Impact of Diverse Support on Performance of Industry–Academia Collaborative Research Teams

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Abstract: Bibliometric analyses show that industry–academia collaborative research projects tend to achieve higher performance. However, these collaborations often encounter barriers such as connection difficulties, resource constraints, differences in organizational culture, and institutional distance between industry and academia. Effective support from governments, firms, and universities is crucial to address these challenges and enhance the performance of industry–academia collaborative research teams. This study empirically examines the impact of such support on research performance using data from more than 200 collaborative research teams in Japan. This study differs from previous studies in several aspects. First, bibliographic information is matched with survey data, which enables team-level analysis instead of focusing on firms, universities, or regions. Bibliometric analysis provides an objective performance measure, i.e., the citation counts of research papers, whereas survey data offer abundant insights into team dynamics. Second, whereas most prior studies primarily examined financial support, this study considers a broader range of support measures, including the introduction of appropriate collaborators (networking), funding, provision of research equipment, management of intellectual property (IP), and assistance with administrative work. Empirical results reveal that all support measures, except for assistance with administrative work, significantly enhance research-team performance. Notably, assistance with administrative work presents a significant negative impact. Comparing the positive effects of various support measures, soft measures such as networking and IP management exert a greater impact than hard measures such as funding and equipment provision. Further analysis of the unexpected negative impact of administrative assistance indicates that administrative support occasionally results in cultural conflicts between industry and academia. These conflicts partially mediate the negative relationship between administrative support and team performance. However, administrative support from a third party in the presence of cultural conflicts within a team improves team performance. Further research is necessitated to determine the type of administrative support that can effectively bridge the organizational culture gap and enhance team performance.

Keywords: Industry–academia collaboration, R&D support, Team performance, Japan

1. Introduction

Collaborative industry–academia research is expected to produce innovative outcomes by combining the heterogeneous and complementary knowledge of both sectors. Previous studies across various countries and time periods demonstrated that papers resulting from such collaborations tend to be cited more frequently and have a greater impact than single-authored papers or those co-authored solely within academia (Pohl 2021; Lebeau et al. 2008; Schneiderman 2018). However, institutional differences between industry and academia present challenges that complicate collaborative research (Sauermann and Stephan 2010; Bruneel, D'Este, and Salter 2010; Albats, Bogers, and Podmetina 2020; Crescenzi, Fillippetti, and Iammarino 2017; O'Dwyer, Filieri, and O'Malley 2023).

In industry, research and development (R&D) is typically conducted in structured teams with limited individual discretion, with emphasis on practical goals aligned with corporate strategies. Firms are cautious about publishing research findings, as they aim to retain economic value and maintain a competitive advantage. By contrast, academia emphasizes individual creativity within disciplinary frameworks, thus endowing researchers with greater autonomy to disclose their findings through publications and conference presentations and gain recognition in the scientific community. These differences in incentives, decision-making processes, and cultural norms render collaboration challenging and highlight the necessity for supportive measures.

Several studies examined the support mechanisms for industry–academia collaboration. Some have analyzed the impact of R&D tax incentives and subsidies on collaboration performance (Cheng et al. 2020; Brokel 2015). However, these studies focus primarily on financial support and assess performance at the firm or regional level instead of at the industry–academia collaborative research team (IA team hereinafter) level. Seppo, Rõigas, and Varblane (2014) conducted an international comparison of various support measures, such as R&D cooperation, knowledge transfer, infrastructure, and research funding, within European countries, but did not examine their effects on research performance. Similarly, studies on the effectiveness of technology transfer offices (TTOs) (Siegel, Waldman, and Link. 2003, Siegel, Veugelers, and Wright 2007; Chapple, et al. 2005) assessed TTO-level efficiency but not their direct impact on IA team outcomes. Okamuro and Nishimura (2013) analyzed how university intellectual property (IP) policies influence industry–academia collaborative research, where they demonstrated that flexible and fair policies positively impact firm performance. However, their study was not conducted at the team level, and performance was measured subjectively using a seven-point Likert scale to assess patenting and new product development.

Despite these efforts, no prior research has systematically analyzed support measures that positively influence IA team research performance using objective performance indicators. Bibliometric databases, such as Scopus and Web of Science, show that IA teams generally receive more citations than other teams. However, they lack detailed information regarding the support measures that the teams receive. Conversely, questionnaire-based studies provide detailed information regarding IA teams but rely on subjective performance assessments from team members. To address these limitations, this study conducts an empirical analysis that combines a questionnaire survey with bibliographic data. The questionnaire gathers information regarding IA team characteristics and the types of support received, whereas citation counts from the Web of Science serve as an objective indicator of research impact. This approach enables an empirical investigation into the support measures that contribute to the success of industry–academia collaborative research.

The remainder of this study is organized as follows: Section 2 presents the framework and key research questions based on prior literature. Section 3 describes the data and empirical model. Section 4 presents the results and their interpretations. Finally, Section 5 summarizes the findings and discusses implications for future research.

2. Prior Research and Conceptual Framework

Albats, Bogers, and Podmetina (2020), based on interviews with 10 European and U.S. firms, and Galán-Muros and Plewa (2016), based on a survey of European universities, highlighted and verified four barriers and two drivers of industry–academia collaboration from an industrial perspective. The first barrier is connection, which refers to the difficulty in identifying the suitable partner and establishing a contact. The second barrier is insufficient resources. The third barrier relates to differences in organizational culture, such as motivation, communication styles, language, time horizons, and bureaucracy between industry and academia. The fourth barrier, i.e., internal organizational differences, includes disagreements over IP rights and firms' limited ability to acquire university-generated knowledge. Drivers are associated with the availability of complementary resources and the relationships between partners. Complementary resources include funding, human resources, and knowledge. Relational drivers include trust, commitment, shared goals, and a balance between different expectations.

The third and fourth barriers have been widely recognized in the literature. For example, in terms of research orientation, universities tend to be discipline oriented, whereas firms focus on problem solving (Bruneel, D'Este, and Salter 2010; Lam 2007, 2011; Sauermann and Stephan 2010; Muscio and Vallanti 2014). Differences in reward structures further complicate collaboration, as universities emphasize reputation building through publications, whereas firms prioritize R&D, which enables the appropriation of knowledge for private gain (Lam 2007, 2011; Sauermann and Stephan 2010). Additionally, IP conflicts have been highlighted frequently (Bruneel D'Este, and Salter 2010; Muscio and Vallanti 2014).

To overcome these barriers, researchers suggest that recurrent collaboration with the same partners and diverse interaction modes (e.g., joint research projects, consultancy, and employee training) can mitigate difficulties (Bruneel, D'Este, and Salter 2010; Gallagher et al. 2023; Muscio and Vallanti 2014). Effective project management, including clear objective setting, progress monitoring, effective communication, and assigning high-quality project managers, has been emphasized as well (Barnes, Pashby, and Gibbons 2002). Studies on human capital highlight the importance of certain competencies and personal characteristics, such as communication and agility skills, negotiation abilities, scientific and technical knowledge, awareness of differences between universities and firms, open-mindedness, curiosity, and tolerance for failure (Albats, Bogers, and Podmetina 2020). Additionally, industry researchers with university experience, or vice versa, have been identified as beneficial for bridging these two sectors (Lam 2011; Albats, Bogers, and Podmetina 2020).

However, no empirical study has systematically examined the effectiveness of support measures in overcoming these barriers. This study assesses the impact of various support measures on IA teams by considering five types of support corresponding to the four barriers identified by Albats, Bogers, and Podmetina (2020) and Galán-Muros and Plewa (2016), as follows: networking to address connection barriers, funding and equipment provision to mitigate resource constraints, administrative assistance to support organizational culture differences, and IP management to resolve internal organizational barriers. Administrative work in the research process is an area in which organizational cultural differences typically emerge; it includes contract negotiations, external funding applications, progress monitoring, and budget management. These support measures are provided not only by public organizations (including central and local governments and international institutions) but also by universities and firms.

Whereas support measures are generally expected to enhance team performance, their effectiveness may vary. For example, researchers in both academia and industry can connect frequently through academic conferences and personal networks without relying on third-party facilitators (Murakami 2025). Using data from a large-scale survey in Japan, Nishimura et al. (2022) discovered that researchers seeking highly capable partners primarily leverage their own contacts, whereas university and industry research collaboration support units are more commonly involved when geographical proximity is a key factor instead of the research partners' capabilities. Consequently, IA teams formed through personal networks may outperform those created through external referrals.

Administrative assistance may not necessarily guarantee improved outcomes. Administrative support that can standardize bureaucratic processes through clear formats, guidelines, and common rules allows researchers to focus on their research and improve their performance. However, if guidelines lack flexibility or conflicts arise regarding procedural standards, then managing administrative tasks internally instead of relying on external support may be more efficient. Similar conflicts may occur in IP management due to third-party involvement. Therefore, an empirical investigation is performed in this study to address the following five research questions:

R1: Is the performance of IA teams that received the introduction of collaborative partners better than that of other teams?

R2: Is the performance of IA teams that received funding support better than that of other teams?

R3: Is the performance of IA teams that received equipment support better than that of other teams?

R4: Is the performance of IA teams that received administrative support better than that of other teams?

R5: Is the performance of IA teams that received support in managing IP better than that of other teams?

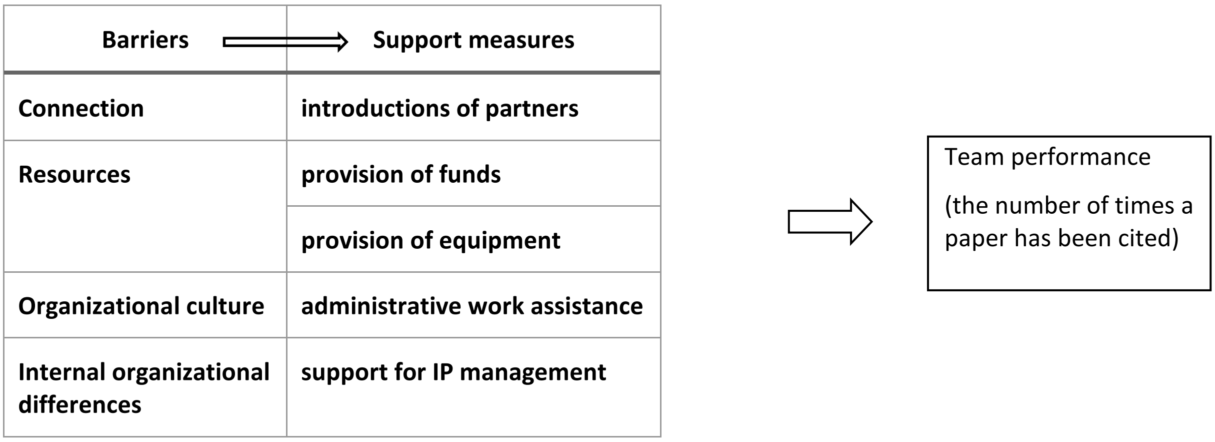

Figure 1: Analytical framework

3. Data and Model

To answer the research questions above, this study used data obtained through an online survey conducted in 2024. Participants were selected using the Science Citation Index Expanded, which is a database from the Web of Science that encompasses science, medicine, and technology. The target sample comprised teams that published papers in 2017 or 2018, with at least one member affiliated with a Japanese industry and at least one with a Japanese university, while teams with non-Japanese addresses were excluded. All 1,231 teams that satisfied these criteria and provided contact information were invited to participate in the survey. Each team representative or a member familiar with the overall team situation was instructed to respond; 234 valid responses were obtained, which yielded a response rate of 19%. This study used the number of citations (NC) as the performance indicator, based on citation data as of September 13, 2024. Poisson regression analysis was performed using the logarithm of the NC as the dependent variable. For log transformation, the NC was converted to 1 when it was zero. Table 1 presents the explanatory variables used in the model. The five variables representing support were coded as dummy variables and set to 1 if the IA team received support, regardless of the provider. The control variables included the technology readiness levels (TRLs), which indicate the stage of new technological development. The first five of the nine TRL stages were identified. Among them, the basic research in which papers are primarily published formed the base. A dummy variable for 2018 was included because the papers published in 2017 and 2018 had different citation periods. The team size was capped at 20 members. Although papers with more than 100 authors are not rare in scientific, medical, and technical fields, members of teams exceeding 20 may struggle to fully understand the overall team situation, and in some cases, may not be familiar with each other.

As the availability of complementary resources and relationships between academia and corporate researchers were identified as key drivers of industry–academia collaboration, complementary knowledge, trust, and past collaboration were included as control variables. The complementary-knowledge variable was calculated as the average of responses to two questionnaire items regarding the success factors of industry–academia collaboration: the importance of members' diverse expertise and the importance of their diverse approaches and methodologies for the research theme, which were measured on a five-point Likert scale. Similarly, the trust variable was derived as the mean of responses to two items: "confidence in the competence and responsibility of other members" and "building emotional bonds with other members (reciprocal interpersonal care and concern)." Additionally, as prior collaboration may contribute to relationship building, the number of papers published by a team comprising approximately half or more of the authors of the focal paper before its publication was included as an explanatory variable, which is referred to as the "past collaboration variable."

Table 1: Definition of variables

Variable names	Definition
Log_NC	Logarithm of NC (number of times a paper has been cited)
Introduction support	Support with introductions of partners = 1, Others = 0
Funding support	Support with funding = 1, Others = 0
Equipment support	Support with equipment = 1, Others = 0
Administrative support	Support with administrative work = 1, Others = 0
IP support	Support with management for IP = 1, Others = 0
TRL2	Technology concept or application formulated = 1, Others = 0
TRL3	Proof of concept = 1, Others = 0
TRL4	Validation in laboratory environment = 1, Others = 0
TRL5	Validation in relevant environment = 1, Others = 0
Team size	Number of team members
2018 dummy	Publication in 2018 = 1, Others = 0
Complementary knowledge	Average of two variables indicating complementary knowledge
Trust	Average of two variables indicating trust
Past collaboration	Number of papers published in the past with more than half of the members (4 categories: 0, 1–3, 4–9, and 10 or more)

The descriptive statistics are presented in Table 2. Most teams received financial support (86%), equipment support (89%), administrative support (61%), and IP support (68%), whereas relatively few received introduction support (29%). Both the complementary knowledge and trust variables indicated an average score exceeding 4 on the five-point Likert scale, thus suggesting that the study leading to the publication of papers was based on strong complementary knowledge and trust among team members. Owing to space limitations, the correlation matrix is not shown herein. Nonetheless, the highest correlation observed was 0.58 between the IP and administrative support variables, whereas all other correlations were below 0.38.

Table 2: Descriptive statistics

Variables	Minimum	Maximum	Average	Standard deviation
NC	1	94	15.6	17.3
Introduction support	0	1	0.29	0.46
Funding support	0	1	0.86	0.35
Equipment support	0	1	0.89	0.31

Variables	Minimum	Maximum	Average	Standard deviation
Administrative support	0	1	0.61	0.49
IP support	0	1	0.68	0.47
TRL2	0	1	0.62	0.49
TRL3	0	1	0.47	0.50
TRL4	0	1	0.39	0.49
TRL5	0	1	0.15	0.36
Team size	2	19	6.65	3.39
2018 dummy	0	1	0.47	0.50
Complementary knowledge	1	5	4.43	0.71
Trust	1	5	4.33	0.70
Past collaboration	1	4	2.41	0.95

Note: N ＝ 218

4. Results of Analysis Regarding Impact of Support Measures on Team Performance

The results of the analysis based on the data and model presented in the previous section are listed in Table 3. First, focusing on the five variables corresponding to the research questions, the coefficients of all variables except administrative support were significantly positive at the 5% or 1% level, thus indicating that receiving such support improves research performance, as measured based on the NC. The number of citations was 1.47 times higher with introduction support than without it, 1.13 times higher with funding support, 1.22 times higher with equipment support, and 1.38 times higher with IP support. Therefore, soft support, such as introduction and IP support, is more effective than hard support, such as funding and equipment support. This finding aligns with those of Nishimura and Okamuro (2011), who examined cluster policies in Japan and discovered that indirect networking/coordination support exerted a greater impact on commercial success and innovation than direct R&D subsidies.

However, the coefficient for administrative support was significantly negative at the 1% level, thus indicating that IA teams receiving this support have significantly fewer citations (0.58 times) than those without it. Although administrative assistance is expected to allow researchers to focus more on their research and improve performance, the results suggest the opposite. Even when administrative support was categorized by provider—public institutions, universities, or firms—each administrative support variable indicated a significantly negative coefficient for the Log_NC variable. Owing to space limitations, detailed results are omitted herein. One possible explanation is that, as suggested earlier, third-party intervention may have caused conflicts due to the strict control of administrative procedures and disagreements over the applicable rules and standards. Therefore, this study hypothesizes that IA teams receiving administrative support are more likely to experience conflicts arising from cultural differences, which consequently mediates lower team performance. The next analysis examines this hypothesis.

Table 3: Estimation results

	Model 1		Model 2		Model 3	
Variables	**Coefficient**	**Standard error**	**Coefficient**	**Standard error**	**Coefficient**	**Standard error**
Introduction support	0.384**	0.0416	0.391**	0.0416	0.381**	0.0418
Funding support	0.123*	0.0601	0.143*	0.0604	0.163**	0.0610
Equipment support	0.201**	0.0657	0.194**	0.0658	0.179**	0.0663
Administrative support (AS)	-0.553**	0.0455	-0.535**	0.0457	-0.684**	0.0803
IP support	0.321**	0.0500	0.313**	0.0501	0.309**	0.0501
TRL2	-0.092*	0.0361	-0.091*	0.0361	-0.088*	0.0361

	Model 1		Model 2		Model 3	
Variables	**Coefficient**	**Standard error**	**Coefficient**	**Standard error**	**Coefficient**	**Standard error**
TRL3	-0.110**	0.0364	-0.109**	0.0365	-0.116**	0.0366
TRL4	-0.045	0.0371	-0.053	0.0372	-0.046	0.0374
TRL5	-0.147**	0.0519	-0.162**	0.0522	-0.159**	0.0522
Team size	0.065**	0.0044	0.066**	0.0044	0.067**	0.0044
2018 dummy	-0.146**	0.0354	-0.120**	0.0362	-0.124**	0.0363
Complementary knowledge	0.325**	0.0314	0.326**	0.0314	0.327**	0.0313
Trust	-0.177**	0.0257	-0.198**	0.0265	-0.200**	0.0266
Past collaboration	0.104**	0.0181	0.110**	0.0183	0.117**	0.0185
Cultural conflicts (CC)			-0.067**	0.0208	-0.125**	0.0337
AS_CC					0.094*	0.0419
N	218		218		218	
LogL	-1704.6		-1699.3		-1696.8	
AIC	3439.1		3430.7		3427.6	

**p < 0.01, *p < 0.05

The survey included questions about the difficulties encountered during industry–academia collaboration. The answers were recorded based on a five-point Likert scale (1 = not applicable to 5 = applicable). One of the items was “conflicts due to cultural differences.” The answer to this question is the cultural conflict variable (CC). A new model incorporating it along with the explanatory variables in Model 1 yielded the results shown in Model 2 (see Table 3). The cultural conflict variable had a significantly negative coefficient at the 1% level, and the coefficient for administrative support (AS) remained significantly negative at the 1% level, although its absolute value decreased from 0.553 to 0.535. This indicates that cultural conflict partially mediates the negative effect of administrative support on performance. Moreover, Model 3, which included the interaction term (AS_CC) of the administrative support and cultural conflict variables, showed that the AS_CC variable was significantly positive at the 5% level and that the “administrative support” and “cultural conflict” variables remained significantly negative at the 1% level. Therefore, whereas both administrative support and cultural conflict are factors that originally degraded performance, the performance improved when administrative support was provided in the presence of cultural conflict.

Finally, focusing on the control variables in Table 3, the complementary knowledge variable—a key driver of industry–academia collaboration—was significantly positive at the 1% level, thus indicating that IA teams with access to diverse expertise and methodological approaches performed better, as measured based on citation counts. This result is consistent with those previous studies that highlighted the importance of complementary knowledge in successful industry–academia collaborations. However, the coefficient for the “trust” variable was significantly negative at the 1% level, thus suggesting that higher levels of cognitive and emotional trust among team members were associated with lower research performance, which is contrary to prior findings. Because approximately 85% of the respondents selected 4 or higher on the trust scale (ranging from 1 to 5), this suggests that whereas some degree of trust is necessary, excessive trust may degrade performance.

The “past collaboration” variable, which also represents relationships among team members, was significantly positive at the 1% level, thereby indicating that teams with a history of jointly publishing papers performed better. This aligns with previous studies proposing that repeated collaboration with the same partners helps overcome industry–academia barriers (Bruneel, D’Este and Salter 2010, Gallagher et al. 2023; Muscio and Vallanti 2014).

Additionally, the nature of research influences citation frequency. When examined based on the TRL stage, the coefficients for TRL 3 and TRL 5 were significantly negative, thus suggesting that papers at the proof-of-concept stage (TRL 3) and the validation-in-relevant-environment stage (TRL 5) were cited less frequently than those involving more basic research. Furthermore, team size showed a significantly positive coefficient at the 1% level, thus indicating that citation counts increased with team size, provided that the team comprised 20 or fewer members.

5. Conclusion

Collaborative research between industry and academia has been promoted in various countries. However, researchers argued that the institutional distance between industry and academia complicates collaborative research. Therefore, this study analyzed the effectiveness of support measures for teams conducting industry–academia collaborative research, with emphasis on how these measures improve research performance. The analyses revealed that introduction, funding, equipment, and IP support contributed to improved research performance. Additionally, soft support, such as introduction and IP support, appeared to be more effective than hard support, such as funding and equipment. Whereas more than 80% of the teams received hard support, the number of teams that received IP and introduction support was relatively low, i.e., 68% and 29%, respectively. Therefore, expanding these types of soft support would increase the number of successful cases in industry–academia collaborative research. Meanwhile, administrative support appeared to be related to cultural conflicts and negatively impacted research performance. Approximately 61% of the total sample received administrative support, of which 47% was provided by universities, 38% by both universities and firms, 10% by firms, and 3% by public institutions. However, this negative impact was observed regardless of the support provider. Many previous studies have discussed the cultural differences between industry and academia. These differences tend to manifest in administrative work, such as contract operations at the beginning of research, preparation for external-funding applications, and the progress and budget management of research projects. This study showed that cultural conflicts caused or increased by the intervention of a third party partially mediated the negative effects of administrative support on performance. Simultaneously, the intervention of a third party in administrative work in the presence of cultural conflicts within a team might have improved team performance. In the future, administrative support that can prevent differences in organizational culture from resulting in conflicts should be examined.

Additionally, the sample for this study was limited to IA teams that had successfully published papers. In other words, the differences in performance among successful teams were analyzed. However, many IA teams are unable to publish papers or patents. A future endeavor may include identifying effective support measures by comparing such teams with those achieving publication success. Furthermore, this study used data from IA teams comprising researchers from Japanese firms and universities. Although the uniqueness of industry–academia collaborative research in Japan is not indicated, future studies using data from other countries are necessary to generalize the findings of this study.

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