knowledgeable person (e.g., leading research professor) to lead the company collaboration might not be the best idea. In practice, it has been seen to be more productive to assign people who are knowledgeable enough but less busy and let them cooperate with industry partners. Remember our previous point about the time and effort devoted to the collaboration. After the idea stage, when needs, limitations and resource realities have been mapped out and clearly defined, bring the questions and knowledge required to the table. This helps the person easily understand their needs and efficiently offer resources for this challenge.

As before, in the industry–student collaboration front, teachers should not drop the student directly into the pool's deep end. Engaging students from the beginning of the project discussions with industry brings fresh perspectives and innovative ideas (Happonen & Minashkina, 2018; Mian et al., 2020; Qureshi et al., 2023) but also allows students to delve deeply into the project. These firsthand interactions equip students with practical insights to fully grasp the project's scope and objectives. As a higher education unit representative, an important thing to consider is what sort of collaborations they have enough resources to support, and this must be done from start to finish. The resource plan must include a buffer for challenging times when things might not go as planned. This sort of planning without reality buffers is a typical source of collaboration problems. In practice, items are assumed to flow quite unproblematically from start to end, and no time has been reserved for potential needs to rethink, pivot, or fix the unexpected issues surfacing in the collaboration. Therefore, it is critical to identify potential stakeholders and resource plans with potential risks and worst-case scenarios.

Third Stage

The third stage consists of defining the legal framework for collaboration. Usually, stakeholders agree on the project outcomes and what each party could gain from the partnership and then draft a memorandum of agreement (MOA) to guide the research work. Establishing a clear understanding between universities and industries is crucial to the success of collaborative projects. Before the collaboration, both parties should engage in thorough discussions to delineate project objectives, roles and responsibilities of each party involved, and expectations from both sides. This lays the foundation for a comprehensive MOA, including intellectual property rights, funding agreements, and dispute resolution mechanisms. It enables a transparent and structured framework that minimizes ambiguity and fosters a collaborative environment conducive to achieving the shared objectives. The mutual agreement contributes to a shared vision for long-term collaboration. First-time and one-time collaboration development can focus on specific sets and limited matters. However, for a long-term

partnership, there should be both (a) a well-established vision and (b) a shared strategy on how that vision will be achieved. Local collaborations, especially, must consider not just the visions of HEIs and companies but also those of municipalities and regional development organizations in order to ensure the collaboration remains fruitful and produces highly useful results. Through open discussions about hopes, goals, views, and expectations for the set vision target(s), all collaborators should have a much clearer understanding of the direction in which this specific context for resource utilization is aiming. In addition, the actions and decisions made by different collaborators on that shared network will be easier to understand and possibly also to predict, creating a trust-based agreement or gentlemen's agreement-like atmosphere. However, there are as many personalities as there are people, and for some of us, having things having things guaranteed in writing is essential. In this environment, trust is achieved through the open willingness to agree on paper on the base realities for the collaboration. In case-by-case events, the agreements could include matters like the original goal and need for this collaboration, the actions expected to be carried out, the timetable for different items, and the people responsible and their areas of responsibility.

Fourth Stage

The fourth stage includes an analysis of previous experience in implementing best practices, which allows for assessing the likelihood of success in adapting the experience to new conditions. Stakeholders should define what type and model best suits their needs and goals. In the case of HEIs, the selection of units, people, and skill sets that come with them will significantly affect the possibility of successful collaboration. For example, in the UIC setting, if industry experts use the university to conduct research, the results will be heavily impacted by what sort of research, with what tools, styles, and mechanisms, and in what sort of contexts the selected experts have done research before. Action research, for example, could be a preferred choice for some collaborations, user experience testing and early adopter tests could be preferred for others, questionnaires, surveys, and interviews work well for others, and so on. In other words, companies will find a different level of fit from the same set of UIC network researchers, teachers, and network partners available from the HEI field. A potential solution for this problem could be a partner-finding service or industry collaboration support service offered by the HEI, as it will be a challenging task for a given SME company to determine what, who, or where in the HEI to find network partners. On the other hand, municipalities should consider mediating or networking services as part of their operations, which support SMEs in growth and business activities to boost local private markets' growth.

Another point is working with HEIs and students in collaborative relationships. Many companies seem inspired to contact educative units for collaboration after receiving positive feedback on successful student projects in their peers' UIC activities. It also seems that most SME CEOs forget that students are about 20 years old and do not have huge, comprehensive, and extensive life experience in multiple different things. As such, there is a greater risk of not knowing something or being ignorant of what older people consider "given." Based on our experience, the biggest disappointments in this sort of collaboration happen when either the companies have unrealistic expectations of the relationship or the HEI unit representatives do not monitor and check often enough on what the students are doing, how the process is progressing, and what sort of discussions and expectations for results students agreed upon with the companies. Disappointments also happen when the company personnel confuse free collaboration work with paid work and start to demand a similar commitment to work as they expect from paid employees. Projects we have seen seem to work much better if the expectations are openly discussed in different phases of the student collaboration and activities and when the risk of highly fluctuating output is well understood by the companies who go into this collaborative relationship with HEIs.

Currently, the line of thought on the HEI end is that companies are not involved enough in the shared planning of student thesis works and shared projects. This is expected to be part of why real needs and problems do not surface as naturally as possible. In the worst case, as the early innovation

part, on the widest opening of the innovation funnel, is not as populated by companies as we see it could be, those previously mentioned companies' real problems might not be noticed at all by HEIs. It is also well known that early involvement leads to a stronger commitment to shared development and collaborative work. Furthermore, the work is going in a direction that benefits all participating partners more. Early collaboration gives everyone a chance to make their mark on the project.

Many projects connected to educational institutions and companies aim to mediate, transfer, move, and promote new ways to operate, think, and work in companies, industries, and municipalities. Based on a wide range of discussions between actors on that middle ground, these efforts do not tend to have a long-term, lasting effect. This is a larger-scale cultural and national-level challenge that needs to be solved. At the project level, previously mentioned solutions to improve productivity, impact, and people's motivation to change could fix things on a micro scale. However, on a macro level, different approaches will be needed. One potential way to solve the problem is through legislation and setting large-scale goals (like United Nation Sustainable Development Goals (SDGs)). When specific things are kept on the news and daily talks for a long term, then people are reminded constantly about the importance of the change, even after a UIC project has already ended, which is expected to improve the effectiveness and more long-lasting nature of those projects results.

Final Stage

The final stage in the approach is adjusting the goals set by the university and industry in the first stage. For strategic fit, it is essential to remember that most organizations, HEIs, and corporations have operational, tactical, and strategic goals. Moreover, these come from internal and external sources, such as organizational goals, targets, and requirements set by national laws.

In the case of companies, if the urgency or priority level of the co-developed challenge is not critical, there is a risk it will drop down on the priority list, especially if there is an unexpected resource need for those higher-priority matters. The same can happen on the HEI side. For example, if people work on a collaborative challenge and are occupied with multiple different things, their priorities might fluctuate. This is also important for the students participating in collaborative activities, as they have priorities in their private lives. Some might produce excellent results; others could face unexpected issues and their output could suffer. Figure 2 presents the illustrated approach described in this section.

GENERAL TIPS FOR UNIVERSITY-INDUSTRY COLLABORATION ON HOW TO BE MORE PRODUCTIVE IN THE EARLY STAGES OF GOAL SETTING

This section presents general guidelines that are valid for each stage of the UIC approach. It is worth noting that these recommendations are helpful outside the proposed approach and can be applied in any collaboration setting. Building relationships is an essential step in successful long-term UIC. On the communication front, many recommendations work in both directions for university and industry. Many assumptions are made about what people know, taken as the default. When this is not the case, it produces a feeling of not being valued enough and reduces the genuine interest in devoting effort and value to this collaboration partnership.

Another typical problem is having too little communication. This can result in people feeling as though nothing is happening—no communication equals no work activities. The wrong type of communication in terms of what type of phrases, jargon, and industry-specific terminology is used can also be a problem. In short, everyone should be more demanding in relationships, and what sort of communication should one assume others understand and be able to digest and utilize efficiently? There is insufficient focus on listening and on a real reflective discussion style of sharing knowledge, worries, and good experiences. Instead, there is too much focus on information and knowledge; time is used to convince the other person to accept what one wants them to accept when it is better to

Figure 2. Visualized Proposed Approach of UICs



listen to what the other side needs. Standardization of message exchange types, time frames, cycles, and tools are usually too overlooked.

Communication during meetings and brainstorming events is crucial. Both ends of the collaboration pipeline assume that the problem did not start with them. This is a complicated issue; personal leadership and knowledge management talents are needed on the HEI end. One way to ease up the problem, especially when it is personality-related, is to let the SMEs, companies, or municipalities invent the ideas on their own, just by nudging them in the assumed right directions. Also, as an industry partner, do not outsource the operational work for HEI partners because that will make them feel undervalued in this collaborative relationship.

Stakeholders should understand the rules of the collaboration. When discussing needs and goals, it is worth defining the scope and communication process—for example, the mentality that work should only take place from 8:00 a.m. to 4:00 p.m. on weekdays. In many instances, the industry partners need solutions fast. However, most of the time, the experience on the HEI side often limits the industry partners' schedule to regular weekdays.

For example, if someone asks a question on Friday at 4:00 p.m., they might not receive a response until the following Monday. They will have the question on their mind the whole weekend, and about three days of potential work will be lost.

For HEIs, one clear and essential need is to develop an easy method for contacting the right persons. For example, a small, local SME has difficulty determining whom they should contact in a sizeable HEI unit with a specific development project in order to find a proper partner. Too often, a company takes a phone in hand, tries a few numbers, and quickly concludes that the university is not interested in their development problem. Many people work in these HEI units, and there could easily be multiple people who would be happy to collaborate. Unfortunately, they will never hear about the opportunity the company would offer the HEI unit. In short, we think HEIs will need to develop their accessibility from a small company's point of view. Furthermore, this does not mean a search portal for people and their specialties. HEIs must offer a customer-friendly way to leave contact requests, to which they will also respond. Furthermore, those who do leave these requests must be mindful and answer all questions appropriately. A badly fulfilled contact request signals someone looking for an easy fix for their problems, who wants to outsource everything to someone else. We already discussed earlier how badly those collaboration relationships tend to end when people seek someone else to do the work.

The reputation of the HEIs and companies can have a positive pre-boost for starting collaborations. For instance, the author's HEIs are oriented towards sustainability initiatives and could be an asset to any company that shares the same orientation and seeks collaboration. Likewise, a specific HEI unit's good reputation and national brand make it an attractive potential collaborative partner. As mentioned,

time and shared trust (Happonen & Siljander, 2020) will be needed for good collaboration. However, we believe hesitance, resistance, or doubts at the start are significantly reduced if the collaborative partner has created a well-known and good brand for itself in previous history. Also, suppose this good reputation is (and in some ways it truly is) transferrable. In that case, being part of a network of collaborators with good, societally beneficial, and locally productive organizations is valuable.

Networking is used to solve issues and meet knowledge needs. Utilizing all the potential HEI resources to fulfill the development requires participation from the industrial or municipal partner presenting the challenge or problem. Too often, it seems to be the case that the HEI representative who works in the collaboration front line tries to solve the issue alone or only depends on their team or close colleague rather than seeking out the full organization's knowledge. There could be multiple reasons for this behavior. One is a lack of knowledge on everything happening in the HEI, who researches what, and who is the best expert in a specific field.

On the other hand, people might just run out of time. This raises the previously mentioned issue of not planning enough time for collaboration. Furthermore, the solution is for HEI personnel to improve their networking and change how they work. However, the municipal industry persons can always ask, "Do you know who the best people are to help you in this matter in your organization?"

Too often, people make 5-second assumptions about others the first time they meet or talk with them. The industry person has been revealed to have a long academic history with them and is familiar with the HEI processes (at least at the same level) and vice versa. Often, people from practice-oriented contexts assume too quickly that academics just work on theory.

This partly boils back to the time issue. Not enough effort is put into the preliminary talks, and people jump directly to the issue at hand. Then, the fundamental issue of how or how well they can solve the matter together is left out of discussions.

Energy crises, COVID-19 social distancing limitations (Fakieh & Happonen, 2022; Happonen et al., 2021), and different wars alike strain the available resources the organizations have access to (Akpan & Umoh, 2021; An et al., 2020; Kwan, 2020). These large-scale challenges require time and many other critical resources. When there is minimal availability of these critical resources, priorities will shift and focus only on those things that must have been done and could be most potent for oneself and fixing the stressful issues or problems. The abovementioned is a particular problem for strategic collaborations, which tend to focus on uncertain innovations, new ideas and services, and other similar development areas. There is inherent uncertainty about the gains and benefits of the actual implementation of this innovation and how much work one might need to do to achieve it. Generally, the quantity of uncertainty should be reduced as much as possible, already at the start of the collaboration process or innovation development RDI opening times.

When considering a strategic problem, the CEO of an SME might ask, "Why do you sleep your night badly?" or "Why do I not get sleep and wake up at night?" and the answer tends to reveal a problem worth solving. From the HEI point of view, the value of a problem can be either in its uniqueness, which has the educational potential for future generations, or in its generalization and how typical the problem is so it can be added to a growing pool of samples. In summary, for fruitful collaboration, a bigger pool of real challenges should be collected from a corporation front and then a group of HEIs representatives who want to answer these challenges should be consulted.

People suggest things they think should be done, but real-life experience from the UIC differs. A researcher was facilitating an industry professionals meeting, and one part of the process was to ask what the company would expect and like to see because of this process. Everyone was given a piece of paper on which they wrote their name and expectations. Then, papers were collected and next everyone was asked to put their name on a second paper and write down what they would do to ensure these results and set goals would happen. One industry person raised his hand and asked for the first paper back to make the expectations more realistic. The learning and moral of the story is that one should not ask what others can give them but ask what effort they are willing to put into goals they hope to achieve together. Overall, this sort of activity should be more common in collaborative

shared activities to make people think about what they require from the collaboration and how much effort they are willing to put into the process to receive these required end goals.

When a UIC is formulated, we believe the partners in this collaborative relationship should put much effort into reducing demand uncertainty. For example, product developers tend to develop their products inside the company or development group as much as possible. This includes planning, building, and implementing it inside the company with as good support features as possible to reduce market rejection risk(s) and technological risks. The problem here is that the result often forgets the end users, clients, and people who will pay the bills and use and purchase this product. The real solution includes early adopter tests, putting the ideas' minimal viable product version in the field, and testing its demand drive as soon as possible. One of the best possible tests is whether money moves with this idea. Do people pay for it (even a tiny amount)? In short, in parallel with the development process and efforts to reduce technological-based uncertainties, companies must also focus on reducing demand uncertainty. Companies could be supported by their collaborative HEI partners in the efforts of defining with more details: (a) who are and can be the actual customers or clients, (b) what sort of direct, indirect, and even unexpected customer needs this new market offering, service, or product could solve, (c) what is the price range and pricing model with which the customer base would be most comfortable compared to the sales related revenues the company needs for proper growth and upkeep of service in the promised service-level agreement (SLA) or service promise level, (d) how many clients or customers can be sourced locally or nationally and even internationally and how the company could contact these potential customers (right now, shortly, in more distance future in international markets), and (e) what are different feasible channels to offer the product for the markets (and is this the same or different way in different market settings). Suppose there is a will and force to reduce demand uncertainty in the early phases of the UIC project or shared development efforts. In that case, there is a high likelihood that the development and scaling to markets will continue after the shared RDI efforts are made in an excellent and trust-based UIC setting. Even if the result would be a shared view on the current offer or product formulation that it will not be a financeable, feasible target to continue with development efforts, then at least all partners would know what was good, bad, and ugly in this specific business opportunity, most likely how to pivot it in the future and maybe wait to give general technology and markets time to mature a bit, so they are ready for this idea to continue its path towards actual implementation.

There is an overall need to see innovation and shared development efforts as a bigger platform than just a way to get forward on the front of the product. For example, business model innovation is a way to consider potential partners, markets, sources of revenues and costs, and customers and their channels. Companies often tend to innovate ideas inside four walls with a tiny group of people and do not market-test their ideas. When this sort of idea is suggested to the UIC interface for a follow-up shared development resource utilization case, it is not that big of a surprise that the concept is facing rejection since, on the other side of the fence, there might be an even bigger group of people discussing with each other and able to see a massive pile of potential problems (and quite often typical issues) that suggest no one has considered how to protect the idea against those challenges. If the ideas were forced on BMC format and included with SWOT analysis, they would usually be much more refined, and most rough edges would be filed away. Many of those early noticeable problems would have been considered as well. On the HEI front, people who want to work in the UIC interface would also be more willing to steer companies (especially SMEs) to take steps back and do those (extended) BMC and SWOT analysis phases, together with the HEI(s).

Based on long-term field experience, many companies refuse to move forward if they feel the resource need is not certain enough. It is assumed that the unwillingness to put effort into uncertain possibilities comes from people who experience history. In the UIC relationship, we suggest that companies turn to a mode of asking more questions and that HEIs prepare to have more ready studies answers. Better preparations, fewer total uncertainties, some fast field tests, and a small number of detailed searches can easily lead to a much better shared experience and the possibility to enjoy

Table 2. Summary of Recommendation for Robust Collaboration Between University and Academia

Group	Description	Practice-based characterization
Communication	Communication happens in each sphere of our lives. Any individual communicating with another individual or society has its goal or target in mind. The baseline idea of communication is to deliver individual goals to another participant	Communication issues lead to unwanted results and misunderstandings. Collaborators should speak “the same language”. Industry and academic terms should be explained. No assumptions and unclear terms. Facilitate open discussion, where every participant feels heard and each proposed/ brainstormed idea is validated and discussed.
Common view on the process	There is a saying, “You attract people that you deserve.” Time spent on the search is worth finding and working with people who share the company/university’s values, principles, and mission.	Collaborators discuss the rules of the collaboration process, e.g., whom to contact in emergencies, what the reachable times are, the assumed company/ university mission, and the alignment of the goals of UIC. Discussion results are documented, too.
Successful Teamwork	Several people are working towards a common shared goal. Everyone knows their responsibility and the way to react to emergency cases. Participants are not trying to escape the tasks or put them on someone else’s shoulders.	Collaborators should understand that they are working on a common goal to achieve better results. They decide on the priorities of each task and frame the person(s) responsible for each task and stage.
A clear vision of the target audience	Properly researching and identifying the target audience eases the working process and minimizes wrong decisions. Spending time on research and analysis is better than regretting unexpected outcomes.	Along with goals, industry and university collaborators should be identified as target audiences and collaboration actors. Depending on the initial goal, it can be the same segment or different audiences.
Resources	Proper resources such as time, money, humans, and information can significantly ease the process of collaboration.	Collaborators identify needed and existing resources for the process. Uncertainty in costs, time, and resources can lead to weak results. Decide who, what, and when to provide for the desired outcome.

potential results. In summary, UIC is an example of an inter-organizational connection that involves universities and companies interacting to exchange tangible (e.g., supplies, money, and equipment) and intangible (e.g., technology and data) resources (Perkmann et al., 2013).

DISCUSSION

The practical advice gathered from the reviewed literature and combined with academic and industrial networks, including the authors’ expertise, has been utilized as the foundation of the study for the university industry’s collaboration toward successful and productive partnerships. The reason this was done is the reality that relationships are like living organisms. They are not located in a vacuum and are affected by the continuously changing world. These relationships need to be analyzed in terms of evolving roles over time (Crespin-Mazet & Ingemansson-Havenvid, 2021). This collaboration has its limitations; for example, it will face challenges in the process of knowledge transfer (Fabiano et al., 2020) and tend to need formal and informal channels (Schaeffer et al., 2020) and formal agreements between organizations and people to keep information flowing between the collaborators.

To ease the start of a collaboration between less seasoned and potential future UIC partners, the research focused on implementing practical guidelines and giving suggestions for improving academic collaboration with practitioners. In other words, our study collected and formulated practical guiding activities for university-industry collaboration to aim toward more productive, open, and inspiring collaboration activities between industrial, NGOs, and municipal entities with higher educational units. The idea is to improve practitioners’ comprehension of research findings and the potential implications

for local and global settings. For extended knowledge into practical activities, in the UIC front, we suggest extending knowledge into the following activities: (a) collaboration agreement (Dickson et al., 2021), (b) tacit knowledge-sharing (Obrenovic et al., 2020), (c) influencers and brand collaboration (Ibáñez-Sánchez et al., 2022), (d) innovation, sharing economy, and product-service systems (Belezas & Daniel, 2023), and (e) artificial intelligence, collaboration, and creativity (Vinchon et al., 2023).

With systematic synthesis, our work created robust, easy-to-start, and follow-up cooperative actions enhancing approaches based on literature analysis, practical experiences, and industrial experts' recommendations. We have structured our approach for UIC in five consecutive stages based on practical experience. The first is goal setting, which involves goal formulation and setting of target objectives and shared work to specify the direction of cooperation, such as education, research and commercialization, and management. The second stage is an analysis of key university and industry stakeholders for the specific set goals and objectives. The third stage includes defining a legal interaction framework, especially in protecting intellectual property rights or research outcomes. The fourth stage includes an analysis of previous experience in implementing best practices, which allows for assessing the likelihood of success in adapting the experience to new conditions. The final stage in the approach is adjusting the goals set by the university in the first stage.

As a final step in the UIC approach (see Figure 3), adjusting the goals set by the university and industries at the first stage is possible. The goals are specified considering the interests of key stakeholders, the legal framework for the project implementation, and the analysis of best practices. Such approaches allow universities to focus on goals and objectives that are important for them to maximize benefits from the interaction with business. Analyzing the interests of key stakeholders, legal restrictions, and available experience in managing similar projects helped increase collaboration success. Moreover, many experts put much weight on cooperating stakeholders' understanding of being flexible and ready for changes. In practice, this would mean a willingness to change aim, modify set goals, and reorganize personnel due to changing environments, policies, market situations, and funding.

Managerial and Practical Implications

When forming new relationships between universities, businesses and municipalities, and citizens alike, critical resources such as time, work hours, finance, information sources, motivation (Palacin et al., 2020), spaces, and time to work with networks are often in short supply. Further, for a person who has never participated and is unfamiliar with UIC, it can be unclear how to build these relationships, where to focus on key aspects, and what to consider when planning the next steps of

Figure 3. The UIC Approach



Table 3. Contribution of the UIC Approach

Approach stage	Contribution to better collaboration
Goal setting	Setting clear goals provides direction and purpose for the university’s activities. It ensures that everyone understands what needs to be achieved. Clear goals create alignment among stakeholders, fostering collaboration by giving everyone a shared understanding of the objectives.
Analysis of key stakeholders of the university	Understanding key stakeholders’ needs, expectations, and interests is essential for effective decision-making and planning. Engaging stakeholders in decision-making promotes transparency and trust.
Defining the legal framework of interaction	A legal framework mitigates legal risks and helps protect the stakeholder’s interests. Also, it mitigates the situation when something was discussed and was not realized, but one party expected it to be delivered. Clarity reduces misunderstandings and conflicts, facilitating smoother collaboration and partnerships.
Analysis of previous experience in implementing best practices	Learning from past experiences helps identify what has worked well and what challenges have been encountered. It provides valuable insights for refining strategies and avoiding common pitfalls.
Adjusting the goals set by the university in the first step	Goals may need to be adjusted based on new information, changes in circumstances, or lessons learned from the analysis conducted in earlier stages. Readjustments allow the university to stay aligned with stakeholders’ evolving needs and priorities, enhancing overall effectiveness and impact. The last step is not mandatory; however, we encourage collaborators to reanalyze the goals of the first step, as it will help achieve more transparent and precise results.

shared processes. Insufficient attention to the analysis of the UIC can lead to problems in perceiving the benefits of such collaboration and, in turn, unwillingness to develop it further or even continue doing it (Kleiner-Schaefer & Schaefer, 2022; O’Dwyer et al., 2022). Therefore, it becomes important to establish trust and clear communication and set goals from the beginning. Our proposed model helps new stakeholders in UIC grasp how the UIC can be and what is essential for achieving the best possible results. Newcomers will be able to assess and set up the goal, understand the importance of legal framework, and find the most suitable practice for their needs. Experienced university-industry collaborators could learn why they achieved or did not achieve, with retrospective analysis, their set goals and desired outcomes from their collaboration by comparing their activities to those pinpointed in this study. It helps to reflect on the current status quo and decide the future direction. Intermediaries and consultants can benefit from the more profound and transparent approach for their clients and test the recommendation systematically. Moreover, we want to emphasize that the fast development of large language models and AI can cause many changes in the current roles of different actors in UIC. Previously outsourced tasks might be partially outsourced back to the companies, which will change how they operate. This can generate the need for the educational sector to offer re-education services. Current development in metaverses might indicate a fast extension of UIC for wider-scope networks (Wang et al., 2022). Additionally, as how people communicate changes from physical to meta-avatars, how we “read” spoken versus unspoken questions in people-to-people communication will produce new considerations. This can indicate new considerations in UIC collaborative agreements and produce opportunities for partnerships that were not possible previously.

CONCLUSION

Different collaborative development relationships between universities and industry partners, not to mention NGOs and municipalities, are increasingly popular nowadays. It is not a surprise, considering the productivity of resources, knowledge, networks, and influencers (Happonen, Manninen, et al.,

2022). Overall, it is definitely in the interests of all main stakeholders to ensure that such lucrative and productive collaborations are implemented and will also stay successful. Especially now, when the world is constantly developing faster and faster, industries are under a phased digital transformation era (Chin et al., 2023). Pressure for employees to keep their knowledge and skills fresh interferes with their work-life balance, and the lifespan of, for example, technology-related knowledge keeps getting shorter year by year. Also, complex real-life problems require intelligence, creativity, and wisdom (Glück, 2023), indicating the rising need for internal and external collaboration (Costa & Matias, 2020, p. 4).

In this constantly changing era of societal and industrial development, our study contributes to higher educational units and industry or municipal collaboration with research and trade experts' knowledge-based recommendations and guidelines for cooperation and collaboration between micro-, small-, and medium-sized enterprises (MSMEs) and higher educational institutions (HEIs) to support innovation and growth. The study utilizes the authors' experience from university-industry collaboration activities, with literature and area experts' contributions, to create insights and positively contribute practices to help university representatives, industry practitioners, municipalities, government representatives, and everyone else involved in collaborations. They can benefit from communication, networking, resource planning, and overall management recommendations for a smoother collaborative process. These insights will help to frame, establish, and maintain fruitful collaborations.

We have created a collaboration approach to serve as a valuable framework for discussions among practitioners and researchers. The five stages are goal setting, analysis of key stakeholders of the university, defining the legal framework of interaction, analysis of previous experience in implementing best practices, and adjusting the goals set by the university in the first stage. Using the proposed UIC approach will increase the probability of success of individual projects within the framework of the university's cooperation with industries and positively impact the regional economy's development. In particular, the use of the approach will contribute to expanding the range of interaction between universities and enterprises, strengthening and supporting long-term cooperation, and developing closer ties between universities and enterprises with the regional economy by increasing demand for the results of joint research from universities and commercial companies, improving the quality of graduates' training and their demand in the labor market. Nevertheless, the approach is only a tool that analyzes the prospects of cooperation between the university and industries in implementing specific projects. Even though its application and following our recommendation will improve the efficiency of managerial decision-making, it is necessary to create additional financial and non-financial incentives to ensure the actual growth of interaction between universities and enterprises. We know our limitations to this approach, so in future studies, we plan to test and validate this approach in practice. Moreover, future studies can dig into extended networks, where more pressure is put in addition to activities between main partners. Another direction is to investigate the extended network, their roles, and certain shared activities, as well as how to get more out of collaboration.

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