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Implementation and Performance Analysis Study of Industry-University Cooperation Group Package Consulting*

Taehoon Kim[1], Younghee Noh[2]

[1]Team Director, Industry-Academic Education Innovation Team, National Research Foundation of Korea, South Korea (k511cw@nrf.re.kr), First Author
[2]Professor, Department of Library and Information Science, Konkuk Univesity, South Korea (irs4u@kku.ac.kr), Corresponding author

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ABSTRACT

The Industry-University Cooperation Group (IUCG) Package Consulting is a project conducted as part of the initiative to improve the functions of the IUCG. This project was carried out as a part of the IUCG Function Improvement Plan (Feb. 2022, Ministry of Education) and the 2023 IUCG Package Consulting Operational Performance Analysis Study (July 2022, Foundation), aiming to enhance and advance the functions of the IUCG. Based on this, the Industry-Academia Innovation Team of the Korea Research Foundation has implemented IUCG consulting to support universities' research and technology being effectively utilized in the actual industrial field. This effort aims to bridge the gap between academia and practical application, contributing to innovation and economic development. In this study, the performance and content of the IUCG Package Consulting were comprehensively analyzed post-implementation. The analysis distinguished between general universities and specialized colleges due to their differing characteristics and the varying items within the consulting manuals. Based on these findings, policy recommendations were proposed to strengthen the governance system between universities and IUCGs, expand the activities of industry-academic cooperation, and enhance the overall planning and management functions of the IUCGs, effectively supporting the reorganization of IUCG functions.

1. Introduction

The Industry-Academia Cooperation Group Package Consulting is a project carried out as part of the enhancement strategies of the Industry-Academia Cooperation Group. According to the Ministry

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of Education's plans for improving the functions of the Industry-Academia Cooperation Group (Feb 2022) and a study on the operational outcomes of the 2023 Industry-Academia Cooperation Group Package Consulting (July 2022), the aim is to promote the enhancement and advancement of the cooperation group's functions.

Based on this, the Academic-Industrial Cooperation Innovation Team of the Korea Research Foundation has been supporting universities' industry-academia cooperation groups so that university research and technology can be effectively utilized in actual industrial sites. This bridging of the gap between academia and practical application aims to contribute to innovation and economic development. In 2022, a pilot package consulting was conducted for 8 university cooperation groups.

The consulting conducted in 2022 showed very high satisfaction and a high demand for follow-up consultations. Out of 354 cooperation groups surveyed in the 2022 pilot consulting demand survey, 38 universities applied, showing very high satisfaction with the consulting.

This led to the need for a second round of consulting and performance analysis in 2023, which was then implemented. The 2023 consulting demand survey showed that 47 cooperation groups expressed a need for consulting.

Among these, universities that had requested consulting in 2022 were prioritized, but considering the type and region of the cooperation groups, 14 universities were selected for consulting. Additionally, the number of consulting committee members was increased approximately fourfold from 8 to 35.

This study thoroughly examines the outcomes and methodologies of the Industry-Academia Cooperation Group Package Consulting, with a particular focus on the distinctions between general and specialized universities, which stem from variations in their consulting guidelines. The primary aim is to reinforce the governance structures linking universities and their cooperation groups, foster the growth of industry-academia initiatives, and provide targeted support for the strategic restructuring of these groups to enhance their planning and management capabilities.

2. Previous Research

It has been observed that there is not an abundance of research related to industry-academia cooperation consulting. As various projects related to industry-academia cooperation, including the LINC project, have been implemented, evaluations and both direct and indirect consulting have likely been conducted. The initial attempts at consulting for the Industry-Academia Cooperation Group were first carried out in 2022 by the Korea Research Foundation's Academic-Industrial Cooperation Innovation Team, which produced some research results.

In 2002, a study led by the Korean Association of Industry-Academia Cooperation Policy, including Noh and others (2022), conducted research on the operational strategies for package consulting aimed at improving the functions of the cooperation groups. This process involved pilot package consulting for the cooperation groups and the development and distribution of a consulting manual for them. Consulting reports for both general and specialized universities were also published as part of these results.

This body of research was founded on studies related to the evaluation metrics for the capabilities of the cooperation groups and the development of characteristic models for these groups. Initially, there has been a range of studies concerning evaluation metrics related to industry-academia cooperation. However, most research has traditionally focused on evaluating universities, faculty, and government-supported projects, with more recent studies developing metrics from a business perspective of industry-academia cooperation. Park Moon-su (2014) proposed restructuring the self-diagnosis measurement system for university industry-academia cooperation based on a survey of the current state, enabling universities to check their capabilities by type and plan for development accordingly. Additionally, the study highlighted the limitations of humanities and social sciences-based convergent research support projects in South Korea, suggesting the need for a shift from result-oriented goals to opportunities for discovering new problems and advocating for alternative approaches to top-down convergent research.

Ko Hyeok-jin (2016) aimed to develop an index that could diagnose the level of industry-academia cooperation from a comprehensive university perspective, providing insights into the entire field of industry-academia cooperation and identifying key variables for measurement. The proposed evaluation metrics considered representativeness, measurability, and reliability, comprising a total of 26 indicators.

Further research into characteristic models for cooperation groups proposed models for enhancing and suggesting improvements in their functions. Song Wan-heup and others (2006) conducted a study on the development of operational models for cooperation groups, which remains a unique study that specifically proposed models by type of university and focused on analyzing industry-academia cooperation centered around these groups. The models were categorized into leader-type, region-specific, and field-centered cooperation groups. Additionally, Kim and others (2020) proposed content for characteristic models related to enhancing the functions of cooperation groups, and Kim H-D and others (2022) expanded and revised a study from 2020 on enhancing and managing the quality of cooperation group functions.

While this research focuses on analyzing the results of industry-academia cooperation group consulting, it is not a study on the effects of the consulting itself. However, it does review other precedents in consulting outcomes. For example, Kim and Jang (2016) conducted empirical analyses on small and medium-sized enterprises in the Seoul, Gyeonggi, and Incheon areas, exploring the moderating role of organizational support in the causal relationship between consulting completeness, work efficiency, and other consulting outcomes categorized into financial and non-financial organizational performance. The results showed that consulting outcomes significantly impact organizational performance, particularly noting that higher consulting outcomes correlate with improved organizational performance. Such studies analyzing the meaning and outcomes of consulting are abundant, including works by Pinto et al. (1990), Barcus et al. (1994), Shapiro et al. (1993), Simon and Kumar (2001), and Ciampi (2009).

These studies highlight the critical role of systematic evaluation and development of metrics in enhancing the effectiveness of industry-academia cooperation. By focusing on the creation of specialized models and diagnostic tools, they provide valuable insights into how universities can improve their collaboration with industry. The research underscores the importance of tailored

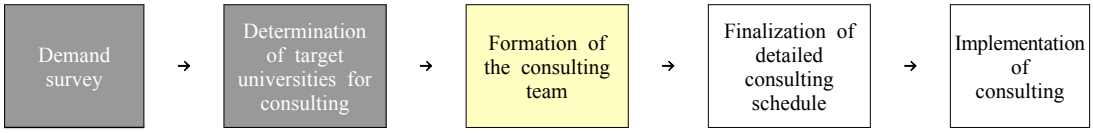
consulting approaches and the need for continuous refinement of strategies to ensure that industry-academia partnerships are both effective and sustainable, ultimately leading to greater innovation and economic growth.

3. Research Design and Methodology

This study proposes future policies based on the results of the industry-academia cooperation group consulting conducted in 2023. The rationale for this consulting initiative is part of the Ministry of Education's plan for improving the functions of the Industry-Academia Cooperation Group (Feb 2022) and the operation and analysis of the 2023 Industry-Academia Cooperation Group Package Consulting (July 2022). The goal is to promote enhancement and advancement of the functions through industry-academia cooperation group package consulting.

The direction of the consulting is to analyze and diagnose based on the characteristics and types of the industry-academia cooperation groups of both general and specialized universities. The consulting areas include the vision and development direction of the cooperation groups, enhancement of their functions (research support and industry-academia cooperation), professionalism (quality improvement), industry-academia infrastructure, and autonomy of the cooperation groups.

The consulting process was conducted as follows:



The consulting areas and the respective committee members were organized as follows:.

Table 1. Composition of committee members by consulting area

Consulting Area		Consulting Items and Content	Committee Member
For General Universities	**Area 1**	- Vision and development direction of the cooperation group	Member A
	Area 2	- Enhancement of functions (research support and industry-academia cooperation)	Member B
	Area 3	- Professionalism of the cooperation group (quality improvement)	Member C
	Area 4	- Autonomy of the cooperation group - Infrastructure	Member D
For Specialized Universities	**Area 5**	- Vision and development direction of the cooperation group	Member A
	Area 6	- Education and employment/entrepreneurship support	Member B
	Area 7	- Research and development and commercialization	Member C
	Area 8	- Infrastructure of the cooperation group	Member D

4. 2023 Industry–Academia Cooperation Group Package Consulting Outcomes and Response Strategies

4.1 Results of consulting for general universities

Initially, the consulting for general universities was categorized into four areas, which included the vision and development direction of the industry-academia cooperation group, autonomy of the cooperation group, enhancement of the group's functions (research support and industry-academia cooperation), and professionalism of the group (quality improvement).

Table 2. Consulting areas for general universities

Consulting Areas		Checkpoints and Key Points
Vision and Development Direction of the Industry-Academia Cooperation Group		1. Self-analysis of Cooperation Group Characteristics
		1.1 Appropriateness of self-analysis results for typologizing the cooperation group based on strengths and weaknesses.
		1.2 Appropriateness of typologizing the cooperation group based on the university's conditions and characteristics.
		2. Characteristics and Directional Linkage of the University's Mid-to-Long-Term Industry-Academia Cooperation Plans
		2.1 Linkage between the university's vision and its mid-to-long-term industry-academia plans.
		2.2 Systematic development of the cooperation group's own strategies based on mid-to-long-term plans.
Enhancement of Functions	Research Support	1. Planning
		1.1 Linkage with the university's central vision.
		1.2 Planning for autonomy strategies based on the type of university.
		2. Support
		2.1 Advancement of the research support functions of the cooperation group.
	Industry-Academia Cooperation	3. Industry Education
		3.1 Talent development through industry education.
		4. Technology Transfer and Commercialization
		4.1 Governance system of technology commercialization frameworks and TLO (Technology Licensing Office).
		4.2 Lifecycle process of technology commercialization and interlinking with related projects.
		4.3 Management of technology commercialization outcomes and reinvestment of technology fees.
		5. Entrepreneurship
		5.1 Regulations, systems, and implementation structure related to entrepreneurship within the university.
		5.2 Comparison and support programs for student entrepreneurship vs. faculty/graduate technology entrepreneurship.
		5.3 Operation and support system for technology holding companies.

Table 2. Cont.

Consulting Areas	Checkpoints and Key Points
Professionalism (Quality Enhancement)	Human Resource System Strengthening
	1.1 Establishment of a personnel system (incentives, promotions) to enhance employment stability and performance rewards within the cooperation group.
	1.2 Enhancement of job expertise through the acquisition of specialized personnel.
	Education and Training
	2.1 Establishment and operation of an industry-academia education center to support professional certification acquisition and integrated management of educational programs.
	2.2 Creation of a learning culture within industry-academia cooperation through study group operations.
	Expansion of Qualifications (National/Private)
	3.1 Recruitment of national qualification holders and support for related national qualification education.
	3.2 Strengthening of educational and qualification links with public-private industry-academia cooperation councils.
Infrastructure	Equipment and Space
	1.1 Infrastructure for joint use of research equipment to facilitate industry-academia cooperation. - Operational system for joint equipment use. - Training for spreading the outcomes of joint equipment use.
	1.2 Securing space for supporting new projects aimed at spreading industry-academia cooperation outcomes. - Availability of dedicated spaces for outcome spreading. - Support system for space for outcome-spreading new projects.
	Information Sharing Platform
	2.1 Establishment of a platform for sharing resources related to industry-academia cooperation within the university. - Continuous operation of the information-sharing platform. - Bidirectional operation allowing interaction between providers and users. - Implementation of a demand-based information provision service.
	2.2 Establishment of an operational organization for utilizing industry-academia cooperation information from the university.
	External Network
	3.1 Securing a cooperative base for activating region-centric industry-academia cooperation. - Diverse participation of different types of stakeholders. - Composition and organic connection of function-specific participants.
Autonomy of the Cooperation Group	1. Securing a Basis for Reinvestment
	1.1 Securing a virtuous cycle structure for industry-academia cooperation profits. - Systems for reinvestment of industry-academia cooperation profits.

Based on the detailed consulting manual for each area, numerous insights were garnered during the consulting process, with some key points outlined below:

4.1.1 Absence of mid-to-long-term development plans for industry-academia cooperation

It has been found that some universities, especially smaller ones or those with less interest in

industry-academia projects, still lack mid-to-long-term development plans for industry-academia cooperation. These universities do not perceive the necessity to establish such plans. It is recommended that examples of development plans for industry-academia cooperation groups be provided, or that follow-up consulting be conducted in the next year to reassess and encourage the establishment of these plans.

4.1.2 Universities unaware of their industry-academia cooperation group type

The Ministry of Education encourages universities to classify the functions of their industry-academia cooperation groups according to the university's conditions and characteristics and to build development models for each type. This approach suggests that consulting should be differentiated based on the characteristics of the cooperation groups. Initially, universities are advised to diagnose their groups into four types based on research support functions and industry-academia cooperation activities: ① educational and research revenue, ② employment numbers, ③ technology fee standards, and ④ real case analyses. Based on these characteristics, universities are encouraged to undertake phase-specific key industry-academia activities.

However, many universities are either unaware of the existence of these classified characteristics for their cooperation groups or, even if they are aware, do not operate their groups in a differentiated manner based on these types. Therefore, it is necessary for the consulting teams to support capacity enhancement through package consulting tailored to the university's specific characteristic model.

4.1.3 High dependence on government projects by the industry-academia cooperation groups' organizations and staff

It has been observed that many organizations and staff of the industry-academia cooperation groups are formed or hired in connection with government projects, with only a minority being directly recruited by the cooperation groups themselves. Therefore, consulting needs to focus on proposing strategies to strengthen autonomy. First, to expand into a base-building model for industry-academia cooperation, consulting should aim at developing specialized personnel centered around the resources of the cooperation groups and enhancing training and education. Second, emphasize autonomy strategies such as faculty entrepreneurship, technology commercialization, and joint activity utilization centers. Third, it's important to highlight that the status of the cooperation groups changes depending on the degree of autonomy achieved.

4.1.4 Lack or inefficiency of a research funding management system

The inconvenience for researchers due to offline and paper-based research administration still persists. Thus, it's recommended to consider adopting an electronic approval system for research funding management to simplify researchers' funding applications and reduce administrative processing time through streamlined document storage at the cooperation groups. Specifically, introducing the procedure for adopting a paperless electronic approval method or showcasing exemplary universities and systems could also be beneficial.

4.1.5 Inadequate participation and specialization in the industry-academia collaboration platform

An "Industry-Academia Collaboration Platform (Metaversity)" is being developed within the Industry-Academia Collaboration Sharing and Collaboration Center to support local industry companies and share equipment and technology status through an industry-academia research sharing system. However, many universities lack a proper platform or even if a platform exists, it is often inadequately equipped with university's industry-academia resources. Therefore, a comprehensive survey of all industry-academia cooperation groups regarding the information platform is necessary, and if developed, its integration possibilities should be reviewed. Firstly, promotion and explanatory sessions for the "Industry-Academia Collaboration Platform (Metaversity)" are required. Secondly, a strategy for integration and differentiation between the industry-academia platform and internal university platforms needs to be established. Thirdly, there is a need to develop specialized industry-academia collaboration platforms (Metaversity) based on the strengths of each university.

4.1.6 Limitations in the specialization of industry-academia cooperation group staff

Many industry-academia cooperation group staff are either temporary or hired through rotational assignments from headquarters, leading to a deepening of non-specialization among them. Two aspects need consideration here:

First, a national-level review of the utilization strategies for specialized industry-academia cooperation personnel is necessary. Building a database for these employees and enabling recruitment advertisements on an industry-academia information-sharing platform could be considered, aiming for a virtuous cycle structure for cooperation group staff across universities.

Second, individual universities should focus on enhancing the sophistication of industry-academia operations through direct appointments. This includes establishing a promotional system and organizational structure for directly appointed staff, avoiding rotational positions from headquarters, constructing a performance-based incentive system including non-regular staff, establishing a rational promotion system, and ensuring long-term employment to enhance specialization in the field of industry-academia cooperation. Additionally, implementing human resource metrics and a compensation system based on these metrics, including transitioning from a seniority-based to a performance-based salary system, could also be considered.

4.1.7 Sustainability issues in industry-academia cooperation information management

According to article 20 (6) of the enforcement decree of the industry-academia cooperation act, an industry-academia cooperation information manager should oversee the management and operation of human and material resources related to industry-academia cooperation within universities. However, in many universities, this position is often filled by non-specialists or as an additional duty. After the conclusion of projects like LINC 3.0, it is essential to maintain and operate this role sustainably by revising related university and cooperation group regulations, augmenting staff, and ensuring these staff develop professional expertise. Additionally, restructuring organizations and placing dedicated staff to fulfill these duties effectively is recommended.

4.1.8 Lack of autonomy strategies for industry-academia cooperation groups

There is a critical need to establish a self-sustaining revenue cycle and institutional systems for the autonomy of industry-academia cooperation groups. This requires a concrete action plan aligned with the university's mid-to-long-term development plans, but this area has been significantly underdeveloped.

Thus, presenting various revenue structures and types of successful case studies seems necessary for clear understanding. First, it should be communicated that indirect costs, as per Article 13 of the Research and Development Innovation Act (Payment and Use of R&D Funds), can be utilized for personnel support, research support, and performance utilization. Second, concrete proposals for the autonomy of Technology Licensing Offices (TLOs) are needed. Third, establishing a reinvestment system for technology transfer revenue and equipment operation revenue is essential. Mentioning the need to build a system for reinvesting revenues from technology commercialization projects is also crucial. Lastly, consulting on revenue structures should include strategies for generating income through the independent operation of technology holding companies, examples of university enterprises based on social innovation, and securing paid family companies for financial independence.

4.1.9 Lack of autonomy strategies for industry-academia cooperation groups

It has been identified that there is a significant deficiency in the strategies for establishing a self-sustaining revenue cycle and institutional systems for the autonomy of industry-academia cooperation groups. A detailed action plan aligned with the university's mid-to-long-term development strategies is necessary but currently lacking.

Therefore, to facilitate a clear understanding, it seems necessary to present various revenue structures and types of successful case studies. Firstly, it is important to communicate that, according to Article 13 of the Research and Development Innovation Act regarding the payment and use of R&D funds, indirect costs can be utilized for personnel support, research support, and performance utilization support. Secondly, concrete proposals are needed for the autonomy strategies of dedicated technology transfer organizations (TLOs: Technology Licensing Offices). Thirdly, there is a need to establish a reinvestment system for revenues from technology transfer and equipment operation. In the same context, the necessity to build a system for reinvesting revenues from technology commercialization projects should be mentioned. Fourthly, consulting on revenue structures is needed from various aspects, including strategies for generating income through the independent operation of technology holding companies, examples of university enterprises based on social innovation, and securing paid family companies for financial independence.

4.2 Consulting results for specialized universities

Consulting for specialized universities was conducted in four distinct areas, specifically focusing on the vision and development direction of the Industry-Academia Cooperation Group, education and employment/entrepreneurship, research and development and commercialization, and the infrastructure of the Industry-Academia Cooperation Group.

Table 3. Consulting areas for specialized universities

Consulting Areas	Checkpoints and Key Points
Vision and Development Direction of the Industry-Academia Cooperation Group	1. Self-analysis of Cooperation Group Characteristics
	1.1 Appropriateness of self-analysis for typifying the cooperation group based on strengths and weaknesses.
	1.2 Appropriateness of typifying the cooperation group based on university conditions and characteristics.
	2. University's Mid-to-Long-Term Industry-Academia Cooperation Plans
	2.1 Linkage between the university's vision and its mid-to-long-term industry-academia plans.
	2.2 Systematic development of the cooperation group's own strategies based on these plans.
Education and Employment/Entrepreneurship	1. Industry Education Support
	1.1 Appropriateness of support for vocational education based on industry-academia collaboration (linked to vocational education, local demand, local industry).
	1.2 Appropriateness of support for lifelong vocational education (local demand, local industry, revenue generation).
	2. Employment and Entrepreneurship Support
	2.1 Appropriateness of employment support systems and specialized models (employment capacity enhancement, employment promotion/support).
	2.2 Appropriateness of entrepreneurship support systems and specialized models (business linkage, regional linkage, practical entrepreneurship support).
Research and Development and Commercialization	1. Research and Development
	1.1 Appropriateness of support for research activities (support system: organization, personnel, regulations).
	1.2 Appropriateness of R&BD technology support (patents/technology transfer, long-term development plans, technology discovery and development).
	2. Commercialization
	2.1 Appropriateness of commercialization support systems (research revenue creation system, intellectual property management system, business model creation plan, dedicated support
	2.2 Appropriateness of commercialization support activities (technology commercialization support, business model creation support, performance management).
Infrastructure of the Industry-Academia Cooperation Group	1. Equipment and Space
	1.1 Infrastructure for joint use of research equipment to promote industry-academia cooperation. - Operation system for joint use of equipment. - Training for spreading the outcomes of equipment utilization
	1.2 Securing space to support new projects for spreading industry-academia cooperation outcomes. - Availability of dedicated spaces for outcome spreading. - Support system for space for outcome-spreading new projects.
	2. Information Sharing Platform
	2.1 Establishment of a platform for sharing university's industry-academia cooperation resources. - Continuous operation of the information-sharing platform. - Bidirectional operation allowing interaction between providers and users. - Implementation of a demand-based information provision service.
	3. External Network
	3.1 Securing a cooperative base for activating regional-centered industry-academia cooperation. - Diverse participation of different types of stakeholders. - Composition and organic connection of function-specific participants.

Consulting for specialized universities was conducted based on the detailed manual across several areas. It was found that many specialized universities share similar issues with general universities, such as the absence of mid-to-long-term development plans, unfamiliarity with consulting types, and challenges related to autonomy. However, specialized universities are in a more disadvantaged position regarding the establishment of an industry-academia cooperation environment, especially in the research sector which is often underprepared.

In the analysis of specialized university consulting, two areas are highlighted distinctively:

4.2.1 Insufficiency of research funding regulations and systems

Specialized universities generally have less interest in securing research funding, leading to poorly established regulations and systems for managing these funds. Therefore, consulting is needed to verify the cyclical structure of the cooperation group's finances, including the use of indirect costs. As previously mentioned, according to Article 13 of the Research and Development Innovation Act, indirect costs can be utilized for personnel support, research support, and performance utilization support. It is crucial to emphasize this and propose ways to link research funding to technological development and technology transfer revenues.

4.2.2 Need for activation of incumbent worker education programs

Operating incumbent worker education as micro-degree programs allows for the extension of vocational education not only to regular students but also to adult learners and local residents who desire such education. Various revenue structure strategies should be proposed in this regard:

First, the introduction of Open Badges by universities to certify participant competencies as a motivational tool for learners.

Second, consideration should be given to jointly establishing and expanding incumbent worker education programs with other universities and related institutions.

Third, identifying local industry demands and linking them with up-skilling, re-skilling, and cross-skilling to establish a support system for lifelong vocational education based on industry-academia cooperation.

Fourth, there is a need to operate custom education programs linked to employment (preferential) based on the demands of niche markets, positioning specialized universities to meet specific workforce demands through a new educational system.

5. Policy Recommendations for Strengthening the Capabilities of Industry-Academia Cooperation Groups

This study proposes four major approaches to achieve the Ministry of Education's original goal of enhancing the capabilities of industry-academia cooperation groups through consulting.

5.1 Composition of consulting teams and consulting implementation plans

5.1.1 Composition of package consulting tams and expansion of expert pool

For effective package consulting of industry-academia cooperation groups, it is necessary to assemble a pool of over 200 experts, categorize them by expertise and region, and build a database. It is essential to provide package consulting to 50 cooperation groups annually to ensure comprehensive consulting across the current 350+ cooperation groups, establishing a cyclical system where each group receives consulting at least once every five years. Considering the government's investment in industry-academia cooperation through programs like LINC and RISE, stabilizing the enhancement of the cooperation groups' functions is crucial to amplify the impact of these investments.

5.1.2 Enhancing the expertise of consulting teams

In terms of the composition of the consulting committee, it is necessary to assemble experts from various fields and ensure a proper distribution between faculty and staff to secure diversity in consulting. This approach allows for effectively responding to the needs of decision-makers and dedicated operational staff.

Before commencing the consulting process, the committee members need to undergo training to familiarize themselves with the currently developed manuals. This training will ensure that they can provide consistent consulting content to the target universities.

To ensure expertise in each consulting area, it is crucial to establish a pool of consulting committee members for each area. These members should receive pre-consulting training and participate in a post-consulting process to adjust the content based on the region or type of the universities they visited. Discussions among experts in each area are also necessary to unify the consulting content across different areas. These discussions should focus on a detailed analysis centered around the universities that have been selected and assigned for consulting.

For this purpose, the consulting committee members assigned to visit the universities should hold preliminary meetings to present and discuss the consulting content among themselves before visiting the target institutions. This preparation will facilitate a more focused and effective consulting session.

5.1.3 Package consulting implementation method

The method of implementing consulting requires deep consideration to enhance efficiency. In 2023, consulting sessions for each university lasted approximately 2-3 hours. However, considering various conditions and circumstances, it has been determined that a three-hour duration is appropriate for future consulting sessions.

Furthermore, an on-site tour of the Industry-Academia Cooperation Group is deemed essential. Visiting the universities to conduct a 30-minute to one-hour tour to inspect the cooperation group and related facilities is necessary. Such tours allow consultants to directly observe and understand the actual working environment, infrastructure, and resources of the cooperation groups. This is crucial because it helps to clearly identify real situations that are difficult to grasp through theoretical knowledge and data alone. Visiting the sites also makes it easier to identify potential issues. By

observing the workflow, equipment usage, and staff allocation on-site, more accurate problem analyses and solutions can be provided.

Regarding the introduction of the cooperation group, time should be allocated for senior executives, such as the head or deputy head of the cooperation group, to explain the current status and challenges faced by the group. This will broaden the understanding between the university and the consulting team, facilitating a more effective consultation process.

5.2 Enhancement of consulting manuals

5.2.1 Updating and supplementing the manuals

The manuals developed for pilot consulting need to be revised based on the findings and experiences from subsequent consulting sessions. A manual is not a static document but should undergo continuous improvement and evolution. As the consulting environment and requirements change over time, the manual must also evolve to keep pace with these changes.

Considering the characteristics of the RISE project and region-linked initiatives, it may be necessary to adjust the direction of the industry-academia cooperation groups to reflect contemporary trends. Additionally, as best practices change, the manuals should be updated to reflect these changes. This is crucial because pilot consulting can reveal practical issues, challenges, and missing information, making feedback based on real experiences essential for making the manual more effective and practical. Tailored strategies are also needed to address specific situations, as each consulting process involves unique circumstances and requirements. By incorporating insights gained from each year's consulting into the manual, strategies can be developed to suit more diverse and complex situations.

In terms of manual development, it is necessary to appoint experts in each area and undertake significant enhancement work over an extended period. This should be followed by gathering feedback, implementing consulting, and further refining the manual in a cyclical process to ensure the manual remains relevant and effective.

5.2.2 Rotation of experts for enhancing the package consulting manual

The initial industry-academia cooperation consulting manual may have lacked focus as it was developed concurrently with pilot consulting sessions. Therefore, it is essential to conduct separate manual enhancement work based on post-consulting experiences, with incremental improvements made annually. The roster of experts involved in updating the manual should be rotated each year for several reasons:

First, involving a diverse group of experts ensures that a wide range of specialized knowledge and perspectives from various fields are reflected in the manual, making it more comprehensive and multifaceted, which can enhance the effectiveness of consulting.

Second, the participation of new experts can bring fresh ideas and innovative approaches to the manual, allowing for its continuous evolution to stay relevant with the times.

Third, rotating experts ensures that the latest trends, technologies, and research findings are incorporated into the manual, which is crucial for keeping the consulting services up-to-date.

Fourth, having a variety of experts participate helps prevent the manual from being overly influenced

by the thought processes or approaches of any specific expert, thereby maintaining objectivity and balance.

Fifth, if the same experts are continuously tasked with manual updates, there could be an increase in fatigue and a decrease in creativity. Introducing new experts can help mitigate these issues by injecting new energy and perspectives into the manual enhancement process.

5.3 Developing a mid-to-long-term roadmap for university consulting plans

To achieve the ultimate goal of enhancing the capabilities of industry-academia cooperation groups as outlined by the Ministry of Education, it is necessary to establish a mid-to-long-term roadmap for university consulting plans. If consulting continues to be conducted in an ad-hoc manner, as is currently the case, not only will there be differentiation in the benefits received from consulting, but improvements based on performance measurement will also fail to be systematically implemented. Therefore, it can be argued that contemplation in the following five aspects is required:

5.3.1 Five-year cycle for consulting benefits across all industry-academia cooperation groups

To sustain the enhancement of industry-academia cooperation capabilities, a solid foundation must be established that allows universities' cooperation groups to fully perform their role in enhancing autonomy and institutional capabilities. Considering the high demand for package consulting as evidenced by the results from the pilot consulting in 2022 and the main package consulting in 2023, it has been noted that especially among specialized universities, there is a significant lack of awareness regarding the operational directions and policies of the Ministry of Education. While projects like the LINC are vital for activating university-industry cooperation, an immediate diagnosis of the foundational organizations of industry-academia cooperation seems more urgent.

Therefore, there is a need to establish a five-year cycle consulting benefit structure for all industry-academia cooperation groups. It will involve comprehensive considerations of the number of cooperation groups nationwide, characteristics of specialized types of cooperation groups, types of universities, and regional distribution to average out the consulting targets over five years. This approach will enable each cooperation group to prepare for and manage the consulting independently and increase the level of engagement among all university members.

5.3.2 Sharing package consulting results across all industry-academia cooperation groups

Sharing the results of package consulting across all industry-academia cooperation groups is necessary. The sharing of consulting outcomes offers other universities opportunities to share experiences and knowledge, which can enhance the capabilities and efficiency of all industry-academia cooperation groups nationwide.

Publishing an operational manual of consulting practices could be considered to facilitate the sharing of best practices and experiences, which could serve as valuable references for other cooperation groups. Publishing a consulting manual every 1-2 years that includes the results from each university and common areas needing improvement is advisable. Distributing and sharing these published manuals on package consulting operations to all industry-academia cooperation groups nationwide would

be a critical resource for enhancing their functions. Additionally, promoting and disseminating these findings through networks such as the Industry-Academia Cooperation Group Directors' Council could also be considered annually.

5.3.3 Establishing a reward system for universities excelling in industry-academia cooperation

A reward system for universities that excel in creating outcomes and enhancing functions related to industry-academia cooperation needs to be established, along with securing incentives for enhancing professionalism. This system would be similar to current awards for excellence in entrepreneurship education, industry-academia education, and commercialization activities. Recognizing the efforts and achievements of outstanding industry-academia cooperation groups can contribute to improving the overall quality of university industry-academia programs and encourage them to strive for better results. Essentially, the reward system serves as a motivation for cooperation groups to continuously improve and develop, leading to long-term qualitative enhancements in university industry-academia programs.

5.3.4 Providing university incentives for the reintegration of package consulting outcomes

Universities need to voluntarily embrace and implement the suggestions made through package consulting and integrate them into the functions of their industry-academia cooperation groups and related financial support projects. A feedback system should be established to periodically review the university's efforts in implementing the consulting recommendations. If a university has successfully improved its industry-academia cooperation group functions and reflected these improvements in related financial support projects, a system should be introduced to provide incentives in evaluations, and budget allocations for those financial support projects. This would further encourage universities to activel

5.3.5 Setting priorities based on the urgency of consulting needs

Finally, it is necessary to establish priorities for consulting targets based on the urgency of their needs. Within a system that allows for consulting at least once every five years, it is essential to determine the priority of each consulting target.

As evident from the analysis of package consulting results, there is a significant disparity among industry-academia cooperation groups. To elevate the overall industry-academia cooperation capabilities in the country, it is crucial to prioritize consulting for those cooperation groups that are below average. Much of the consulting content for well-performing universities tends to confirm their strengths, which although important, may not be as urgently needed as support for those lagging behind.

Additionally, considering a structure where more advanced industry-academia cooperation groups provide consulting to other universities could also be valuable. This would create a framework where cooperation groups at a more developed stage assist others, fostering a culture of mutual improvement and learning. Organizing workshops that involve cross-consulting between groups of different levels or within the same level is also recommended to enhance collaborative learning and development across all industry-academia cooperation groups.

5.4 Post-consulting evaluation

5.4.1 Continuous improvement based on satisfaction surveys

It is necessary to conduct satisfaction surveys and gather improvement requests from the universities targeted by the consulting. Satisfaction surveys should cover various aspects such as the expertise of the consulting committee members, the methodologies used in consulting, and the timing of the consulting sessions. It is also recommended to conduct surveys on the demand for consulting and the needs for further improvements.

5.4.2 Necessity for checking the implementation of consulting recommendations

Given the significant resources and budget involved in conducting consulting, a minimum level of checking the implementation of consulting recommendations is deemed necessary. Universities should compile a list of the consulting implementation items, detailing them by area and item to facilitate easy review. Based on this list, decisions regarding the necessity for additional consulting in the following year can be made. This is not mandatory; however, if there are difficulties in implementing the consulting recommendations, provisions should be made for additional consulting to assist the universities as needed.

6. Conclusion and recommendations

This study conducted a comprehensive analysis of the outcomes and content of IUCG package consulting, distinguishing between general and specialized universities due to their different characteristics and the diverse items in the consulting manuals. Based on this, we proposed policy measures aimed at strengthening the governance system between universities and their cooperation groups, expanding industry-academia activities, and enhancing overall planning and management functions to effectively support the restructuring of IUCG capabilities.

The consulting performed in this study helped IUCGs identify their strengths and enhance their core competencies. It was designed to assist in setting strategic directions that contribute to achieving long-term goals. By understanding market trends, industry changes, and technological advancements through consulting, IUCGs can effectively respond to rapidly changing environments. Future research should systematically analyze the outcomes of consulting, considering both internal and external factors influencing consulting success, and develop performance measurement indicators to enhance the sophistication and efficiency of IUCG consulting.

Conflicts Interest

No author has any other conflict of interest to declare.

References

Barcus III, S. W., & Wilkinson, J. W. (1994). *Handbook of Management Consulting Services*. New York: McGraw-Hill.

Ciampi, F. (2009). Exploring knowledge creation pathways in zdvanced management consulting. *Information Age Publishing, 9*, 3-39.

Hong, E. Y., & Choi, J. I. (2018). A study on the factors influencing the sustainability of industry-academia cooperation: focused on the strength of industry-academia relationships and overcoming obstacles. *Journal of the Korea Academia-Industrial Cooperation Society, 19* (3), 410-422.

Hong, E. Y., & Choi, J. I. (2018). The impact of university administration efforts and trust between industry and academia on industry-academia cooperation barriers. *Journal of Venture Start-ups, 13* (1), 105-117.

Kim, J. Y., Choi, M. J., Lee, H. L., & Kim, H. T. (2018). *Improvement and Utilization Base of The National Science and Technology Standard Classification System in 2018*. Chungcheongbuk-do: Korea institute of science and technology planning and evaluation.

Kim, M. J., & Jang, S. I. (2016). A study on the effects of consulting performance influencing organizational outcomes: focusing on the moderating role of organizational support. *Management and Information Research, 35* (2), 185-203.

Kim, S. W., & Yoon, Y. K. (2020). Analysis of the employment effects of government support for industry-academia-research cooperation. *Small Business Research, 42* (2), 179-193.

Korea institute of science and technology planning and evaluation (2018). *2018 Planning Study for the Comprehensive Revision and Improvement of the National Science and Technology Standard Classification System*. Sejong: Ministry of Science and ICT.

Korea institute of science and technology planning and evaluation (2019). *Building a Linkage Base between the National Science and Technology Standard Classification System and Related Technology Classification Systems in 2019*. Sejong: Ministry of Science and ICT.

Korea industrial technology promotion agency (2012). *R&D Systems and Characteristics of Major Countries*.

Ministry of Education (2013). *Recognition criteria for industry-academia collaboration focused professors*.

Ministry of Education (2017). *Act on the promotion of industrial education and industry-academia-research cooperation (abbreviated as the Industry-academia cooperation act)*.

National Law Information Center. National Science and Technology Standard Classification System [Enforcement 2018.2.13] [Notification No. 2018-10 of the Ministry of Science and ICT, 2018.2.7., Partial Amendment]. Retrieved from https://www.law.go.kr/행정규칙/국가과학기술표준분류체계/(2018-10,20180207).

Noh, Y. H., Park, M. S., Shim, K. S., Lee, J. S., Huh, J. W., & Han, J. S. (2022). *A study on the operation of package consulting for the improvement of the functions of industry-academia cooperation groups*. Daejeon: Korea Research Foundation.

Noh, Y. H., Park, M. S., Shim, K. S., Lee, J. S., Huh, J. W., & Han, J. S. (2022). *Consulting*

manual for industry-academia cooperation groups. Daejeon: Korea Research Foundation.

Noh, Y. H., Yang, J. M., Kang, J. H., Kim, Y. H., Lee, J., & Wahg, D. (2021). *A study on improving the revision process of the academic standard classification system*. Daejeon: Korea Research Foundation.

Pinto, J. K., & Prescott, J. E. (1990). Planning and tactical factors in the project implementation Process. *Journal of Management Studies, 27* (3), 305-327.

Shapiro, E. C., Eccles, R. G., & Soske, T. L. (1993). Consulting-has the Solution Become Part of the Problem?. *Sloan Management Review, 34* (4), 89-95.

Son, C. G., Park, J. H., & Kim, Y. T. (2013). A study on the development of a performance evaluation model for industry-academia collaboration focused professors. *Journal of the Korean Society of Industrial and Engineering Chemistry, 14* (8), 3656-3664.

Song, W. H. (2007). Strategies for building an incentive system for the activation of industry-academia cooperation. *Journal of Innovation, 2* (1), 1-26.

Yoo, J. T. (2018). *KISTEP Technology brief: trends in research and development in Japan*. Chungcheongbuk-do: Korea Institute of Science and Technology Planning and Evaluation.