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The Influence University and Industry collaboration promotion on research benefit of Mongolian Universities

Jargalsaikhan Namuudari[1], Ochirbat Altangoo[2]*

[1]*Division of Research and Innovation, Mongolian National University of Education, Ulaanbaatar 14191, Mongolia*
[2]*Department of Physics, School of Mathematics and Science, Mongolian National University of Education, Ulaanbaatar 14191, Mongolia*

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The university–industry collaboration plays a vital role in improving the research quality of higher education institutions. In this study, we primarily aimed to examine how the supporting (disseminating) mechanism of university–industry collaboration influence on activities and outcomes of university. This study employed a quantitative, cross-sectional research design to investigate the relationships between university–industry collaboration (UIC) mechanisms, collaborative activities, and the resulting research benefits for universities. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used as the analytical method. According to our findings, the supporting mechanisms of university–industry collaboration positively influence key collaborative activities—professional mobility, joint R&D, entrepreneurship, and the commercialization of R&D outcomes—which, in turn, enhance the research benefits gained by universities. However, professional mobilities shows a negative relationship with universities' research benefits, while other activities demonstrate positive associations with research benefits of universities. The findings also emphasize the need to identify and address the factors hindering faculty and students from contributing to the research outcomes of universities through collaboration with industry. Within the framework of university–industry collaborative activities, it is essential to enhance the participation of faculties, students, and industry professionals in joint academic publications, research and development, start-up growth, and product development processes to foster more effective cooperation.

1. INTRODUCTION

In the contemporary knowledge-based economy, university–industry collaboration (UIC) has become a key driver in improving the research quality

Corresponding author. Email*: altangoo@msue.edu.mn*
ORCID: https://orcid.org/0009-0000-6995-9138

and innovation capacity of higher education institutions (OECD, 2019, p.23). Universities play a crucial role in generating new knowledge, meanwhile industries contribute more in application and commercialization of research outputs. Effective collaboration between these two sectors not only strengthens the research performance of universities but also enhances their contribution to national innovation systems and economic development (Etzkowitz and Leydesdorff, 2000, p.115).

Public policy significantly shapes the nature and extent of university–industry collaboration. It can influence the propensity of firms to collaborate and the scope of such partnerships through multiple mechanisms (Bozeman, 2000, p.630). Furthermore, governments play a direct role in providing funding to universities, as well as for research and development (R&D) projects, and a regulatory role by determining the operational frameworks of public universities and shaping the intellectual property rights (IPR) regime (Etzkowitz, 2003, p.113). Moreover, policy interventions often include the establishment of supporting infrastructure, such as technology transfer offices, science parks, and business incubators, which serve as intermediaries between academia and industry. In addition, soft policy measures—such as offering partnership facilitation services, organizing networking events, and promoting the importance of collaboration—also play a crucial role in encouraging mutual engagement (Siegel et al., 2003, p.35).

Despite the recognized importance of UIC, the effectiveness of promotion mechanisms and their influence on universities' research outcomes remain underexplored, particularly in emerging and transition economies. Understanding how these supportive mechanisms—such as funding schemes, infrastructural development, and institutional incentives—affect collaborative activities and their resulting research benefits is essential for both policymakers and academic leaders (Perkmann et al., 2013, p.431).

Therefore, this study aims to examine how the promotion and supporting mechanisms of university–industry collaboration influences the research benefits of universities. Specifically, it investigates the factors that are positively or negatively associated with research outcomes derived from such collaborations. The findings are expected to provide valuable insights into how universities and policymakers can design more effective strategies to enhance the impact of UIC on research performance and innovation capacity.

Literature review: UIC engagement as a criterion in the academics' evaluation system for promotion/tenure connects directly to academic motivation (Polt et al., 2001, p.258; Siegel et al., 2007, p.495). For example, the inclusion of commercialisation and UIC achievements in universities promotional systems seem to increase academics' engagement (Carolin and Quester, 2006, p.377).

In terms of who should be incentivized, specifically for encouraging invention disclosures and commercializing, faculty are normally the ones to receive/profit from the incentives/rewards directly (Debackere and Veugelers, 2005, p.331; Friedman and Silberman, 2003, p.22; Henrekson and Rosenberg, 2001, p. 215; Thursby et al., 2001, p.66) although rewards given to technology transfer staff have also been positively associated with the university’s entrepreneurial activity (Lockett et al., 2005, p.987).

A new system of promotions should be created in universities to regonize the efforts of the academics participating in partnerships with industry. Rewards and incentives are expected to influence the motivations and level of engagement of individuals, leading to more effective collaboraions (Awasthy et al., 2020, p. 53). Research on academic engagement shows that clear, low-friction incentives—royalty/revenue sharing, seed funds for industry pilots, mobility/secondments, and reduced contracting frictions—raise the expected career return from collaboration and increase participation across channels (contract research, joint labs, consulting, co-publications). Syntheses emphasize that incentives complement intrinsic motives and disciplinary norms and are most effective when embedded in supportive institutional policies (Perkmann et al., 2013, p. 437).

Incentives tied to technology transfer (transparent royalty shares, equity options, IP clarity) correlate with higher invention disclosures and deal flow, particularly when Technology Transfer Offices (TTOs) are professionalized and aligned with researcher incentives (de Falani and Torkomian, 2024, p.4461). Where promotion and tenure (P&T) recognize innovation and entrepreneurship outputs (patents, licenses, spin-offs, industry reports, datasets/software) alongside publications, academics face lower career risk and engage more with firms. Calls to “count” commercialization in P&T have argued for explicit rubrics and evidence standards (e.g., license income or adoption letters), moving beyond ad-hoc recognition.

UIC scales with an enabling organizational that supports collaboration: boundary-spanning units (TTOs/industry liaison), standardized governance (model agreements, IP and publication clauses), and physical/programmatic interfaces (incubators, joint labs). The UK Lambert Toolkit reduces transaction costs via pre-negotiated templates that clarify foreground IP ownership, publication review windows, and licensing options—practices associated with faster deal cycles and more collaborations.

Externally, universities act as ecosystem orchestrators through low-barrier instruments and outreach: innovation vouchers for SMEs, challenge calls, front-door concierge services, and sector roundtables. Randomized and quasi-experimental evidence indicates that vouchers catalyze first projects, increase SME innovation activity, and can have persistent impacts on behavior and performance. Related programs (e.g., the UK’s Knowledge Transfer Partnerships) demonstrate how light-touch co-funding paired with active marketing reduces risk and cost for SMEs and expands the reach of UIC.

Governments deploy policy bundles—collaborative R&D grants, innovation vouchers, tax incentives, mobility schemes, and procurement for innovation—aimed at lowering transaction costs and aligning incentives across the Triple Helix. Evaluations show these tools work best in combination and when sustained over time; isolated or unstable funding often yields fragile collaborations (Kleine et al., 2022, p.3). Standard-setting resources such as the Lambert Toolkit and WIPO’s guidance also diffuse good contracting and IP practice across the system, indirectly promoting UIC by shortening negotiations and clarifying expectations.

The absorptive capacity (ACAP) of firms—their ability to identify, assimilate, and exploit external knowledge—strongly conditions whether promotion mechanisms translate into innovation outcomes; policies that pair UIC instruments with ACAP-building supports (e.g., advisory/mentoring, digital readiness) are more likely to produce additionality for SMEs. Within universities, TTO capability and portfolio management likewise moderate effectiveness; recent reviews link professionalization and clear KPIs to better translation performance (de Falani and Torkomian, 2024, p.4463).

Promotions to benefits of Research in University and Industry Collaboration: Supporting mechanisms are measures to develop and administer UIC, put in place by HEI managers or governments to create favourable conditions in which UIC can prosper and deliver benefit to society (Galán-Muros et al., 2017, p.187). Due to the fact that humans’ resistance to change is a natural phenomenon and that the process of change opens up competition and hostility, mechanisms aim to change the culture of universities (Kliewe, 2015, p.4) and bridge the substantial cultural differences between universities and industry (Jones-Evans et al., 1998, p.59). (Bozeman, 2000, p.633) without mechanisms, UIC would likely remain an isolated and rare activity reliant on the whims of individuals. The identification and management of these supporting mechanisms is essential to understand, analyse and improve UIC (Korff et al., 2014, p.282). Their effectiveness has been widely recognised to either remove or reduce barriers or drive UIC, although they need to be adapted to the specific collaboration activity (Henrekson and Rosenberg, 2001, p.215)

Mechanism can be in form of policies, strategies, structures and activities (Davey et al., 2011, p.338) even if discussions tend to be too focussed on TTOs and incubators (Carolin and Quester, 2006, p.376). Additionally, these mechanisms need to be aligned with a mission and culture for UIC through strategy development (Fini et al., 2011, p.1115) and link all levels of the institution (Rasmussen et al., 2006, p.520). As an example, polices provide the regulatory and economic conditions (e.g. tax concessions for R&D) in which UIC strategic mechanisms are created (e.g. UIC strategy with a dedication of resources) often involving the creation of structural mechanisms (e.g. creation of a knowledge transfer centre or position), which can then initiate operational mechanisms (e.g. UIC workshops addressing academics). Challenges exist to provide favourable conditions for UIC, including having the right mix of support, drivers and liberty from barriers whether they be top-down or bottom up (Korff et al., 2014, p.285), create efficient and aligned mechanisms and optimize the use of funds.

2. MATERIALS AND METHODS

Research Design:

This study employed a quantitative, cross-sectional research design to investigate the relationships between university–industry collaboration (UIC) mechanisms, collaborative activities, and the resulting research benefits for universities. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used as the primary analytical method due to its suitability for complex models with multiple latent variables and its ability to handle non-normal data distributions.

Participants and Sampling:

The target population consisted of academic and administrative staff from universities actively engaged in collaboration with industry. Participants included professors, lecturers, researchers, and university officers who had direct experience with UIC. A purposive sampling strategy was used to ensure that responses were collected from individuals with relevant knowledge of UIC processes. We sampled 366 participants from 26 universities that have established collaborations with industry and are recognized for demonstrating leading practices in Mongolia. We developed a self-administered online survey questionnaire in Google form to investigated academic of universities in Mongolia. This sample size meets the recommended PLS-SEM requirement for statistical power.

Six latent variables represent diverse UIC mechanism, activities and research benefits. The extent of development was measured using a 7-points Likert scale, from 1 ‘not at all’ to 7 ‘to a very large extent’. Participants were provided with the definitions of each of the UIC activities so that they could assess them accurately.

The questionnaire captured (1) demographic information, (2) perceptions of UIC mechanisms (promotions), (1) collaborative activities (professional mobility, joint R&D, entrepreneurship, and R&D commercialization), and (4) the benefits universities derive from collaboration. Each latent variable consisted of reflective indicators. Reliability and validity were assessed according to established PLS-SEM guidelines (Sarstedt et al., 2021, p.5).

Data Analysis:

We used SmartPLS ver.4.0 to analysis our data. The PLS-SEM procedure followed two major steps: a) evaluations of the measurement model and b) evaluations of the structural model. To assess the measurement model, several criteria were applied. Indicator reliability was examined by ensuring that all outer loadings met or exceeded the threshold of 0.70. Internal consistency reliability was evaluated using Cronbach's alpha and Composite Reliability (CR), with acceptable values ranging between 0.70 and 0.95. Convergent validity was verified through the Average Variance Extracted (AVE), which was required to be at least 0.50. Discriminant validity was assessed using both the Fornell–Larcker criterion and the Heterotrait–Monotrait ratio (HTMT). The HTMT values below 0.85 (strict criterion) or 0.90 (lenient criterion) indicated adequate discriminant validity, while bootstrapped confidence intervals were used to confirm that none of the HTMT intervals included 1.0. The Variance Inflation Factor (VIF) is used to assess multicollinearity among the predictor variables in a structural or regression model. Multicollinearity occurs when two or more independent variables are highly correlated, which can distort coefficient estimates and weaken the interpretability of the model. VIF quantifies how much the variance of an estimated regression coefficient increases due to collinearity. A VIF value up to 5 as acceptable (Sarstedt et al., 2021, p.10). Values higher than these thresholds suggest potential collinearity problems that may bias the estimation of path coefficients.

After validating the measurement model, the structural model was assessed. This included evaluating t-statistics and p-values obtained through a 5,000-sample bootstrapping procedure, and the coefficient of determination (r^2), which was used to determine the explanatory power of the endogenous constructs.

Table 1. Definitions of variables

Variables	**Indicator name**	**Definitions**	**Source**
Promotions	Prom	Offices: Structures within the universities that support UIC, such as: career offices, internal agencies dedicated to UIC or incubators for the development of new business. Promotion: Internal and external communication of UIC aimed at different stakeholders using diverse media and including a documented universities mission and vision embracing UIC.	(Davey et al., 2011, p 111)
Professional mobility	PM	The temporary movement of teaching staff or researchers from universities to industry; and employees, managers and researchers from business	

		to universities, the temporary movement of students at all levels from universities to business	
Commercialisation of R&D results		The entry of scientific research and technologies in the market through the trading of intellectual property assets (disclosures of inventions, patenting, licenses or others) or spin-offs	
Collaboration in R&D	RD	The joint development of a fixed programme of courses, modules, majors or minors, planned experiences as well as guest lectures by delegates from external organizations within undergraduate, graduate or PhD programmes	
Entrepreneurship	ENT	The creation of an entrepreneurial culture or start-ups by universities students and academics	
Research of Benefits	BEN_R	Faculty members publish research articles and other academic works as a result of collaboration, the development of start-up companies or other companies is accelerated through collaboration, the fact that collaboration organization provides financial support for the development of a specific research area of the university.	(Ankrah & AL-Tabbaa, 2015, p. 12-13)

Hypothesis development:

H1a: Promotions are positive support to Professional Mobility, H1b: Promotions are positive support to JRD, H1c: Promotions are positive support to Entrepreneurship, H1d: Promotions are positive support to RDC.

H2a: Professional Mobility are positive support to Benefits of research, H2b: JRD is positive support to Benefits of research, H2c: Entrepreneurship are positive support to Benefits of research, H2d: RDC is positive support to Benefits of research.

Variables definitions:

A pilot study was conducted to understand the reliability of the questionnaire. Secondly, based on the result of the pilot study the questionnaire was modified and prepared a final questionnaire and after amendment the validity and reliability of the questionnaire was good enough to go forward. Third step there are total of 27 items in questionnaire, also the questionnaire is related to main 6 latent variables and 21 observed variables and it was divided into three domains.

Domain 1: Promotions with 5 latent variables: This measure ‘‘please indicate to what extent you (your university) collaborate with industry in respect.

Domain 2: Professionally mobility and R&D with 4 latent variables, respectively, Entrepreneurship with 2 latent variables and R&D commercialization with 3 latent variables, which makes it with total 13 latent variables,

Domain 3. Research benefits with 3 latent variables. All latents variables measured by Likert scale with responses ranging from 1=not to all; 2=small extent; 3=medium extent; 4=medium extent; and 5=a lot extent; 6=a lot extent; 7=a large extent.

Table 2. Measurement of constructs

Constructs	**Indicators**		**Dimensions**	**Source**
Promotions	1	Prom_1	The university has a technology transfer center that supports this collaboration.	(Davey, Baaken, et al., 2011b, p. 117-129)
	2	Prom_2	The university has an incubator that develops new businesses resulting from this collaboration.	
	3	Prom_3	The internal organization of the advertisement in support of collaboration between the university and the business organization	
	4	Prom_4	How the school promotes collaboration in the external environment	
	5	Prom_5	The government's promotion of collaboration between universities and business organizations	
Personal mobility	6	PM_a	Exchange of personnel to work at one another's facilities	
	7	PM_b	Lectures by business members at universities and vice versa	
	8	PM_c	Project conducted by students in collaboration with industry	
	9	PM_d	Student -exchanges from university to business	
R&d	10	RD_a	Joint Research and development projects	
	11	RD_b	Contracted research projects	
	12	RD_c	Business projects as part of training and education	
	13	RD_d	Bachelor, Master, and PhD thesis written in collaboration with business	

Entrepreneurship	14	ENT_a	Entrepreneurship education offered to academics	(Davey, Baaken, et al., 2011b, p.117-129)
	15	ENT_b	Entrepreneurship education offered to students	
Commercialization	16	RDC_a	License deals	
	17	RDC_b	Patents registered	
	18	RDC_c	Spin-offs created from joint research results	
Research benefits	19	BEN_R_a	Faculty members publish research articles and other academic works as a result of collaboration.	
	20	BEN_R_b	The development of start-up companies or other companies is accelerated through collaboration.	
	21	BEN_R_c	The fact that collaboration organization provides financial support for the development of a specific research area of the university.	

3. RESULTS

Descriptive statistical, correlation and VIF test: The constructs measured in this include incentives, and activities and benefits. Each construct was measured via multi-item scales. The descriptive statistics analysis was undertaken using central tendency and dispersion (i.e., standard deviation, Skewness, and kurtosis) for all items in each construct.

Table 2 showed the conversative Cronbach's alphas, of all first-order constructs, exceeded the threshold 0.70, expect for all constructs. Moreover. The composite reliability (rho_a) measures of all first-order constructs were above the value of 0.70. Therefore, the internal consistency reliability was established. The results in Table 5-1 also indicated that the measures of all first-order constructs provide satisfactory levels of convergent validity, since their average variance extracted values (AVEs) were greater than 0.5.

Table 3. Construct reliability and validity

Constructs of Latent Variables	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Promotes	0.851	0.884	0.657
Professional Mobility	0.813	0.871	0.628

Joint R&D	0.914	0.939	0.794
Entrepreneurship	0.926	0.963	0.929
R&D Commercial	0.912	0.942	0.844
Benefits of research	0.922	0.951	0.865

Table 3 showed Heterotrait-monotrait ratio (HTMT) was employed to assess the discriminant validity, following the guidelines of Hair. According to the findings, the computed HTMT ratios of the constructs were below threshold 0.9, apart from that between the Joint R&D and Professional Mobility components. Nevertheless, the correlation between these two constructs was computed as 0.925, which is very slightly above 0.9 value. All the other HTMT ratios were less than lower threshold value of 0.85. as such, these findings provided satisfactory support for the discriminant validity of constructs of the model. Once the estimated measurement properties of the first-order model exhibited acceptable values, the construct scores were extracted for the first-order components and then use to assess the second-order constructs.

Table 4. Heterotrait-monotrait ratio (HTMT) - Matrix

No	**Constructs of Latent Variables**	**Cronbach's alpha**	**1**	**2**	**3**	**4**	**5**	**6**
1	Benefits of research	0.936	-					
2	Entrepreneurship	0.916	0.829	-				
3	Promotes	0.718	0.614	0.623	-			
4	Joint R&D	0.896	0.664	0.614	0.796	-		
5	Professional Mobility	0.77	0.709	0.721	0.773	0.925	-	
6	R&D Commercial	0.898	0.716	0.750	0.702	0.717	0.759	-

Stationary test: Table 4 showed the structural model was assessed considering the metrics indicated by (Hair et al., 2013, p. 128-136). Before assessing the structural model, the collinearity was examined using the variance inflation factors (VIF). The results pointed out that the VIFs values of the antecedent latent variables ranged from 1.694 to 4.623, which are below the threshold of 5. Therefore, collinearity (VIF) among these constructs was not considered an issue for this study.

Table 5. Collinearity statistics, Variance Inflation Factors

Constracts	Latent Variables	VIF
Promotes	Prom_1	2.110
	Prom_2	2.357
	Prom_3	2.759
	Prom_4	2.438
	Prom_5	1.763
Professional Mobility	PM_1	1.856
	PM_2	1.911
	SM_1	1.867
	SM_2	2.214
Joint R&D	JRD_1	3.707
	JRD_2	4.623
	JRD_3	3.766
	JRD_4	1.811
Entrepreneurship	ENT_1	3.778
	ENT_2	3.778
R&D Commercial	RDC_1	3.840
	RDC_2	3.874
	RDC_3	2.319
	RDC_4	3.936
Benefits of Research	Ben_R1	3.567
	Ben_R2	3.146
	Ben_R3	3.646

We evaluated the significance of the path coefficient and confirmed the developed hypothesis. The Promotes high relationship with Professional Mobility (H1a, T=16.0, p=0.000), Joint R&D (H1b, T=27.992, p=0.000), Entrepreneurship (H1c, T=8.889, p=0.00), R&D Commercial (H1d, T=17.992, p=0.00) also positive associated.

Professional Mobility high negative relationship with benefits of research (H2a, T=0.528, p=0.59) (Neckermann et al., 2008, p.23), Joint R&D positive relationship with Benefits of research (H2b, T=2.202, p=0.028), Entrepreneurship positive relationship with Benefits of research (H2c, T=7.201, p=0.000), R&D Commercial with Benefits of research (H2d, T=2.996, p=0.003).

Table 6. Hypothesis testing first-level, Path coefficients

H	Items	Paths of Constructs	SD	T statistics	P	Supported
Hypothesis 1	A	Promotes → Professional Mobility	0.039	16.302	0.000	+
	B	Promotes → Joint R&D	0.025	27.992	0.000	+
	C	Promotes → Entrepreneurship	0.049	8.889	0.000	+
	D	Promotes → R&D Commercial	0.036	17.922	0.000	+
Hypothesis 2	A	Professional Mobility → Benefits of research	0.053	0.528	0.598	-
	B	Joint R&D → Benefits of research	0.079	2.202	0.028	+
	C	Entrepreneurship →Benefits of research	0.074	7.201	0.000	+
	D	R&D Commercial → Benefits of research	0.044	2.966	0.003	+

4. DISCUSSIONS

In this study, we initially developed university-industry collaboration, as well as a step-by-step procedure for research benefits in the university. The investigation was conducted to link the mechanism, activities, and research benefits of university-industry collaboration, according to the previous, different activities performed to develop collaborations between academics of universities (Jargalsaikhan et al., 2025, p.10). Our findings indicated that joint R&D mediates the relationship between promotion mechanisms and the research benefits of universities in the context of university–industry collaboration (UIC). Likewise, entrepreneurship mediates the relationship between promotion mechanisms and the research benefits that universities obtain through UIC. The final indirect effect results further indicated that R&D commercialization mediates the relationship between promotion mechanisms and the overall benefits that universities derive from UIC.

Although academics typically place a high value on academic freedom, achieving complete freedom in practice can be challenging (Behrens et al., 2001, p.181). Nevertheless, in an effort to preserve a degree of autonomy, some academics prefer to retain control over their lectures and avoid involving other researchers in their work (Borah et al., 2023, p.19). Our findings support this observation and suggest that one key reason faculty members and researchers do not fully benefit from collaborative research within universities is the limited academic freedom provided to them, which has significant implications for fostering effective collaboration.

Academic and commercial researchers often pursue distinct goals, motivations, constraints, and interests. These differences can lead to misunderstandings, conflicts of interest, and mistrust among university–industry collaboration (UIC) partners, thereby reducing participant satisfaction and diminishing the overall effectiveness of UICs (Hou et al., 2021, p.458). Consequently, one of the most critical determinants of UIC success is the ability to manage projects effectively while bridging organizational and cultural divides between academic and industrial partners.

When controlling for the type of instruction (undergraduate versus graduate), (Bozeman and Boardman, 2013, p.110) offer a more nuanced perspective, revealing that UICs tend to have a negative impact on undergraduate teaching but a positive influence on postgraduate education. Overall, the findings suggest that incentive structures play a pivotal role in enhancing the educational benefits that universities derive from UIC activities.

Conclusions: For Mongolian universities, providing offices and laboratories, supporting communication networks, and allocating financial resources have a positive impact on university–industry collaboration, particularly in the areas of research and development (R&D), entrepreneurship, and R&D commercialization. The effectiveness of these activities positively influences universities' academic and research outputs, projects, and funding. However, professionals involved in university–industry collaboration need to focus more on academic research, project development, and funding management to further enhance the effectiveness of such collaboration.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTION

JN: Conceptualization; Data curation; Formal analysis; Writing-original draft, Methodology. **OA**: Conceptualization; Writing review & editing.

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