The Investigating the Impact of University-Industry Cooperation, Mechanisms, and Activities on the Benefits of Research in Universities (Some Mongolian universities)

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Abstract. University-Industry collaboration plays an important role in improving the quality of research in universities. This research aims to study the mechanisms, activities, and benefits of university and industry research collaboration. The critical study is to clarify two research questions. The hypothesis test results showed that financial support is positively associated with activities such as professional mobility, R&D, entrepreneurship, R&D results commercial, some collaboration activities from those are negatively related to the benefits of research. This research concludes that universities should create activities to recognize the efforts of the lecturers participating in partnerships with the industry. Benefits and UIC activities are expected to influence the usefulness of UIC and professionals' engagement levels, leading to more effective collaborations. Finally, a study could out that the university needs to conduct research to identify barriers to research and development cooperation, the mobility of professionals, and joint research and development.

Keywords: University · Cooperation · Industry · Activities · Benefits · Research

1 Introduction

For many years, collaboration between academia and business has benefited all parties. This can be seen from the research results of

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previous researchers and the actual results discussed in the context of good practices and policies of countries. However, on the other hand, it is observed that the support mechanisms of the important sections of the university, which are not effective in university-industry cooperation, are turning away. This unproductive turn can be attributed to a number of factors. In order to promote interactions between industry players and academics, governments have also launched a variety of incentives and legal initiatives [1]. For example, supporting a mechanism without any research has a negative impact on the process of cooperation and benefits.

2 Literature of review

University-industry collaborations involve partnerships between academic institutions and various sectors of industry. These collaborations are designed to promote knowledge exchange, research advancements, and the practical application of academic insights in real-world settings. There are several types of university-industry collaboration, each with its own goals and characteristics.

Finance support (FR)

University-industry collaboration financial support refers to the funding and resources provided to facilitate partnerships and collaborations between universities (academic institutions) and industries (private sector companies or organizations). This collaboration aims to bring together the expertise, research capabilities, and resources of universities with the practical knowledge, innovation, and resources of industries to achieve mutual benefits. In spite of the acknowledged importance of UIC as a source of competitive advantage [2] and the knowledge that suitable treatments or incentives can effectively UIC encourage [3] [4], [5], the university management of UIC still lacks a systematic learn of organizational mechanisms. More insight into how organizational operations take place can be gained by looking at the organizational mechanisms that underpin the organizational processes [6].

The literature from universities is rarer and primarily focuses on the research and teaching assignments, even in contexts when organizational mechanisms are frequently investigated in industry. These collaborations can have numerous benefits. Universities gain access to industry insights, real-world challenges, and funding sources, while industries benefit from academic expertise, innovative ideas, and potential talent recruitment. It's important to note that such collaborations often involve contractual agreements specifying the terms of the collaboration, including intellectual property rights, publication policies, and financial arrangements.

Professional mobility (PM)

University and industry collaboration Professional Mobility (PM) refers to programs or initiatives that facilitate the movement of professionals, researchers, and experts between academic institutions (universities) and industrial or corporate settings. The primary goal of professional mobility programs is to foster knowledge exchange, skill development, and collaboration between academia and industry by allowing individuals to temporarily transition from one environment to the other. Professional mobility is the short-term movement of personnel for business-related reasons between institutions and industries.

Sabbatical intervals of departure for academics and professionals, secondments nonacademic "in-residence" professionals from surrounding communities, and professors of practice [7] are examples of forms of mobility. Professional mobility is still the least established type of partnership in Europe practice [8]. Its effectiveness depends on how effectively the knowledge is assimilated and put to use economically, which is difficult given the disparate routines, norms, and standard operating procedures of both organizations. Professional mobility programs require coordination between universities, industries, and relevant stakeholders to ensure successful placements and collaborations. These programs contribute to a more dynamic and interconnected ecosystem where academic research finds practical applications and industries benefit from cutting-edge knowledge and research.

Joint Research and Development (JRD)

Joint R&D can be understood as arrangements under which university and industry collaborate to pursue research objectives together regardless of where the funding comes from. This activity includes all joint R&D activities [9], including collaborative research projects funded by industry [10], contract research [11], R&D consulting [12], business testing and certification [13], and joint publications with firm scientists. The opportunity to access discoveries at a preliminary phase [14], the capacity to share the R&D risk and expense [15], the researchers [16], the co-funding of Ph.D. students, and the industrial majority [16] for industries.

Commercialization of R&D (RDC)

The process of commercialization is how new scientific discoveries and technological advancements are introduced to the market through the exchange of intellectual property. Invention disclosures [17], patents [18], licensing [19] [9], and sales ([20]) are examples of commercialization methods. While academics and universities achieve income [21]) and reputation, [22] the industry accesses new products and services [23] [24] generating competitive advantages [25]. UIC policy and operational domains have placed a greater emphasis on commercialization

since the Bayh Dole Act was passed in the USA in 1980, with university regulations and governmental initiatives encouraging such activities [26][27]) ([28]).

Entrepreneurship (ENT)

In terms of UIC, entrepreneurship is defined as activities taken by universities in support of the founding of new businesses by students [5], faculty members acting on their own initiative or not [29], and academics and industry partners working together [30]. A small amount of entrepreneurship for academics still takes the form of start-ups or spin-outs [8] usually focused on the information technology and, more and more, the biotechnology/medical technologies sectors [31]. Legal restrictions typically prevent academics from starting an industry, so they focus more on collaborative R&D or licensing [32], [33].

Benefits of research (BR)

University and industry collaboration in research can yield a wide range of benefits for both parties involved, as well as for society as a whole. Here are some key benefits of such collaborations:

Academic researchers bring theoretical knowledge, expertise, and innovative ideas to industry partners. Industry professionals contribute practical insights, challenges, and real-world data that can guide academic research. Innovation and Collaborations can lead to the development of new technologies, products, and services that have practical applications and commercial value[34]. Joint research projects often result in novel solutions that wouldn't have been possible within the confines of one sector. Universities provide access to research facilities, equipment, and specialized laboratories that may be costly for industries to establish independently[35].

Industries offer funding, infrastructure, and resources that can support ambitious research projects. Industry partners bring real-world challenges and problems to the table, driving research towards solutions that address practical issues[36].

Academic researchers offer fresh perspectives and methodologies for approaching complex problems. Talent Development and Recruitment: Collaborations provide opportunities for students and researchers to gain industry experience, enhancing their skills and employability.

In summary, university and industry collaboration in research can bridge the gap between theoretical knowledge and practical applications. By combining the strengths of academia and industry, these collaborations can drive innovation, economic growth, and societal progress.

3 Methodology

The university-industry collaboration was developed, and then a step-by-step procedure for education benefits in the university was explained. An investigation was conducted to link the mechanism, activities, and benefits of university-industry collaboration according to the previous actions to develop partnerships between heads, lecturers, and staffs of universities. The research framework that we proposed focused on the practices of universities so our study was directed toward the heads, lecturers, and staffs of universities. Six latent variables represent diverse UIC activities and research benefits. A seven-point Likert scale was used to gauge the level of development, ranging from 1 ‘not at all to 7 ‘to a very large extent. Participants were provided with the definitions of each UIC activity so they could assess them accurately. Different UIC activities and research benefits are represented by six latent variables. Using a 7-point Likert’ scale, from 1 meaning "not at all" to 7 meaning "to a very considerable extent," the degree of development was assessed.

So that they could evaluate the UIC activities fairly, participants were given the definitions of each one. Mongolian public and private sectoral 40 universities collaborate with industry, which has best practices in their own country. Due to pandemic considerations, and the self-administered online survey questionnaire with Google form was distributed to all academics that’s universities in Mongolia. Data were collected from 311 responses on Google Forms.

We were contacted by the head of a department in branch schools in those universities, and the head of the innovation center passed it on to some lecturers within their universities. The survey was translated from English to Mongolian languages using back-and-forth translations, a method commonly adopted in the literature. The demographic statistics for the respondents: Approximately 37.7% were males, and 62.3% were females. The majority of respondents (52.5%) were between 40 and 49 years of age. In terms of educational level, most respondents (46.7%) held a Ph.D. Degree. A majority (45.9%) had 20+ years of experience as a academics at a university.

Table 1. Reliability of constructs

N	Constructs	Cronbach's alpha	Average variance extracted (AVE)
1	Benefits of Research	0.938	0.843
2	Commercialization of R&D results	0.898	0.831
3	Entrepreneurship	0.918	0.925
4	Financial Support	0.718	0.639
5	Joint research and development	0.895	0.765
6	Professional mobility	0.779	0.601

Table 1 shows overall, the discriminant validity assessed using [37] can be accepted for this measurement model and supports the discriminant validity between the constructs as well as their means and standard deviations. The Cronbach's alpha is another measure of internal consistency reliability that assumes the same threshold but yields lower values than the composite reliability. Table 1 presents the scale's content validity by conducting a confirmatory factor analysis to confirm its structure. In this pilot phase, the data for analysis to make a reliable interpretation of the scale factors are 0.7 up to all constructs satisfied

4 Data Analysis and Results

Table 2. Hypothesis testing

Hypothesis	Constructs	T Statistics	P value	Results	Associated
Financial Support -> Professional mobility	H1a	10.206	0.000	Accepted	+
Financial Support -> Joint research and development	H1b	16.861	0.000	Accepted	+
Financial Support -> Entrepreneurship	H1c	8.675	0.000	Accepted	+
Financial Support -> Commercialization of R&D results	H1d	10.774	0.000	Accepted	+
Professional mobility -> Benefits of Research	H2a	0.792	0.428	Rejected	-
Joint research and development -> Benefits of Research	H2b	1.336	0.181	Rejected	-
Commercialization of R&D results -> Benefits of Research	H2c	2.840	0.005	Accepted	+

Entrepreneurship -> Benefits of Research	H2d	7.100	0.000	Accepted	+

5 Discussion

Hypothesis testing summary as shown in (Table 2) financial support is positively associated with people mobility (H1a, T=*10.206*, P=*0.000*), joint R&D (H1b, T=*16.861*, P=*0.000*), R&D commercialization (H1c, T=*10.774*, P=*0.000*), entrepreneurship, (H1d, T=*8.675*, P=*0.000*), is positively associated with benefits of education (H2a, T=*7.587*, P=*0.000*). Personal mobility and R&D benefits of education (H2a, T=*1.336*, P=*0.181*) is negatively associated with benefits of research (H2b, T=*0.792*, P=*0.428*) also commercial R&D (H2c, T=*2.840*, P=*0.005*) and benefits of education (H2d, T =*7.100*, P =*0.000*) are positively associated

This paper demonstrated UIC activities associated with financial support have significant correlations with the majority of the four UIC activities. It also showed thus entrepreneurship Commercialization of R&D results without activities as professional mobility and research and development are not significantly associated with research benefits in Mongolian universities.

There is a highly negative association between R&D in the effectiveness of university research, and, likely R&D of university-industry collaboration are not sufficiently effective. The positive association of financial supports with entrepreneurship and entrepreneur characteristics, Commercialization of R&D results that are evolved in lecturers and students in which brings research benefits to Mongolian universities.

Institutional Barriers certain industries or organizations may not have a culture that supports or values collaboration with academia [38]. They may be comfortable with their existing practices and may not be willing to adapt. This can create legal and contractual complexities that may deter some from getting involved. Differing Priorities is the priorities and timelines of academia and industry can be quite different. Academics may focus on long-term research goals, while industry may prioritize short-term commercial objectives [39].

Professionals caught in the middle may find it challenging to align their own career goals with these disparate priorities. Because it might according to research and development be negatively associated with the benefits of research, and also only very few universities and departments worldwide commercialize their knowledge and technologies, and generally, a minority of UICs is driven by the expectations of commercial products [40].

6 Conclusion

Professional mobility can indeed benefit from collaboration between universities and industries in various ways. However, the extent to which individuals can harness these benefits may depend on several factors, and there could be challenges or barriers that hinder professional mobility from fully capitalizing on such collaborations. Here are some reasons why professional mobility may not always fully realize the benefits of university-industry research collaboration. Lack of Awareness is professionals may not be aware of the opportunities arising from university-industry collaborations. These collaborations often result in cutting-edge research, innovative technologies, and business opportunities, but if professionals are not informed about these developments, they may miss out.

Access and Networking is access to collaboration opportunities and networks can be a significant barrier. Not all professionals have easy access to universities or industries engaged in collaborative research. Access to such networks and opportunities can be limited by geographic location or professional background. Skill and Knowledge Gaps is collaboration between academia and industry can lead to the development of new skills and knowledge.

However, professionals may face challenges in acquiring these skills or adapting to the rapidly evolving requirements of interdisciplinary research. Resistance to Change some professionals may be resistant to change or may not see the value in adopting new methods or approaches that emerge from these collaborations. This can make it difficult for professionals in those settings to take advantage of university-industry research opportunities.

Resource Constraints is not all professionals have the resources, such as time or funding, to engage in collaborative research projects. These projects often require a commitment of time and effort, and not everyone can afford to participate. Despite these challenges, professional mobility can still benefit from university-industry collaboration by actively seeking out opportunities, building networks, acquiring new skills, and staying informed about the latest developments. Additionally, efforts from governments, educational institutions, and industries to promote and facilitate collaboration can help bridge some of these gaps and create a more conducive environment for professionals to harness the benefits of research collaborations.

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