YEREVAN STATE UNIVERSITY

Karlen Khachatryan
Anna Hakobjanyan
Kristine Nikoghosyan

Bridging Academia and Industry:
Unraveling University-Industry Collaborations in the EU and Transitioning Economies

Insights from Armenia and Italy

YEREVAN
YSU PRESS
2024

UDC 378:33

Publication is recommended by the
Yerevan State University Academic Council

Reviwers: Doctor of Economics, Professor Liana Grigoryan
PhD in Economics, Associate Professor Narine Mirzoyan
PhD in Economics, Associate Professor Amalya Galstyan

Editor: Doctor of Economics, Professor Gagik Vardanyan

Khachatryan Karlen, Hakobjanyan Anna, Nikoghosyan Kristine
Bridging Academia and Industry: Unraveling University-Industry Collaborations in the EU and Transitioning Economies. *Insights from Armenia and Italy*. Yerevan, YSU Press, 2024, 182 p.

The monograph examines the critical role of university-industry partnerships in driving innovation, technological progress, and economic growth. Through a comparative analysis of the European Union and Transition Economies, it highlights the potential for such collaborations to modernize education, improve graduate employment, and optimize knowledge utilization. The study provides a comprehensive framework for successful implementation, supported by case studies from Armenia and Italy, and offers strategic insights and recommendations for policymakers.

The work was supported by the Science Committee of RA in the frames of the research project No. 21T-5B193, "The Problems of the Development University-Organization Partnership and the Ways of Solutions in RA."

ISBN 978-5-8084-2675-7
https://doi.org/10.46991/YSUPH/9785808426757

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FROM EDITOR

In the Republic of Armenia, university-industry collaboration is constrained by historically rooted cultural and institutional barriers that were not overcome during the transition to a market economy. Meanwhile, such cooperation is a critical component for developing efficient national innovation systems, a key pillar of a knowledge economy that grows through innovation. University-Industry collaboration is essential for skills development, the creation, transfer, and adoption of knowledge, and fostering entrepreneurship.

Despite the Armenian government's long-standing goal of transitioning the country to an innovative development path, it has not yet succeeded in creating a national innovation system. A central component of such a system is effective collaboration between universities and industry, which is crucial for increasing economic complexity - one of the targets established in the Government of the Republic of Armenia's Program for 2021-2026.

In this context, the monograph "Bridging Academia and Industry: Unraveling University-Industry Collaborations in the EU and Transitioning Economies" by a group of authors holds practical value for policymakers in the field of state innovation policy and for economic development policy in general. This work is not only about economic and technological progress but also about enhancing economic dynamics, creating new growth opportunities for the country, and ensuring national security.

The monograph is a comprehensive scientific work, distinguished by its high level of logical presentation, clear structure, and a robust scientific and doctrinal source base. The author has conducted an in-depth analysis of both foreign and domestic scientific publications in this area, presenting a systematization of accumulated knowledge and making appropriate generalizations and conclusions.

Doctor of Economics, Professor Gagik Vardanyan

ABSTRACT

University-Industry Partnership is a catalyst for innovation, technological progress, enhanced productivity, economic growth, and the dissemination of scientific technology. It plays a pivotal role in modernizing the education sector, improving graduate employment, and optimizing knowledge utilization. This research explores the potential for developing university-industry partnership and offers a comprehensive framework for their successful implementation.

The study adopts a comparative approach, analyzing innovative capacity and research and development activities in the European Union (EU) and Transition Economies. It analyzes specific indicators to evaluate these regions, conducts case studies in Armenia and Italy, and focuses on two universities, Ca' Foscari University of Venice and Yerevan State University.

Methodologically, the research examines university-industry partnership from three perspectives: university, industry, and students. It employs interviews, site visits, and surveys, focus groups to offer a comprehensive analysis.

This research contributes to knowledge by uncovering factors influencing successful university-industry collaboration, providing insights for strategy development, and addressing challenges. It sheds light on similarities between EU and Transitioning Economies and offers recommendations for structural, functional, and legal changes at the national level. Moreover, it aims to guide policymakers in establishing effective university-industry partnership for sustainable economic and educational growth.

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BERD	Business Expenditure on Research and Development
EEN	European Enterprise Network
EIC	European Innovation Council
EIP	European Innovation Partnership
EIS	European Innovation Scoreboard
EIT	European Institute of Technology
ERA	European Research Area
ETP	European Technology Platforms
EU	European Union
GBARD	Government Expenditure to Research and Development
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on Research and Development
HERD	Higher Education Expenditure Research and Development
HRST	Human Resources in Science and Technology
IPR	Intellectual Property Rights
JRC	Joint Research Centers
NEET	Not in Education, Employment, or Training
OECD	Organization for Economic Co-operation and Development
PPP	Public-Private Partnerships
R&D	Research and Development
RTD	Research, technological development
SDG	Sustainable Development Goals
SME	Small and Medium-sized Enterprises
SSS	Smart Specialization Strategy
STP	Science and technology parks
TBI	Technology business incubators
TFEU	Treaty on the Functioning of the European Union
TISC	Technology and Innovation Support Centers
TTO	Technology Transfer Offices
UNESCO	United Nations Educational, Scientific and Cultural Organization
URE	University Research Ecosystem
WIPO	World Intellectual Property Organization
YSU	Yerevan State University

Introduction

Background and Scope: The alliance between education and industry is widely acknowledged as a critical factor in shaping human resources. Both parties have distinct expectations from this collaboration. Universities are keen on partnering with businesses to produce more competitive graduates and align them with labor market demands. Conversely, businesses seek personnel with the most relevant skills and knowledge, expecting that training costs will be minimized. This symbiotic relationship represents a traditional yet pivotal mechanism of university-industry cooperation.

Universities play a multifaceted role in the contemporary landscape beyond merely training specialists and conducting academic research. Academic research institutions are increasingly tasked with fostering innovation and cultivating business ideas among students and scholars. The collaboration between universities and industries serves as a wellspring of innovative solutions, propelling organizational technological progress, enhancing productivity, and fostering economic growth (Chedid & Teixeira, 2018). It also facilitates the exchange of new knowledge and interactions and yields long-term benefits (Van Rijn et al., 2018), contributing to the diffusion of scientific technology (Rahm et al., 2000).

The primary goal of university-industry cooperation is to modernize the education sector, enhance graduate employability, and ensure efficient knowledge utilization. Therefore, reinforcing the partnership between universities and industries is crucial, representing a cornerstone in the educational policies of many countries globally. This issue is particularly acute in developing nations, where economic progress is intricately linked to the development of human capital.

In this context, effective collaboration between universities and industries assumes paramount importance. Functioning as a tool with specific mechanisms and channels, this collaboration can enhance the skills and abilities of workers, elevate productivity levels, address labor market mismatches, and, notably, improve the quality of education. Notably, the mismatch between industry and university holds special significance, as it can create imbalances in the labor market. However, collaboration emerges

as the most suitable approach to address and mitigate these challenges, offering potential solutions that benefit all partners.

In the present era, numerous countries worldwide are not just exploring but actively pursuing fresh opportunities for collaboration between universities and industries. The goal is to establish and enhance a systematically structured model of university-industry collaboration through strategic, functional, and institutional measures.

As we strive to ensure the quality of higher education, formulating and implementing an efficient model of university-industry collaboration becomes paramount. This model, specifically focusing on enhancing support services for student and alumni careers, addressing challenges related to partner compatibility, and upholding the overall quality of education, promises significant benefits.

Significance of the Study: In light of the necessity for practical solutions grounded in scientific understanding, it is crucial to highlight the need for comprehensive elaborations and analyses on this scientific matter. The chosen thesis topic holds significant importance for several compelling reasons.

The collaboration between universities and industries in the context of University-Industry Partnership is poised to bring about noteworthy benefits:

- ✓ *Economic Progress*: The development of human capital is intricately linked to economic advancement. Without a well-educated and skilled workforce, achieving economic progress remains a challenging task. Strengthening the bonds between universities and industries emerges as a strategic move to enhance human capital development. This is achieved by aligning academic curricula with industry needs, providing students with practical experience through internships, and facilitating the transfer of knowledge and skills from industry professionals to students.
- ✓ *Skill Enhancement and Productivity*: The effective collaboration between universities and industries functions as a potent tool, incorporating specific mechanisms and channels to enhance the skills and capabilities of workers. This collaboration also contributes to

elevating productivity levels, directly impacting economic growth and enhancing competitiveness in the global market.

- ✓ *Overcoming Labor Market Mismatch*: The persistent issue of mismatch between the skills possessed by job seekers and the demands of the labor market can be addressed through university-industry collaboration. This collaboration facilitates tailoring education and training programs to meet industry needs, reducing unemployment and underemployment.
- ✓ *Quality of Education*: Collaborative efforts with industries ensure education remains relevant, up-to-date, and aligned with real-world requirements. This, in turn, enhances the quality and effectiveness of the educational system.
- ✓ *Balancing Labor Market*: A strong partnership between universities and industries can mitigate imbalances in the labor market resulting from mismatches between labor supply and demand. This collaboration aligns educational programs with the demands of the job market, reducing such imbalances.
- ✓ *Enhancing Innovative Capacity*: A robust collaboration between universities and industries catalyzes enhancing innovative capacity within a country. The exchange of knowledge, research findings, and practical experience between academia and industry fosters an environment conducive to innovation.

The primary objective of this research is to discern the contemporary potential for advancing University-Industry Partnerships. Employing a comprehensive methodology and framework, this study seeks to facilitate the effective implementation of such collaboration to ensure educational quality, address imbalances in the labor market, and augment innovative capacity.

Outlined Research Questions:

1. Evaluate the current state of collaboration between universities and industries in the European Union (EU) and Transitioning Economies.
2. Identify prevailing challenges within the collaborative framework of university-industry partnerships, particularly in educational quality, and formulate comprehensive proposals for their resolution.

Within the delineated research scope, the following subtasks are identified:

- Investigate existing activities and experiences related to University-Industry Collaboration, focusing on collaboration channels, institutional structures, motivations, and benefits among partners.
- Analyze possibilities for deepening cooperation and explore potential interaction mechanisms between universities and industries within the higher education state policy framework and existing legislative regulations, policies, and tools.
- Identify obstacles and factors contributing to a mismatch between provided education and labor market requirements.
- Identify effective and practical mechanisms for developing university-industry partnerships with applicability in developing and developed countries, ultimately enhancing the quality of higher education.
- Conduct a comparative analysis between the European Union (EU) and Transitioning Economies, utilizing specific indicators to assess innovative capacity and research and development (R&D) performance.
- Undertake Case Study analyses in Italy and Armenia, focusing on the perspectives of University, Industry, and Students.

This study adopts a comparative approach to assess and contrast the levels of innovative capacity and research and development activities in two distinct sets of countries: those within the European Union (EU) and those in Transitioning Economies. Key indicators employed for the comparative research include:

- Summary Innovation Index Value
- Gross Domestic Expenditure on Research and Development (% of GDP)
- Gross Domestic Expenditure on R&D by source of funds in the EU (% of total)
- International Scientific Co-Publications (Regional) Value
- Public-Private Co-Publications (Regional)
- Scientific Publications among the Top 10% Most Cited (Regional)
- Human Resources in Science and Technology (HRST)
- Horizon Europe, Horizon 2020, Projects Applications, and Eligible Proposals

- SME Applications and Participation in Horizon Europe and Horizon 2020 projects
- Not in Education, Employment, or Training (NEET)
- Employment Rate
- Patent Applications

With a comprehensive literature review, this study aims to establish a profound understanding of the main framework of the University-Industry Partnership. Databases from prominent sources such as OECD, Eurostat, World Bank Database, AIDA, Cordis, EIS, Horizon Dashboard, Istat, National Statistical Databases, and SDG Databases will be employed during this research.

Methodology: In this research, we have undertaken a comprehensive examination of university-industry partnership from three distinct perspectives: University, Industry, Students: To investigate the university perspective, we have employed interviews and surveys as our primary method, coupled with site visits to engage with the responsible structures and divisions within these institutions. Furthermore, from the industry perspective, we have provided specific examples of industries in both countries, and have been organized focus group discussions among industry representatives. Additionally, we have emphasized the alignment of these partnerships with the United Nations Sustainable Development Goals (SDGs) as a key framework for assessing their overall performance and impact on societal and environmental sustainability in both regions. This multi-faceted approach allows us to delve deeply into the intricacies of university-industry partnership, offering a well-rounded analysis of their implications and potential for positive change. In this thesis, we introduce a fresh perspective by incorporating surveys that target students from Ca' Foscari University and Yerevan State University. This approach is a new focus as far as until now in the academic literature have been discussed the perspectives of universities and industries alone.

In this research, a comprehensive examination of university-industry partnerships has been undertaken, considering three distinct perspectives: University, Industry, and Students. The investigation into the university perspective involves using interviews, surveys, and site visits, focus group

discussions as primary methodologies. These methods facilitate engagement with pertinent structures and divisions within the academic institutions. Specific instances of industries in both countries have been delineated from the industry perspective. Additionally, the alignment of these partnerships with the United Nations Sustainable Development Goals (SDGs) has been emphasized, serving as a fundamental framework for the comprehensive assessment of their overall performance and impact on societal and environmental sustainability in the respective regions.

This multifaceted approach has been adopted to thoroughly explore the intricacies of university-industry partnerships, offering a well-rounded analysis of their implications and potential for instigating positive change. An innovative facet introduced in this thesis is the incorporation of surveys targeting students from Ca' Foscari University and Yerevan State University. Including the student perspective is crucial (students are the main stakeholders of the University-Industry partnership), representing a departure from the prevailing focus in academic literature, which predominantly addresses the perspectives of universities and industries in isolation.

Contribution to Knowledge and Practical Implication: The primary objective of this research is to illuminate the distinctive factors that exert influence on the successful implementation of university-industry collaboration. The outcomes of this study are anticipated to not only enrich the prevailing body of knowledge but also provide academic researchers, policymakers, and stakeholders with valuable insights for formulating strategies and frameworks conducive to fostering effective partnerships between universities and industries, both in developing and developed countries. Additionally, the research endeavors to identify potential areas for growth and innovation while addressing the challenges impeding the establishment of successful university-industry collaborations.

Furthermore, through a detailed analysis of specific challenges and opportunities, this research aims to unveil common patterns and trends that may be prevalent in Transitioning Economies and European Union (EU) countries, considering the historical and political similarities in the region. This study is designed to bridge existing gaps in the literature, presenting

policymakers, academic researchers, and stakeholders with a strategic plan/package that includes proposals for structural, functional, and legal changes at the national level. It is envisioned that, within the strategic partnership framework, the formulation and pilot implementation of this strategic plan/package, in collaboration with all interested parties, will pave the way for establishing guidelines to inform future policy development and implementation.

Chapter 1: Literature Review and University-Industry Partnership Framework

1.1 Conceptual Framework of University-Industry Partnership

The collaboration between universities and the industry has become a focal point of scholarly discussions. A crucial measure for ensuring the socio-economic advancement of a nation involves the successful establishment of collaboration between universities and industries.

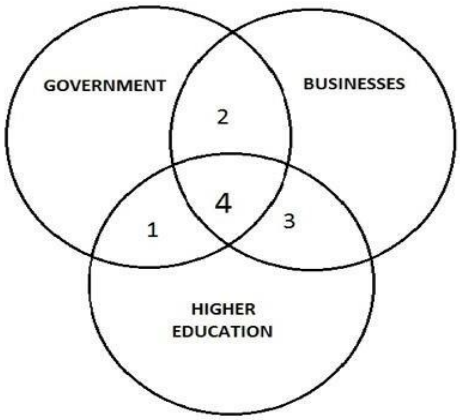
The term "universities-industry collaboration" denotes the engagement between higher educational institutions and the industrial sector, primarily aimed at facilitating knowledge and technology transfer (Ankrah & AL-Tabbaa, 2015). The University-Industry Partnership has been a subject of research and debate, particularly in the last decade, within the conceptual framework of developing the National Innovation System (Freeman, 1995; Lundvall, 1985; Nelson, 1993).

Universities play a pivotal role as drivers of a knowledge-based economy at national and institutional levels (Deiaco & Hughes, et al., 2012; Tumuti, et al., 2013; Valero, Reenen, 2019). They produce knowledge, technology, and innovation (Etzkowitz & Leydesdorff, 1998; Rossi, 2010; Ankrah, Al-Tabbaa, 2015; Ivanova & Leydesdorff, 2016). In contemporary times, the role of universities extends beyond the traditional functions of training qualified specialists and conducting academic research. Aligned with educational activities, universities now aim to facilitate the implementation of "entrepreneurial university" activities (Clark, 1998; Guerrero & Urbano, 2012; Bathelt et al., 2017; Feola et al., 2021) by fostering academic innovation and business ideas. In the past decade, universities have shifted from predominantly fulfilling teaching functions to a more research-oriented stance. They are increasingly entrepreneurial and engaged with business and industry, serving as catalysts for new startups, spin-offs, and spin-outs. Within the context of Industry 5.0, the role of private and public organizations transcends the provision of products or services, incorporating innovation as a crucial source of growth for competitive advantages, achieved through contractual and collaborative research and development.

University-industry cooperation emerges as a source of innovative solutions that propel technological progress, enhance productivity, stimulate economic growth (Chedid & Teixeira, 2018), foster new knowledge and interactions, yield long-term benefits (Van Rijn et al., 2018), and contribute to the dissemination of scientific technology (Rahm et al., 2000). Consequently, university-industry cooperation is directed towards modernizing the education sector, improving graduates' employability, and ensuring efficient knowledge utilization.

Within this context, the "Triple Helix" concept, developed by Etzkowitz and Leydesdorff (2000), underscores the mutually beneficial relationship between universities, industries, and the government (Fig. 1.1). Over the past two decades, there has been substantial growth in theoretical and empirical research within the Triple Helix framework. This framework serves as a valuable tool for examining complex dynamics in innovation and forms the basis for shaping innovation and development policies at national, regional, and international levels. Key elements of Triple Helix systems encompass interactions between universities, industries, and government entities (Ranga & Etzkowitz, 2013).

Figure 1.1 Representation of the “Triple Helix Model"



1. **Components:** The components of the Triple Helix system comprise the institutional framework of university, industry, and government. These actors are categorized into (a) individual and institutional innovators, (b) entities engaged in both R&D and non-R&D innovation, and (c) institutions exclusively operating within one sphere and those functioning as hybrid institutions bridging multiple spheres.
2. **Relationships:** The term "relationships" within the Triple Helix system pertains to the interactions and connections among its components.

These relationships encompass various aspects such as technology transfer, collaboration, conflict resolution, collaborative leadership, substitution, and networking.

3. **Functions**: The functions of the Triple Helix system denote the capabilities and competencies demonstrated by its various components, ultimately influencing its overall performance. While the primary function is centered around generating, disseminating, and utilizing knowledge and innovation, it extends beyond techno-economic competencies as described in innovation system theory. The scope includes entrepreneurial, societal, cultural, and policy competencies embedded within the 'Triple Helix spaces,' comprising knowledge, innovation, and consensus spaces.

This model has evolved into the Quintuple Helix framework, which adopts a more interconnected approach to innovation. The Quintuple Helix incorporates two additional dimensions: civil society/citizens and the environment (Fig. 1.2).

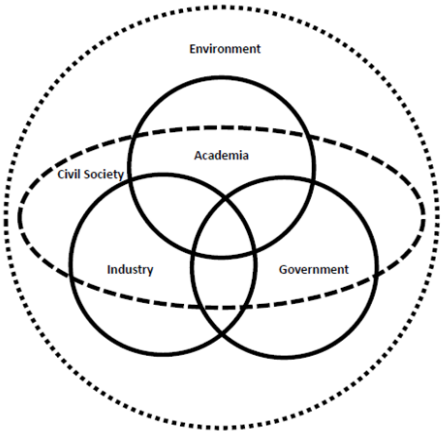


Figure 1.2 Representation of the "Quintuple Helix Model"

This expanded model visualizes the collective interaction and exchange of knowledge and technology across five subsystems or helices: (1) education system, (2) economic system, (3) natural environment, (4) media-based and culture-based public (also civil society), and (5) the political system (Carayannis et al., 2009).

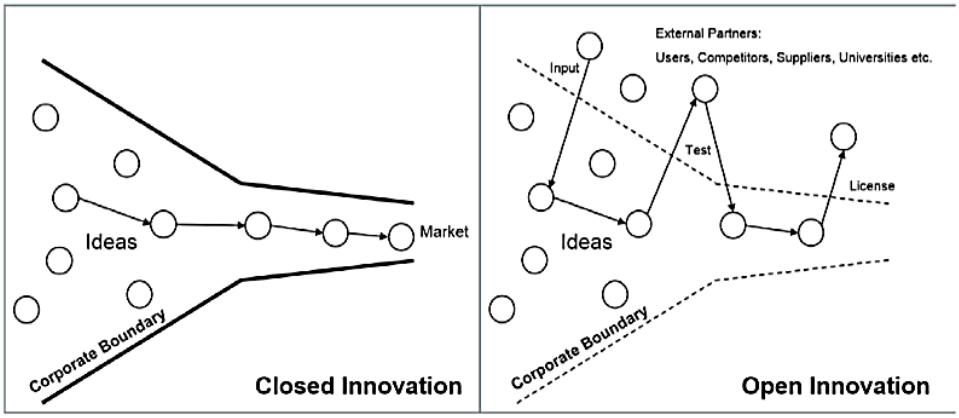
University-industry partnerships play a crucial role in reinforcing the implementation of the **Smart Specialization Strategy (SSS)** (Interreg Europe, 2020). This partnership fosters collaboration, knowledge exchange, and innovation within the specialized areas identified by the strategy. The interconnected concepts of university-industry partnership and the Smart Specialization Strategy aim to promote regional innovation and economic development, creating a synergistic relationship between

academia and industry to enhance the region's capacity in chosen areas of specialization and drive economic growth. Smart specialization involves an entrepreneurial process and differentiation of operations and products in global markets based on comparative advantage (OECD, 2013). Thus, there is a clear imperative to promote university research and researchers within the entrepreneurial activities of technological Parks and Centers within the framework of the Smart Specialization Strategy.

Another foundational concept of University-Industry Partnership is **Open Innovation**. These two concepts are closely intertwined and complement each other in research, development, and innovation. Open innovation, as defined by the Oxford Dictionary, involves a company not solely relying on its internal ideas and resources for innovation but actively seeking external collaboration and utilizing various external sources, such as customer feedback, published patents, competitors, external agencies, and the public, to drive innovation (Chesbrough & Bogers, 2014).

The innovation models proposed by Chesbrough (Fig. 1.3) distinguish between closed and open innovation. Open innovation, within this context, is construed as a strategic approach that underscores the exploration beyond organizational boundaries to commercialize ideas generated internally and externally.

Figure 1.3 Representation of the “Open and Closed Innovation"



The closed nature of the model is characterized by a unidirectional progression, originating from internal company resources and moving

toward market penetration. In contrast, the open innovation framework allows for the permeation of ideas from external partners.

Establishing collaboration between universities and industrial companies requires a nuanced approach to ensure that the partnership does not transform one entity into another. Instead, collaboration must be managed to add value, enhance the innovation ecosystem, and exchange Knowledge and Technology.

This coordinated and seamless partnership between universities and industrial companies is not just collaboration but a potential powerhouse for advancing educational and research domains. It holds the potential to foster economic growth and innovative capabilities within the industry, serving as a foundational pillar for these advancements.

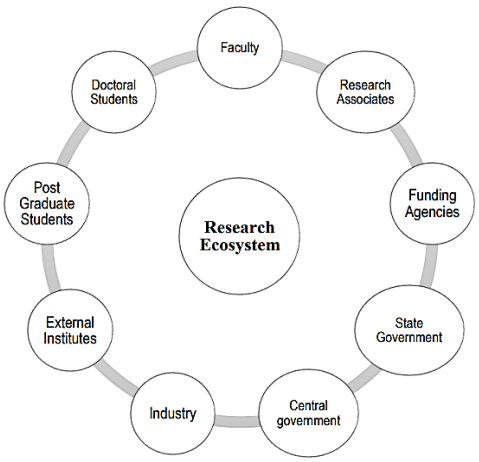


Figure 1.4 Representation of University Research ecosystem

Pandey and Pattnaik (2015) introduce the pivotal concept of the' University Research Ecosystem' (URE) in the context of university-industry partnership (Fig. 1.4). URE is a comprehensive framework that encapsulates a diverse array of elements, participants, and actions, all aimed at promoting cooperation between academic institutions and industries to drive research, innovation, and knowledge exchange. Participants in this framework include regulatory authorities, teaching staff, administrative personnel, competitors, donors, governmental organizations, industry representatives, and other stakeholders.

In the realm of university-industry cooperation, sustained collaboration among the involved parties can emerge as a cornerstone for the development of educational and research spheres (Albuquerque et al., 2015), contributing to the expansion of economic and innovative capacities within

organizations. It also serves as a prerequisite for increasing labor mobility between the public and private sectors (Larsen et al., 2019).

A primary challenge in university-industry collaboration lies in the communication barriers arising from the differing orientations of the two entities. Universities favor standardized knowledge transfer, while industries prioritize economic profitability and efficiency (Giuri et al., 2019; Ahmed et al., 2022). Sanders (2017) posits that existing cultural differences among partners impede cooperation, emphasizing the need to reduce boundaries between universities and industries to delineate benefits and drawbacks, thereby circumventing challenges (Lee, 2000; Meyer-Krahmer & Schmoch, 1998; Siegel et al., 2003; Burnside & Witkin, 2008).

To facilitate and enhance knowledge and technology transfer between academia and the business sector, it is imperative to delve into the motivations of academics. The role of organizational and institutional structures must be recognized in this process, necessitating the introduction of effective partnership channels and mechanisms. The subsequent discussions will delve into these crucial topics, shedding light on their impact on the dynamics of university-industry partnership.

1.2 Collaboration Channels of University-Industry Partnership

A growing body of literature exists concerning interaction approaches, encompassing drivers, interaction channels, perceived benefits, and other pertinent issues. This section aims to conduct a literature review focusing on the dimensions of university-industry cooperation channels, which are the systems of interaction facilitating the establishment of relationships.

Understanding cooperation channels is crucial for gaining a comprehensive view of partner relations. This necessitates clarifying various concepts used in scientific literature, such as channels, mechanisms, forms, and links. Perkmann and Walsh (2007) pointed out the sociological imprecision of the terms' channel' and' mechanism.' To tackle this conceptual ambiguity, this study uses the term' channel' following the classification by Fuentes and

Dutrénit (2012), acknowledging that channels are employed through specific cooperation forms or mechanisms.

Academic literature offers a diverse range of ways to introduce the main channels. This complexity underscores the need for a comprehensive review, which will present some broad-distinct categorizations, grouped categorizations, and criteria-specified categorizations conditionally.

Bekkers and Freitas (2008) conducted a significant study exploring the frequency and importance of channels for knowledge exchange between universities and industries. They divided these channels into six groups with 23 subgroups: Publications, Networking, Mobility, Joint Projects, Contract Research and Consultancy, Intellectual Property, and Others. Their cluster analysis scrutinized the impact of factors like sectoral effects, disciplines, organizational characteristics, and individual attributes on the importance of these channels. Notably, their findings revealed that sector-specific activities did not significantly account for variations in the importance of knowledge transfer channels. Instead, factors such as the academic discipline, knowledge characteristics, researchers' attributes, and the overall environment had a more pronounced effect on determining channel importance.

Regarding criteria-specified categorizations, the OECD (2019) classifies channels into formal and informal categories.

Formal channels include:

- Collaborative Research,
- Contract Research,
- Academic Consultancy,
- Intellectual Property Transactions,
- Research Mobility,
- Academic Spin-offs,
- Labor Mobility.

Informal channels encompass:

- Publication of Public Research,
- Conferencing and Networking,
- Networking Facilitated by Geographic Proximity,

- Facility Sharing,
- Courses, and Continuing Education.

Chedid and Teixeira (2018) contribute to categorizing knowledge transfer and exchange channels by introducing four dimensions: short-term vs. long-term, institutional vs. personal, and low-intensity vs. high-intensity. The subsequent discussion will detail each dimension (Fig. 1.5).

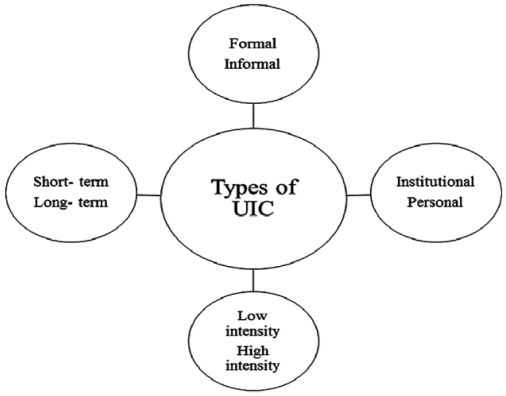


Figure 1.5 University-Industry Types

Short-Term vs. Long-Term Dimensions: These dimensions pertain to knowledge transfer mechanisms designed to yield immediate or relatively prompt outcomes. Short-term channels are specifically tailored to address immediate needs or resolve specific problems. In contrast, long-term channels are strategically implemented to facilitate continuous knowledge exchange. They often aim at fostering enduring relationships and capabilities over an extended period.

Institutional vs. Personal Dimensions: These dimensions encompass the avenues through which knowledge transfer transpires, differentiating between formalized organizational structures, processes, and individual interactions. Institutional channels involve knowledge transfer through established, formal mechanisms such as technology transfer offices, research partnerships, or protocols for knowledge sharing within organizations. Conversely, personal channels involve knowledge exchange through individual interactions and relationships, which can encompass informal networking, mentoring, or direct communication between individuals, irrespective of formal organizational structures.

Low-Intensity vs. High-Intensity Dimensions: These dimensions characterize the intensity of knowledge transfer, distinguishing between channels that require minimal effort (low-intensity) and those demanding substantial resources, time, and effort for effective knowledge transfer

(high-intensity). Low-intensity channels typically involve knowledge transfer with minimal resource or time commitments. In contrast, high-intensity channels require significant resources and a substantial investment of time and effort to facilitate effective knowledge transfer.

Chedid (2018) identified six groups for classifying interaction channels, as follows:

1. Information: This group includes channels such as publications, conferences, informal contacts, etc.
2. R&D projects: Encompassing contract R&D, consulting, and joint R&D.
3. Licenses and patents.
4. Business: This category involves joint or cooperative ventures, purchase of prototypes developed at science, creation of physical facilities, and university spin-offs.
5. Training: Encompassing supervision of Ph.D. and Master's theses, training of employees of enterprises, and students working as trainees.
6. Human resources: This group involves personnel mobility and hiring recent graduates.

Based on the mode of interaction with industry, four types of channels have been introduced by Dutrenit et al. (2010), Arza (2010), Franco & Haase (2015), and Nsanzumuhire & Groot (2020):

1. Bi-directional.
2. Commercial.
3. Service.
4. Traditional.

Table 1.1: Partnership Forms and Channels

FORMS	CHANNELS
Networking with firms, Joint R&D projects, Research contract	Bi-directional (BCh)
Patents, Technology licenses, Incubators, Spin-off from PRO	Commercial (CCh)
Staff mobility, Consultancy and technical assistance, Informal information exchange, Training staff	Services (SCh)
Conferences and expos, Publications, Graduates recently employed in industry	Traditional (TCh)

- **Bi-directional channel**: Motivated by long-term targets of knowledge creation by universities and innovation by firms (joint and contract R&D projects, participation in networks), where knowledge flows in both directions, and agents provide knowledge resources.
- **Commercial channel**: Encouraged by an attempt to commercialize scientific outcomes that universities have already achieved (patents, technology licenses, incubators), where knowledge primarily flows from universities to firms.
- **Services channel**: Related to providing scientific and technological services in exchange for money (e.g., consultancy, quality control, tests, training), where knowledge primarily flows from universities to firms.
- **Traditional channel**: Involves traditional ways of interaction (e.g., hiring graduates, conferences, and publications), where knowledge primarily flows from universities to firms.

In the context of grouped categorization, Fuentes and Dutrénit's (2012) study distinguishes four channels (Table 1.2):

1. Info channel: Includes publications, conferences, informal information, and training.
2. Project channel: Encompasses contract R&D, joint R&D, and consultancy.
3. IPR channel: Involves technology licenses and patents.
4. HR channel: Encompasses the hiring of recent graduates.

Table 1.2 Channels and Interaction forms

Knowledge Channels	Forms of interaction
Information & training (InfoChannel)	Publications Conferences Informal information Training
R&D projects & consultancy (ProjectChannel)	Contract R&D Joint R&D Consultancy
Contract R&D Joint R&D Consultancy	Technology licenses Patents
Human resources (HRChannel)	Hiring recent graduates

Regarding University-Industry Partnership Channels, differing viewpoints exist among authors. Some mention that, from the industry viewpoint, joint R&D projects, human resources, networking, open science, and patenting are of utmost significance. Conversely, when examined from a University standpoint, the main channels are joint and contract R&D projects, meetings and conferences, the mobility of human resources, training and consultancy, and new physical facilities (Fuentes, Dutrénit, 2012).

Bonaccorsi and Piccaluga (1994) mention six organizational forms of interaction:

1. Personal Informal Relationships.
2. Personal Relationships.
3. Third parties.
4. Formal Targeted Agreements.
5. Formal Non-targeted Agreements.
6. The Creation of Focused Structures.

Building upon this compilation, Ankrah and AL Tabba (2015) expanded on the sub-divisions introduced earlier by Bonaccorsi and Piccaluga. D'Este and Patel (2007) classified channels into five groups based on frequency and importance:

1. Meetings and Conferences.
2. Consultancy and Contract Research.
3. Creation of Physical Facilities.
4. Training.
5. Joint Research.

Muscio and Pozzali (2013) identified 12 types of collaboration channels and grouped them into five macro-areas following the approach of D'Este and Patel (2007). Perkman and Walsh (2007) analyzed the dynamic relationship between universities and industries in the context of open innovation, using seven groups to describe links:

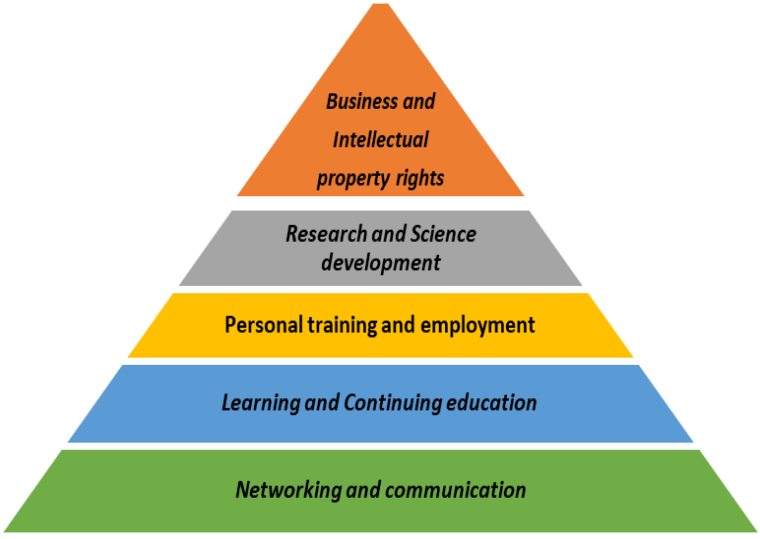
1. Research Partnership.
2. Research Services.
3. Academic Entrepreneurship.
4. Human Resource Transfer.
5. Informal Interaction.

6. Commercialization of Property Rights.
7. Scientific Publications.

Schartinger et al. (2002) employed three primary categorizations of interactions—informal personal relationships, formal personal relationships, and formal targeted agreements—to identify nine types of interactions based on three primary dimensions: formalization of interaction, transfer of tacit knowledge, and personal (face-to-face) contacts. This conceptualization, termed "Relational Involvement" by Perkman and Walsh (2007), distinguishes between links with low relational involvement, such as publications, and those with intermediate relational involvement, exemplified by mobility. Other classifications found in the works of Cohen et al. (2002) and Bruneel et al. (2010) align closely with the mentioned channels.

Given the diversity of classifications in the literature and the specificities of cooperation in the Armenian context, this scientific article establishes distinct channels, utilizing a hierarchical approach. Each channel comprises subchannels, providing implications for the initiation and highest level of collaboration (Khachatryan et al., 2023).

Figure 1.6 U-I collaboration channels in Hierarchic approach



The academic literature suggests various criteria for describing and categorizing collaboration channels, drawing from works by M. Franco & H. Haase (2015), Fuentes De & Dutrénit (2012), Schartinger et al. (2002), Polt et al. (2001), Ankrah & Omar AL-Tabbaa (2015). The identified criteria are as follows:

1. **Degree of Formalization:** The structured and documented nature of the collaboration arrangement.
2. **Degree of Interaction:** The extent of engagement and interaction between university and industry partners.
3. **Potential of Obtaining an Applied Result:** The likelihood of achieving practical and applicable outcomes.
4. **Direction of Knowledge and Technology Flows:** Whether knowledge and technology primarily flow from academia to industry, vice versa, or in both directions.
5. **Intensity of Knowledge and Technology Flows:** The depth and frequency of exchanging knowledge and technology.
6. **Length of Agreements:** The duration of collaborative agreements or partnerships.
7. **Resource Deployment:** The allocation of resources, including funding, personnel, and facilities.
8. **Extensity of Tacit Knowledge Transfer:** The level of transfer of implicit or experiential knowledge.
9. **Personal Interaction:** The extent to which individuals from academia and industry directly interact.
10. **Sequence of Interaction:** The order and timing of interactions between partners.

Building on the categorization developed by K. Khachatryan et al. (2023), this theoretical approach, complemented by insights from various scholars, describes each collaboration channel. The classification enhances understanding of the nature and characteristics of different collaboration methods. Table 1.3 synthesizes these perspectives, offering comprehensive insights into each collaborative avenue's effects, feasibility, and suitability.

Table 1.3: Criteria Based Analysis of Collaboration Channels

Criteria's	**Channels**				
	Networking and communication	**Learning and Continuing education**	**Personal training and employment**	**Research and Science development**	**Business and Intellectual property rights**
Degree of formalization	low	low	Intermediate	Upper Intermediate	Higher
Degree of Interaction	low	low	Intermediate	Upper Intermediate	Higher
Potential of obtaining applied result	Low	Low	intermediate	Upper Intermediate	Higher
Direction of Technology and Knowledge flow	U-I	U-I	U-I I-U	U-I I-U	I-U
Intensity of knowledge and technology flows	Low	Median	Intermediate	Upper intermediate	Higher
Length of Agreement	one-time	3-6 months	6 months and more	1 year and more	Long-run
Resource deployment	No resources	No resources	Non-defined	Bilateral	Bilateral
Extensity of tacit knowledge transfer	Higher	Higher	low	Higher	Lower
Personal/institutional	Personal	Personal	Personal	Institutional	Institutional
Sequence of interaction	U►I	U►I	U►I	U◄I, I►U	U►I I►U

However, it is crucial to acknowledge that these assessments may vary due to distinct national contexts and unique attributes, with the table primarily reflecting the context of Yerevan State University and the broader characteristics of the country (Khachatryan et al., 2023).

1.3 Benefits and Challenges of Collaboration

This section conducts a comprehensive literature review focusing on the dimensions of University-Industry cooperation motivations. Understanding the main reasons for cooperation and delineating the benefits and challenges among partners is crucial for overcoming potential obstacles during the

collaborative process. Scientific literature presents numerous classifications regarding the motives among the partners.

Universities are increasingly oriented toward standardized knowledge transfer methods in the collaborative framework, while industries emphasize economic profitability and efficiency mechanisms. University-industry motivations are the reasons and driving forces behind collaborative partnerships between higher education institutions and private sector organizations. These motivations vary depending on specific goals, needs, and collaboration contexts. Such collaboration leads to knowledge and technology spillovers, technological advancements, increased innovation, enhanced competitiveness for universities and industries, and overall economic growth. A comprehensive understanding of the primary drivers of cooperation and outlining the mutual benefits derived by the partnering entities can mitigate potential obstacles, enhancing the overall efficacy and success of the collaboration.

Chedid and Teixeira (2018) mention that one of the main obstacles to university-industry partnerships is the differences in expectations, actions, and vision among partners. Sanders (2017) also considers the cultural differences between these "two worlds" as a barrier to cooperation. In this case, it is necessary to identify the range of motivations, benefits, and opportunities; therefore, such a research approach will help to avoid the challenges and limitations among partners (Wallin & Isaksson, 2014).

Numerous stakeholders can be identified considering the general broadness and multidisciplinarity of collaboration. Thus, motivations can be commonly described by Students, Higher Education Institutions, Public-Private Organizations, Academics, and Government (Abbas et al., 2019; Fayolle et al., 2018).

Universities engage in collaboration programs, knowing that there are several clear expectations regarding the benefits. Financial benefits of the partnership will give the possibility of additional funding and income from licensing and patenting for the long term (Barnes et al., 2002; Ankrah & AL-Tabbaa, 2015; Perkmann, 2013; D'Este & Perkmann, 2011; Fuentes & Dutrénit, 2012; Fernandes et., all 2010).

Furthermore, **universities** will have the opportunity to adapt research to the real needs of the workplace better, and students will have access to corporate technologies that can often be better and more specific for targeted research (Abbas & Asad, 2019).

Recently, there has been much emphasis on the university's role as a generator of spin-offs. Governments and institution directors are implementing a strategy of fostering entrepreneurship and shifting toward a more entrepreneurial mindset, which will boost the economy with fresh-blood entrepreneurs attracting the dynamic and growth needed in each economy. Licensing academic research and creating entrepreneurial clusters are sometimes seen as the magic seeds that will propel economic growth in rich and developing countries. Patents are often a direct consequence of R&D. The possibility of field research, combined with funds provided by industries or the state when a favorable policy is in place, increases the number of patents generated and enhances the prestige of both sides.

Wallin & Isaksson (2014) consider this partnership an opportunity for students to easily access the labor market, review ongoing curricula, and update them. Hence, student recruitment and internship opportunities are among the essential benefits in the framework of collaboration (Al-Tabbaa & Ankrah, 2015; Yong Lee, 2000; Fernandes & Sullivan, 2022; Nsanzumuhire & Groot, 2020). The university-industry partnership provides excellent opportunities to expose students to industry culture so that when students graduate, they are better prepared to start working at these companies. Also, in the collaboration framework, students can develop entrepreneurial skills and recognize self-employment opportunities (European Commission, 2007).

From an **industrial perspective**, collaboration with universities offers access to recent research and creates networks with faculty staff, key opinion leaders, and lead scientists (venturewell.org, 2019). Moreover, industries that lack ideas and have an absence of implementation and commercialization mechanisms should have a higher incentive to collaborate with Universities (O'Dwyer et al., 2023; Freitas & Verspagen, 2017). Furthermore, thanks to collaboration, industries gain access to skilled personnel Wallin & Isaksson, (2014), especially in commercializing their

products and services (Rampersad, 2015). Hence, other significant benefits are better commercialization of products and an increase in the quality of companies' public image.

Many governments support partnerships between universities and industries in an era of fast technological development and worldwide competitiveness (Schartinger et all., 2001, 2002). Effective collaboration enables the exploitation of research to be transferred to industry for economic growth (Lima & Torkomian et al., 2021). Hence, it is an essential concern for the government's policy-making process to support this interaction due to the fast-changing technological and competitive environment. Governments and universities are implementing a strategy of fostering entrepreneurship and shifting toward a more entrepreneurial mindset, which will boost the economy with fresh-blood entrepreneurs.

There is a bi-directional flow of knowledge between universities and companies; an example can be the which has achieved excellent results in collaboration with industry, leading research on the sector and at the same time facilitating the exchange of both tacit and codified information from the academic world to the company.

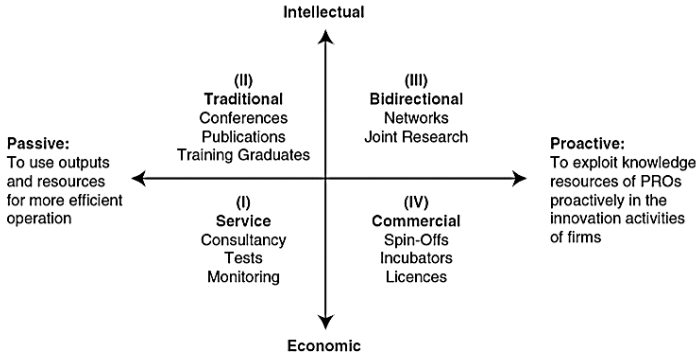
In conclusion, all prior studies, primarily on developed nations, show that research-oriented institutions may help enterprises directly through a range of connections and the provision of skills and indirectly through spillovers. These institutions contribute to national growth, and some famous examples of universities provide the critical underpinnings of vibrant industrial clusters inside metropolitan districts.

Summarizing the boundaries of universities' motivation, Arza (2010) mentioned two forms of motivation: Intellectual, which is related to the exchange of information, new research ideas, new publications, and the increase of academic efficiency; Economic, by raising the necessary funds for new research. We accept that the Arza approach is one of the applicable ones. We would also like to add Institutional and Social Benefits for both partners based on the broad academic literature with different implications and collaboration prospects. In the end, we have four dimensions to discuss benefits and losses among partners: (economic, intellectual, institutional, and social). The social aspect is taken from the idea of the Quintuple Helix

(Carayannis et al., 2009), where the university, industry, and government added the sum of the social interactions and environmental aspects of collaboration.

Arza (2010) and D'Este & Perkman (2011) have pointed out that the choice of cooperation channels between the parties and the combination of motivations/benefits are directly comparable. The direct relationship between the benefits and the choice of channels is presented through the corresponding diagram (See Fig. 2). Arza (2010) proposed a grouped categorization of channels: Service, Traditional, Bi-directional, and Commercial. Moreover, Arza (2010) distinguished a group of motivations for Universities: Intellectual and Economic Benefits, and for Industries: Passive short-term production benefits and active, long-term innovation Motivations.

Figure 1.7. Relationship of collaboration channels and motivations



The ensuing categorization establishes a direct correlation between collaboration channels and motivations, as illustrated in Figure 1.7. This classification delineates four quadrants based on the intersection of University Economic motivations and passive short-term benefits of Industry:

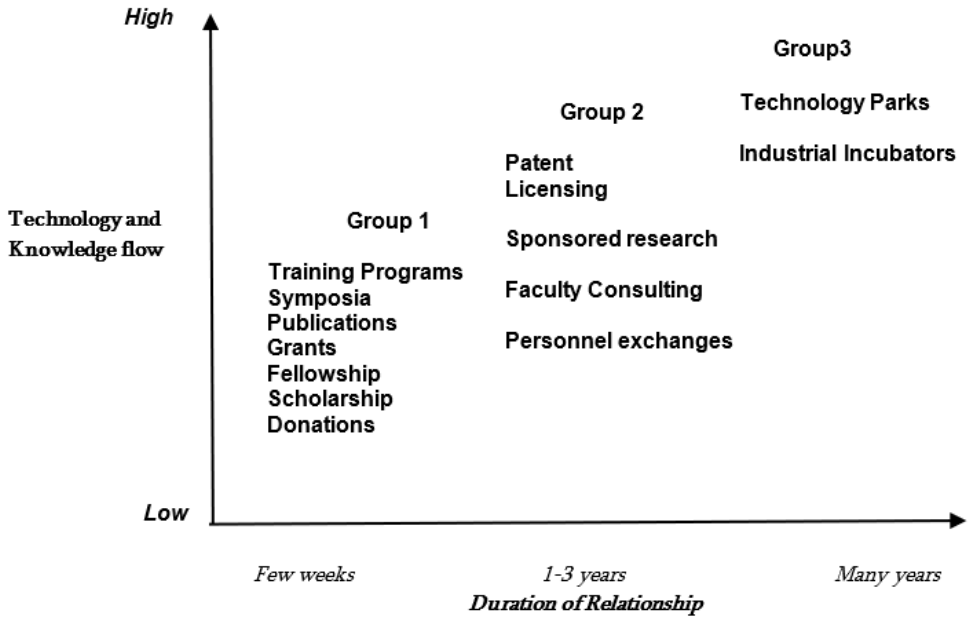
- **Quadrant 1:** University Economic motivations and passive short-term benefits of Industry. In this scenario, the service channel is the chosen collaboration mechanism. Knowledge flows from universities to the organization through consulting, equipment utilization, quality control, testing, and monitoring.
- **Quadrant 2:** University intellectual and passive (non-interactive) benefits of Industry. The traditional mechanism is the designated

channel, with expected outcomes linked to hiring graduates, publications, and conferences. Knowledge primarily flows from universities to the Industry.

- **Quadrant 3:** Universities' intellectual and active benefits of Industry. In this quadrant, bi-directional channels serve as the mechanism, facilitating a reciprocal flow of information. The cooperative result hinges on the execution of joint research and development programs.
- **Quadrant 4:** Universities' Economic and Active Benefits of Industry. The commercial mechanism is chosen as the channel, reflecting the universities' goal to commercialize academic products.

Chen (1994) has presented a diagram (Figure 1.8) that underscores the differentiation between technology flow and collaboration periods, aligning them with existing channels. To enhance this diagram, we propose incorporating an indicator for the intensity of knowledge flow (Line 2). Including a knowledge flow intensity indicator offers a comprehensive visualization of the timeframes associated with each channel and the anticipated levels of technology and knowledge transfer.

Figure 1.8 Framework of University-Industry Technology Transfer Framework



Consequently, for parties seeking medium-term cooperation characterized by a balanced flow of knowledge and technology, channels within the 2nd group become viable options. This diagram is an effective tool, illustrating the relevant time intervals for implementing each channel and predicting the intensity of technology and knowledge exchange

It is crucial to note that Higher Education Institutions (HEIs) are driven to engage in collaborative ventures primarily due to the substantial financial benefits. These partnerships open up additional funding channels and create opportunities for revenue generation through licensing and patenting (Valentin, 2000; Barnes et al., 2002; D'Este & Perkmann, 2011; Fernandes et al., 2010; Fuentes & Dutrénit, 2012; Perkmann et al., 2013; Ankrah & AL-Tabbaa, 2015). Moreover, these joint initiatives offer perks such as student recruitment and internship opportunities, which hold significant value within the collaborative framework (Ankrah and Al-Tabbaa, 2015; Lee, 2000; Fernandes et al., 2022; Nsanzumuhire and Groot, 2020).

It is essential to underscore that students who actively participate in these collaborations can acquire entrepreneurial skills and create opportunities for self-employment (Jongsma et al., 2007). Furthermore, industries that partner with universities can tap into recent research and build connections with faculty staff, key opinion leaders, and lead scientists. This collaborative synergy ensures that industries gain access to skilled personnel, especially in commercializing their products and services (Wallin et al., 2014; Rampersad, 2015).

In this age of swift technological advancement and global competition, it is worth emphasizing that many governments are backing the alliance between universities and industries, acknowledging its potential to leverage research for economic growth (Schartinger et al., 2001, 2002; Lima et al., 2021). As a result, effective collaboration facilitates the transfer of research results to the industry, spurring economic growth. Therefore, it is of utmost importance for government policy-making processes to endorse this interaction, considering the rapidly evolving technological and competitive environment. Governments and universities are adopting a strategic approach centered on fostering entrepreneurship and shifting towards a more entrepreneurial mindset, expecting an economic uplift with the introduction of innovative entrepreneurial ventures.

The burgeoning academic discourse on University-Industry Partnership **barriers and challenges** attests to the increasing recognition of impediments that can obstruct effective collaborations between academia and industry. Delving into the challenges inherent in university-industry collaboration becomes imperative for formulating strategies, informing policy decisions, and advancing theoretical and practical knowledge in this domain (Etzkowitz & Leydesdorff, 2000). A thorough exploration and analysis of hindering factors empower policymakers and stakeholders to devise targeted interventions that effectively address identified barriers, fostering an enabling environment conducive to successful collaborations.

Understanding the barriers to collaboration from the university perspective is crucial. These barriers predominantly revolve around capacities and resources, legal and contractual mechanisms, and institutional, social, and economic issues (Nsanzumuhire & Groot, 2020). The need for more financial resources and the absence of research and technical capabilities are significant obstacles that hinder universities from progressing in the collaborative framework (Jauhari, 2013; Jonbekova et al., 2020).

It is important to note that diverse organizational cultures and environments and misalignment between academic goals and technological transfer activities pose hindrances to collaboration. However, the role of researchers' attitudes and behavior must be considered. Scholars like Muscio and Vallanti (2014) and Bruneel, D'Este, and Salter (2010) underscore that these human factors can detrimentally impact collaboration.

Insufficient knowledge among partners emerges as another formidable challenge in the evolution of collaboration (Kl. Schaefer & Ke. Schaefer, 2022). Moeliodihardjo et al. (2012) highlight that a lack of mutual understanding and trust between universities and industries can be a fundamental obstacle in the developmental phase of collaboration.

Addressing intellectual property rights (IPR) becomes a potential source of contention if not well-defined in the early stages of collaboration. On the economic front, universities must navigate the delicate balance of not becoming overly dependent on funds granted by companies while the latter assumes the risk of investing in research. At the institutional level, bureaucratic challenges arise, with an awareness that the differing nature of

the parties results in distinct working methods. Companies tend to be more flexible and focused on rapid results, whereas universities often operate more methodically.

Mokyr's work (2009) suggests that protecting intellectual property rights, such as patents, was pivotal in encouraging innovation and technological advancements during the Industrial Revolution. The existence of a patent assured inventors that their proposed invention, once adopted by a manufacturer, would receive proper protection and compensation. However, further study reveals that IPR rights need to be better defined, posing a potential challenge for both partners.

Drawing upon Arza's classification of motivations (economic and intellectual) and introducing two additional motivations developed during this study, we aim to elucidate benefits and losses from economic, intellectual, social, and institutional perspectives among partners. The results are derived from a comprehensive survey that sheds light on the multifaceted outcomes of collaborative engagements between universities and industries (Table 1.4).

Table 1.4: Benefits and Losses for University and Industry

	University		***Industry***	
	Benefits	Losses	Benefits	Losses
Intellectual	Knowledge and information accumulation, Well-trained students, Improvement of the quality of teaching	Outflow of trained specialized academic staff from University to business IPR conflicts between the two sides	Access to a well-qualified labor Strengthen research, innovation, technology development. Joint publications	IPR conflicts between the two sides caused by the structural difference in interest.

Economic	Additional sources of funding, Employment opportunities	Financial dependence of the university on company funds The increase in resources from the private sector could lead that the government will reduce funding for universities	Boost company's sales Higher productivity Saving money invested in R&D Reduction of expenses on employee trainings Access to "cheaper" labor	Loss of financial resources spent on students trainings Inefficient cooper ation/failures and unreliable partners
Social	Improvement of the university image	Failures in Collaboration will lead to the disappointment of interest parties	Strengthening their status and image by connecting with major universities	Failures in collaboration will impact on Corporate Image of the Organization
Institutional	Establishment of specialized structures, centers, techno parks Improvement of t echnological equipment in universities Improvement of the university image	Overload the university and bureaucratic system Conflict of interest and difficulties to choose strategic orientation	Use of University research infrastructure Improve technological performance	Substantial differences in the way of working between the parties (Long-term, short-term results)

In synthesizing the spectrum of benefits and drawbacks delineated in Table 2, it becomes apparent that the involved parties stand to gain a diverse array of advantages. Conversely, attendant losses and risks stem from lacking requisite institutional structures, infrastructures, and agile communication frameworks.

A recurrent challenge encountered by higher education institutions is bureaucratic inefficiency. Consequently, the establishment and implementation of appropriate structures with efficient management are imperative to preempt potential impediments.

Furthermore, a salient issue that may arise pertains to unmet expectations. Collaborative endeavors between parties inherently imply the attainment of specific outcomes. While results may be realized, practical applicability could be lacking. For instance, a specialist trained at a university may only possess theoretical knowledge with corresponding practical skills, rendering their participation in research programs less effective. Addressing this challenge involves incorporating organizational representatives in revising and transforming educational programs and establishing a crucial channel for mitigating the issues mentioned above. The development and adaptation of unified strategic and action plans should be cognizant of the involved parties' long and short-term expectations, interests, and needs.

1.4 Institutional structures of University-Industry Partnership

Within the context of university-industry collaboration, specialized structures and infrastructures emerge as a pivotal consideration. These encompass technology transfer offices, entrepreneurship development centers, research and innovation centers, career centers, and other dedicated units within universities. These structures serve as indispensable prerequisites for fostering effective collaboration among partners. Notably, the genesis of institutional units dedicated to university-industry collaboration dates back to the establishment of **Career Centers** or services, with their prevalence increasing notably in the 1970s and 1980s despite initial iterations in the 1940s. Remarkably, the roots of such institutional entities can be traced back to the UK's 1902 Education Act, which laid the groundwork for work advice and placement-oriented services like the Appointment Boards (UK) or Placement Offices (USA), initially geared toward exceptional graduates rather than comprehensive student support (Terzaroli, 2019).

Examining the historical evolution in the United Kingdom, the inaugural Career Service was instituted at the University of Oxford in 1892, followed by Cambridge in 1914 and later adopted by nine additional universities between the World Wars. In the 1950s and 1960s, this office became a standard feature across institutions. Since the late 1980s, there has been a substantial proliferation of these structures, fostering institutional interactions between universities and businesses (Freitas et al., 2013). Career centers have metamorphosed into vital conduits between graduates and employers (McGrath, 2002), representing critical infrastructure that facilitates student career development, promotes scientific outcomes (Chin Yuk et al., 2018), and serves as a unique link between teaching, research, and entrepreneurship (Terzaroli & Oyekunle, 2019). The establishment of career centers addresses theoretical concerns related to university-work mismatches.

During the 1990s and 2000s, career centers underwent a transformative shift into dynamic network centers, particularly driven by the growth of the IT industry and the Technological Revolution (Dey & Cruzvergara, 2014). This evolution aimed at aligning personnel training with contemporary labor market demands, student employment needs, and technological advancements (Hayden & Ledwith, 2014). The scope of services offered by these institutes evolved from a job placement focus to encompass a comprehensive range of career planning services, embracing work experience, entrepreneurial education, and the cultivation of a "Portfolio of Achievements" (Curaj et al., 2020).

The changing nature of collaboration is underscored by the imperative for practical knowledge and technology transfer between academic institutions and the business sphere (Muscio & Vallanti, 2014). Academic institutions are increasingly integral to commercial and "entrepreneurial" research activities, marking a significant shift in the cooperative landscape. The growth of the IT industry and the Technological Revolution catalyzed the dynamic evolution of career centers, reinforcing their role as vital network centers attuned to prevailing labor market requirements and technological dynamics (Dey & Cruzvergara, 2014; Hayden & Ledwith, 2014).

An indispensable facet explored in this study pertains to **Research and Development (R&D) centers**, which primarily endeavor to enhance the

education system and elevate student achievement through rigorous research, development, evaluation, and national leadership initiatives (Wilkinson, 2014). Specifically, the US National Center for Education Research houses R&D Centers with the overarching objective of actively engaging in the generation and dissemination of robust research findings and resources. These endeavors are meticulously designed to provide effective solutions to substantial educational challenges in the United States.

In a corporate context, Research and Development (R&D) centers play a pivotal role in the conception and provision of innovative products and services. Functioning primarily within businesses, R&D service providers assume a foundational role in the initial phases of product development. These specialized companies dedicated to R&D services extend support to enterprises in introducing groundbreaking products and services to the market, concurrently augmenting their financial viability. The significance of Research and Development (R&D) services is underscored in their pivotal role in enabling businesses to uphold their competitiveness within the swiftly evolving technological landscape. By engaging in R&D activities, companies can generate products that pose challenges for competitors to replicate. Moreover, R&D service providers contribute to heightened operational efficiency, thereby fostering increased profitability and competitiveness. In essence, involvement in research and development activities empowers companies to maintain a vanguard position in the industry by foreseeing customer demands and anticipating emerging trends.

The World Intellectual Property Organization (WIPO) defines *Technology Transfer Organizations* as academic or commercial entities that facilitate the management of intellectual property rights and technology transfer by bridging the gap between research and practical applications. According to the WIPO categorization, various types of technology transfer organizations include:

1. **Technology Transfer Offices (TTOs):** These offices facilitate technology transfer from universities to industry and commercialize university knowledge. TTOs serve as a support system within the university, focusing on tasks such as licensing, consultancy agreements, patent processes, and the establishment of spin-off companies. Although their primary purpose is not to promote collaboration, they

provide crucial administrative assistance in these areas (Freitas & Verspagen, 2017).

2. **Technology and Innovation Support Centers (TISCs):** These centers provide innovators access to patent data, scientific and technical literature, search tools, and databases. Their objective is to enhance innovators' effectiveness in utilizing these resources, fostering innovation, facilitating technology transfer, promoting commercialization, and facilitating the practical application of technologies.
3. **Science and Technology Parks (STPs):** Typically associated with a university or research institution, STPs serve as hubs that support the development and expansion of companies within them. Their primary purpose is facilitating technology transfer and promoting open innovation among resident companies.
4. **Technology Incubators:** These entities assist startup companies and individual entrepreneurs nurture their businesses by offering various services, including training, facilitation, and financial support.
5. **IP Marketplaces:** Internet-based platforms that connect stakeholders and facilitate transactions related to intellectual property.

Alongside these structures, a significant and growing trend is the creation of innovation and entrepreneurship development centers. These centers are crucial in supporting students or academicians in turning their inventions into commercial products and establishing their enterprises or businesses (Wilczynski & McLaughlin, 2017). It is important to note that in developed countries, university-industry collaboration is multifaceted, encompassing employment, education, training, research, and innovation, according to UNESCO (2000).

The ultimate aim of university-industry collaboration is to bring to life the entrepreneurial university concept (Etzkowitz, 1983) and to put academic entrepreneurship into practice (Klofstena et al., 2019). This is accomplished through educational programs that foster mutual learning, information exchange, and innovation (Nakagawa et al., 2017; Khachatryan et al., 2022). As the landscape of collaboration evolves, innovation and entrepreneurship development centers are emerging as key players in creating a dynamic environment that facilitates translating academic knowledge into practical applications and commercial ventures.

Chapter 2: University-Industry Partnership in EU and Transitioning economies

2.1 University-Industry Partnership in EU

In this subsection, a comprehensive examination will be undertaken to explore the intricate dynamics of collaboration between universities and industries. A detailed analysis will delve into the legal intricacies, regulatory dimensions, ongoing initiatives, and governing policies delineating the contours of the University-Industry Partnership within European Union Countries.

The extant legal framework for the European Union's (EU) research, technological development (RTD), and space policy is enshrined in Articles 179-189 within Title XIX of the Treaty on the Functioning of the European Union (TFEU). The foundational objectives of this policy, articulated in Article 179 TFEU, encompass establishing a European Research Area and the enhancement of EU Scientific and Technological Excellence.

Commencing in 1984, the EU embarked on its inaugural RTD program, driven by overarching objectives to enhance the EU's competitiveness, fortify its scientific and technological prowess, and foster collaborations in research and development. The year 2000 marked a pivotal juncture, where the EU prioritized the scope of innovation with the Lisbon Agenda and the Europe Horizon 2020 strategy. The Lisbon European Council convened on March 23 and 24, 2000, assumed significance in the European Union's endeavors to fortify its competitiveness in the face of the evolving global economy.

While the official pronouncements of the Lisbon Strategy do not explicitly reference university-industry partnerships, specific goals and themes integral to this strategy bear fundamental relevance to such partnerships:

- **Knowledge-based Economy:** The Lisbon Strategy underscored the pivotal role of knowledge and innovation in propelling economic growth. This emphasis accentuates the fundamental contribution of universities and public research institutions in effecting knowledge and

technology transfer, subsequently harnessed by industries for innovation.

- **Research and Development (R&D):** Integral to achieving the Lisbon Strategy's objectives was the emphasis on augmenting investment in research and development. A specific target aimed for 3% of the EU's GDP to be allocated to R&D, with universities emerging as central hubs for R&D activities, rendering them indispensable partners for industries intent on conceiving and implementing novel technologies.
- **Innovation and Entrepreneurship:** The Lisbon Strategy sought to cultivate innovation as a means of augmenting competitiveness. Universities, recognized as pivotal sources of innovation, play a critical role in facilitating the transfer of innovative ideas among students and researchers, fostering an environment conducive to entrepreneurship.
- **Human Capital Development:** The Council, aware of the imperative of nurturing a highly skilled workforce, underscored universities' pivotal role in the education and training of individuals endowed with the requisite skills. In this context, universities are central in aligning education with the evolving demands of industries and the broader economy.

Moreover, concomitant with the Bologna reform process, the European Commission unveiled a seminal document in 2006 titled "Delivering on the Modernization Agenda for Universities: Education, Research, and Innovation." This document holds distinction as the first to underscore the tripartite roles of universities—Education, Research, and Innovation—signifying the crucial role Higher Education Institutions (HEIs) play in shaping Europe's future. Within this paradigm, the Commission advocated for the creation of the European Institute of Technology (EIT).

The primary aspiration of the Council was to bridge the gaps in this framework and, by the year 2010, position Europe as "the most competitive and dynamic knowledge-based economy in the world." The Lisbon Strategy, the document "Delivering on the Modernization Agenda for Universities: Education, Research, and Innovation," and the establishment of the EIT (European Institute of Innovation and Technology) stand as pivotal milestones in the 21st century, coordinating efforts and laying the groundwork for university-industry partnerships.

Established in 2008, the EIT sought to amalgamate the crucial facets of innovation, business, education, and research, delineating the following primary objectives:

- Facilitating the development of innovative products and services.
- Fostering the creation of new companies.
- Providing training for a new generation of entrepreneurs.

The beneficiaries of the EIT's endeavors encompass a diverse spectrum of stakeholders within the innovation ecosystem, including businesses, entrepreneurs, public authorities at EU, national, regional, and local levels, researchers, students, and universities. In essence, the EIT assumes a foundational role in propelling innovation across Europe by fostering collaboration among key players and stakeholders.

Additionally, extant structural and infrastructural initiatives within the EU include:

- Joint Research Centers (JRCs): Aligned with the overarching goals of Horizon Europe, these collaborative platforms engender partnerships between universities, research institutions, and industries to address specific research and innovation challenges. JRC centers are oriented towards field-specific research in collaboration with national organizations.
- European Innovation Council (EIC): Constituting part of Horizon Europe with a budget of €10.1 billion, the EIC lends support to innovators, entrepreneurs, and small businesses to scale up innovations, often entailing partnerships with universities. Its principal objective is to identify, develop, and scale up breakthrough technologies within the EU.

In 2009, just before the onset of a severe financial crisis, the Strategic Framework for European cooperation in education and training was formulated. Responding to this context, the Europe 2020 strategy was devised in 2010, delineating a vision for innovative, sustainable, and inclusive growth. It underscored the imperative to enhance the quality of education, fortify research performance, foster innovation, and facilitate knowledge and technology transfer throughout the Union. A derivative of Europe 2020, the European Commission's Agenda for New Skills and Jobs

was crafted and aligned with the broader goal of achieving an employment rate of 75% for women and men in the 20-64 age groups by 2020. An updated communication on the modernization of higher education was published in 2011, titled "Supporting growth and jobs – an agenda for the modernization of Europe's higher education systems" under the EUROPE 2020 initiative.

An additional significant undertaking was the Horizon 2020 program, the EU's research and innovation funding initiative spanning 2014-2020, endowed with an approximately €80 billion budget. This program aimed to bolster scientific excellence and spur innovation in Europe by financing a diverse array of research and innovation projects across various sectors. It sought to facilitate collaboration among academia, industry, and other stakeholders, fostering the translation of research outcomes into practical applications and commercial products.

The ongoing Horizon Europe project, the EU's research and innovation program for 2021-2027, is endowed with a budget of €95.51 billion. As a continuum of the Horizon 2020 program, it currently stands as one of the world's biggest funding programs for research and innovation. The program is geared towards addressing challenges related to climate change, the UN's Sustainable Development Goals, and the EU's competitiveness and growth. Notably, Horizon Europe actively addresses the policy challenge of promoting university-industry collaboration through initiatives such as Erasmus+ and the advocacy of "mission-oriented innovations."

Numerous initiatives, projects, and structural developments have been initiated, including:

- The European Research Area (ERA), launched in 2000 and rejuvenated in 2018, aims to establish a single, borderless market for researchers, scientific knowledge, and technology. It promotes collaboration between universities and businesses to strengthen research and innovation capacities. Recent measures announced by the Commission on July 13, 2023, include a Council Recommendation establishing a new European framework for research careers, a new Charter for Researchers, and the European Competence Framework for Researchers (ResearchComp). These measures further underline the ERA's

commitment to fostering a robust European research and innovation environment.

- European Innovation Partnerships (EIPs): These partnerships bring together relevant EU, national, and regional entities to coordinate and develop existing financial instruments and initiatives. Active EIPs include Active and Healthy Ageing, Agricultural Productivity and Sustainability, Smart Cities and Communities, and Raw Materials.

Table 2.1 categorically presents and analyzes key EU projects, initiatives, and tools that play a fundamental role in shaping and enhancing university-industry partnerships.

Table 2.1 EU projects, Strategies and Initiatives

Project	**Tool/ network**	**Policy / Strategy**	**Structure**	**Organizations / initiatives**
Science with and for Society (SwafS) The RISE Group (Rising Europe's Industrial Strategy for Employment): European Research Area (ERA) Horizon Europe Program	European Innovation Scoreboard ERA-NETs (European Research Area Networks) European Technology Platforms (ETPs) European Enterprise Network (EEN) European Cluster Collaboration Platform Knowledge and Technology Transfer Networks	Cluster Policy and Regional Development Strategies National Innovation Strategies Open Science Policy Smart Specialization Strategy Innovation Union Strategy EU Industrial Policy	Joint Research Centers (JRCs) European Innovation Council (EIC) European Institute of Innovation and Technology (EIT)	European Association for Innovation and Technology (EAIT) Joint Technology Initiatives (JTIs) and Public-Private Partnerships (PPPs):**. European University Alliances European Cluster Observatory European Innovation Partnerships (EIPs):

This analysis delves into pivotal policies and strategies shaping the evolution of University-Industry Partnerships (UIPs) within the European Union (EU). Examining these strategies illuminates the commitment to fostering collaborative efforts between academia and industry to advance research, development, and economic growth. The identified policies and strategies include:

1. **National Innovation Strategies:**
   EU member states have individually crafted robust national innovation strategies, strongly emphasizing fostering partnerships between universities and industries. The overarching goal is to invigorate research and development and spur economic growth.
2. **Smart Specialization Strategy:**
   Encouraging regions to discern and leverage their distinctive strengths, this strategy aims to cultivate collaboration between universities, research institutions, and industries in specific sectors. It aligns with the broader goal of enhancing regional innovation ecosystems.
3. **Innovation Union Strategy:**
   Geared towards cultivating a more conducive innovation environment in Europe, this strategy actively encourages partnerships between universities and industry. Its focal points encompass driving research and development, facilitating technology transfer, and promoting entrepreneurial initiatives.
4. **EU Industrial Policy and Strategy:**
   Policies tailored to specific industries, exemplified by initiatives like the Circular Economy Action Plan or the Digital Agenda for Europe, serve as catalysts for collaboration between businesses and universities within these sectors. This targeted approach aligns with the EU's broader industrial objectives.
5. **Open Science Policy:**
   The EU's Open Science policies, advocating for the open sharing of research outcomes, data, and publications, are pivotal in facilitating collaboration between universities and industries. This ethos promotes transparency and seamless knowledge exchange.

University-Industry Partnership stands as a linchpin in the EU's strategic endeavors to propel innovation, enhance competitiveness, and foster

economic growth. The EU has meticulously instituted a legal framework and an array of initiatives and programs to stimulate collaboration, facilitate knowledge transfer, and propel advancements in research and technology. The unwavering commitment to innovation, research, and collaboration between universities and industries is evident, with Horizon Europe exemplifying this commitment by emphasizing mission-oriented innovations. While adopting diverse models of university-industry collaboration, European countries share a common objective of bridging the gap between academia and industry. Many actively position university-industry partnerships as integral components of national innovation systems, reflecting a collective dedication to advancing knowledge, innovation, and economic development.

This study undertakes a macro-level analysis of university-industry partnerships within chosen European countries. It employs specific statistics and key indicators to discern nuanced differences among these nations, facilitating a comparative exploration of the strategies and outcomes associated with university-industry collaborations. This approach sheds light on the strengths and weaknesses inherent in each country's approach.

Primary databases, including Eurostat, OECD Database: World Bank, and the European Innovation Scoreboard 2023, serve as the cornerstone for data and statistics collection in this research endeavor.

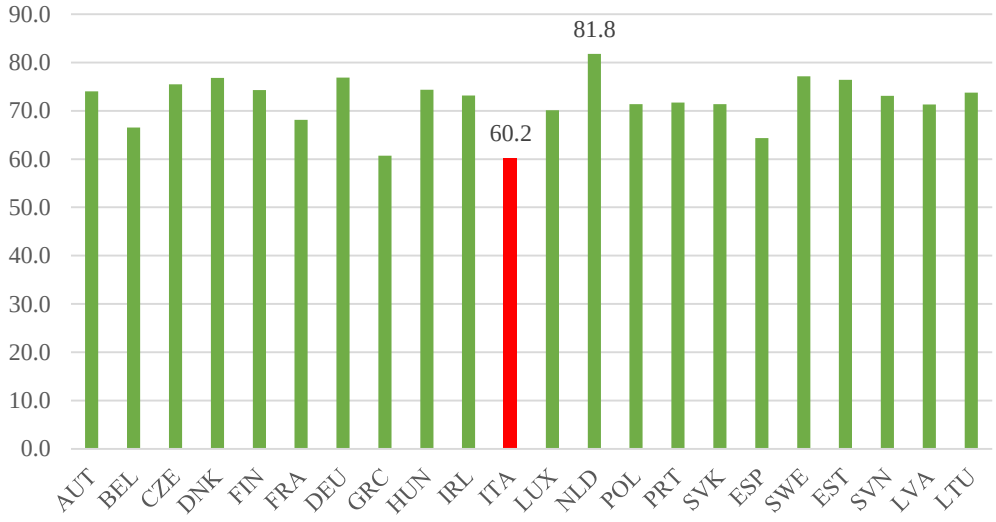
The selection of appropriate indicators holds paramount significance in shaping the research's direction and depth, aiming to comprehensively comprehend and evaluate university-industry partnerships in European countries. The chosen key indicators illuminate various facets of these partnerships and their impact on research, innovation, and economic development. The selected indicators include:

1. **Employment Rate**
2. **(NEET) Not in Education, Employment, or Training**
3. **Gross Domestic Expenditure on Research and Development (GERD)**
4. **Higher Education Research and Development (HERD):** HERD expenditure provides insights into the commitment of higher education institutions to research activities, reflecting the financial investment made by universities in advancing knowledge and innovation.

5. **Government Budget Allocated to Research and Development (GBARD):** GBARD showcases the government's expenditure to foster research and innovation within the national context, emphasizing the public sector's role in supporting and catalyzing R&D efforts.
6. **Business Expenditure on Research and Development (BERD):** BERD signifies the private sector's engagement in research and innovation endeavors, highlighting the extent to which industries invest in R&D activities, potentially in collaboration with academic institutions.
7. **Co-Publications:**Co-publications denote the synergy between academia and industry in generating new knowledge, offering tangible outcomes of collaborative research efforts and knowledge exchange between these sectors.

This research aims to provide a holistic perspective on the state of university-industry partnerships in European countries. Framed within the University-Industry partnership context, the investigation uses indicators such as the employment rate and NEET status across EU countries. The study endeavors to unravel the intricate dynamics of university-industry collaborations and their implications for broader societal and economic development through these meticulously selected indicators.

Figure 2.1 Empoyment Rate in EU countries, % 2022,
OECD Database



These indicators assume significance as they illuminate the opportunities available to young individuals and provide insights into the existing gaps and dynamics within the labor market.

Drawing upon data from the OECD database, the employment rate in various European countries yields noteworthy results (Graph 2.1). Critical comparisons are outlined below:

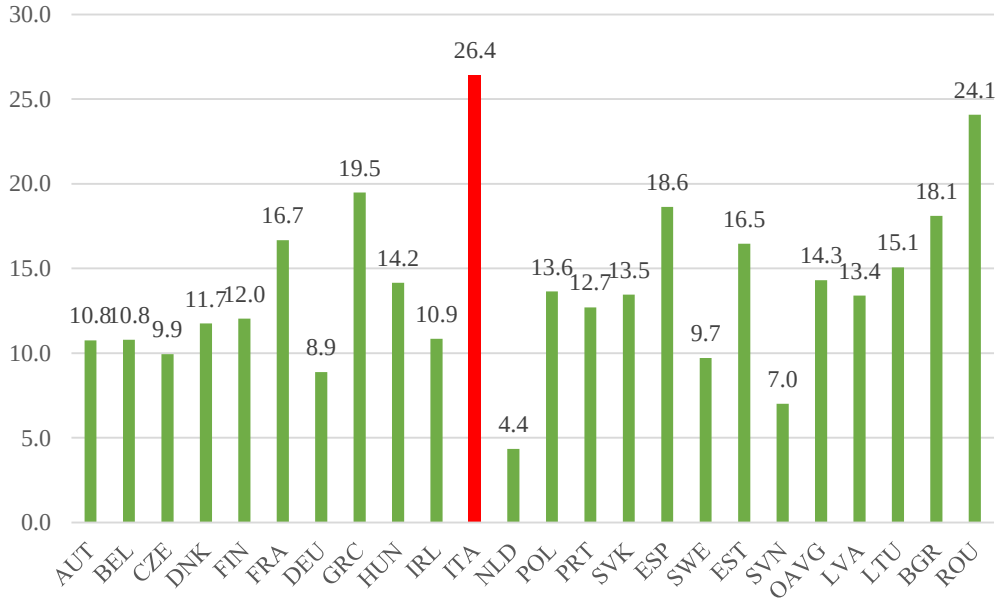
- **Highest Employment Rate:** The Netherlands boasts the highest employment rate at 81.8%, signifying that a substantial portion of its populace is employed.
- **Northern European Comparison:** Denmark, Sweden, and Finland exhibit relatively high employment rates ranging from 74.3% to 77.1%, reflecting robust labor force participation in these Northern European countries.
- **Central European Comparison:** The Czech Republic, Hungary, and Slovakia display employment rates spanning from 71.4% to 75.5%, portraying favorable employment conditions within these Central European nations.
- **Southern Europe:** Greece, Italy, and Spain grapple with lower employment rates, fluctuating between 60.2% and 64.4%. These Southern European countries encounter challenges linked to unemployment and labor market dynamics.
- **Western European Comparison:** Germany, France, and Belgium present employment rates between 66.5% and 76.9%, showcasing diverse labor market scenarios in Western Europe.
- **Baltic States:** Estonia, Latvia, and Lithuania demonstrate employment rates ranging from 71.3% to 76.4%, indicating relatively robust employment conditions in the Baltic region.
- **Benelux Region:** Belgium and Austria register employment rates of 66.5% and 74.0%, respectively. While Austria reports a higher employment rate, both countries exhibit significant labor force participation.
- **Ireland and Luxembourg:** Ireland and Luxembourg report employment rates of 73.2% and 70.1%, respectively, indicative of favorable employment conditions in these countries.

Turning to the NEET (Not in Education, Employment, or Training) rates in various European countries, notable comparisons arise (Graph 2.1):

- **Lowest NEET Rate:** The Netherlands achieves the lowest NEET rate at 4.4%, suggesting a limited proportion of young individuals in the country are disengaged from education, employment, or training, signifying robust youth engagement opportunities.
- **Highest NEET Rate:** Italy and Romania grapple with the highest NEET rates at 26.4% and 24.1%, respectively, highlighting significant challenges concerning youth disengagement from education and employment.
- **Central European Comparison:** The Czech Republic boasts a relatively low NEET rate of 9.9%, whereas neighboring countries like Slovakia and Hungary report higher rates of 13.5% and 14.2%, respectively, indicating variations in youth opportunities within Central Europe.
- **Nordic Countries:** Denmark and Sweden present 11.7% and 9.7% NEET rates, respectively, showcasing comparatively low levels of youth disengagement compared to the European average (OAVG) of 14.3%.
- **Southern Europe:** Greece, Spain, and Portugal grapple with NEET rates of 19.5%, 18.6%, and 12.7%, respectively, confronting challenges associated with youth unemployment and education accessibility.
- **Baltic States:** Estonia, Latvia, and Lithuania exhibit NEET rates of 16.5%, 13.4%, and 15.1%, respectively, falling generally within the range of the European average.
- **Benelux Region:** Belgium and Austria report NEET rates of 10.8%, indicating favorable conditions for youth engagement in education or employment.

Elevated NEET rates signal challenges in providing opportunities for young individuals, whereas lower rates suggest enhanced youth engagement in education and employment. Addressing NEET rates becomes imperative for ensuring the well-being and prospects of youth populations.

Graph 2.2 Youth Not in Education, Empoyment and Training, (NEET), %, EUROSTAT, 2022



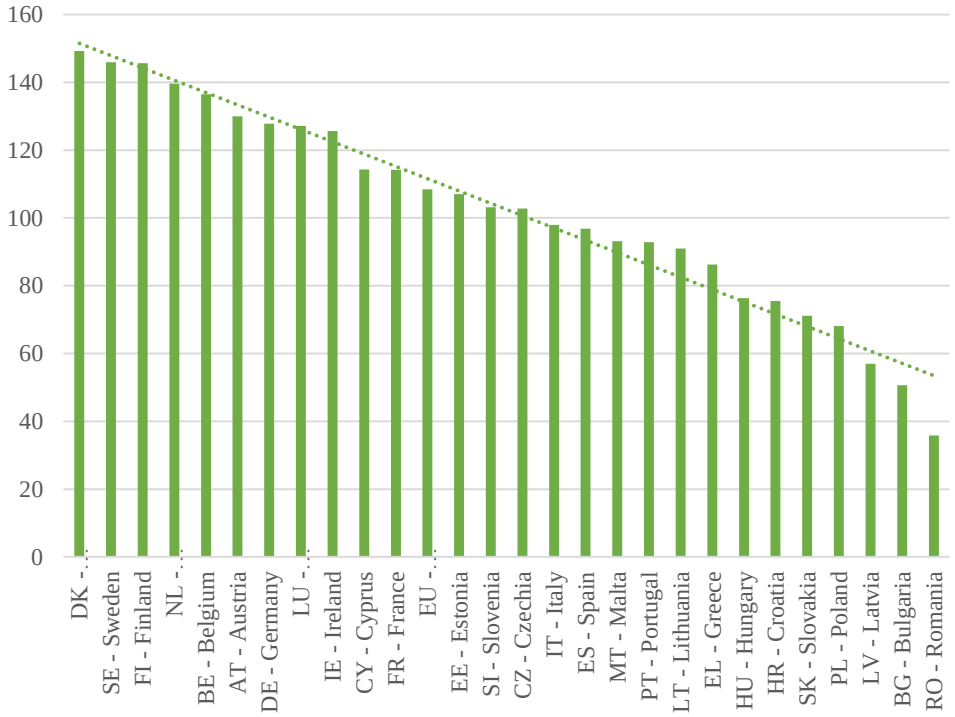
Italy presents a distinctive profile regarding employment and NEET values within the context of European countries. The nation exhibits a relatively low employment rate of 60.2%, positioning it among the countries with one of the lowest rates in the listed cohort. Concurrently, Italy grapples with a high NEET rate of 26.4%, significantly surpassing the average NEET rate for the listed countries (OAVG - 14.3%).

Comparatively, Italy's employment rate falls below the average of the listed countries, signaling a notable challenge in affording employment opportunities for its populace. This scenario suggests difficulties in providing sufficient avenues for occupational engagement. Moreover, Italy's NEET rate stands substantially higher than the European average, indicating that a noteworthy segment of its population, especially youth, neither pursues education nor participates in gainful employment. The elevated NEET rate underscores concerns about a significant cohort of young individuals disengaged from the workforce and educational pursuits.

In summary, Italy confronts a significant challenge characterized by a high NEET rate juxtaposed with a relatively low employment rate, necessitating a comprehensive examination of strategies to address this complex issue.

Within the framework of university-industry partnerships, the European Innovation Scoreboard (EIS) assumes strategic significance as a fundamental indicator of the innovation ecosystem. Based on the European Innovation Scoreboard 2023, the rankings have shifted substantially, with Denmark claiming the top position, displacing Sweden from its 2022 pinnacle (Figure 2.3).

Figure 2.3: EU Countries, Summary Innovation Index Value, 2023



The European Innovation Scoreboard 2023 categorizes EU member states into distinct innovation categories: Innovation Leader, Strong Innovator,

Moderate Innovator, and Emerging Innovator. Notably, Denmark, Sweden, Finland, Netherlands, and Belgium emerge as Innovation Leaders (Table 2.2), emphasizing their exceptional performance in fostering innovation.

Table 2.2 Innovation Union index 2023	
Innovation leader	Denmark, Sweden, Finland, Netherlands, Belgium
Strong innovator	Austria, Germany, Luxembourg, Ireland, Cyprus, France
Moderate innovator	Estonia, Slovenia, Czech Republic, Italy, Spain, Malta, Portugal, Lithuania, Greece, Hungary
Emerging innovator	Croatia, Slovakia, Poland, Latvia, Bulgaria, Romania

Table 2.3 Gross Domestic Expenditure on Research and Development in EU (%), 2019-2021

YEAR	2019	2020	2021
	Gross Domestic Expenditure on Research and Development (%)		
European Union - 27 countries (from 2020)	2.22	2.3	2.26
1. Belgium	3.16	3.35	**3.22**
2. Bulgaria	0.83	0.85	0.77
3. Czech Republic	1.93	1.99	2
4. Denmark	2.93	2.96	**2.81**
5. Germany	3.17	3.13	3.13
6. Estonia	1.63	1.75	1.75
7. Ireland	1.23	1.23	1.06
8. Greece	1.28	1.51	1.45
9. Spain	1.25	1.41	1.43
10. France	2.19	2.3	2.21
11. Croatia	1.08	1.24	1.24
12. Italy	1.46	1.51	1.48
13. Cyprus	0.71	0.84	0.87
14. Latvia	0.64	0.69	0.69
15. Lithuania	0.99	1.14	1.11
16. Luxembourg	1.18	1.09	1.02
17. Hungary	1.47	1.59	1.65
18. Malta	0.56	0.65	0.64
19. Netherlands	2.18	2.31	**2.25**
20. Austria	3.13	3.2	3.19
21. Poland	1.32	1.39	1.44
22. Portugal	1.4	1.61	1.68
23. Romania	0.48	0.47	0.47
24. Slovenia	2.04	2.14	2.14

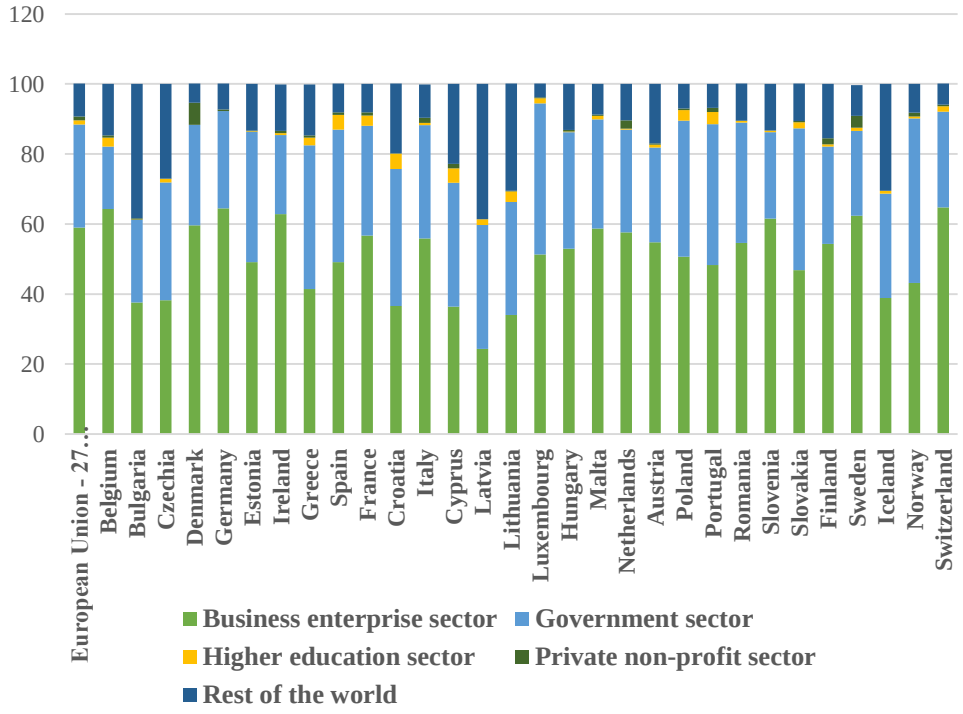
25.	**Slovakia**	0.82	0.9	0.93
26.	**Finland**	2.8	2.91	**2.99**
27.	**Sweden**	3.39	3.49	**3.35**
28.	**Iceland**	2.32	2.47	2.81
29.	**Norway**	2.14	2.24	1.94
30.	**Switzerland**	3.15	:	:

A noteworthy observation stems from the fact that, despite substantial R&D investments in countries such as Germany, France, Austria, and Ireland, these nations are classified as "Strong Innovators" in 2023 rather than attaining the status of "Innovation Leaders." This juxtaposition prompts further exploration into the nuanced dynamics influencing innovation outcomes and classifications within these countries.

Furthermore, the analysis extends to Gross Domestic Expenditure on Research and Development (GERD) at national and regional levels in the European Union (EU), expressed as percentages. This approach provides valuable insights into allocating resources dedicated to research and development activities. Over the period from 2019 to 2021, a discernible upswing in R&D expenditure percentages is evident across the European Union on average.

When scrutinizing the Gross Domestic Expenditure on Research and Development (R&D) in the European Union for the year 2020, a discernible pattern emerges in the distribution of funding sources, particularly within the categories of Higher Education Expenditure on R&D (HERD), Government Budget Allocated to Research and Development (GBARD), and Business Expenditure on Research and Development (BERD).

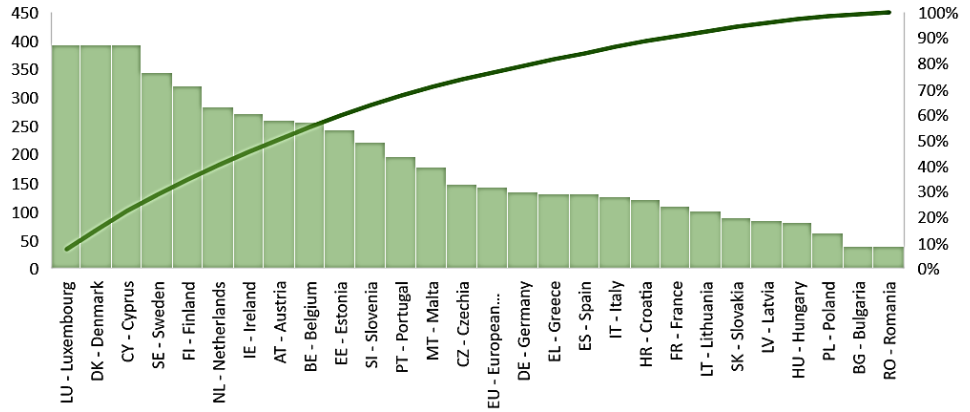
Graph 2.4 Gross domestic expenditure on R & D by source of funds, EU, 2020 (% of total)



Graph 2.4 illustrates that, unequivocally, BERD stands out as the predominant funding source for R&D activities in the EU.

Co-publications are another pivotal metric for consideration, representing collaborative endeavors between academia and industry. Co-publications are a crucial indicator of the depth of collaboration in research and knowledge generation (Graph 2.5). When the frequency of co-publications between universities and businesses is substantial, it signifies a robust partnership and meaningful knowledge exchange between these two sectors.

Graph 2.5 International scientific co-publications (Regional) Value, 2023



In the context of the European Union, Luxembourg, Denmark, and Cyprus emerge as exemplars of strong collaboration in terms of co-publications, indicative of active and fruitful University-Industry Partnerships in these nations.

Elevated co-publication statistics suggest that Luxembourg, Denmark, and Cyprus have effectively fostered an environment where academia and industry engage in proactive collaboration, contributing significantly to generating new knowledge and the impetus for innovation. These partnerships play a pivotal role in advancing research and innovation within these countries, thereby bolstering their competitiveness on the global stage.

2.2 University-Industry Partnership: Sweden, Germany, Czech Republic, Bulgaria

This chapter delves into the realm of innovation across four prominent EU countries: Sweden, Germany, Czech Republic, and Bulgaria. These nations serve as apt representatives showcasing diverse levels of innovation within the European landscape, spanning from the apex of innovation leadership exemplified by Sweden to the nascent emergence seen in Bulgaria.

As an innovation leader, Sweden exhibits extensive involvement in European partnerships, supported by public funds and industry initiatives.

Its significant investments in Research and Innovation and a pronounced emphasis on international collaboration position Sweden as a trailblazer in the innovation domain, epitomizing a knowledge-driven society.

The selection of Sweden, Germany, Czech Republic, and Bulgaria as representatives aligns with a thoughtful approach, considering their distinct positions on the innovation spectrum, as elucidated in Table 2.2.

Innovation Leader: Sweden

Globally recognized as one of the most innovative countries, Sweden strongly emphasizes research and development, education, and fostering a culture of entrepreneurship and innovation. Its substantial investments in high-tech industries, such as ICT and life sciences, underscore its leadership in innovation.

Strong Innovator: Germany

Germany, acclaimed for its prowess in innovation, particularly in engineering, automotive manufacturing, and industrial technologies, earns the status of a decisive innovator. Robust research institutions, collaborations between industry and academia, and a steadfast commitment to engineering excellence collectively establish Germany's strong position in the innovation landscape.

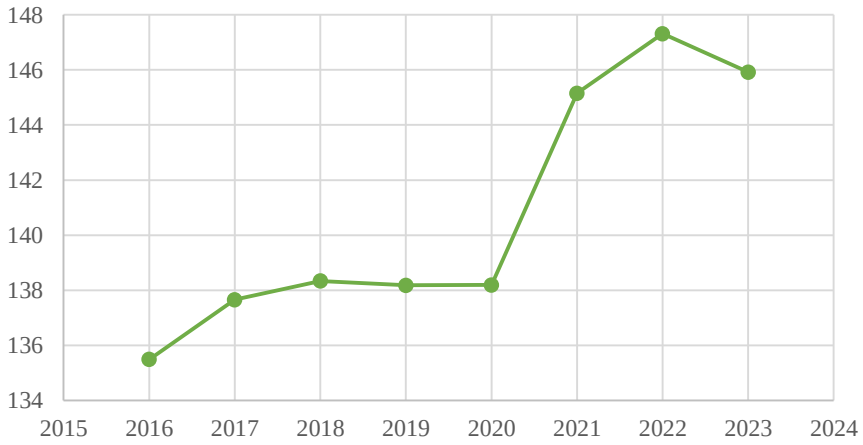
Moderate Innovator: Czech Republic

Czech Republic demonstrates notable progress in innovation, particularly within the technology and manufacturing sectors. While it may not claim global leadership, Czech Republic actively engages in automotive innovation, biotechnology, pharmaceuticals, renewable energy, and environmental innovation.

Emerging Innovator: Bulgaria

Bulgaria, marked as an emerging innovator, has recently intensified efforts to fortify its innovation ecosystem. Initiatives to enhance research and development, promote start-ups, and attract foreign investment in technology. IT contributes to Bulgaria's status as an emerging innovator, reflecting its strides in fostering innovation.

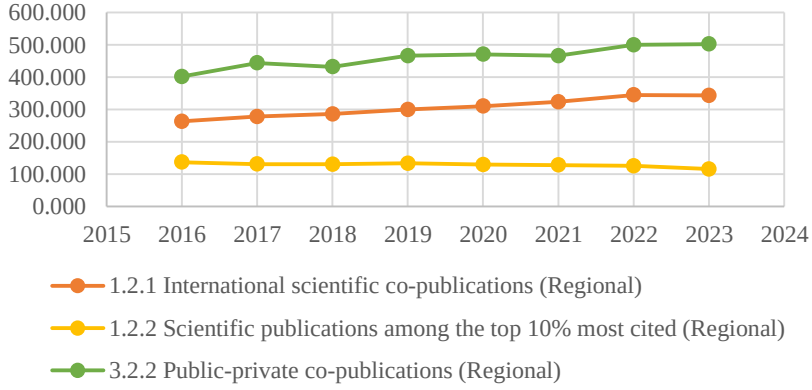
Figure 2.6 Sweden profile over time 2016-2023
Summary Innovation Index



SWEDEN

Sweden demonstrates Innovation Leadership, boasting a performance 134.5% above the EU average. The Innovation index remained relatively constant from 2016 to 2020, experiencing a notable surge in 2021 (Graph 2.6). Our subsequent analysis delves into scientific collaboration metrics in Sweden from 2016 to 2023, focusing on International Scientific Co-Publications, Scientific Publications in the Top 10% Most Cited, and Public-Private Co-Publications (Graph 2.7).

Graph 2.7 Scientific Collaborations and Publications,
2016-2023, Sweden



- **International Scientific Co-Publications (Regional):** Notably, International Scientific Co-Publications consistently rose from 262,900 in 2016 to 343,566 in 2023, underscoring Sweden's active engagement in collaborative research with international peers.
- **Scientific Publications among the Top 10% Most Cited (Regional):** Scientific Publications within the Top 10% Most Cited for Sweden depict variable trends. Commencing at 136,694 in 2016, experiencing a modest increase in 2017, followed by a decline before stabilizing, the count reached 115,346 in 2023. This pattern suggests that, despite Sweden's enduring presence in highly cited publications, fluctuations have occurred in this category over the observed period.
- **Public-Private Co-Publications (Regional):** The number of public-private co-publications in Sweden has ascended from 2016 to 2023, commencing at 402,062 in 2016 and culminating at 502,562 in 2023. This trend indicates robust collaboration between Sweden's public and private sectors concerning scientific publications.

  Notably, Sweden possesses a network of technology transfer offices and intermediaries that offer comprehensive support and guidance of industry collaboration, patenting processes, and the commercialization of research outcomes.

In the context of specific case studies related to the University-Industry Partnership in Sweden, several noteworthy examples merit consideration:

- KTH Royal Institute of Technology and Ericsson: A substantial collaboration between KTH, a premier technical university, and Ericsson, a global telecommunications giant, primarily centers on research on advanced communication technologies, including 5G and beyond.
- Chalmers University of Technology and Volvo Group: This enduring partnership involves collaborative research and development initiatives focused on autonomous vehicles, electrification, and sustainable transportation solutions.
- Uppsala University and AstraZeneca: A robust partnership has been established between Uppsala University and AstraZeneca, a pharmaceutical company, encompassing joint efforts in drug discovery research and development.

- KTH Innovation and Start-Up Ecosystem: Operating as an innovation hub within KTH Royal Institute of Technology, KTH Innovation provides comprehensive support and resources to students, researchers, and alumni seeking to establish their technology ventures, fostering the emergence of successful start-ups.
- Lund University and Tetra Pak: A collaboration between Lund University and Tetra Pak, a company specializing in packaging and processing solutions, centers on sustainability, materials science, and innovations in food packaging.
- Swedish University of Agricultural Sciences (SLU) and IKEA: SLU collaborates with IKEA on sustainable forestry practices and wood sourcing, ensuring responsible and sustainable utilization of wood resources in IKEA's product development.

Vinnova (2023), Sweden's innovation agency, has released a comprehensive report detailing Sweden's involvement in Horizon Europe from January 1, 2021, to February 8, 2023. Within the overall Horizon Europe budget of 15.7 billion EUR (net), Sweden secured a grant of 534.7 million EUR (net), constituting 3.4 percent of the allocated funds. Sweden is the ninth most prosperous country regarding EU funding (net). However, Sweden's grant rate of 3.4 percent falls below the national strategic objective of surpassing 3.7 percent of EU funding (net). Analysis of Horizon Europe participation indicates that Swedish entities are actively engaged in 1,038 projects, with universities spearheading this involvement by securing 53.5 percent of the funds (net) allocated to Sweden.

The Vinnova research highlights a significant observation regarding the ten major participants in the Horizon Europe program, all of which are universities. These institutions collectively have been granted a total of 277.64 million EUR in net EU financing, surpassing half of the overall granted EU net financing of 534.7 million EUR. The prevalence of universities among major participants aligns with expectations for a research and innovation framework program like Horizon Europe, where universities constitute a primary target group.

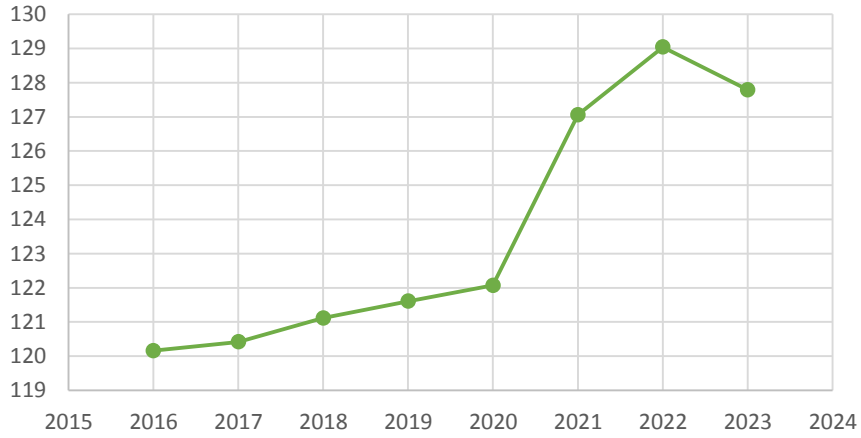
The selection of Sweden as a hub for university-industry partnerships within research or innovation collaborations is influenced by multifaceted factors:

- Innovation Ecosystem: Sweden boasts a rich history of collaboration between universities and industries within its innovation ecosystem.
- Research Excellence: Swedish universities consistently achieve high rankings in global research assessments, contributing to their attractiveness for collaborative initiatives.
- Innovation-Friendly Policies: Sweden's policy landscape incorporates incentives and mechanisms such as grants and tax incentives, fostering an environment conducive to innovation and collaboration between academia and industry.

GERMANY

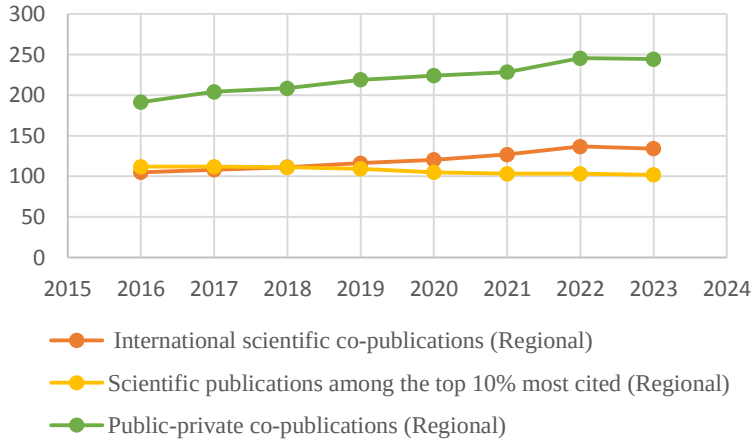
GERMANY stands as a Strong Innovator, achieving a performance level of 117.8% of the EU average, surpassing the mean of the Strong Innovators. The Innovation Index demonstrated relative stability between 2016 and 2020, with a discernible uptick from 2021 to 2023 (Graph 2.8).

Graph 2.8 Germany (2016-2024)
Summary Innovation Index



Subsequently, we will expound upon various scientific collaboration and publication metrics for Germany from 2016 to 2023. Analogous to our approach for Sweden, we will meticulously scrutinize three categories: International scientific co-publications, Scientific publications within the top 10% most cited, and Public-private co-publications. These indicators will be dissected and elucidated for comprehensive understanding (Graph 2.9).

Graph 2.9 Scientific Collaborations and Publications, 2016-2023, Germany



- **International Scientific Co-Publications (Regional):** From 2016 to 2023, the count of international scientific co-publications exhibited consistent growth. The data reveals that 2016 there were 104,876 such publications, escalating to 136,765 in 2022.
- **Scientific Publications Among the Top 10% Most Cited (Regional):** Throughout the years, the quantity of scientific publications from the region among the top 10% most cited has generally remained stable in Germany. While there may be minor annual fluctuations, the data consistently portrays a robust presence of high-impact research emanating from the region.
- **Public-Private Co-Publications (Regional):** This metric gauges the volume of scientific publications resulting from collaborations between public (academic or research institutions) and private (industry or corporate) entities within the region. The data elucidates a substantial

increase in public-private co-publications from 2016 to 2023. Specifically, there were 191,333 such publications in 2016, which surged to 245,496 in 2022.

In Germany, various public measures and initiatives are in place to foster connections between universities, businesses, government facilities, and other entities within supportive networks. The federal government's exploitation offensive underscores the significance of university-industry collaboration, emphasizing the accelerated translation of scientific research outcomes into market applications.

Regarding specific case studies related to University-Industry Partnerships in Germany, notable examples include:

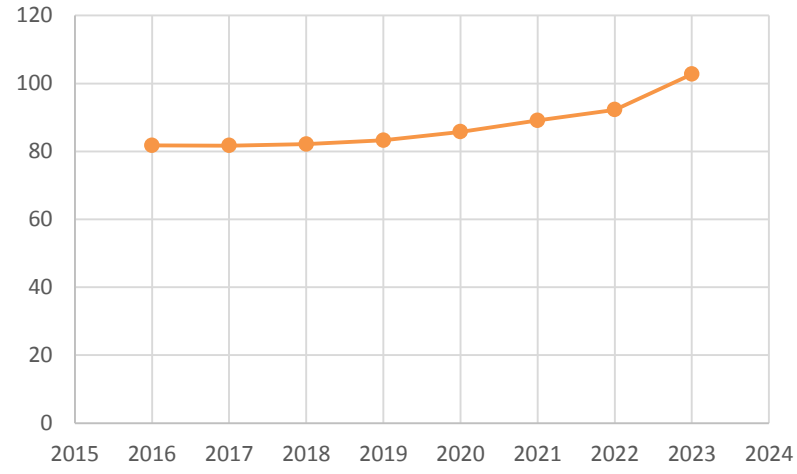
- Siemens AG and Technical University of Munich (TUM): Siemens, a global technology powerhouse, engages in extensive collaboration with TUM. Their joint research projects span diverse domains, including energy, healthcare, and transportation.
- BASF and Karlsruhe Institute of Technology (KIT): BASF, one of the world's largest chemical companies, closely collaborates with KIT, focusing on research areas such as materials science and sustainable chemistry.
- Volkswagen Group and the Technical University of Braunschweig: Volkswagen collaborates with the Technical University of Braunschweig on various automotive research projects, particularly in developing electric and hybrid vehicle technologies.
- Bosch and RWTH Aachen University: Bosch collaborates with RWTH Aachen University on research related to automation and artificial intelligence, contributing to the advancement of intelligent manufacturing solutions and industrial automation technologies.
- Audi AG and Technical University of Ingolstadt: Audi, a leading automobile manufacturer, partners with the Technical University of Ingolstadt in researching autonomous driving technologies and electric vehicle innovations, shaping the future of mobility.
- AstraZeneca and Max Planck Society: AstraZeneca, a pharmaceutical company, collaborates with various Max Planck Institutes in Germany, focusing on drug discovery, precision medicine, and improving treatments for various diseases.

Under the Horizon Europe program, German companies have demonstrated significant success. Large-scale industry players, defined as those with more than 250 employees, achieved a success rate of 25.4%. Similarly, small and medium-sized enterprises (SMEs), encompassing companies with fewer than 250 employees, also exhibited a positive success rate of 23.4%.

Czech Republic

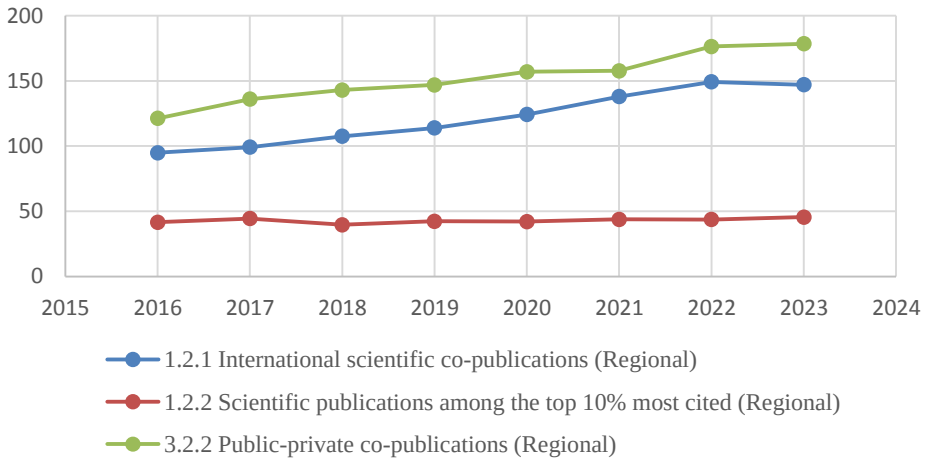
Czech Republic is identified as a moderate innovator, achieving 94.7% of the EU average and surpassing the mean of moderate innovators. Graph 2.10 illustrates a consistent upward trajectory in the Innovation Index from 2016 to 2023, indicating a conducive environment for innovation. The growth rate intensifies over time, with a substantial increase observed from 2022 to 2023, suggesting heightened innovative activities or substantial investments.

Graph 2.10 Czech Republic's profile over time, (2016-2023) Summary Innovation Index



In addition to the overarching analysis, various scientific collaboration and publication metrics—namely, International Scientific Co-Publications, Scientific Publications among the Top 10% Most Cited, and Public-Private Co-publications—are presented for Czech Republic (Graph 2.11).

Graph 2.11 Scientific Collaborations and Publications, 2016-2023, Czech Republic



1. **International Scientific Co-Publications (Regional):** In 2016, Czech Republic engaged in 94,936 international scientific co-publications, demonstrating its active participation in global research networks. From 2017 to 2023, there was a consistent increase, culminating in 147,101 co-publications in 2023. This growth signifies Czech Republic's sustained involvement in global research endeavors.
2. **Scientific Publications Among the Top 10% Most Cited (Regional):** Czech Republic exhibited 41,536 highly cited scientific publications in 2016, indicating the impact and recognition of its research. Although fluctuations occurred from 2017 to 2023, the numbers remained stable, with 45,531 highly cited publications in 2023. This stability suggests Czech Republic's consistent research quality and impact.
3. **Public-Private Co-publications (Regional):** In 2016 Czech Republic witnessed 121,328 public-private co-publications, showcasing collaborative efforts between academia and industry. The numbers steadily increased, reaching 178,540 co-publications in 2023. This growth underscores a robust partnership between academia and industry in Czech Republic.

In summary, Czech Republic's designation as a Moderate Innovator, surpassing its category average, aligns with the positive trend in the

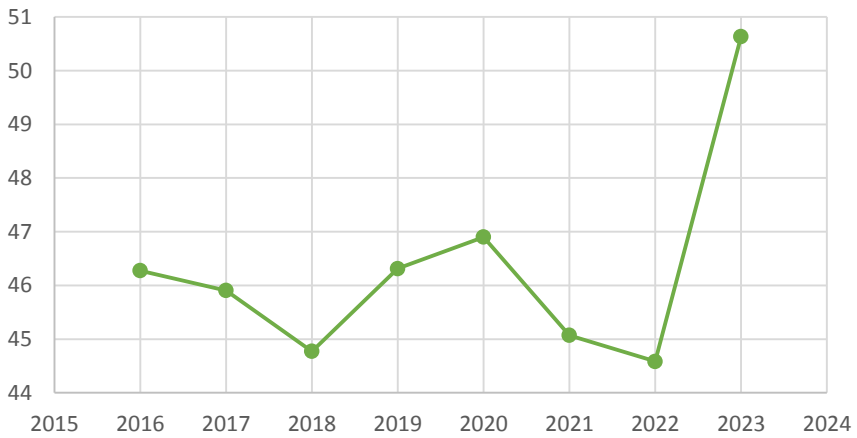
Innovation Index. The observed growth in international scientific collaboration and public-private co-publications indicates Czech Republic's active role in global research networks and a strengthening partnership between academia and industry. Czech Republic maintains a stable presence among highly cited publications amid fluctuations, reflecting its ongoing commitment to research quality and impact. Czech Republic's endeavors in fostering innovation and facilitating academia-industry collaborations position it as a significant contributor to global research and socioeconomic advancement.

BULGARIA

Bulgaria is identified as an Emerging Innovator, performing at 46.7% of the EU average. Bulgaria's innovation performance was evaluated in 2016, with a Summary Innovation Index of 46.276.

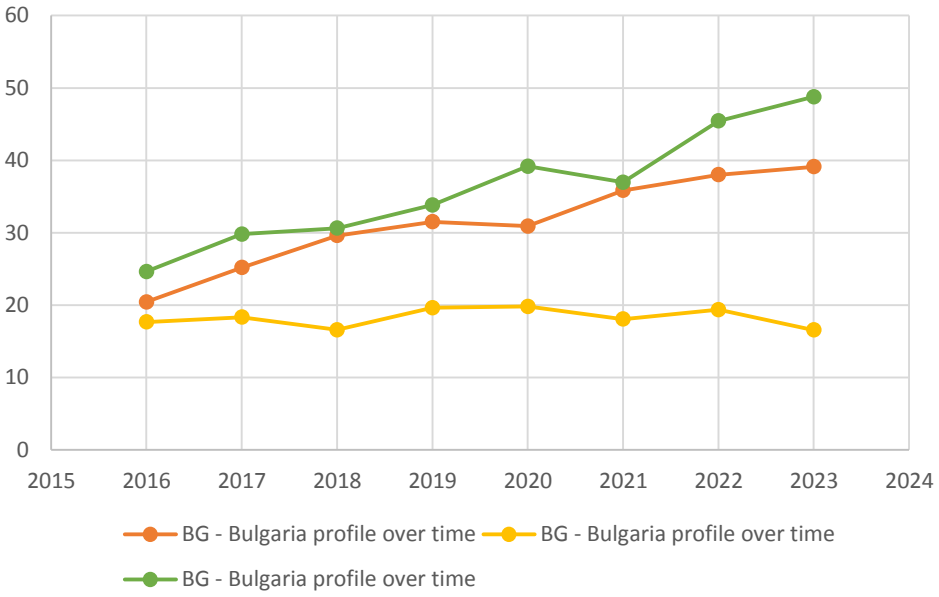
Subsequently, there were fluctuations, declines, recoveries, and a significant improvement in 2023 (Graph 2.12). This pattern highlights the dynamic nature of Bulgaria's innovation landscape over the years.

Graph 2.12 Bulgaria profile over time, (2016-2023)
Summary Innovation Index



In addition to this overarching analysis, various scientific collaboration and publication metrics—namely, International Scientific Co-Publications, Scientific Publications among the Top 10% Most Cited, and Public-Private Co-publications—are presented for Bulgaria (Graph 2.13).

Graph 2.13 Scientific Collaborations and Publications, 2016-2023, Bulgaria



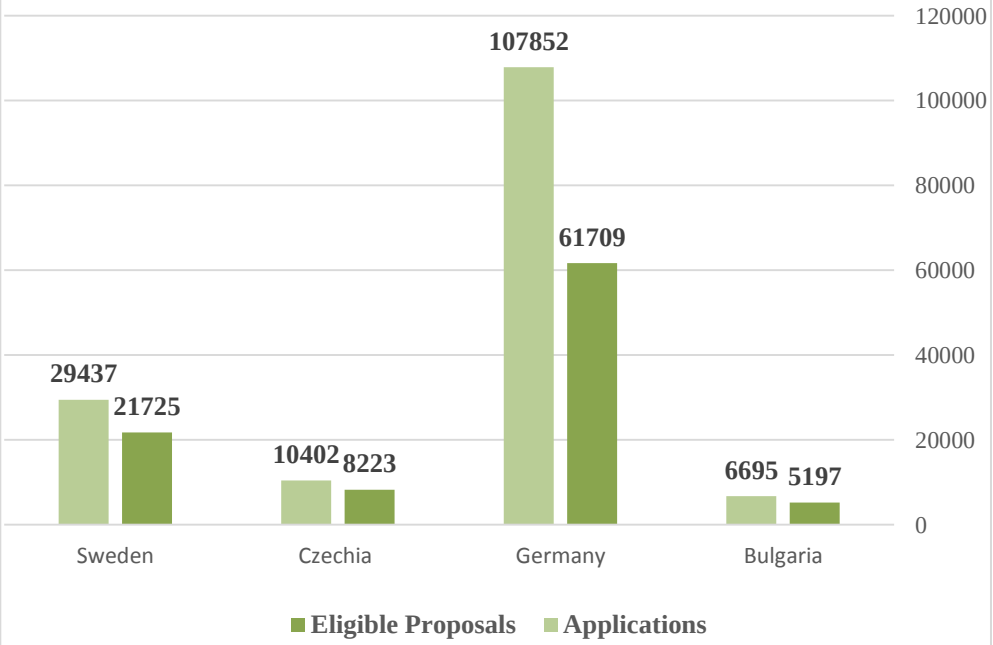
- **International Scientific Co-Publications (Regional):** In 2016 Bulgaria engaged in 20,443 international scientific co-publications, signifying its active participation in global research networks. This number steadily increased, reaching 39,105 in 2023, showcasing Bulgaria's sustained involvement in global research endeavors.
- **Scientific Publications among the Top 10% Most Cited (Regional):** In 2016 Bulgaria contributed 17.66 scientific publications among the top 10% most cited. Although experiencing fluctuations, this metric remained relatively stable, with 16.57 in 2023, indicating a consistent presence in highly cited publications.
- **Public-Private Co-Publications (Regional):** In 2016 Bulgaria recorded 24,631 public-private co-publications, illustrating collaboration between academia and industry. This metric demonstrated growth, reaching 48,772 in 2023, underscoring a strengthening partnership between these sectors.

Bulgaria encountered challenges in its participation in the European Partnership under Horizon 2020. Higher education institutions, research-

performing organizations, and SMEs showed limited interest and capacity to engage in European Partnerships. The deficit in knowledge exchange and cooperation was addressed in a report, which proposed policy and infrastructure suggestions to provide support.

Furthermore, the Horizon Europe program was analyzed for Bulgaria, Germany, Italy, and Sweden, representing the number of eligible proposals and applications submitted (Graph 2.14).

Graph 2.14 Number of Eligible Proposals and Applications Submitted, HORIZON 2020



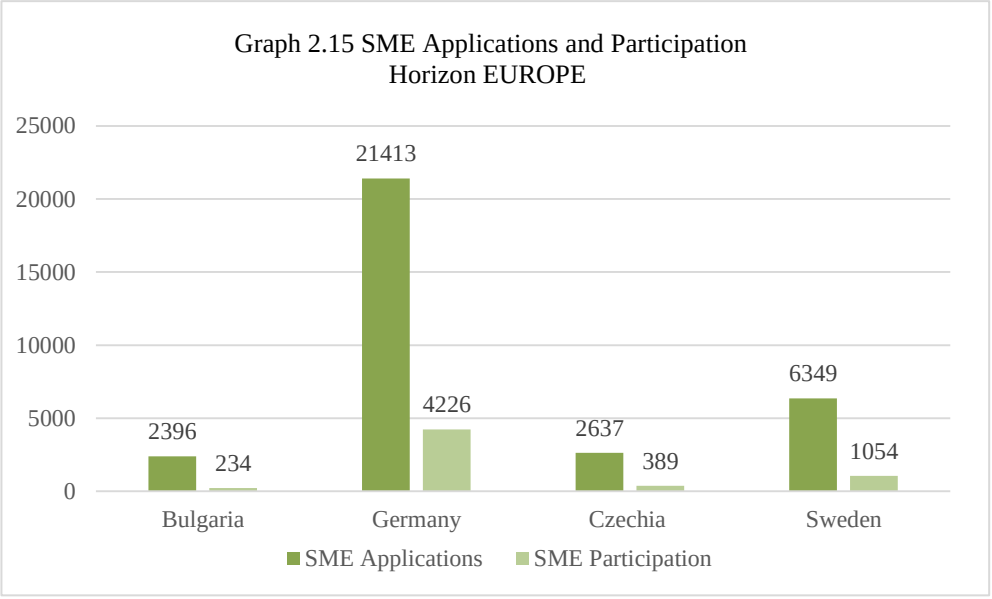
Bulgaria: Submitted 6,695 applications, with 5,197 deemed eligible, indicating active participation and interest in securing funding for research and innovation projects within the Horizon Europe program.

Germany Stands out as one of the most active participants, submitting 107,852 applications, of which 61,709 proposals were considered eligible, reflecting Germany's robust commitment to research and innovation.

- With 10,402 applications, Czech Republic exhibits noteworthy participation in the Horizon Europe program, with at least 80% of these applications being considered eligible.

- In the case of Sweden, although submitting a comparatively lower number of applications, the country maintains a commendable level of engagement, with 21,725 eligible proposals out of 29,427.

Examining the active involvement of Small and Medium-sized Enterprises (SMEs) from these EU-28 countries in the Horizon Europe program reveals valuable insights into SMEs' interest and engagement in securing funding for research and innovation projects.



As depicted in Graph 2.15, Germany and Sweden display many SME applications and robust SME participation, underscoring their strong commitment to research and innovation. Despite submitting fewer applications, Czech Republic demonstrates a considerable presence of SMEs, indicative of a focus on high-quality projects. As an emerging innovator, Bulgaria exhibits a moderate number of applications and SME participation, signaling a growing interest in research and innovation opportunities.

Conclusions:

The presented statistics unveil intriguing dynamics in countries' participation in the Horizon Europe program, particularly concerning their innovation rankings and research collaboration indicators:

- Sweden's standing as a top-ranked country in the Innovation Index underscores its profound dedication to research and innovation. Despite submitting fewer applications than a country like Germany, Sweden's prioritization of quality over quantity emerges as a contributing factor to its leadership in innovation. The robust performance in co-publications and Human Resources in Science and Technology (HRST) statistics reflects Sweden's emphasis on research collaboration and the availability of skilled personnel in science and technology, offering insight into its sustained leadership in innovation.
- Renowned for its high innovativeness, Germany demonstrates substantial involvement in the Horizon Europe program, which is evident in the multitude of applications and eligible proposals.
- The data for Bulgaria, designated as an emerging innovator in 2023, reveals a noteworthy increase in the Innovation Index, co-publications, and international scientific co-publications. With these remarkable advancements, Bulgaria holds considerable potential to enhance its standing within the innovation framework.

2.3 University-Industry Partnership in Transitioning Economies

Within Transitioning Economies, university-industry partnerships manifest primarily along three core dimensions, as documented by scholars such as Huisman et al. (2018), Baskakova et al. (2016), Kekonnen and Sigova (2016), Bychkova (2016), and Jonbekova et al. (2020):

- personnel training,
- job opportunities for graduates,
- science and innovation.

Common collaboration channels involve student mobility facilitated through internship programs and the implementation of joint research programs culminating in publications. Notably, the participation of employers in developing educational programs, academic business ideas, joint R&D projects, and academic entrepreneurship still needs to be improved (Chernitsov & Marutina, 2017; Shabaevaa & Kekkonen, 2017). This

deficiency is attributed to a need for more awareness regarding collaboration benefits, the absence of institutional structures, and a misalignment between industry demands and the knowledge and skills acquired during studies (Bychkova, 2016; Gokhberg et al., 2016).

In Transitioning Economies, university-organization efforts predominantly center on employing student mobility mechanisms, while other structures find lesser applicability or need more institutional foundations. Our comprehensive review highlights the presence of graduate and career guidance centers in Transitioning Economies' universities, primarily disseminating information about available jobs and career development activities. However, structures facilitating the commercialization of academic results need more applicability or are absent.

This study, rooted in interviews within Armenian higher educational institutions, extrapolates its findings to encompass the broader region of Transitioning Economies due to shared historical and regional similarities. The identified institutional drawbacks challenge the efficacy of collaborations between academic institutions and industries. Each of these challenges will be scrutinized.

Career Centers/Services

- **Human Resource Deficiency:** University-industry partnerships frequently encounter challenges due to insufficient qualified personnel dedicated to managing these collaborations. This shortage can lead to project execution delays and impede the identification and exploitation of mutual opportunities.
- **Financial Constraints:** Inadequate funding for collaborative projects and initiatives can restrict the scope and impact of university-industry partnerships. More resources may help research and development efforts, technology transfer, and the establishment of joint ventures.
- **Communication Discrepancies:** Effective communication between universities and industry partners is imperative for successful collaboration. Disparities in communication styles and the absence of established channels may impede the exchange of ideas and information.

- **Trust and Credibility Issues:** Trust is fundamental to successful university-industry partnerships. Concerns related to intellectual property protection, transparency, and ethical standards can pose challenges during the development of collaborations.
- **Regulatory and Legal Barriers:** Complex and inconsistent regulatory frameworks can create obstacles for university-industry partnerships. Legal uncertainties, bureaucratic hurdles, and disputes over intellectual property rights can impede innovation and cooperation.
- **Skills Mismatch:** Mismatched skill sets between academic researchers and industry professionals can hinder the practical application of research findings. Bridging this gap is crucial for translating theoretical knowledge into real-world solutions.
- **Technology Transfer Challenges:** Transferring academic research and innovations into commercial products or services can be intricate. Universities may need more mechanisms and expertise to transfer technology to industry partners.
- **Limited Engagement:** Some university faculties or departments may need to fully engage with industry collaboration efforts, resulting in missed opportunities and underutilized resources.
- **Absence of Job Offers:** The availability of job offers to students may be restricted, and the existing offers may need to align better with students' skills and career goals.
- **Lack of a Mechanism for Assessing Employer and Student Needs:** A mechanism for systematically assessing the needs of employers and students may be lacking, contributing to inefficiencies in the university-industry partnership landscape.

Entrepreneurship development centers within universities in Transitioning Economies manifest diverse statuses, encompassing discontinued operations, recently established centers, actively functioning centers with success stories, and the absence of such centers altogether. Several key issues have been identified, elucidating the challenges faced by these centers:

- **Insufficient Funding:** Financial constraints hinder the operational capacity of many entrepreneurship centers, impeding the execution of crucial programs and initiatives.

- **Inadequate Technical and Territorial Support from Universities:** Universities may need adequate infrastructure, resources, or physical space to operate entrepreneurship centers efficiently.
- **Legal Gaps in Intellectual Property Rights Regulation:** The presence of legal gaps in the regulation of intellectual property rights poses obstacles to the protection and commercialization of innovative ideas, inventions, start-ups, and spin-offs.
- **Lack of Interaction between Intra-University Structures:** A dearth of collaboration and coordination among various departments, units, and faculties within universities may result in missed opportunities for entrepreneurship development.
- **Absence of an Action Plan for Institutional Structures:** Some centers need a well-defined action plan or strategy, and there may be a need for more consensuses among university stakeholders regarding the significance and direction of entrepreneurship development initiatives.
- **Lack of Innovative Thinking among Students, Especially in Humanities Specializations:** Entrepreneurship centers need help fostering innovative thinking, particularly among students with humanities backgrounds.
- **Insufficient Opportunities for State Support:** Limited access to government support and funding presents a significant obstacle to the continued development of these entrepreneurship centers.

Concerning Research and Development (R&D) centers within Transitioning Economies ecosystems, several challenges have come to light:

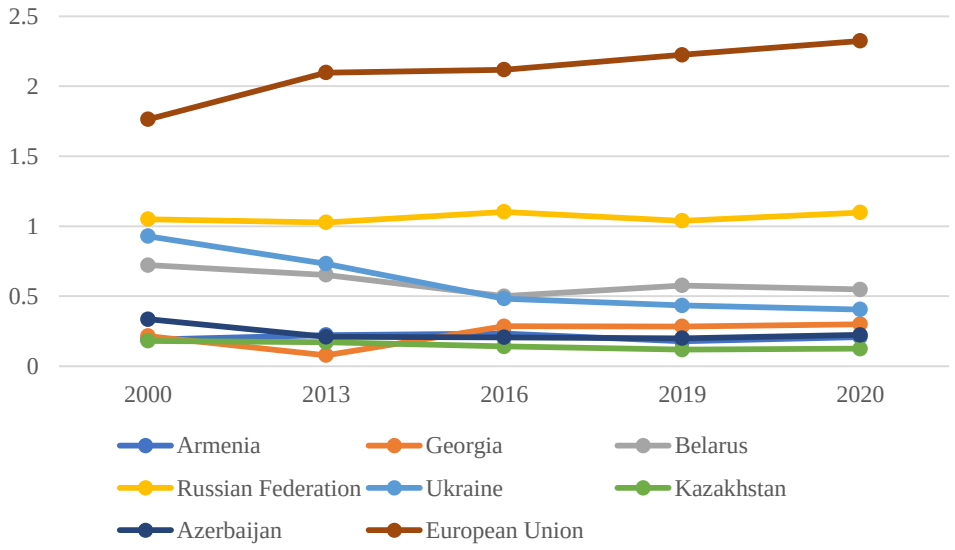
- **Standard and Theoretical Research vs. Market Demand:** A predominant focus on traditional and theoretical research by many university-affiliated R&D centers may result in a misalignment with the dynamic needs and demands of the market. This misalignment can impact the relevance of research outcomes and the practical solutions required by industries and society.
- **Lack of Innovative Collaborative Culture:** The establishment of an innovative and collaborative culture within R&D centers is often hindered by the persistence of hierarchical and bureaucratic structures inherited from the Soviet era. These structural impediments can impede cooperation and creative problem-solving, restricting the center's capacity to generate cutting-edge research and solutions.

- **Lack of Qualified Specialists:** Identifying and retaining highly qualified specialists in specific fields presents a notable challenge for R&D centers.
- **Low Public Financial Support:** Inadequate funding from public sources constrains the breadth and quality of R&D activities.
- **Absence of State Legal Acceleration:** The absence of a clear and supportive legal framework for R&D centers constitutes a significant challenge.

These challenges are particularly accentuated when R&D centers are relatively nascent additions to the university ecosystem in these countries. Consequently, such centers may need help establishing themselves as valuable contributors to academic research and practical innovation.

Resolving challenges related to awareness, institutional structures, and skills mismatch is imperative for fostering enhanced collaboration between academia and industry. These endeavors are poised to contribute significantly to these countries' economic development, innovation, and overall advancement. Our analysis examines the Gross Domestic Expenditure on Research and Development (GERD) data for Transition countries (Graph 2.16).

Graph 2.16 R&D Expenditure in GDP, World Bank, 2022



- **Armenia:** In 2000, Armenia allocated approximately 0.19% of its GDP to research and development (GERD). This percentage experienced a slight increase to about 0.22% in 2013 but subsequently declined to 0.18% in 2019. Notably, in 2020, there was resurgence, with an allocation of 0.21% of GDP.
- **Georgia:** In 2000, Georgia's GERD as a percentage of GDP was around 0.22%. A notable decrease ensued, reaching approximately 0.08% in 2013. However, there was a subsequent increase to 0.29% in 2016, maintaining relative stability in 2019 and 2020.
- **Belarus:** Belarus exhibited a relatively high GERD in 2000, constituting around 0.72% of GDP. Over the years, this percentage gradually decreased, reaching approximately 0.55% in 2020.
- **Russian Federation:** Russia's GERD was approximately 1.05% of GDP in 2000. Despite fluctuations, it generally increased to around 1.10% by 2016 and remained at a similar level in 2019 and 2020.
- **Ukraine:** Ukraine's GERD was around 0.93% of GDP in 2000, yet it significantly decreased, reaching approximately 0.41% in 2020.
- **Kazakhstan:** Allocating about 0.18% of its GDP to research and development in 2000, Kazakhstan's percentage fluctuated but remained relatively low, settling at around 0.13% in 2020.
- **Azerbaijan:** In 2000, Azerbaijan's GERD was approximately 0.34% of GDP, remaining relatively stable, slightly increasing to around 0.22% in 2020.
- **European Union:** The European Union demonstrated a notably higher GERD, at approximately 1.76% of GDP in 2000. This commitment strengthened, reaching around 2.32% of GDP in 2020.

In summary, this data elucidates the diverse levels of investment in research and development as a percentage of GDP across these countries/regions. While some, like Belarus and the Russian Federation, sustained higher GERD percentages from 2000 onwards, others, such as Ukraine, witnessed substantial declines. The European Union consistently showcased a robust commitment to research and development. Furthermore, our analysis delves into Scientific Publications for 2010, 2013, 2016, 2019, and 2020, providing detailed insights into the data (Table 2.4).

Table 2.4 Scientific Publication at Transition Economies 2010-2020

Country Name	2010	2013	2016	2019	2020
Armenia	492	537	538	606	599
Azerbaijan	603	474	585	860	994
Belarus	1051	1094	990	1342	1352
Georgia	340	471	594	610	621
Russian Federation	33855	38295	60205	87168	89967
Ukraine	6011	7271	7864	11931	12777

- **Armenia:** The quantity of scientific publications in Armenia steadily rose from 492 in 2010 to 599 in 2020, with intermittent fluctuations.
- **Azerbaijan:** Azerbaijan experienced a decline in scientific publications from 603 in 2010 to 474 in 2013, followed by a consistent increase, reaching 994 in 2020—a substantial upswing in research output.
- **Belarus:** In 2010, Belarus boasted many scientific publications (1051), slightly decreasing to 1094 in 2013. Despite fluctuations, it eventually rose to 1352 in 2020.
- **Georgia:** Georgia's scientific publications demonstrated a general upward trend, progressing from 340 in 2010 to 621 in 2020.
- **Russian Federation:** The Russian Federation consistently maintained a high volume of scientific publications. There was a significant increase from 33,855 in 2010 to 60,205 in 2016, culminating in 89,967 publications in 2020.
- **Ukraine:** Ukraine exhibited growth in scientific publications, escalating from 6,011 in 2010 to 12,777 in 2020.

In the comparative analysis of the University-Industry Partnership (UIP) between European countries and Transitioning Economies, distinct patterns emerge:

- ✓ European countries exhibit a multifaceted approach to UIP, aiming to bridge academia-industry gaps through collaborations emphasizing employment opportunities, personnel training, and innovation. Collaboration channels encompass student mobility, joint research programs, co-publications, and commercialization of Research and Development (R&D) outcomes. Northern and Central European nations demonstrate robust employment rates. Southern European countries, particularly Italy, face challenges indicated by lower employment rates

and higher NEET (Not in Education, Employment, or Training) rates, especially among the youth.

- ✓ Transitioning Economies focus their UIP on personnel training, job opportunities, and science and innovation. Collaboration channels predominantly involve student mobility and joint research programs, with limited participation in academic entrepreneurship and joint R&D projects. Institutional drawbacks include awareness gaps, absence of structures, and misalignment between industry demands and educational outcomes. Challenges extend to career centers, entrepreneurship development centers, and research and development centers, encompassing funding issues, infrastructure, legal constraints, and skills mismatch.
- ✓ European countries emphasize diverse innovation indicators, including employment rates, innovation performance, and varied collaboration channels. Transitioning Economies concentrate more on personnel training and job opportunities, with less emphasis on innovation metrics. While European countries engage in extensive co-publications and commercialization, Transitioning Economies exhibit limited involvement in entrepreneurial activities and joint R&D projects.
- ✓ Challenges faced by European countries relate to labor market dynamics, while Transitioning Economies encounter foundational issues of institutional readiness and awareness, reflecting distinct obstacles in building effective partnerships. Notably, European countries allocate a higher percentage of GDP to research and development, underscoring a robust commitment to innovation. Furthermore, European countries surpass Transitioning Economies in the number of scientific publications, signaling a more entrenched research culture.
- ✓ EU versus Transitioning Economies: The European Union (EU) consistently allocated a higher percentage of its Gross Domestic Product (GDP) to research and development (GERD) compared to Transitioning Economies. In 2000, the EU's GERD was approximately 1.76% of GDP, while Transitioning Economies, such as Armenia, Georgia, and Azerbaijan, exhibited lower initial GERD percentages, ranging from 0.19% to 0.34%.

- ✓ Variations in Transitioning Economies: Some Transitioning Economies, including Belarus and the Russian Federation, commenced with higher GERD percentages in 2000 and maintained relatively stable investments. Conversely, Ukraine witnessed a substantial decline in GERD percentages over the years.
- ✓ The Netherlands (EU) versus Transitioning Economies: Within the EU, the Netherlands, an EU member, boasts the highest employment rate at 81.8%, suggesting robust employment opportunities. In contrast, certain Transitioning Economies, such as Armenia and Georgia, reported lower employment rates during specific years, highlighting disparities in job availability.
- ✓ Central and Eastern Europe (CEE) versus Western Europe (WE): Central and Eastern European Transitioning Economies generally exhibit employment rates similar to or slightly lower than Western European EU member states. This indicates varying labor market conditions within the EU and among Transitioning Economies.
- ✓ NEET Rates (Not in Education, Employment, or Training): The EU, including countries like the Netherlands, Denmark, and Luxembourg, tends to have lower NEET rates, signaling better opportunities for youth engagement. Conversely, some Transitioning Economies, including Armenia and Ukraine, reported higher NEET rates, suggesting challenges in providing opportunities for young individuals.
- ✓ Innovation Performance: The European Innovation Scoreboard (EIS) elucidates the innovation performance of EU countries. Innovation leaders within the EU, such as Luxembourg, Denmark, and Cyprus, showcase robust collaboration between academia and industry, contributing to their innovation performance. Transitioning Economies encounter challenges catching up with the EU due to lower research and development investment.
- ✓ Co-publications: Luxembourg, Denmark, and Cyprus in the EU exhibit strong collaboration between academia and industry through co-publications, indicating active and productive University-Industry Partnership. While some Transitioning Economies have demonstrated growth in scientific publications, their numbers generally remain lower than leading EU countries.

In conclusion, the comparisons between Transitioning Economies and the EU underscore significant disparities in research investment, employment rates, NEET rates, and innovation performance. European countries manifest a more comprehensive and established approach to university-industry partnership, emphasizing innovation metrics and diverse collaboration channels. In contrast, Transitioning Economies grapple with foundational challenges, resource constraints, and a narrower focus on personnel training and job opportunities.

2.4 University-Industry Partnership in Armenia and Italy

The collaboration between educational institutions and industries is recognized as a pivotal factor in the development of human resources, with each party having distinct expectations from this collaborative endeavor. Universities are motivated to engage with businesses to cultivate highly competitive graduates and align with the demands of the labor market. Conversely, businesses anticipate acquiring personnel possessing profound knowledge and essential skills, focusing on cost-effective training. This traditional university-industry mechanism has evolved into a contemporary source of innovative solutions, driving technological advancements within organizations, enhancing productivity, fostering economic growth (Chedid & Teixeira, 2018), generating new knowledge and interactions, yielding long-term benefits (Van Rijn et al., 2018), and disseminating scientific technology (Rahm et al., 2000).

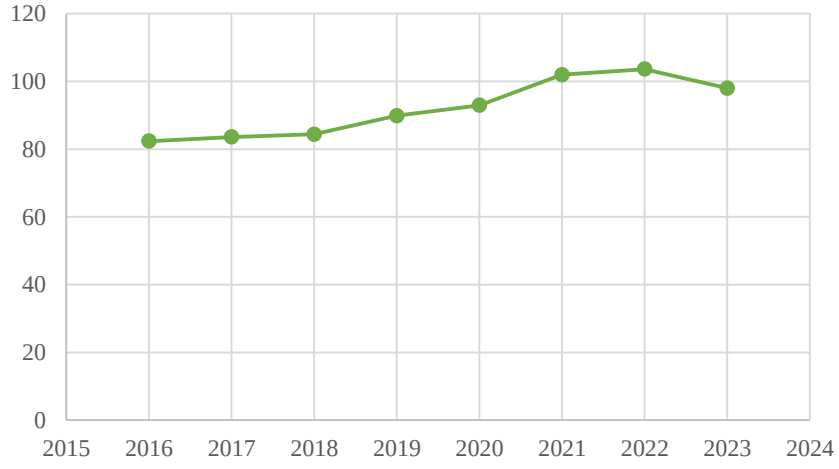
Thus, the contemporary objectives of university-industry collaboration extend beyond the traditional paradigm. The collaboration is geared towards modernizing the education sector, improving graduates' employability, and maximizing knowledge utilization. Within this framework, sustained cooperation between the involved entities emerges as a cornerstone for advancing educational and research domains (Albuquerque et al., 2015). Moreover, such collaboration facilitates the expansion of economic and innovative capacities within organizations, setting the stage for enhanced labor mobility between the public and private sectors (Larsen et al., 2019).

This subchapter aims to illuminate the collaboration between universities and industries in Italy and Armenia. By delving into these partnerships' dynamics, strategies, and outcomes, we aspire to unveil the distinctive approaches and challenges these countries encounter in bridging the academia-industry divide. Exploring collaborative projects, research initiatives, and knowledge exchange endeavors intends to offer insights into how these partnerships significantly contribute to innovation, economic growth, and societal development within the Italian and Armenian contexts.

ITALY

ITALY stands as a Moderate Innovator, achieving a performance level of 90.3% of the EU average, surpassing the average of other Moderate Innovators. Notably, there has been a consistent improvement in the innovation index from 2016 to 2020, reflecting gradual advancements in Italy's innovation ecosystem. The subsequent period from 2021 to 2023 witnessed a substantial increase, signifying notable progress. However, a slight decline in 2023 suggests the necessity for sustained efforts to uphold and augment the nation's innovation capabilities (Graph 2.17).

Graph 2.17 Italy profile over time, (2016-2023) Summary Innovation Index

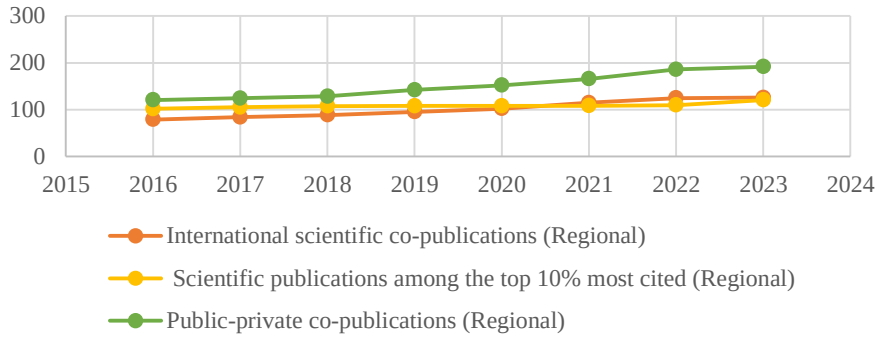


- **Examining International Scientific Co-Publications (Regional)** reveals that Italy, in 2016, participated in 79.031 international scientific co-publications. This figure exhibited a steady annual increase, culminating in 125.774 co-publications in 2023. The continual growth

in international collaborations indicates the active engagement of Italian researchers and institutions with global partners, thereby expanding their international research networks.

- Similarly, in the domain of **Scientific Publications among the Top 10% Most Cited (Regional)**, Italy recorded 79.031 international scientific co-publications in 2016, which consistently rose yearly, reaching 125.774 in 2023. This pattern underscores the proactive involvement of Italian researchers and institutions in collaborative efforts with international partners, contributing to expanding their global research networks.
- **Public-Private Co-Publications (Regional):** Italy recorded 120.69 public-private co-publications in 2016. Subsequently, this metric was a discernible annual rise, culminating in a noteworthy figure of 191.772 by the year 2023, as illustrated in Graph 2.18.

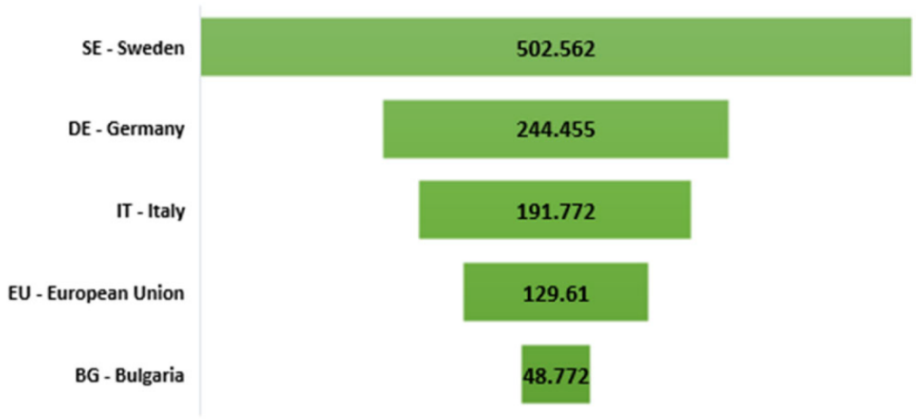
Graph 2.18 Scientific Collaborations and Publications, 2016-2023, Italy



Between 2016 and 2021, notable advancements were observed in business-science collaborations, particularly within the Research and Development framework. However, a decline occurred in 2022, coinciding with Italy's overall decrease in innovation performance. In 2021, Italy's Research and Development (R&D) intensity, represented by gross domestic expenditure on R&D as a percentage of GDP, was 1.48%, dropping from the peak of 1.53% in 2020 (World Bank). This figure remains significantly below the European average of 2.27% in 2021. Despite public-private co-publications surpassing the EU average (Graph 2.19), Human Resources in Science and

Technology (HRST) job-to-job mobility is notably low. Comparative analysis with selected countries reveals that Italy's HRST level is lower than Bulgaria's (Graph 2.20).

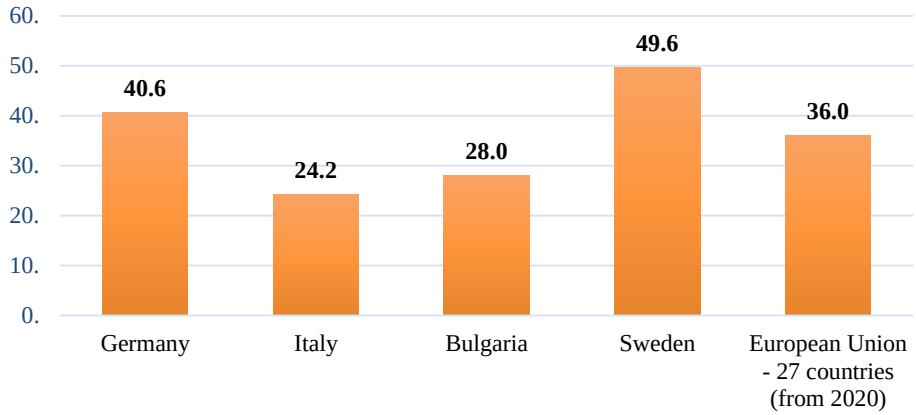
Graph 2.19: Co-publications in Sweden, Germany, Italy, Bulgaria, 2023



Business-science linkages in Italy exhibit underdeveloped potential, given the nation's moderate innovation performance. Both private enterprises and the public sector contribute less to research and innovation than the EU average.

This chapter provides an overview of specific case studies relevant to the discussed topic. Detailed analyses of these case studies will be conducted in subsequent chapters to offer a comprehensive understanding.

Graph 2.20 HRST Job to job mobility, 2023



Università Cattolica del Sacro Cuore and Nestlé Italia:
Collaboration between Università Cattolica del Sacro Cuore and Nestlé Italia, a prominent food and beverage company.

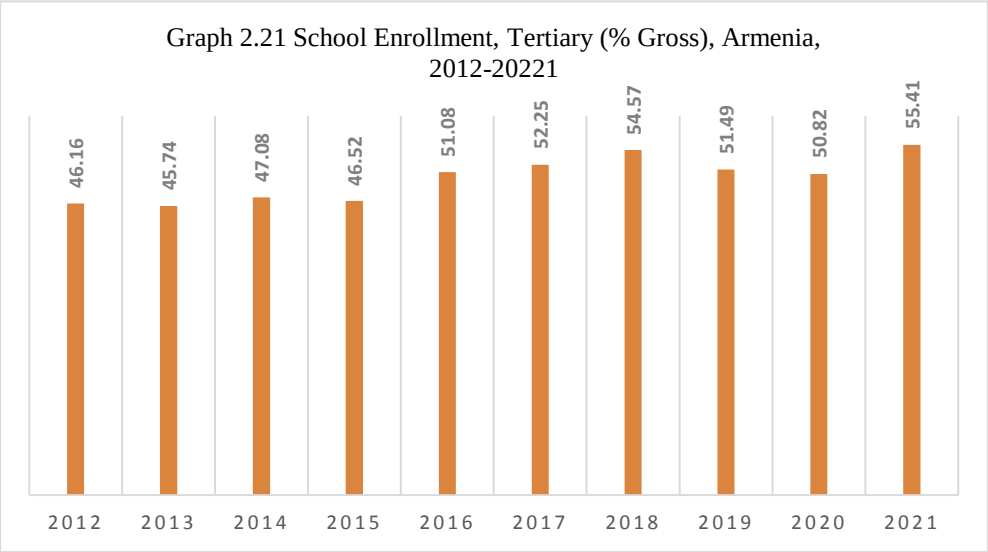
Politecnico di Milano and Pirelli:
Joint efforts on research and development projects centered around tire technology and materials. This collaboration has resulted in innovations in tire design, enhanced performance, and sustainability within the automotive sector.

Università di Bologna and Ducati Motor Holding:
Collaboration involves research projects concerning motorcycle design, engine technology, and materials.

Politecnico di Torino and Fiat Chrysler Automobiles (FCA):
Joint research initiatives focusing on electric and autonomous vehicles, vehicle connectivity, and sustainable mobility solutions.

Armenia
Armenian universities are currently positioned at 78th out of 125 countries, per the 2019 Global Talent Competitiveness Report, an annual publication. Armenia is ranked 101st among these nations in higher education spending, while it holds the 50th position for higher education enrollment. These enrollment and expenditure statistics are extracted from a UNESCO Institute for Statistics publication. Notably, state funding for Armenian universities is conspicuously limited, with an annual allocation from the state budget amounting to approximately 12 billion AMD, equivalent to less than 25 million US dollars.

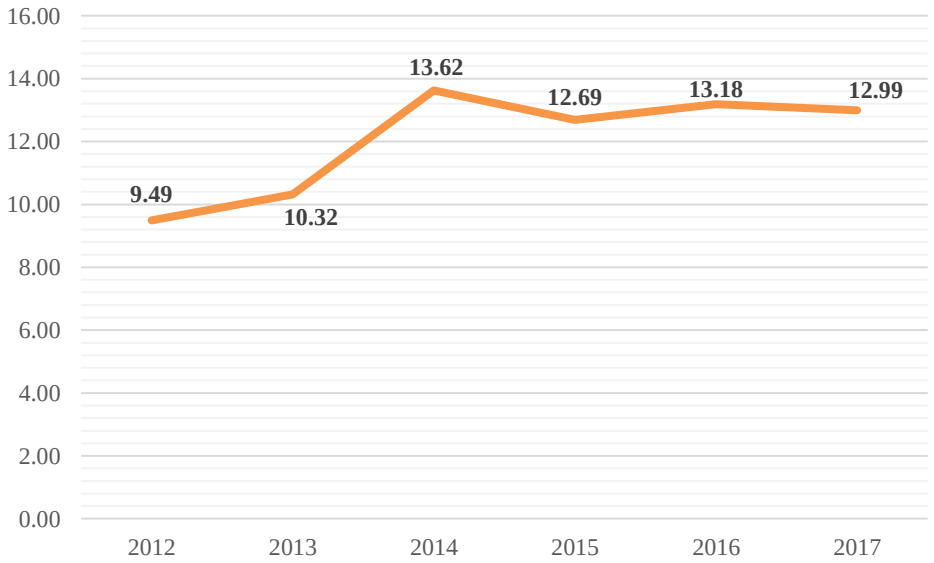
The computation of the tertiary school enrollment percentage, encompassing all students in higher education irrespective of age, involves dividing the number of enrolled students by the population eligible for higher education in a specific age group and multiplying by 100. Graph 2.21 delineates the trajectory of this enrollment index in Armenia from 2012 to 2021. In 2021, the higher education enrollment rate in Armenia was established at 55.41%.



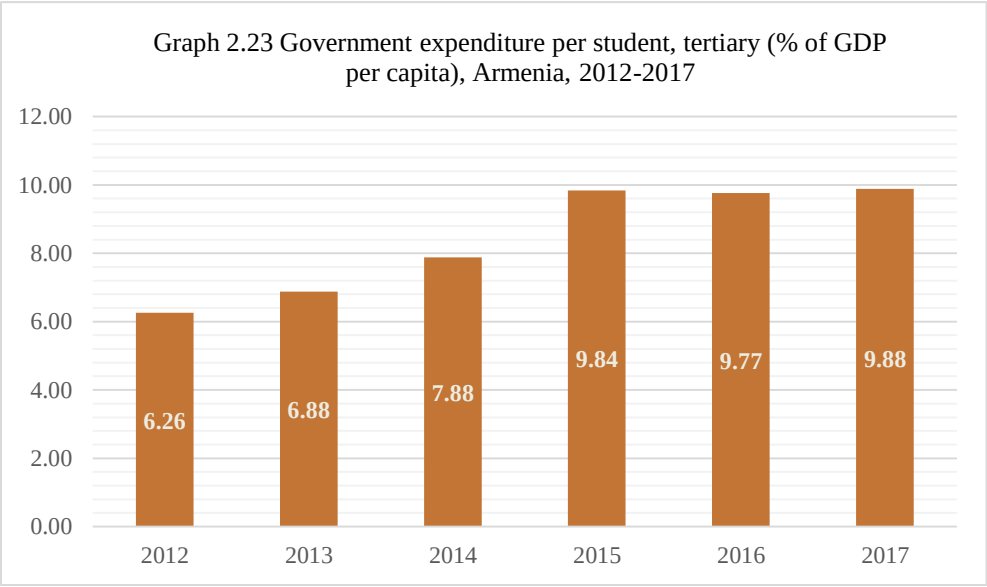
The allocation of funds to higher education is a proportion of the overall government expenditure on education. Specifically, the expenditure on tertiary education represented as a percentage of government expenditure on education is computed by dividing the government's spending on tertiary education by the total government spending on education across all levels, then multiplying by 100. These statistics are obtained from World Bank estimates.

Examining the segment of public expenditure dedicated to a specific education level provides valuable insights into the government's prioritization of that level concerning others. The most recent World Bank data concerning public spending in higher education pertains to 2017. The trends in public spending on higher education from 2012 to 2017 exhibit minimal fluctuations, as illustrated in Graph 2.22.

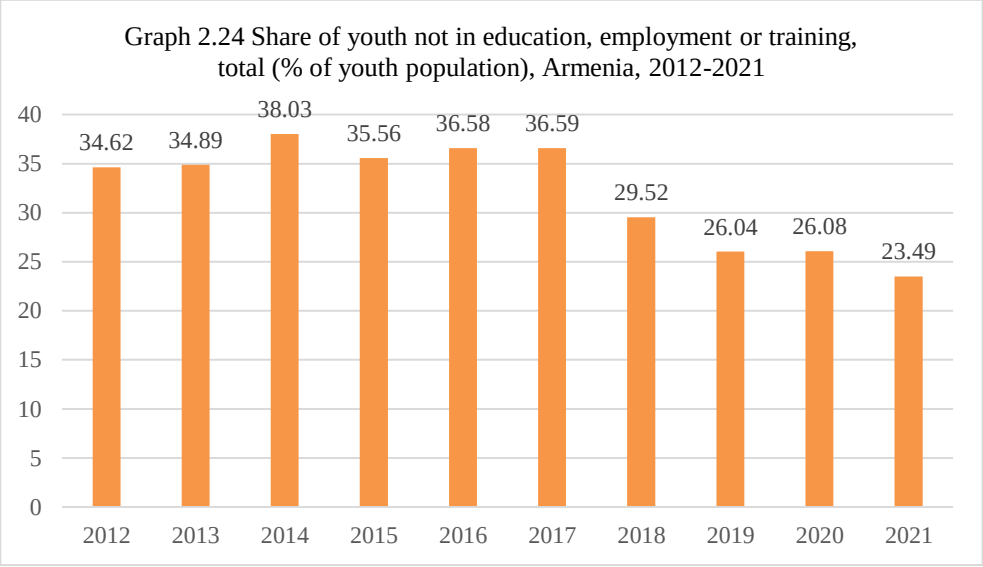
Graph 2.22 Expenditure on tertiary education (% of government expenditure on education) Armenia, 2012-2017



Another pertinent metric for consideration is the government expenditure per student indicator, articulated as a percentage of GDP per capita. Termed Government expenditure per student, tertiary (% of GDP per capita), this metric signifies the total government spending, encompassing current, capital, and transfers, per student at a specified educational level. To compute total government spending per student, the overall government expenditure on higher education is divided by the number of students enrolled in higher education and subsequently expressed as a percentage of GDP per capita, as elucidated in Graph 2.23.

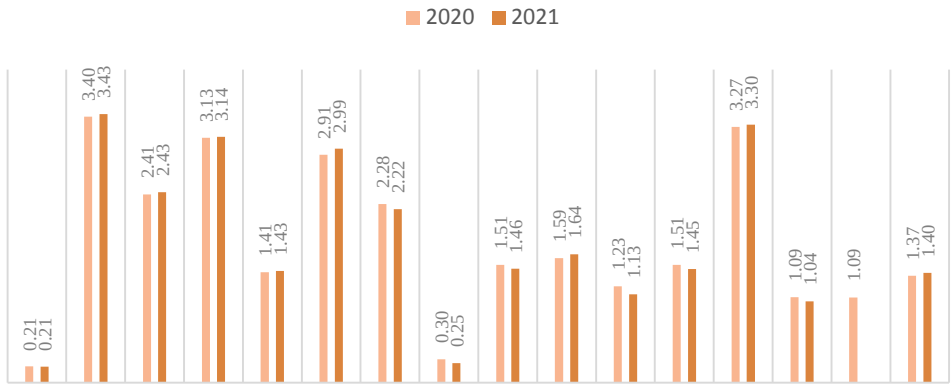


Another crucial metric is the NEET, as per World Bank reports. Armenia's share of young individuals not involved in employment, education, or training (NEET) is prominently high globally. The Labor Force Survey data reveals that in 2021, more than a quarter (23.49 percent) of individuals aged 15 to 24 fell under the NEET classification.



For comparative analyses, we have chosen to scrutinize Gross Domestic Spending on Research and Development (R&D) using data from the OECD and the World Bank. This indicator assumes significance in comprehending the financial resources allocated to R&D initiatives.

Figure 2.25 Research And Development Expenditure (% Of GDP), 2020, 2021



As depicted in Graph 2.25, Italy's investment in research and development falls notably below that of Belgium (3.40%), France (2.28%), and Germany (3.13%). In the Asian context, China and Japan exhibit substantial investments in research and development, with Japan's expenditure slightly exceeding China's. In 2022, Japan allocated 3.30% of its GDP to R&D, while China allocated 2.43%. Despite being influential in innovation and technology, Japan appears marginally more committed to R&D investment than China.

Comparatively, Armenia's investment in research and development is lower than that of Georgia. 2022 Armenia allocated 0.21% of its GDP to R&D, whereas Georgia allocated 0.30%. This metric is a crucial indicator of a country's scientific and technological progress and the extent of work undertaken in these fields.

In the global context, investments in science and research have become priorities, yet many countries need more extensive opportunities for public financial support for research and technology businesses. Analyzing the share of total R&D expenses in 2020, it is evident that Asian countries lead,

constituting 45.4%, North America at 26.9%, Europe at 19.7%, and Africa, the Middle East, and South America combined at 5%. This underscores Asia's significant achievements in the realm of science and research.

Addressing these concerns, the strategic development of university-industry partnerships in the Republic of Armenia (RA) necessitates reevaluating action plans and incorporating conceptual, operational, and structural changes. Prioritizing socio-economic progress and enhancing the efficiency of the scientific research sector in the RA emerge as critical issues, paving the way for scientific-technological and research progress in various formats. Considering the multifaceted channels of university-industry partnership, strategic plans and actions are imperative, employing the Triple Helix approach involving the university, organization, and state in the R&D science and research field.

Chapter 3: Research Analyses:

3.1 Student Perspective Ca’ Foscari University of Venice, Yerevan State University

This study aims to discern the challenges and prospects inherent in university-industry collaboration within higher education institutions, particularly from the viewpoint of students. The investigation focuses on the employment and entrepreneurial opportunities available to Ca' Foscari University and Yerevan State University students.

Founded on August 6, 1868, as the "Scuola Superiore di Commercio" (Advanced School for Commerce), Ca'Foscari University of Venice is the first Italian institution dedicated to advanced education in Business and Economics. It encompasses eight departments, hosts nearly 21,000 students, houses 19 research centers, engages in over 700 foreign exchanges, offers 27 double and joint degrees, features 1,000+ researchers, provides 28 degrees in English, and presents 35+ professional Masters.

To acquire empirical data, surveys were used to collect primary information through written inquiries (Glasow, 2005; Phellas et al., 2011), disseminated among university students. The Career Service facilitated the distribution of surveys to all Ca' Foscari students. The research conducted is grounded in an online questionnaire survey available at https://questionpro.com/t/AScsPZmYkb.

A total of 197 students participated in the survey, and the distribution across faculties and study levels is presented in Table 3.1. The survey, inclusive of closed and open questions in both Armenian and English (refer to Annex 1), seeks to achieve the following objectives:

- Explore students' overall satisfaction, awareness, visit frequency to Career Service, and proposed activities.
- Examine the challenges and opportunities encountered by students when approaching Career Services.
- Investigate the employment and job searching rates among students and their placement experiences.

- Explore entrepreneurial activities among students, assessing their level of participation in start-ups or spin-offs, involvement in patent teams, and the challenges faced during idea development.
- Analyze the support students receive for start-up ideas and the institutional structures they approach for assistance.

Table 3.1 Student participation %, Number

	Answer	Count	Percent
1.	Bachelor Student	72	36.55%
2.	Master Student	114	57.87%
3.	Alumni	8	4.06%
4.	Visiting Erasmus Student	1	0.51%
5.	Erasmus Mundus Student	0	0.00%
6.	Other, Please specify	2	1.02%
	Total	197	100%

Viewed	Started	Completed	Completion Rate	Drop Outs (After Starting)	Average Time to Complete Survey
545	**197**	**154**	**78.17%**	**43**	**3 minutes**

Regarding department involvement, the Table 3.2 delineates the enumeration and proportion of participation for each department.

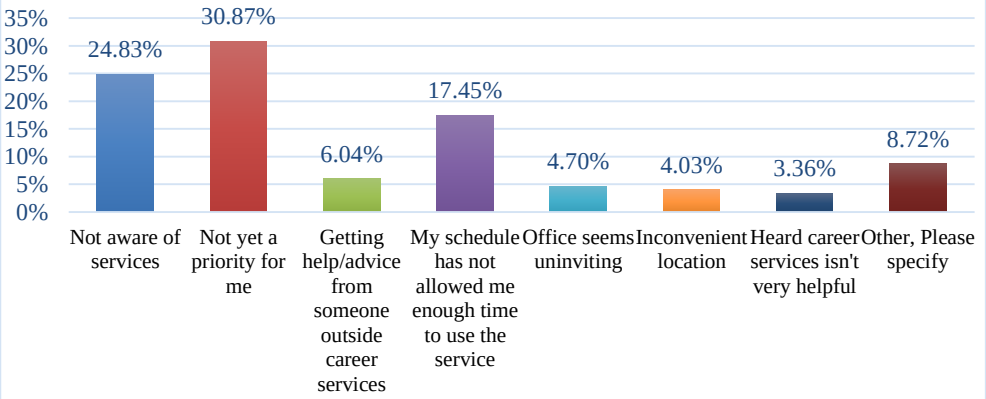
Table 3.2 Ca' Foscari Participation Rates by Faculty

	Answer	Count	Percent
1.	Economics and Management	76	38.58%
2.	Languages and Cultures	44	22.34%
3.	Science and Technology	25	12.69%
4.	Arts and Humanities	25	12.69%
5.	Public Governance and Social Change	0	0.00%
6.	International Studies and Globalization	10	5.08%
7.	Preservation and Management of Cultural Heritage	7	3.55%
8.	Other, Please specify	10	5.08%
	Total	197	100%

Regarding awareness of Ca' Foscari University's Career Service, 157 participants (79.70% of total respondents) acknowledged awareness, while 40 participants (20.30%) expressed a lack of awareness. In response to the inquiry about using Career Services during their study years, of 153

respondents (some responses omitted), approximately 48.37% (74 respondents) affirmed using the services during their academic tenure.

Graph 3.1 Reasons for Non-Usage of Career Service



The findings at Ca'Foscari University of Venice underscore a discernible gap between students' awareness and utilization of career services, which will be further explored in the subsequent presentation of Yerevan State University results. The data reveals that a notable percentage (24.83%) needs more awareness of career services, indicating a need for enhanced promotional strategies. Additionally, a considerable fraction (30.87%) does not currently prioritize utilizing these services, citing factors such as time constraints (17.45%) and perceptions of an unwelcoming office environment (4.70%) as significant barriers (Graph 3.1).

Examining the purposes for which respondents visited the Career Service, prevalent reasons include seeking internship information (25.00%), job search assistance (22.22%), and career counseling (16.67%). While a few respondents (3.70%) expressed no need for appointments, a minority (1.85%) cited other specific reasons not covered in the provided options.

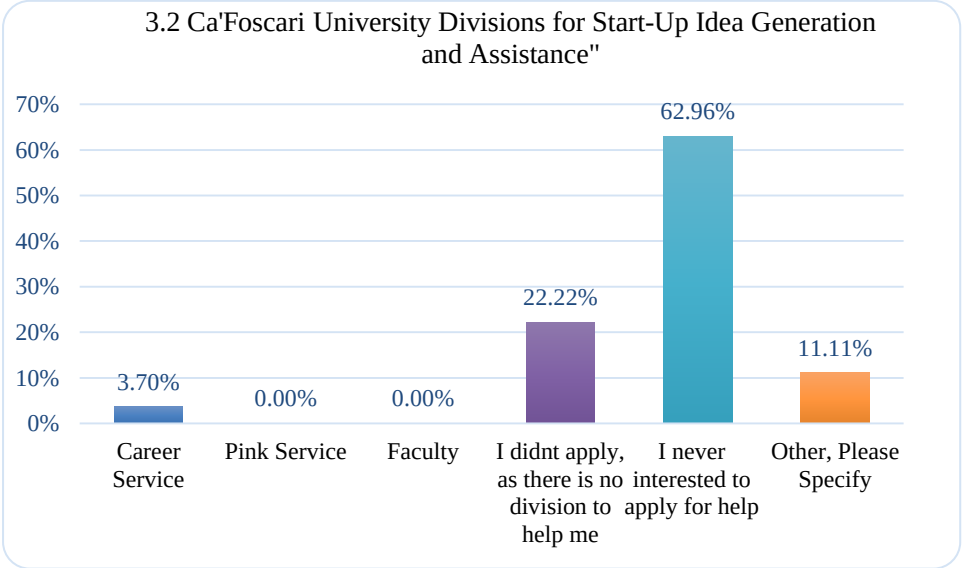
Regarding overall satisfaction with the provided services, a substantial majority (79.66%) either agreed or strongly agreed that Career Services staff members were attentive and diligent in meeting their needs, reflecting a generally positive experience. Furthermore, 74.58% agreed or strongly agreed that the Career Services staff members demonstrated competence

and knowledge. The majority (83.05%) expressed intent to return for future assistance, highlighting the perceived value of the services offered.

An analysis of the respondent's employment status revealed that approximately one-fifth (25%) are employed, likely balancing work commitments with their studies. The majority (75%) reported not being currently employed, encompassing students, those actively seeking employment, or individuals not engaged in the job market for various reasons.

Among respondents with current employment or internship positions, a significant majority (59.09%) secured their positions through independent job search efforts. A smaller percentage (6.82%) credited their college or educational institution for placement support. Furthermore, a considerable majority (66.87%) of respondents not currently employed expressed an active pursuit of employment opportunities, indicating a strong desire to enter or re-enter the job market.

In entrepreneurial endeavors, the collected data indicates that approximately 19.88% (32) of respondents have entertained startup ideas, while the majority, 80.12% (129), has not engaged in such entrepreneurial thinking. This data unveils a minority of respondents involved in startup ideation, highlighting a prevalent disposition toward more traditional career paths among the surveyed students.



Subsequently, respondents were inquired about the specific Ca 'Foscari University Division they sought assistance from or engaged in generating a startup idea or obtaining support (Graph 3.2). The derived data indicates a comparatively restricted utilization of university divisions or resources for generating or supporting startup ideas. Most respondents either needed more interest in seeking assistance or perceived the absence of a dedicated division available to aid them in startup-related pursuits.

Further probing involved students specifying the developmental stage of their startups. Among the minority of respondents (19.88%) with startup ideas, 44.00% (14 respondents) are situated in the idea development stage, signifying a phase dedicated to conceptualizing their startup concepts. Additionally, 4.00% have progressed to the prototype development stage, reflecting advancement in transforming their ideas into tangible products or services. The study identifies 12.00% of respondents in the growing company stage, indicating that their startups are in the early growth and expansion phases. An 8.00% subset has reached the developed company stage, indicative of a more advanced stage in business development. Meanwhile, 28.00% needed help materializing their startup ideas, underscoring challenges or obstacles in realizing their entrepreneurial endeavors.

Following examining the Ca' Foscari University of Venice case, a parallel survey was executed among Yerevan State University (YSU) students. Yerevan State University, inaugurated in 1919, stands as Armenia's largest university and a prominent public institution of higher education. Across its 19 faculties, YSU has graduated approximately 100,000 students and presently accommodates an enrollment of around 20,000 students. A diverse faculty exceeding 1,600 highly qualified specialists facilitates the educational process, including 207 professors, 581 associate professors, 375 assistants, and 453 lecturers. These faculty members actively contribute to the university's educational and research pursuits, organized across over 100 chairs equipped with state-of-the-art techniques and equipment.

The survey gathered responses from 191 YSU students, and the ensuing participation is detailed according to faculty and study level (refer to Table 2). The survey link for further reference is available at (https://questionpro.com/t/AScsPZtAAI).

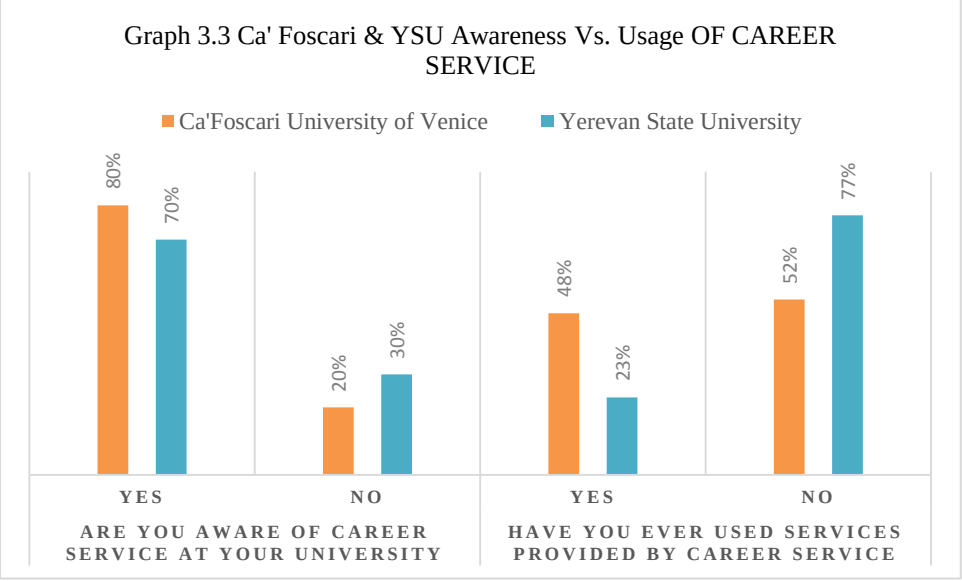
Table 3.3 Yerevan State University: Student participation %, Number,

	Answer	Count	Percent
1.	Bachelor	71	37.57%
2.	Master	23	12.17%
3.	Alumni	70	37.04%
4.	PhD	20	10.58%
5.	Other, Please mention	5	2.65%
	Total	189	100%

Viewed	Started	Completed	Completion Rate	Drop Outs	Average Time
603	**191**	**140**	**73.3%**	**51**	**2 minutes**

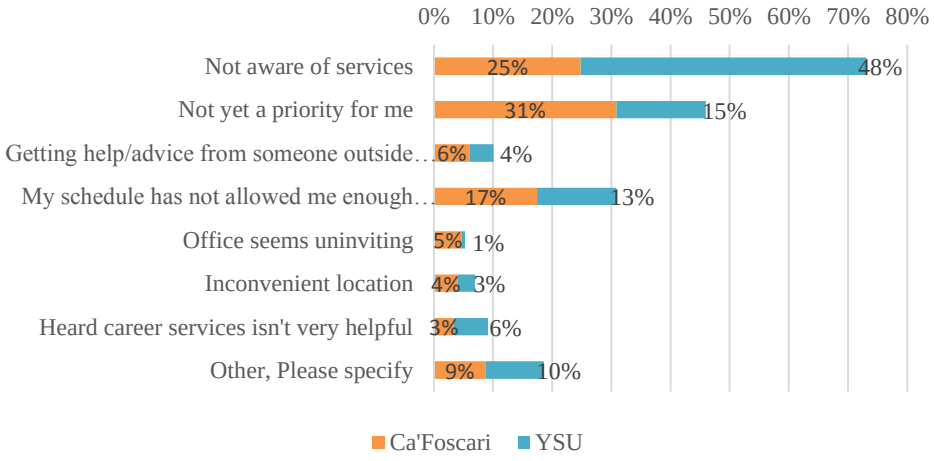
In this section, we present a consolidated comparison of the survey results from Yerevan State University (YSU) and Ca' Foscari University, specifically focusing on entrepreneurship and employment. The analysis encompasses key aspects such as awareness and utilization of Career Services, reasons for non-engagement, and a detailed examination of employment and entrepreneurial pursuits.

Exploring the awareness and utilization of Career Services, the combined results for both universities indicate nuanced differences (Graph 3.3). Notably, YSU exhibits a 70% awareness of the Career Center's functions, while Ca' Foscari University boasts an 80% awareness. However, the utilization of Career Center services during academic years stands at 27% for YSU, compared to a higher 48% at Ca' Foscari University.



Addressing the reasons for the non-utilization of Career Services despite awareness (Graph 3.4), YSU students predominantly need more awareness (48%). In comparison, Ca' Foscari University faces a similar challenge, with only 25% attributing non-engagement to awareness issues. Conversely, around 31% of Ca' Foscari University students considered the services a lower priority, posing concerns about the perceived value of these services or potential limitations in service offerings.

Graph 3.4 Reasons for not using Career Center services

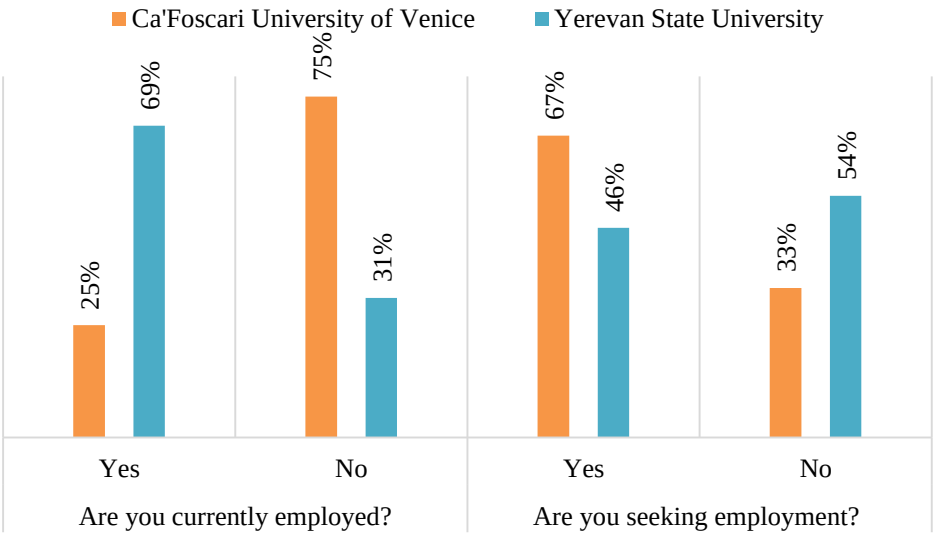


Moving to the employment and entrepreneurship domain, the comparison reveals significant disparities (Graph 3.5). Currently employed individuals at Ca' Foscari University constitute 25%, whereas YSU boasts a substantially higher employment rate of 69%. Analyzing Master's degree students, Ca' Foscari University exhibits a higher percentage (56%), but YSU's Master's degree student participation remains lower at about 12%. Interestingly, when considering alumni participation, only 4% of Ca' Foscari graduates responded compared to 37% of YSU graduates, influencing the overall employment rate disparity.

The data implies specific challenges within Ca' Foscari's Master's degree student cohort, leading to noteworthy unemployment concerns. In conclusion, Yerevan State University demonstrates a significantly higher overall employment rate, predominantly influenced by a more significant number of participating graduates. Despite Ca' Foscari's higher percentage

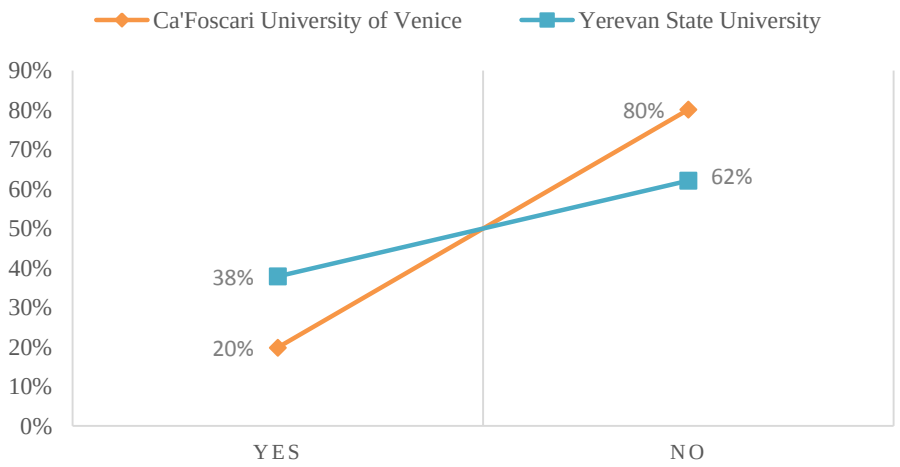
of Master's degree students, they grapple with substantial unemployment challenges within this cohort, indicating the need for detailed examination and targeted interventions to enhance their employment prospects.

Graph 3.5 University Employment And Job-seeking Rate"



Examining the status of students engaged in active employment searches reveals intriguing insights. At Ca' Foscari University, 67% of students are presently immersed in job-seeking endeavors. This indicates that, among the entire student populace, 75% confront unemployment, with a substantial majority actively pursuing job opportunities. Consequently, the elevated employment rate at Ca' Foscari cannot be ascribed to mere student participation; the data underscores that a significant proportion of students (67% out of 75%) proactively explore job prospects. In contrast, Yerevan State University (YSU) manifests a scenario where 69% of students are currently employed, yet 46% remain actively engaged in job searches. This suggests that a substantial segment of employed YSU students may harbor dissatisfaction with their current roles, actively seeking improved employment opportunities.

Graph 3.6 Startup Ideas Among Students Rate



Subsequently, an examination was conducted to assess whether students in both institutions harbored startup ideas and, if so, to scrutinize the developmental stages of these startup concepts and discern any support received from internal university structures. The data unveiled notable disparities, with 38% of students from Yerevan State University (YSU) reporting startup ideas, surpassing the 20% reported by their counterparts at Ca' Foscari University of Venice (Ca'Foscari) (Graph 3.6).

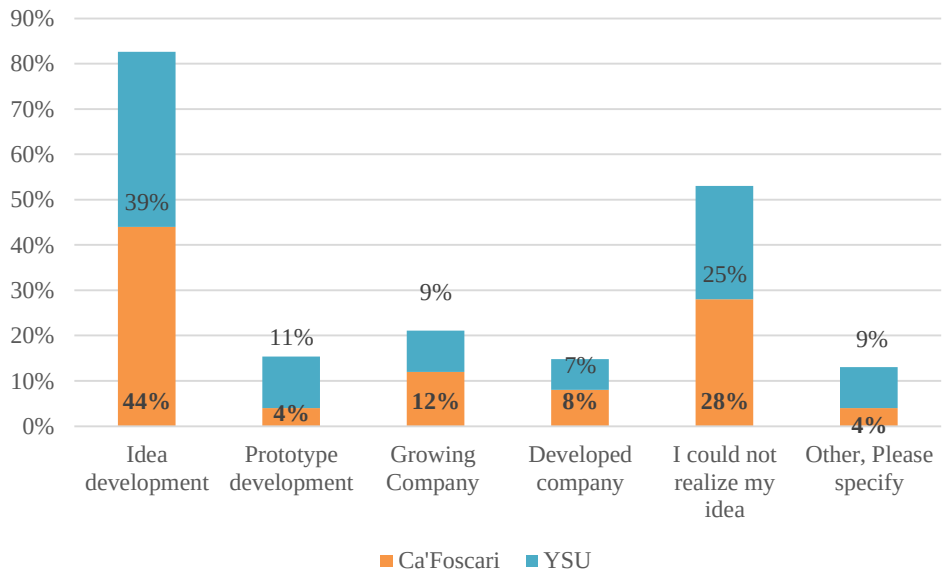
Further analysis delved into the responses provided by Ca'Foscari and YSU students concerning their startup development experiences. The findings were categorized into stages of startup evolution, along with segments for unrealized ideas and "Other" responses (Graph 3.7).

In the Idea Development stage, 44% of respondents at Ca'Foscari and 39% at YSU engaged in the initial development of startup ideas. Moving to the Prototype Development stage, a smaller percentage at both institutions worked on prototypes, with 4% at Ca'Foscari and 11% at YSU reaching this phase.

The category of Growing Company, indicative of students progressing to the point of establishing a growing company, reflected 12% at Ca'Foscari and 9% at YSU. Developed Company, representing the successful development of startup ideas into established companies, saw 8% of students at Ca'Foscari and 7% at YSU achieving this level of success.

Notably, a considerable proportion of respondents at both institutions (28% at Ca'Foscari and 25% at YSU) expressed an inability to realize their startup ideas, citing diverse reasons for the unfulfilled initiatives.

Graph 3.7 Starup Development Stage Among Students



In conclusion, the data indicates a substantial engagement of students from both universities in the nascent startup development phases, focusing on conceptualizing their ideas. However, a discernibly lower proportion of students have advanced to stages involving prototype development and the evolution of their ideas into tangible companies. Furthermore, a notable cohort at both institutions encountered impediments, hindering the realization of their startup initiatives.

Subsequently, exploring students' responses regarding the university divisions they approached for assistance in generating startup ideas revealed noteworthy patterns. Many Yerevan State University (YSU) and Ca' Foscari University students indicated a need for more applications or interest in applying to any specific university division for support. The breakdown of responses is as follows:

At YSU, 39% of students expressed non-application due to the absence of a dedicated structure or division for startup support, and 41% displayed disinterest in applying to any division for assistance.

At Ca' Foscari, 22% of students cited the absence of a specific division for seeking assistance, and a more substantial percentage, 63%, articulated a lack of interest in applying to any division for support. In summary, this data suggests that many students at Yerevan State University and Ca' Foscari University either perceive a dearth of relevant divisions or structures available for supporting startup ideas or lack the inclination to seek assistance from such entities.

Conclusions drawn from the data and analysis are as follows:

1. **Awareness and Usage Discrepancy:** The study highlights a significant disjunction between students' awareness of Career Services and their actual utilization. This underscores the necessity for proactive communication strategies to bridge this awareness-usage gap effectively.
2. **Satisfaction and Service Quality:** Students who have availed themselves of Career Services express high satisfaction levels, implying that the rendered services are perceived as valuable and of commendable quality. Leveraging this positive feedback can encourage a broader student population to avail themselves of these services.
3. **Startup Involvement:** A minority of students have delved into startup ideas, primarily in the early stages of idea development. This presents an opportunity for the university to intensify support mechanisms for aspiring student entrepreneurs and innovators.
4. **Obstacles to Startup Realization:** The substantial proportion of students needing help to realize their startup ideas indicates potential barriers or challenges in the entrepreneurial journey. Identifying and mitigating these barriers can increase innovation and success in student-led startups.
5. **Employment Status:** Most respondents are not presently employed, aligning with typical student circumstances. This underscores the importance of providing robust career support to facilitate a smooth post-graduation transition into the job market.

6. **Future Trajectory:** The study is a foundational reference point for comprehending the challenges and prospects within university-industry collaboration. It informs forthcoming initiatives to enhance career services and nurture entrepreneurial endeavors among students. These conclusions offer nuanced insights into the existing state of university-industry collaboration and student involvement, providing actionable guidance for future enhancements and initiatives.

3.2 University Perspective: Ca' Foscari University of Venice, Yerevan State University

A methodical series of strategic procedures was employed to comprehensively investigate the University-Industry Partnership at Ca' Foscari University of Venice and Yerevan State University. These steps were designed to gain nuanced insights into the partnership, elucidate its operational intricacies, and assess its impact.

The initial phase of this research initiative encompassed on-site visits and interviews with key stakeholders and participants integral to the University-Industry Partnership ecosystem. At the Ca'Foscari University of Venice, interviews and site visits were conducted at the Career Service, Pink Service, VeniSIA, and Ca'Foscari Spin-offs.

The initial visit and interview were coordinated with Rosaria Valastro, who oversees the Career Center. During this engagement, a comprehensive discussion was held on student employment and entrepreneurship topics. The primary platform for accessing employment opportunities was identified as Jobiri. However, as detailed in Subchapter 3, survey findings indicate that students generally do not perceive the Career Service as a prominent resource for seeking support in innovative or entrepreneurial pursuits.

Furthermore, an analysis was conducted on other projects and structures promoting research and entrepreneurship within Ca' Foscari University. Notably, the university participates in the Research and Innovation Corporate Affiliation Program (RICAP), which is designed to enhance

research collaboration opportunities between the university and industry, explore and exploit research results, and develop innovative projects.

Notably, until 2016, the university needed a dedicated technology transfer office. The establishment of such an office was part of the 2014-2020 Strategic Plan, which led to various initiatives fostering university-industry partnerships. Within this framework, the Pink office was created. The Pink Service at Ca' Foscari University of Venice is a specialized unit that fosters knowledge, entrepreneurship, and innovation. The service promotes entrepreneurship within the university community by providing aspiring entrepreneurs with essential tools, mentorship, and resources.

Pink Service extends a comprehensive technology transfer encompassing various services, including scouting activities for scientific results, identification of financing opportunities, technological enhancement, and consultancy in prior art search and filing phases. Additionally, the Service engages in the valorization and promotion of inventions. The Pink Service at Ca'Foscari University of Venice is a pivotal catalyst for entrepreneurship and innovation by offering various services and resources, empowering individuals to translate their concepts into successful ventures.

Examining the research metrics at Ca' Foscari in 2023 provides a quantitative perspective:

- Total University Investments in Research: €15 million
- Investments in Research Projects and Archaeological Excavations: €1 million
- Marie Curie Individual Fellowships, First in Italy: 143
- ERC Projects (European Research Council): 17
- ESF Research Grants (European Social Fund): 169
- Research Scholarships: 80
- International Projects since 2014: 235, of which Horizon 2020: 151
- Researchers: +600
- Research Fellows: +130
- Visiting Scholars: +100
- Ph.D. Students: 350
- Patents filed with Ca' Foscari inventors: +50
- Spin-offs: 13

- A notable initiative at Ca'Foscari University is VeniSIA, established in 2020 and located in Venice, which is dedicated to fostering innovation with a focus on nurturing business concepts and technological innovations. Operating as a sustainability innovation accelerator, VeniSIA is oriented toward developing solutions addressing climate change and environmental challenges, aiming to transform Venice into an accelerator. VeniSIA collaborates with private and public entities, independent entrepreneurs, students, and the academic sector.
- MOSAICO, or Ca' Foscari Innovation Network, represents a strategic initiative interlinking education, research, and societal aspects to create innovation and knowledge transfer opportunities.
- Additionally, the Service Center for the University's Scientific Instruments (CSA) at Ca'Foscari, which manages and leverages the university's scientific equipment, serves as a central hub. The center pursues funding independently or through partnerships to acquire cutting-edge interdisciplinary equipment. It also oversees technological platforms accessible to both university-affiliated and external users.
- Interviews were conducted with Ca' Foscari Spin-offs, including VeNice, Biofuture Medicine, and Strategy Innovation. To achieve University Spin-off status, inventors must apply for accreditation, which is valid for five years. Following this period, a reevaluation is necessary to ensure compliance with regulations regarding conflicts of interest related to business activities. Spin-offs losing status will no longer access university facilities and services, and associated support will cease.
- Noteworthy challenges identified among spin-offs include a gap between researcher and industrial thinking, fundraising difficulties, bureaucratic hurdles, financial challenges, limited university support, and intellectual property rights protection issues. Understanding and addressing these challenges are crucial for enhancing the effectiveness of spin-offs associated with Ca' Foscari University.

Yerevan State University (YSU) underwent a comprehensive investigative process involving interviews with key personnel from the Career Center and the Vice-Rector responsible for student collaborations and employment. Secondary data analysis drew upon the YSU Charter (2016-2021/2011-

2015), the strategic plan (2019-2020), the report on the strategic plan's implementation, and information on the YSU website.

An interview with the Director of the Career Center at YSU aimed to elucidate the center's role in supporting students and alumni in job searches, professional skill development, and career progression. A Specialized Committee was established to foster business collaboration in tandem with the Career Center. Objectives included facilitating partnerships between YSU faculties and enterprises, addressing students' career-related challenges, and promoting entrepreneurship. Despite having a confirmed membership and convening several meetings, the Committee encountered limited progress in executing its tasks due to a lack of interest and engagement from involved parties, including employers, faculty representatives, and university administrative staff. Regrettably, the Committee is presently inactive. The potential contributions of this Committee within the University-Industry Partnership context remain unrealized due to its current state of inactivity.

In 2017, Yerevan State University inaugurated the Entrepreneurship Development Center, strategically focusing on cultivating entrepreneurship among YSU students and fostering knowledge and expertise in innovation. The center aspired to promote and support entrepreneurial initiatives within the university community. Unfortunately, the Entrepreneurship Development Center ceased its operations due to organizational and human resource adjustments. The challenges encountered by the center resulted in its discontinuation, thwarting its initial mission to nurture entrepreneurship and innovation within YSU. The discontinuation of the center stands as a setback, preventing the sustained support of entrepreneurial growth and innovation among YSU students and the broader university community.

Another significant structural division is the "Innovation Solutions and Technologies Center," which steadfastly pursues its mission to enhance educational capabilities in the IT sector, bolster research potential in education, and cultivate an environment conducive to business development. Although physically located within YSU's premises, the center extends its resources to students across all Armenian universities and individuals affiliated with the private sector. As clarified in interviews, it is

imperative to underscore that the ISTC primarily functions as a hub for short-term projects and is not expressly configured as a startup business incubator. However, it is noteworthy that a business incubator was established at Yerevan State University in 2021 and is currently in the finalization stages of processes and frameworks. The university needs a structured entity dedicated to developing entrepreneurial and innovative ideas among students and academicians.

Upon scrutinizing the secondary analysis, it becomes apparent that the YSU Strategic Development Program for 2021-2026 articulates a commitment to advancing innovative research across diverse academic disciplines, encompassing social sciences, socioeconomics, humanities, natural sciences, and mathematics. Nevertheless, it is noteworthy that the strategic plan explicitly mentions fostering innovation and entrepreneurship, and there needs to be more specified indicators or guidelines detailing the necessary institutional, structural, and procedural prerequisites to support these objectives.

Upon closer examination of YSU's strategic development plan and annual activity reports, a significant emphasis is placed on promoting research collaboration among research institutes, universities, and businesses. Remarkably, the university's initiatives in Career and Entrepreneurship activities have experienced minimal changes throughout the strategic planning and implementation processes. This observation suggests a high orientation towards stable development within the existing structures, indicating a reluctance to introduce substantial changes over time.

In conclusion, the interviews have revealed several challenges and obstacles, prompting considerations for policy development implications and presenting recommendations for potential enhancements.

Structural Issues pertain to the functionality of institutional structures within the University-Industry Partnership framework. At YSU, the Entrepreneurship Development Center is no longer operational, and the recently established Business Incubator has yet to achieve full functionality. The Career Center primarily focuses on post-graduation employment support, lacking communication structures for students during their studies. Consequently, there needs to be a structured body fostering academic and

student entrepreneurship and innovation. Yerevan State University initiated specific steps in planning cooperation with enterprises in 2013, establishing faculty-level structures. Despite conducting meetings, practical steps in this direction have yet to materialize due to limited interest from employers, faculty representatives, and university administrative staff.

Conversely, Ca'Foscari University boasts considerable experience promoting entrepreneurship among its academic staff, successfully establishing numerous academic spin-off businesses. However, support for student entrepreneurship is still in its infancy, necessitating significant improvements in the institutional structure.

Operational issues are evident in both universities, characterized by an ineffective communication mechanism between universities and industries and a need for more well-defined regulatory frameworks. The strategic and tactical approaches need more clarity in terms of functionality, and the functions of structural divisions still need to be updated to align with recent changes. This underscores the need for streamlined operational processes and a more coherent approach to achieving partnership objectives.

Systematic issues in university-industry cooperation at YSU persist in reliance on traditional channels, needing more development of advanced structures like Technoparks and spin-offs. From a systematic perspective, the government and relevant ministry exhibit limited commitment, needing a comprehensive approach or projects to stimulate collaboration. The legal framework similarly needs to implement activities and regulations, mirroring the situation at the university level, where strategic planning overlooks the potential utilization of available channels.

It is noteworthy that, in contrast to the robust academic innovation at Ca'Foscari University, the integration of student innovation at YSU remains nascent. Research findings indicate that students prefer seeking support from external sources rather than relying on internal university mechanisms.

Educational issues at YSU include the absence of dedicated modules or courses fostering innovation among students and academics. In contrast, Ca' Foscari University addresses this gap through its MINOR educational program, engaging students across diverse fields. Consisting of three

courses with additional credit offerings, the program enhances students' innovative and entrepreneurial capabilities. A challenge arises after post-program completion, as the university needs to facilitate connections for further idea development or provide necessary technical and financial support. This highlights a potential area for improvement in fostering continuous support for student innovation.

To address the identified challenges, the following policy implications and recommendations are proposed:

Structural Recommendations:

1. **YSU Initiatives:** Implement practical measures to initiate the operations of the Business Incubator at YSU, fostering the development of innovative business ideas among academics and students.
2. **Career Center Enhancement:** Transform and review practices within the YSU Career Center, considering the establishment of new departments dedicated to promoting university-enterprise cooperation. Career centers should be integrated into these frameworks for comprehensive support.
3. **Technological Cooperation:** Recognize and address the underdeveloped aspect of technological cooperation and joint research in the university-enterprise collaboration landscape in Armenia. Introducing technology parks could serve as a valuable institutional solution, serving as a model for university systems and contributing to the economic and technological advancement of the country.

Implementation Strategies:

1. **Resource Mobilization:** Given universities' financial and organizational limitations, mobilize resources through engagement with donor structures such as the European Union and the World Bank. State-level policies should involve various consulting and support structures to ensure effective implementation.

Ca' Foscari University-Specific Strategies:

1. **Information Dissemination:** Implement operations at Ca'Foscari University to enhance the dissemination of information, ensuring that students are well-informed about available opportunities.

2. **Financial Support:** Recognize and address the financial constraints academic business founders face. Facilitate avenues for essential financial resources for business development within the university. Advocate for increased state support in this regard, acknowledging the current limitations.

These recommendations and strategies aim to enhance structural frameworks, encourage collaboration, and secure necessary resources to foster a more robust and effective university-industry partnership.

Systematic Aspects:
It is recommended that legislative regulations be established to foster university-industry collaboration systematically. These regulations should incentivize universities through increased state financial support and provide tax benefits to organizations engaging in such collaborative endeavors. This strategic approach creates a conducive environment for sustained and purposeful cooperation.

Operational Enhancement:
Addressing operational challenges involves

- the establishment of a structured communication framework,
- ensuring ongoing engagement and
- implementing targeted programs tailored to the specific needs of all stakeholders.

Creating a graduate-employer interaction platform informed by the lessons learned from unsuccessful programs is imperative for effective operationalization.

Educational/Learning Initiatives:
A proposed educational module at Yerevan State University (YSU) should be introduced across humanities and science-oriented faculties to enrich the educational landscape. This module should include mechanisms for continuous monitoring of developed ideas, provision of technical and financial support, and active involvement of employers in the educational process. The engagement of employers in curriculum development, organizing reciprocal visits and meetings, and the practical utilization of resources and opportunities can initiate a transformative culture within the University-Industry Collaboration framework.

Strategic Outlook:
In conclusion, fostering university-industry cooperation is foundational for the country's scientific, technical, and socio-economic advancement. Developing new collaboration channels and mechanisms, considering the diverse interests and needs of all stakeholders, is crucial for enhancing labor productivity, improving quality, bolstering national competitiveness, and cultivating the nation's innovative potential. This strategic vision underscores the significance of a holistic and inclusive approach to university-industry collaboration for comprehensive societal and economic development.

3.3 University-Industry Partnership in the Armenian Higher Educational System: Case Studies from 6 Universities

The absence of research on the implementation of university-industry collaboration within the academic systems of post-Soviet countries has prompted the initiation of the present study. The primary focus is to discern the specific challenges and opportunities associated with adopting university-industry approaches, with the Republic of Armenia selected as the case study for an in-depth exploration of the subject.

The dissolution of the USSR brought about substantial transformations in Armenia's economic, educational, and labor market systems (Atoyan et al., 2021). Despite these changes, the enduring influence of the Soviet legacy persists in Armenia, manifesting in the prevalent belief that universities predominantly serve academic functions rather than actively engaging with industry to drive innovation. While Armenia encounters shared challenges and common obstacles with other post-Soviet nations—such as limited financial resources, bureaucratic impediments, institutional gaps, and a Soviet-era social mindset—efforts have been made to address these issues through market-oriented reforms and the establishment of mechanisms supporting entrepreneurship and innovation (Karakhanyan, 2018).

The ongoing developments in Armenia, marked by its integration into the European Higher Education Area and the adoption of the Bologna System,

represent crucial factors in promoting collaboration and nurturing innovation (Keryan et al., 2020). These reforms have been strategically implemented to confront challenges inherited from the Soviet era, aiming to establish an effective environment conducive to robust university-industry partnerships.

Through this research endeavor, the primary objective is to elucidate the distinctive factors influencing the successful implementation of university-industry collaborations in Armenia. The outcomes of this study are anticipated to enrich the existing scholarly knowledge and provide valuable insights for formulating strategies and frameworks conducive to fostering effective partnerships between universities and industries in Armenia. Furthermore, the research endeavors to reveal potential areas of growth and innovation while addressing the challenges impeding the establishment of prosperous university-industry collaborations in Armenia. By scrutinizing the specific challenges and opportunities in Armenia, the research aims to unveil common patterns and trends likely to extend to other post-Soviet countries, given the historical and political similarities in the region.

The research seeks to address the following questions, focusing on the University Perspective in Higher Educational Institutions in Armenia:

(1) What are the primary collaboration channels and existing institutional structures/units facilitating interactions between universities and industries in Armenia?

(2) What benefits, barriers, and challenges have universities in Armenia encountered in their partnerships with industry?

This study aims to identify the challenges and opportunities in university-industry cooperation within higher education institutions in the Republic of Armenia. The investigation targets multi-facility universities in Armenia with 3000 or more students, as outlined in Table 3.4.

Empirical data were acquired through surveys, a widely employed method for collecting primary information through written and oral inquiries (Glasow, 2005; Phellas et al., 2011). Surveys were distributed among university faculty and leadership, including chairpersons, department heads, and deans directly involved in developing, managing, and implementing

university-organization cooperation policies. The research utilized an online questionnaire survey (https://questionpro.com/t/AScsPZs6ks), disseminated through the Mulberry document circulation system to faculty leaders (Deans, Vice-deans, Heads of Departments, et) at six higher education institutions in the Republic of Armenia: Yerevan State University (YSU), Armenian State University of Economics (ASUE), National Polytechnic University of Armenia (NPUA), Armenian National Agrarian University (ANAU), Brusov State University (BSU), and National University of Architecture and Construction of Armenia (NUACA).

- The survey elicited responses from 153 participants, and their demographic distribution is presented in Table 3.5. Utilizing the Mulberry document circulation system, surveys were disseminated among the respondents. The survey outcomes, detailed in Table 2, are grounded in the study's theoretical foundation, drawing insights from peer-reviewed scholarly literature. Comprising both closed and open-ended questions in the Armenian language (refer to Annex 1), the survey sought to achieve the following objectives:
- To investigate the prevailing state of university-industry cooperation in the Republic of Armenia.
- To identify the challenges and opportunities inherent in university-organization cooperation at the institutional level.
- To gauge the extent of respondents' participation and involvement in establishing startups or spin-offs and their engagement in patent teams or personal representation in patent applications.
- To scrutinize the institutional structures of universities designed to promote university-industry partnerships.
- To examine collaboration channels and mechanisms within the framework of university-industry cooperation.

Table 3.4: University Description

N	**University**	**Faculties**		**Chairs**	**Students Number**
1.	Yerevan State University (YSU) 1919 (http://www.ysu.am/)	19		100	20 000
		Humanitarian Sciences	Natural Sciences		
		12	7		

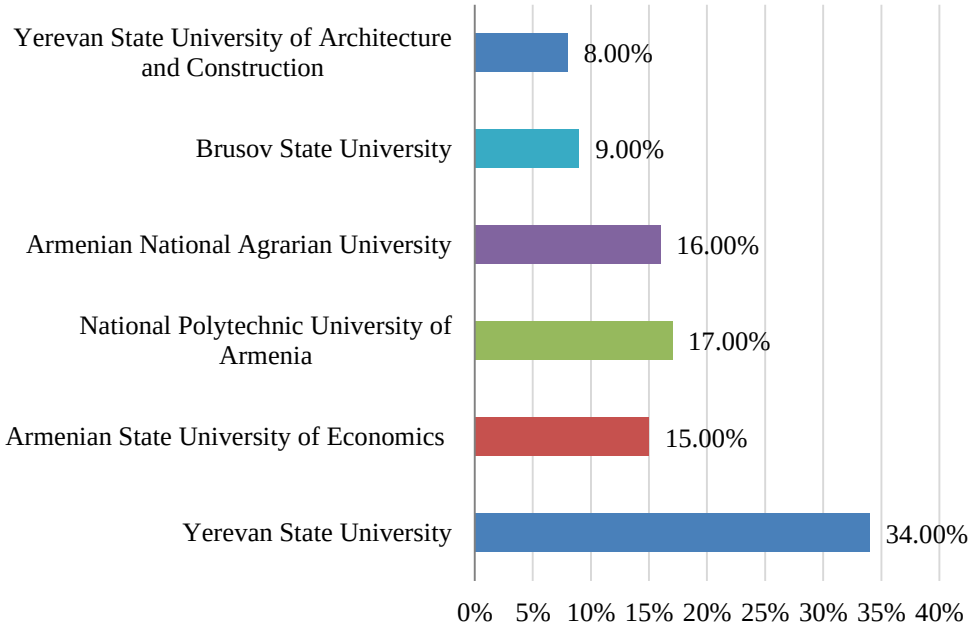
2.	Armenian State University of Economics (ASUE), 1975. (https://asue.am/)	6		20	8 000
		Humanitarian Sciences	Natural Sciences		
		5	1		
3.	National Polytechnic University of Armenia (NPUA), 1933թ. (https://polytech.am)	5		32	10 000
		Technical Sciences			
4.	Armenian National Agrarian University (ANAU), 1930 թ. (https://anau.am/)	5		25	6 000
		Humanitarian Sciences	Natural Sciences		
		5	0		
5.	National University of Architecture and Construction of Armenia (NUACA) 1921թ. (https://nuaca.am/)	5		23	3 000
		Technical Sciences			
6.	Brusov State University (BSU), 1935թ.(https://brusov.am/)	4		10	5 000
		Humanitarian Sciences	Natural Sciences		
		4	0		

Table 3.5: Participation Rate by University

N	**University**	**Respondents number**	**Participation rate %**
1.	Yerevan State University	52	33.65
2.	Armenian State University of Economics (ASUE)	24	15.48
3.	National Polytechnic University of Armenia (NPUA),	27	17.42
4.	Armenian National Agrarian University (ANAU),	25	16.13
5.	National University of Architecture and Construction of Armenia (NUACA)	12	7.74
6.	Brusov State University (BSU), 1935թ.(https://brusov.am/)	14	9.03

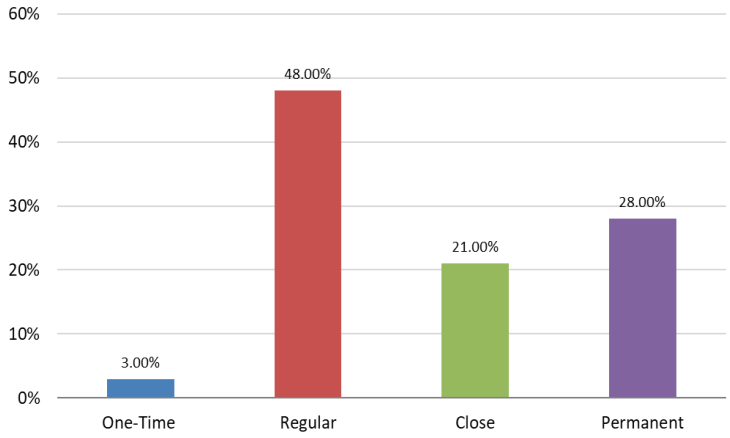
The survey findings provide comprehensive insights into the dynamics of university-industry partnerships within six higher education institutions in Armenia. The data offers valuable perspectives on diverse facets, encompassing collaboration challenges, motivations, benefits, financial mechanisms, channels, and institutional frameworks. This exploration unravels the intricacies and subtleties of cultivating effective and fruitful university-industry partnerships. Notably, the survey garnered responses from 153 participants, as depicted in the participation representation (Graph 3.8).

Graph 3.8: Representation of Participation by University, %



Concerning collaboration between the faculty/unit and private/public organizations, 91% (139 respondents) affirmed such cooperation. Regarding the frequency of collaboration, respondents indicated varied levels: 48.14% (65) described regular-periodic partnerships, 28.35% (38) reported permanent collaboration, and 20.14% (27) highlighted close partnerships (Graph 3.9).

Graph 3.9 Frequency of Cooperation by Respondents, %



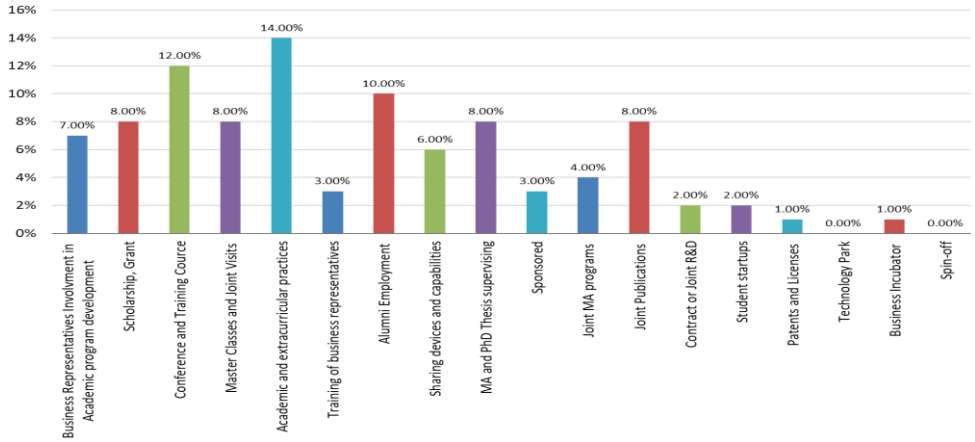
The presented statistics reveal a favorable perspective, with 96% of respondents perceiving collaboration as permanent, close, or periodic. This positive indication suggests a commitment to long-term collaboration, emphasizing the intent of parties to sustain and enhance their partnerships. Table 3.6 provides a breakdown of respondents by university, detailing the frequency and presence of collaboration.

Table 3.6: Partnership and Intensity for each single University

University	Respondent number	Partnership Yes	Partnership No	One time	Regular	Close	Permanent
YSU	51	46	5	3	19	9	13
ASEU	24	24	0	1	11	8	4
NPUA	27	24	3	0	18	1	5
ANAU	25	23	2	0	9	5	9
BSU	14	12	2	0	2	3	5
NUACA	12	10	2	0	6	1	2
Overall	**153**	**139**	**14**	**4**	**65**	**27**	**38**

Within university-industry partnerships, a pivotal aspect pertains to collaboration channels and mechanisms. It is imperative to examine the utilization of such channels and mechanisms across six higher educational institutions in Armenia. According to responses, prevalent channels include educational and extracurricular practices (14.30%), conferences and training courses (12.35%), alumni employment (9.88%), and joint publications (8.45%). Figure 3.10 illustrates the percentage distribution of various potential cooperation channels.

Graph 3.10: Most Frequently Used Collaboration Channels by Respondents, %



Examining infrastructures or institutional structures is a pivotal aspect of investigating university-industry collaboration. Respondents were queried regarding the institutional structures within the collaborative framework. Survey data illustrates the respondents' insights into the formats through which cooperation between the university and industry is realized.

Table 3.7: Collaboration Formats

	Personal connections	**Faculty committees**	**Institutional structures**	**Chairs**	**Administrative staff of the faculty**	**Other**
YSU	3.35	1.24	1.87	2.63	2.76	0.22
ASEU	3.50	0.92	3.63	3.63	1.17	0.25
NSPU	3.96	0.83	1.79	3.42	1.67	0.83
ANAU	2.78	1.91	3.09	2.57	1.70	0.30
BSU	3.42	1.58	2.67	3.42	2.42	2.17
NUACA	3.50	1.80	3.70	1.50	2.30	0.40
Overall	**3.42**	**1.38**	**2.79**	**2.86**	**2.00**	**0.70**

Table 3.7 presents the average indices for each format across individual universities. At YSU, personal connections hold significance (3.35/5), with other formats receiving average values ranging from 1.24 to 2.76. ASEU emphasizes institutional structures, chairs (3.63/5), and personal connections (3.5/5). Personal connections (3.96/5) and chairs (3.42/5) are pivotal at NPUA. ANAU exhibits a predilection for university institutional structures (3.09/5). BSU leans toward personal connections and chairs, both scoring 3.42/5. NUACA favors personal connections (3.5/5) and

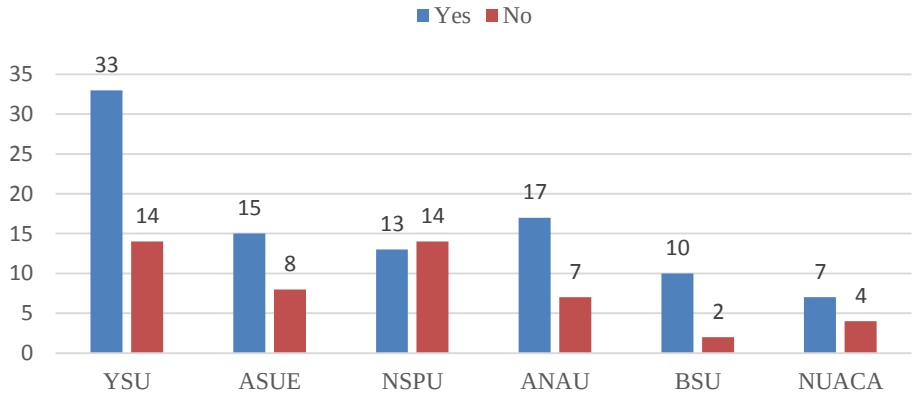
institutional structures (3.7/5). Respondents also disclosed the operational institutional structures within their universities, as detailed in Table 5.

Table 3.8: Institutional structures at universities

	Career Center	Entrepreneurship Development centers	Faculty Committees	There is no such structure	Other
YSU	28	2	5	8	1
ASEU	21	5	2	1	2
NSPU	18	4	5	2	0
ANAU	22	1	6	0	2
BSU	9	1	4	0	2
NUACA	9	3	3	0	2
Overall	**107**	**16**	**25**	**11**	**9**

The prevalence of career centers as institutional structures is notable, with 107 respondents affirming their existence. This prevalence extends to individual universities, with specific counts for YSU (28), ASEU (21), NSPU (18), ANAU (22), BSU (9), and NUACA (9), as detailed in Table 3.8. The involvement in joint Research and Development (R&D) and Consulting projects is pivotal in university-industry cooperation. Respondents, numbering 144, were queried regarding their faculty's participation in such endeavors over the last five years, yielding 95 affirmative responses and 49 negative responses. Graph 3.11 delineates the responses from each university.

Graph 3.11: Engagement in Joint R&D and Consulting Projects with the Industry, by single University (Number)"



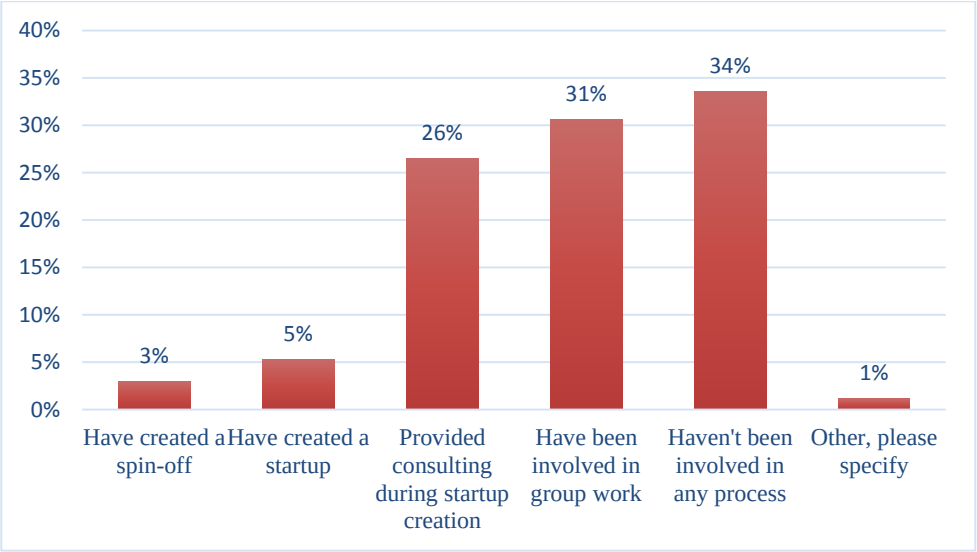
Moreover, respondents were prompted to provide insights through an open-ended question regarding specific programs conducted within the Research & Development (R&D) realm. Noteworthy responses encompassed activities such as "Students' involvement in research activities addressing industrial issues," "Prototyping and patent development," "Formulation of bachelor's and master's degree programs," and "Training for professors along with site visits facilitated by public and private sector representatives."

Table 3.9: During the last 5 years, the possible participation of academic employees in spin-offs or startups.

	Creation of Spin-Off	**Creation of Start-up**	**Consulting activities**	**Have been involved in group works**	**No activity**
YSU	1	1	10	14	22
ASEU	0	1	11	16	2
NSPU	1	1	5	9	13
ANAU	2	3	8	6	11
BSU	1	2	5	2	4
NUACA	0	0	5	5	5
Overall	**5**	**8**	**44**	**52**	**57**

Within the university-industry partnership framework, creating academic spin-offs and student start-ups is a pivotal avenue. Respondents were questioned about academic faculty's involvement in the establishment of spin-offs or start-ups over the preceding five years. Table 3.9 presents the distribution of responses for each university. For a comprehensive overview across Armenian universities, Graph 3.11 visually represents the data. Evidently, at an individual level, only 8% of academic employees engaged in the initiation of a start-up or spin-off. These outcomes lead to the inference that there is a modest level of entrepreneurial and innovative pursuits among academicians within Armenian higher education institutions.

Graph 3.11: Academic employees' participation in creating a spin-off or startups, %



Collaborating with private/public organizations involves financial inflows and executing jointly financed projects. Regarding whether faculties received financial resources from private/state organizations in the past five years, 65 units affirmed receiving such resources, while 74 units did not. The breakdown by individual universities indicates the following responses based on the proportion of yes/no: YSU 29/15, ASUE: 8/15, NSPU: 9/17, ANAU: 10/13, BSU: 5/7, NUACA: 4/7 (Table 3.10).

Table 3.10: Possible Connections between University Academicians' innovative activities and Financial Resources from Public/Private Organizations

	Received fin. funds and provided consultation to the students	**Received fin. funds and was involved in group work**	**Did not participate, but received a fin. Funds**	**Didn't get fin. funds and provided consultation to the students**	**Didn't get fin. funds but have been involved group works**	**Did not participate and did not receive a fin. funds**
YSU		8	11	11	2	3
ASEU		6	4	0	5	12
NSPU		4	3	3	1	6
ANAU		6	2	4	2	4
BSU		3	0	1	2	2
NUACA		2	1	2	3	4

Subsequently, we endeavored to discern potential correlations between the involvement of university academicians in the startup creation process and the financial resources acquired from public/private entities. Table 6 elucidates that participation predominantly manifested through advising students and engaging in collaborative endeavors. As indicated in the survey results (Table 7), 50 respondents who dispensed guidance to students during startup development or engaged in group efforts concurrently received financial support from organizations. Conversely, 21 respondents who were not actively participating in academic business or startup creation still received financial backing. Additionally, 46 respondents actively involved in advising or collaborative efforts did not receive financial funds, while 36 neither participated in academic business creation nor received financial support.

Regarding the funding sources (Graph 3.12), it is discerned that the principal funding streams emanated from the government (35%) and international organizations (32%), with private organizations contributing a modest 14%. This observation suggests potential gaps in financing collaboration with private entities and underscores the need for mechanisms for joint project implementation.

Graph 3.12: Main funding sources by %

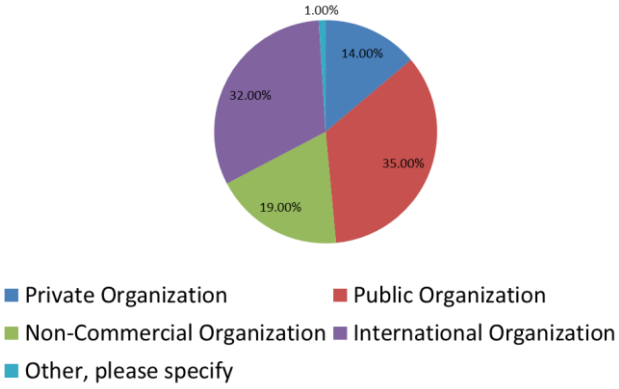


Table 3.11 delineates the funding sources across individual universities and the prevalent financing forms. Among the respondents, 52 affirmed that grants constituted the most frequent form of financing, while 28 specified joint projects as their financing modality. This information underscores the

significance of grants as a predominant financial instrument in university-industry collaboration, shedding light on the diverse avenues through which funding is secured for collaborative endeavors.

Table 3.11: Sources of funding and type of financing for each single university

	Private Organization,	Public Organization	Non-commercial organization	International Organization	Grant	Donation	joint project funding
YSU	7	21	9	17	27	4	14
ASEU	2	6	5	3	6	0	3
NSPU	2	5	1	3	6	2	4
ANAU	1	1	4	7	6	1	4
BSU	3	1	1	4	4	2	3
NUACA	0	3	0	0	3	0	0

Furthermore, respondents were presented with a 1-5 scale to evaluate the extent to which various factors contribute to the effectiveness of university-industry partnerships. This approach aimed to elucidate the primary benefits arising from such partnerships. The identified benefits/factors encompassed aspects such as funding influx for commercializing academic outcomes (patenting, licenses), access to research prospects, provision of infrastructure and equipment for researchers and students, opportunities for student career development and employment, practical application and dissemination of research findings, networking opportunities, scientific efficacy among researchers, training and mobility of university personnel and researchers, possibilities for academic publications, and the regional and international standing of the university.

Table 3.12: Benefits of University-Industry Partnership

	Inflow of additional funding for commercialization of academic output	Access to research infrastructure and equipment	Student's career and employment opportunities	Practical application and transfer of research results	Network and collaboration opportunities	Increasing scientific efficiency among researchers	Training of university staff and researchers, academic mobility	Local and international attractiveness of the university
YSU	2.54	3.02	3.02	3.04	2.87	3.24	2.80	3.09
ASEU	3.67	3.38	3.96	3.67	3.71	3.88	3.96	3.75
NSPU	2.63	3.67	3.67	3.42	3.33	3.63	3.88	3.67
ANAU	2.70	3.65	3.35	3.22	3.39	3.26	3.65	3.70
BSU	4.08	4.00	4.25	4.33	4.00	4.00	4.33	4.33
NUACA	2.10	3.10	3.20	3.60	2.60	3.00	3.70	3.50
Overall	2.95	3.47	3.57	3.55	3.32	3.50	3.72	3.67

Table 3.12 displays the highest average values, with "Training of university employees and researchers, and academic mobility" ranking at 3.72, followed by "Regional and international reputation of the university" at 3.67. Notably, YSU highlighted "The regional and international reputation of the university" (3.09) and "Practical application and transfer of research results" (3.04) as the most significant cooperation contributors. In ASEU, pivotal factors were "Training of university staff and researchers, wide opportunities for publications and academic mobility" (3.96), and "Student career and employment opportunities" (3.96). Details for other universities are outlined in Table 9.

Additionally, respondents were queried about factors impeding their department's collaboration with private/state organizations. The outcomes in Table 3.13 underscore that the foremost inhibiting factors are time constraints and administrative burdens on teaching staff (2.80). Furthermore, insufficient financial resources within the university hinder the implementation of specific structures (2.55).

Table 3.13: University-Industry Collaboration Limits

	Research and Technical capabilities of the faculty do not meet the requirements of organizations	There is a time limit of the academic staff	Researchers are not aware of the collaboration channels and funding opportunities	The low level of interest and trust by organizations	University norms and procedures hinder cooperation with the organizations	There is no institutional and structural background	University's insufficient financial resources	There are no norms and regulations in the scope of partnership
YSU	1.98	3.09	2.33	2.24	2.11	2.09	2.46	2.07
ASEU	2.08	2.50	2.17	2.63	1.54	1.75	1.71	1.67
NSPU	2.50	2.88	2.38	2.58	1.67	2.54	2.88	2.67
ANAU	2.35	2.65	2.35	2.61	1.61	1.87	2.78	1.83
BSU	2.83	3.50	3.17	3.00	3.00	3.00	3.25	2.92
NUACA	2.40	2.20	2.70	1.90	1.50	2.10	2.20	2.80
Overall	2.36	2.80	2.51	2.49	1.90	2.22	2.55	2.32

The research addressed two fundamental inquiries concerning university-industry collaboration in the Armenian context: (1) What are the primary collaboration channels and institutional structures/units between universities and industries in Armenia? Moreover, (2) What benefits, barriers, and challenges do universities in Armenia face in their industry partnerships?

The study reveals a need for more collaboration between Armenian universities and public/private organizations, necessitating a comprehensive approach for improved engagement. A broader spectrum of channels and structures is essential for fostering entrepreneurship, innovation, securing funding, and enhancing academic research quality and relevance to industry and society, as underscored in prior research (Etzkowitz & Leydesdorff, 2000; Chesbrough, 2003; Rothaermel et al., 2007; Rasmussen & Borch, 2010). In Armenia, collaboration primarily hinges on traditional mechanisms, with limited utilization of advanced channels related to business collaboration and intellectual property rights (IPR). The absence or inadequate functionality of critical structures, such as Career Centers, Technology Transfer Offices (TTOs), and Entrepreneurship Development Centers, poses significant hurdles to successful university-industry collaboration, corroborating previous research findings (Etzkowitz & Leydesdorff, 2000; Siegel et al., 2003; Markman et al., 2008; Guerrero et al., 2012). These structures are pivotal in leveraging research capabilities, safeguarding intellectual property, and formulating commercialization strategies. Addressing these structural deficiencies is imperative to fortify the university system.

The study underscores the urgent need for a comprehensive approach to developing institutional structures that effectively facilitate and promote university-industry partnerships in Armenia. This may involve establishing units dedicated to managing such collaborations, formalizing partnerships, and fostering agreements between universities and organizations. These recommendations resonate with previous research conclusions (Feldman & Desrochers, 2004; Laredo, 2007; Huggins & Williams, 2011; De Fuentes & Dutrénit, 2012), emphasizing the importance of robust institutional frameworks for effective university-industry collaboration.

Various scholars emphasize the pivotal role of academic spin-offs and student start-ups in the landscape of university-industry collaboration (Mustar et al., 2006; Rasmussen & Borch, 2010; Perkman et al., 2013). Notably, the absence of such entities characterizes Armenian higher educational institutions, facing formidable barriers like limited funding access and inadequate entrepreneurial support systems. Addressing these challenges requires comprehensive policies encompassing entrepreneurship

education, industry-academia collaboration promotion, infrastructure development, and improved intellectual property protection mechanisms. Such recommendations align with the recurring themes found in prior studies (Etzkowitz & Leydesdorff, 2000; Markman et al., 2008).

University-industry collaboration yields diverse benefits, including financial gains through jointly financed projects (D'Este & Patel, 2007; Geuna & Muscio, 2009). In our study, predominant funding sources are government and international organizations, underscoring limited private sector contributions. Addressing this discrepancy necessitates the establishment of effective collaboration mechanisms with private entities, a point echoed in numerous studies (Geuna & Rossi, 2011; Chesbrough, 2003).

Consistent with existing literature (Mowery et al., 2004; O'Shea et al., 2005; Carayannis & Campbell, 2009), our research emphasizes the multifaceted benefits of university-industry cooperation. However, respondents exhibit a relatively low belief in the collaboration's potential to increase funding or commercialize academic output. This suggests a need for more emphasis on commercializing academic results in Armenia, potentially reflected in insufficient steps toward patenting and licensing. In line with (Etzkowitz and Leydesdorff, 1998 Bercovitz and Feldman, 2006 Geuna and Muscio, 2009), time constraints on professors emerge as a significant barrier, underscoring the challenge of balancing teaching, research, and external commitments. Additionally, universities need more funding to support faculty and students involved in collaborative projects adequately, hindering the progress of research and innovation projects, as indicated by previous studies (Perkmann & Walsh, 2007; Gupta et al., 2005). Moreover, respondents' limited awareness of engagement in collaborative projects acts as a barrier, echoing Etzkowitz's & (2013) observation, emphasizing the need for universities to provide comprehensive information and guidance to stakeholders navigating the intricacies of industry collaboration.

The findings of this study must be interpreted in the context of certain limitations. One notable limitation pertains to the response rate regarding the participation of academic employees in the establishment of spin-offs and startups. Given that the survey primarily targeted faculty leading representatives, some of whom may not have academic workloads,

excluding academic lecturers may have resulted in an incomplete understanding of their contributions and perspectives in this domain. This limitation suggests that the study might need to provide a wholly accurate depiction of the overall involvement of academic employees in the creation of spin-offs and startups. To address this limitation, future research endeavors should incorporate a more diverse sample, including academic lecturers, to garner a more comprehensive understanding of their engagement in these initiatives.

The existing state of university-industry collaboration in Armenia underscores the necessity for concerted efforts to cultivate a more conducive environment for collaboration. This entails a multifaceted approach involving operational and structural changes to enhance the applicability of collaboration channels and institutional structures.

The inquiry disclosed that primary collaboration channels between universities and industries in Armenia encompass research projects, internships, and joint educational programs. However, the survey's findings depict that these channels exhibit only partial applicability in the current context. Notably, channels reliant on academic entrepreneurship and innovation are nonviable and necessitate substantial operational and structural changes for future viability.

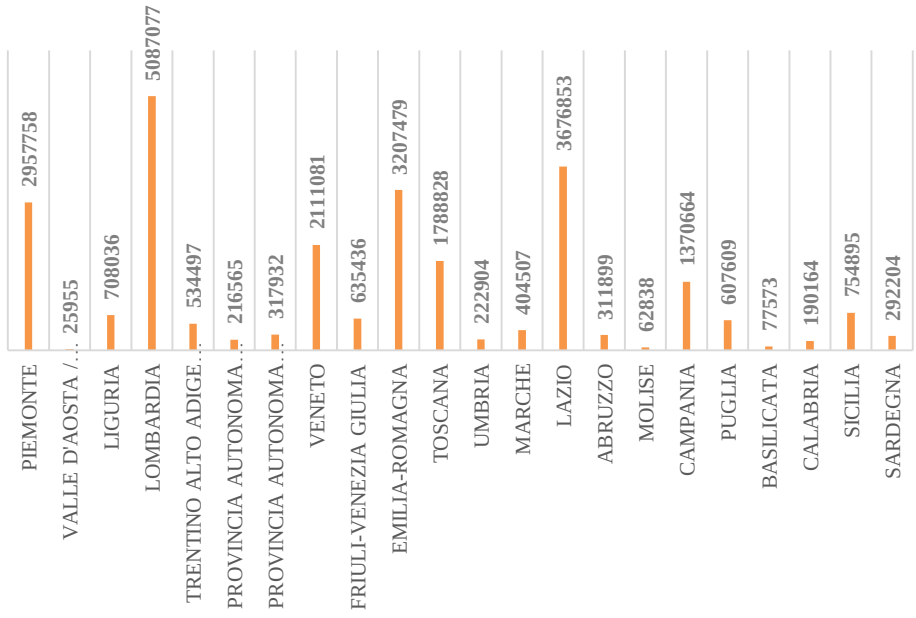
Within the realm of university-industry partnerships in Armenia, it is crucial to recognize the existence of institutional structures designed to facilitate collaboration. Nonetheless, the effectiveness of these structures is subject to certain limitations. While six universities boast designated structures for fostering university-industry partnerships, these structures encounter challenges that impede their optimal functionality. Further research is imperative to delve into the specific reasons underlying the suboptimal functioning of these structures.

Furthermore, a comprehensive analysis of the challenges and opportunities in Armenia's university-industry partnerships can reveal common patterns and trends that may also manifest in other post-Soviet countries. This consideration gains significance due to shared historical and political similarities within the post-Soviet region.

3.4 Regional description and Industry Perspective

In this section, we intend to scrutinize the industrial dimensions of Armenia and Italy within the framework of the University-Industry Partnership. This examination will leverage the SDG Index scores and insights from the Country Profiles Dashboard for a comprehensive analysis. Our attention will be directed toward SDG goals encompassing indicators linked to Innovation, Entrepreneurship, and university-industry collaboration. After a statistical analysis, we will elucidate specific instances of distinct industries in each country.

Graph 3.13 Domestic Research And Development Expenditure In-house (Thousands Of Euro In Current Values), Italy, REGIONS, ISTAT



As previously delineated, Italy assumes the status of a Moderate Innovator, encompassing 21 regions, with three identified as Strong Innovators, 16 as Moderate Innovators, and two as Emerging Innovators. Drawing upon the ISTAT results, Piemonte and Valled'Aosta/Vallée d'Aoste are categorized as Moderate Innovators, witnessing increased innovation performance over time (17.6% and 7.8%, respectively). Sardegna is designated as an

Emerging Innovator, experiencing a noteworthy increment in innovation performance (12.3%).

For a more intricate analysis, we turn to Research and Development (R&D) expenditure across Italian regions (Graph 3.7). Lombardia is a leader in R&D expenditure, committing €5,087,077 thousand, underscoring its robust dedication to innovation and technological progress. Lazio follows closely with €3,676,853 thousand, driven by the presence of Rome and prominent research institutions. Northern regions, including Lombardia, Emilia-Romagna, and Veneto, consistently allocate higher R&D budgets than their southern counterparts. Regions like Calabria and Molise exhibit lower R&D expenditure, suggesting a potential necessity for increased investments in research and innovation.

Economically affluent regions, exemplified by Lombardia and Emilia-Romagna, significantly invest in R&D, contributing to their industrial and technological prowess. Toscana and Marche also manifest notable allocations for R&D, mirroring their economic significance. Regions like Friuli-Venezia Giulia and Trentino Alto Adige strategically invest in R&D, often aligning with sectors that reflect their unique cultural and environmental contexts. The Autonomous Province of Trento, within Trentino Alto Adige, stands out for its commitment to research and innovation.

Smaller regions, such as Valle d'Aosta and Basilicata, allocate resources for R&D despite their demographic modesty, indicating active participation in research initiatives. The Autonomous Province of Bolzano in Trentino Alto Adige contributes to the regional innovation ecosystem through strategic investments in R&D. Coastal regions like Liguria and Sicilia dedicate resources to R&D, potentially fostering advancements in maritime technologies and research. The observed regional variations in R&D expenditure underscore Italian regions' diverse economic landscapes and strategic priorities.

INDUSTRIES IN ITALY

This section delves into private enterprises engaged in collaborative initiatives with Ca' Foscari and Yerevan State University.

One notable participant is ENI, the Italian multinational energy company, which actively participates in collaborative ventures with Italian universities, particularly in energy, sustainability, and technology. The 2022 annual report of ENI provides comprehensive insights into their University-Industry partnerships, encapsulating specific statistical details. A synopsis of key findings from the report includes the disbursement of approximately 200 university scholarships, funding or co-funding of 55 scholarships for Ph.D. programs, initiation of 24 joint research projects, incubation/acceleration of over 100 innovative start-ups, and the signing of 30 agreements for socio-economic development and health initiatives (ENI Annual report, 2020, 2021, 2022).

Furthermore, the research scrutinizes the Research and Development (R&D) expenditure and the number of patent applications submitted by ENI during 2020, 2021, and 2022. R&D expenditure signifies the financial resources allocated by ENI to research and development endeavors in each respective year. The marginal reduction in R&D spending from 2021 to 2022 may be attributed to shifts in economic conditions or broader economic challenges (refer to Table 3.4). This analysis offers a nuanced understanding of ENI's commitment to innovation and research activities, contextualizing fluctuations within the economic landscape.

Table 3.14: R & D expenditure and Patent Application by ENI

ENI		2022	2021	2020
R & D expenditure	Euro, Million	164	177	157
Patent Application	Number	23	30	25

The quantity of patent applications serves as a metric reflecting the extent to which ENI sought legal protection for novel inventions or innovations through the patent application process in each respective year. It is imperative to underscore that both Research and Development (R&D) spending and submitting patent applications are pivotal indicators signifying a company's dedication to fostering innovation and its endeavors to uphold competitiveness within its industry.

In collaboration with Ca' Foscari University of Venice, ENI, through its school of entrepreneurship, plays a central role in the Co-Innovation program on Circular Economy & Climate Change alongside VeniSIA Innovation Accelerator. In the VeniSIA 2022 Co-Innovation Program framework, ENI provided financial support to the startup Cervest, which proposes a climate-risk forecasting and modeling solution tailored for Eni's infrastructure asset management.

GEOX, an Italian footwear and clothing brand recognized for pioneering technology in crafting breathable and comfortable shoes, was established in 1995 by Mario Moretti Polegato. The company's distinctive innovation lies in the patented "Geox breathes" technology, facilitating air exchange while preventing water ingress into the shoe. As of 2023, GEOX holds a portfolio of 64 patents, and a detailed breakdown of patent applications and R&D expenditure is presented in Table 3.5 (refer to GEOX Annual Report, 2020, 2021, 2022).

Table 3.15: R & D expenditure and Patent Application by GEOX

GEOX		2022	2021	2020
R & D expenditure	Euro, Million	11.313	11,273	10.381
Patent Application	Number	3	5	11

A recent development in the collaborative engagement between Ca' Foscari University and Geox is exemplified by the "Geox & Formula E: Strategy for Excellence" initiative. This project featured the participation of Geox's Founder and President, Mr. Mario Moretti Polegato, who visited Ca' Foscari University. During this visit, Mr. Polegato actively engaged with students, imparting insights into the entrepreneurial realm and elucidating the diverse opportunities for innovation.

BARILLA, a prominent global pasta and food conglomerate, has actively participated in numerous university-industry collaborations and initiatives centered around food science, nutrition, and sustainability. Barilla's establishment of the Barilla Center for Food & Nutrition (BCFN), an independent think tank, underscores its commitment to collaborating with universities and research centers, fostering research, and promoting awareness regarding global food-related issues. Notably, Barilla sponsors scholarships and internships for students pursuing degrees in fields related

to food science and nutrition. Furthermore, organized meet-ups at Ca' Foscari have been orchestrated to acquaint students with potential working and internship opportunities.

Barilla boasts a substantial global patent portfolio totaling 971 patents, of which 759 have been granted. Over 58% of these patents remain active, with Europe as the primary region for patent filings, succeeded by Germany and Italy (refer to Table 3.6, Barilla Annual Report, 2020, 2021, 2022).

Table 3.16: R & D expenditure and Patent Application by Barilla

		2022	2021	2020
R & D expenditure	Euro, Million	42	39	40
Patent Application	Number	5	24	62

FERRARI, an illustrious and renowned automotive manufacturer in Italy, has a distinguished track record of active participation in university-industry partnerships and collaborative endeavors, particularly within automotive engineering, technology, and research. Ferrari has historically engaged in collaborative academic research ventures with various universities and research institutions, focusing on projects associated with automotive engineering, design, and technological advancements. Notably, Ferrari has been instrumental in providing internship and cooperative education programs tailored for students pursuing degrees in engineering and related fields. Furthermore, the company has supported university teams engaged in the Formula SAE (Society of Automotive Engineers) competition, where students design and construct formula-style race cars. Ferrari's assistance may encompass financial support and technical guidance. A recent initiative involved organizing meetups and presentations from the Ferrari Academy specifically for Ca' Foscari students.

Table 3.17: R & D expenditure and Patent Application by Ferrari

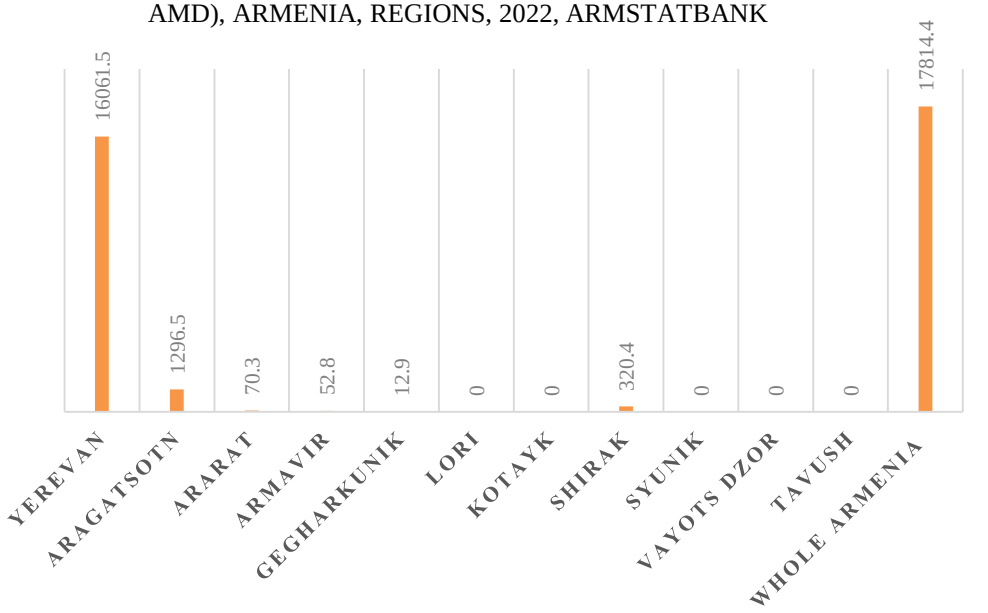
		2022	2021	2020
R & D expenditure	Euro, Million	817.143	908.744	808.046
Patent Application	Number	13	6	8

Armenia

In 2022, Armenia allocated 17,814.4 million AMD to research and development (R&D) endeavors, as depicted in Graph 3.8. Notably, a

substantial portion of this investment is centralized in the capital city, Yerevan, amounting to 16,061.5 million AMD, equivalent to approximately 90% of the nation's overall R&D investment. This pronounced concentration of R&D funding in Yerevan raises a significant concern for Armenia.

GRAPH 3.14 DOMESTIC RESEARCH AND DEVELOPMENT EXPENDITURE IN-HOUSE (MILLION LOCAL CURRENCY, AMD), ARMENIA, REGIONS, 2022, ARMSTATBANK



Armenia is geographically segmented into ten regions, including Yerevan, and the concentration of a substantial portion of research and development (R&D) investment in the capital city raises concerns about regional disparities in economic development and innovation. Regions such as Lori, Kotayk, Syunik, and Vayots Dzor, outside Yerevan, may need more access to the advantages of R&D investment, potentially exacerbating economic imbalances and impeding the holistic progress of the nation. Examining private sector involvement, noteworthy instances include:

Synopsys: Synopsys Armenia, a globally recognized company specializing in electronic design automation (EDA) and semiconductor IP, is in Yerevan. It engages in software development, research and development (R&D), and engineering services, primarily focusing on EDA tools and semiconductor IP solutions. Synopsys Armenia actively collaborates with local universities,

exemplified by establishing a dedicated classroom and engineering laboratory at Yerevan State University for students specializing in IC design.

In the fiscal year 2022, Synopsys witnessed a notable surge in R&D expenses compared to the preceding fiscal year, with total R&D expenses reaching $1,680.4 million, constituting 33% of the total revenue. Synopsys holds a global portfolio of 5,236 patents, of which 3,844 have been granted.

PicsArt: PicsArt is the world's largest digital creation platform, facilitating multimedia editing and sharing. Recognized for its creative tools and features, PicsArt enables users to craft visual content, including photos, videos, and digital art. The American University of Armenia (AUA) and PicsArt collaboration culminated in the establishment of an Artificial Intelligence (AI) Lab. This collaborative endeavor involves faculty and students conducting advanced machine learning and computer vision research.

Philip Morris Armenia has committed to supporting educational and research initiatives in collaboration with Yerevan State University. A memorandum has been formalized with the Polytechnic University, outlining the company's intent to establish a scientific and research center within the university's premises.

In the context of Sustainable Development Goals (SDG), our focus revolves around the following key indicators and targets:

- **SDG 9: Industry, Innovation and Infrastructure:**

TARGET 9.5: Facilitate scientific research and enhance the technological capabilities of industrial sectors globally, with a specific emphasis on developing countries. By 2030, foster innovation and significantly increase the number of research and development workers per 1 million people, coupled with a substantial rise in public and private research and development spending.

TARGET 9.B: Support technological advancement, research, and innovation within developing countries. This involves creating a conducive policy environment that encourages industrial diversification and adds value to commodities.

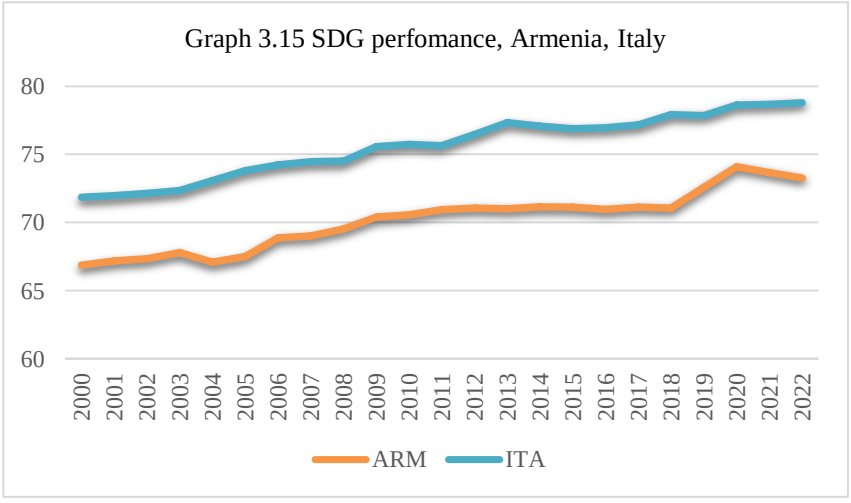
➢ **SDG 4: Quality Education:**

TARGET 4.4: Strive to substantially increase the number of youth and adults equipped with relevant skills, including technical and vocational skills. This aims to enhance employability, foster the creation of decent jobs, and stimulate entrepreneurship.

➢ **SDG 17: Partnerships for the Goals:**

TARGET 17.16: Strengthen the Global Partnership for Sustainable Development by fostering multi-stakeholder collaborations. Such partnerships should mobilize and share knowledge, expertise, technology, and financial resources, contributing to the collective effort to achieve the Sustainable Development Goals universally, focusing on developing countries.

We will proceed to present SDG data for analysis of Italy. In the SDG Index ranking, Italy is 24 out of 166 countries, with an Index Score of 78.79 out of 100. In comparison, Armenia's SDG Index Score is 73.26/100, ranking 56 out of 166. Both Italy and Armenia demonstrate commendable positions in the SDG Index. With its higher Index Score, Italy outperforms Armenia, implying more comprehensive advancements across diverse SDGs. This disparity underscores Italy's broader progress in addressing a spectrum of Sustainable Development Goals compared to Armenia, as illustrated in



In the Italian context, challenges persist within the framework of SDG 9, with the score demonstrating moderate improvement but falling short of goal attainment. Notably, the number of articles published in academic journals per 1,000 population reached 2.3 in 2021, and the expenditure on research and development amounted to 1.5% of GDP in 2020. SDG 4 exhibits substantial challenges, with progress stagnating or increasing at a rate below the required 50%. In the sphere of SDG 17, notable challenges persist despite moderate improvement, indicating insufficient progress toward the goal.

Conversely, Armenia faces considerable obstacles in realizing Goal 9, experiencing only moderate improvement and inadequate progress. The number of articles published in academic journals per 1,000 population, at 0.4 in 2021, has remained stagnant. Moreover, the country's expenditure on research and development, constituting 0.22% of GDP in 2020, is in decline. Concerning Goal 4, Armenia grapples with significant challenges, with progress stagnant or below the required 50%. Under Goal 17, Armenia encounters notable challenges, as its score displays moderate improvement but needs to achieve the goal.

3.5 Industry Perspective in Republic of Armenia: Survey & Focus Group Interviews

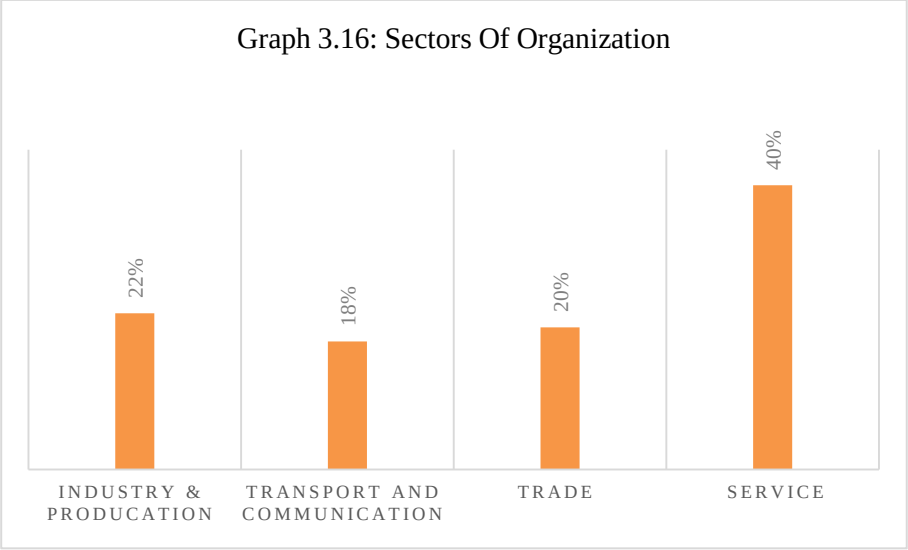
To understand the industry's perspective, a **Survey and Focus Group Interviews were conducted to examine the dynamics of university-industry collaboration from the viewpoints of both public and private organizations.**

In the first part of the research, the results of the survey will be presented, followed by the results of the focus group interviews in the second part. Finally, we will validate the findings by comparing the results from both methods.

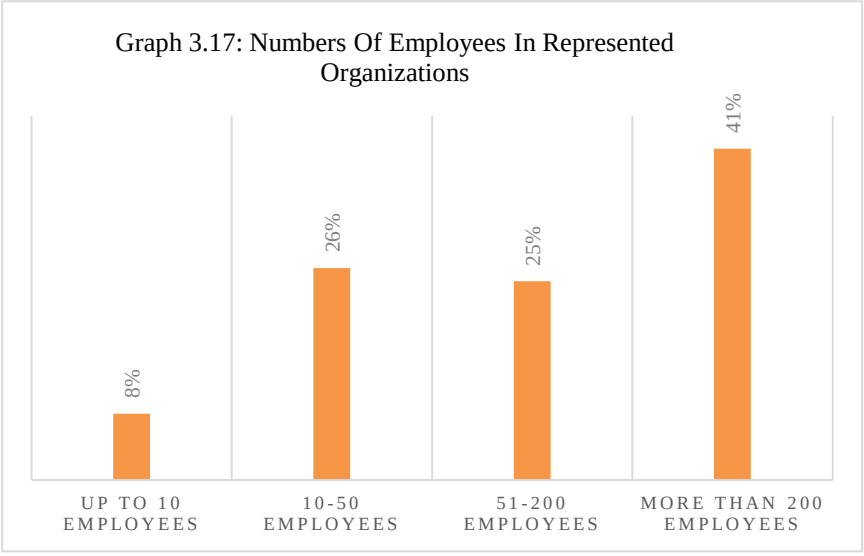
The primary objective of the survey was to shed light on how Public/Private organizations engage in partnership with universities, identify prevalent

challenges, and propose potential strategies for fostering improved cooperation.

The survey involved the participation of 100 representatives from diverse sectors.



Graph 3.16: displays the percentage distribution of organizations across four big sectors: Industry & Production, Transport & Communication, Trade and lastly Service. Unfortunately, sectors such as agriculture and construction did not feature any answer among the responses.



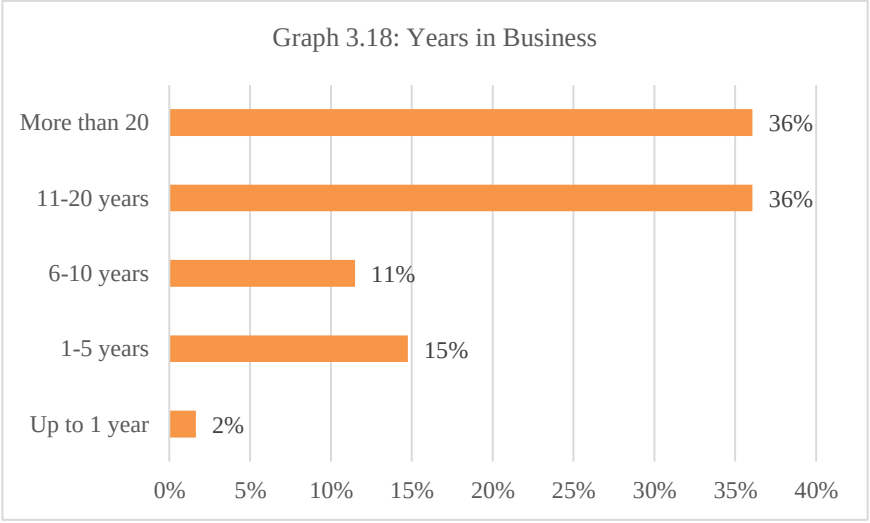
To reveal the size of participating organizations, the respondents were asked to provide the number of employees within their respective organizations. **Results indicate (Graph 3.17) a dominance of large organizations, with over 200 employees, comprising 41% of respondents.**

Additionally, organizations with 51-200 employees accounted for 24.6%, while those with 11-50 employees represented 26.2% of respondents. The smallest category, consisting of organizations with up to 10 employees, constituted only 8.2 % of respondents.

These findings show the dominance of larger companies within the surveyed sample, providing valuable insights into the distribution of workforce size across organizations. This is also important in the context of the scale of cooperation. It is clear that these small companies not only don't have enough financial, human and other resources to start a dialogue with universities and get involved in various processes in the academia, but also they cannot initiate some cooperation projects themselves.

Then the respondents have been asked about their organization years in business, which means how long the organizations have been operating.

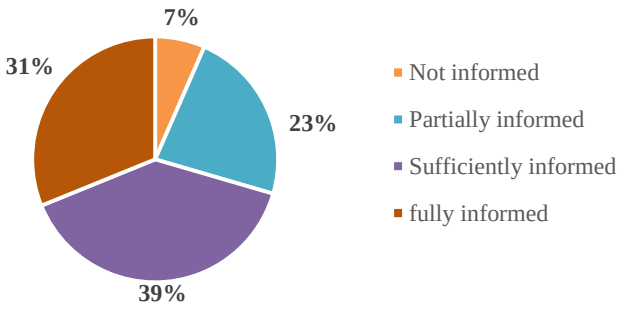
The survey revealed (Graph 3.18) that over 2/3 of the participating organizations possess more than 11 years of tenure. Specifically, 36.1% of respondents reported more than 20 years of work experience, while another 36.1% indicated tenure of 11-20 years.



This trend makes sense because newer companies often lack the funds needed to join university-industry partnerships. These collaborations usually require resources and stability, which older companies are more likely to have. Therefore, the survey results reflect a landscape where the ability to participate in university-industry partnerships correlates with organizational tenure and financial stability.

To the question how the respondents are familiar with forms of university-industry cooperation, the survey findings (Graph 3.19) revealed that 39.34% are sufficiently informed, while 31.15% stated they were fully informed. Additionally, 22.95% expressed partial awareness, with 6.56% indicating a lack of awareness entirely.

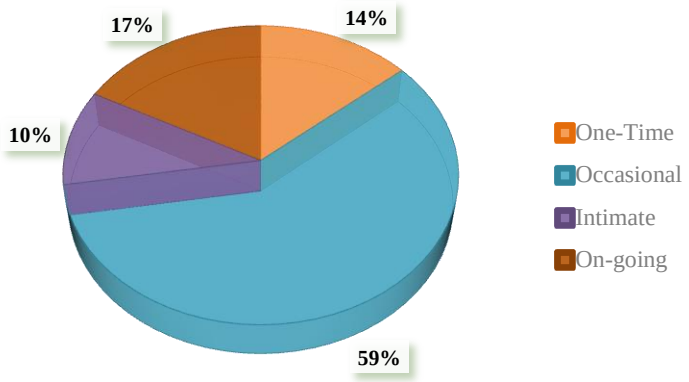
Graph 3.19: Familiarity with University-Industry Partnership



When asked about their organization's involvement in partnerships with universities, the survey revealed that the **majority of respondents, 72.13%, confirmed that their organization is involved in cooperation with higher education institutions or research centers**. Conversely, 27.87% indicated their organization does not take part in such collaborative efforts. The data implies that higher levels of awareness and understanding of university-industry cooperation forms correlate with greater involvement in collaborative efforts between organizations and higher education institutions. Conversely, a lack of awareness is associated with lower participation rates. Increasing awareness and providing more information about cooperation forms could potentially enhance the level of organizational engagement in university-industry partnerships.

In terms of Intensity of partnership, survey results (Graph 3.20) show that 58.62% of respondents described the cooperation as occasional, 17.24% answered it as ongoing, 13.79% reported it as a one-time occurrence, and 10.34% referred to it as intimate collaboration.

Graph 3.20: Intensity Of Partnership



The majority of collaborations are occasional, suggesting that many organizations engage with universities sporadically rather than on a continuous basis. Major part of collaboration is occasional, with fewer ongoing or intimate partnerships. Addressing the reasons behind sporadic engagements, understanding the barriers, and implementing strategies to foster sustained collaborations can lead to more robust and mutually beneficial outcomes for both universities and industries.

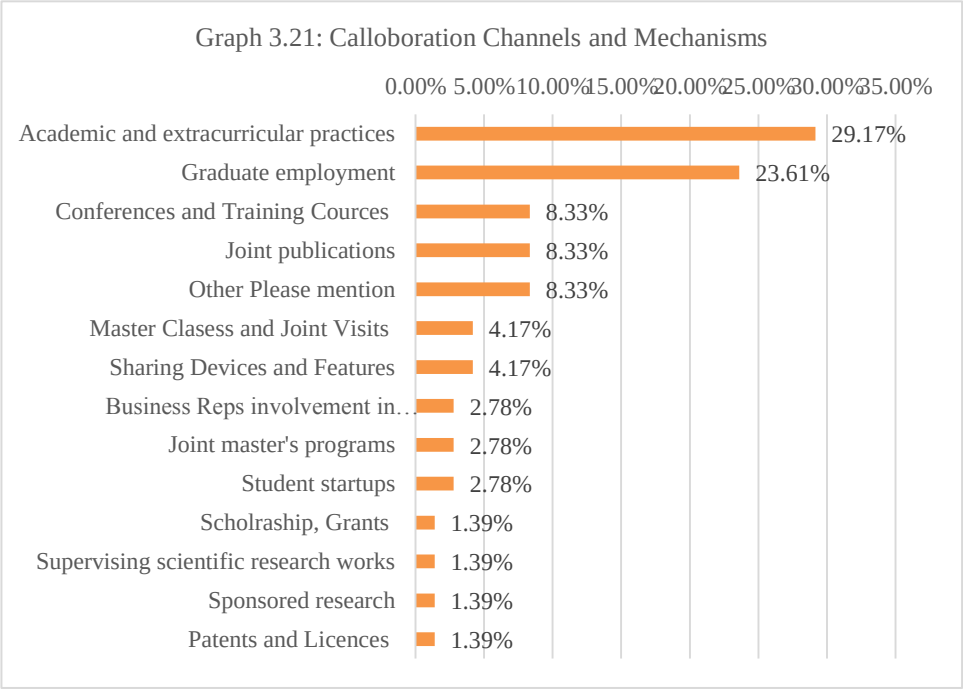
Table 3.18 displays the universities with which the organizations have been engaged in cooperation. Yerevan State University emerges as the leading collaborator, with 26.76% of respondents indicating that their organization has collaborated with Yerevan State University.

Table 3.18: Universities which are involved in Partnership

	Answer	**Percent**
1.	Yerevan State University	26.76%
2.	French University of Armenia	11.27%

3.	Armenian State University of Economics	11.27%
4.	American University of Armenia	8.45%
5.	Armenian-Russian University	8.45%
6.	Armenian National Agrarian University	7.05%
7.	Brusov State University	5.63%
8.	National Polytechnic University of Armenia	5.63%
9.	Academy of Public Administration	4.23%
10.	Other	11.28%
	Total	100%

The next graph (3.21) shows the channels of cooperation between universities and organizations utilized over the past 5 years.



Nearly a third (29.17%) cited educational and extracurricular practices as a primary channel. Additionally, 23.61% emphasized the employment of graduates as a significant part of collaboration. Scientific conferences and Training Courses were mentioned by 8.33% of respondents, while an equal percentage noted the importance of joint publications in facilitating cooperation between universities and organizations. Spin-offs, Start-ups, and Technoparks: These structures have received 0% of responses,

indicating a lack of engagement in entrepreneurial activities and innovation hubs.

Patents, Sponsored Research, and R&D: These channels also receive very small percentages, suggesting limited involvement in high-level research and development activities.

The lack of engagement in advanced forms of collaboration (e.g., spin-offs, start-ups, patents, R&D) suggests that Armenian organizations are not yet leveraging the full potential of university partnerships. This could be due to several factors, including resource constraints, lack of awareness, or insufficient incentives.

The survey highlights that while Armenian organizations primarily engage in practical forms of university-industry collaboration, there is limited involvement in advanced collaborations such as spin-offs, patents, and R&D.

Regarding the institutional structures within their organizations that could enhance cooperation with universities, the majority (70%) identified the Human Resources Management unit for this purpose. Additionally, 13.33% mentioned Research and Development Centers, while 10 % reported the absence of such structures. These findings suggest that specialized units dedicated to fostering university-organization collaboration are lacking in many organizations.

According to the survey findings, collaboration between universities and organizations among the surveyed employers primarily occurs through organization initiatives (41.38%). Additionally, personal connections and university initiatives play significant roles, accounting for 24.14% each. The remaining 10.34% utilize institutional structures within the organization to facilitate cooperation.

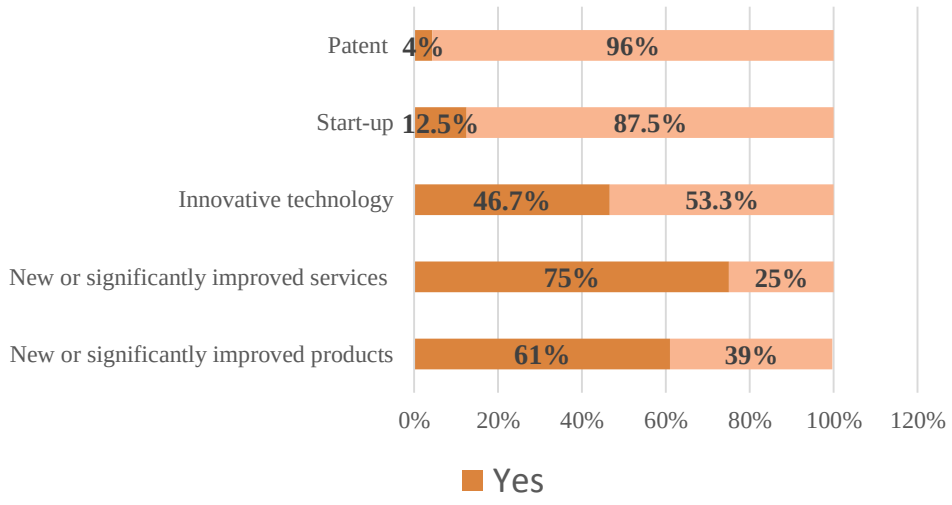
As regards the organization's involvement in research activities with universities over the last 5 years, only 17.78% reported implementing research, development, and consulting programs with universities, while the majority (82.22%) stated no involvement in such programs.

The survey further asked about the financing received by organizations for the development of innovative activities. **The results indicate that in**

92.11% of cases, respondents did not receive financing during the observed period. Conversely, 2.63% of respondents received financing from each of the following sources: local government, international organizations, and foundations.

Further, respondents have been asked if the organization presented new or significantly improved products/services, innovative technology, startup, patent during the considered period (2020-2023). 75 % of the respondents stated that they presented a new or improved service, 61.29% indicated that they introduced new or improved products, 46.67% introduced an innovative technology, 12.5 % founded a startup and 4.35% applied for a patent (Graph 3.22). The obtained results indicate that the majority of innovations were allocated to improved services and products.

Graph 3.22: Organization new or impoved services and products



The majority of innovations, around 87.88%, were introduced by organizations independently, while approximately 12.12% were the outcome of collaborative efforts with other organizations. However, concerning collaboration with universities, there is a notable absence of innovation from organizations in this dimension, which raises concerns.

Within the scope of this survey, participants were given the chance to highlight trends or specify research areas where they wished to engage

in collaboration with universities. Responses predominantly centered around filling vacant positions, producing cutting-edge technologies, and undertaking joint analyses with universities.

Under the last part of research with 2 main questions have been discussed why organizations choose to work with universities and what they hope to gain from such collaborations. The second question delved into the specific benefits organizations expect or have already experienced from these collaborations. By understanding these motivations, we can better tailor collaboration initiatives to meet the needs and goals of both parties. By understanding the perceived or actual advantages, we can assess the effectiveness of current collaborations and identify areas for improvement.

In summary, these questions helped us understand both the motivations behind university-organization collaboration and the practical benefits organizations seek or have gained.

Employers also highlighted their motivations for cooperation, with the primary ones being talent recruitment at 51.72%, followed by research and innovation at 20.69%. Additionally, 10.34% mentioned access to specialized research, while 6.90% and 5.17% cited the potential for commercialization. Only 1.72% stated that they found no reasons for collaboration.

When asked about the benefits that university-organization cooperation would offer organizations, 45.9% of respondents highlighted access to the student base as a valuable recruitment source. Another 21.31% emphasized that such collaboration would provide access to new knowledge and research. Additionally, 13 % pointed out that it would lead to expanded innovative opportunities, while the same percentage mentioned that it would confer competitive advantages to the organization. Only 1.64% indicated that it would present financing opportunities, while 4.92% mentioned other benefits.

Regarding the desire of organizations to invest resources in developing cooperation, 44% of respondents mentioned human resources, indicating a willingness to allocate personnel to this endeavor. Additionally, 20%

highlighted investment in equipment and technologies as a priority. However, 14% stated that they lack the necessary resources for such investment, while 12% specifically mentioned financial resources as a consideration. Finally, 10% cited other sources of investment. Organizations are not ready to make financial investments in promoting university-organization cooperation.

Respondents were asked regarding the factors that hinder cooperation between universities and organizations, along with the extent to which these factors impede collaboration. Approximately 15 reasons were presented, and participants were asked to evaluate each factor's hindrance level, ranging from high, moderate, low, to no impact. (Table 2)

Based on the survey findings, it's evident that financial constraints, including both lack of funds within organizations and the financial resources of partners, are perceived as moderate hindrances, with 30.77% and 30.77% of respondents rating them as such, respectively.

Moreover, high innovation costs and economic risks are significant concerns, with 11.54% and 15.38% of respondents, respectively, rating them as high hindrances.

Market dynamics, such as uncertain demand for innovative solutions and the monopoly of established organizations, pose considerable barriers, with 20.83% and 16.67% of respondents rating them as high hindrances.

Additionally, regulatory and policy constraints, including bureaucracy and inflexible regulations, are seen as significant hindrances, with 16.67% and 13.04% of respondents rating them as high hindrances, respectively. Furthermore, the complexity of innovation and patenting processes is perceived as a moderate hindrance by 21.74% of respondents. Lastly, the data indicates that low demand for innovative solutions is a notable barrier, with 26.09% of respondents rating it as a high hindrance.

Table 3.19: Factors hindering University-Industry Partnership

Statement	High	Average	Low	Factor is not applicable
Lack of funds within the organization	7.69%	30.77%	11.54%	50.00%
Lack of financial resources of partners	3.85%	30.77%	3.85%	61.54%
Innovation costs are too high	11.54%	19.23%	15.38%	53.85%
High economic risks	3.85%	26.92%	15.38%	53.85%
Lack of qualified personnel within organization	4.00%	48.00%	16.00%	32.00%
Lack of information on technology	12.50%	25.00%	20.83%	41.67%
Lack of market information	4.17%	25.00%	16.67%	54.17%
Difficulty finding partners for innovation	4.17%	33.33%	8.33%	54.17%
Monopoly of established organizations in the market	16.67%	4.17%	16.67%	62.50%
Uncertain demand for innovative products or services	8.33%	16.67%	20.83%	54.17%
The complexity of innovation/patenting	4.35%	13.04%	21.74%	60.87%
Bureaucracy of the organization	4.17%	16.67%	12.50%	66.67%
Insufficient flexibility of regulations or standards	13.04%	13.04%	26.09%	47.83%
Constraints of public policy on science and technology	13.04%	13.04%	4.35%	69.57%
Low Demand for Innovative Solutions	4.35%	8.70%	26.09%	60.87%

In conclusion, the survey findings highlight several key factors that hinder cooperation between universities and organizations. Financial constraints, both within organizations and among their partners, are significant barriers, often rated as moderate hindrances. High innovation costs and economic risks further complicate collaboration efforts, being perceived as substantial obstacles by a notable portion of respondents.

Market dynamics, including uncertain demand for innovative solutions and the dominance of established organizations, also pose significant challenges. Regulatory and policy constraints, characterized by bureaucracy and

inflexible regulations, add to the complexity of fostering effective collaboration. Additionally, the intricacies of innovation and patenting processes are perceived as moderate hindrances.

In the end the respondents were asked about the standards utilized by organizations to assess the success of university-organization cooperation. The majority, at 38.64%, cited talent recruitment outcomes-Numbers, followed by 15.91% who referenced initiated research programs. Additionally, 13.64% mentioned publications and innovative solutions as indicators of success, while 11.36% stated that no specific measurements were employed for evaluation purposes.

The survey conducted to explore university-industry collaboration dynamics from the perspective of organizations. It offers valuable insights into the landscape, challenges, and potential opportunities for enhanced cooperation. It reveals a diverse representation of industries, with a notable presence of larger organizations, indicating a robust and established business environment. Despite this, significant barriers such as financial constraints and bureaucratic hurdles hinder collaboration efforts, underscoring the need for targeted strategies to overcome these challenges. However, there is a clear appetite for collaboration, with a majority of respondents already engaged in partnerships with universities, driven by motivations such as talent recruitment and access to innovative knowledge. Moving forward, addressing these challenges and capitalizing on the identified motivations can lead to more fruitful university-organization partnerships, fostering innovation, and driving socio-economic growth in Armenia.

However, to validate the results of survey have been conducted focus group interviews among the some representatives of Public/Private Organizations. The aim was to examine how public and private sector organizations collaborate with universities, identify current challenges in these partnerships, and propose strategies for enhancing cooperation. To better highlight sector-specific impacts and conduct a comprehensive analysis of the results, separate focus groups were convened. One group consisted of Human Resources Management heads and other functional department heads from eight organizations within the financial and banking sector. The second group included counterparts from eight organizations

within the service sector. Discussions within each group have been divided into 4 parts:

Collaboration channels and Forms:

In the framework of Channels and Forms, respondents answer how their organizations value working with universities, what channels they use for collaboration, what factors affect their choice of universities to work with, and how they communicate and work together. Representatives from financial, banking, and service sectors mostly said they support working closely with universities. Generally, cooperation formats include reimbursing tuition fees, offering scholarships, internships, sometimes with job placements, and hiring graduates or students.

As a result of the focus group survey, respondents highlighted collaborations such as master classes and extracurricular courses. Commercial banks specifically engage with universities through formal agreements and student programs they develop. During the discussions, representatives from financial, banking, and service sectors expressed readiness to collaborate on educational program development, thematic research projects, and commissioned graduation works. They view universities as crucial in training specialized professionals. Some in the financial and banking sectors advocate for universities transforming into more business-oriented institutions, emphasizing practical skills. Others believe universities should maintain their academic excellence while enhancing practical training through formats like short courses and case studies.

R&D Programs

Within the framework of R&D programs, organization representatives provide the details about the research, development, and consulting projects they have collaborated on with universities over the past five years. They were also asked to identify areas of research where they would like to cooperate with universities in the future. Representatives from the financial and banking sectors noted that while there may currently be issues of mistrust, they believe that it is realistic to undertake research projects with

universities in the near future. When asked about factors that could hinder cooperation, the organization representatives highlighted a lack of confidence in the quality of the work and a lack of time. Interestingly, the provision of financial resources was not seen as an obstacle by either the financial and banking sectors or the service sector. However, some participants did mention that their organizations are not presently ready to allocate financial resources for such collaborations.

Reasons, Benefits, and Limitations of Cooperation

Within this framework, organization representatives discussed the reasons, benefits, and obstacles related to their cooperation with universities. Both the financial and banking sectors and the service sector indicated that the primary motivation for collaborating with universities is to recruit personnel for vacant positions. Employers highlighted additional benefits of this cooperation, such as the flow of new ideas and the development of a fresh culture of thinking brought by young personnel. According to the respondents, new employees are highly motivated by the prospects of gaining new knowledge, experience, and professional growth. Additionally, organizations view the training of young personnel as part of their social responsibility.

However, obstacles to cooperation were also noted. Some representatives mentioned the lack of academic knowledge among students, while others pointed to a lack of practical skills. To address these gaps, employers offer experience programs such as Dual Education and Beginning Leaders programs. Time constraints were also cited as a barrier to cooperation. Representatives from the financial and banking sectors emphasized that universities should play a pivotal role in bridging the gap between students and employers, aligning student motivations with sector needs to achieve more significant outcomes.

Resource Investments

In this framework, representatives of organizations were asked if they are prepared to invest in developing cooperation with universities. The overwhelming majority of focus group participants expressed their

willingness to provide resources, primarily in the form of financial investments and the involvement of their staff in the training process or various extracurricular formats. However, specific technological provisions have not yet been defined by the organizations at this stage.

Recognizing the importance of cooperation, representatives from the financial and banking sectors indicated their readiness to invest financial resources. Moreover, some representatives suggested commissioning research programs from universities on a paid basis. They believe this approach would enhance quality and create a higher level of accountability.

Conclusions

Both methods reveal a strong emphasis on practical and educational collaborations, such as internships, scholarships, and hiring graduates. The focus groups provide additional sector-specific insights, highlighting formal agreements and student programs in the financial and banking sectors.

Both methods highlight a lack of current involvement in R&D programs and similar hindrances, such as lack of confidence in work quality and time constraints. The focus groups reaffirm that financial resources are not a significant barrier for collaboration.

Both methods emphasize talent recruitment as a primary motivation for collaboration and acknowledge benefits like access to new ideas and professional growth. The obstacles mentioned are consistent, focusing on financial constraints, bureaucracy, and skill gaps among students.

Both methods indicate a willingness to invest in cooperation, particularly through human resources and financial investments. Focus groups provide more detailed insights into specific forms of investment, such as commissioning research programs.

The comparison between the survey and focus group results provides a well-rounded perspective on the current state of university-industry collaboration. Both methods reveal a strong interest in practical collaborations, identify significant barriers, and underscore the importance of addressing skill gaps and aligning student motivations with industry needs. The research reveals a

robust interest in university-industry collaboration, driven by mutual benefits such as talent recruitment, innovation, and knowledge exchange.

However, significant challenges, particularly financial constraints, bureaucratic hurdles, and skill gaps, must be addressed to unlock the full potential of these partnerships. By implementing targeted strategies and fostering a supportive ecosystem, university-industry collaborations can significantly contribute to socio-economic growth and innovation in Armenia.

CONCLUSIONS AND SUGGESTIONS

University-industry Partnerships are pivotal in facilitating knowledge transfer and innovation and fostering economic and innovative growth. Universities are transitioning into entrepreneurial institutions, expanding their focus beyond traditional teaching and research to promote innovation and business activities actively. The Triple Helix and Quintuple Helix conceptual frameworks offer valuable models for comprehending and augmenting these collaborations, underscoring the interconnectedness of academia, industry, government, civil society, and the environment. Additionally, university-industry partnerships prove crucial in supporting regional development strategies like the Smart Specialization Strategy, thereby propelling innovation and economic development.

This study presents a comprehensive framework elucidating collaboration channels and mechanisms. The systematic review uncovers the multifaceted nature of collaboration methods, delineating the distinctive characteristics of each channel. It underscores the imperative of considering context-specific factors when assessing the efficacy and feasibility of each channel, recognizing potential variations based on national contexts and institutional attributes. Consequently, a reasonable selection of channels should be informed by the unique needs and capabilities of academia and industry within a specific region or context.

The study also encompasses a review of motivations and challenges in university-industry partnerships. Many motivations and benefits propel universities and industries into partnerships, spanning economic, intellectual, social, and institutional gains. Nevertheless, these motivations coexist with potential losses and challenges that impede collaboration effectiveness.

Furthermore, the study delves into institutional and structural units pivotal for university-industry collaboration, such as career centers, research and development (R&D) centers, Technology Transfer Offices (TTO), and Entrepreneurship Development Centers.

The principal objective of this study was to conduct a comparative analysis between European Union (EU) member states and Transitory Economies to

facilitate the exchange of experiences and best practices. The focus was on fostering mutual learning and knowledge sharing. The study entailed an in-depth analysis of the legal and regulatory framework governing the University-Industry Ecosystem. Various indicators were employed to assess progress and potential developments in these areas. Additionally, perspectives from students, universities, and industries were considered to obtain comprehensive insights.

The EU has instituted an extensive legal framework and initiatives to promote and enhance university-industry partnerships. This framework encompasses research, technological development, and innovation policies, all aimed at creating a competitive and dynamic knowledge-based economy. Ongoing initiatives such as Horizon Europe, the European Research Area (ERA), and European Innovation Partnerships play pivotal roles in shaping university-industry collaboration. The European Institute of Innovation and Technology (EIT) is a crucial driver, bringing together innovation, business, education, and research.

Various key indicators were examined to comprehend the state of these partnerships in the EU, shedding light on the strengths and challenges of different countries.

- Employment rates and NEET (Not in Education, Employment, or Training) rates varied across European countries, with the Netherlands demonstrating the highest employment rate and Italy facing challenges with a relatively low employment rate and a high NEET rate.
- Denmark claimed the top position in innovation leadership, with several countries categorized as strong innovators.
- Research and Development (R&D) investment, including Business Expenditure on Research and Development (BERD), Higher Education Expenditure on Research and Development (HERD), and Government Budgetary Expenditures on Research and Development (GBERD), emerged as primary funding sources for R&D activities in the EU.
- Co-publications between universities and businesses were highlighted as a strong indicator of collaborative research and knowledge exchange. Luxembourg, Denmark, and Cyprus stood out for their higher co-publication results.

Furthermore, the study selected four countries (Germany, Czech Republic, Sweden, and Bulgaria) to illustrate development patterns and prospects in university-industry partnerships. The analysis revealed distinct patterns in each country's innovation landscape, including their participation in the Horizon Europe program.

Furthermore, our investigation extended to exploring partnership experiences in Transition Economies. Employing a similar approach and indicators for EU countries, this comparative analysis aimed to provide deeper insights into university-industry partnerships in Transitioning Economies. The comparative examination between the European Union (EU) and Transitioning Economies yielded the following findings:

- University-industry partnerships in the EU are firmly established, encompassing personnel training, job opportunities, and advancements in science and innovation. Robustly funded career services, entrepreneurship centers, and Research and Development (R&D) centers are focal points. In contrast, transition countries encounter challenges related to funding constraints, inadequacy of qualified personnel, and coordination issues. While there is an emphasis on student mobility and joint research programs, the commercialization of academic results is less prevalent.
- Gross Expenditure on Research and Development (GERD): The EU consistently allocates a higher percentage of Gross Domestic Product (GDP) to research and development (R&D), showcasing a profound commitment to innovation. In 2020, this allocation reached approximately 2.32% of GDP. Transition economies exhibited varying levels of GERD, with certain countries like Belarus and the Russian Federation initially investing a relatively high percentage of GDP but experiencing fluctuations. Others, such as Ukraine, witnessed a significant decrease in GERD as a percentage of GDP.
- Co-Publications: The EU consistently demonstrated many scientific publications, reflecting a robust research output. In 2020, the EU maintained a substantial number of publications. Scientific publications in Transition economies exhibited variability, with some countries experiencing growth (e.g., Armenia and Azerbaijan) while others

encountered fluctuations (e.g., Belarus). The Russian Federation consistently maintained high publication numbers.

- Overall Innovation Environment: The EU manifests a well-developed innovation ecosystem characterized by high GERD, a strong emphasis on scientific publications, and a matured university-industry partnership landscape. Transition Economies display diverse stages in developing their innovation ecosystems, with some undergoing growth in research output and collaboration yet concurrently facing challenges related to funding limitations and institutional structures.

Subsequently, we initiated micro-level examinations of university-industry interactions, delving into in-depth case studies of two countries and two universities. This meticulous analysis encompassed three dimensions: Student, University, and Industry. Accordingly, our chosen case countries were Italy and Armenia, explicitly emphasizing two prominent institutions: Yerevan State University and Ca'Foscari University of Venice.

The surveys, meticulously administered at Ca'Foscari University of Venice and Yerevan State University, rendered valuable insights into students' perspectives concerning university-industry collaboration, employment prospects, and entrepreneurial pursuits. The ensuing key conclusions are drawn from the discerning analysis of survey results:

1st Pillar: Student Perspective:

- Awareness and Utilization Gap: Both educational institutions encounter challenges in mitigating the gap between students' awareness of available career services and their actual utilization. Proactive communication and outreach strategies are imperative to enhance students' awareness of existing services and motivate their engagement.
- Startup Engagement: Although a minority of students has explored startup ideas, there exists untapped potential for increased engagement in entrepreneurship. Both universities may consider expanding support for aspiring student entrepreneurs, including establishing incubators, mentorship initiatives, and networking platforms.
- Barriers to Startup Realization: A notable portion of students with startup ideas face challenges in realizing them, indicating the presence

of barriers. Identifying and addressing these impediments is essential for fostering student innovation and entrepreneurial success.

- Employment Status: Most respondents in both academic institutions are currently unemployed, underscoring the significance of providing adequate career support to facilitate a successful student transition into the job market.

2nd Pillar: University Perspective:

- At Ca' Foscari University of Venice, the investigation uncovered a well-established framework for fostering innovation and entrepreneurship, particularly among academic staff. This has resulted in the successful establishment of numerous academic spin-off businesses. However, concerning the support for student entrepreneurship, the university is in its nascent stages, indicating a necessity for substantial enhancements in the institutional structure. The university's structures and initiatives, including the Career Service, Pink Service, VeniSIA, and the Center for Acquiring Scientific Equipment, are pivotal components of its University-Industry Partnership ecosystem. These entities facilitate entrepreneurship, innovation, technology transfer, and research collaborations.
- In contrast, Yerevan State University grapples with structural, operational, systematic, and educational challenges within its University-Industry Partnership ecosystem. The university encounters issues related to the functionality of crucial structures like the Entrepreneurship Development Center and the Business Incubator. Communication mechanisms between the university and industries require improvement, and transparent regulatory frameworks are lacking. Moreover, Yerevan State University lacks modules or courses explicitly designed to cultivate innovation and entrepreneurship among students and academics.
- Ca' Foscari University has achieved notable progress in promoting innovation and entrepreneurship, particularly among academic staff. In contrast, Yerevan State University faces diverse challenges in establishing an effective University-Industry Partnership ecosystem.

3rd Pillar: Industry Perspective:

Following this, we present a detailed exposition of the industrial dimensions of Italy and Armenia within the context of Industries/Business. The analysis encompasses research and development (R&D) expenditure, SDG performance, patent applications, and specific instances of private companies collaborating with Ca' Foscari University and Yerevan State University, all within the Sustainable Development Goals (SDGs) framework. The key insights derived from this examination include:

- R&D Expenditure: Italy manifests regional disparities in R&D spending, with affluent regions like Lombardy and Lazio significantly outpacing southern regions in research and innovation investments. Conversely, Armenia grapples with a pronounced concentration of R&D investment in the capital city, Yerevan, resulting in regional imbalances in economic development and innovation.
- SDG Progress: Despite Italy's high standing in the Sustainable Development Goals (SDGs), challenges persist, notably in academic publications and R&D spending. Armenia is diligently progressing towards SDG attainment, facing specific challenges in Goal 9 (industry, innovation, and infrastructure) and Goal 4 (quality education). Goal 17 (partnerships) shows moderate progress but remains insufficient.
- Innovation Commitment: Italy's commitment to innovation is reflected in its R&D expenditure and patent applications. The marginal reduction in R&D spending in 2022 could be attributed to prevailing economic conditions.
- Private Sector Collaboration: Italian corporations such as ENI, Geox, Barilla, and Ferrari actively participate in collaborations with universities, particularly in domains related to energy, footwear technology, food science, and automotive engineering.

Furthermore, surveys and focus group interviews were conducted to explore university-industry collaboration dynamics in Armenia from the perspectives of public and private organizations. Both methods underscore a strong focus on practical and educational collaborations such as internships, scholarships, and hiring graduates, while opportunities for academic-business partnerships, startup incubation in technoparks, and related

frameworks are notably absent. Both also highlight a limited involvement in research and development programs, citing concerns over work quality and time constraints as primary hindrances.

Talent acquisition emerges as a key driver for collaboration, offering benefits such as access to fresh ideas and professional development. Persistent challenges include financial constraints, bureaucratic hurdles, and skill gaps among students.

SUGGESTIONS

Channels

Prioritizing an exhaustive examination of the local and national context and the characteristics of university and industry partners is imperative to discern the most fitting channels and modes of interaction. Recognition of the specific strengths and weaknesses inherent in each collaboration channel is vital, ensuring alignment with the objectives and resources of the involved partners. The hierarchical approach necessitates considering that involvement in Intellectual Property Rights (IPR) channels requires prior engagement in networking channels—a step-by-step process. The involvement of various stakeholders, encompassing government bodies, research funding agencies, and civil society, is pivotal to adapting channels in response to evolving needs, changing circumstances, and emerging opportunities. Implementing mechanisms for assessing the impact and outcomes of collaboration channels allows for continuous improvement and optimization.

Motivation, Benefits, Challenges

The following recommendations are offered to navigate the intricacies and maximize the benefits of university-industry collaborations: Establishing effective management structures and specialized units by both universities and industries to facilitate collaboration is essential. Defining clear roles and responsibilities is crucial, aligning the interests and expectations of both parties. Regular meetings and feedback mechanisms ensure that collaboration remains focused on shared objectives. Universities and industries should establish clear and mutually acceptable intellectual

property rights agreements at the outset to prevent conflicts over research outcome ownership. Adapting educational programs within universities to include practical skills development and industry-relevant content is recommended. Collaboration with industry partners in curriculum design aids in bridging the gap between academic knowledge and practical application.

Institutional Structures

To bolster collaboration, universities and businesses should reinforce their institutional structures, encompassing career centers, research and development (R&D) centers, Technology Transfer Offices (TTOs), and Entrepreneurial Development Centers. Universities are advised to broaden career services to meet the evolving demands of the job market, incorporating entrepreneurial education and work experience opportunities for enhanced student workforce readiness. Alongside traditional career services, advocacy for establishing innovation and entrepreneurship development centers within universities is recommended, backed by adequate support and resources for research addressing significant educational challenges. Collaborative efforts among governments, universities, and industry partners are essential for funding and promoting these centers. Encouraging the establishment of technology transfer organizations like TTOs, Science and Technology Parks (STPs), and Technology Incubators (TBIs) is pivotal, as these entities play a critical role in commercializing university knowledge and nurturing innovation. A focus on entrepreneurial education within universities, fostering academic entrepreneurship through programs facilitating mutual learning, information exchange, and innovation, is encouraged. Streamlining bureaucratic processes within universities is imperative to ensure efficient collaboration with industry partners, with effective management structures contributing to overcoming potential obstacles in the collaboration journey.

Opportunities for Experience Exchange:

- Knowledge Transfer: Transitioning Economies stand to gain valuable insights from the European Union's (EU) experience in nurturing university-industry partnerships, particularly in commercializing

research and development outcomes and instilling an innovative culture within academic institutions.

- EU institutions are well-positioned to provide guidance and support to Transitioning Economies in formulating institutional structures and policies conducive to fostering collaboration between academia and industry. Sharing expertise on securing and managing funding for research and development projects can prove instrumental in assisting Transitioning Economies in overcoming financial challenges.
- Leveraging their well-established entrepreneurship ecosystems, EU member states can collaborate with Transitioning Economies to promote academic entrepreneurship and innovation through joint programs.
- EU countries are poised to contribute to developing clear and supportive legal frameworks for university-industry partnerships, addressing intricacies related to intellectual property rights and technology transfer.
- Experience exchange can elevate the quality of research in Transitioning Economies by adopting best practices in research methodology, publication standards, and peer review processes. Collaborative efforts can tackle the skills mismatch challenge by facilitating skill development programs aligned with industry demands.

Drawing from the micro-level analyses of both universities, several recommendations emerge:

- Yerevan State University (YSU) should prioritize more effective communication strategies to narrow the gap between students' awareness and utilization of Career Services. Lessons can be gleaned from Ca' Foscari's adept strategies in promoting these services among its student body.
- While Ca' Foscari exhibits a lower percentage of students with startup ideas than YSU, YSU must foster and support student entrepreneurship. Exploring the practices and programs at Ca' Foscari, such as incubators, mentorship initiatives, and networking opportunities, can provide valuable insights for YSU in implementing similar initiatives to stimulate entrepreneurial activities on its campus.

- YSU should thoroughly investigate the factors hindering some students' realization of startup ideas. Learning from Ca' Foscari's experiences, YSU can pinpoint and address specific challenges and obstacles student entrepreneurs face, potentially offering additional resources, mentorship, or training to help students overcome these barriers.
- Both YSU and Ca' Foscari can explore collaborative opportunities and knowledge exchange in areas such as entrepreneurship support, career services, and student engagement. This collaboration may entail sharing best practices, experiences, and innovative ideas to enhance the overall student experience and outcomes.

In summary, these findings lay the groundwork for advancing university-industry collaboration, fortifying support for student entrepreneurship, and better-preparing students for successful academic and professional trajectories. Addressing the identified challenges and leveraging the strengths of each institution, Ca' Foscari University of Venice and Yerevan State University can cultivate a more conducive environment for their students' academic and professional development.

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ԿԱՄՐՋԵԼՈՎ ԲՈՒՀԸ ԵՎ ԲԻԶՆԵՍԸ. ԲԱՑԱՀԱՅՏԵԼՈՎ ԲՈՒՀ-ԿԱԶՄԱԿԵՐՊՈՒԹՅՈՒՆ ՀԱՄԱԳՈՐԾԱԿՑՈՒԹՅՈՒՆԸ ԵՄ-ՈՒՄ ԵՎ ԱՆՑՈՒՄԱՅԻՆ ՏՆՏԵՍՈՒԹՅՈՒՆՆԵՐՈՒՄ

Կառլեն Խաչատրյան, Աննա Հակոբջանյան,
Քրիստինե Նիկողոսյան

Բուհ-կազմակերպություն համագործակցության ամրապնդումն աշխարհի բազմաթիվ երկրների կրթական քաղաքականության առանցքում է: Հատկապես անցումային տնտեսությամբ երկրներում այս հարցն առավել սուր է արտահայտված, քանի որ տնտեսական առաջընթացն առանց մարդկային կապիտալի զարգացման անհնար է իրականացնել: Այս իմաստով, երկրի սոցիալ-տնտեսական զարգացման, հետևաբար նաև արտադրողականության աճի գրավականներից մեկը կարող է հանդիսանալ բուհ-կազմակերպություն արդյունավետ փոխգործակցությունը: Այս հարթությունում կողմերի համակարգված և շարունակական համագործակցությունը կարող է դառնալ **տնտեսական զարգացման նախապայման***:*

Սույն աշխատության շրջանակում ուսումնասիրվել են բուհ-կազմակերպություն համագործակցության կապուղիները և ձևաչափերը, դրանց կատարելագործման հնարավորությունները՝ որպես հետազոտական, նորարարական կարողությունների ընդլայնման հիմնաքար, քննության են առնվել համագործակցող կողմերի՝ բուհերի, պետական/մասնավոր հատվածի կազմակերպությունների համագործակցության պատճառները, օգուտներն ու սահմանափակումները:

Հետազոտական թեմայի շրջանակում մենագրությունում զետեղված արդյունքները ստացվել են շահագրգիռ կողմերի շրջանում կատարված հետազոտությունների արդյունքում (հարցաթերթիկային հարցումներ, հարցազրույցներ, ֆոկուսխմբային հարցումներ): Մասնավորապես, հարցաթերթիկային հարցում է իրականացվել ՀՀ 6 խոշոր բուհերի շրջանում (ԵՊՀ, ՀՊՏՀ, ՀԱՊՀ, ՀԱԱՀ, ԲՊՀ, ՃՇՀԱՀ), ինչպես նաև ՀՀ արտադրական, ֆինանսաբանկային, ծառայությունների այլ ոլորտների կազմակերպու-

թյունների 100 ներկայացուցիչների շրջանում: Ընդ որում, մեծ տեսակարար կշիռ են կազմել 200-ից ավելի աշխատակից և 10 տարուց ավելի աշխատանքային փորձ ունեցողները: Հարցման նպատակն է հանդիսացել բացահայտել բուհերի և պետական/մասնավոր հատվածի կազմակերպությունների միմյանց հետ համագործակցության կառուցակարգերը, հասկանալ համագործակցության ձևաչափում առկա խնդիրները և նախանշել ուղիներ համագործակցությունը սերտացնելու ուղղությամբ:

Հարցաթերթիկային հարցումից զատ գործատուների շրջանում իրականացվել են ֆոկուսխմբային հարցումներ: Ոլորտային առանձնահատկությունների ազդեցություններն առավել ակնհայտորեն պատկերացնելու և արդյունքներն առավել հանգամանորեն վերլուծելու նպատակով քննարկումները կազմակերպվել են 2 առանձին ֆոկուս խմբի շրջանում: Ֆոկուսխմբային հարցմանը մասնակիցել են խոշոր կազմակերպությունների մարդկային ռեսուրսների կառավարման և այլ ֆունկցիոնալ ստորաբաժանումների ղեկավարներ: Հարցման արդյունքները փաստում են, որ բուհ-կազմակերպություն համագործակցության շրջանակն առավելապես ընդգրկում է պրակտիկաների, փորձնակության, ուսանողներին աշխատանքի ընդունելու, կրթաթոշակների տրամադրման ծրագրերը, վարպետության և արտալսարանային դասերի կազմակերպումը: Մինչդեռ հետազոտական և զարգացման ծրագրերում համագործակցության հնարավորությունները սահմանափակ են, ինչպես նշում են գործատուները՝ իրենց ժամանակի պակասի, ուսանողների ոչ բավարար հմտությունների և որոշ դեպքերում ֆինանսական միջոցների բացակայության պատճառներով:

Ուսումնասիրելով և վերլուծելով ԵՄ և անցումային երկրների նորարարական, հետազոտական կարողությունների ներուժը, կատարվել են դեպքերի ուսումնասիրություններ Վենետիկի Կա'Ֆոսկարի համալսարանի և Երևանի պետական համալսարանի ուսանողների, պրոֆեսորադասախոսական կազմի ներկայացուցիչների և վարչական ապարատի աշխատակիցների շրջանում: Հետազոտության արդյունքները երկու համալսարաններում էլ փաստում են թափուր հաստիքների վերաբերյալ ուսանողների տեղեկացվածության պակասի վերաբերյալ, նկատելի են ակտիվացման որոշակի միտումներ նորարարական գաղափարների գեներացման, մենթորության ծրագրերին, ստարտափներին մասնակցության

հարցերում: Առանձին անդրադարձ է կատարվել բուհերում ինստիտուցիոնալ կառույցներին, դրանց գործունեության շրջանակին, ինչպես նաև հետազոտությունների ու նորարարությունների խթանման, արտոնագրերի, բիզնես ինկուբատորների, հետազոտական կենտրոնների, բուհ-կազմակերպություն էկոհամակարգի ինստիտուցիոնալ այլ կառույցների կայացվածության խնդիրներին:

Կատարված վերլուծությունների և հետազոտությունների արդյունքում առաջադրվել են միջացառումներ բուհ-կազմակերպություն համագործակցության ուղիների զարգացման և կատարելագործման ուղղությամբ:

* * *

Հեղինակը հաստատում է, որ ծանոթ է «ԵՊՀ գրահրատարակչական քաղաքականությանը», և գրքում առկա փաստերը, դիրքորոշումները, կարծիքները շարադրված են հեղինակային իրավունքի և էթիկայի միջազգայնորեն ընդունված սկզբունքների պահպանմամբ:

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YEREVAN STATE UNIVERSITY

Karlen Khachatryan
Anna Hakobjanyan
Kristine Nikoghosyan

Bridging Academia and Industry: Unraveling University-Industry Collaborations in the EU and Transitioning Economies

Insights from Armenia and Italy

Cover design A. Patvakanyan
Computer design K. Chalabyan
Tech. editor L. Hovhannisyan

Submitted for publication 25.07.2024.
Size 70x100$^{1}/_{16}$: Publisher: 11.375 press.
Issues 100.

YSU Press
Yerevan, 0025, Al. Manoogian 1
www.publishing.am