A Study on the Development of a Classification System for Industry-Academia-Research Cooperation Information

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ABSTRACT

Purpose: This study aims to develop a systematic classification system for efficiently managing and utilizing information related to industry-academia-research cooperation, addressing the gaps in structured data management.
Methodology: The study employs literature review, case studies, expert interviews (FGI), and integrated analysis. A hierarchical decimal coding system was designed to ensure logical organization and accessibility of data.
Findings: The proposed classification system comprises six major categories—organization, infrastructure, workforce development, entrepreneurship and employment, research and development, and commercialization—enhancing data usability and policy support.
Implication: This study provides a foundational framework for managing industry-academia-research cooperation information, contributing to ecosystem sustainability. Future work should focus on governance policies for data protection, quality control, and institutional accountability.

1. Introduction

Industry-academia-research cooperation plays a pivotal role in fostering innovative technologies and knowledge, driving national and regional economic and social development. Through collaboration among academia, industries, and research institutions, it becomes possible to address complex problems that cannot be solved by a single entity, creating new opportunities for sustainable development. However, to maximize the outcomes of such cooperation, systematic information management and sharing are essential.

Currently, the information systems supporting industry-academia-research cooperation face significant limitations due to a lack of integrated and systematic management. Specifically, the absence

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of a classification system results in excessive time spent searching for relevant information, often making it difficult to efficiently locate necessary data. This inefficiency not only reduces the overall effectiveness of cooperation but also leads to missed opportunities for collaboration.

Furthermore, the lack of structured information management results in redundant research and projects, leading to inefficient use of resources. The inability to provide timely support in specific areas of collaboration exacerbates resource wastage, ultimately undermining the sustainability of industry-academia-research cooperation.

The absence of systematic information management also has a severe impact on policy and strategy formulation. Without accurate insights into the current state of cooperation, governments and related organizations struggle to design and implement effective policies. The lack of concrete data hinders the development of targeted support programs and incentives, reducing the effectiveness of cooperative activities.

In addition, difficulties in performance evaluation and knowledge sharing hinder the progress of industry-academia-research cooperation. The lack of systematic evaluation of cooperative activities makes it challenging to analyze successful models and identify areas for improvement. Moreover, the failure to document and share diverse cooperation cases and experiences limits the ability of other institutions to leverage these as references for similar opportunities.

To address these challenges, the establishment of an Industry-Academia-Research Cooperation Information System (IARCIS) is imperative. Such a system can serve as a critical foundation for enhancing the efficiency and sustainability of cooperation efforts. This study aims to build an IARCIS to support the effective management and advancement of industry-academia-research cooperation. By developing a systematic and practical classification system, the study seeks to establish a framework for managing and utilizing extensive cooperation-related information.

The establishment of an IARCIS is expected to contribute in several significant ways. First, it will enhance information accessibility and utilization, improving the efficiency of industry-academia-research cooperation. This includes expanding collaboration opportunities, preventing redundant research, and enabling the efficient use of resources. Second, the provision of systematic data on the state of cooperation will support policy formulation and strategic planning. Governments and related organizations will be better equipped to design effective support programs and incentives. Third, the ability to evaluate and analyze performance will enable the identification of successful models and areas for improvement, strengthening the sustainability of cooperation efforts. Finally, sharing diverse cases and experiences will foster the development of the cooperation ecosystem and promote a culture of collaboration.

This study is expected to not only contribute to the systematic management and advancement of industry-academia-research cooperation but also provide a foundation for exploring new possibilities in this vital field.

2. Literature Review

2.1 Previous Studies on Database Development and Integrated Information Networks
The development of databases and integrated information networks for the systematic management

and utilization of industry-academia-research cooperation information has been extensively studied across various fields. These studies primarily focus on structuring information, enhancing usability, and providing policy support. Key studies are as follows:

Lee et al. (2015) proposed an optimal approach to database construction for groundwater data in Gyeonggi Province, including well locations, usage, water quality, groundwater levels, and pollution areas. They combined this data with spatial information to create maps, improving the utilization of dispersed data and enhancing regional resource management efficiency.

Gong et al. (2012) conducted a study on constructing a database for information about assistive devices for people with disabilities. By analyzing online data collection and sharing systems, they proposed a framework for providing reliable and comprehensive information, contributing to improved data reliability and accessibility.

Song (2006) investigated the development of a GIS-based integrated database for the Korean Land Information System (KLIS) to resolve data inconsistency and redundancy issues. This study emphasized the necessity of constructing a national network using high-speed broadband to enhance data management.

Kim and Park (2020) explored ways to improve public services using big data on marine information. Through online surveys conducted by government agencies, they identified concrete strategies to enhance service quality, accessibility, and user satisfaction.

The Ministry of Land, Infrastructure, and Transport (2020) highlighted the necessity of developing integrated information networks for solving urban problems through the establishment of a smart city platform. Their approach involved inter-ministerial cooperation to build a unified platform, improving administrative service efficiency.

2.2 Previous Studies on the Utilization of Industry-Academia-Research Cooperation Information Networks

Research on the utilization of industry-academia-research cooperation information networks has proposed various models to enhance the efficiency and usability of integrated information networks. Key studies include:

Park (2001) developed an operational framework for a radiation safety management integrated information system. This framework provided a systematic approach to managing disaster response, public inquiries, regulation, and safety information, contributing to industrial and technological advancement and national competitiveness.

Kim (2002) introduced a process-integrated information system (PIIS) for the LNG industry, focusing on integrating safety management, construction processes, and operations. The study emphasized improving flexibility and expertise in the LNG sector and proposed measures to enhance international competitiveness.

Choi et al. (2008) addressed the construction of integrated job information networks for South Korea. Their study suggested directions for providing essential information for students' career planning and employment, based on surveys and demand analyses. They also identified gaps between the services provided and those actually utilized by students and proposed improvements to address these discrepancies.

These prior studies demonstrate the importance of systematic information management and utilization for maximizing resource efficiency and supporting policy and strategy development. Building upon this foundation, the present study aims to develop an integrated information management system and thematic classification framework for industry-academia-research cooperation. This effort seeks to establish a more efficient and systematic information network to support collaboration and innovation.

3. Research Procedures

This study employed a systematic approach to develop a subject classification system for industry-academia-research cooperation information. The process involved four key steps: literature review, case studies, expert feedback (FGI), and comprehensive analysis. The methodology and detailed processes for each step are as follows:

The first step involved conducting a literature review of existing studies related to industry-academia-research cooperation information at both domestic and international levels. This analysis provided foundational data on the classification systems and information management practices used in the field. It also helped establish the theoretical framework for the study, guiding the development of an initial draft for the classification system. The literature review served as the basis for setting the overall direction of the research.

In the second step, case studies were conducted to identify and analyze organizations offering similar information systems. This included investigating cases managed by other institutions and analyzing the websites of comparable organizations. Specifically, websites categorized under industry-academia-research cooperation networks or university-industry collaboration centers were examined to compile relevant examples. Based on these case studies, insights into thematic structures and metadata requirements for industry-academia-research cooperation information were derived. This step was instrumental in designing a practical and applicable classification system.

The third step focused on drafting the initial classification system for industry-academia-research cooperation information. This draft was developed using findings from the literature review and case studies. To validate the draft, focus group interviews (FGI) were conducted with experts in the field. Five experts with over 10 years of experience in industry-academia-research cooperation participated in two rounds of FGIs. Their feedback was used to evaluate the validity of the draft classification system. Based on the insights gathered, the draft was refined and revised to address gaps and improve its practical utility.

In the final step, the findings from the FGIs and earlier research stages were synthesized to finalize the subject classification system. The finalized system provides a standard framework for the systematic management and utilization of industry-academia-research cooperation information. It also includes recommendations for future research and practical applications to enhance its usability.

This methodology ensured the development of a comprehensive and practical classification system, contributing to the effective and systematic management of industry-academia-research cooperation information. The study's findings are expected to serve as a significant tool for advancing collaboration and innovation in this critical field.

Stage	Research Content	
Step 1 Literature Review	✓ Analysis of existing studies related to industry−academia−research cooperation information at domestic and international levels	
Step 2 Case Studies	**Criteria−Based Case Study**	✓ Investigation of cases conducted by other institutions ✓ Analysis of websites of similar organizations
	▼	
	Case Study on Industry−Academia−Research Cooperation Networks	✓ Examination of websites providing information under the name of industry−academia−research cooperation networks. ✓ Analysis of websites of university−industry collaboration centers
	▼	
	Insights from Case Studies	✓ Derivation of thematic insights for industry−academia−research cooperation information. ✓ Identification of metadata−related implications.
Step 3 Drafting the Subject Classification System	**Drafting the Subject Classification System**	✓ Development of an initial draft of the subject classification system based on case studies and literature review.
	▼	
	Focus Group Interviews (FGI)	✓ Collection of expert feedback on the initial draft of the subject classification system for industry−academia−research cooperation. ✓ Two rounds of interviews conducted with five experts in the field.
	▼	
	FGI−Based Analysis	✓ Refinement and validation of the final subject classification system based on FGI analysis results.
Step 4 Finalizing the Subject Classification System	✓ Integration of research findings to establish the final subject classification system ✓ Inclusion of recommendations for future research and practical applications	

Fig. 2 Development Procedures and Content of the Subject Classification System for Industry-Academia-Research Cooperation Information

4. Analysis of the Construction and Case Studies of the Industry−Academia−Research Cooperation Information System

4.1 Investigation and Classification of Similar Cases

This study investigated and classified similar cases to derive practical insights for the construction and utilization of the Industry-Academia-Research Cooperation Information System (IARCIS). The

cases were categorized into the following types:
  1) Integrated information networks related to industry-academia cooperation,
  2) Other relevant integrated information networks, and
  3) Thematic information resource websites.

The selection criteria for these cases were as follows: The cases had to provide insights into potential utilization strategies for the IARCIS, be actively operated by reliable institutions through 2024, and demonstrate active user engagement.

Additionally, for other relevant integrated information networks, the focus was placed on employment and education-related platforms, as they are likely to attract the main stakeholders of the IARCIS, including corporations, government agencies, research institutions, and students.

  1) Cases of Integrated Information Networks Related to Industry-Academia Cooperation
  The CNU Industry-Academia Cooperation Mediation Center, operated by Chungnam National University, is a system that supports collaborations between universities and industries in the Chungnam region. It fosters partnerships between universities and companies, enhancing regional industry-academia-research connections. The system is accessible via the [CNU Industry-Academia Cooperation Mediation Center Website](https://connect.cnu.ac.kr).

  Konkuk University operates WE-LINK, an information-sharing system that systematically provides data on industry-academia cooperation activities at Konkuk University and its Glocal Campus. The system promotes collaboration among universities and facilitates interaction between academia and industries. Detailed information can be found on the [WE-LINK Website](https://welink.kku.ac.kr/main.do).

  The Industry-Academia-Research PLUS platform facilitates collaboration and exchange between industries and academia to enhance the technological capabilities and development potential of small and medium enterprises (SMEs). It supports technology development for SMEs and shares various collaboration cases and information. The platform is available on the [Industry-Academia-Research PLUS Website](https://plus.auri.go.kr).

  2) Cases of Integrated Information Networks for Talent and Researcher Management
  Managed by the National Research Foundation of Korea, KRI is a researcher information network that provides systematic management and sharing of research information through keyword or name-based searches. It strengthens collaboration among researchers. Additional details are available on the [KRI Website](https://www.kri.go.kr/kri2).

  Operated by NTIS under KISTI, this network provides detailed researcher information categorized by scientific and technological specialties. It fosters networking among researchers and enhances collaboration opportunities. This system is accessible via the [NTIS Website](https://www.ntis.go.kr/ThMain.do).

  3) Other Relevant Integrated Information Networks
  WorkNet, provided by South Korea's Ministry of Employment and Labor, is an employment

information network offering comprehensive data on job opportunities, careers, and vocational training. It connects job seekers with employers through an integrated platform. Further details are available on the [WorkNet Website](https://www.work.go.kr/seekWantedMain.do).

Centrelink, operated by the Australian government, is a public service platform offering a wide range of employment-related services. It provides integrated resources for job seekers, including employment and welfare-related support. Additional details are available on the [Centrelink Website](https://www.servicesaustralia.gov.au/centrelink?context=1).

These case studies provide valuable operational models and utilization strategies for constructing the IARCIS. They offer significant insights into industry-academia collaboration, researcher network formation, systematic information management, and employment-related information networks. The findings from these cases contribute to refining the direction and framework for building the IARCIS, ensuring its practicality and effectiveness.

4.2 Similar Cases in the Development of the Industry-Academia-Research Cooperation Information Classification System

In the process of developing a classification system for the Industry-Academia-Research Cooperation Information System (IARCIS), an investigation into existing studies and cases revealed that no direct examples of classification system construction for such a purpose currently exist. As a result, this study collected foundational data for classification system development by referencing studies and cases with strong relevance to the subject. These examples are broadly categorized into four groups, each offering significant insights into data management and systematic approaches within the context of industry-academia cooperation.

Table 1. Reference Materials for the Industry−Academia−Research Cooperation Information System Classification

Category	Title	Description
Ministry of Education (2022)	University−Industry Cooperation Activity Survey Report	▪ Aims to systematically investigate, analyze, and provide statistics on university−industry cooperation in Korea to establish a scientific foundation for promoting cooperation policies.
Hye−Jin Jeong (2021)	Study on Enhancing the Effectiveness of University−Industry Cooperation Activity Surveys	▪ Proposes improvements to the university−industry cooperation survey process by designing a system that includes planning, implementation, evaluation, and feedback cycles.
Hyuk−Jin Ko (2021)	Joint Data Platform Development Plan for Government−University−Industry	▪ Suggests building a standardized and distributed data platform for higher education financial support, aiming to enhance fiscal rationality, efficiency, and university−industry partnerships.
Younghee Noh (2022)	Development of Expertise Indices for Industry−Academia Cooperation Experts and Service Design for Sanhak−Injaenet	▪ Presents strategies to activate Sanhak−Injaenet by utilizing the expert pool for industry−academia cooperation to provide various service solutions.
National	Package Consulting	▪ Supports capacity building by organizing expert advisory panels to

Research Foundation of Korea (2023)	Manual for Enhancing the Functions of Industry−Academia Cooperation Foundations	offer customized consulting for specialized models in industry−academia cooperation foundations.

First, the University-Industry Cooperation Activity Survey Report by the Ministry of Education (2022) systematically investigated and analyzed statistics on university-industry cooperation in Korea. This report established a scientific foundation for data-driven policies to promote industry-academia cooperation. By emphasizing the importance of data management and utilization, the report provided a direction for enhancing the effectiveness of industry-academia collaboration.

Second, Hye-Jin Jeong's (2021) Study on Enhancing the Effectiveness of University-Industry Cooperation Activity Surveys proposed a structured system for planning, designing, implementing, and providing feedback on surveys related to university-industry cooperation activities. This study presented specific strategies to improve the efficiency and effectiveness of the survey process, thereby laying the groundwork for achieving tangible outcomes in industry-academia cooperation.

Third, Hyuk-Jin Ko's (2021) Joint Data Platform Development Plan for Government-University-Industry suggested a plan for building a standardized platform to generate and distribute higher education financial support data. This research proposed a concrete data management model to strengthen partnerships between universities and industries while improving the rationality and efficiency of higher education financial management.

Fourth, Younghee Noh's (2022) Development of Expertise Indices for Industry-Academia Cooperation Experts and Service Design for Sanhak-Injaenet presented various service strategies utilizing the expert pool offered by Sanhak-Injaenet. This study contributed to expanding the potential of industry-academia cooperation by effectively leveraging expert networks and designing innovative services to activate the Sanhak-Injaenet platform.

Lastly, the National Research Foundation of Korea's (2013) Package Consulting Manual for Enhancing the Functions of Industry-Academia Cooperation Foundations proposed consulting solutions tailored to specialized models of industry-academia cooperation foundations through the organization of expert advisory panels. This manual has been widely used as a critical resource to strengthen the capacity of industry-academia cooperation foundations and support their systematic management and operations.

These cases provide valuable insights into the development of a classification system for the Industry-Academia-Research Cooperation Information System (IARCIS). They highlight practical approaches for systematically managing and utilizing data related to industry-academia cooperation. Building on these examples, this study aims to develop a thematic classification system for the IARCIS, contributing to maximizing the efficiency and impact of industry-academia cooperation.

5. Analysis Subjects and Development of the IARCIS Thematic Classification System

5.1 Subjects of Analysis and Methodology for Developing the Thematic Classification System

for the Industry-Academia-Research Cooperation Information System

1) Subjects of Analysis

This study selected the following studies and cases as subjects of analysis to develop the thematic classification system for the Industry-Academia-Research Cooperation Information System (IARCIS):

The first subject of analysis is the University-Industry Cooperation Activity Survey Report. This report systematically investigates and analyzes statistics on university-industry cooperation in Korea, providing a scientific foundation for policy formulation to promote such cooperation. It enables a data-driven understanding of the current state of university-industry cooperation and offers policy directions.

The second subject of analysis is the Study on Enhancing the Effectiveness of University-Industry Cooperation Activity Surveys. This study proposes a structured system for planning, designing, implementing, and providing feedback on surveys to improve their effectiveness. Such an approach contributes to maximizing the efficiency of data management and utilization in industry-academia cooperation.

The third subject of analysis is the Joint Data Platform Development Plan for Government-University-Industry. This research suggests a plan to standardize, generate, and distribute data on higher education financial support through a shared platform. The study aims to enhance the rationality and efficiency of higher education financing and strengthen partnerships between universities and industries.

The fourth subject of analysis is the Development of Expertise Indices for Industry-Academia Cooperation Experts and Service Design for Sanhak-Injaenet. This study proposes various service strategies utilizing the expert pool provided by Sanhak-Injaenet and derives activation measures for the platform. It lays the foundation for the effective operation and expansion of expert networks in industry-academia cooperation.

2) Methodology for Developing the Thematic Classification System

To systematically design and construct the thematic classification system for the IARCIS, this study applied the following methodology:

The first step involved preliminary investigation and analysis. Existing literature and resources related to industry-academia cooperation were reviewed to collect foundational data required for the design of the classification system. Additionally, cases of domestic and international organizations with similar classification systems were analyzed to identify elements for benchmarking. Interviews with key stakeholders from academia, industry, research institutions, and government agencies were conducted to gather information requirements and necessary data.

The second step focused on classification system design. The major domains of industry-academia-research cooperation were identified, and overarching categories were defined. Subcategories and specific items were detailed under each category, with clear definitions of the required data. Terminology within the classification system was standardized to ensure consistency and clarity, resulting in a structured and precise classification framework.

The third step involved data collection and organization. Existing data related to industry-academem-

ia-research cooperation were collected and aligned with the newly designed classification system. Additional investigations and data collection activities were conducted to address gaps. Collected data were refined and standardized to ensure accuracy and consistency, enabling the provision of reliable and structured information.

The selection of subjects of analysis and the application of this structured methodology establish a solid foundation for effectively developing the thematic classification system for the IARCIS. These efforts ensure the systematic provision of reliable information, contributing to the efficient management and utilization of industry-academia-research cooperation data.

5.2 IARCIS Classification System

1) Initial Draft of the IARCIS Classification System

This study developed an initial draft of the IARCIS classification system based on the analyzed studies and cases. The classification system consists of six main categories and corresponding sub-categories designed to systematically organize various types of information and data related to industry-academia-research cooperation.

The first main category is Industry-Academia Cooperation Organizations, which is divided into Organizations and Personnel. The Organizations subcategory includes four items, while Personnel comprises five subcategories.

The second main category is Infrastructure, further divided into Budget, Space, Equipment, Systems, and Networks. These are detailed as follows: Budget (6 items), Space (4 items), Equipment (4 items), Systems (5 items), and Networks (6 items).

The third main category is Workforce Development, which is categorized into General Education and Industry-Academia-Based Education. General Education includes three items, while Industry-Academia-Based Education consists of six items.

The fourth main category is Entrepreneurship and Employment, divided into Entrepreneurship Education and Employment & Entrepreneurship. Both subcategories contain four items each.

The fifth main category is Research and Development, which is split into R&D Activities and Research Achievements. The R&D Activities subcategory includes three items, while Research Achievements consists of five items.

The sixth main category is Commercialization, divided into Commercialization Activities and Enterprise Support. Commercialization Activities includes seven items, while Enterprise Support comprises two items.

This classification system is designed to provide a framework for systematically managing and maximizing the utility of various types of information related to industry-academia-research cooperation. Each category reflects the key components of such cooperation and provides a structured basis for the efficient operation and utilization of the information system.

2) Coding of the IARCIS Classification System

To enable systematic and logical management of the IARCIS, the classification system was coded hierarchically. This coding system enhances efficiency in information retrieval and management,

creating a user-friendly data management system. The coding structure is based on the principles of the decimal classification system, following the hierarchical format below:

Table 2. Joint Data Platform Development Plan for Government−University−Industry

Main Category	Subcategory	Detailed Subcategory
One−digit code ex) 1	Two−digit code ex) 11	Three−digit code ex) 111

3) Completion of the Final Classification System Draft

The final draft of the IARCIS classification system is designed based on the principles of the decimal classification system, incorporating hierarchical codes for main categories, subcategories, and detailed subcategories. The coding system focuses on enhancing the efficiency of information management and utilization, enabling logical data retrieval and systematic organization.

The coded classification system will serve as a core tool for the integrated management and standardized utilization of data within the IARCIS. Its structured approach ensures scalability and adaptability for various applications, thereby supporting the comprehensive management of industry-academia-research cooperation information.

5.3 Expert Opinions

This study collected feedback from experts with over 10 years of experience in the field of industry-academia-research cooperation to design a more systematic and practical classification system for the IARCIS. The expert feedback focused on verifying the system's suitability, usability, and validity. It included a review of the six main categories, their subcategories, and detailed items, along with suggestions for improvement.

1) Key Expert Feedback

First, experts pointed out the need for reorganization of certain items where the distinction between main, sub, and detailed categories was unclear. Specifically, clearer definitions were required for overlapping items between "Industry-Academia Cooperation Infrastructure" and "Workforce Development."

Second, they recommended including specific examples and case studies for better user understanding when applying the classification system in practice. For instance, they suggested adding practical examples, such as internships and capstone design projects, under the "Industry-Academia-Based Education" category.

Third, experts advised further subdivision of network-related items to distinguish between corporate, community, and international cooperation more explicitly. They emphasized the importance of differentiating between global and domestic industry-academia cooperation.

Fourth, the need for standardization of terminology to ensure consistency and clarity was highlighted.

Some item names were considered academically appropriate but potentially difficult for practitioners to understand.

Fifth, they stressed the importance of developing specific guidelines to prevent duplication and ensure consistency in data collection and management.

2) Incorporation of Expert Feedback

Based on the expert feedback, the study made the following improvements to refine the classification system:

First, improved clarity between categories. Ambiguous items in "Industry-Academia Cooperation Infrastructure" and "Workforce Development" were redefined to eliminate overlaps. For example, "General Education" and "Industry-Academia-Based Education" were clearly distinguished, and their subcategories were further specified.

Second, added specific examples. Practical examples were included for each subcategory to enhance usability in the field. For instance, real-world internship programs and success stories were incorporated under "Industry-Academia-Based Education."

Third, further subdivided network-related items. Network-related categories were divided into "Corporate Support Networks," "Community Networks," and "Global Networks" to provide clear distinctions based on scope and target audiences.

Fourth, standardized terminology. All terms were revised to ensure they could be commonly understood from both academic and practical perspectives. For example, the item "Personnel System for Industry-Academia Cooperation" was rephrased for better clarity.

Fifth, enhanced the data management framework. Standardized guidelines for data collection, refinement, and management were designed to improve the system's functionality. These guidelines aim to prevent duplication and inconsistencies in the data.

Through these improvements, the final classification system enhances the usability and validity of the IARCIS. It has been completed as a framework that is easy to understand and utilize for diverse user groups, thereby contributing to the effective management and application of industry-academia-research cooperation information.

5.4 Final Thematic Classification System for the Industry-Academia-Research Cooperation Information System

The final classification system for the IARCIS organizes information related to industry-academia cooperation into six main categories: organizations, infrastructure, workforce development, entrepreneurship and employment, research and development, and commercialization. Each category includes detailed subcategories, such as personnel, budget, networks, education, and R&D activities, which are further broken down into specific items.

The system employs a hierarchical coding structure based on the decimal system for efficient data management and retrieval. It provides a comprehensive framework to systematically organize information, support practical applications, and facilitate collaboration among diverse stakeholders in industry-academia cooperation. This classification system enhances resource utilization and strategic decision-making while ensuring clarity and usability.

Table 3. Final Thematic Classification System for the IARCIS

Main Category		Subcategory		Detailed Subcategory	
Item	Code	Item	Code	Item	Code
Industry−Academia Cooperation Organizations	1	Organizations	11	▪ University Headquarters	111
				▪ Industry−Academia Cooperation Center	112
				▪ University Research Institutes	113
				▪ Other Organizations	114
		Personnel	12	▪ Full−Time Faculty	121
				▪ Students	122
				▪ Professional Staff	123
				▪ Researchers	124
				▪ Other Personnel	125
Infrastructure	2	Budget	21	▪ Scholarships	211
				▪ Tuition Fees	212
				▪ Endowment Funds	213
				▪ Financial Support Programs	214
				▪ Matching Funds	215
				▪ Other Budget	216
		Space	22	▪ Student Support Spaces	221
				▪ Research Support Spaces	222
				▪ Enterprise Support Spaces	223
				▪ Other Spaces	224
		Equipment	23	▪ General Equipment	231
				▪ Shared Research Equipment	232
				▪ Lab−Factory Operations	233
				▪ Other Equipment	234
		Systems	24	▪ Cooperation−Friendly Personnel Systems	241
				▪ Cooperation−Friendly Academic Systems	242
				▪ Enterprise & Community Support Systems	243
				▪ Cooperation Mileage Systems	244
				▪ Other Systems	245
		Networks	25	▪ Family Enterprises	251
				▪ Cooperation Committees	252
				▪ Regional Cooperation	253
				▪ Global Cooperation	254
				▪ Enterprise Support and Advisory	255
				▪ Other Networks	256
Workforce Development	3	General Education	31	▪ General Education	311
				▪ Remote/Online Education	312
				▪ Other General Education	313
		Industry−Academia−Based Education	32	▪ Internships	321
				▪ Capstone Design	322
				▪ University Enterprises	323
				▪ Contract−Based Programs	324
				▪ Custom Curricula	325

				▪ Other Industry−Academia−Based Education	326
Entrepreneurship & Employment	4	Entrepreneurship Education	41	▪ Regular Courses	411
				▪ Extracurricular Programs	412
				▪ Regional Entrepreneurship Education Systems	413
				▪ Other Entrepreneurship Education	414
		Employment & Entrepreneurship	42	▪ Employment	421
				▪ Student Startups	422
				▪ Further Studies	423
				▪ Other Employment & Entrepreneurship	424
Research & Development	5	R&D Activities	51	▪ National R&D	511
				▪ Private R&D	512
				▪ Other R&D	513
		Research Achievements	52	▪ Papers	521
				▪ Books	522
				▪ Patent Applications & Registrations	523
				▪ Intellectual Property Rights	524
				▪ Other Research Achievements	525
Commercialization	6	Commercialization Activities	61	▪ Technology Transfer	611
				▪ Faculty Startups	612
				▪ Laboratory Startups	613
				▪ Regional Startups	614
				▪ University Technology−Based Startups	615
				▪ Technology Holding Companies	616
				▪ Other Commercialization Activities	617
		Enterprise Support	62	▪ Industrial Support	621
				▪ Other Enterprise Support	622

6. Results and Discussion

6.1 Conclusion

This study was conducted based on the awareness that, despite the significant role of industry-academia-research cooperation (IARC) in driving national economic growth and innovation, there is a lack of systematic management and utilization of related information. Efficient information management is essential to maximize the outcomes of IARC, and this requires the development of a structured classification system and metadata. The necessity of this research is emphasized in the following aspects:

First, systematic classification of information facilitates easier database management and information retrieval, enhancing usability.

Second, a clear classification system allows IARC opportunities to be more easily identified and connected.

Third, structured data provision supports effective decision-making during policy and strategy formulation.

Fourth, it provides foundational data for performance evaluation and analysis, enabling systematic assessments of IARC activities.

Fifth, organizing and sharing collaboration cases and experiences contributes to the dissemination and growth of IARC.

The purpose of this study is to develop a classification system and metadata to systematically manage and enhance access to IARC information. Through this, the study aims to maximize the consistency and utility of IARC information and contribute to policy formulation and performance evaluation. Specifically, the objectives of this study are, first, to develop a thematic classification system for IARC information; second, to design metadata for systematic information management; and third, to build an IARC information repository based on the developed framework.

To achieve these objectives, this study employed the following methodologies: literature review, case studies, expert feedback (FGI), and comprehensive analysis. The literature review provided the theoretical foundation for the classification system, while case studies analyzed domestic and international examples for benchmarking. In the expert feedback process, professionals with over 10 years of experience in the IARC field were invited to validate the suitability and practicality of the classification system and metadata. These processes enhanced the applicability and usability of the classification system.

The final proposed classification system comprehensively covers the key elements of IARC and consists of the following six main categories:

First, IARC Organizations, including university headquarters, IARC centers, and university-affiliated research institutes. Second, IARC Infrastructure, addressing physical and institutional resources such as budget, space, equipment, systems, and networks. Third, Workforce Development, divided into general education and industry-academia-based education, focusing on practical training. Fourth, Entrepreneurship and Employment, including entrepreneurship education and career-related activities, supporting startups and career development. Fifth, Research and Development, encompassing R&D activities and outcomes, covering both national and private R&D achievements. Sixth, Commercialization, including technology transfer and enterprise support activities, bridging research outcomes to commercialization.

This study contributes to IARC information management and utilization in the following ways:

First, it provides a framework for comprehensively understanding and managing the diverse aspects of IARC. Second, the classification system and metadata maximize systematic information management and usability. Third, it provides reliable data for effective decision-making in policy formulation and performance evaluation. Fourth, by systematically organizing collaboration cases and experiences, it promotes the dissemination and development of IARC.

The results of this study are expected to enhance the usability of IARC information and contribute to the development of IARC ecosystems at both national and regional levels. Continuous improvement and expansion of this classification system and repository are encouraged to further increase the value of IARC.

6.2 Recommendations for Future Research

To ensure the sustainable operation and reliability of the IARC information repository, it is essential to establish data governance policies. Specifically, legal governance related to information management must be established to guarantee data security, privacy, and ethical use. It is important to implement institutional measures to prevent legal and ethical issues in the processes of data collection, storage, sharing, and deletion.

Legal governance should clearly define procedures for information collection, management, sharing, and protection, and provide a framework that clarifies the responsibilities and authorities of participating organizations. This system will enhance transparency and reliability in data management and support the sustainability of the IARC ecosystem.

Key components of legal governance include the following:

First, data protection and privacy management. The IARC information repository must handle sensitive personal and corporate data in compliance with data protection laws and related regulations. To ensure the security of information management, robust data protection policies must be established and thoroughly implemented. Second, clarification of access and usage rights. The data access and usage rights of participating organizations must be clearly defined, and strong security measures must be implemented to prevent unauthorized access. This will clarify accountability during the data usage process. Third, establishment of data quality management systems. Standardized procedures must be introduced to maintain the accuracy and consistency of collected data. A data quality management system must be established to enhance the reliability of data utilization. Fourth, responsibility sharing and dispute resolution mechanisms. Responsibilities in the data lifecycle, including provision, management, and usage, must be clearly defined. A structured mechanism for resolving disputes that may arise must also be established, contributing to mutual trust among participating organizations and improving cooperation efficiency. Fifth, strengthening legal compliance and audit procedures. The repository must comply thoroughly with relevant laws and regulations during its operation, and regular audits and evaluations must be conducted to identify and address operational and legal issues. This will ensure the sustainability and reliability of the information management system.

Data governance policies play a pivotal role in reinforcing the operational stability and trustworthiness of the IARC information repository. These policies ensure clarity and transparency in information management, strengthen collaboration among participating organizations, and maximize the effectiveness of IARC. Future research should focus on designing and implementing detailed data governance policies, thereby contributing to the development of practical and sustainable IARC ecosystems.

References

Choi, D., Kim, N., Kang, G., & Jeong, B. (2008). Preliminary Research on Employment-Related Integrated Information Network Development. Sejong: Ministry of Education, Science, and Technology.

Gong, J., Kwon, S., & Park, J. (2012). Research on Database Construction and Provision Strategies for Assistive Devices for People with Disabilities. Disability and Employment, 22(3), 25-49.

DOI : 10.15707/disem.2012.22.3.002

Jeong, H. (2021). Strategies for Improving the Effectiveness of University-Industry Collaboration Activity Surveys. Busan: Pusan National University.

Kim, C. (2002). A Study on Integrated Safety Management Systemof LNG Storage/Transport Facilities. KIGAS, 6(1), 59-65.

Kim, S., & Park, B. (2020). Strategies for Providing Public Services Using Marine Big Data. Korean Journal of Big Data, 5(2), 241-225.

Koh, H., Kim, S., Park, J., Lee, H., Choi, Y., & Hwang, I. (2021). Government-University-Industry Collaborative Data Platform Development Strategy. Seoul: The 4th Industrial Revolution Committee.

Lee, G., Ok, J., Han, S., & Kang, S. (2015). Study on Groundwater Database Construction and Mapping in Gyeonggi Province. Suwon: Gyeonggi Research Institute.

Ministry of Education. (2022). University-Industry Cooperation Activity Survey Report. Sejong: Ministry of Education.

Ministry of Land, Infrastructure, and Transport. (2020). Smart City Integrated Platform Development. Sejong: Ministry of Land, Infrastructure, and Transport.

National Research Foundation of Korea. (2023). Package Consulting Manual for Enhancing University-Industry Collaboration Center Functions. Daejeon: National Research Foundation of Korea.

Noh, Y. (2022). Development of Expertise Indices for University-Industry-Research Collaboration Experts and Service Design for SANHAKINet. Daejeon: National Research Foundation of Korea (Issue Paper).

Park, M., Jung, J., Im, B., Kim, H., Jang, G., Nam, G., & Cho, H. (2001). Radiation Safety Management Integrated Information System Operation. Daejeon: Korea Institute of Nuclear Safety.

Song, Y. (2006). Land Comprehensive Information Network and Korea Land Information System. Seoul: Korea Land Corporation.

Centrelink Website. https://www.servicesaustralia.gov.au/centrelink?context=1
CNU Industry-Academia Cooperation Mediation Center Website. https://connect.cnu.ac.kr
Industry-Academia-Research PLUS Website. <plus.auri.go.kr>
Konkuk University WE-LINK Website. https://welink.kku.ac.kr/main.do
Korean Researcher Information (KRI) Website. https://www.kri.go.kr/kri2
LAWDATA. (n.d.). Open Cyber Law Firm for Lawyers and Experts. Seoul: LAWDATA.
NTIS Researcher Information Website. https://www.ntis.go.kr/ThMain.do
WorkNet Website. https://www.work.go.kr/seekWantedMain.do

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