A Study on the Improvement of the Revision Process Based on the Analysis of the Current Status and Relevant Issues of the Academic Standard Classification System*

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ABSTRACT

In Korea, there are various classification systems in use, such as the national science and technology standard classification system, the classification system based on educational organization units, and the Korean standard education classification by the National Statistical Office. However, these classifications are based on different fundamental structures, making it difficult to use them in a uniform manner. Furthermore, they are not suitable for statistical calculations or evaluations, resulting in mixed classifications depending on the purpose of use. Therefore, this study aims to identify issues related to academic standard classification by analyzing the current state of academic standard classification, standard classification system issues in academic societies and research institutes, and the existing research issues. The study proposes improvement measures for the revision process of the academic standard classification system. As a result of the analysis, the study indicates that maintaining and strengthening the linkage between relevant departmental classification systems and enhancing the linkage with relevant classification systems are necessary to maintain and strengthen the coherence of academic classification systems. In addition, a systematic improvement cycle and management system settings for the revision process are required.

1. Introduction

The National Research Foundation (NRF) has developed The Academic Classification system that lists academic research fields. The academic area classification table, which is a standard academic classification system prepared in accordance with Article 12 of the Science Promotion Act, is used for the execution and management of academic research support projects. For efficient management of academic matters, the classification table published by the NRF is generally followed, unless there are special provisions in other laws. The Current Academic Research Area Classification Table is widely used for researcher information management, management and statistics for academic research support, investigation of universities' research activities, and the receipt, review, and selection of evaluators for research projects in the humanities and social sciences.

As of 2015, the Academic Research Area Classification Table consists of four classes of Major, Middle, Small, and Sub with (8) major classes, (152) middle classes, (1,551) small classes, and (2,468) subclasses in a vertical structure. For instance, there are 8 major classes consisted of Humanities, Social Science, Natural Science, Engineering, Medicine and Pharmacy, Marine Agriculture, Fishery, Arts and Kinesiology, and Interdisciplinary Studies in which two or more of the above are combined (NRF, 2021). Although the primary purpose of the Academic Standard Classification System was to facilitate research cost management and statistics by dividing research areas for NRF support, it is not limited to research expense management. Universities also use this system to classify their academic departments.

Even though an academic classification system is used for such a variety of purposes and it needs to reflect all aspects of academic fields that change according to various changes in standards and sciences in a timely manner, developing such a classification table is a difficult process as every classification table has its own structure, format, and scope of contents. In fact, it is particularly difficult to divide and classify abstract studies. In addition, domestic and international researchers are attempting various approaches such as breaking down the boundaries of collaboration within a single field and converging fields to solve problems. In academia, the concept of convergence and complexity is being newly established and its scope is expanding. In this context, continuous changes in the academic classification system are being demanded.

Accordingly, three major attempts - "A Study on the Reorganization of the Knowledge Classification Scheme" in November 1999 and May 2000, "The Strategy Study of Establishment and Application of Learning Classification Standard" in June 2006, and "Study on Redesign of Research Field Classification Table" in February 2009 - were made to improve the Academic Research Area Classification Table. However, there has made no significant difference nor major revision (draft) to the Classification Table compared to the results of the research conducted in November 1999.

As the classification system has remained the same for about 20 years, academic societies and individual researchers have emphasized the need for reorganizing the classification system, criticizing the absence of consideration for the latest academic fields and insufficient consistency. In addition, no revision to the classification system has also lead to the lack of interest in revising the classification system.

Therefore, in this study, an attempt was made to devise improvement measures required for

the reorganization process of the Standard Academic Classification System by deriving issues pertinent to the academic standard classification through analyzing the current status of academic standard classification, issues related to the standard classification system such as research foundation associations and research institutes, and matters examined in prior studies.

2. Prior Research

In order to derive issues of the Standard Academic Classification System, literatures on the Standard Academic Classification System and other related classification systems were analyzed. As a result, prior studies conducted on the Standard Academic Classification System, including those focusing on academic classification, classification system revision, etc., were identified.

A Study on the Reorganization of the Knowledge Classification Scheme (Chung, 2000), The Strategy Study of Establishment and Application of Learning Classification Standard (Seol et al., 2006), etc., were found to be conducted in relation to the Standard Academic Classification System since 1999.

Chung made an attempt to design the knowledge classification schedule for the classification of the research fields and majors in education, particularly for knowledge based society. In order to do so, Chung suggested effective ways for disciplinary information organizations and interdisciplinary research by reorganizing the NRF's Knowledge Classification Scheme, which was used as a support tool for academic research, and making clear divisions and separations between disciplines. Based on the research results, new period and regional supplementary tables that can be commonly applied to each academic field were added with a correlation index composed of the terms used in the main and supplementary tables to facilitate access to the main table and make it easy for researchers to find the corresponding field code in the Knowledge Classification Scheme, Moreover, Chung suggested to organize all information on academic research and researchers using the newly organized Knowledge Classification Scheme. Seol et al. (2006) proposed plans and strategy study, as a basic preparation step for the establishment of the policy alternatives that can link the research support task of the NRF and education and employment, the basic tasks of the Ministry of Education and Human Resources Development, to implement classification system that can fulfill the following two goals. Analyzing implications of previous research on the Standard Academic Classification System revealed the specific area of expertise of the researcher through his/her academic classification which can be used to measure various statistical data and importance required for research support, thereby serving as a helpful tool for academic support evaluation.

Furthermore, it was found to enhance the national research information capability by providing a framework for the library classification and leading to effective operation of academic information organizations. Therefore, it is deemed necessary to categorize research, development, and academic activities across the country and provide fundamental data for effective academic policy by developing academic classification table through revision and improvement of the Academic Classification System.

It was analyzed that most of the domestic and foreign studies conducted in relation to academic classifications identify problems with academic classification in research area classification tables and propose measures for the administrative and educational development and promotion of research,

such as dissertations, academic journals, books, etc. Link AN (1995) conducted an empirical study on the basic, application, and development categories of industry-related R&D of the National Science Foundation (NSF) of the United States and demonstrated that the NSF's classification system is suitable for undertaking R&D activities that have a great impact on the industry. Deville & Turpin (1996) carried out a study to compare Australia's classification system against that of various countries for continuous R&D activities with socio-economic purposes in the Asia-Pacific region. Lee (2003) conducted a study and suggested the academic classification of Earth System Science (Earth Environment Science) in the field of Earth Science so as to revise and supplement the existing classification system by suggesting the name of the academic area to the Korean Earth Science Association. His study was submitted and adopted through the public hearing on the academic classification of science and technology field hosted by KISTEP and revised the classification system as he originally proposed. Seo and Lee (2003) pointed out the problems with the academic classification criteria for e-commerce in the 'Research Field Classification Table' of the 'NRF', and suggested a new classification model and domains, proposing further classification into a middle class, 4 small classes, and 17 subclasses of the major class of Interdisciplinary Study. Likewise, efforts were made to deduce a new academic classification suitable for each discipline of study. For instance, Park (2003) investigated the classification system of the music literature, Chong and Kim (2006) examined the Korean food service industry from the standpoint of the 'Korean Standard Industrial Classification Table' and 'Classification by the Tourism Promotion Act', and Kwon and Kim (2006) identified problems with the academic classification of Cadastral Science in the NRF's 'Research Area Classification Table' and showed administrative and educational history and examples and direction of active research in forms of dissertations, academic journals, and books in order to upgrade the classification of Cadastral Science. The studies conducted in relation to the academic classification imply that they referred to the 'Research Area Classification Table' of the NRF as the standard for the academic classification system and used content analysis, one of qualitative analysis research methods. In addition, it was also found that studies on the academic classification system were also conducted abroad for the continuous development of the research field.

Moreover, the analysis on the revision of the standard classification system found a number of studies conducted on the improvement and revision of the National Science and Technology Standard Classification Table System. Kang et al. (2007) prepared a provisional classification plan in line with the preliminary revision of the ICT industry classification by the OECD. Similarly, Lee et al. (2012) studied the management, operation, and cross-ministerial support of the National Science and Technology Standard Classification Table System, and Kim et al. (2019) conducted a study on the improvement and application base of the National Science and Technology Standard Classification Table System, collecting the opinions of stakeholders, including related organizations and ministries, and researchers on the results and findings from the top-down / bottom-up revision demand survey performed in 2018. Lee et al. (2020) conducted a preliminary planning study to improve the National Science and Technology Classification System by investigating and analyzing statistical data based on the standard classification system. The authors found that there wass no classification system to include items related to human resource development, facilities, equipment, and other related items outside of pure research projects, as there is a lack of coverage in some

of the subcategories. As a result of analyzing previous studies on the revision of the classification system, it was found that the standard classification system is optimized for the classification of national R&D projects on science, technology, humanities, etc., having a great significance for the systematic and efficient management of R&D and as a statistical analysis standard therefor. Consequently, it is necessary to expand the subject of revision demand submission and understand the need for revising the classification system by conducting a demand survey for revision process and sub-classification for a timely update of the system with new technology and terminology.

3. Research Methods

3.1 Research Method and Procedure

This study aimed to identify major issues in the Standard Academic Classification System by analyzing relevant studies and issues related to the standard classification system from various academic societies and research institutes. To achieve this, we first analyzed previous research and issues related to the standard classification system. Then, we collected opinions from researchers and experts to illustrate the direction of the Standard Academic Classification System based on the identified issues. We discussed the current issues of the Standard Academic Classification System for each discipline among the research team and expert members. Finally, we identified the major issues and provided implications for the revision process of the Standard Academic Classification System. Figure 1 illustrates the research process used to derive these issues.
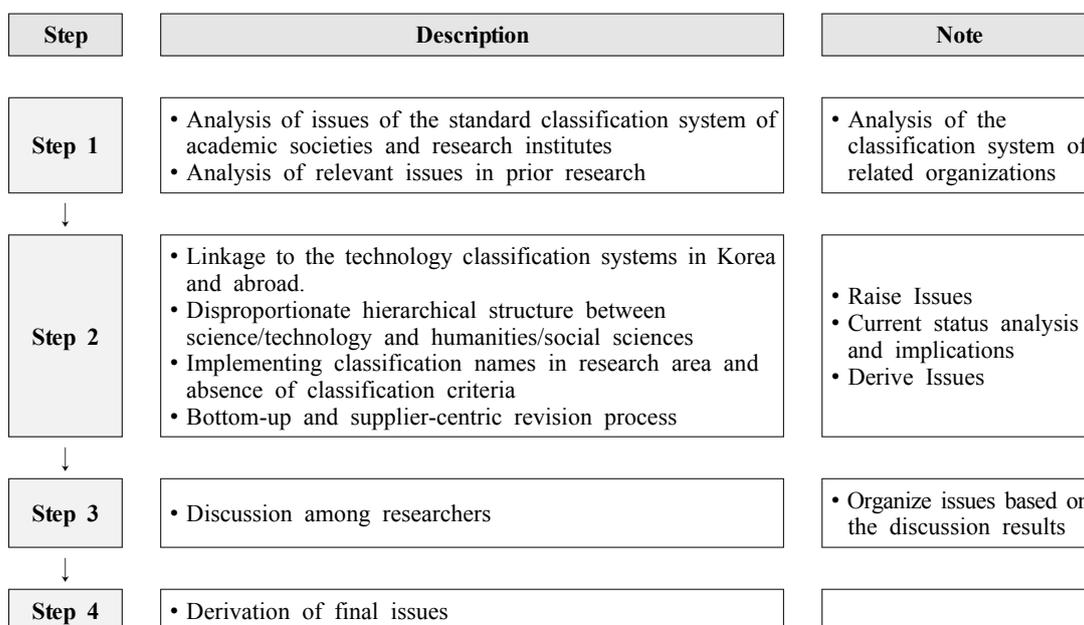
Step	Description	Note
Step 1	• Analysis of issues of the standard classification system of academic societies and research institutes • Analysis of relevant issues in prior research	• Analysis of the classification system of related organizations
Step 2	• Linkage to the technology classification systems in Korea and abroad. • Disproportionate hierarchical structure between science/technology and humanities/social sciences • Implementing classification names in research area and absence of classification criteria • Bottom-up and supplier-centric revision process	• Raise Issues • Current status analysis and implications • Derive Issues
Step 3	• Discussion among researchers	• Organize issues based on the discussion results
Step 4	• Derivation of final issues	

Fig. 1. Issue Derivation Research Process

3.2 Research Subject and Contents

In order to derive issues of the Standard Academic Classification System, first, studies on the revision of the academic research field classification of academic societies and research institutes were analyzed. Next, issues were also derived by analyzing previous research and reports. As for the contents, problems related to the definition, classification level, and subdivision of individual academic research field were analyzed, and major issues such as name changes and sub-classification changes were identified according to social and academic changes in each field. In addition, problems associated with leaving out new technologies and selecting new research fields by individuals and academic groups were identified. Finally, issues raised in handling obsolete academic fields that are no longer available or integrated with others according to the change of the times were analyzed. The research team discussed recent academic standard classification system issues for each discipline, which were organized based on the issues and literature research results derived from the standard classification systems of various academic societies and research institutes.

4. Derivation of Major Issues Related to the Standard Academic Classification System

4.1 Linkage to Relevant Classification Systems in Korea and Abroad

The Standard Academic Classification System was reviewed and compared with related classification systems. While there is not much difference between the Standard Academic Classification System and other related systems in a broader context, some academic fields are classified differently. For instance, there was a major difference in the classification of 'Library Information Science', 'Psychology', 'Anthropology', and 'International Area Studies', with 'Anthropology', 'Psychology', and 'International Area Studies' classified as 'social science' by the KEDI standard classification system but as 'humanities' by the KEDI standard academic classification.

The degree of conformity between the Standard Academic Classification System and related technology classification systems used in Korea was analyzed. Out of the 1,556 small classes of academic research, 370 were commonly used among the systems, and 273 classes were partially consistent. Only 32.2% (49 classes) of the 152 middle classes were found to be consistent among the systems, and only 61.2% were either consistent or partially consistent (with 44 partially consistent classes), indicating a relatively low degree of agreement among the systems. This is because different classification systems have different criteria and scope, as they serve different purposes of classification and utilization. However, there is still a need to establish a linkage between classification systems in similar fields. According to the Study on National S&T Standard Classification System Revision (2019), the degree of agreement between the National Science and Technology Standard Classification Table System and Standard Academic Classification System was found to be 23.8% and 41.3%, including partial agreement.

Table 1. Comparison/Analysis of the Standard Academic Classification System and the National Science and Technology Standard Classification

Standard Academic Classification System		National Science and Technology Standard Classification Table		
Major Class	Middle Class	Category		Major Class
Humanities	Lexicography, History, Philosophy, Religious Studies, Christian Theology, Catholic Theology, Confucian Studies, Buddhist Studies, Linguistics, Literature, Korean Language and Literature, Chinese Language and Literature, Japanese Language and Literature, Other Oriental Languages and Literature, English Language and Literature, French Language and Literature, German Language and Literature, Spanish Language and Literature, Russian Language and Literature, Western Classical Languages and Literature, Other Western Languages and Literature, Interpretation and Translation Studies, Other Humanities	Humanities & Social Science	Anthropology	History/Archeology, Philosophy/Religion, Language, Literature, Culture/Art/Physical Education
			Society	Law, Politics/Administration, Economy/Management, Society/ Humanity/Welfare/Women, Life, Geography/Region/Tourism, Psychology, Education, Media/ Communication/Literature Information
Social Science	Social Science General, Political Science, Economics, Agricultural Economics, Business Management, Accounting, International Trade, Sociology, Social Welfare, Area Studies, Anthropology, Education, Law, Public Administration, Public Policy, Geography, Regional Development, Tourism, Journalism and Broadcasting, Military Science, Psychological Science, Other Social Science		Human Sciences Technology	Brain Science, Cognitive/ Affective Science, Science Technology and Social Sciences
Arts and Kinesiology	Arts General, Musicology, Art, Design, Costumes, Photography, Beauty, Theater, Film, Kinesiology, Dance, Other Arts and Kinesiology			
Interdisciplinary Studies	Science and Technology Studies, Technology Policy, Library and Information Science, Gender Studies, Cognitive Science, Brain Science, Affective Science, Interdisciplinary Research			
Natural Science	Natural Science General, Mathematics, Statistics, Physics, Astronomy, Chemistry, Biology. Earth Science, Geology, Atmospheric Sciences, Oceanography, Life Sciences, Other natural science	Science Technology	Nature	Mathematics, Physics, Chemistry, Earth Science (Earth/Atmosphere/Ocean/ Astronomy)
Engineering	Engineering General, Mechanical Engineering, Automotive Engineering, Aerospace Engineering, Chemical Engineering, Polymer Engineering, Ergonomics, Control and Instrumentation Engineering, Electrical Engineering, Materials Science and Engineering, Environmental Engineering, Electronics / Communications Engineering, Computer Science, Civil Engineering, Architectural Engineering, Industrial Engineering, Safety Engineering, Nuclear Engineering, Marine Engineering, Ocean Engineering, Fiber Engineering, Resources Engineering, Metallurgical Engineering, Traffic Engineering, Biomedical Engineering, Agriculture Engineering, Forestry Engineering, Other Engineering		Artifact	Machinery, Materials, Chemical Engineering, Electricity/Electronics, Information/Communications, Energy/Resources, Nuclear Power, Environment, Construction/Transportation

Standard Academic Classification System		National Science and Technology Standard Classification Table	
Major Class	Middle Class	Category	Major Class
Medicine and Pharmacy	General Medicine, Anatomy, Physiology, Biochemistry, Pathology, Pharmacology, Microbiology, Parasitology, Preventive Medicine/ Occupational and Environmental Medicine, Immunology, Internal Medicine, General Surgery, Pediatrics, Obstetrics and Gynecology, Psychiatry, Orthopedic Surgery, Neurosurgery, Cardiothoracic Surgery, Plastic Surgery, Ophthalmology, Clinical Optics, Otorhinolaryngology Dermatology, Urology, Radiology, Anesthesiology, Rehabilitation Medicine, Physical Therapy, Working Therapeutics, Neurology, Clinical Pathology, Family Medicine, Emergency Medicine, Dentistry, Veterinary, Nursing Science, Korean Medicine, Pharmacy, Other Medicine and Pharmacy	Life	Life Science, Food, Agriculture, Forestry and Fisheries, Health Care
Marine Agriculture, Fishery	Agriculture, Forestry, Landscape Architecture, Livestock Science, Fishery Science, Marine Transportation Studies, Food Science		

The To identify the linkage between relevant domestic and foreign classification systems, the issues of the academic classification system were analyzed based on the current status. The analysis found several issues that need attention. Firstly, there is a lack of a systematized relationship among related classification systems. It is necessary to clarify the relationships and systems among related classification systems such as the standard classification system, National Science and Technology Standard Classification Table System, and classification systems for university majors. The need for such a linkage between related classification systems will grow significantly with the promotion of integrated research support systems by government organizations. Therefore, it is necessary to continuously monitor changes in international classification systems. For example, the OECD's FORD (Field of Research and Development) classification system has been expanding from 20 fields in 2002 to 42 fields in 2021.

Second, management procedures for the academic standard classification table need improvement to enable integrated management of national researcher information and clarify the management systems used by national R&D project promotion departments and other specialized institutions. Finally, activity-related issues were found, such as the omission of research fields. The 2017 National Science and Technology Standards System Improvement Survey revealed that individual researchers and institutes face inconvenience due to the omission of new research fields and the difference between their own classification system and the standard classification system when using the small classes of the standard classification system.

4.2 Disproportionate Hierarchical Structure of Science and Technology Fields

As Several alternative classification systems exist, including the National Science and Technology Standard Classification by the NRF, the Korean Standard Education Classification by the National Statistical Office, and the Standard Classification of the Units of Educational Organizations of Higher Education Institutions by the Ministry of Education. Upon analyzing the hierarchical structure of the science and technology fields in these alternative systems, it was found that the National Science and Technology Standard Classification Table System underwent a significant revision in 2018, with a substantial portion of its hierarchical levels differing from those of the current academic research area classification system. This indicates that the current academic research area classification system may not be suitable for the current R&D environment. Therefore, a more effective solution would be to comprehensively reorganize the standard classification system by applying a classification system that is more widely used in the humanities and social sciences fields, instead of making individual revisions to the middle classes of the standard classification system.

Table 2. Comparison/Analysis of Alternative Academic Fields Classification Systems

	Academic Research Area Classification	Korean Standard Education Classification - Education Area	Classification of Units of Educational Organizations in Higher Education Institutions	National Standard Science and Technology Classification System
Governing Institute	National Research Foundation	Statistical Office	Ministry of Education	Ministry of Science and Technology Information and Communication
Classification Units and Structure	(Major)8 - (Middle)152-(Small)1,551 - (Sub)2,468	(Major)11-(Middle)29-(Small)81	(Major)5-(Middle)34-(Small)184	(Major)33-(Middle)371-(Small) 2,898
Classification Criteria and Principles	• All academic fields • Inclusiveness, similarity, scale, universality, etc. • Number of researchers and projects	• Based on the main contents of academic subjects • **(Major Classification)** Similarity of theoretical knowledge and learning purpose • **(Middle Classification)** Object of interest • **(Small Classification)** Methods, techniques, tools, and equipment	• Educational organization unit (undergraduate/department/major) • Similarity, exclusivity, inclusiveness, scale, universality, flexibility, etc.	• Related to science and technology • scale, progressiveness, universality, independence, policy, etc.
Classification Structure	• Names of majors in domestic and foreign universities and graduate schools • Curriculum • Constructed through analysis of the details of	• Based on the main contents of academic subjects • **(Major Classification)** Similarity of theoretical knowledge and learning purpose	• **(Major Classification)** Education and Research Objects • **(Middle Classification)** Full coverage of the scope of the lower small classes	• Comprehensive national-level classification system covering all sectors of science and technology activities • Organized to be

	Academic Research Area Classification	Korean Standard Education Classification - Education Area	Classification of Units of Educational Organizations in Higher Education Institutions	National Standard Science and Technology Classification System
	major fields and comparison of domestic and foreign academic classification table items by professors in Korea	• **(Middle Classification)** Object of interest • **(Small Classification)** Methods, techniques, tools, and equipment	• **(Small Classification)** Educational goals, courses, career paths and employment fields	compatible with various science and technology classification tables used by research and management specialized institutions of each department
Advantage	• **(Advantage)** Clear academic classification criteria, inclusive of all fields including R&D low variability	• **(Advantage)** Can be used to compare international data with easy management as it is based on internal standard academic classification used by different countries	• **(Advantage)** As a single classification system with clear classification criteria, e.g., guideline, and revision process, it is effective in data linkage between institutions producing and utilizing statistical information on higher education	• **(Advantage)** Based on international science and technology classification systems while reflecting the characteristics of domestic science technology development
Disadvantage	• **(Disadvantage)** Too many items as it independently classifies all subdivisions of each field	• **(Disadvantage)** Has different classification system compared to the standard classification system	• **(Disadvantage)** Although the education field is subdivided, other fields have high variability due to integration, omission, or to frequent changes in departments	• **(Disadvantage)** It is stipulated to revise and supplement the system every 5 years but updating/reflecting a new technology is delayed as the cycle is too long.
Implication	The unit of middle classes in the standard classification system is similar to that of the academic research area classification system.	This classification system is different from the standard classification system as its classification criteria is the application area through education (※ basic program and qualifications, etc.)	It has the same classification criteria but has high variability and inadequately reflects the actual R&D filed.	Based on international classification systems while reflecting the characteristics of domestic academic fields & interoperable among research management institutions of various departments.

Source: Reconstruction of A Study on National S&T Standard Classification System Revision.
(Korea Institute of Science & Technology Evaluation and Planning (KISTEP), 2018)

4.3 Realization of Taxonomy in the Field of Research and Absence of Classification Criteria

In order to revise the names and criteria of classifications, feedback was gathered from academic societies, research institutes, and previous studies on classification criteria. A total of 17 cases were identified that required changes to middle, small, or sub-classification names of academic areas, including: 1 International / Regional Development, 2 Mechanical Engineering, 1 Other Social Science,

1 law, 1 Arts and Kinesiology, 1 Horticulture, 4 Medicine and Pharmacy, 1 Philosophy, 2 Civil Engineering, 1 Interdisciplinary Studies, and 1 Aerospace Engineering cases.

Table 3. Academic Research Area Requiring a Revision

Middle Classification	Number of Cases	Middle Classification	Number of Cases	Middle Classification	Number of Cases	Middle Classification	Number of Cases
International / Regional Development	1	Law	1	Medicine and Pharmacy	4	Interdisciplinary Studies	1
Mechanical Engineering	2	Arts in General	1	Philosophy	1	Aerospace Engineering	1
Other Social Science	1	Horticulture	1	Civil Engineering	2	Total	17

Since 1999, there has not been a large-scale reorganization of the research field or the establishment of new research fields, which has resulted in a lack of clear criteria for the middle, small, and sub-classifications of the research area classification. Moreover, upon reviewing the middle classes, it was found that most of the major classes have two or more overlapping criteria for classification. Therefore, a more comprehensive evaluation to identify the need for revisions and review classification criteria must be performed by an expert committee to ensure a more systematic assessment.

4.4 Bottom-up and Supplier-Centric Revision Process

After analyzing the current revision process, it was discovered that the cycle for the revision demand survey is determined based on the level of agreement with the classification system's principles (such as inclusiveness, similarity, scale, and universality), as well as the number of researchers in the field and the number of supported projects. However, there is no separately set cycle for the revision process. The current system manages demands for revision in the order of collecting opinions (society and researchers) → sending official documents (receiving demand under the name of the society) → reviewing suitability → notifying results (sending the results of the suitability review to the society) → reflecting results (reflecting on the research foundation system). However, the current revision process has no specific period/cycle set for the revision demand survey and there made no significant change to the Academic Research Area Classification Table since its establishment in 1999, despite the 3 attempts made by studies conducted in 2002, 2006, and 2009. In particular, the biggest problem is that the burden of proposal writing is increased due to the reception of demand for all levels of research field classification, and there is no separate application cycle for the Korea Research Foundation, which leads to handling only as inquiry matters. Consequently, there are some areas where the need for revision exists, but the demand for revision is not being received. In addition, there are parts where it is difficult to process even if there is a need for revision. As a result, the current situation is such that there is a limitation to the bottom-up approach by academic societies and researchers, and it is impossible to comprehensively review the standard

classification and classification system experts in a top-down manner to excavate the demand for revision. Moreover, due to the lack of an official feedback system after submitting the proposal for revision, there is confusion and inconvenience caused by the lack of understanding of the proposing organization regarding the selection of the results of the revision feasibility evaluation. Due to these current problems, it is difficult to have a comprehensive perspective on the standard classification system through a micro-level approach, and there is a lack of reflection of new research fields and new technologies in academic fields. Therefore, it will be necessary to reconsider the process of revising the standard classification system through demand surveys and expert validation centered on the needs of users in the future.

4.5 Legal Issues

The 「Sciences Promotion Act」 and the 「Framework Act On Science And Technology」 designate laws on academic classification systems, contributing to the widespread use of academic classification systems. The legal basis for the academic classification system presented in Article 12 (Establishment of Standard Academic Classification System) of the 「Sciences Promotion Act」 and Article 27 (Establishment of National Science and Technology Standard Classification System) of the 「Framework Act On Science And Technology」 is as shown in below Table 4.

Table 4. Legal Basis of the Classification System in the Sciences Promotion Act and the Framework Act On Science And Technology

Sciences Promotion Act	Framework Act On Science And Technology [Fully Amended on 2010. 2. 4.]
Article 15 (Establishment of Standard Academic Classification System) ① The Minister of Education may establish a standard academic classification system and formulate a standard academic classification table after consulting with the heads of the relevant central administrative agencies so as to efficiently manage human resources, information, projects, etc. related to sciences. <Amended on Mar. 23, 2013> ② The Government shall endeavor to widely utilize a standard academic classification table under paragraph (1) ③ The Minister of Education shall designate institutions in charge by field of studies and require them to consistently supplement and develop a standard academic classification table, and may subsidize expenses incurred in the operation of such institutions. <Amended on Mar. 23, 2013> ④ Matters necessary for formulating a standard academic classification table under paragraph (1),	**Article 27 (Establishment of National Science and Technology Standard Classification System)** ① The Minister of Science and ICT shall establish the National Standard Classification System for Science and Technology in consultation with the heads of relevant central administrative agencies to ensure the efficient management of the information, human resources and research and development projects, etc. relevant to science and technology, and shall develop and apply the national science and technology standard classification table. <Amended on 2010. 12. 27., 2013. 3. 23., 2017. 7. 26.> ② The Government shall endeavor to ensure wide utilization of the national science and technology standard classification table under paragraph (1) ③ The Minister of Science and ICT may designate a specialized agency to steadily improve and develop the national science and technology standard classification table, and subsidize

designating institutions in charge under paragraph (3), and revoking the designation thereof shall be prescribed by Presidential Decree.

expenses incurred in its operation. <Amended on 2010. 12. 27., 2013. 3. 23., 2017. 7. 26.>

④ Matters necessary for procedures for establishing the national science and technology standard classification table and for the designation of a specialized agency under Paragraphs (1) through (3) shall be prescribed by Presidential Decree.

Enforcement Decree of the Sciences Promotion Act	Enforcement Decree of The Framework Act On Science And Technology

Article 12 (Preparation of Standard Academic Classification System)

① When the Minister of Education establishes the standard academic classification system pursuant to Article 12 of the Act, he/she shall formulate and announce a plan therefor in advance. <Amended on 2013. 3. 23.>

② The Minister of Education may request the heads of the relevant central administrative agencies to cooperate in establishing the standard academic classification system. In such cases, the heads of such relevant central administrative agencies shall comply with such request except in extenuating circumstances. <Amended on 2013. 3. 23.>

③ The Minister of Education shall prepare, determine and announce the standard academic classification system and shall utilize it for the systematic and balanced development of sciences when promoting science support projects. <Amended on 2013. 3. 23.>

Article 13 (Designation, etc. of Institutions to be Fully in Charge of Studies by Field)

① The Minister of Education may designate institutions to be fully in charge of studies by field referred to in Article 12 (3) of the Act (hereinafter referred to as "institution to be fully in charge of studies by field") among the institutions or organizations referred to in the subparagraphs of Article 5 (2) of the Act. <Amended on 2013. 3. 23.>

② When the Minister of Education designates an institution to be fully in charge of studies by field, he/she shall enter into an agreement which includes the following with such institution <Amended on 2013. 3. 23.>

1. Matters concerning the details and scope of business affairs
2. Matters concerning the period for conducting

Article 41 (Establishment of National Science and Technology Standard Classification System)

① A specialized agency under Article 27 (3) of the Act shall be the Evaluation and Planning Institute.

② The President of the Evaluation and Planning Institute shall develop a plan for creation of science and technology standard classification tables in an effort to establish the national science and technology standard classification system and shall notify it to the heads of respective support agencies engaged in research planning, evaluation and management for national research and development projects.

③ Upon receiving notification of the plan under paragraph (2), the heads of respective support agencies shall prepare science and technology standard classification tables in the fields under their jurisdiction and submit them to the President of the Evaluation and Planning Institute.

④ The President of the Evaluation and Planning Institute shall prepare a draft of the National Standard Classification Table for Science and Technology after compiling a science and technology standard classification table for each field submitted under paragraph (3) based on opinions gathered from the academic circles and organizations relating to science and technology and the Presidential Advisory Council on Science and Technology established under the 「Presidential Advisory Council on Science and Technology Act」.

⑤ The Minister of Science and ICT shall prepare the National Standard Classification Table for Science and Technology based on the draft submitted under paragraph (4), finalize and make public announcement thereof after deliberation by the Presidential Advisory Council on Science and Technology.

⑥ The Minister of Science and ICT shall research

business affairs

3. Matters concerning reporting on the results of conducting business affairs

4. Matters concerning amendment, termination and measures for breach of agreement

5. Matters concerning revocation of designation

6. Matters concerning revocation of designation

③ When the Minister of Education designates an institution to be fully in charge of studies by field, he/she shall announce such fact via the Ministry's Internet web-site. <Amended on 2013. 3. 23.>

④ The Minister of Education may require institutions to be fully in charge of studies by field to formulae and submit detailed business plans, such as the management of the standard academic classification system, and budget plans. <Amended on 2013. 3. 23.>

⑤ Except as otherwise expressly prescribed in Paragraphs (1) through (4), the Minister of Education shall determine matters necessary for the designation, operation, etc. of institutions to be fully in charge of studies by field. <Amended on 2013. 3. 23.>

and analyze trends in science and technology classifications in developed countries, and revise and improve the National Standard Classification Table for Science and Technology every five years, in consideration of emergence of new technologies

⑦ The heads of the relevant central administrative agencies shall fully utilize the National Standard Classification Table for Science and Technology finalized under paragraph (5) in performing the following duties

1. Research planning, evaluation and management for national research and development projects

2. Research planning, evaluation and management for national research and development projects

3. Management and distribution of knowledge and information relating to science and technology

Although the enforcement decree of the science and technology classification system describes the revision process by stipulating the responsibility of the President of the Evaluation and Planning Institute to receive and compile the standard classification tables from each head of respective support agencies to prepare a draft of the National Standard Classification Table for Science and Technology based on opinions from the Presidential Advisory Council. However, there is no legal basis for the application cycle of the academic standard classification system of the NRF. As a result, even when there is a need for revision or a demand for it, the revision request may not be received, and even if it is received, it may be difficult to handle.

5. Improvement Measures for the Academic Standard Classification System

This study analyzed the current status of academic standard classification, as well as issues related to the standard classification system in academic societies and research institutes, and previous research on these issues. Through this analysis, we aimed to identify issues related to academic standard classification and propose solutions to improve the process of revising the academic standard classification system. This study is a preliminary investigation aimed at identifying various issues related to improving the classification system, rather than an actual effort to improve the system itself. As a result of analyzing the current status of the academic standard classification system, issues of insufficient linkage to relevant classification systems in Korea and abroad, disproportionate

hierarchical structure of science and technology fields, and limited implementation of classification names in research area and absence of classification criteria and legal issues were derived and used to suggest reorganization measures for the revision process.

Improvement direction as for an academic standard classification system that has linkages to relevant classification systems in Korea and abroad should be reestablished. In order to do so, first it is necessary to establish roles of/between classification systems by linking relevant classification systems and improve the completeness, practicality, and usability of the standard classification system. Such a linkage will establish the identity of standard classification and related classification systems, provide consistent statistics among them, and enable a joint use of the evaluator pool. Also, creating a classification system that strengthens the linkage with relevant classification systems by making the standard classification system the highest classification system in the academic field that encompasses all related technology classification systems and limiting the scope of related classification systems to the sub classes of the major classes of the standard classification system is imperative and linking between the middle classes under the major classes of the standard classification system and the small classes of relevant classification systems is imperative. In addition, keywords should be used for the small classes of the standard classification system to increase flexibility and each relevant classification system should subdivide the small classes within its corresponding area and use the small classes of the standard classification system as the reference for the subdivision or sub classes. Lastly, revision of the 'Academic Promotion Act (Article 12) Enforcement Decree' applied to the standard classification system and other laws applicable to related technology classification systems seems can effectively promote the linkage between the standard classification system and related technology classification systems. The Enforcement Decree of the Sciences Promotion Act and other laws applicable to related classification systems should be revised to include a clause requiring classification systems established and managed by ministries to consider a linkage with the standard classification system.

Moreover, in order to resolve the imbalance in the hierarchical structure between classification systems, it should be based on the international classification systems while reflecting the characteristics of the domestic academic field and being interoperable among the research management institutions of various departments.

The following improvement measures are proposed based on the analysis on the implementation of classification names in research area and classification criteria. First, the revision process and management system should be established. Since there is neither criterion for classifying middle, small, or sub classes of research fields, clear definition, nor usage in actual research field and different names are required for some classifications by different research fields, it is essential to set a periodic and systematic improvement cycle. Second, it is necessary to set the revision frequency to once per year and quickly reflect changes in new technologies and academic fields by receiving the applications twice a year, during the first and second half of each year. For example, it is necessary to hold the Standard Academic Classification Survey and Deliberation Committee twice a year to make revisions and confirmations every year. Third, it is important to set the revision process in a total of 5 steps, '[Step 1] Revision demand survey → [Step 2] Temporary classification through suitability assessment → [Step 3] Evidence and impact monitoring → [Step 4] Feasibility

study → [Step 5] Revision of the classification. Subsequently, standards for the revision submission and review procedure should be established in the following order: 'Preparation of standard classification table (academic societies and researchers) → Submission of standard classification (academic societies and researchers) → Review of standard classification table (NRF) → deliberation and opinions (standard classification review committee) → notification of results (submission of suitability review results to academic societies and researchers) → Submission of objection (academic societies and researchers) → Re-deliberation (standard classification review committee) → Confirmation → Reflection of results (update the NRF system)'. Furthermore, it is necessary to select a management system for the collection and management of information within the NRF's academic standard classification system and the organization and operation of the standard classification review committee.

Following proposals are made for the improvement direction based on the problems of the current revision process. First, it is crucial to expand the period of the revision demand survey to multiple years to secure timeliness in reflecting new technologies. Second, in connection with improving the timing of the survey, the survey population should be gradually improved. It is necessary to actively induce revision demands by simplifying the revision demand proposal form. Third, the scope of organizations for submitting revision demands should be expanded to include companies to actively reflect industrial demands. Fourth, in addition to the bottom-up method, it is vital to introduce a top-down method using experts in each research field to comprehensively check the classification name and system for each research field and to discover revision demands. Lastly, an official feedback system should be implemented to announce the evaluation results after conducting the revision demand survey.

In addition, a legal basis for the revision of the classification system should be established. A legal provision on the survey class, scope of demand submission organizations, and comprehensive inspection methods for classification names and systems for each research field is required. It was observed that Article 12 of the Enforcement Decree of the Sciences Promotion Act should be amended to revise and supplement the standard academic classification table and specify the revision cycle

6. Conclusion and Recommendation

In this study, improvement measures for the standard academic classification system are proposed by deriving issues related to the standard academic classification through the analysis of the current status of academic standard classification, issues of the standard classification systems used by academic societies and research institutes, and matters investigated by prior studies. In addition, this study also presents the directions of improvement to seek changes in the revision process that would better serve the purpose of the standard academic classification system. Consequently, this study is expected to bring about a major change in the academic standard classification system.

The following improvement directions are suggested by deriving the issues of the standard academic classification system. First, it is necessary to change the perception of the need to establish an

official standard academic classification system. Although the NRF's Academic Research Area serves the role of the standard academic classification system, no official standard academic classification system has been established on the basis of the Sciences Promotion Act. Therefore, it is imperative to recognize the absence of an official standard academic classification system and the importance of establishing an official standard academic classification system based on the Sciences Promotion Act. Moreover, the need for establishing a standard classification system for all research area should also be recognized. The academic research area classification system and the standard science and technology classification system make the absence of an official academic classification system commonly used by all academic fields throughout the country inconspicuous. In fact, a change of perception is necessary to recognize the need for a standard academic classification system which has not been well perceived due to the existence of the scientific and technological standard classification system. A standard academic classification system, inclusive of all academic fields, is required not only for the purpose of understanding all academic fields, but also for effective manpower management and support for academic fields at national level.

Second, the role of the NRF's academic research area classification system needs to be established; a plan to use the academic research area classification system as a practical academic standard classification system is required. Since the standard academic classification system has been arbitrarily established by the NRF and the Academic Research Area Classification Table of the NRF has been presented as an unofficial classification table for all academic fields, it is important to establish a concrete role of the academic research area clarification system in order to operate it as an official standard academic classification system.

Third, recognizing the need to revise the academic research area classification system of the NRF is vital. Although the classification system has been maintained for about 20 years without a major change and the need for reorganizing the classification system due to the lack of consistency in the classification system and omission of the latest academic fields has been increasing, there is no interest in the reformation of the classification system. Therefore, it is necessary to recognize the necessity of changing the revision system of the classification system, the need to establish a standardized system for the establishment and revision of standard classification systems, and the importance of implementing a detailed management system that can reflect the current of the times and track the history of revision.

Lastly, since the standard academic classification system is based on related laws, it is necessary to clarify the matters related to the operation of the institution in charge of the standard academic classification system and establishment and revision of the standard classification system through the amendment of the Sciences Promotion Act and the enforcement decree of the same law and to recognize the importance of revising the applicable laws.

Conflicts of Interest

The authors declare no conflict of interest.

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