COLLABORATION BETWEEN ACADEMIA AND INDUSTRY

Examining the situation in Austria

Arbresha Meha & Sabine Einwiller

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EXECUTIVE SUMMARY

This research project “Collaboration between academia and industry. Examining the situation in Austria” explored the collaboration between public universities (in the following “universities”), universities of applied sciences (UAS) and industry in Austria to gain insights into their strategies and approaches. It focused on the objectives, goals, areas and forms of collaboration, the role of the major actors in orchestrating the collaboration, organizational structures, and the role of the government in support of the collaboration.

Key findings

Institutional strategy processes play an important role in shaping how universities, UAS, and companies approach collaborations. These strategies reflect the unique goals and priorities of each institution. The study shows that large universities (with a broad range of faculties and programs) prioritize fulfilling their third mission (the transfer of knowledge and technology, innovation, scientific communication, and the interaction between universities and industry). The regional universities prioritize support for the local and regional economy while the specialized universities emphasize the collaboration with companies to foster societal and economic development. For UAS, establishing strong partnerships with local businesses and industries is integral to their mission and vision. Companies prioritize collaboration in their specific fields of interest to develop innovative products and services and enhance their economic performance. (pp. 13-23)

The written strategies to reach the collaboration goals are part of the overall institutional strategy. The successful activities over the past few years to increase the universities' responsibility to not only serve as knowledge carriers but to also impart that knowledge to the economy and society, are attributed to the third mission and responsible science, embedded within the university strategy. Moreover, university collaboration goals are directed toward supporting the local/regional industries and economies, by promoting regional ecosystems and economic growth. The written collaboration goals of UAS are focused on improving education by combining theoretical aspects with practical requirements. They provide support for regional companies, with a special focus on small and medium-sized enterprises (SMEs). The collaboration goals and interests of companies are systemic innovation to drive growth and create value for their customers and society. Accordingly, leveraging the company resources through the expertise from academia are essential to advance their research and development (R&D). (pp. 20-23)

The government takes on a role as a coordinator of strategic processes to improve and encourage innovation, research, and knowledge transfer between academia and industry. The Federal Ministry of Education, Science and Research's (BMBWF) goals for the development of the system of Higher Education Institutions (HEI) in the country, along with the individual visions and objectives of universities, are negotiated and reflected in Performance Agreements (PA). The main objectives and targets of the PA are embedded within the development plans of universities.
The strategies of UAS are developed to reflect the future possibilities and sector-wide framework conditions as stated in the Development and Funding Plan for UAS of the BMBWF. (pp. 10-12)

Collaborations are implemented differently depending on the type of institution. The visionary and networking abilities of senior management are often considered contributory to embed their institutions into networks. However, at universities the process is more decentralized, with researchers themselves taking the lead and managing the interface with partners. In UAS and companies, the process is more centralized. At UAS collaborations are initiated by senior management or the researchers. If researchers are the initiators, management is always also actively engaged in setting up and managing the partnership with industry and aligning the collaboration with the institutional mission and objectives. For companies, having a centralized approach when collaborating with universities and UAS allows them to manage the utilization of resources and intellectual property (IP) and to engage in quality control. (pp. 24-30)

The implementation of the collaboration strategy by the management team also involves leveraging the organization's unique selling preposition (USP). The study results show that enhancing and crafting the USP is crucial for providing and generating value from collaborative partnerships. (pp. 24-25)

Researchers/professors with their outstanding work in research and development act as key players in initiating collaborations. Their motives to engage in applied research and utilize their knowledge and expertise to solve practical problems and improve real-world situations. Subsequently, addressing problems through applied research necessitates fundraising to expand the research team. Subject-driven motivation is another important factor that drives researchers to work on applied research projects. Hence, researchers join forces with companies in specific disciplines to provide intelligent and sustainable solutions for the challenges faced. However, researchers' willingness to engage in collaborations with industry varies. Some researchers feel more comfortable communicating solely with other researchers rather than engaging with industry partners. (pp. 31-34)

Establishing and managing partnerships and fostering collaborations are also associated with difficulties. The most often mentioned difficulties are aligning and defining the scope of the collaboration, resources needed, defining roles and responsibilities, time constraints and pressure, as well as insufficient communication between parties. (pp. 35-38)

Institutional support structures play an important role when it comes to providing internal support to researchers, offering incentives, making investments, lobbying for funds and the development of joint collaborative infrastructures. Furthermore, the governmental agencies at the national and local levels offer support for the establishment of partnerships between academia and industry through regulatory frameworks, services, infrastructure, and financial programs. (pp. 42-45)

Role of communication departments for developing and implementing collaborative strategies. The results of the study indicate that communication departments lack a strategic role to initiate partnerships and to achieve collaboration objectives. The primary function of the communication department lies in public relations activities on collaboration outputs. (pp. 39-41)

Conclusion and recommendations

Universities' primary roles of conducting research and training future scholars have been expanded by the third mission, i.e. transferring the generated knowledge to the wider society to accelerate social, economic and technological progress. The focus of UAS when collaborating with industry is directed at solving current industry problems, and preparing graduates with knowledge to address real-world problems. Recognizing the development towards a start-up culture and the need for innovation, universities and UAS want to raise the social and economic return of research and combine science perspectives with industry practice. Additionally, government and companies view universities and UAS as well-suited places to nurture collaboration because of their objectivity and curiosity in research.

Enhancement and improvement of collaboration between academia and industry is a process that necessitates institutional engagement from management, researchers/professors and support staff. Therefore, collaborations should be tackled strategically and in accordance with the overall institutional strategy. Recommendations for improving collaborations include:

- Universities/UAS/companies and government should further enhance knowledge exchange and sharing of resources to drive innovation.
- The leadership and research groups/researchers at universities and UAS should improve their shared understanding of strategy and goals of collaborations with industry.
- Companies should prioritize rigorous research instead of seeking quick solutions, and recognize that research projects can yield varied outcomes.

INTRODUCTION

Higher education institutions (HEI) are considered creators and disseminators of scientific knowledge based on research carried out in different academic areas.[1] The creation of knowledge in a permanent and innovative way,[2] and extending that knowledge to the wider society is one of the missions of HEIs that has gained greater attention in recent years.[3] One of the ways of transferring this knowledge is by establishing collaborative relationships between HEIs and the industry sector.

Companies, operating in a globalized and knowledge-based economy, are seeking strategic partnerships with HEIs to fuel their innovation processes.[4] They recognize the importance of using the scientific knowledge for enhancing their own capacities. Hence, the collaboration of companies with universities is crucial for the development of technological and innovative capacities of the industry sector.[5] On the other hand, collaboration with industry offers possibilities for researchers to work in a practical environment, with the possibility to transform research outcomes into tangible products, processes, technologies. This increases the significance and quality of their research.[6]

When this interaction becomes more active, the investment in research and development by the government, companies, and HEIs can have a strong impact on the economic growth and structure of the innovation system in a region.[7] Therefore, many European countries have implemented reforms to increase knowledge transfer from universities to industry. The government focus has shifted to universities as well, embedding the third mission, namely the contribution of universities to society through knowledge transfer and technology exchange.[8]

HEIs' are taking an increasingly active role in interacting with industries and promoting knowledge and technology transfer,[9] however, knowledge on the strategies and approaches to interaction by the different institutions is still scarce. While the literature on academia-industry collaboration is developing, there are open questions regarding universities' strategies, the mechanisms and the output of such collaborations.[10] Thus, there is a need to analyze the strategies and approaches to collaborative partnerships by the different institutions, their impact, efficacy and outcomes. The research project “Collaboration between academia and industry. Examining the situation in Austria” has set itself the goal to explore the collaboration between public universities, universities of applied sciences (UAS) and industry in Austria to gain insights into their strategies and approaches. It focuses on the goals, areas and forms of collaboration, the role of the major actors in orchestrating the collaboration, organizational structures, and the role of the government in support of the collaboration.

1 Lopes & Lussuamo (2021)
2 Etzkowitz (2013)
3 Abreu et al. (2016); Urdari et al. (2017)
4 Gallego et al. (2013)
5 Boardman (2009)
6 Abramo et al. (2009); Garcia et al. (2020)
7 Etzkowitz & Klofsten (2005); Jiao et al. (2016)
8 Bellucci & Pennacchio (2016)
9 Clark (1998); Bercovitz & Feldman (2007); Rothaermel et al. (2007)
10 Mascarenhas et al. (2018)

RESEARCH DESIGN

In the course of the project, an extensive literature review and three empirical studies were carried out between November 2022 and March 2023.

Literature review

In addition to practitioner-oriented literature on the collaboration between academia and industry, scientific publications from the disciplines of strategy management, education, technology, innovation, and communication studies were examined and integrated.

Semi- structured interviews with 52 academic and industry representatives

Building on the literature review, the study explored the collaboration between academia and industry at universities, UAS and companies in Austria. The goals of universities, UAS, and companies were investigated in terms of their collaborative efforts, as well as whether they have a written strategy for such collaborations. Additionally, the role of management in implementing these strategies and their support in initiating collaborative efforts were examined. Given that a substantial proportion of collaborative efforts were initiated and carried out by researchers/professors the underlying motives behind such initiatives were explored as well. This study is also of relevance to communication departments, as it sheds light on their role in developing and implementing collaborative strategies.

In total 52 interviews were conducted with representatives of:

- 10 universities (3 large universities each offering a broad range of faculties and programs, 2 regional universities, and 5 universities with specific fields and profiles such as technology, art, veterinary science),
- 10 UAS,
- 1 Start-up/Innovation Hub,
- 1 research organization (COMET Competence Center), and
- 15 companies (9 large companies and 6 SMEs).

The sample comprised:

- 34 representatives from management (from universities and UAS: vice rectors for research and innovation, deans, vice-deans, heads of technology transfer and knowledge sharing, heads of research organization and research centers, and heads of IT-services. From companies: managers of global funding, managers of innovation and quality, scientific directors, principal patent attorney, heads of IT, head of innovation, head of people and culture, and logistics engineering),
- 13 researchers/professors (from the fields of mathematics, informatics, computer science, social sciences, business, logistics),
- 5 representatives of PR departments (heads of communications and public relations, head of communication department, head of external affairs).

Interviews with representatives of the Austrian Higher Education and Research System

Additional interviews were conducted to gain a better understanding of the Austrian Higher Education Area and the role of the government in support of cooperative relationships between science and industry, the programs, initiatives and networks to strengthen innovation in Austria:

- 4 interviews with representatives of the Federal Ministry of Education, Science and Research of Austria (BMBWF) responsible for higher education, UAS, and research and development,
- 1 interview with the Austrian Research Promotion Agency (FFG).

Document analysis

The third empirical study involved an analysis of written university, UAS and company strategies with regard to the collaboration goals and objectives. For universities, the guiding strategy document is the "Development Plan", which describes the status of development and the orientation for the future. Strategy documents of UAS and companies reflect their institutional development, orientation, and goals.

THE AUSTRIAN HIGHER EDUCATION SYSTEM

The focus of the research is on two types of higher education institutions in Austria: universities and UAS. The government policies, programs, initiatives, and networks play a role to strengthen innovation and support of collaborations between science and industry; key actors at universities, UAS and companies foster engagement and knowledge sharing.

STRUCTURE OF THE AUSTRIAN HIGHER EDUCATION SYSTEM

The Austrian Higher Education Area encompasses a diverse range of HEIs that differ in size and organizational structure. HEIs also differ in their emphasis on teaching, research, the third mission, and in the variety of education programs they deliver. This research project focused on two types of institutions: universities and UAS. In Austria, there are 22 public universities (öffentliche Universitäten) that operate independently and autonomously. Academic and scientific knowledge as well as research are vital pillars of universities. Besides these universities, there are 21 UAS (Fachhochschulen) that provide education, which is both scientific and occupation-oriented. UAS emphasize strong partnerships with industry and the labor market to ensure that their programs align with the needs of the economy and society.[11]

To guide and monitor the development of the higher education sector, the Austrian National Development Plan for Public Universities (Gesamtösterreichischer Universitätsentwicklungsplan — GUEP) and the Development and Funding Plan for UAS outline priorities and report on progress towards achieving capacity objectives. Every three years, universities enter into performance contractual agreement with the Federal Ministry of Education, Science and Research (BMBWF) to set objectives and key targets that serve as basic indicators for the funding mechanism. In this negotiation process, agreements are reached on the main objectives and goals for the development of the education system, which are reflected in each university's development plan.[12] Universities receive financial backing from the government. The funding structure of the UAS is different from universities as it is a combination of various sources. UAS receive Federal funding only for study places, and financial and organizational support from external legal entities outside of higher education.[13]

KEY ACTORS' ROLES IN ACADEMIA-INDUSTRY COLLABORATION

The role of the government

Austria as a participatory country in the study "HEInnovate"[14] strongly values the societal role of HEIs, emphasizing their proactive and stimulating impact on innovation. Universities as active participants and important drivers for a successful economy and society, are supported by the BMBWF to develop innovative and entrepreneurial approaches towards education, research and engagement with businesses and society.

11 Federal Ministry of Education, Science and Research (2021)
12 Federal Ministry of Education, Science and Research (2021)
13 University of Applied Sciences Act (Fachhochschulgesetz) — FHG (1993)
14 OECD/EU (2019)

Another Austrian policy priority is centered on Research, Technology and Innovation (RTI) to foster competitiveness and support future-oriented development, as crucial for sustainable economic growth and enhancing the resilience of the entire economic system. The RTI Strategy for 2030 recognizes that reinforcing and expanding applied research is essential as it serves as a bridge between basic research and the needs of industry and society. Collaboration among relevant stakeholders, esp. researchers at universities, UAS and companies, is necessary to set priorities, since the achievement for example of climate targets is heavily reliant on research, technology, and innovation.[15] National agencies such as the FFG and other research funding agencies provide funding for universities, UAS and research institutions for applied research in cooperation with industry. This funding supports scientists to advance their research and fulfill their responsibility to society and the economy; it also helps industry in their development of innovative ideas, products and services. These support initiatives are the "COMET" program, "K2 Centers", Christian Doppler Research Association laboratories, and Research Studios Austria.

To promote partnerships between science and industry, the Austrian government has implemented numerous policies, with a recent focus on greater societal engagement. These policies have resulted in the establishment of knowledge and technology offices based on international models. It also led to an increase of spin-offs by students with innovative ideas, supported by scientists, in their efforts to establish their own companies, and the development of business incubators jointly with the regional industry sector.[16]

The role of universities and UAS

Universities are key strategic institutions that accelerate social, economic and technological progress by generating both highly qualified human potential and knowledge relevant to society. Their contributions to fundamental and applied research are crucial in fostering innovation and development of a knowledge-based society. The targeted use of academic knowledge for society and the economy takes place in a number of fields of activity, which are assigned to the so-called third mission. The successful activities of the past few years, attributed to the "third mission" and "responsible science", have been expanded and integrated into the strategy through performance agreements with universities. The transfer of knowledge and technology has become increasingly crucial as a fundamental aspect of the third mission. Consequently, universities have an even greater responsibility now to not only act as disseminators of knowledge, but also to impart that knowledge to both society and industry.[17]

UAS were established in the 1990s with the focus on vocational-oriented education and applied research. UAS introduced a new professionally oriented sector of tertiary education, with the aim to facilitate the diversification of higher education degree programs and to bridge the gap between academic institutions and the job market. UAS provide a scientifically rigorous professional education at higher education level, in accordance with the University of Applied Sciences Act (Fachhochschulgesetz) — FHG. This means that UAS prioritize both connecting with professional practice and providing higher education-level instruction.[18] UAS are integrated into their own regional ecosystems and act as hubs of regional and national networks, promoting the co-operation between academia and businesses and, more generally, producing value for the economy and society.[19]

15 Federal Government of the Republic of Austria (2020)
16 OECD/EU (2019); Federal Ministry of Education, Science and Research (2018)
17 Federal Ministry of Education, Science and Research (2018); Federal Ministry of Education, Science and Research (2021)
18 OECD/EU (2019); Federal Ministry of Education, Science and Research (2023)
19 Federal Ministry of Education, Science and Research (2023)

The role of the industry sector

The relationship between universities, UAS and the industry sector has progressed as a result of the growth of open innovation. Companies seek partnerships with academic researchers in different fields and disciplines for development of innovative products and services. Austria's research and development (R&D) intensity has continued to rise, and the economic development will have a significant influence on the extent to which the industry sector will further increase its R&D expenditures. The aim is to develop research projects resulting in findings that are new to the business and not already used in the industry. Therefore, the R&D project should aim for new objectives, concepts and ideas that improve existing knowledge.[20] The RTI strategy emphasizes the need to launch research, technology and innovation programs that will attract companies and strengthen their innovation intensity. Support for small and medium-sized enterprises (SMEs) is also highlighted by providing advice to improve their innovation capabilities and outputs. Hence, increasing long-term planning and financial security for applied research will significantly result in the increase of collaboration between academia and industry. These are part of the RTI strategy to support applied research and its impact on the economy and society.[21] Responding to the strategies and financial programs offered by the Austrian government, companies have established interaction with universities and UAS to support their innovative processes.

AT A GLANCE

- The Austrian Higher Education Area encompasses a diverse range of HEIs that differ in size and organizational structure.
- In Austria, there are 22 public universities financed by the government that operate independently and autonomously.
- There are 21 UAS that provide education, which is both scientific and occupation-oriented, with the mixed funding structure coming from federal and external legal entities.
- The universities' primary roles of conducting teaching and research are enriched with the sharing of knowledge with external stakeholders and wider society.
- The UAS strongly emphasize partnerships with industry and are oriented towards vocational-oriented education and applied research thereby generating substantial benefits for both business and society.
- The government of Austria in support of research and innovation has established policies, financial programs, initiatives, and networks. This includes strengthening start-ups, enhancing linkages between science and industry, and facilitating knowledge transfer between academia and the industry sector.
- Companies in order to keep up with the speed of innovation, and in response to financial programs by the Austrian government, have created a diverse portfolio of interaction formats together with universities and UAS.

20 Federal Ministry of Education, Science and Research et al. (2022)
21 Federal Government of the Republic of Austria (2020)

INSTITUTIONAL STRATEGY PROCESSES ON COLLABORATION BETWEEN ACADEMIA AND INDUSTRY

The institutional strategy processes and approaches play an important role in the establishment of collaborations between academia and industry. These strategies reflect each institution's unique goals and priorities. This chapter addresses the various strategic approaches of universities/UAS and companies towards collaboration, the main goals/objectives and the specific areas and sub-areas of collaboration. Moreover, the strategies of universities/UAS and companies are analyzed with regards to collaboration outputs and future orientation.

STRATEGIES OF THE DIFFERENT TYPES OF ORGANIZATIONS FOR COLLABORATING

Institutional strategy processes play an important role in shaping how universities, UAS, and companies approach collaborations. These strategies reflect the unique goals and priorities of each institution. The study revealed that large universities prioritize fulfilling their third mission and these activities include the transfer of knowledge and technology, innovation, scientific communication, and the interaction between universities and industry. The regional universities focus on supporting the local and regional economy while the specialized universities emphasize collaboration with companies to foster societal and economic development. For UAS, establishing strong partnerships with local businesses and industries is integral to their mission and vision. Companies prioritize collaboration in their specific fields of interest to develop innovative products and services and improve their economic performance.

Large universities — fulfilling their third mission

Universities have gradually grown into fulfilling their new role, the third mission, as active enablers and promoters of economic growth and social advancement. The activities undertaken by universities in fulfilling the third mission are directed toward facilitating the transfer of knowledge and technology from universities to industry and society as well as fostering the development of entrepreneurial skills, innovation, and social welfare.[22] This approach involves utilizing knowledge and innovation for the greater good. The commitment of universities to third mission activities represents a departure from their traditional 'ivory tower' role, where teaching and research were their primary objectives, towards a more practical and society-engaged role.[23] One researcher claimed: *"At our university this is called third mission, and there is an objective to provide outreach outside the university. It means that you should not create knowledge in the ivory tower, but you should also create knowledge that can be used outside of academia. This can be society, citizens, journalism, but also businesses."*

22 Compagnuccia & Spigarelli (2020)
23 Nakwa & Zawdie (2016)

In support of third mission activities, universities have established Knowledge and Technology Transfer Offices (KTTOs), which are responsible for managing and supporting these activities as part of the university's third mission objectives. These offices support the establishment of spin-offs, interaction between faculties/researchers and companies, promotion of entrepreneurship education, and a culture of collaboration with industry among students and the academic staff.[24]

Regional universities — supporting the local/regional economy

Universities as lead institutions, together with industry and society, shape the development of regional ecosystems for innovation. Increasing synergies by establishing and using joint innovation infrastructures, such as industry clusters, science parks and research laboratories,[25] have generated positive impact on local economic growth.[26] Both management and researchers recognize the importance of joint hubs for the delivery of products and services as a result of the activities undertaken by all parties. This has led to an increase in interaction, bringing together researchers, students and companies. Their strategic positioning as a regional lead institution to boost regional economic productivity is strongly rooted in the universities' philosophy, as a representative from the management of one regional university pointed out: *"Universities located in the region tend to foster a strong connection with the economy and industry, resulting in the establishment of numerous institutes within these regions that boost joint research. Hence, advocating for deep-seated collaboration with the industry is fundamentally rooted in the university's core philosophy!"*

Specialized universities — collaborating with companies to drive societal and economic development

Universities with specific fields such as engineering, technology, medical, arts, or business, carry out collaboration activities in specific disciplines, and establish strong ties with industry related to their field of focus. As a researcher specialized in business and analytics stated: *"Collaboration in our specific domain and field forms the pathway for our collaboration. When we wanted to address the waste problem, we worked with government and a waste company to find a solution, using our extensive experience and data in this field."* Collaboration in specific fields also provides opportunities for students through internships and education programs to gain extensive experience in that field. This also has positive impacts on companies as they get to know their future workforce.

UAS — building strong partnerships with local businesses and industries is integral to their mission and vision

UAS focus on offering practice-oriented education that is linked to real-world applications and industry needs, and conduct research that stems from the challenges in society.[27] With the aim to improve education and professional practices, UAS focus on updating and developing their curriculum in close collaboration with companies, by integrating the latest trends and technologies that are relevant for the local industry.

24 Etzkowitz (2003); Riviezzo & Napolitano (2010); Backs et al. (2019)
25 Budyldina (2018)
26 Mueller (2006)
27 Kyvik & Lepori (2010); Coombs & Meijer (2021)

Additionally, the development of students' skills and knowledge needed by the local economy ensures that when students enter into the labor market they bring applicable knowledge and can help boost innovation.[28] On the importance of collaborating with industry, as one of their primary stakeholders in both education and research, a representative from the management of a UAS stated: *"We, as UAS, concentrate on practical application in two aspects: our approach to hands-on education and our emphasis on applied research. Through collaboration we get to know the company pressing issues and long-term goals, and focus our research activities on the issues that are in the interest of the company. We prepare our students with relevant practical skills needed in the market. Thus, the company insights are fuel for our path, and their input is valuable in tailoring our products."*

Companies — collaborating on their specific fields of interest to increase their economic performance

Due to the intense global competition and rapid technological advancement, companies are constantly under pressure to change. They need to be able to provide innovative products, and advance the path of the technological trajectory.[29] Subsequently, a company does not innovate alone; it depends on a strong interaction with its environment.[30] Strengthening the relations with universities/UAS contributes significantly to the generation of innovation and economic growth. Universities generate scientific knowledge and companies transform and apply the knowledge generated into new technologies.[31] Companies concentrate their collaboration on specific sectors like engineering, chemistry, pharmacy and electronics to support R&D for relevant innovative products. On the importance to innovate in collaboration with universities/UAS, a representative from the management of a company stated: *"We constantly explore novel opportunities and areas where we lack expertise or do not conduct research internally. These partnerships culminate in the creation of innovative products for our organization."*

GOALS OF COLLABORATION

The goals of collaboration that recurred in the interviews with representatives of universities, UAS and companies can be grouped into six main categories: facilitating knowledge transfer, advancing research and development, enhancing education and training, addressing societal challenges, generating third-party funding, and promoting economic development (see figure 1).

28 Pfister et al. (2021)
29 Nelson & Rosenberg (1993); Lemos & Cario (2017)
30 Fagerberg et al. (2018)
31 Lundvall (2016)

Figure 1. Collaboration goals of universities, UAS and companies

Knowledge transfer, economic development and addressing societal challenges were more strongly highlighted by universities and the goal of enhancing education and training was mentioned more often by UAS, whereas generating third-party funding was considered equally important for universities and UAS. The need for advanced research and development was mentioned by interview partners from universities, UAS and companies alike.

Facilitating knowledge transfer

The goal of knowledge transfer recurred in interviews regularly with representatives of universities, UAS and companies. It is considered essential for the development of the economy and society. All parties recognize the importance of knowledge and technology transfer to drive innovation, enhance education and address societal challenges. Developing, strengthening and expanding the Knowledge and Technology Transfer Offices (KTTOs) and research offices within these institutions is considered an important element to support the collaboration efforts.

Advancing research and development

Building bridges between academia and industry to advance applied research and development is another priority goal. Through applied research the information, expertise, and skills are used to foster innovation and find solutions to real-world problems. Strengthening and expanding applied research as a bridge between basic research and the needs of industry and society is a goal within the Research, Technology and Innovation (RIT) strategy. This goal is embraced by both universities and UAS.

Enhancing education and training

UAS are mandated to offer vocationally-oriented education, and interaction with industry in education and training is an overarching goal. The objectives of this collaboration include designing curricula so that the qualification of graduates meets industry needs. UAS also offer “dual study programs” where UAS and companies, combine academic education and practical training in companies. An important component of collaboration for UAS is working with external lecturers from industry. As highlighted by management in some UAS, around 40% of teaching is conducted by external lecturers. The goal is to convey deep insights into professional practice. In universities, collaboration in education mainly focuses on bachelor, master and doctoral thesis.

Addressing societal challenges

Responsibility toward societal challenges and utilization of research and knowledge for the benefit of society is a priority that is increasingly recognized and acted upon by universities, UAS, and companies. Collaborations are focused on supporting the transfer of knowledge to society and industry to generate value of applied research by providing sustainable and innovative solutions.

Generating third-party funding

For universities and UAS, generating third-party funding through collaborative research projects and contract/service research projects helps to ensure financial stability. At universities, in addition to the "global budget", which comes from the state, important contributors to research projects are companies,[32] and over the past years this has been growing continuously.[33] UAS, on the other hand, are legally required to perform applied research, which is conducted in close co-operation with industry, businesses (SMEs) and other employers. Hence, for university and UAS researchers generating third party funding is another priority goal within their work. For companies, the financial resources secured from the state (FFG, EU) in collaborative research projects with universities and UAS support them to innovate, venture into new markets, and enhance competitive advantages.

Promoting economic development

Fostering collaboration to enhance innovation and economic development is understood as a collective responsibility by the management and researchers of all institutions. They agreed that collaborations help to find practical solutions to problems, create start-ups, they bring developments in technologies, business expansion, and commercialization of products. These joint efforts contribute to economic growth and development.

AREAS OF COLLABORATION

The study delved into the specific areas of collaboration, which align closely with the overarching goals of the collaboration. The main specific areas are: research and development, funding and grants, training and education, commercialization of research and support policy making (see figure 2).

32 Federal Ministry of Education, Science and Research (2021)
33 OECD/EU (2019)

Figure 2. Areas of collaboration with the number indicating the frequency as mentioned by participants; the numbers in brackets indicate the frequency of mentions

Areas and sub-areas of collaboration

These specific areas of collaboration can be further subdivided into more specific domains:

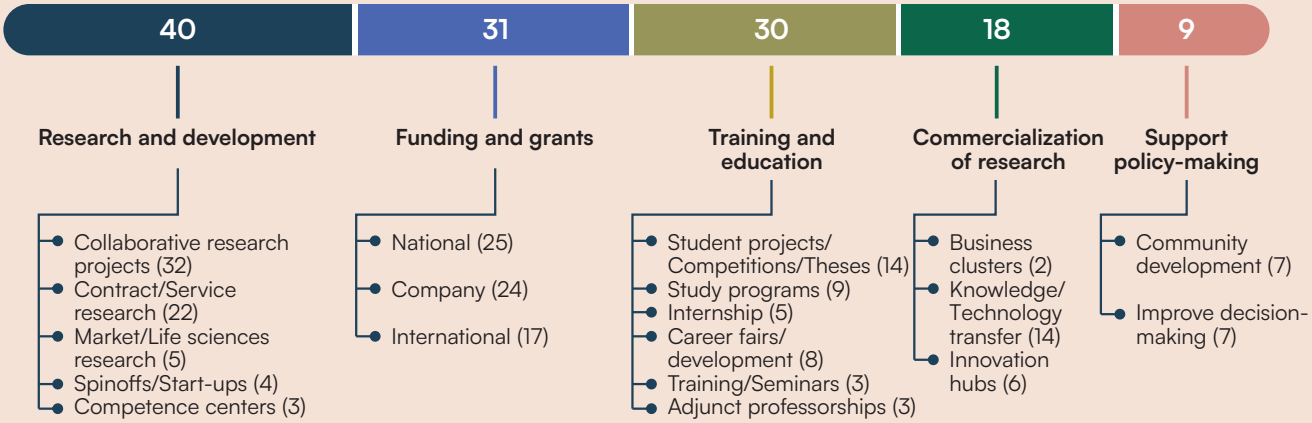


Figure 3. Areas and sub-areas of collaboration with the number indicating the frequency as mentioned by participants; the numbers in brackets indicate the frequency of mentions

Research and development (R&D)

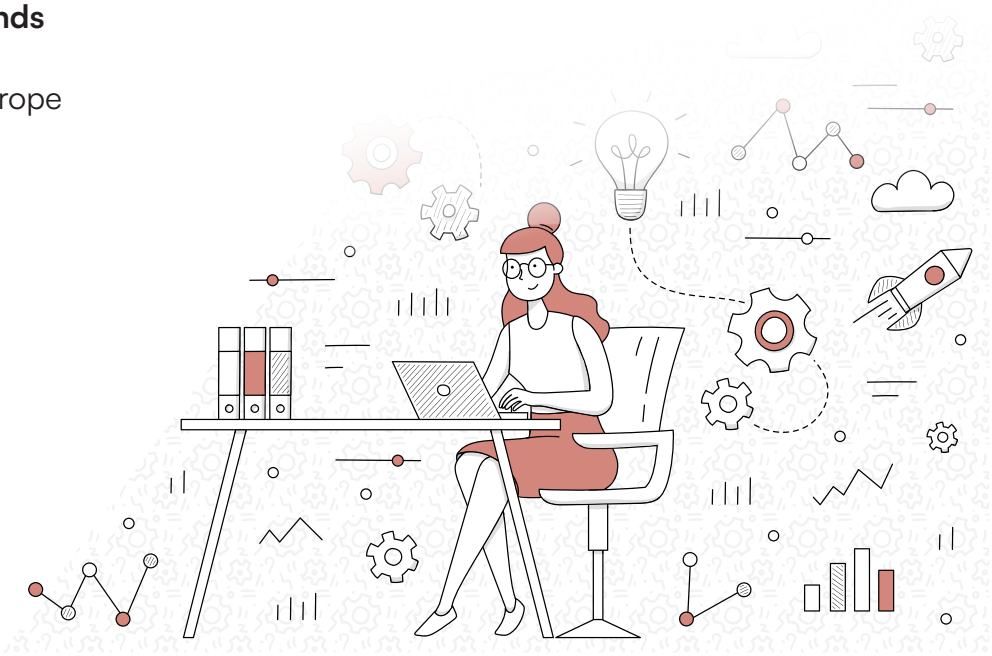
Collaboration in R&D is the predominant area of collaboration, which is carried out through:

- Collaborative research projects: joint endeavors between universities/UAS and companies, supported by national/international research programs and funds.
- Contract/service research projects: projects outsourced by a company or the government to a university/UAS or researcher to conduct on the company's/ government's behalf.
- Market/life sciences research: projects measuring market trends and/or consumer behaviors, and life sciences research conducted in clinical trials.
- Spinoffs and start-ups: collaboration effort to establish academic spinoffs and start-ups.
- Competence centers: serving as hubs for fostering innovation and development.

Funding and grants

Another important area of collaboration is securing funds and grants for the development of joint initiatives. The key non-university national/international research funding institutions are:

- **National agencies:**
  - Österreichische Forschungsförderungsgesellschaft mbH FFG (Austrian Research Promotion Agency)
  - Austria Wirtschaftsservice Gesellschaft mbH — aws (Austrian Federal Promotional Bank)
  - Christian Doppler Research Association (CDG)
  - OeAD GmbH — Agency for Education and Internationalisation
  - Austrian Science Fund (FWF)
- **Company funds**
- **EU funds:**
  - Horizon Europe
  - Erasmus +



Training and education

Training and education as an area of collaboration was highlighted mostly by UAS. Through collaboration innovative study programs and training modules are developed to meet the needs of the labor market. The very specific areas of collaboration are carried out through:

- Student projects: linking academic learning with real-world applications.
- Competitions: to solve real-world problems and find innovative solutions.
- Theses: facilitating students/candidates to scientifically address a real-world problem with the support of a company.
- Internships: for bachelor and master students offering hands-on experience directly aligned with industry needs.
- Career fairs/development: platforms serving as a linkage between potential employers and a pool of skilled talent, ready to step into the corporate world.
- Trainings/seminars: exchange of ideas and knowledge, networking and fostering relationships.
- Adjunct professorships: bringing expertise from industry, professional experience and practical knowledge to students.

Commercialization of research

Research findings generated by universities, UAS, and companies are commercialized into specific products and services. The most common/specific aspects of research commercialization, as noted by participants, are through:

- Knowledge/technology transfer: translating scientific findings into practical applications and products.
- Innovation hubs: environments where universities/UAS and companies collaborate, learn, and grow through a combination of physical infrastructure, mentorship, and funding opportunities.
- Business clusters: serving as hubs of innovation and as a means to foster competition.

Support policy-making

Researchers/professors often offer support to the government by offering innovative solutions through evidence-based research. The support provided aims to:

- Improve decision making: for the government or for the institutions, by conducting studies and analyses that can clarify complex issues, and translate the research findings into policy recommendations.
- Community development: the expertise, resources and networks are focused on education initiatives, research and innovation, health and wellbeing, economic development and environmental sustainability.

WRITTEN COLLABORATION STRATEGIES

The results of the analysis of written strategies by universities, UAS and companies to reach collaboration goals indicate a lack of a separate written strategy at all types of organizations. The topic of collaboration is rather part of the overall university/UAS and company strategy. At universities the collaboration goals with industry are contained in the targets to accelerate social, economic and technological progress, which are part of the so-called third mission. At UAS, the goals of collaborating with industry are very specific and form an integral part of the mission and vision stated in their strategic documents. Companies, in their strategic documents, articulate a clear objective to foster collaborative partnerships with academia, focusing on R&D areas.

University Development Plan

In Austria, universities enter into a "Performance Agreement" (PA), which is a contract between the state and the university, valid for three years. This agreement sets out objectives and key targets that serve as basic indicators for the funding mechanism. The PA outlines only the most critical and current developments, representing the tip of the iceberg. The main objectives and targets of the PA are embedded within the Development Plans of universities, which are strategic documents that present the framework conditions, the general principles of the university's policy measures and the plans coordinated with the faculties and centers regarding the future direction of research and teaching.

The Development Plans of universities set out a number of objectives and emphasize basic research and teaching. They also highlight the importance of strengthening and expanding the applied research, especially in universities and faculties specialized in medicine, computing, engineering, chemistry, technology, law etc. However, the research activities undertaken by faculties and researchers/professors with other research institutions including industry have to follow a well-balanced relationship between basic and applied research. In addition, the successful acquisition of high-quality third party-funded projects (including funds coming from industry), especially if they are acquired through competitive procedures, is an indication of the competitiveness of the university and therefore highly valued. Examples are projects within the framework of the 2nd pillar of Horizon Europe, the FFG or Christian Doppler Laboratories.

Universities want to be perceived as open, reliable partners also in the area of knowledge exchange. Hints and suggestions for academic questions from industry and society are welcomed to stimulate an innovation cycle. The prerequisite for functioning knowledge exchange is a network of trusting partnerships with stakeholders outside the university, and this network comprises representatives of industry and the wider economy. Through cooperation and exchange with partners from industry, society, and the state, universities also make an important contribution to strengthen innovation. A strong network with external partners, including companies is also the starting point for new sources of funding.

Universities are important institutions for advancing new technologies, and successful technology transfer begins with the academics' awareness of the transfer potential of their research results. It also requires strong partnerships with industry for the further development and exploitation of new applications arising from it. In the creation, development and commercialization of intellectual property (IP), universities want to pay attention to synergies with industry partners and rely on the support and advice of their academics. Students, graduates and academics at the universities can also contribute to the economic development of society by licensing service inventions or with start-ups or spin-offs. In support of these activities, in each university measures are envisaged ranging from information about programs for students, training programs for early stage researchers as well as support in the acquisition of external funds or the integration of start-ups into the university environment.

The development plans emphasize the universities' role in society as well. This can be reflected through active involvement in outreach activities to illustrate the dissemination of knowledge to the wider society.

UAS Strategic Plan

UAS in Austria were introduced with the aim to facilitate the diversification of higher education degree programs, to better meet the various demands of students and heterogeneous social and economic needs. Their aim is also to bridge the gap between academic institutions and job market and to promote the permeability of the educational system. Driven by their mandate and aims, the UAS strategies are focused on the involvement of industry professionals to create a link between theoretical and practical aspects. This approach is reflected in the UAS' strategic documents.

The mission statements of UAS emphasize that collaboration with companies, especially with regional businesses, is a key success factor. Partners from industry are involved as members of the team responsible for the development of the teaching programs, and as members of review teams in the process of their accreditation. This involvement ensures that demand for the program among potential students is consistent with demand for graduates in the labor market. Furthermore, experts from industry are involved as lecturers in the programs to offer practical perspectives which complement the more academic contents. Practical experience on the job constitutes a mandatory part of the curriculum of bachelor and diploma degree programs, so companies are the places where students complete their practical training part. Collaboration with industry takes place also in bachelor/master thesis projects.

Another collaboration goal of UAS is to enhance applied research with real-world applications, which is achieved through close collaboration with industry. These are research projects where researchers/professors and students work together with industry partners. These activities lead to innovative solutions and companies integrate the results into their business processes. On the other hand, the industry partners provide funding for applied research projects and offer resources such as equipment, data, and access to technology.

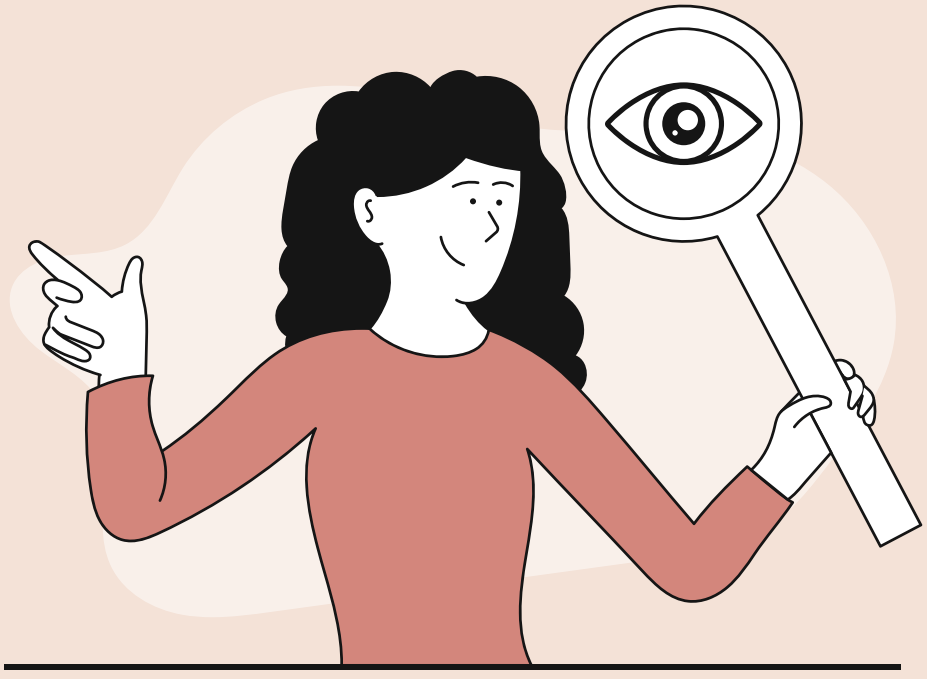
Company strategy

Company strategies are focused on the R&D of innovative products and services. Companies believe that leveraging internal R&D together with external ideas and competences coming from university and UAS researchers can provide better solutions to customer needs and create value for society. Their goal is to work on research projects that lead to innovations, patents, and advancements in technology. They encourage the flow of academic research findings into practical applications, and use open innovation to explore new commercial prospects and technologies.

Collaboration goals with universities and UAS are also focused on the involvement of students to develop bachelor/master/doctoral theses and to find solutions for particular problems. Scholarships are provided to motivate and reward top academic achievers while at the same time enabling them to concentrate fully on their studies by easing the financial burden of tuition. In the long run, these students are also welcomed to join the companies as new scientists.

AT A GLANCE

- Institutional strategy processes play an important role in shaping how universities, UAS, and companies approach collaborations. These strategies are reflective of each institution's unique goals and priorities.
- The primary focus of large universities is on fulfilling their third mission. The regional universities prioritize support for the local and regional economy. The specialized universities emphasize collaboration with companies to foster societal and economic development.
- For UAS, forging strong partnerships with local businesses and industries is integral to their mission and vision.
- Companies prioritize collaboration in their specific fields of interest to enhance their economic performance.
- With regard to the goals of collaborations, knowledge transfer, economic development and addressing societal challenges are more highlighted by universities, education and training by the UAS, whereas generating third-party funding are stressed by both universities and UAS. The need for advanced research and development is mentioned by all universities, UAS, and companies.
- There is no separate written strategy for business/university/UAS collaboration. Collaboration goals are part of the university/UAS and company overall strategy.
- The written collaboration goals of universities, UAS and companies are in line with the results of the interviews with academic and industry representatives.



IMPLEMENTATION OF THE COLLABORATION STRATEGY

The visionary and networking abilities of senior management are seen as contributory to embed their institutions into networks that build a connective institutional culture, and to establish a framework for collaborations. Additionally, fostering the interest of collaboration partners involves leveraging a unique selling proposition (USP) to attract and engage potential partners. This chapter addresses the role of the USP to build a successful partnership, the role of the management in initiating collaboration, the main ways and initiators of collaboration, and providing a support framework for collaborations.

HOW TO FOSTER THE INTEREST OF COLLABORATION PARTNERS?

In their efforts to attract and engage partners, universities, UAS, and companies utilize their USPs to foster partner interest. Crafting a strong USP[34] is crucial to motivate the partner for collaborative initiatives. It involves identifying and highlighting the unique strength that sets their institution (organization) apart from others. Universities, UAS, and companies value their USPs that make them credible and attractive to partners.

Frequency of USPs

The results of the study show that the USP most frequently mentioned by all interview partners is providing "access to research, knowledge, and technology" (see table 1). A well-articulated USP, as emphasized by participants, helps them to create a unique space in the partnership landscape. A USP is specifically effective if it cannot be easily matched by competitors.[35] It becomes a powerful tool for the business and provides a significant edge in the market, as a company manager claimed: *"For our company the USP is profound. If we compare our company with other major companies that are specialized in consulting, they may have an upper hand in marketing. However, when it comes to hands-on work and mathematical models, we clearly have the edge."*

USPs	University	UAS	Company
Access to research, knowledge, and technology	**16**	**9**	**11**
Access to expertise	**13**	**7**	1
Access to funding	4	2	**9**
Access to technology and services	1	3	**6**
Access to innovation and entrepreneurship	3	3	2
Access to data sets for publications	1		**7**
Branding/reputation and visibility	**6**	1	1
Access to skilled workforce	2	**6**	1
Access to teaching/industry expertise		2	4
Access to industry-aligned study program		4	

Table 1. Frequency of USPs mentioned per institution

34 Belch & Belch (2018)
35 Armstrong & Patnaik (2009)

Specific USPs

For universities and UAS, a crucial USP is their expertise. Researchers/professors are continuously exploring new knowledge and innovation which makes them valuable partner. Collaborations also offer them opportunities to give and further develop their expertise.

For universities, brand/reputation and visibility characterize another important USP that represents their quality and self-identification and makes them loyal and trustful partners.[36] These elements constitute the university identity, research capabilities, and their societal impact, which makes them credible partner for collaboration. Working with a prestigious institution or professor can help businesses improve their reputation and image[37] and also make them appear more legitimate to influential stakeholders.[38] As a university manager highlighted: *"We offer them the brand of our university. Businesses can proudly state in their professional contexts that their research and recommendations are backed by scholars from our university, which gives them high credibility and trustworthiness."*

UAS also often highlighted that providing access to a skilled workforce was one of their USPs. Providing practice-oriented education with lecturers who have relevant professional experience and practical training makes graduates particularly valuable. Subsequently, getting access to students and hiring qualified students is an important benefit for companies.[39] As a UAS manager highlighted: *"We develop our student's skills for their future jobs. How innovation works, what they need to start their own business, startup activities. We implement this in our study programs. (...) We are educating the future staff of companies, which is a clear goal for us and a need from the companies that seek our collaboration."*

Companies value and highlight their strengths in providing access to funding as an important source of revenue for universities.[40] Additionally, they stressed their capacities to provide access to technology, services, and data sets. They possess data and have the processes that fit well to specific research projects, which makes them valuable partners.

HOW DOES MANAGEMENT IMPLEMENT THE STRATEGY?

The management's strategy of collaboration is implemented differently at universities, UAS and companies. At universities the process is more decentralized, with researchers themselves taking the lead and managing the interface with partners. At UAS the central management is more involved in facilitating the establishment and management of industry partnerships and in ensuring the alignment of the collaborations with the institutional mission and objectives. Companies have a centralized management approach in collaboration with universities and UAS, which allows them to manage the utilization of resources, intellectual property (IP), and to ensure quality control.

Ways of initiating the collaboration

The most prominent ways of initiating collaboration between universities, UAS and companies include innovation networks, past collaborative research experiences, outreach programs, personal connections, alumni networks, and engagement through conferences and publications (see table 2).

36 Petty et al. (2010)
37 Siegel et al. (2003)
38 Mian (1997)
39 Mueller (2006)
40 George et al. (2002)

Frequency			
Innovation networks	(23)	Personal connection	(13)
Past collaboration research	(15)	Alumni networks	(11)
Outreach programs	(13)	Conferences and publications	(10)

Table 2. The table highlights the most common ways of initiating collaboration; the numbers indicate the frequency of their use by partners

Innovation networks are the most common ways used by universities, UAS and companies to leverage new partners, or to connect with previous partners. These triple helix formats of interaction (universities/UAS, governments, and companies) aim to develop and strengthen an innovation ecosystem and create conditions to combine academic perspectives with innovation needs of businesses and public agencies. They represent a potential way for businesses, especially SMEs, to get around obstacles and foster innovation.[41]

Extending collaboration through past collaboration research experiences is a very common way used by partners in initiating collaborations. Through previous collaborations partners have created communication channels, they understand each other's expectations, strength and capacities. Conserving the pre-existing relationships is important because through previous successful collaborations partners have built a level of trust.[42] However, continuously collaborating with the same partners may lead to a lack of diversity and innovativeness, and there is a risk of losing autonomy due to becoming overly dependent on the same partner.[43]

Outreach programs are also used to promote joint university-industry projects to the community, illustrating contributions to societal challenges and local economic development. The strategic outreach program "University Meets Industry" at the University of Vienna[44] for example wants to help develop Austria into an even more progressive knowledge society with sustainable economic development, more and better jobs and even stronger social cohesion.

Another way of initiating collaborations is through personal connections, when partners approach each other on a personal level to work in a specific field. These partnerships might reflect the instability of social networks due to unrecorded collaborations. The company partner might be open to collaborate with other researchers/professors in the same university/UAS in the future, but others are often not aware of the partnership. Maintaining a strong and constant relationship is important to keep up valuable connections and build trust among partners.[45]

Alumni networks are also used to initiate collaborations. Given their unique position, having experienced academic life and then transitioned into the professional world, alumni are a good source for collaborations.

41 Marinho et al. (2020)
42 Schartinger et al. (2001)
43 Todeva & Knoke (2005)
44 Postgraduate Center (2023)
45 Inkpen & Tsang (2005)

Some universities and UAS maintain a vibrant alumni network, as it is an opportunity to discuss industry problems and find ways of working together. Maintaining strong and ongoing relationships with alumni can enhance the industry engagement, increase research funding, donations, and generate a broader societal impact.[46]

Conferences where both academics and professionals participate are places that bring together researchers and industry partners, which can lead to potential collaborations. Some companies also consult reputable academic journals when looking for academic expertise in a particular field. Collaborations can later on result in joint publications. Publishing with university/UAS scientists has a significant impact for companies as this provides validity to research results, which companies would not be able to achieve alone.[47]

INITIATORS OF COLLABORATION

The primary initiators of collaboration at universities are researchers/professors. At UAS, both the management team and researchers play significant roles in initiating collaborations. At companies, collaboration initiation is predominantly driven by the management team and institutes/departments within the organization (see table 3).

Most frequent initiators of collaboration	University	UAS	Company
Researchers/professors	**21**	**8**	5
Company representatives	**9**	4	4
Designated offices for research collaboration/funding	**8**	2	3
Management team	5	**10**	**14**
Institutes/departments	4	3	**6**
Innovation hubs	4	2	
Alumni offices	1	2	3
Study program directors		**5**	

Table 3. Main drivers of initiation of collaboration per institution; the numbers indicate the frequency of their use by partners

What makes university researchers initiate collaborations with industry?

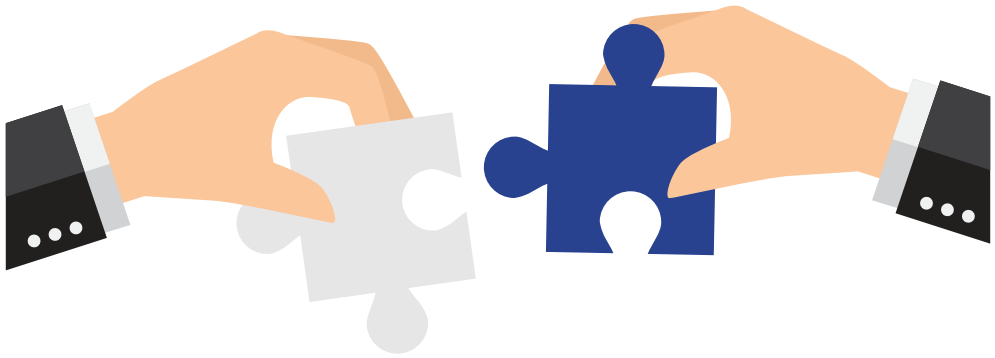
While the university sets up the necessary framework, conditions, and environment for collaboration, the collaborations largely depend on the attitudes, skills, and experiences of the individuals and teams involved.[48] Analyzing university-industry collaborations, Nsanzumuhire and Groot[49] conclude that managing collaborations, selecting the partner, as well as mediation and facilitation mostly happen at the institutional level, while other processes such as trust formation and constructing "disinterested research" are fundamentally individual processes. Institutions provide the overarching environment and resources for research, yet the real drive, motivation, and personal touch that initiate meaningful collaborations come from individual researchers. A researcher claimed: "*When I am motivated and the collaboration aligns with my research or teaching, the chances of success in initiating a collaboration are significantly increased.*" Both representatives of management and researchers stated that the majority of collaboration initiatives originate from researchers, accounting for approximately 90% of the cases, and the success is bigger when the impetus comes from researchers rather than from the management.

46 Awasthy et al. (2020)
47 Jaina et al. (2009)
48 Rajalo & Vadi (2017)
49 Nsanzumuhire & Groot (2020)

Initiators of collaborations at UAS

Collaborations between UAS and companies are mostly regulated within the hierarchy of the institution. At the highest level, industry collaborations are guided by the institution's mission and strategic goals, such as promoting innovation, developing new technologies, establishing joint research projects, developing joint study programs, and enhancing students' employability. Hence, the involvement of the central management to ensure the alignment of collaboration goals is crucial, as a UAS representative from management stated: *"There are topics strategically crucial for the success of our UAS which are pushed by management, and all members are encouraged to actively engage and collaborate on these strategic initiatives."* Researchers are also actively engaged in initiating and establishing partnerships with industry.

Below this level, collaborations with companies are overseen by specific departments or centers within the UAS. Many UAS have research centers or industry liaison offices that are responsible for identifying and managing collaborations with external partners with regard to industry collaboration projects. The heads of study programs are also responsible for managing the interface with business partners during the process of curriculum design in order to identify the job market needs.



Initiators of collaborations at companies

Companies usually initiate collaborations with universities and UAS when there is a clear focus on research that aligns with their interests. This can be a field that is relevant to the company and research area with the potential to drive innovation. Considering that collaborations involve a significant budget, they are more likely to be successful when initiated by the CEO or high-level management. This is because negotiations do not have to go through a long hierarchy for approval, which can slow down the process and potentially hinder the success of the collaboration. Taking the lead to initiate these collaborations, the management ensures to align the collaboration with company strategies and goals and to channel the budget to cutting-edge development areas. As stated by a company representative from the management team: *"There is a well-defined process and a budget allocated for collaborations, and the process is managed by the top management of the company to ensure that it is aligned with the company's overall strategy and goals."*
The company focus and approach is to identify universities/UAS that are at the forefront of scientific research and key opinion researchers/professors that have the potential to drive innovation in their respective fields. The university and UAS researchers also approach companies when they have a new idea or proposal that aligns with company interests.

SUPPORT BY THE MANAGEMENT TEAM FOR COLLABORATIONS

The management team's role to support collaborations is mainly focused on providing institutional framework conditions that strengthen and ease the collaboration efforts between partners. In each university/UAS and company there are research/knowledge transfer offices that offer support to researchers to establish collaboration. The support is also offered in terms of helping researchers with legal agreements, use of funds, mechanisms for resolving potential conflicts, and - what is important - the right to publish findings, which are core principles of universities and UAS. The framework support offered by the management teams is highly valued by researchers.

Management teams also play a role in onboarding new and significant partners. In UAS, driven by their mandate to create links with industry, the leadership and management team are involved in onboarding new and big partners. Similarly, in companies, due to the financial implications, the management team is directly involved and plays a decisive role when establishing collaborations with new and big partners from universities and UAS.

Involvement of the management team in increasing and orchestrating networks is more common in UAS and companies. However, in some universities as well — particularly in those operating in the regions and in specialized universities — the management team acts strategically and responsively in creating links and connections with regional partners.

Facilitating the development of innovation hubs/research centers is another priority of the management team at the majority of institutions involved. In many institutions and cities innovation hubs/research centers have been established as places with positive impact on partners. Their practical role is to connect partners and share goals, aims and progress.

In UAS the management team is involved in negotiations for funding with the local government and other stakeholders. The aim is to improve framework conditions for research activities, increase knowledge exchange and strengthen connections with the local industry and SMEs.

AT A GLANCE

- Management's strategy to facilitate collaborations is different depending on the type of institution.
- At universities the process is decentralized, with researchers taking the lead managing the interface with partners. In UAS and companies, the process is more centralized and collaborations are more overseen by top management and heads of the organization.
- Fostering the interest of collaboration partners involves leveraging a USP to attract and engage potential partners and combine forces to create mutual growth opportunities.
- The primary initiators of collaboration at universities are researchers/ professors. At UAS, both the management team and researchers play significant roles in initiating collaborations. At companies, collaboration initiation is driven by the management team and institutes/ departments within the organization.
- The management team's primary role revolves around providing a framework for collaborations, in onboarding new and significant partners, networking with industry associations, facilitating the development of innovation hubs, and engaging in negotiations for funding.

MOTIVATION OF RESEARCHERS FOR COLLABORATING WITH COMPANIES

Researchers/professors with their outstanding work in research and development act as key players in initiating collaborations. This chapter addresses the wide range of researchers' motives, as well as researchers' hesitation to engage in collaborations with industry.

WHAT MOTIVATES RESEARCHERS TO COLLABORATE WITH INDUSTRY?

The researchers'/professors' primary motives for collaborating with industry are engagement in applied research and utilizing their knowledge and expertise to solve practical problems (see figure 4). Subject-driven motivation is an important factor that drives researchers to work on applied research projects. To address such applied problems it is generally necessary to raise funds to expand the research team. Hence, the key researchers join forces with companies in specific disciplines to provide intelligent and sustainable solutions to the challenges faced. However, the willingness to engage in collaborations with industry varies, and some researchers feel more comfortable communicating solely with other researchers rather than engaging with industry partners.

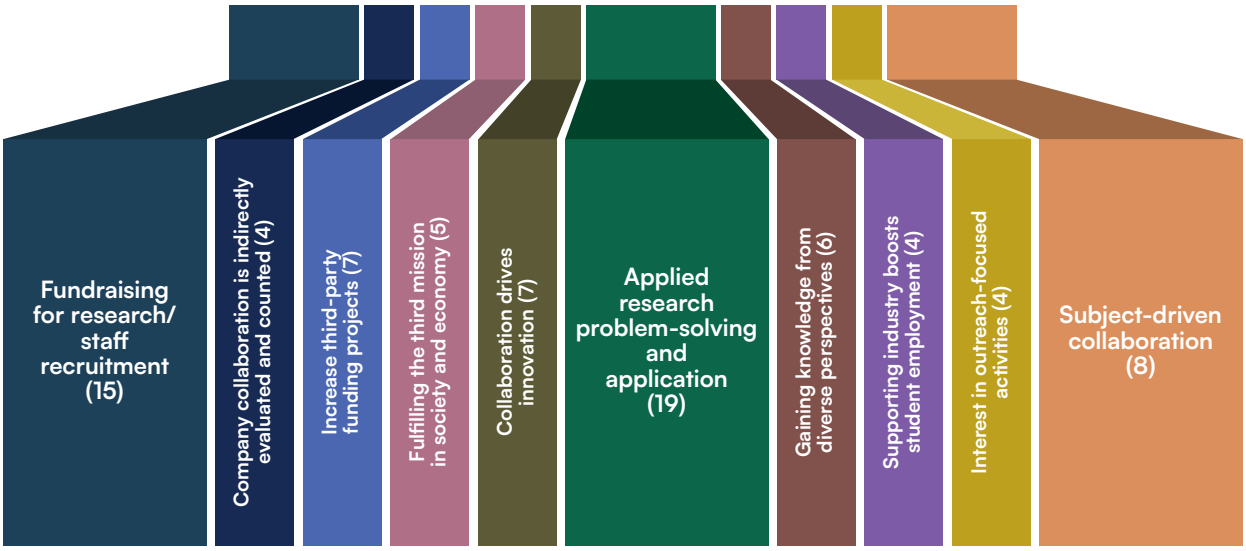


Figure 4. Motivation of researchers for collaborating with companies; the numbers in brackets indicate the frequency of mentions

Applied research problem-solving and application

Solving practical problems and improving the real-world situations through applied research is a key motive for researchers. Collaborating with industry in applied research ensures that the findings and innovations resulting from such research are translated into real-world applications,[50] as a researcher highlighted: *"I am motivated by the desire to see the results of our research being applied in the real-world settings, with tangible impact, and used by companies to improve their processes."*

Another key motive for researchers is generating research with both scientific and societal impact. Research and knowledge creation, along with their utilization for practical benefits, ensure that the outcomes of research extend beyond academic papers and are translated into tangible impacts, as a researcher stated: *"For me producing papers is important, but at the end the real-world impact is more important."*

Subject-driven collaboration

Both researchers/professors and companies focus their applied research on specific sectors and disciplines. Such collaborations are mostly initiated by companies when they face a specific problem for which they want to generate an innovative solution. Successful collaboration that generates gains for both the researchers and the company in a certain field requires strong motivation from both partners. It also presents unique challenges that require persistent effort from both partners.[51]
Collaborations in a specific subject are particularly likely in sectors like engineering, medicine, chemistry, pharmacy, electronic, and IT.

Fundraising for research/staff recruitment

Working on applied research projects with tangible effects requires researchers/professors to secure sufficient funding, which in turn is used to employ PhD students and postdoctoral researchers. Using research funds to hire additional personnel allows researchers to dedicate more time to research and to further enhance the quality and quantity of the research output.[52]

Companies, in addition to providing salaries for personnel, also provide industry equipment, materials and data for research. These resources ensure researchers to have access to the latest data and advanced technologies and methodologies.

What else motivates researchers to collaborate with companies?

Motivation of researchers/professors is also driven by the goal to support innovation processes which lead to an increase of innovative products. They contribute to companies that lack resources or expertise and help them to overcome challenges related to innovation.[53] On the importance of engaging with academia, a company manager stated: *"Universities and UAS are seen as highly innovative since they often approach problems from novel viewpoints. We have the state-of-the-art technology, production technology, but we are constantly seeking product innovations, so we turn to universities/UAS for fresh perspectives."*

50 Franco & Haase (2015)
51 Rajalo & Vadi (2021)
52 van Rijnsoever & Hessels (2021)
53 Chryssou (2020)

Successful collaboration apart from boosting innovation increases third party funding, which can be generated from national, international and company funds. Finding new innovative solutions necessitates joining forces from both knowledge producers (researchers) and those who supply funding and resources (companies or other agencies).[54] Securing and increasing third-party funding that aligns with the university's strategy and goals is another important task for researchers/professors. However, within universities' budgets there needs to be a balance between third-party funding and the government money such that third party funds don't exceed 30-35%.

Another motive for researchers/professors to collaborate with industry is to fulfill their contribution to the third mission. Engagement in third mission activities is also influenced and motivated by the individual perceptions and personal values of researchers.[55]
For researchers reaching out to society and organizations is very important. Hence, participation in outreach activities offers possibilities to promote their research, create networks and raise awareness for the research. Additionally, the outreach efforts contribute to the reputation of the institution and the researchers.

Universities and UAS are not only judged on their scientific discoveries, but also on the contribution of their research to society. Subsequently, the research quality is not only determined by the number of journal articles and citations, but also by how the research contributes to society.[56] However, as noted by the majority of researchers (mainly those working in universities), paper publications and obtaining research grants are considered tangible outputs, whereas the transfer of research findings to real-world applications is appreciated, but they are not "counted" when it comes to their academic advancement.

For researchers working in UAS, strengthening the industry sector, with a focus on SMEs, is very important. It also enhances possibilities for employment for young researchers and students. Following students' required practical training within companies, and involvement in research projects, many students are offered long-term employment. As a UAS researcher pointed out: *"We have a clear statement in our UAS to support industry and SMEs. All that is needed for growing the industry sector, to ensure increased employment opportunities for students in the future. If we don't do that [collaborating with industry], in the long run it will have a bad impact on all UAS and students."*

What makes researchers hesitate to collaborate with companies?

The researchers'/professors' willingness to engage with industry varies. There are researchers that hesitate to collaborate. Some researchers are committed to basic research and express concerns about maintaining their academic freedom and the university's independence. Some researchers are hesitant to collaborate with companies due to their deep expertise in their field and the difficulty to communicate their knowledge and work effectively to non-experts in a corporate setting. Some researchers feel more comfortable communicating solely with other researchers and not with industry partners, or others may not have the necessary communication skills or desire to engage with them. Many researchers agreed that hesitation and unwillingness of researchers to collaborate with industry should not be perceived as bad things, but just that the research is focused on basic rather than applied research. If it doesn't make sense from a scientific point of view, such research should not be disrupted by the interests of a company.

54 Figueiredo & Ferreira (2022)
55 Owen-Smith & Powell (2001)
56 D'Este et al. (2018)

AT A GLANCE

- The main motive of researchers to engage in applied research is to utilize their knowledge and expertise to solve practical problems and improve real-world situations.
- Another motive is fundraising for research and recruitment of more staff, which offer the possibility to expand the capacity and expertise of the research team.
- Subject-driven motivation is another important factor that drives researchers to work on applied research projects.
- The willingness to engage in collaborations with industry varies among researchers. Some researchers feel more comfortable communicating solely with other researchers rather than engaging with industry partners.

Fundraising for research/staff recruitment
WHAT MOTIVATES
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Fundraising for research/staff recruitment
WHAT MOTIVATES RESEARCHERS TO COLLABORATE WITH INDUSTRY?
Subject-driven collaboration
What makes researchers hesitate to collaborate with companies?
What else motivates researchers to collaborate with companies?
Applied research problem-solving and application

DIFFICULTIES IN COLLABORATIONS

Establishing and managing partnerships and fostering collaboration are associated with difficulties. It requires understanding the needs, strengths, and limitations of each partner. This chapter addresses the most common difficulties the partners encounter in their collaboration practices.

MOST COMMON DIFFICULTIES IN ACADEMIA-INDUSTRY COLLABORATION

The research findings indicate that there are numerous difficulties that partners encounter in collaborative partnerships. These difficulties range from building partnership expectations such as defining and aligning objectives, goals and scope of collaboration, to resources needed, and roles and responsibilities. Time constraint pressure poses difficulties as well, because industry has a short-term perspective for research and implementation, whereas researchers prioritize careful planning, analyzing and the validation of research findings. Insufficient communication between parties is another difficulty that creates barriers in collaborations (see figure 5).

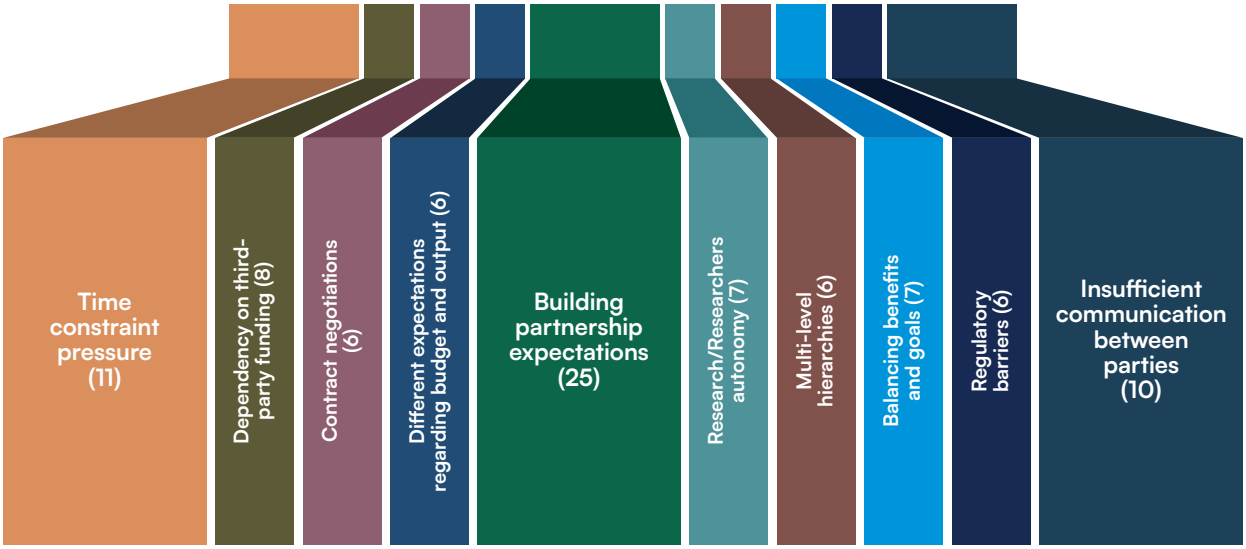


Figure 5. Difficulties in collaborations; the numbers in brackets indicate the frequency of mentions

Building partnership expectations

Establishing collaborative partnerships is associated with difficulties, mainly due to different objectives, goals, priorities and timelines the partners have. Successful collaborations are based on partners' agreements on shared interests and practices, and aligning them with institutional objectives and goals.[57] A UAS representative from the management pointed out: *"We welcome the opportunity to secure contracts with companies, however, we must establish clear expectations and align them with our and companies' expectations and goals, and balancing them can be challenging."*

57 Ingstrup et al. (2021)

Researchers find it challenging to manage company expectations regarding research outcomes. The output of the collaboration is not necessarily a finished product. In fact, companies can use the knowledge generated to further enhance their capacities. On the other hand, companies find it difficult when university/UAS researchers/professors fail to meet their expectations or provide the necessary focus, attention, resources, and efforts to ensure successful outcomes.

Time constraint pressure

Companies often have urgent needs for product development, driven by market demands, competitive pressures, and customer expectations. They need to deliver innovative and competitive products quickly to stay ahead in the market. On the other hand, researchers — in order to ensure quality, reliability, and validity of research findings — usually need more time. The difference between partners regarding their timelines is that universities take a long-term view on research while industry has a short-term perspective on research and implementation.[58] Hence, clear time management and the establishment of guidelines for collaboration right at the beginning, before starting the collaboration, is crucial.[59]

Insufficient communication between parties

Insufficient communication leads to misunderstandings and misalignment of expectations. The lack of effective communication can hamper the establishment of long-term partnerships, the overcoming of cultural differences, and the development of personal relationships and trust.[60] Synergies often cannot be realized due to poor communication. Finding a common language and understanding is essential, which involves constantly addressing challenges and progress, using appropriate communication channels and terminology that can be understood by everyone involved.

Other difficulties

Securing funding for research and relying on external funding sources, such as industry partners, poses a challenge for UAS. Raising research money is time-consuming as it requires to actively seek out funding opportunities and present convincing research proposals to potential sponsors and partners. A representative from the management of a UAS pointed out: *"A major difficulty in research is the lack of fixed funding. Researchers need to apply for funding to develop research projects and other activities."*

For universities as well increasing third-party funding can be challenging. It can lead to a dependency on certain funding sources coming from industry, which might influence priorities and research direction. Therefore, as stated by the majority of university researchers and management, there needs to be a balance between improving the quantity and quality of collaborations and their effectiveness to achieve the university's primary goals.

58 Rossoni et al. (2023)
59 Mannak et al. (2019)
60 Galan-Muros & Plewa (2016); de Wit-de Vries et al. (2019)

Negotiating the contract conditions is another difficulty. Differing objectives, questions about intellectual property rights, confidentiality, funding and resources, publication rights, duration and scope are very important aspects when negotiating the contract. Lack of legal certainty in these areas can lead to excessive bureaucratic procedures and mistrust between partners.[61]

Having a clear regulatory framework is very important when entering into a partnership. Any uncertainty regarding the regulatory framework impedes or limits certain activities, initiatives and decisions. There are many regulations with different rules. Different universities have their own perspectives on collaboration and varying degrees of flexibility.

Autonomy and strategic orientation are important determinants of collaborative projects. Maintaining a balance between the autonomy of researchers and the specific goals and guidelines of the industry partners is considered crucial. As a researcher pointed out: *"We shouldn't be overly reliant on companies! For my research, I focus on what is vital for society, such as sustainability, the economy, and so on."*

Building partnership expectations	11	Balancing benefits and goals	3
Insufficient communication between parties	6	Staff shortage for collaborative research projects	2
Different expectations regarding budget and output	5	Multi-level hierarchies	2
Weak advocacy for university industry collaboration	5	Fundraising bureaucracy	2
Contract negotiations	5	Intellectual property rights (IPR)	2
Research/Researchers autonomy	4	Rapid market feedback vs long-term research	2
Time constraint pressure	4	Universities maintaining perception as non-commercial entities	2
Regulatory barriers	3	Unstructured support for direct university	2
Companies not valuing academic publications enough	3	company collaboration	
Dependency on third party funding	3	Need for streamlined structures	1
Fostering mutual trust	3	Companies changing their priorities	1

Table 4. Difficulties in collaborations at universities; the numbers indicate the frequency of mentions

Dependency on third party funding	5	Companies not valuing academic publications enough	2
Building partnership expectations	5	Rapid market feedback vs long-tern research	2
Lack of funding for basic research	4	Companies changing their priorities	2
Time constraint pressure	3	Multi-level hierarchies	2
Research/Researchers autonomy	3	Need for streamlined structures	1
Staff shortage for collaborative research projects	3	Partner/Talent shortage in specific fields	1
Insufficient communication between parties	2		

Table 5. Difficulties in collaborations at UAS; the numbers indicate the frequency of mentions

61 Bürger & Fiates (2021)

Building partnership expectations	9	Insufficient communication between parties	2
Time constraint pressure	4	Intellectual property rights (IPR)	2
Balancing benefits and goals	4	Multi-level hierarchies	2
Fundraising bureaucracy	3	Staff shortage for collaborative research projects	1
Partner/Talent shortage in specific fields	3	Contract negotiations	1
Regulatory barriers	3	Different expectations regarding budget and output	1

Table 6. Difficulties in collaborations at companies; the numbers indicate the frequency of mentions

AT A GLANCE

- Establishing partnerships, managing partnerships and fostering the collaborations are associated with different difficulties.
- The most frequently mentioned difficulties are:
- 1) Building partnership expectations, such as defining the goals and scope of the collaboration, resources needed, roles and responsibilities, and expected outcomes.
- 2) Time constraint pressure: Companies often have urgent needs for product development, driven by market demands and competition, while researchers prioritize careful planning, analyzing and validating their research findings.
- 3) Insufficient communication between parties creates barriers to effectively collaborate and joint problem-solving efforts.

COMMUNICATION DEPARTMENTS' ROLE IN COLLABORATIVE PARTNERSHIPS

Developing and implementing collaborative communication strategies requires a strategic approach from management and proactive commitment from communication departments. This chapter addresses the role of the communication department in collaborative partnerships, suggestions for further facilitating collaborations and challenges in collaborative partnerships.

ROLE OF THE COMMUNICATION DEPARTMENT IN STRATEGY DEVELOPMENT AND IMPLEMENTATION

The results indicate that communication departments lack a strategic role when it comes to achieving collaboration objectives. Only in few universities and companies, the communication department actively participates in discussions and in fostering collaborations with companies. The primary function of the communication department lies in public relations activities on collaboration outputs (see table 7).

The status of communication departments

Despite the growing understanding of the importance of communication for the success of an organization, communication departments and professionals often face the challenge of having a relatively low status.[62] Their primary function is commonly understood as that of channel producers or technicians.[63] Correspondingly, the results of this research indicate that communication departments are not well integrated into the overall planning process. Ideally, the communication department should be integrated into the full planning cycle: from analysis to strategic planning, operational implementation, and evaluating the plan.[64] In reality, it is not involved in the first two steps, as a university Head of Communication and PR stated: *"We are not involved from the beginning! The involvement of the communication department should be more structured, more integrated across departments, and more aligned with the university's strategic priorities. (...) The communication department should be involved in every phase of the planning process. We mainly assist with organizing access, managing the website, handling email addresses, and facilitating communication."*

However, the role of the communication department is viewed differently at those universities where it is involved in all strategic processes. A representative from the management of a university stated: *"At our university the communication department is part of our weekly rectorate meetings. We think that communication has such a strategic role, so every decision we take they have to be there and get the information first hand. They are part of the discussions of our development plan. The communication department is not something like, back there is communication, do what we tell you to do, but they are part of developing strategies. They are involved in increasing our visibility and attracting new partners, and they help a lot to raise the potential for cooperation."* The communication department cannot only handle the day-to-day communication tasks, it contributes strategically by implementing effective measures for organizational survival in dynamic environments.[65]

62 Falkheimer et al. (2017)
63 Simcic Brønn (2014)
64 Smith (2013); Smith (2021)
65 Falkheimer et al. (2016)

The role of the communication departments and its leaders has changed, and they are no longer only in charge of managing media relations and enhancing the visibility, reputation, and positive perception of their institutions' leaders. Indeed, their role is to monitor the public opinion, and serve as advisers to management.[66] This is the case in a company where the communication department has also a monitoring role, as the Head of Communications stated: *"I am a member of the management team, and this team builds the strategy with a long-term focus to decide where we want to go. We get together, we plan and decide what to support! We monitor on an ongoing basis the dynamic changing environment!"*

Communication professionals also complained about their unclear role and responsibilities.[67] This was the case with the majority of communication professionals, but not in universities and companies where the communication department has a strong position within its institution and acts proactively, as stated by a Head of the Communication and PR: *"I have worked to establish my current position, as it was not the case from the beginning! We have established a big department and we are now 20 employees in the department, and we try to coordinate everything. It is part of our integrated communication strategy!"*

Communication departments' role and possibilities for facilitating collaboration

The research investigated how communication departments can facilitate collaboration. Most participants suggested that the communication department can further facilitate collaboration through enhancing the attractiveness of the organization; others suggested that it can support the information flow and delivery (see table 7). Additionally, the role of the communication department lies in showing the societal impact. Topic development is another area in which communication departments can support institutions.

Communication departments' role in collaborative partnerships		Suggestions for further facilitating collaborations	
PR/Marketing activities	29	Enhancing attractiveness of the organization	11
Event coordination	7	Supporting information flow and delivery	5
Fostering visibility of the cooperation	8	Showing the societal impact	4
Strategic collaboration participant	3	Topic development	3
Monitoring media and public sentiment	2	Partnering in the development of the collaboration strategy	2

Table 7. Communication departments' role in collaborative partnerships and suggestions for further facilitating collaborations; the numbers indicate the frequency of mentions

66 Berger et al. (2017)
67 Tench et al. (2017)

CHALLENGES FOR COMMUNICATION DEPARTMENTS IN COLLABORATIVE PARTNERSHIPS

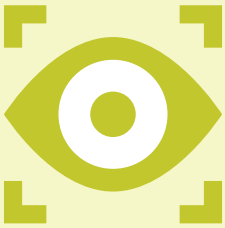
Challenges are due to the restricted disclosure of information. Collaborations between universities/UAS and companies are not always made public, and the communication department may not even get to know about it. When there is limited access to information, it hinders the department's ability to craft and deliver messages internally and for the public. In big companies, collaborations are made public only when they are high impact collaborations with regional impact.

Communication departments are also challenged by limited resources to support researchers in collaborative projects. With limited staff, it is difficult for communication departments to manage public relations at a larger scale and for every collaborative project.

Limited involvement in daily research operations is another challenge faced by communication departments. The lack of timely involvement in research developments hinders their ability to provide up-to-date information to stakeholders, and communicators miss out on opportunities for storytelling.

Another challenge highlighted is the centralized information flow and delivery, which reduces flexibility, limits the diversity of ideas and perspectives in communications. It creates an environment where staff hesitates to communicate issues or ideas.

AT A GLANCE



- Communication departments and professionals face the challenge of having a relatively low status within their institutions.
- The primary function of the communication department lies in public relations activities on collaboration outputs.
- Only in two universities and in one company, the communication department actively participates in discussions and in fostering collaborations.
- Communication departments can facilitate collaborations by enhancing the attractiveness of the organization.
- The communication departments encounter challenges like restricted disclosure of information, limited resources, and limited involvement in daily research operations.

INSTITUTIONAL SUPPORT STRUCTURES

Institutional support structures play an important role in providing internal support to staff and initiatives, offering incentives, making investments, and jointly lobbying for financial and infrastructure development. This chapter addresses the support/facilitation of collaborations by the management team, the impact of organizational structures and processes on collaboration, and incentives for researchers/professors.

SUPPORT/FACILITATION OF THE COLLABORATION BY THE MANAGEMENT TEAM

Support and facilitation of collaborations by the management team ensures that the collaboration is strategically aligned and well resourced. Universities, UAS and companies have established the necessary support structures to foster collaborations.

The results indicate that several key aspects are provided, including:

Structured support services

To facilitate collaboration a comprehensive set of resources, tools, and personnel are dedicated to ensure efficient operations. Structures such as Knowledge and Technology Transfer Offices (KTTOs), Research Centers and Institutes, and Industry Liaison Offices serve as centralized platforms where universities/UAS and companies can connect. They provide support to faculties, research groups and researchers to link with companies and bridge the right expertise with the right company. They promote collaboration, establish communication, offer guidance, and provide networking opportunities.

Negotiating/setting up the contract

To ensure a well-defined contract the legal personnel gets engaged. A well-defined contract defines roles and responsibilities, terms and conditions, obligations, rights, and liabilities of each party. It describes the collaboration's financial arrangements in detail, confidentiality and conditions under which the collaboration can be terminated. Having the structured support from the legal department ensures the avoidance of errors and misinterpretations.

Corporate-sponsored structured environments

Another form of supporting/facilitating collaborations by the management team is the establishment of centers co-funded by companies and academic institutions. It brings together joint research teams from universities/UAS and companies on specific projects or themes. By having these structured environments, more possibilities for establishing collaborations are created.

AREAS IN NEED FOR IMPROVEMENT

Communication

Setting up well-structured communication channels improve the communication and information flow as well as the relationships. It increases the engagement of researchers/teams, and fosters an environment of collaboration.

Promoting a culture of collaboration

Promoting a culture of collaboration, particularly when it is encouraged and communicated by the management team, leads to more synergies, and visibility for researchers/professors and students. Continuously presenting the collaborative outputs and benefits for the institution, researchers, students and society can positively influence the attitudes of researchers and research teams regarding the collaboration of universities/UAS and industry.

Valuing collaboration with industry

Researchers want their engagement with industry to be valued, particularly from the management of their institutions. In UAS and companies collaborations are more valued. Management encourages researchers and staff to focus on academia-industry collaborations as a means to enhance the practical relevance of research, provide opportunities for students, secure funding, and foster innovation.

Fostering collaborations

Help from the management team to foster collaborations, in particular at universities, can be a driving force and motivation for researchers to participate in networking events or outreach programs, which can result in collaborative activities with industry. When management actively supports and promotes collaboration efforts, it shows that they value collaborations, which engenders a more dynamic and collaborative environment.

Explore funding options

UAS need to secure funding for applied research, hence the management team has to be well acquainted with international, national and regional funding schemes to provide the necessary support for securing avenues for funding. This will ease researchers' struggle of setting up joint initiatives and activities with companies and students.

Support structures for collaborative projects of researchers/ professors and companies

Better support structures for establishing direct contracts with companies will help researchers. In many universities the research services are more tailored to provide support for projects funded by the national science foundation, Horizon Europe etc., but not for collaborative projects with companies.

IMPACT OF ORGANIZATIONAL STRUCTURES AND PROCESSES ON COLLABORATION

There are hindering factors that can slow down the initiation and implementation of collaborations. These are, above all, the complex structures that are particularly common within the large universities. Lengthy approval procedures, multiple levels of review, and coordination challenges make large universities less attractive to companies who seek agile partnerships. Centralized leadership that is more pronounced in big companies and UAS, with their control over resources, operations, and strategies can slow down the collaborative partnerships. Creating a balance or combining decentralized and centralized approaches is considered important for facilitating the initiation and implementation of collaborations.

High overhead costs in universities can be a hindering factor as it increases the overall project costs. While overhead costs are important, especially for large universities, addressing them at the planning stage and openly communicating about them with companies is necessary.

The results also indicate the need for having a comprehensive collaborative management system to streamline and improve the process of collaboration between universities/UAS and companies. Such a tool can serve as a centralized hub where all aspects of collaboration can be managed, tracked, and coordinated. Additionally, having a platform with all the necessary data on funding organizations ensures that researchers/teams can align their projects with the funder's priorities and specifications and plan ahead. This is especially relevant for UAS that heavily depend on external funding to conduct research.

Finally, having a transparent regulatory framework, specifically ensuring a common understanding about legal aspects when it comes to research collaboration contracts is very important to avoid misinterpretations.

INCENTIVES FOR RESEARCHERS/PROFESSORS

Universities often find it challenging to design and implement appropriate incentives to encourage researchers/professors to engage in social (third mission) and commercial activities.[68] The results indicate that universities/UAS incentivize the collaboration with industry differently (see table 8). At UAS, professors involved in collaboration projects with industry have the possibility to reduce their teaching load. The overheads allocated to universities and UAS departments are another incentive for researchers/professors. These resources are used to support research activities, maintain and equip labs and foster innovation.

Collaborations also offer possibilities to increase visibility and career advancement for researchers, and some universities and UAS offer research awards. Collaborative research projects also provide the opportunity for researchers/professors to publish, and many times they are able to cover the costs for participating in conferences.

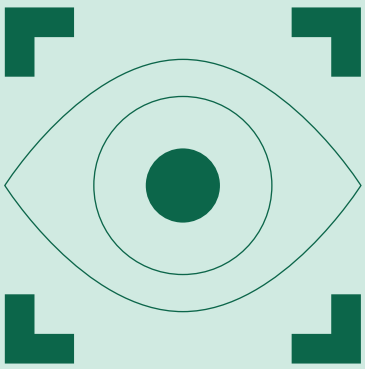
68 Compagnucci & Spigarelli (2020)

Bonuses	Extra vacation days
Reduction of teaching load	Job advancement
Increased research opportunities	Research awards
Overheads allocated to departments	Publications
Visibility/career advancement for researchers	Conference travel resources

Table 8. Main incentives for researchers/professors when collaborating with companies

AT A GLANCE

- Support and facilitation of collaborations by the management team ensures that the collaboration is strategically aligned and well resourced.
- Universities, UAS and companies have established the necessary support structures that provide legal and structured support and facilitate the initiation and implementation of collaborations.
- However, there are areas where further support/facilitation for collaborations by the management team is needed such as setting up better communication channels and promoting a culture of collaboration.
- There are also hindering factors that can slow down the initiation and implementation of collaborations, and there is a need to further improve the organizational structures and processes for collaborations.
- Researchers/professors are incentivized differently by their organizations, mainly through a variety of non-financial rewards and motivators. These include possibilities to reduce the teaching load, overheads allocated to departments etc.



CONCLUSION AND RECOMMENDATIONS

The findings of this research project confirm the importance of collaborations between academia and industry to drive innovation and economic progress. Joint collaborative initiatives lead to strengthening and expanding applied research to solve real-world problems, improve processes, products and technologies.

The enhancement and improvement of collaboration between academia and industry is a process that requires institutional engagement from management, researchers/professors and support staff. Collaborations should be tackled strategically and in accordance with the overall strategy of the organization, so that the organization's vision and objectives are fostered and valued accordingly. The results indicate that providing structured support services by the management team improves the collaboration. Thus, commitment of the management is important, however the drivers of collaborations are researchers/professors with their motivation to solve practical problems.

Based on the results of the study, the following recommendations for improving and enhancing collaborations between universities/UAS and companies can be derived:

- Universities and UAS should improve the shared understanding of strategy and goals of collaboration among the leadership and research groups/researchers. Having a structured top-down and bottom-up commitment and approach impacts on the creation of a collaborative environment.
- Universities/UAS/companies and the government should further enhance knowledge exchange and sharing of resources to drive innovation. It requires multi-actor collaboration networks to effectively bring actors together.
- Universities, UAS and companies should broaden alliances beyond current networks to cultivate a dynamic collaborative environment and drive innovation.
- Companies should prioritize rigorous research instead of seeking quick solutions. The initial solution (e.g., reduction of cost to 10%), can pave the way for further research, leading to more significant outcomes.
- Universities and UAS should prioritize timely feedback, market validation, and objectives aligned with industry needs. When working with SMEs, conducting long-term research projects may not be feasible. In this case, striking a balance between quick solutions and rigorous research to maximize long-term impact is important.
- It is important to set up communication channels that allow for regular communication to foster a culture of trust and openness.
- Universities, UAS and companies should create an environment where the importance of knowledge and technology transfer is recognized and appreciated.
- Companies should understand that research projects can yield varied outcomes, both positive and negative findings, and not necessarily a finished product. The knowledge generated can be used to further enhance their capacities.
- University and UAS should increase students' visibility to the industry through project collaborations that demonstrate their skills and potential for employment.

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