JTS

The Journal of Transdisciplinary Studies, 2(1): 69-97, 2018
https://doi.org/10.22685/JTS.2018.2.1.069

Suggestion of Policy through Analysing Performance of Humanities and Social Science based Interdisciplinary Convergence Research

Younghee Noh[1], Kwang Hee Lee[2], Dae-Keun Jeong[3]†

[1]Professor, Department of Library and Information Science, Konkuk University, Korea
[2]Program officer(PO) in the Division of Culture & Convergence at the National Research Foundation of Korea
[3]Research Professor, Department of Library and Information Science, Konkuk University, Korea

ARTICLE INFO

Article history:
Received 02 June 2018
Revised 14 June 2018
Accepted 18 June 2018

Keywords:
Performance,
Interdisciplinary,
Convergence Research,
Humanities,
Social Science,
NRF

ABSTRACT

The purpose of this study is to present policy directions for the interdisciplinary convergence research support projects by analyzing the results of the interdisciplinary convergence research support projects and comparing them with the results of other research and development support projects. Analyzing the results of the interdisciplinary convergence research projects showed that first, academic achievement and manpower performance showed high performance, whereas the intellectual property rights performance and industrial support performance were very low. Second, the results of the convergence research are shown in terms of public participation and public relations, convergence researcher network. Third, quantitative results of academic journals outperformed other R&D support projects, but the quality index of the Impact Factor (IF) was low. Fourth, the subsequent generations of scholars showed higher performance than other R&D support projects. Fifth, intellectual property (patent) rights performance and industrial support performance were very low compared to other R&D support projects. Through these, the policy suggestions are as follows: First, it is necessary to expand the research support project through the allocation of additional budget, because it provides high-quality results in line with the purpose of the interdisciplinary convergence research project. Second, it is necessary to further expand the research stage to create intellectual property right performance and industrial support performance. Third, it is necessary to develop a model that can develop a performance index suitable for humanities and social sciences interdisciplinary convergence research projects and model the effectiveness of the various outcomes generated during the research process.

† Corresponding Author : Dae-Keun Jeong, Research Professor, Department of Library and Information Science, Konkuk University, Korea (basicwindy@naver.com)

1. Introduction

The fast growth of the IT industry, namely the digital revolution in the latter half of the 20th century, has led to a rapid transition from the information society to the knowledge society. If labor or capital were a core paradigm of society in the industrial society, it turned into a major paradigm to produce and propagate enormous information in the information society. In the traditional industrial society, the "law of diminishing returns" where the marginal output gradually decreases when capital or labor is added was common. However, in the information society, the production volume increases as the input factor increases, representing the "law of increasing returns." This has fundamentally changed the traditional paradigm of growth and has become a driving force in building a knowledge-based society (Lee et al., 2013).

The importance of information has led to efforts to create new information nationwide, and as of 2016, Korea's total R&D expenditure has increased by KRW 3.4 trillion (5.2%) from the previous year to KRW 69.4 trillion, and is investing high R&D costs (Ministry of Education, 2017). The government's R&D enforcement status also increased by 0.7% from the previous year to KRW 19.4 trillion, and the annual average growth rate for the past five years has risen to 4.5%.

The rise of research and development expenses led to various measures to maximize the management and efficiency of the research and development field, and the government enacted the "Act on Performance Evaluation and Performance Management of National Research and Development Projects" thereby enabling the systematic and scientific investigation and analysis of the research outcome.

As such, in order to resolve complex and diverse social problems creatively and rationally, there is a need for interdisciplinary research that goes beyond the existing academic scope. The practical researches that have converged by researchers in each field are also increasing steadily. At this point, the National Research Foundation of Korea promoted interdisciplinary convergence research projects for 2009, and it seems that it has accomplished much. In addition, 10 years have passed, and systematic and comprehensive research and analysis are needed to maximize the efficiency of the project and determine the policy direction for the future.

Academic research support project's performance evaluation is the process of calculating research expenses such as selection, reduction, maintenance and dropout of research support by comprehensively examining the purpose of project, the scale of the project, and appropriateness of research funding. It is meaningful to review the feasibility of the research budget for achieving the goals of the research project, to improve the efficiency of the research support at the appropriate scale, and to secure the researcher's confidence in research support (Lee, 2016).

Therefore, in this study, we analyzed the performance analysis index of academic research support projects and analyzed the research result of interdisciplinary convergence research support projects from 2009 to 2017 by deriving the performance index for the research, and the purpose of this study is to transparently analyze the current status of the National Research Foundation of Korea's interdisciplinary convergence research projects and based on which to present the policy directions for the interdisciplinary convergence research projects.

2. Literature Review

2.1 Previous Research

The concept of interdisciplinary convergence research began to emerge with the founding of the Social Science Research Council of the United States in the 1920s, but various arguments have been raised among scholars regarding the conceptual definition (Han & Kyung, 2011). This is so because various conceptual definitions are made according to the viewpoints of the terminology, the conceptual definition, and the execution method used by the scholars in the convergence research (Kyung, 2012). In spite of these complex concepts, convergence research is useful for solving complex and multifaceted social problems of modern society, and convergence research can organize problem oriented, and accommodate diverse perspectives to present scholarly directions for diverse demands, thereby increasing importance (Convergence Research Policy Center, 2015, 34). As a result, various researches on system classification and type classification have been attempted as well as various studies on convergence research. In recent years, with the revitalization of convergence research, there has been a growing interest in the results of convergence researches that have been carried out to date.

In connection with the convergence research performance analysis, Kim (2015) conducted a study on the improvement of support through analyzing the results of convergence research projects in order to increase the importance of interdisciplinary convergence research and to promote efficient project implementation and effective management. The research and performance analysis of the interdisciplinary convergence research support project and the general joint research and the support for the middle researcher were conducted, and it was proven that the interdisciplinary convergence research support project showed higher performance than the other support projects. Based on this evidence, they emphasized the need for the restructuring of the whole in implementing the convergence research support project.

Jung, Choi, and Jung (2015), who attempted to analyze interdisciplinary research of government research and development projects, reviewed and analyzed the status and results of interdisciplinary research on government research and development projects from 2009 to 2013. Based on this, they determined that convergence policy between research fields requires researcher centric convergence policy rather than technology convergence policy and also argued that the government should revitalize the field of knowledge sharing among academic disciplines. In addition, they mentioned the need for cultivating interdisciplinary human resources for various interdisciplinary researches.

The Ministry of Science and ICT (2018) has been analyzing the achievements at the level of ministry using the performance data input from the national R&D project research and analysis since 2008, and published in February 2018 the 2016 National R&D Project Performance Analysis Report. This Report analyzed the achievements of national R&D project researches and analysis subjects, and the analytical subjects are papers, patents, technical fees, commercialization, manpower support, and training support, and the analytical items are ministry, R&D phase, research undertaking subject, future promising new technology (6T), and region, etc.

The National Research Foundation of Korea publishes annual performance report for the purpose

of deriving the information necessary for the establishment of science and technology and academic policies by investigating and analyzing the input and output performance of academic research support projects delegated by the Ministry of Education and the Ministry of Science and ICT. The academic research support project research and analysis project of the Ministry of Education is for the field of science and technology and the humanities and social sciences, and the research and analysis project of the Ministry of Science and ICT is the basic research project, the original technology development project, the nuclear power R&D projects, macro science R&D project, and science and technology internationalization project, etc. The performance indicators include performance of publishing papers in academic journals, achievements of academic papers, achievements of intellectual property rights, achievements of contracts for technology implementation, achievements of human resources development, invited lectures of international academic conferences, quality level indicators of papers, quality level indicators of domestic patents, and paper and patent performance indices account for contribution rate, etc.

Lee (2016) conducted a policy study to improve the convergence research evaluation system to help support excellent convergence research project, and analyzed the achievements of the interdisciplinary convergence research support project. Performance analysis is divided into five categories of academic and technological achievements, human resources development and research facilities, international cooperation, industry support and utilization of research results, and other achievements, and the results of these were identified as the status and arithmetic basic statistics.

Kim and Lee (2018) conducted research on the experience and satisfaction level of the research team of interdisciplinary convergence research project. The result of this study was such that the most positive experience that can be achieved is the ability to communicate with researchers with diverse perspectives and improve the level of communication and understanding with researchers across other major fields. On the other hand, the lack of knowledge in other fields of study and the feeling of pressure on the achievements appeared to be a negative experience that made convergence research difficult. The researchers were highly satisfied with the convergence research process and results, and the desire for retrial of convergence research, persistent intention and recommendation were also found to be very high, among others. In particular, positive experiences of communication, understanding, and harmony with the researchers are important experiences that can help enhance the satisfaction level of convergence research, and as a result, we derived the conclusion that it is possible to increase the satisfaction level of convergence research by increasing such a positive experience.

2.2 Interdisciplinary Convergence Research Support Project and Performance Indicators

In this study, the performance analysis index was derived to analyze the achievements of the National Research Foundation of Korea's interdisciplinary convergence research project, and we reviewed the outline of the research project of the National Research Foundation of Korea's interdisciplinary convergence research project. First, we examined the academic research support project performance indices used by the national R&D and the National Research Foundation of Korea, and also examined related literatures on the academic research indices and derived the performance indices

for comparison and analysis in this study.

2.2.1 National Research Foundation of Korea's interdisciplinary convergence research support project

The National Research Foundation of Korea's interdisciplinary research support project is based on the humanities and societies, and is an academic support project which has been conducted continuously since 2009. The interdisciplinary convergence research support project has been implemented to support the interdisciplinary convergence research in the general basic research support project with 5% of the new project budget. however, since 2015, the project to support convergence research has been integrated and supported in interdisciplinary research (Lee, 2016).

According to Articles 3 and 5 of the Academic Promotion Act, the interdisciplinary convergence research project aims to create a creative and rational solution to complex social problems by combining scientific rationality, imagination and insight of humanities and social sciences, and artistic creativity. It also aims to train mid to long term interdisciplinary professionals by providing research opportunities to subsequent generations via connection with education.

The key direction of the interdisciplinary convergence research project is to promote the interdisciplinary convergence research between the humanities and societies, the culture, the arts, and the science and technology, and to achieve this, it is necessary to share research performance and facilitate network for interdisciplinary convergence research while providing support and achieving the systematic convergence research.

Reviewing the support type of the interdisciplinary convergence research support project, the type of support is divided into the seed type, which is the project focused on the agenda discovery, and the sprout type, which is the support project for the convergence research between medium and long term interdisciplinary fields, and the convergence research control center for sharing performance and facilitating network between convergence research support project team. The details are shown in Table 1.

Table 1. Types of support for interdisciplinary convergence research support project

Support type	Scope of support	Application period	Remarks
Seed type	Within 40 million won / year (Overhead expenses paid separately)	1 year	• Agenda discovery centric planning project (more than 4 people including research director)
Sprout type	Within 200 million won / year (Overhead expenses paid separately)	5 years (3+2)	• Mid to long term interdisciplinary convergence research support project (6 people or more including research director) • Allowed entry of sprout type without performing existing project type (seed type, etc.) for inducing excellent researchers
Convergence research	Within 130 million won / year (Overhead expenses paid separately)	3 years	• Type of limited support for university affiliated research institutions that have experiences of conducting convergence research and foundation for website operation

The main contents of the interdisciplinary convergence research support project are as follows. In the case of the support budget, 27 projects are selected with annual grant of 5 billion won starting from 2 billion in 2009. The selection of new projects is based on the type of support plan, but it is adjusted flexibly considering the number of projects and the selection rate. Subject for support is a combination of the fields of humanities and social sciences, including the arts and physical education, and science and engineering fields including natural science, engineering, medicine, agriculture and oceanography.

Table 2. Major details of the 2018 interdisciplinary convergence research support project

Classification	Size of support	Remark
Support budget	• Support: total of 5,000 million won (27 projects or less) • New support: 1,042 million won (11 projects or less) • Continued support: 3,958 million won (16 projects or less)	The selection of a new project is made based on the 'type specific support plan' in principle, but can be flexibly adjusted considering the number of project applied for and the selection rate by type
Support subject	• Convergence area of humanities and social science (including arts and physical education) and science and engineering (natural sciences, engineering, medicine, agricultural and marine)	Issues for handbook, dictionary compilation, textbook development, translation, exhibition, concert, etc. are excluded from support
Support subject	• Must be a researcher applicable under Article 2(5) of the "Academic Promotion Act" and must be affiliated with a domestic university or research institution and should have at least 3 papers (or at least 5 researchers in the field of science and engineering).	

2.2.2 Academic research support project's performance analysis index

(1) National R&D project's performance analysis index

In the case of R&D projects, it is continuously supported by the government and the private sector. In the case of the government R&D budget, the R&D efficiency needs to be improved due to the continuous increase in the number of applications such as annual average growth rate of 4.5% over the last five years (2012-2016), and systematic investigation and multidirectional analytical data on the national R&D project performance can be used as an important basic data for future policy decisions, and so the need for performance analysis is increasing (Ministry of Science and ICT 2018).

Give these, the Ministry of Science and ICT (2018) conducted a pilot survey with the Korea Institute of S&T Evaluation and Planning (KISTEP) only for the projects that could be submitted for the 2005 performance data, and the mandatory performance data were input in 2006, however, the validation was not implemented due to constraints such as validation DB, etc. The 2007 performance index was simplified from 15 items to 6 items, and SCI (E) papers, domestic patents, and technology fee items were validated, but did not lead to actual performance analysis. Since 2008, we have

analyzed the results of the last two years through the survey and analysis data, and also analyzed the results at the level of ministry using the performance data input from the national R&D research project survey and analysis.

In the case of performance indices prior to 2007, survey was performed on 15 items such as papers, patents, technical fees, commercialization, human resources support, training support, industry technology manpower, personnel exchange, technical trade, international conference installation / hosting, technical cooperation (executing MOUs), demand survey, joint research, industrial support, and employment creation, etc., and after 2007, we analyzed the performance of 6 achievement items such as paper, patent, technology fee, commercialization, human resource support (only submitted projects) and training support. Table 3 provides the specific performance analysis items and contents.

The performance analysis of national R&D projects includes analysis items of the five major items of research and analysis task information, and also includes performance statistics for 5 items such as ministry (including 35 ministries, agencies, and committees related to R&D), R&D phases, research conducting subject, and promising new technology of the future (6T), and region, as well as the performance statistics of each item.

Table 3. National R&D project performance analysis index (Ministry of Science and ICT 2018)

Classification	Details
Paper	• Papers published in academic journals during the survey year (based on year of published journals) • Classified for survey by SCI (E) paper and non-SCI (E) paper
Patent	• Patents formally registered with the Korean Intellectual Property Office within the relevant period (date provided in the application and registration certificate) • Surveyed by classifying into domestically applied patent, domestically registered patent, overseas applied patent, and overseas registered patent
Royalty fee	• Technical fee actually collected by the research management specialized agency or non-profit entity within the relevant period
Commercialization	• Generate sales and public value through business start-up, commercialization, and process improvement within the relevant period
Human resources development support	• If the subject person is supported in the year ※ Prepare only for the manpower development support project
Training support	• If there is a national or international training support result for the subject person in the year

(2) National Research Foundation of Korea's academic research support project performance analysis index

The National Research Foundation of Korea is a national R&D project planning, evaluation and management organization, and analyzes the basic data necessary for R&D management and policy formulation by collecting the research results of the relevant R&D projects and announces the results every year.

The National Research Foundation of Korea (2017) is responsible for academic research support projects in the field of science and engineering and academic research support projects in the humanities and social sciences from the Ministry of Education, and the Ministry of Science and ICT delegated basic research projects, original technology development projects, macro scientific research and

development projects, and science and technology internationalization projects. In addition, it conducts academic research support projects that are delegated and managed and investigates and analyzes the research results that are generated by researchers for the purpose of deriving information necessary for establishing academic policy.

The National Research Foundation of Korea uses performance on academic research papers, research paper presentation in academic conferences, intellectual property rights, technology contracts, human resources training, international scholarly invited lectures, qualitative level indicators of papers, quality level indicators of domestic patents, papers considering contribution rates, and patent performance indicators.

Among the performance analysis indicators of the academic research support project of the National Research Foundation of Korea, the academic performance index for specialized academic journals is divided into the quantitative index and the qualitative index. In the case of quantitative indicators, the evaluation is based on the number of SCI papers and non-SCI papers published, whereas the qualitative indicators are based on the Impact Factor (IF) index of the JCR (Journal Citation Report). Table 4 shows the specific performance indicators and analysis criteria.

Table 4. National Research Foundation of Korea's academic research support project's performance analysis index (1) specialized academic journal section

Classification	Performance index	Analytical standard	Major details
Quantitative index	Total number of papers published	By project, by area	Classified into SCI and non-SCI
	Number of research papers per 100 million	By project, by area	Classified into total papers and SCI, KCI, etc.
	Number of SCI international joint papers	By project	
	Number of papers published in Foundation (candidate)	By project	Classified by publication in domestic academic journals (candidates)
Qualitative index	Number of papers published in the world's 3 major journals (NSP)	By project	NATURE, SCIENCE, PNAS
	Number of NSP papers per 100 billion	By project	Input contribution to output
	Number of papers published in major scientific journals	By project	Comparison of major countries and Korea
	Number of major scientific journals per 100 billion	By project	Input contribution to output (compared with overall domestic)
	Scoreboard	By project	Compared all of Korea
	Average IF (Impact Factor)	By project	Compared all of Korea
	Sector impact index	By project	Classified papers with IF of 5, 10, 20 or more / Compared all of Korea
	Number of papers ranked high for IF	By project	Compared all of Korea
	Standardized ranking correction index	By project	Compared all of Korea
	Complementary rank correction factor	By project	Compared all of Korea
	IF of SCI international joint paper	By project, by area	Compared all of Korea
	Top 5% based on IF percentage, number of papers of top 10% journal	By project	Used as project evaluation index and added analysis

In particular, as shown in Table 5, the results of the research published through academic research support projects are quantified through specific analysis criteria.

Table 5. Qualitative level of paper

Performance index (Quantitative index)	Analytical standard	Major details
Number of citations	• Number of times cited by other articles, including self-citation	It is improper as a project evaluation method because the citation of individual paper is done over a long period of time.
Journal impact index (IF)	• Refers to the average number of citations of journals in the last two years excluding the corresponding year. • Mainly used as index for journal evaluation	Does not reflect deviation of IF by sector.
Sector impact factor index	• The impact factor (IF) of each journal divided by the average impact index of each journal's field • A score of 1.0 or higher means that the journal is above the average level (IF based) in the field. • The field refers to the field in Thomson's JCR (Journal Citation Report). • If a journal belongs to several areas, the average value of the field's impact index for each area is defined as the impact factor index.	
Rank correction influence index	• Represents the stature of specific journals in the field. • If a particular journal is at the top of the field, the rank correction index takes a value of "1" and the lowest value is close to "0".	The rank correction index of the lowest journal (IF based) in the field depends on the number of journals in the field.
Standardized rank correcetion impact factor	• It is a value that standardized the rank correction index's minimum value to 0 and maximum value to 100. • Standardized rank correction impact factor index	
Complemented rank correction factor	• Divide by an integer value between 1 and 5 based on the standardized rank correction index.	

The National Research Foundation of Korea provides specific quantitative performance indicators such as the publication of academic journals, invitations to international academic conferences, lectures, intellectual property rights, contracts for technology implementation, training of human resources, and support for subsequent generations, etc. (See Table 6).

Table 6. National Research Foundation of Korea's academic research support project's performance analysis index (2)

Classification	Performance index (Quantitative index)	Analytical standard	Major details
Academic conference	Total number of papers	By project, by area, By subject, By institution	Classified into domestic and overseas
	Number of research papers per 1 billion won of research cost	By project	Classified into domestic and overseas

Classification	Performance index (Quantitative index)	Analytical standard	Major details
Invited lecture at international academic conference	Invited lecture at international academic conference	By project, by area	
Authored books	Authored books performance	By project, by area, By subject, By institution	Classified into authored and translated books
Intellectual property right	Number of patent application and registration	By project	
	Number of patent application and registration and share	By project, by area	Classified into domestic and overseas
	Number of patent application and registration per 1 billion won of research cost	By project, by area	Classified into domestic and overseas
	Number of overseas patent application and registration	By country	
	Net applications and registrations	By project	Remove duplication between projects
	Contribution of patent application and registration		Consider contribution rate by project
Executed contract for technology implementation	Execution performance (number of cases and amount)	By project	
	Sponsoring institution collection performance (amount)	By project	
	Top 20 institutions for technology fees	By project	Based on sponsoring institution's collection amount
HR development	Degree production performance	By project, by area, By subject, By institution	Classified into master's and PhD
	Form of career path	By project, by area	Employment, degree, advancement, postdoctoral researcher, etc.
Support for subsequent generations of scholars	Career path of beneficiaries of science and engineering area academic subsequent generations of scholars project	Full-time college teacher Non-full time college teacher Postdoctoral researcher Other institutional employment	Analysis of beneficiaries for 2012-2016
	Career path of beneficiaries of humanities and social science area academic subsequent generations of scholars project		

(3) Other academic research support project performance analysis index

Lee (2016) conducted a research on the improvement of convergence research evaluation system for selection and support of the excellent convergence research projects among the academic support

projects for the humanities and social sciences. In this study, he conducted a performance analysis of interdisciplinary convergence research support projects as a basic research for improvement of convergence research evaluation system, and the research results are directly related to the research results created through academic activities within the academic community, and the indirect effect of the research results on the human resource development and the economic ripple effect was classified.

In this study, the research indicators for the academic research support projects of the National Research Foundation of Korea were divided into five areas of scholarly and scientific and technological achievements, human resource development and research facilities, international cooperation, industrial support and utilization of research results, and other achievements. Table 7 provides the detailed performance items for each performance index item.

Table 7. Academic research support project performance index (Lee Young-Beom, 2016)

Classification	Detailed performance	
<Integration 1> Academic and science and technology performance	• SCI • Non-SCI • Intellectual property right application • Intellectual property right registration • Intellectual property right program	• Invited lecture at international academic conference • Presentation of academic papers • Honors and awards • Authored books • Reports
<Integration 2> HR development and research facility	• Degree producing HR • Domestic and international research support	• Opening of related lecture program • Purchase of research equipment
<Integration 3> International cooperation	• Overseas dispatch • Domestic inducement • MOU execution	• International joint research • Hosting academic conference
<Integration 4> Industrial support and research performance utilization	• Technology transfer • Technical guidance • Technology evaluation • Contract for technology implementation	• Promoting subsequent research • Commercialization in progress • Use for other purposes • Technical marketing
<Integration 5> Other performance	• Press release	

2.2.3 Comparative analysis and implications of performance indicators

In this study, we compared the national R&D project performance index conducted by the Korea Institute of S&T Evaluation and Planning (KISTEP) against the academic research support project performance index conducted by the National Research Foundation of Korea and the research support project performance index items separately conducted by Lee (2016), whose results are as provided in Table 8.

Table 8. Comparison of performance index by institution

National R&D project (KISTEP)		Academic research support project (National Research Foundation of Korea)		Research support project (Lee Young-Beom)	
Performance index	Details	Performance index	Details	Performance index	Details
Papers	SCI(E), Non-SCI(E) Qualitative index	Specialized academic journal	number of paper publication SCI , non-SCI Qualitative index	Academic and science and technology performance	number of SCI, non-SCIs
Patents	Patent application Patent registration	Intellectual property right	Application and registration of intellectual property right		Application and registration of intellectual property right
					Intellectual property program
-	-	Invited lecture at international academic conference	-		Invited lecture at international academic conference
		Academic conference	-		Academic conference papers
		-	-		Honors and awards
		Authored books	-		Authored books
		-	-		Report
HR development support		HR development	Degree production	HR development and research facility	Degree producing HR
Training support		Support for subsequent generations of scholars			Support for domestic and overseas research
-	-	-	-		Opened related lecture program
					Purchase of research equipment
				International cooperation	Dispatch overseas
					Domestic inducement
					Executed MOU
					International joint research
					Hosting academic conferences
				Industry support and utilization of research performance results	Technology transfer
					Technical guidance
					Technical evaluation
Technical fees	-	Signed contract for technology implementation	-		Contract for technical implementation
-	-	-	-		Implementing subsequent research
Project development	-				Promoting commercialization
-	-				Use for other purposes
					Technical marketing
		-	-	Other performance	Press release

Reviewing the performance index items by institution, 5 items such as papers, intellectual property rights (patents), human resource support, training support (subsequent generation support), and technology implementation contract (technology fee) were included in all 3 performance indicators, and qualitative indicators of papers, lectures by invitation to international academic conferences, conference proceedings, and authored publications were included in the two performance indicators.

First, in the case of the national R&D project evaluation index, there are 15 items in the performance index before 2007, and a large part of Lee Young-Beom's performance index was included, however, for the difficulty of verification and the actual data collection, they have been reduced to 6 items. This suggests that further discussion of performance indicators that can adequately evaluate the research outcomes through further research in terms of the performance of research support projects is needed.

Second, Lee Young-Beom's research composed performance index of the data gathered from the National Research Foundation of Korea, and therefore, it includes all of the evaluation indicators of the research project of the National Research Foundation of Korea. However, there is a tendency to overlook qualitative aspects in the index of specialized academic journals. Nevertheless, it is important to integrate various individual performance indicators and reduce them to 5 indicators to present performance indicators.

3. Method

3.1 Research questions

In this study, we intended to establish the direction for the future interdisciplinary convergence research project based on the achievements of the research project supported by the National Research Foundation of Korea since 2009, and to that end, we formulated the following research questions.

- First, what is the research result obtained from the National Research Foundation of Korea's interdisciplinary research support project from 2009 to 2017?
- Second, what is the level of research achievement of interdisciplinary convergence research support project compared with the research result of the nation's entire research support project performance and similar academic research support project's research performance?
- Third, through academic research support research results, what are the areas in which interdisciplinary convergence research projects should be more focused, and what are the future directions?

3.2 Subject and method of analysis

The results of this study are the results of the research project of the National Research Foundation of Korea's interdisciplinary convergence research project from 2009 to 2017. The performance data were collected and analyzed based on the results of research submitted online by the research director using the National Research Foundation of Korea's research project integration support system's performance management system. The results of this study are analyzed for all items collected,

and comparatively analyzed by each year. In addition, the results of the interdisciplinary convergence research project were compared and analyzed with the results of other projects, which were compared and analyzed based on the performance indicators of national R&D projects. Table 9 provides the performance analysis indicators used to analyze the interdisciplinary convergence research support project performance.

Table 9. National Research Foundation fo Korea's convergence research support project performance analysis index

Classification	Detailed performance results	Remark
Academic performance	Specialized academic journal	Quantitative: Interdisciplinary SCI, non-SCI (KCI, etc.) performance Qualitative: JCR IF index
	Academic conference paper	Number of academic conference papers
	Invited lecture at international academic conference	Invited lectures at international academic conferences
	Report	Report publication performance
	Authored books	Publication of authored books performance
	Honors and awards	Academic awards
HR development performance	Degree producing HR	Master's and PhD production performance
	Support for training domestic and overseas	Training performance at home and abroad
	Related course program	Opening of relevant course programs and the number of hours
Cooperation performance	Overseas dispatch for international exchange of scientists at home and abroad	Domestic and overseas dispatch results
	International joint research	International joint research results
	Hosting academic conference	Hosting conference performance
Intellectual property performance	Intellectual property application	Number of intellectual property applications
	Intellectual property registration	Number of intellectual property registrations
Industrial support performance	Technical marketing	
	Contract for technical implementation	
	Technology diffusion technology map	
	Promoting commercialization	
	Implementing subsequent research	
Other performance	Purchase of research equipment	Details of purchase of research equipment
	Press release	Press release
	Use for other purposes	Educational materials, public interest, research materials, etc.

4. Results and Discussion

4.1 Status on the application for and selection of interdisciplinary convergence research project

In 2009, the National Foundation of Korea's interdisciplinary convergence research support project supported 23 projects with KRW 2 billion in 2009, and KRW 5 billion was allocated to each year since 2014. By 2017, a total of 232 project teams were supported, and the total number of projects and the number of projects are provided in Table 10.

Table 10. Total budget and number of support project for the interdisciplinary convergence research support project

Classification	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Total budget	2 billion	3 billion	4 billion	3.38 billion	3.38 billion	5 billion	5 billion	5 billion	5 billion	35.78 billion
number of support project	23	30	33	13	19	38	27	22	27	232

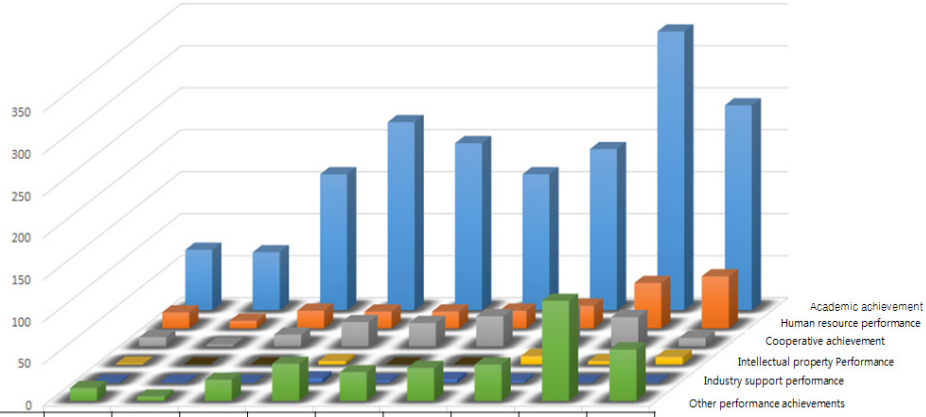
The interdisciplinary convergence research support projects are divided into seed type and bud type depending on the type of support. In case of seed type, support is provided focusing on the agenda discovery, and in the case of bud type, it is implemented targeting mid to long term interdisciplinary convergence research. Since 2009, a total of 710 projects have been selected and 181 projects have been selected for the seed type with the selection rate being 25.6%. The total number of sprout type was 356 and 32 were selected with the selection rate being 12.6%. By 2017, a total of 1,095 project teams applied and 216 project teams were selected with the selection rate of 21.1%. The difference in the selection rate between the seed type and the sprout type was more than 7% in the case of the project, which was caused by the fact that the excellent researcher could apply for the sprout type directly without passing through the seed type.

Table 11. Current status of interdisciplinary convergence research support project by support type

Classification	Seed type			Sprout type			Total		
	Applied	Selected	Selection rate	Applied	Selected	Selection rate	Applied	Selected	Selection rate
2009	116	21	18.1	35	2	5.7	151	23	23.8
2010	95	24	25.3	49	6	12.2	144	30	20.8
2011	82	26	31.7	31	4	12.9	139	33	23.7
2012	54	11	20.4	9	2	22.2	63	13	20.6
2013	60	17	28.3	9	2	22.2	69	19	27.5
2014	118	33	28.0	18	4	22.2	130	37	28.4
2015	71	21	29.6	89	6	6.7	160	27	16.9
2016	74	18	24.3	77	4	5.2	151	22	14.6
2017	40	10	25.0	48	2	4.2	88	12	30.7
Total	710	181	25.6	356	47	12.6	1,095	218	23.1

4.2 Analysis of interdisciplinary convergence research support project's performance (2009-2017)

The performance analysis of interdisciplinary convergence research support projects was divided into 6 large classifications. As a result of examining the difference between the large classification results, a total of 1,651 academic achievements were the most common, followed by other achievements including media reports (385) and manpower performance (253). On the other hand, intellectual property rights registration (28) and industrial support achievement (18) were found to be relatively very low due to the nature of humanities and social science based research.



	2009	2010	2011	2012	2013	2014	2015	2016	2017
Academic achievement	72	69	162	224	199	162	192	332	224
Human resource performance	19	9	21	20	20	21	27	54	62
Cooperative achievement	11	2	14	29	28	36	40	35	10
Intellectual property Performance	1	0	0	4	0	0	10	4	9
Industry support performance	1	1	1	5	2	4	2	1	1
Other performance achievements	15	5	25	44	34	39	43	119	65

Figure 1. Status of performance by area for interdisciplinary convergence research support project

(1) Academic achievement

The details of academic achievement were composed of specialized academic journals, academic conference papers, invited lectures, reports, chapters, and awards. As a result of the analysis of the academic results, the highest proportion of the items in the academic papers (856) was followed by the specialized academic journals. On the other hand, the proportion of invited lectures and reports was relatively low. As a result of analysis by year, the overall trend is increasing from 72 cases in 2009, and it was the highest with 332 cases in 2016. In the case of 2017, it is expected that the final result will be higher through the additional publication of additional research results such as additional specialized academic journals.

Table 12. Academic performance by year

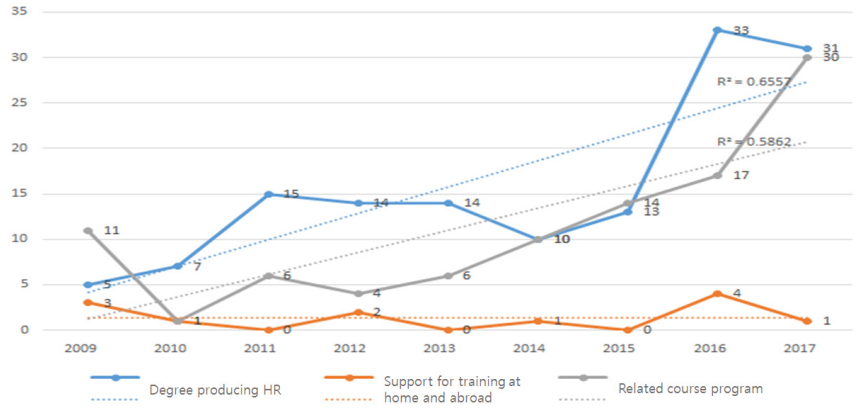
Details of academic performance		2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Specialized academic journal	SCI	-	4	7	4	9	7	16	25	8	80
	Non-SCI	7	10	55	87	78	72	76	96	71	552
Academic conference paper presentation		45	34	83	117	93	69	101	175	139	856
Invited lecture at international academic conference		2	4	3	1	3	-	-	13	10	36
Report		11	9	6	3	-	-	-	4	1	34
Authored books		4	5	2	13	14	11	2	12	12	75
Honors and awards		4	3	6	3	2	3	7	11	12	51
Total		72	69	162	224	199	162	192	332	244	1,656

(2) Human resource performance

The detailed items of human resources training consisted of degree producing manpower, domestic and overseas training support, and related lecture programs, and the number of degree producing manpower (142) was the highest. On the other hand, support for training at home and abroad was relatively low. Reviewing the graph of manpower development, it can be seen that the degree producing manpower and the support for domestic and overseas training are increasing as a whole. Statistically verifying it through the line of trend, the degree producing manpower was found to be R^2=0.6557, the related lecture program R^2=0.5862, and the explanatory power was found to be 65% and 58%, so no perfect explanation could be achieved.

Table 13. Human resources development performance by year

Details of human resources development	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Degree producing HR	5	7	15	14	14	10	13	33	31	142
Support for training at home and abroad	3	1	-	2	-	1	-	4	1	12
Related course program	11	1	6	4	6	10	14	17	30	99
Subtotal	19	9	21	20	20	21	27	54	62	253



The aspect in which the humanities and social science based convergence research is most distinguished from the science based convergence research is the educational aspect. This can be confirmed through related lecture programs. The number of related lecture programs has been consistently increasing since 2009, and in 2017, approximately 1,489 people participated in 30 programs. This is a result of increasing interest in convergence research and promoting continuous convergence research. It is a good example to continuously share the result of research with the citizens. Therefore, convergence research, which is drawing attention in the era of the 4th industrial revolution, should be continued, and active support should be provided so that research results can be shared with citizens in terms of education.

Table 14. Number of related programs and trend in training participation by year

Classification	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Number of cases	11	1	6	4	6	10	14	17	29	98
Training hours	221	45	240	39	270	278	499	660	514	2,766
Trainees	695	3	139	165	176	619	739	986	1,489	5,011

(3) Cooperative achievement

The results of cooperation are composed of 3 items of exchange of scientists from home and abroad, overseas dispatch, international collaborative research, and hosting academic conferences. In the case of interdisciplinary convergence research projects for interdisciplinary research in humanities and social sciences, and exchange of scientists from home and abroad and overseas dispatch, and international collaborative research, there were no results, and the results via holding academic conferences have steadily increased since 2010 and showed a low rate of hosting in 2017.

Table 15. Cooperation performance by year

Detailed cooperation performance	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Exchange of domestic and international scientists and overseas dispatch	-	1	-	-	-	1	-	-	-	2
International joint research	-	-	-	-	-	-	-	-	1	1
Hosting academic conference	11	1	14	29	28	36	40	35	9	203
Subtotal	11	2	14	29	28	37	40	35	10	206

(4) Intellectual property performance

Intellectual property rights performance is divided into application and registration of intellectual property rights. In 2010, 10 cases were filed for the largest number, and 7 cases were filed in

2017. The number of registrations was none until 2015, but as the rate of applications filed after 2015 increased, the number of registrations began to increase from one in 2016 to 2 in 2017. As the registration of intellectual property rights with the Patent Office is becoming increasingly strict, the patent registration is decreasing overall, but in the case of the interdisciplinary convergence research project, it is expected that the registration rate will increase over time.

Table 16. Intellectual property rights (patent) performance by year

Details of intellectual property right performance	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Intellectual property right application	1	-	-	4	-	-	10	3	7	25
Intellectual property right registration	-	-	-	-	-	-	-	1	2	3
Subtotal	1	-	-	4	-	-	10	4	9	28

(5) Industry support performance

The results of industrial support were composed of technical marketing, technology implementation contract, guidance of technology proliferation, pursuing commercialization, and subsequent research. The results of the industrial support showed the results between 2012 and 2015, but there were no results after pursuing subsequent research.

Table 17. Industry support performance by year

Details of industrial support performance	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Technical marketing	-	-	-	2	-	-	-	-	-	2
Contract for technical implementation	-	-	-	-	-	1	-	-	-	1
Technology diffusion technology map	-	-	-	2	2	1	1	-	-	6
Promoting commercialization	-	-	-	-	-	1	1	-	-	2
Implementing subsequent research	1	1	1	1	-	1	-	1	1	7
Subtotal	1	1	1	5	2	4	2	1	1	18

(6) Other performance achievements

Other performance items consisted of purchase of research equipment, media reports, and other purposes. The item capturing the highest percentage among the other performance items was the result of media report, which has been increasing continuously since 2009 as a part of public relations efforts for the interdisciplinary convergence research.

Table 18. Other performance results by year

Details of other performance results	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Purchase of research equipment	4	3	1	-	-	3	2	5	-	18
Press release	11	2	16	32	34	35	39	104	58	331
Use for other purposes	-	-	8	12	-	1	2	10	3	36
Subtotal	15	5	25	44	34	39	43	119	61	385

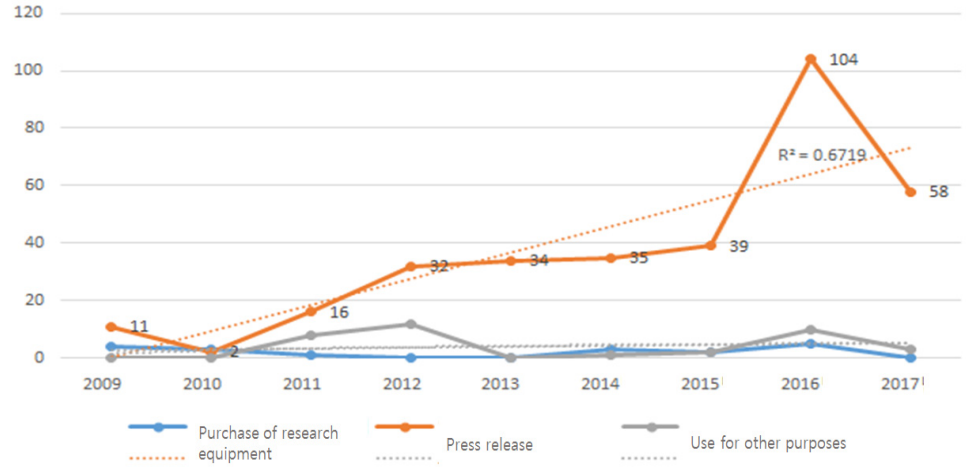


Table 19 summarizes the overall performance of the National Research Foundation of Korea's interdisciplinary convergence research project.

Table 19. National Research Foundation of Korea's interdisciplinary convergence research support project performance results (2009-2017)

Classification	Detailed performance results		2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Academic performance	Specialized academic journal	Interdisciplinary SCI	-	4	7	4	9	7	16	25	8	80
		Non-SCI	7	10	55	87	78	72	76	96	71	552
	Academic conference paper presentation		45	34	83	117	93	69	101	175	139	856
	Invited lecture at international academic conference		2	4	3	1	3	-	-	13	10	36
	Report		11	9	6	3	-	-	-	4	1	34
	Authored books		4	5	2	13	14	11	2	12	12	75
	Honors and awards		4	3	6	3	2	3	7	11	12	51
	Subtotal		72	69	162	224	199	162	192	332	244	1,656
HR performance	Degree producing HR		5	7	15	14	14	10	13	33	31	142
	Support for training at home and abroad		3	1	-	2	-	1	-	4	1	12
	Related course program		11	1	6	4	6	10	14	17	30	99
	Subtotal		19	9	21	20	20	21	27	54	62	253

Classification	Detailed performance results	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Cooperation performance	Overseas dispatch for international exchange of scientists at home and abroad	-	1	-	-	-	1	-	-	-	2
	International joint research	-	-	-	-	-	-	-	-	1	1
	Hosting academic conference	11	1	14	29	28	36	40	35	9	203
	Subtotal	11	2	14	29	28	37	40	35	10	206
Intellectual property right	Intellectual property application	1	-	-	4	-	-	10	3	7	25
	Intellectual property registration	-	-	-	-	-	-	-	1	2	3
	Subtotal	1	-	-	4	-	-	10	4	9	28
Industrial support performance	Technical marketing	-	-	-	2	-	-	-	-	-	2
	Contract for technical implementation	-	-	-	-	-	1	-	-	-	1
	Technology diffusion technology map	-	-	-	2	2	1	1	-	-	6
	Promoting commercialization	-	-	-	-	-	1	1	-	-	2
	Implementing subsequent research	1	1	1	1	-	1	-	1	1	7
	Subtotal	1	1	1	5	2	4	2	1	1	18
Other performance	Purchase of research equipment	4	3	1	-	-	3	2	5	-	18
	Press release	11	2	16	32	34	35	39	104	58	331
	Use for other purposes	-	-	8	12	-	1	2	10	3	36
	Subtotal	15	5	25	44	34	39	43	119	61	385
Total		120	86	223	330	283	263	324	549	396	2,574

4.3 Comparative analysis of major achievements of interdisciplinary convergence research support project

In this study, the major achievements of the interdisciplinary convergence research project were compared with other academic research support projects, and the base year is 2016. Compared with other projects, there are 4 areas of performance, such as specialized academic journals, intellectual property (patent) achievements, academic conferences, and subsequent generations of academic achievements. (R&D), and the comparatively analyzed projects are the Ministry of Education's academic research support project for the humanities and social science (hereinafter, "humanities and social science"), the Ministry of Education's academic research support project for the science and engineering (hereinafter, "science and engineering"), Ministry of Science and ICT's major R&D project (hereinafter, "science and technology"), Ministry of Science and ICT's convergence R&D project (hereinafter, "convergence R&D"), government's R&D project (hereinafter, "government R&D"), and national research support project (hereinafter, "national R&D"), etc. Comparisons were made by comparing and analyzing the R&D expenditure of the project.

(1) Specialized academic journals (academic papers)

Reviewing the papers via the implementation of the interdisciplinary convergence research support project from 2009 to 2017, there were 80 SCI published papers and 552 non-SCI papers.

A total of 121 publications, including 25 SCI papers and 96 non-SCI papers, were submitted as the results of the National Research Foundation of Korea's interdisciplinary research support project in 2016. The results of the comparison with other research support projects are shown in

Table 20. The annual research cost for interdisciplinary convergence research projects is 5 billion, and the number of papers per billion was examined. As a result, there were about 24 papers per billion with 5 SCI papers and 19 non-SCI papers. The SCI paper is 6 times higher than the national R&D project and 3 times more than the Ministry of Education's humanities and social science. Also, it is higher than the convergence technology R&D paper results. Despite the fact that it is based on humanities and social science, it showed a high SCI publication rate. The number of non-SCI paper was 19.20 per billion, which is the highest, except for the Ministry of Education's humanities and social science research support project (21.68). When compared with the convergence technology R&D project, the difference was about 10 times. As a result, the results of the paper publication showed that the interdisciplinary convergence research project has a better performance than the other projects in terms of budget.

Table 20. Comparison of 2016 convergence research papers performance results per billion

Classification	R&D cost	SCI		Non-SCI		Total	
		# of cases	Per billion	# of cases	Per billion	# of cases	Per billion
Convergence research	5 billion	25	5.00	96	19.20	121	24.20
Humanities and social science	249.8 billion	472	1.88	5,420	21.68	5,892	23.57
Science and engineering area	34.04 billion	8,221	25.90	2,490	7.32	10,711	31.50
Science and technology	219.74 billion	23,660	10.74	3,884	1.77	27,544	12.54
Convergence technology R&D	3.4864 trillion	11,408	3.27	6,878	1.97	18,286	5.24
Government R&D (15)	18.89 trillion	35,849	1.90	21,272	1.13	57,141	3.02
Country R&D	69.4055 trillion	59,628	0.82	-	-	-	-

In this study, qualitative comparisons were made with quantitative comparisons. Qualitative comparisons were made through the Impact Factor (IF) index of the Journal Citation Report (JCR). The average IF index of the SCI paper submitted as the achievement of interdisciplinary convergence research support project was 1.99 (as of 2016), which was lower than the average IF index of other projects, and the qualitative performance was lower than the quantitative performance of the research. Therefore, it seems necessary to prepare for complementary measures.

Table 21. Comparison of IF index for convergence research SCI papers

Classification	Average IF
Convergence research	1.99
Humanities and social science	2.45
Science and engineering area	3.24
Science and technology	4.44
Country R&D	3.13

(2) Intellectual property rights (patents) performance

As a result of examining the intellectual property (patent) achievements of the interdisciplinary convergence research project, 3 applications were filed for intellectual property rights in 2016, and 1 was registered. If it were calculated at cost per billion, it yielded very low with 0.6 application and 0.2 registration. This is relatively low when other academic research support projects are filed and registered for 4 intellectual property rights per billion. Considering the fact that humanities and social sciences are converged even if considering the special characteristics of convergence research based on the humanities and social science, it should be considered to extend the results of convergence research to intellectual property rights.

Table 22. Comparison of intellectual property right (patent) performance for 2016 convergence research per billion

Classification	R&D cost	Applied		Registered		Total	
		# of cases	Per billion	# of cases	Per billion	# of cases	Per billion
Convergence research	5 billion	3	0.6	1	0.2	4	0.80
Humanities and social science + science and engineering	590.3 billion	1,640	2.78	765	1.29	2,415	4.09
Science and technology	2.1974 trillion	7,768	3.53	3,016	1.37	10,784	4.90
Convergence technology R&D	3.4864 trillion	13,637	3.91	3,661	1.05	16,998	4.87
Government R&D (15)	18.89 trillion	32,508	1.72	16,866	0.89	49,374	2.61
Country R&D	69.4055 trillion	-	-	92,400	1.19	-	-

(3) Academic conference paper performance

Reviewing the results of academic conferences in interdisciplinary convergence research projects, they achieved approximately 35 cases per billion for a total of 175 cases. This is the highest number among other projects, except for the academic research support project (64.36) of the Ministry of Education's academic research support project for the humanities and social science, and it shows the nature of the middle zone between the humanities and social science and the science and engineering.

Table 23. Comparison of academic conference paper performance for 2016 convergence research per billion

Classification	R&D cost	Academic conference paper	
		# of cases	Per billion
Convergence research	5 billion	175	35.00
Humanities and social science	249.8 billion	16,090	64.36
Science and engineering area	340.4 billion	3,534	10.30
Science and technology	2.1974 trillion	46,939	21.36

(4) Production of subsequent generations of scholars

The production of subsequent generations of scholars is an important part of the sustainability of research, and to that end, many efforts are being made at the national level. The results of the interdisciplinary convergence research project also include the subsequent generations of scholars, and the annual trend shows that it has increased steeply since 2016.

A total of 142 mater's and PhD's were produced through the interdisciplinary convergence research project, including 24 PhD's, in order to lay the foundation for a sustained convergence research. In particular, since 2016, as the interdisciplinary convergence research projects have settled, the production of subsequent generations of scholars has also been increasing as a trend.

In this study, we compared and analyzed with other countries' projects on the subsequent generations of scholars. In the case of the interdisciplinary convergence research project, 5.20 master's per billion and 1.40 PhD's per billion for the total of 6.60 people. This is far superior to the convergence technology R&D project (1.08) as well as the academic research institute (1.70) in the humanities and social sciences of the Ministry of Education. Therefore, the sustainability of the interdisciplinary convergence research project should be secured from the educational aspect, and further support is desperately needed in order to facilitate the interdisciplinary convergence research project in terms of input budget.

Table 24. Comparison of subsequent generation of scholars production performance for 2016 convergence research per billion

Classification	R&D cost	Master's		PhD's		Total	
		# of cases	Per billion	# of cases	Per billion	# of cases	Per billion
Convergence research	5 billion	26	5.20	7	1.40	33	6.60
Humanities and social science	249.8 billion	330	1.32	95	0.38	425	1.70
Science and engineering area	340.4 billion	2,865	8.42	829	2.43	3,694	10.86
Science and technology	2.1974 trillion	4,676	2.12	1,969	0.89	6,645	3.02
Convergence technology R&D	3.4864 trillion	2,554	0.64	1,218	0.35	3,772	1.08

4.4 Discussion

In this study, based on the results obtained through the interdisciplinary convergence research projects, research questions were formulated to set the future policy direction. Prior to discussing the research questions, in this study, we set up indicators for analyzing the performance of the national R&D projects and academic research support projects, and provided a basis for comparing the results.

First, the research questions on the achievements of interdisciplinary convergence research projects were divided for review into academic achievement, human resource performance, cooperation achieve-

ment, intellectual property achievement, industrial support achievement, and other achievements. As a result of the analysis, the interdisciplinary convergence research project showed high achievement in academic achievement and human resource development performance, and the number of lectures and the number of participants are continuously increasing by encouraging the participation of the people through the establishment of related lecture programs through publicity of the people. In addition to this, we also made efforts to revitalize the network of convergence researchers through the hosting of the conferences continuously. This result can be explained through the purpose and goal of the interdisciplinary convergence research project. The interdisciplinary convergence research project is the research support project based on humanities and social science, their goal is based on Article 3 (Duties of the Government) and Article 5 (Promotion of Academic Support Project) of the Academic Promotion Act, and provides research opportunities linked to education to subsequent generations of scholars, thereby fostering mid to long term interdisciplinary human resources. Nevertheless, when we review the selection rate of interdisciplinary convergence research support project, the seed type average is 25% and the bud type average is 18%. This shows that despite the increased interest in national interest in convergence research and the interest of related scholars, sufficient research has not been conducted due to low budget. There is a need to increase the selection rate to 30% by securing additional budgets.

As a result of comparing the second research question of other academic research support project and performance of interdisciplinary convergence research support project, it was evident that the performance of the intellectual property right application and registration and industry support was every low. As shown in the analytical results, 0.8 case per billion for intellectual property rights is very low relative to convergence technology R&D project (4.87), major R&D projects of Ministry of Science and ICT (4.90), and academic research support project of the National Research Foundation of Korea (4.09). In the case of industrial support outcomes, even comparable items that could actually be compared were insufficient. Considering that the core policy of the present government is the realization of innovation led growth even considering the objectives and goals of interdisciplinary convergence research projects, research results that can contribute to the real growth of the nation through the convergence of humanities and social sciences seem necessary. In order to solve these problems, it is necessary to fundamentally change the currently supported interdisciplinary convergence research projects. In the case of the seed type, the convergence research agenda is implemented in a year, and the bud type is 3 years + 2 years for up to 200 million won a year. This means that the budget and period are insufficient to connect to the actual results of intellectual property right, technical agreement, technology transfer, etc., although it is sufficient budget and period in terms of extension of convergence research network for expanding the base for academic and convergence research. In order to solve this problem, it is necessary to support the new stage of research after the bud type focusing on the actual industrial support performance. We will need full support for possible projects and budgets.

In the case of interdisciplinary convergence research projects, the results of SCI papers and non-SCI papers are shown to be higher than other research and development projects. However, the IF index average of SCI papers was significantly lower than that of other projects. In other words, although it achieved the results in quantitative terms, it can not be said that the qualitative performance

is insufficient. However, the results of this analysis are optimized for national R&D support project qualitative analysis index and qualitative analysis index applied in the Ministry of Education and the Ministry of Science and ICT's academic research support projects. Therefore, it can be said that there is a low level of fitness in measuring the performance of the humanities and social science based research. For example, the weight of domestic journals in qualitative assessment is 0.7, and the weight of 1-5 is given for overseas SCI journals. That is, it is concluded that overseas journals can be worth 7 times more than domestic journals if weights are given. In addition, the performance analysis of important book publication in the field of humanities and social science has limitations in that it can not be worth as much as a journal. Therefore, it is necessary to develop the performance indicators suitable for the interdisciplinary convergence research support project.

5. Conclusion

In order to solve complex and diverse social problems creatively and rationally in the era of the 4th industrial revolution, the need for interdisciplinary research beyond the existing scholarship has arisen. In particular, the value of research combining humanities and social science with science and technology has been increasing with the aim of creating new values, and actual researches converged by researchers in each field are continuously increasing.

Amidst the flow of time, the National Research Foundation of Korea has planned and implemented the interdisciplinary convergence research support project, and it has been 10 years since the start of the project to maximize the efficiency of the project, and the systematic and scientific research and analysis became necessary to determine the future policy direction. Given those, in this study, we analyzed the results of interdisciplinary convergence research project and compared them with the results of other project units and presented the policy direction for the interdisciplinary convergence research projects.

The results of the interdisciplinary convergence research project and the results of other R&D projects are summarized as follows.

First, in case of the interdisciplinary convergence research project, academic achievement and manpower performance were high. On the other hand, intellectual property right performance and industrial support performance were found to be very low.

Second, the results of the convergence research are shown in terms of public participation and public relations, convergence researcher network. The number of lectures and the number of participants in the related lecture program are increasing each year, and the media publicity for public publicity has also been increasing every year. In addition, hosting conferences to create a network of convergence researchers showed higher performance than other items.

Third, quantitative achievements of specialized academic journals showed higher performance than other academic research support projects. On the other hand, the Impact Factor (IF) average index, which is a qualitative result, was lower than other projects.

Fourth, in the case of nurturing subsequent generations of scholars, it showed a higher performance

than other academic research support projects. This is consistent with the purpose of this project.

Fifth, intellectual property (patent) performance and industry support performance were very low compared with other academic research support projects.

In this study, the policy direction of interdisciplinary convergence research support project is suggested as follows through the results analysis of the interdisciplinary convergence research support project.

First, as a result of reviewing the results of this study, it is found that the interdisciplinary convergence research support project is being carried out effectively and systematically in accordance with the direction of creative social problem solving and the subsequent generations of scholars and the fostering of professional convergence researchers. Nevertheless, the appropriation budget is very scarce and the selection rate is also very low, so it is urgently necessary to expand research support projects through the additional budget allocation.

Second, academic performance and manpower performance show clear results, but intellectual property performance and industry support performance are very low compared to other R&D support projects. This is a very low achievement even though the interdisciplinary convergence research support project is a study based on the humanities and social science and in view of the purpose and goals of the research project. However, the nature of the interdisciplinary convergence research project, which only works up until the sprout type project, may have been fundamentally impossible to create intellectual property right performance and industrial support performance. Therefore, it is necessary to expand the research stage so that the actual social problems can be solved beyond the scholarly achievement through the progress of the further extended research.

Third, in this study, quantitative performance and qualitative performance are presented separately in academic performance, and the qualitative performance of the interdisciplinary convergence research support project is indicated low through IF index in terms of qualitative performance. However, these performance indicators are focused on the publication and citation of overseas leading journals, as assessed by the national R&D support project and the Ministry of Education, Ministry of Science and ICT. Therefore, it is necessary to develop a model that can develop a performance index suitable for humanities and social sciences interdisciplinary research support project, and model it to clearly analyze the effect of various outcomes generated in the course of conducting research.

This study analyzed the performance results of the interdisciplinary convergence research project of the National Research Foundation of Korea and proposed future directions by comparing the results with other R&D support projects. However, the data used for performance comparison have the following limitations. First, based on the data entered by the researcher, incorrect data may have been entered due to misunderstandings, errors, errors, mistakes, and the like. Second, there may be a difference in the numerical value of the data due to the difference in the times inputs were made. Third, there is a possibility that statistics have been distorted according to classification criteria in the comparative analysis with other R&D support projects.

References

Bear, J. B., & Woolley, A. W. (2011). The role of gender in team collaboration and performance. *Interdisciplinary science reviews, 36*(2), 146-153.

Bruhn, J. G. (2000). Interdisciplinary research: A philosophy, art form, artifact or antidote?. *Integrative Psychological and Behavioral Science, 35*(1), 58-66.

Bruun, H., Hukkinen, J. I., Huutoniemi, K. I., & Thompson Klein, J. (2005). *Promoting interdisciplinary research*. Academy of Finland.

Convergence Research Policy Center. (2015). A Study on the Methods of Convergence Research: Focused on the National R&D Project. *Convergence Research Review, 1*(2).

Han, E. Y., & Kim, J. I. (2018). *Current Status Analysis of the Government Research and Development Budget for 2018*. Seoul: Korea Institute of Science and Technology Evaluation and Planning.

Han, S. H., & Jung, K. W. (2011). An Empirical Analysis for Promoting Interdisciplinary Convergence Research: Focused on Differences in Perceptions Among Academic Areas. *Journal of the Korean Association for Policy Studies, 20*(1).

Huutoniemi, K., Klein, J. T., Bruun, H., & Hukkinen, J. (2010). Analyzing interdisciplinarity: Typology and indicators. *Research Policy, 39*(1), 79-88.

Jung, K. W. (2011). Seeking a New Direction for Convergence Research: Life Complexity within the NRF's Environment and Comparison of Interdisciplinary Convergence Research Support Projects. *Journal of the Korean Association for Policy Sciences, 15*(1), 151-177.

Kim, E. J., & Lee, S. Y. (2018). A Study on the Experience and Satisfaction Level of Interdisciplinary Convergence Research Project Research Team. *The Asia-Pacific Journal of Multimedia Services Convergent with Art, Humanities, and Sociology, 8*(1), 33-50.

Kim, H. Y., Choi, M. Y., & Jung, S. Y. (2015). A Study on the Interdisciplinary Research Performance Results of Government R&D Projects. *Korea Technology Innovation Society's Academic Conference*, 165-173.

Kim, Y. R. (2015). A Study on Improving Support Through the Analysis of Convergence Research Results by Project. *The National Research Foundation of Korea.*

Kyung, J. W. (2012). *A Study on the Factors Affecting Government Roles on the Convergence Research's Effectiveness*. Ph. D diss. University of Seoul.

Lattuca, L. R. (2001). *Creating interdisciplinarity: Interdisciplinary research and teaching among college and university faculty*. Vanderbilt university press.

Lee Y. B. (2016). Improvement of Convergence Research Evaluation System for Supporting Excellent Convergence Research Project. Policy Study-2016-14-Cultural Convergence.

Lee, K. H., Kim, S. H., Choi, J. H., Seo, J. Y., Kang, J. H., & Lee, A. J. (2013). Survey of Convergence Research Project and the Characteristics of Research and Development. Science and Technology Policy Institute. Policy Study 2013-09.

Marts, S. A. (2002). Interdisciplinary research is key to understanding sex differences: report from the Society for Women's Health Research Meeting on understanding the biology of sex differences. *Journal of women's health &gender-based medicine, 11*(6), 501-509.

Ministry of Education. (2017). *The 2017 Ministry of Education's Academic Research Support Project*

Performance Analysis Report. Daejeon: The National Research Foundation of Korea.

Ministry of Science and ICT. (2017). *The 2017 Ministry of Science and ITC's Academic Research Support Project Performance Analysis Report*. Daejeon: The National Research Foundation of Korea.

Ministry of Science and ICT. (2018). *The 2016 National R&D Project Performance Analysis Report*. Seoul: Korea Institute of Science and Technology Evaluation and Planning.

Shinn, M. (2006). External, not internal challenges to interdisciplinary research. *American journal of community psychology, 38*(1-2), 303-309.

Song, W. J. (2010). *Need and Challenges of Science and Technology and Humanities and Social Science Convergence Research*. Seoul: STEPI Insight 47.

Thompson, J. L. (2012). *Interdisciplinary research team dynamics: A systems approach to understanding communication and collaboration in complex teams*. AV Akademikerverlag.