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A Study on the Prioritization of Policy for Gendered Innovations

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Abstract Gendered innovation in Science, Technology and Innovation, which seeks better science for both men and women by integrating sex and gender analysis, has become an important issue in the entire process of STI, as initiated by the European Commission, Canadian Institutes of Health Research in Canada and the National Institutes of Health in the United States. Korea has also attempted to reflect gendered innovations in Science and Technology as a critical factor in the 3rd and 4th National Plan, followed by the Act on Women Scientists and Engineers (2002). Against this background, the aim of this study is to prioritize the policy instruments regarding gendered innovation in Research and Development. Through the Focus Group Interview (FGI) and the Analytic Hierarchy Process (AHP), this study attempts to set the priority among selected criteria, various types of policy instruments, and the applied research development area. As a result, this study shows the preparation of the relevant legal and institutional mechanisms for the full introduction of gendered innovation in S&T, and the importance of various policy instruments for S&T innovation in the fields of planning, budgeting, managing national R&D projects, evaluating and impact assessment, etc., being derived in a systematic way to ensure their effectiveness.

Keywords Gendered innovations in science and technology, STI, R&D, science policy, AHP

I. Introduction

The present study investigates the establishment of optimal priorities in incorporating gendered innovation in science, technology, and innovation (STI) and research and development (R&D) with respect to South Korea's political and legal background. Application of gendered innovations has demonstrated improved outcomes in all phases of basic and applied research by considering

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how gender and sex affect how research is designed and conducted (Schiebinger and Klinge, 2013). As is evident from the trends in advanced countries and various scientific evidence, the introduction and implementation of gendered innovations in science and technology (S&T) research is important.

However, the reality is that research planning and management and R&D policy departments are delaying the introduction of systems to each other's modus operandi. In the course of changing the R&D preliminary feasibility study method from 'economic feasibility' to 'technological policy feasibility' that reflects research and development characteristics, 'gendered innovation' issues should be introduced to determine the important differences in R&D. The perception of professional organizations is that 'long-term tasks' or 'those not related to goals' will eventually become 'system failures' without the 'reflection of policy instruments and laws.' Researchers in STI, as well as experts in economics and social policy, were interviewed by focus group to establish a list of priorities when adopting S&T gendered innovations. After compiling the responses gathered from the interviews, urgency, effectiveness, efficiency, and feasibility were chosen as the four criteria in the adoption of S&T gendered innovations. In addition, a hierarchy of policy tools was created in targeting the adoption and evaluation of S&T gendered innovations.

In addition, under the National S&T Standard Classification system, national R&D projects categories as well as national R&D project, planning, management, and evaluation content were selected. And then, this study conducted an Analytic Hierarchy Process (AHP) using a pool of STI experts, R&D researchers, and policy and institutional experts to derive priority criteria. The results of this study are expected to be referenced and implemented in future amendments to current S&T law.

If the findings are reflected in the S&T policy instrument, and the legal and institutional improvements are implemented, it is also expected that the scientific quality and societal relevance of the produced knowledge will not only maximize the efficiency of the STI by stimulating and promoting gender equality, but also trigger new industry and new product innovations that respond much more rapidly to the fourth industrial revolution.

II. Research Background: Gendered Innovations

1. STI Policy Harnessing Gendered Innovations

Gendered innovations provide a tool to examine the bias originating from differences in sex and gender and its effect on the process of fundamental and advanced R&D (Schiebinger and Klinge, 2013). Considering that such factors

promote novel ideas and enhance the quality of R&D. This results in a dramatic overall change in S&T.

In particular, the European Commission has initiated gendered innovations in science research since the publication of the report 'Gendered Innovations: How Gender Analysis Contributes to Research'. One of the highlights of the report is the following: "Thirty years of research have revealed that sex and gender bias is socially harmful and expensive. Gender bias also leads to missed market opportunities. In engineering, for example, assuming a male default can produce errors in machine translation. In basic research, failing to use appropriate samples of male and female cells, tissues, and animals yields faulty results. In medicine, recognizing osteoporosis as a female disease delays diagnosis and treatment in men. In city planning, not collecting data on care giving work leads to inefficient transportation systems" (Schiebinger and Klinge, 2013).

Based on this research evidence, the European Union's Framework Program for Research and Innovation (Horizon, 2013) requires the submission of research plans that reflect the elements of gender dimension, which means integrating sex and gender analysis into research and gender equality into research and innovation content. The National Institutes of Health (2016) in the U.S. announced the implementation of the 'Policy on Sex as a Biological Variables' in 2016 and provides guidelines for researchers, while the Canadian Institutes of Health Research (2019) also requires sex and gender analysis in health research. In addition, the gendered innovation team at Stanford University is actively conducting systematic analysis and case studies of gendered innovations in the field of science, engineering, health & medicine, and environment (Schiebinger et al., 2018).

It is worth mentioning that the Global Research Council, a virtual organization comprised of the worldwide heads of science and engineering funding agencies, recommended as part of a series of efforts harnessing gendered innovations in research that 'the integration of the gender dimension in research design and in the analysis of research outcomes' should be one of the two aspects of the equality and status of women in research (Global Research Council, 2017).

2. Why Are Gendered Innovations Necessary?

R&D costs public money: "Doing research wrong costs lives and money. For example, between 1997 and 2000, 10 drugs were withdrawn from the U.S. market because of life-threatening health effects. Eight of these posed greater health risks for women than for men (GAO, 2001; Schiebinger et al., 2018).

Not only in this drug case, but also in many that followed, case studies on gendered innovations showed that S&T developed mostly by men and tested on men is not gender neutral and has produced many gender knowledge gaps,

which may further reproduce or even amplify the gender data gap. For example, commercial face recognition algorithms work better for men and some voice recognition algorithms do not recognize women's voices well.

A recruit algorithm developed by Amazon had to be withdrawn because of gender bias. These have skewed the gender data gap and, together with both conscious and unconscious bias, may result in socioeconomic obstacles to the fourth industrial revolution. Many cases have proven that gendered innovations add value to science and engineering research by ensuring excellence, quality outcomes, and sustain ability. Gendered innovations add value both to society by making research more responsive to social needs and to business by developing new ideas, patents, and technology (Schiebinger and Klinge, 2013).

To generate value through gendered innovations, securing institutional and political support is imperative.As gendered innovations aim to broaden the beneficiaries of science and engineering, which in turn seek to advance the human condition, there is a continuing interest for research into gendered innovations. Consequently, there is a growing need to promote a policy instrument of gendered innovations in South Korea by revising existing legislation to facilitate the growth of a new market and R&D that involve people-centered studies in a responsible manner.

Numerous countries, such as the U.S., has demonstrated that promoting a policy of research and development of gendered innovations necessitates support of the research integrating the gender dimension to avoid a potential future trade barrier through innovative development, especially in the bio industry and the world class research into sex and gender characteristics.

Therefore, establishing a sustainable support system by revising the current one is key to achieving gendered innovations that reflect the promotion of 3rd and 4th National Plan on Women in Scientists and Engineers.

3. Selected Cases That Exemplify Gendered Innovations

To integrate the gender dimension into research, it is crucially important to identify existing sex and gender bias as well as unconscious bias. It is also crucial to understand how these biases operate in S&T development (Schiebinger and Klinge, 2013). A thorough examination of the case study of gendered innovations exemplifies how integrating the gender dimension results in gendered innovations in the different fields of study. The field of basic science encompasses health and biomedical study, conceptual and theoretical review on the genetics of sex determination and gender analysis of cases of stem cell research. In addition, in the case of heart disease, novel treatments and diagnosing methods have been developed for men by recognizing their proclivity to excessive smoking and drinking habits as a disease. Another leap

in this case is that the gender knowledge gap was reduced and new treatment was developed by recognizing the differences between men and women.

In osteoporosis, rethinking standards and reference models for new diagnostics and treatment were created for men. Regardless of consideration for gender difference, the same study found that the likelihood of late diagnosis and mortality rate was both higher for women than men, which can be attributed to the male-oriented nature of current treatments. In a rapidly aging society, integrating the gender dimension into assistive technologies including smart robots for the elderly will create a new market and value to support independent living for both older men and women. Research shows that application of gendered innovations is on the rise in the study of engineering field in general. Algorithms may contain significant gender bias not only from the existing gender data gap, but also in the process of machine learning. Google translate has a masculine default and therefore overuses male pronouns (he, him) even where the text refers to a woman (Schiebinger et al., 2018).

However, Naver machine translation Papago uses masculine pronouns (he or him) for doctors, CEOs, and leaders, but female pronouns (she or her) for nurses, secretaries, and housekeepers. This unconscious gender bias in algorithms amplifies gender inequality. How to develop more accountable artificial intelligence that enhances social justice is a significant challenge. In the environment research field, one study investigated climate change through an element analysis that incorporates gender and gender analysis, while another is a case study of substances of environmental chemistry in health and biomedical research. There is also a case highlighting the necessity of gender factor analysis in urban planning research (Schiebinger and Klinge, 2013).

III. Research Method: Procedure of FGI and AHP

This study derives a hierarchy of criteria that considers policy instruments, system, and contents of a system through FGIs. Via the implementation of experts' conference regarding various deduced policy instrument types, supporting policies and standard of setting priority and screening, the standard of establishment and policy instruments were arrived at through AHP survey. Through expert interviews with FGI, the feasibility of the evaluation standard was examined based on the proposal of research staff. After examining the suitability of the analysis process, and performing questionnaires, procedure, subject of application, and the application propriety of the AHP method was designed. First and foremost, items regarding a classification method and confirmation of policy instruments of science technology/institution/project were identified for the priority derivation of legal system improvement

regarding the gendered innovations of S&T among related policy research. Second, various issues were examined for priority derivation through application of the AHP method. Third, there was a determination of the target application of AHP. Fourth, there was an application procedure of the AHP method. There were 15 participants in the FGI, consisting of five chiefs of research and participating researchers and ten experts in the field of the S&T of gendered innovations. In FGI, the facts about the standard setting regarding the 'economic, social and cultural ripple effect' that were emphasized in the research plan was examined. As a result, the priority-setting criteria were derived and target policy instruments for the AHP survey were established.

1. Feasibility of Applying AHP Method

AHP helps to reach the final decision-making by integrating the opinions of group members. Thus, the final decision is affected by which type of member is selected in a group. The targets for investigation of AHP analysis should satisfy the two following conditions.

First, they must be knowledgeable about their respective field as well as the specific content of the research, satisfy the requirements to achieve the goals and objective detailed by the research, and should be in a position where they can rationally and objectively predict the ripple effect of the research. Secondly, it should have enough validity to conduct an AHP survey in the aspect of enhanced economic and social contribution of science and technology due to the law institution improvement of research development, pertaining to the qualities of S&T gendered innovations.

Table 1 Application in AHP survey

Classification	Category/ Field	Number
AHP method	Researcher/ Researcher of gendered innovations	10
	Policy expert/ Legalization expert	10
	Women studies related/ Various classes, women's organizations, researchers of women studies	5
	Total	25

2. Application in AHP Survey

The law institution improvement related topic for the S&T of gendered innovations was divided into three groups listed in Table 1. The first group was

composed of 10 researchers who have a deeper understanding of gendered innovations and are acquainted with gendered innovations-related researchers of science, technology, and engineering. The second group was composed of 10 legislation and policy experts on the 'Framework Act on Science and Technology.' The last group did not belong to any grouping, whereby they could be affected if the research is applied so that 25 participants in total from various classes and five related experts were selected as targets for the AHP survey. Overall, the subject group consisted of experts on policy instruments and institutions, STI experts, and R&D experts. It was possible for research targets to select priority for law institution improvement by considering the economic, social, and cultural ripple effect and the urgency for the improvement of the legal system in relation to research and development for gendered innovations of S&T for the AHP analysis. It was set up to reflect the opinion of the research targets while maintaining the priorities of R&D investment and the legal system that the related congressional committee promotes, in compliance with the guiding philosophy of government that supposedly supports the S&T policy.

3. Application Procedure of AHP Method

Firstly, the requirements were clarified by defining the research topic and the social issue at hand. Secondly, a hierarchy was constructed using all the criteria related to the focus of the study from the highest goal to the alternatives at the lowest level through selection and evaluation. Third, the relative importance of the subordinate evaluation criteria on the high level was established in the comparison matrix by conducting the evaluation items based on the middle item.

Fourth, the consistency of a response was examined after assigning an estimate relative weight in each evaluation item from comparison matrices in a previous step. If deemed inconsistent, the comparison result was re-examined by using the Consistency Ratio (CR) for measurement scale of response consistency. Although it can vary depending on hierarchy, in general, the coherence problem was re-examined in the event a rate exceeded 20%, and deemed unproblematic if the CR was lower than 10%. The process above can be described in detail as follows:

After reviewing the base information with an expert and an advisory conference, the brain-storming proceeded. Based on information through brainstorming, the FGI was conducted. Subsequently, the policy alternative, the AHP standard for the improvement of the legal system of the S&T of gendered innovations was examined.

4. Analysis Process and AHP Questionnaire Design

The questionnaire was designed based on the selection criteria and utilized the nine-point general measurement in the AHP. The first important consideration in the questionnaire is ensuring the respondents comprehend the contents and respond according to the established intent by defining terms. Secondly, it is essential to understand the structure of hierarchy layers in a clear manner. To accomplish this objective, an illustration that indicates the structure of hierarchy was included at the top of each page. Third, an attempt was made to make the responders recognize with clarity that relative importance is evaluated based on the use of the ratio scale in the case of AHP analysis. This research consisted of an AHP analysis program based on the web and addressing all the respondents; 23 respondents met the verification criteria of validity whereby the ratio of consistency was less than 0.1. When the consistency ratio exceeds 0.01, the judgments often required reexamination (Saaty, 1987). The result of each analysis is as follows: the priority outcome of the law institution improvement plan for the S&T of gendered innovations that the AHP method applied.

IV. Research Outcome

1. Outcome of the AHP Method for Priority Derivation

Table 2 is the criteria of the AHP method for priority derivation. They are urgency, effectiveness, efficiency and feasibility.

Table 3 shows the priorities and the weight in each policy instrument of the evaluation index. Urgency was evaluated as the highest rank, followed by effectiveness, efficiency, and feasibility.

Table 2 Criteria on selection and assessing policy

Criteria	Urgency	Effectiveness	Efficiency	Feasibility
Assessment criteria of policy	If the result of the policy satisfies the value, priority, and demand of the group in a proper timing	How much was achieved by the result or the valuable outcome. To what extent the achievement of the result resolved the problem	What degree of effort is required to reach a high achievement of the result?	If the policy cost and benefit between two groups is evenly distributed. If the desirable outcome is useful and valuable. If the process is based on the agreement between interest groups or citizens.
Researcher (chronological order)	Dunn (1994), Ammons (2014)	Dunn (1994), Ammons (2014)	Dunn (1994), Ammons (2014)	Dunn (1994), Ammons (2014), Leach et al. (2002)

Table 3 Priorities and the weight in each evaluation index

Criteria	Urgency	Effectiveness	Efficiency	Feasibility
Weight	0.36	0.31	0.12	0.21

Note: C.R.= 0.00129

2. Comparing and Contrasting the Application with Priorities

2.1 Selection of Subject Application

Table 4 Table type styles

A. Policy Instruments of Science and Technology	Alternatives that the aspect of gendered innovations or relative project should reflect when the planning of policy of science and technology is carried forward
B. National S&T Standard Classification System	Alternatives by types of national project R&D that the aspect of gendered innovations of science technology should reflect when a national R&D project is selected and supported
C. R&D Planning and Assessment scheme	Alternatives regarding the contents that should be examined by reflecting on the aspect of gendered innovations science technology when the planning, management, and assessment scheme of national R&D projects are conducted

2.2 Priority Application of Gendered Innovations

Table 5 shows how the weighting of priority application of gendered innovations of S&T was selected. S&T policy instruments were selected as the highest ranking followed by contents of planning assessment and R&D classification in that order.

Table 5 Application subject of priorities in gendered innovation

Criteria	Urgency 0.36	Effectiveness 0.31	Efficiency 0.12	Feasibility 0.21	Priority list
-Policy Instruments -R&D Classification	0.52	0.53	0.37	0.43	0.49
-Contents of the Planning	0.22	0.22	0.30	0.27	0.24
assessment	0.26	0.25	0.33	0.30	0.27

Table 6 Examples of policy instruments and contents

Classification	Examples of policy instruments	Contents
A) Reflection of planning and system	① Basic planning, manpower training planning establishment	- Establishment of basic planning of national S&T basic policy in which gendered innovations are reflected. (annual plan included) - Establishment of training plan of national S&T manpower in which gendered innovations are reflected (annual plan included)
	② Impact assessment system introduction and management	- Impact assessment system introduction and management in the major field of S&T of gendered innovation
B) Reflection of national R&D management	③ R&D budget advanced mediation	- Reflection on budget of advanced mediation of national research development
	④ Investigation/ analysis / assessment/ reflection	- Reflection on project of investigation/ analysis/ assessment of national R&D project system
	⑤ Research planning guide, reflection on assessment	- Reflection on planning guide of national R&D project system
		- Implementation of result assessment of gendered innovation in the follow up evaluation of the national R&D project system
C) Enhancement of support system	⑥ Exclusive R&D, reflection of human resources training project budget	-Exclusive support of budget installation and management of gendered innovation
		- Budget assignment that the aspect of gendered innovation is reflected in the human resources training project
	⑦ Reflection of system, purchase, and auction	- Reflection on the aspect of gendered innovation on the bidding contract system of the government purchase system
	⑧ Reflection on national standard	- Reflection of the aspect of gendered innovation on the national standard
D) Support of institution building	⑨ Complete charge department, BH secretary installation	- Installation and management of exclusive department or office of science and technology innovation, Ministry of Gender Equality and Family and Ministry of Science and ICT
		- Installation and management of exclusive secretary of gendered innovation in BH
	⑩ General service division/ research institution	- Installation and management of supportive research institution of gendered innovations
	⑪Appearance / direction management of institution, reflection of management assessment	- Government appearance research institution and the Ministry of Information and Communication technology by direct organization reflection on management assessment and legislation trend of items that forces the reflection of the aspect of gendered innovations under management

Note: Basis: the third Korean National S&T Basic Policy

2.3 Priority List by Types of Policy Instrument

The support system enhancement was selected as the highest ranking in the priority list by types of policy instrument, followed by planning & reflective system, national R&D management, and institution building support in that order.

Table 7 Priority list by types of policy mean

Criteria	Urgency	Effectiveness	Efficiency	Feasibility	Priority list
-Reflection of planning and system	0.31	0.35	0.32	0.27	0.32
-Reflection of national R&D management	0.20	0.19	0.25	0.25	0.21
- Enhancement of support system	0.37	0.32	0.31	0.33	0.34
- Support of institution building	0.12	0.14	0.12	0.15	0.13

2.4 Priority Lists by Type of Detailed Policy Instruments

a) Priority list reflection of planning and system

In the priority list reflection of planning and system, vision planning establishment was selected as the highest ranking followed by impact assessment system.

Table 8 Planning and reflective system on priority ranking

Criteria	Urgency	Effectiveness	Efficiency	Feasibility	Priority lists
- Vision planning establishment	0.53	0.58	0.52	0.58	0.56
- Impact assessment system introduction and management	0.47	0.42	0.48	0.41	0.44

b) Reflective priority list of national R&D management

In the reflective priority list of national R&D management, R&D advanced mediation was selected as the highest ranking followed by reflective planning assessment and R&D in that order.

Table 9 Reflective priority lists of national R&D management

Criteria	Urgency	Effectiveness	Efficiency	Feasibility	Priority list
-R&D advanced mediation	0.37	0.43	0.47	0.42	0.41
-R&D Investigation/ analysis / assessment/	0.22	0.20	0.20	0.21	0.21
-Reflection of assessment planning	0.41	0.37	0.33	0.37	0.38

c) Priority of voluntary system enhancement

As a priority list of supportive system enhancement, exclusive budget installation was selected as the highest ranking, followed by purchase system and national standard system in that order.

Table 10 Priority list of support system enhancement

Criteria	Urgency	Effectiveness	Efficiency	Feasibility	Priority list
-Exclusive budget installation	0.56	0.59	0.60	0.62	0.06
-Purchase system	0.15	0.16	0.16	0.18	0.04
-National standard system	0.29	0.25	0.24	0.20	0.03

d) Priority list of institution-building support

In the priority list of institution-building support, modification mechanism was selected as the highest ranking and specialized institutional management and institutional management assessment followed in that order.

Table 11 Priority list in institution building support

Criteria	Urgency	Effectiveness	Efficiency	Feasibility	Priority list
-Modification mechanism	0.45	0.47	0.45	0.42	0.45
-Specialized institution management	0.31	0.33	0.34	0.33	0.33
-Institution management assessment	0.24	0.20	0.21	0.25	0.22

e) Priority list by types of detailed 11 policy instruments

Table 12 shows the selection of the priority list by types of detailed 11 policy instruments. Specialists recognized the exclusive budget installation as the most significant criterion, and vision planning establishment, effect evaluation, R&D institution building evaluation, national standard system, planning evaluation reflection, modification mechanism, R&D and institution management evaluation were selected in that order.

Table 12 Priority list by types of detailed policy instruments

Criteria	Urgency	Effectiveness	Efficiency	Feasibility	Average	Priority list
Vision planning establishment	0.53	0.58	0.52	0.58	0.18	2
Impact Assessment	0.47	0.42	0.48	0.41	0.14	3
R&D advanced mediation	0.37	0.43	0.47	0.42	0.09	4
R&D	0.22	0.20	0.20	0.21	0.04	9
Reflective assessment and planning	0.41	0.37	0.33	0.37	0.08	6
Exclusive budget installation	0.56	0.59	0.60	0.62	0.20	1
Purchase contract system	0.15	0.16	0.16	0.18	0.05	8
National standard system	0.29	0.25	0.24	0.20	0.08	5
Modification mechanism	0.45	0.47	0.45	0.42	0.06	7
Specialized agency management	0.31	0.33	0.34	0.33	0.04	10
Organization performance evaluation	0.24	0.20	0.21	0.25	0.03	11

f) National S&T of standard classification system

The National S&T of standard classification system was legislated on the legal basis as a standard measure of classification regarding the overall field of S&T to be utilized in common for the efficient planning and management of the national R&D project system, the efficiency of human resource management in S&T, and the distribution of information in relation to S&T. Therefore, revisions are implemented annually as well as every five years.

The legal basis (Framework Act on Science and Technology Article 27) details that contents about managing the department (Ministry of Science and ICT) as well as management and establishment regarding the National S&T standard classification system (The Framework Act on Science and Technology Enforcement Degree, paragraph 6 of Article 41), and the contents about exclusive institution (Korea Institution of Science Technology Planning and Evaluation), are to be supplemented and updated every five years.

2.5 Priority List by Field of R&D Project

Table 13 Field of performance of national S&T classification

National Science Technology of Standard Classification System			AHP classification
Hierarchical classification	Subdivision		Higher layer
Nature	NA	Math	Natural sciences
	NB	Physics	
	NC	Chemistry	
	ND	Earth Science / Atmosphere/ Ocean Astronomy	
Artifact	EA	Machine	Engineering Science
	EB	Material	
	EC	Chemical Engineering	
	ED	Electric/ Electronic	
	EE	Information and Communication	
	EF	Energy / Resource	
	EG	Nuclear Energy	
	EH	Environment	
	EI	Construction/ Transportation	
Biotechnology	LA	Life science	Biotechnology / brain science
	LB	Food, Agriculture, Forestry and Fisheries	
	LC	Health and Medical Treatment	
Human Science and Technology	OA	Brain Science	
	OB	Recognition/ Emotional Science	
	OC	Society of Humanity and Science Technology	Humanity / Society / Art/ Fusion
Human	HA	History/ Archeology	
	HB	Philosophy/ religion	
	HC	Language	
	HD	Literature	
	HE	Culture /	
Society	SA	Law	
	SB	Politics/ Administration	
	SC	Economy/ management	
	SD	Society/ Humanity/ Welfare/ Women	
	SE	Life	
	SF	Geography/ Region/ Tourism	
	SG	Psychology	
	SH	Education	
	SI	Media/ Communication/ Information	
Temporary	OX	Human resource/ Infrastructure	Human resource/ Infrastructure

a) Priority list in the National S&T standard classification

Table 14 shows the selection of priority lists in the field of National S&T standard classification system. Specialists selected the biotechnology/brain science as the most important factor, followed by engineering, infrastructure, natural science and Humanity/Society/Art/Fusion in that order.

Table 14 Priority list in National S&T standard classification

Criteria	Urgency	Effectiveness	Efficiency	Feasibility	Priority lists
-Natural science	0.14	0.13	0.17	0.17	0.15
-Engineering	0.20	0.19	0.23	0.19	0.20
-Biomedical brain science	0.38	0.39	0.33	0.35	0.37
-Society of humanity and convergence in arts	0.12	0.12	0.11	0.12	0.12
-Personnel infrastructure	0.16	0.17	0.16	0.17	0.17

b) Priority list in the National R&D projects

For a systematic research plan, technology assessment in a broad meaning is required. Although it was divided into seven planning and evaluation contents (Park, 1996), the FGI process was reclassified into four types in consideration of feasibility and effectiveness.

Table 15 Selection of planning contents in national R&D project

Assessment by types of technology	Contents of assessment
Technology Environment Assessment	- General environment (politics, economy, society and culture) - S&T environment - Technology development and technology strategy
Technology Status Assessment	- Condition and trend of technology - Technology maturity
Technology Needs Assessment	-Application field of technology / understanding of market scale -The world and domestic market size and estimation of growth
Technology Performance & Impact Assessment	- Technological/economical assessment of the relevant technology - Overall impact assessment regarding the relevant technology

Note: Basis: modified based on the leading technology development project of technology assessment (Park, 1996)

Table 16 shows the selection of the priority list of planning contents of national R&D project. Specialists selected the Technology needs assessment as the most important element and technology environment assessment and Technology performance and Impact Assessment as the union priority; the present Technology Status Assessment was selected as the last. The result shows the importance of integrating Gendered Innovations perspectives into all processes of the national R&D project.

Table 16 Priority list in national R&D project

Criteria	Urgency	Effectiveness	Efficiency	Feasibility	Priority list
-Technology Environment Assessment	0.28	0.23	0.22	0.22	0.24
-Technology Status Assessment	0.19	0.24	0.22	0.26	0.22
-Technology Needs Assessment	0.28	0.29	0.33	0.28	0.30
-Technology Performance & Impact Assessment	0.25	0.24	0.23	0.24	0.24

IV. Conclusion

1. Implications for Legal System of Gendered Innovations

The ratifications of legislations that mandate gendered innovations in S&T are expected to lead to the creation of an interagency dedicated to sustainable gendered innovations.

The global issue of S&T should be utilized in the aspect of knowledge creation and the contents of research innovation, including the overall agenda.

The legal system should be modified to accommodate research to enable the proliferation of gendered innovations, and both the aspect of gendered innovations in legal system and the R&D project that is not actually connected to the national R&D management system should become institutionalized.

2. Implications of Employing S&T Policy Instrument

According to the international society's obligation the gender analysis in the field of S&T research, global competition and a precise National S&T standard classification system is required, whereby gendered innovations are reflected in the related policy instrument, and improvements to the management of R&D is

expected as well. Furthermore, the management of R&D and policy instruments of S&T should be developed hand in hand in order to ensure compatibility when disseminating development guidelines and gendered innovations of research/ development/evaluation that requires gender analysis in the activity of research development in the field of S&T. And research on gendered dimension has a very important position in term of responsible research and innovation. However, this area is still in an early stage in Korea and requires more research and development in the future (Hwangbo, 2019).

The gendered innovations of S&T are expected to encourage competition within policy research and social proliferation regarding the necessity of gender analysis in the field of S&T, which will inevitably lead to the improvement of policy instruments. Furthermore, the gendered innovation with technology and its social filters such as policy, law, and design, provides us with an opportunity to understand better how technology both amplifies and alters social relations.

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