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The Evolution of Korea's Basic Acts on Science and Technology and their Characteristics

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Abstract This study examined the evolution of S&T Basic Acts in Korea from the Science and Technology Promotion Act (1967) through the Special Act on STI (1997) to the Framework Act on Science and Technology (2001) in the following aspects: 1) comprehensive plans, 2) coordination mechanisms for S&T policies, 3) enforcement of R&D programs and performance diffusion, 4) promotion of human resources, 5) and S&T investment and budgeting. Before the Framework Act on S&T was enacted in 2001, critical issues were found in establishing S&T master plans, promotion of R&D programs, comprehensive coordination mechanisms, and R&D budgeting. The three Basic Acts have expanded the scope of regulation over time to cover the entire cycle of the S&T process. They concern a wide range of issues, including creating a basis for scientific and technological development, S&T promotion, disseminating and commercializing research outcomes, and preventing adverse effects from science and technology. The content of the Basic Acts has evolved in response to changes in the political, economic, and social environment of Korean industry during the past five decades.

Keywords Basic Acts on S&T, Framework Act on S&T, Special Act on STI, S&T Promotion Act, S&T Basic Plan, National Council on S&T, S&T Master Plan

I. Introduction

The legislative and regulatory framework for Korea's science and technology (S&T) involves interactions among various factors: Plans on S&T, the Basic Acts on S&T, Technological Regulations that ministries stipulate to implement STI policies in their relevant sectors, and Functional Regulations that stipulate the institutional foundation to promote S&T, including performance

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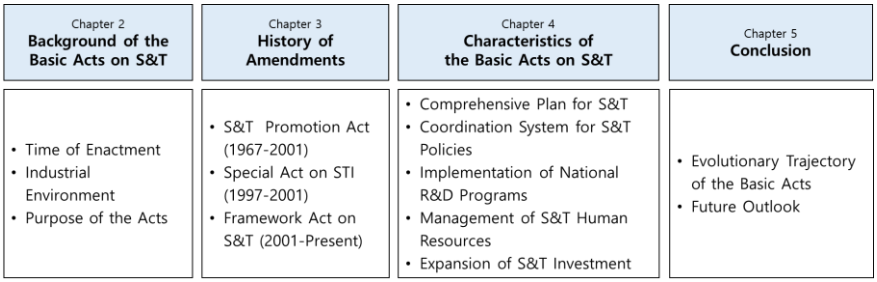
management, safety regulations, and human resources building (Yoon, 2012; 890). Among these factors, the Basic Acts are particularly significant. They play a central role in navigating the direction and implementation of national S&T policies, the systemization of S&T plans and institutions, and the continuation and alignment of S&T policies. The Korean government enacted the first basic act to implement S&T policies, the "S&T Promotion Act," which came into force in 1967, was wholly amended in 1991 and was subsequently abolished in 2001. Recognizing the constraints of the S&T Promotion Act in systemically responding to the changing S&T environment, the Korean government attempted to enact a new Act prior to other S&T regulations, which could increase the effectiveness of its enforcement. National S&T innovation (STI) policies are mainly formed through legislative processes rooted in laws on science and technology and their implementation. The Special Act on STI in 1997 was the outcome of these efforts, but the Special Act, with a five-year expiration, was enforced in parallel with the S&T Promotion Act. The new Framework Act on S&T was enacted in 2001 to reflect future-oriented regulatory demands and to lay out a new direction and philosophy for long-term national S&T policies for a knowledge-based information society. The Framework Act on S&T (2001) was enacted as the new legislative framework succeeding both the S&T Promotion Act (1967) and the Special Act on STI (1997). As a consequence, the two prior Acts were abolished. The Framework Act on S&T has subsequently been refined thirty-three times by amendments, including most recently in 2021.

This paper reviews how Korea's S&T legislative framework has evolved as of 2021 from the S&T Promotion Act (1967) through the Special Act on STI (1997) to the Framework Act on S&T (2001), and analyzes its characteristics. This study aims to provide significant implications both in the legislative evolution aspect and in the aspect of the establishment of new regulatory policies on S&T. With respect to the three Basic Acts, the subjects of this study include the enacted and amended articles, the rationales of the enactments and amendments, and the evolution of the legal texts. The study subjects reflect previous research on Korea's laws and regulations, which has mainly focused on ensuring consistency and linkages between S&T laws and regulations (Song, 1994; Lee et al., 2006; Yoon et al., 2012; Yang et al., 2012; Yang et al., 2017). In addition, Lee (1996) and other scholars (Oh, 1999; Lee, 2000; Yoo, 2019) researched controversial issues in the legislation and amendments of the three individual laws.

Regarding the structure of the study, Chapter 2 reviews the background to the legislation of the Basic Acts on S&T. Chapter 3 examines significant amendments in the Basic Acts through time. Based on the results, Chapter 4 further analyzes major characteristics found in the evolution of the Basic Acts on S&T. Finally, Chapter 5 summarizes the outcomes of the Basic Acts.



Source: Authors

Figure 1 Structure of the Study

II. Background of the Basic Acts on Science and Technology

The Korean government's first Basic Act on S&T was the S&T Promotion Act (1967). Enacted in 1997, the Special Act on STI that was temporarily enforced for 5-years had a status equivalent to the Basic Act. Later, the S&T Promotion Act and the Special Act on STI were replaced by the Framework Act on S&T in 2001, which has been in force until today.

In the 1950s, the role of R&D was insignificant as Korea's industrial structure relied on labor-intensive industries based on low labor costs. As technologies were transferred from advanced countries during the period of economic development in the 1960s, the Korean government realized the need to have a certain level of technology to absorb and improve the transferred technologies. Recognizing the importance of industrial R&D, the Korean government began to pay more attention to R&D investment. In the late 1960s, the increased level of technologies required for economic development in chemical engineering, steel, and mechanical engineering demonstrated the need for S&T promotion at the government level. The Korean government established its S&T administration system after founding the Korea Institute of Science and Technology (KIST) in 1966. To support these initiatives, the S&T Promotion Act was enacted in January 1967 (Ministry of Science and Technology, 2008:28-41). Article 1 of the S&T Promotion Act states that "the Act aims to contribute to the industrial development and stabilization and improvement of lives of Korean people by stipulating matters relevant to the establishment of comprehensive basic policies and master plans, the establishment of systems for their implementation, and the derivation of financial measures." With the enactment of the S&T Promotion Act, the Korean government became equipped with an administrative as well as an institutional system to support national S&T policies.

The implementation system for national R&D programs in Korea was diversified in the late 1980s into various S&T-related ministries such as the Ministry of Industry, the Ministry of ICT and the Ministry of S&T, and national R&D programs were distributed across various ministries. In the 1990s, there was a growing understanding that the Korean government should pursue S&T policies with a post-catch-up national innovation system transformed from the previous chase-and-imitate innovation system. As it entered the 1990s, the Korean government invested significantly in large-scale national R&D mega-programs. Along with such measures, national R&D programs that were jointly planned and participated in by all ministries were also undertaken. G7 Programs can be taken as examples of national R&D mega-programs, which, in 1992, were planned and pursued by all ministries. Entering the 1990s, innovation activities and technology development emerged as national priorities, and the Korean government increased investment in R&D. However, the implementation of national R&D programs in a distributed manner by related ministries caused inefficiencies in the investment of national R&D programs, including the dispersed capacity of national R&D, and redundant or overlapping investments (Ministry of Science and Technology, 2008:144-145). Along with the increased need for investment in S&T, restructuring the S&T coordination system to address these issues emerged as a priority. Critics stated that the S&T Promotion Act was not appropriate to pursue S&T policies comprehensively in response to fast-changing environments. As a result, the Special Act on STI was enacted in April 1997. The reform aimed to create institutional measures to implement a comprehensive STI policy by increasing national R&D for the following five years, stimulating the effective utilization of R&D resources and the R&D activities of industries, and enhancing the morale of scientists. Article 1 of the Act states that it aims to contribute to national economic development, and the quality of Korean people's lives, by undertaking special measures for STI.

Despite the contributions brought by the S&T Promotion Act and the Special Act on STI as the Basic Acts for national S&T promotion, issues resurfaced as to their status and roles since the two Acts lacked coordination with ministerial policies or connection with other S&T related laws. Experts expressed that it was necessary to enact a new Act to replace the Special Act on STI. With a limited enforcement period of five years, until June 2002, the Framework Act on S&T was enacted to replace the previous two Acts in January 2001 (Yoon, 2014). The Framework Act on S&T (2001) was legislated in such ways that the nature and effectiveness of science and technology were aligned so that the Act functioned as a norm for national S&T policies. The Act and its subsequent amendments provided the foundations for Korea's S&T policies in the following decades by reflecting new legislative demands from the knowledge-based society of the twenty-first century and the changing national and international

environment in technologies. It was written to be in alignment with other S&T laws while it absorbed some articles from the S&T Promotion Act and the Special Act on S&T (which were abolished) that were necessary for the Framework Act on S&T (Park, 2001:4). Article 1 under the Framework Act on S&T outlined its overall purpose: "The purpose of this Act is to contribute to the national economic development and further to the elevation of quality of citizens' life and the development of human society by creating the basis for the development of science and technology, innovating science and technology, and strengthening the national competitiveness."

III. Evolution of Amendments to the S&T Promotion Act, the Special Act on STI and the Framework Act on S&T

1. Amendments to the S&T Promotion Act

The S&T Promotion Act included fifteen Articles. Article 3 laid out the roles of the government in national S&T promotion, and Article 4 related to the establishment of a Long-term Comprehensive Plan for S&T Promotion and basic policies. Article 5 stipulated provisions for establishing an Advisory Committee on S&T Promotion. Other Articles stipulated provisions on the administrative and financial measures necessary for S&T promotion policies - Articles 6 and 7, for example, on Capacity Building for S&T human resources; Article 8 on establishing S&T and R&D Planning; Article 9 on deploying necessary resources for S&T promotion and economic development; Article 10 on measures for the effective implementation of activities related to foreign technology importation and technology cooperation; Article 11 on matters related to the establishment of an S&T Fund endowed by the government, foreign aid, and individuals; Article 12 on concurrent positions for scientists and engineers; and Article 13 on their rewards; Article 14 on assistance to S&T organizations; and Article 15 on enforcement decrees. The S&T Promotion Act was amended five times before being abolished in 2001. The first amendment was made in March of 1967 due to the change of the administration organization for the Act to Korea's first S&T Ministry. Significant changes in the S&T Promotion Act were made with partial amendments in 1972, and more comprehensive amendments in 1991 as referred to in the following Table 1.

Three major changes can be found in the second amended S&T Promotion Act (1972). First, it stipulated the establishment and function of a General Deliberative Committee on S&T, which was a coordinating body for S&T policies. Second, it added articles for the institutionalization of the system to nurture S&T information organization and the distribution of S&T information.

Third, it provided the background for the establishment of the Science Foundation in order to support universities, research institutes, and companies.

In 1991, the S&T Promotion Act was wholly amended in its fourth amendment. First, it provided policies and measures necessary for S&T promotion. Second, it introduced new legislation and enforcement of technology assessment and technology standards. Third, it attempted to close institutional loopholes and shortcomings, including abolishing a measure for scientists holding concurrent positions and the Advisory Committee on S&T Promotion. The number of articles was also increased from 15 to 19.

Six distinctions can be found in the contents of the wholly amended S&T Promotion Act (1991). First, it aimed to increase the effectiveness of the Comprehensive Plan for S&T Promotion. It stipulated expanding the coverage of the Plan and strengthening ministerial cooperation in the planning of the Comprehensive Plan for S&T Promotion. It also laid out provisions for trend analysis on S&T development to improve the rationality of the Plan. Second, it expanded the roles and the functions of the General Deliberative Committee on S&T. In addition to expanding the scope of the subject matter reviewed by the Committee, the number of committee members was also increased. A co-chairmanship was added, and the Minister for S&T was mandated to act as an administrator. In addition, central and local governments should reflect and implement the decisions made by the General Deliberative Committee on S&T in their relevant S&T plans and programs. They should report implementation plans and outcomes to the Committee. Third, it specified that developing measures to increase S&T investment was the role of the government. Fourth, provisions on the promotion of joint R&D were newly stipulated. It mandated the government to prioritize policies and measures to promote joint R&D in the industry, academia, and the research community through joint utilization of resources such as human resources, facilities, equipment, and funds for R&D. It also laid out new provisions to encourage and facilitate the mutual exchange of scientists and technicians for joint R&D, and to ensure that scientists and engineers who participated in joint R&D should not be subject to any disadvantages in their status and salaries. Fifth, it stipulated that the government should develop policies and measures to help the people improve their understanding and absorptive capacity on science and technology in line with the development of S&T. It also designated a legal entity to undertake and support this task. Lastly, it stipulated provisions about S&T assessment and technology standards. The government should conduct assessments in advance on the expected benefits and side effects that may be caused by new technologies. The government should develop and implement technology standards to undertake the assessments.

Table 1 Major Amendments of the S&T Promotion Act

Category	Major Amendments
First Amendment (March 30, 1967)	• In accordance with the Government Organization Act, changing the administration organization for the S&T Promotion Act from the Economic Planning Board to the Ministry of S&T
Second Amendment (February 18, 1972)	• Founding the General Deliberative Committee on S&T under the supervision of the Prime Minister, which was responsible for developing and coordinating policies and measures for such as the management of S&T information • Establishing the S&T Foundation.
Fourth Amendment (November 22, 1991)	• Improving the effectiveness of the Comprehensive Plan for S&T Promotion and the General Deliberative Committee on S&T • Expanding investment in S&T • Encouraging joint R&D • Improving public awareness of S&T • Legislating S&T evaluation and technology criteria
Fifth Amendment (January 28, 2000)	• Simplifying and improving the efficiency of the operation system for S&T-related funds as a result of integrating S&T Foundation Fund and S&T Culture Fund to the S&T Promotion Fund

Source: The Korean Law Information Center
https://www.law.go.kr/LSW/lsRvsRsnListP.do?lsId=000763&chrClsCd=010202&lsRvsGubun=all (accessed on September 15, 2021)

2. Amendments to the Special Act on STI

Enacted in April of 1997, the Special Act on STI was composed of nineteen Articles. Article 2 laid out the roles and responsibilities of the central government, local governments, universities, and research institutes. Article 3 stipulated the establishment of a Five Year Plan for STI, equivalent to a comprehensive plan on STI policies. Article 4 provided a Ministerial Meeting on S&T to act as a coordinating body for S&T policies. Article 5 mandated the roles of government in expanding the STI budget and increasing the rate of public R&D investment while also laying out provisions regarding policy tools to support national R&D. Article 6 stipulated matters regarding surveillance, analysis, and evaluation of national R&D programs. Article 8 stated matters regarding critical national R&D programs directly selected and supported by the government. Article 9 covered matters on expanding investment in basic research, while Article 11 stated matters related to financial support for joint R&D in collaboration with industries, universities, and research institutes. Article 15 stipulated support for business entities that provide technical advisory service, conduct evaluations on R&D programs, lease equipment necessary for

R&D, and process and sell technical information. Article 10 outlined the promotion of S&T globalization, and Article 11 covered local S&T promotion. Article 13 and 14 mandated matters as to support for technology development by Small and Medium Enterprises (SMEs) and secured loans for technology based on technical evaluations. Article 16 provided tax incentives, while Article 17 stipulated matters for developing policies and measures to create a culture of S&T. Article 19 mandated various matters, including the establishment of the Korea Science Culture Foundation.

The Special Act on STI was amended five times, and underwent two major amendments as referred to in Table 2. The first major amendment was undertaken in February of 1998. As a result of government restructuring, the status of the Ministry of S&T was strengthened. The change gave the Minister for S&T the chairmanship of the Ministerial Meeting on S&T, a primary coordinating body for S&T policies, which served to strengthen the role of the Ministry of S&T. Partial amendments to the Special Act on STI which became effective from January 29, 1999, focused on revising the direction and management of S&T policies and national R&D programs. First, the coordination system for the promotion of S&T was restructured. The President headed the National Council on S&T to review matters, including prioritizing major policies for S&T promotion and national R&D programs and the efficient use of budgets. Second, it restructured the support system for R&D by establishing the Korea Institute of Science & Technology Evaluation and Planning (KISTEP) as an implementing organization with tasks including surveillance of national R&D programs, research planning, evaluation and management, analysis of S&T information, mid- and long-term technology forecasting, and a short-term technology demand survey. Third, it stipulated funding sources to secure R&D investment. A lottery for technology development was permitted to cover funding sources for the S&T Promotion Fund. Lastly, local S&T was promoted by the central government by stipulating matters as to the promotion of S&T at the local level. A Comprehensive Plan for Local S&T Promotion was developed to implement related policies and measures effectively, and it was allowed to create and operate the Local Committee on S&T.

Table 2 Major Amendments of the Special Act on STI

Category	Major Amendments
First Amendment (February 28, 1998)	• Strengthening the status of the Ministry of S&T: upgraded from an agency to a ministry as a result of government organizational restructuring.
Second Amendment (January 29, 1999)	• Strengthening the status of the coordinating body for S&T policies: upgraded from a Ministerial Meeting on S&T to the National Council on S&T. • Stipulating legal grounds for founding the KISTEP to support national R&D programs

Source: The Korean Law Information Center https://www.law.go.kr/LSW/lsRvsRsnListP.do?lsId=000757&chrClsCd=010202&lsRvsGubun=all (accessed on September 15, 2021)

3. Amendments to the Framework Act on S&T

The Framework Act on S&T (2001) took a number of provisions from the Special Act on STI, for example, the establishment of the National Council on S&T, the development of a Five Year Plan for STI, the Comprehensive Plan for Local S&T Promotion, the establishment of KISTEP and the Korea S&T Culture Foundation, and the S&T Promotion Fund. The S&T Promotion Act and the Special Act on STI were each enacted with a single grouping of Articles in one chapter, but the Framework Act on S&T is composed of thirty-three Articles organized under five chapters. Chapter 1 lays out the objective of the Act and its principles, along with the responsibilities and tasks of the government and the research integrity of scientists. As found in Articles 1 to 6, the Framework Act on S&T stipulates matters regarding the establishment of a national innovation system. It also stipulates that S&T policies shall be prioritized when national policies are planned and implemented. The government shall pursue scientific and computerized policies and develop measures enabling the private sector to participate in policymaking.

Chapter 2 of the Framework Act on S&T specifies matters regarding the planning of S&T policy and its implementation system. Articles 7 and 8 under Chapter 2 set out the establishment of the S&T Master Plan and the Comprehensive Plan on Local S&T Promotion. Articles 9 and 10 mandate matters related to establishing the National Council on S&T as a coordinating body for S&T policies. Matters as to the implementation of R&D are enacted in Chapter 3 of the Framework Act on S&T. In Articles 11 through 20, it stipulates matters regarding the implementation and management of national R&D programs, the surveillance, analysis, and evaluation of national R&D programs, science and technology forecasting, impact assessment of technologies,

evaluation of technology levels, the promotion of basic science, support for private sector technology development, the facilitation of joint R&D, the globalization of S&T, cooperation between South Korea and North Korea, and the foundation of KISTEP responsible for the effective support of science and technology policies and R&D programs. Chapter 4 lays out provisions for increasing S&T investment and human resources. Articles 21 and 22 specify the establishment of the S&T Promotion Fund to promote S&T and create an S&T culture. From Article 23 to Article 25, the Act stipulates matters regarding nurturing human resources by prioritizing nurturing and using S&T human resources, women in STEM1, and the identification and education of talented students. Chapter 5 stipulates consolidating the foundation for S&T and creating a suitable environment for innovation.

Since its enactment, the Framework Act on S&T has undergone 33 amendments over 20 years. Thirteen amendments were intended as amendments of other related laws, while twenty other amendments were motivated by revising the Act itself. By October 2021, the Framework Act on S&T had extended its coverage to five chapters and fifty-two Articles. Amendments to the Framework Act were made more frequently than the S&T Promotion Act and the Special Act on STI. The major amendments can be summarized by chapter. The following Table 3 shows the main contents of the amendments to the Framework Act on S&T.

In accordance with Chapter 2 under the Framework Act on S&T stating matters regarding the planning and implementation of S&T policies, major amendments include regulations on the National Council on S&T and the S&T Master Plan. When it comes to the evolution of regulations on the coordinating body for S&T policies, the roles of the National Council on S&T in terms of funding distribution and the coordination of national R&D programs were consolidated through the Fourth (amended in 2004) and the Fifth Amendments (amended in 2005) into the Framework Act on S&T. Following the Eighth Amendment (amended in 2008) to the Framework Act on S&T, the roles of the National Council on S&T were adjusted as a result of the amendments to the Government Organization Act. The evaluation and funding distribution for national R&D programs were moved to the Ministry of Planning and Finance. The Twelfth Amendment (amended in 2010) stipulated that the National Council on S&T shall be supervised under the President as one of the Standing Administrative Commissions. In addition, the Council was further strengthened with expanded functions for the planning and implementation of the S&T Master Plan and the funding distribution, coordination, and evaluation of national R&D programs. Under Chapter 2-2, with the Twelfth Amendment to

1. STEM stands for science, technology, engineering, and mathematics.

the Framework Act on S&T, matters as to the National Council on S&T were newly stipulated. According to the Sixteenth Amendment, effective from March 23, 2013, major roles and responsibilities related to S&T were moved to the Ministry of S&T, and the coordinating body was renamed the National Deliberative Committee on S&T. Subsequently, the Twenty-Sixth Amendment (amended in 2018) stipulated that the National Deliberative Committee on S&T was abolished and integrated into the Presidential Advisory Council on Science & Technology. As a result, provisions on the coordinating body for S&T policies were transferred from the Framework Act on S&T to the Presidential Advisory Council on Science & Technology Act.

The evolution of regulations on the comprehensive plan for S&T can be examined according to the evolution of Amendments to the Framework Act. The Fourth Amendment (amended in 2004) stipulated that directions for industry, human resources, and local technology innovation policies shall be included in the S&T Master Plan, while the subsequent Fifth Amendment (amended in 2005) mandated that the frequency of planning for the Comprehensive Plan on Local S&T Promotion shall be included in the S&T Master Plan. Following the Twenty-first Amendment (amended in 2015), matters as to the implementation plan for the S&T Master Plan, the Comprehensive Plan on Local S&T Promotion, and their outcomes shall be reported to the National Assembly. The Twenty-eighth Amendment (amended in 2019) provided legal grounds for local governments to legislate matters necessary for facilitating local S&T promotion as local ordinances. In newly added Articles under the Thirty-third Amendment, gender issues shall be considered, and matters to upgrade social values shall be included when planning the S&T Master Plan.

In Chapter 3, Implementation of S&T R&D under the Framework Act on S&T, mainly matters related to the implementation of national R&D programs were revised. The Sixth Amendment (amended in 2006) clarified the applicable legal foundations for the evaluation of national R&D programs. A number of new articles on implementing national R&D programs were added in the Eleventh Amendment (amended in 2010). More specifically, the articles provided legal grounds for taking measures to restrict participation in R&D programs for violations of the agreement on the commission and services for national R&D programs; for ownership and royalties from the outcomes of national R&D programs; for safeguarding the outcomes of national R&D programs; for solid linkages between universities and government-funded research institutes; and for the designation of a management organization for R&D-related facilities and equipment. While matters as to the restriction of participation in R&D programs were added, the Seventeenth Amendment, enforced as of May 28, 2014, stipulated new provisions for the protection and security of results from national R&D programs; the diffusion of R&D performance; the commercialization of

technology transfer; support for technology-based startups; identification and nurturing of development engines; the prevention of side-effects from S&T; and promotion for industry-university-research institutes cooperation. Matters related to national R&D continued to be revised in response to pending issues. For instance, the Nineteenth Amendment stipulated measures for increasing the restitution rate for inappropriately secured funding from national R&D programs. While the Twentieth, the Twenty-second, the Twenty-ninth Amendments provided for restrictions against participation in R&D programs for violations, the Thirty-second Amendment covered measures for the promotion and support of challenging and creative R&D. Following the National R&D Innovation Act, enforced from January 1, 2021, provisions on the implementation of national R&D were removed, while leaving core provisions in place. New provisions for addressing social challenges through S&T were added in the Nineteenth Amendment (amended in 2014). The Twenty-seventh Amendment (amended in 2018) stipulated matters related to strengthening international cooperation in the areas of S&T, and procedures and grounds for establishing an affiliated organization (here, KISTEP).

Matters related to the S&T Promotion Fund were amended mainly in Chapter 4, Expansion of S&T Investment and Human Resources, under the Framework Act on S&T. The Sixth Amendment, enforced as of September 27, 2006, stipulated that the S&T Promotion Fund may increase funding resources, and it may support an organization responsible for the commercialization of R&D outcomes. The Fourteenth Amendment (amended in 2011) stated that the S&T Promotion Fund may receive voluntary contributions from individuals and business entities to increase its funding resources.

As for Chapter 5, substantial changes were made in the Seventeenth Amendment, enforced as of May 28, 2014. The Seventeenth Amendment newly stipulated a separate provision to establish the Korea S&T Foundation with its primary mission to nurture S&T culture. A provision was revised regarding the management and operation of R&D facilities and equipment in the Twentieth Amendment (amended in 2015).

Table 3 Major Amendments of the Framework Act on S&T

Category	Major Amendments
Second Amendment (December 30, 2003)	• Stipulating legal grounds for funding programs and a management organization aiming to create S&T culture
Fourth Amendment (September 23, 2004)	• Advancing the National innovation system • Capacity building of the National Council on S&T to enhance the effectiveness of national R&D programs
Fifth Amendment (December 30, 2005)	• Specifying the period of establishing the Comprehensive Plan for Local S&T Promotion • Establishing the Committee on Basic Research under the National Council on S&T
Sixth Amendment (September 27, 2006)	• Complementing shortcomings in the operation of measures, including legal grounds for the utilization of the S&T Promotion Fund and unifying the evaluation process of national R&D programs
Twelfth Amendment (December 27, 2010)	• Restructuring the National Council on S&T, the coordinating body to the Standing Presidential Council and strengthening its functions
Fourteenth Amendment (July 21, 2011)	• Encouraging donations from individuals, business entities and organizations to ensure funding resources for the Science Promotion Fund
Sixteenth Amendment (March 23, 2013)	• Taking over the R&D coordination function of the National Council on S&T to the Ministry of Future, Planning, and Science • Replacing the National Council on S&T with the National Deliberative Committee on S&T
Seventeenth Amendment (May 28, 2014)	• Complementing shortcomings in the operation of national R&D programs • Planning policies for new industry and job creation • Conducting survey and analysis on S&T statistics and indices
Nineteenth Amendment (December 30, 2014)	• Improving the rate of return for inappropriate use of national R&D funding • Adjusting the schedule for allocating national R&D program funding • Addressing social challenges by using S&T • Stipulating legal grounds for the establishment of the Korea Foundation for the Advancement of Science and Creativity
Twenty-first Amendment (December 1, 2015)	• Stipulating matters as to submitting an annual report on Master S&T Plan and Master Plan on Local S&T Promotion to the National Assembly
Twenty-second Amendment (December 22, 2015)	• Stipulating to ensure the funding stability for R&D programs • Prohibiting misconducts as to national R&D programs • Establishing the legal grounds for the designation and operation of the management organization supporting incubation and innovation of SMEs and venture companies

Category	Major Amendments
Twenty-sixth Amendment (January 16, 2018)	• Integrating and unifying the functions of reviewing and coordinating S&T policies • Assigning the Ministry of Science and ICT the functions of budget allocation and coordination
Twenty-seventh Amendment (April 17, 2018)	• Strengthening S&T ODA to support the economic development of developing countries and to improve their welfare
Twenty-eighth Amendment (August 27, 2019)	• Allowing local governments to stipulate an ordinance as to matters necessary for the establishment and implementation of policies for local S&T promotion
Twenty-ninth Amendment (June 9, 2020)	• Stipulating the establishment of a mid-and long-term R&D investment strategy for a period of 5 years • Strengthening restriction to the participation of those who had a misconduct in applying for national R&D projects
Thirty-third (April 20, 2021)	• Reflecting gender characteristics on the survey and analysis on S&T statistics and indices

Source: The Korean Law Information Center https://www.law.go.kr/LSW/lsRvsRsnListP.do?lsId=009177&chrClsCd=010202&lsRvsGubun=all (accessed on September 15, 2021)

IV. Characteristics of the Evolution of the Three Basic Acts on S&T in Korea

Significant characteristics of the evolution of the three Basic Acts on S&T from the S&T Promotion Act (1967) through the Special Act on STI (1997) to the Framework Act on S&T (2001) can be analyzed on five dimensions: 1) the establishment of the comprehensive plan for S&T; 2) the institutionalization of the S&T policy coordination system; 3) the implementation of national R&D programs and diffusion of their outcomes; 4) the management of S&T human resources; 5) expanding S&T investment and improving its efficiency.

1. Establishment of the Comprehensive Plan for S&T

One of the primary objectives of the S&T Promotion Act at the time of its enactment in 1967 was to establish the master plan on S&T promotion and related policies. The S&T Promotion Act stipulated that the government should establish a Long-term Comprehensive Plan for S&T Promotion and basic policies at the central government level. The comprehensive plan for S&T is distinctive from specialized plans aimed at establishing master plans in specific sectors or programs related to science and technology. Targeting all sectors

related to S&T, the comprehensive plan served to establish regulations in a comprehensive way. The establishment of the comprehensive plan for S&T promotion was adopted in the Special Act on STI, and again in the Framework Act on S&T. Three major findings from the evolution of regulations on the establishment of the comprehensive plan for S&T in Korea were found: 1) the scope and contents covered by the comprehensive plan were extended; 2) along with the comprehensive plan for S&T, the establishment of a comprehensive plan for local S&T promotion was mandated; 3) a provision to ensure the effectiveness of established plans was stipulated.

The first finding from the comprehensive plan for S&T can be discussed in the scope of the comprehensive plan. When the Long-term Comprehensive Plan for S&T Promotion was enacted in 1967, it also mandated research plans for social science that is closely linked with natural science in addition to the R&D plan, a human resources development plan, a resources survey plan, and a plan for technology cooperation and technology acquisition. Under the Special Act on STI (1997), the Plan was renamed as the Five Year Plan for STI, which elaborated R&D sectors and mandated the establishment of an R&D investment plan. Under the Framework Act on S&T (2001), the Plan was again renamed as the S&T Master Plan, and it laid out the basic directions for national S&T policies to address social challenges through S&T promotion and the utilization of S&T beyond supporting R&D and technology development. Article 7 under the current S&T Master Plan stipulated more sophisticated provisions for the realization of S&T in order to pursue social values.

In sum, R&D, human resources, investment, the management of scientific knowledge and information, and the promotion of S&T culture have been major priorities since the enforcement of the S&T Promotion Act. Adapting to the changing environment of S&T policies, new provisions were added in the current S&T Master Plan, such as the expansion of S&T investments, the promotion of basic science, the diffusion of research outcomes, the promotion of local science and technology, the facilitation of private-sector-driven technology development, inter-Korean cooperation and exchanges on S&T, technology acquisition, the nurturing of development engines, the improvement of social values, and measures for addressing social challenges. In particular, the provision for inter-Korean cooperation and exchanges on S&T is special for Korea as a divided country.

Second, the regulation on local S&T promotion was firstly stipulated in the Special Act on STI of 1997. The Framework Act of 2001 specified that affairs related to local S&T promotion should be included in the S&T Master Plan. Moreover, The Comprehensive Plan on Local S&T Promotion should include measures for promoting R&D programs and building S&T infrastructure; the distribution and commercialization of outcomes of local S&T promotion; capacity building of local business, education, research institutes, and S&T

related organizations; nurturing S&T related human resources; and establishing distribution systems for S&T information.

Third, measures to increase the effectiveness of the comprehensive plan for S&T were stipulated in the three Basic Acts on S&T and are reflected in the process of implementing the comprehensive plan. As the country entered the 1980s, S&T policies became a whole-of-government priority (Ministry of Science and Technology, 2008; 92-93). The S&T Promotion Act, wholly amended in 1991, stipulated that the government develop the Comprehensive Plan for S&T Promotion through consultations with related ministries. The coordinating body, the General Deliberative Committee on S&T was mandated to review the Plan. According to the Special Act on STI (1997), both central and local governments were mandated to develop their annual implementation plans guided by the Five Year Plan for STI, and to report their implementation outcomes. The Framework Act on S&T (2001) stipulated that the Ministry of S&T shall implement the S&T Master Plan by compiling related S&T plans and policies from other Ministries to ensure linkages between the S&T Master Plan and the Sectoral Plans of each Ministry. A provision for reporting the S&T Master Plan to the National Assembly was also added. This provision provided an institutional tool to check whether the opinions of the Assembly were reflected in the S&T Master Plan developed by the Administration.[2]

2. Establishment of the Coordination System for S&T Policies

A primary role of the coordinating body is to coordinate S&T-related matters among Ministries according to a mid- and long-term S&T plan. In Korea, coordination was one of the pending issues, as coordination over R&D funding became more critical due to the expansion of national R&D programs (Kim et al., 2020:24). The key missions of the coordinating body for S&T policies in Korea are establishing directions for S&T policies at the national level and allocating the R&D budget to S&T-concerned ministries with the consultation of the Ministry of Finance and Ministry of Science and Technology.

Characteristics of the major amendments for the S&T coordinating body can be analyzed from the aspects of the status of the coordinating body within the government organization and the scope of its function.

First, efforts to strengthen the status of the coordinating body were made in a number of amendments. The General Deliberative Committee on S&T, the first coordinating body for S&T, was established in 1972 in accordance with the amendments to the S&T Promotion Act. The S&T Promotion Act, which was

2 Bill Information System of National Assembly, https://likms.assembly.go.kr/bill/billDetail.do?billId=PRC_J1M9Z0Z7A1A2U0E9Y1B5Q3K7R0W7Z9 (Accessed on September 26, 2021).

wholly amended in 1991, stipulated new regulations to bolster the effectiveness of the coordinating body by, for example, increasing the number of council members. Despite such stipulations, remaining issues included a gap between the results from the Committee meetings and the actual allocation of budgets and a continuing lack of cooperation among S&T-concerned Ministries (Lee, 1996; 7-9). The Special Act on STI (1997) stipulated regulations mandating S&T Ministerial meetings previously set up by a Presidential Decree in 1996. Ministerial cooperation remained low despite ministerial meetings having legal grounds under the Special Act. This led to the establishment of the National Council on S&T chaired by the President following the Amended Special Act in 1999. At the time of enacting the Framework Act on S&T in 2001, the scope of work by the National Council on S&T was extended, and the National Council on S&T members gained more authority. In 2010, the National Council on S&T was reformed into a Standing Presidential Council headed by a minister and operated within the Ministry of S&T. However, in 2013, the National Council on S&T was abolished due to government reorganization. A new Ministry named the Ministry of Science, ICT, and Future Planning took on the tasks of the National Council on S&T. The National Council on S&T was then renamed as the National Deliberative Committee on S&T and was co-chaired by the Prime Minister and a member from the private sector. In 2018, the S&T coordination responsibility was transferred from the National Deliberative Committee on S&T to the Presidential Advisory Council on Science and Technology.

Second, the institutional form of the coordinating body has changed depending on the government, and it is a general trend that the role is becoming more sophisticated. Established in 1972, the General Deliberative Committee on S&T was responsible for establishing the comprehensive S&T plan and coordinating major policies; adjusting funding for S&T promotion; selecting national R&D programs; enhancing human resources; and coordinating major technological agreements and developments; and surveying resources. In the S&T Promotion Act that was wholly amended in 1991, the functional scope of the General Deliberative Committee on S&T was extended to include nurturing S&T education and research institutes; facilitating the production, distribution, and utilization of S&T information; and increasing public awareness of S&T. The Special Act on STI (1997) stipulated matters as to the S&T Ministerial Meeting, and the amended Special Act in 1999 stipulated that the National Council on S&T shall review matters related to prior coordination over the priorities of national R&D programs and the effective execution of funding and evaluation over public research institutes. The functional scope of the National Council on S&T in the Framework Act on S&T that came into force in 2001 is broader than that of the Special Act on STI. In the evolution of the Framework Act on S&T, attention needs to be paid to the fact that items for reviewing R&D

budgets have changed according to the status of the coordinating body. While, in 2004, the coordinating body had an authority to review and coordinate national R&D budgets, in 2008, the roles of the coordinating body were narrowed down to only providing opinions for the direction over funding allocation for national R&D programs, as the authority of the Ministry of Finance was strengthened. In 2010 when the coordinating body was reformed into the Standing Administrative Committee, an authority to coordinate R&D programs in the review process was restored to the National Council on S&T.

3. Implementation of R&D Programs and Diffusion of their Outcomes

With the achievement of economic growth through national R&D programs, the Korean government stipulated various R&D policies ranging from developing R&D plans, selecting flagship R&D programs, and promoting general R&D programs, to disseminating the R&D outcomes. Also notable is that the scope of R&D policy included policies to support private R&D beyond policies for national R&D programs. The details are as follows.

First, regarding R&D plans, the S&T Promotion Act of 1967 stipulated that R&D plans should be included in the Long-term Comprehensive Plan for S&T Promotion. The Special Act on STI (1997) stated that an implementation plan for R&D programs and national flagship R&D programs, and a promotion plan on basic research, should be included in the Five Year Plan for STI along with a plan to support private technology development. The Framework Act (2001) stipulated matters as to disseminating R&D outcomes and fostering technology transfer and commercialization. New provisions regarding the facilitation of interdisciplinary R&D and the promotion of technology startups were added to the Framework Act on S&T when it was amended in 2014.

Second, The Special Act on STI (1997) contained stipulations as to selecting and supporting national flagship R&D programs. The flagship programs, which required the participation of more than two ministries, had the nature of joint technology development programs between ministries, and they were implemented in the period from 1998 to 2002 (Ministry of Science and Technology, 2008; 134). The Special Act provided legal grounds for national R&D programs and stipulated matters to support expenses; the designation of specialized organizations responsible for the planning, evaluation, and management of national flagship R&D programs; and support for the diffusion of their outcomes.

Third, all three Acts of 1967, 1997, and 2001 laid out provisions for R&D promotion. Included were measures for implementing joint R&D and national R&D programs, the promotion of basic research, and private-sector-driven STI.

For example, the S&T Promotion Act, wholly amended in 1991, stipulated a provision to facilitate joint R&D among universities, industry, and research institutes. The Framework Act on S&T stipulated a new provision for the implementation of national R&D programs. The amendments to the Framework Act in 2010 laid out principles[3] for implementing national R&D programs and designated a specialized organization to undertake tasks related to the planning of national R&D programs. In 2014, principles such as activating interdisciplinary, creative, and challenging R&D were added to the provision. The provision related to basic research was first included in the Special Act on STI in 1997, and it was then adopted into the Framework Act on S&T. The Framework Act on S&T stipulated that facilitating private technology development shall be included within the S&T Master Plan, and a new provision was added for the support for private technology development of technology-intensive SMEs and technology-based startups.

Fourth, regarding the diffusion of R&D outcomes, the Special Act (1997) had stipulations for the commercialization of flagship R&D outcomes and collateral technology; there were no explicit provisions for diffusing R&D outcomes. The Framework Act (2001) contained a provision for the diffusion of R&D outcomes, and its amendment in 2014 specified the roles of the government in the dissemination of R&D outputs, technology transfer, and commercialization.

4. Management of S&T Human Resources

In the three Basic Acts related to S&T promotion, regulations on human resources have evolved in three directions: first, the establishment of a human resources plan for human development; second, comprehensive support for scientists and engineers; and lastly, the selection of targets and support for human resources development.

First, the S&T Promotion Act (1967) stipulated that a human resource development plan shall be developed and included within a Long-term Comprehensive Plan for S&T Promotion. Following the S&T Promotion Act, provisions were stipulated to establish a directive for strengthening STEM and promoting technical training, supporting engineers to go abroad, and ensuring the protection of scientists and engineers. The Special Act on STI (1997) contained no general provisions on human resources. However, it stipulated that the promotion of research activities in science and engineering universities, manpower training and utilization, S&T education, and research facilities should

3 The principles include the division of labor with the private sector, providing the best research environment for researchers and research institutes, prioritizing the autonomy of researchers and research institutes, public opening of research results through diffusing outcomes and practical use. (The Framework Act, Article 11 (2), Amended in 2010)

be included in the Five Year Plan for STI. The Framework Act on S&T (2001) stipulated a separate chapter on S&T investment and enhancing human resources. The Framework Act on S&T also stipulated that matters as to diversifying S&T education, improving its quality, and nurturing S&T resources were included in the S&T Master Plan.

Second, policies friendly to scientists and engineers were implemented based on the S&T Promotion Act (1967) that provided various incentives such as allowing them to hold concurrent positions, supporting science and engineering-related organizations, and operating an awards system for those who contributed to the promotion of S&T. Under the wholly amended S&T Promotion Act in 1991, a provision allowing scientists and engineers to have a concurrent position was removed, and a new provision was included to provide financial supports for legal entities and organizations. The Special Act on STI (1997) also laid out provisions for preferential treatment for scientists and engineers in promoting R&D, rewarding results, and supporting the commercialization of outcomes. The contents of the Framework Act on S&T (2001) are not fundamentally different from those of the Special Act, but some additions have been made. A provision was stipulated, for example, as to the registration of scientists and engineers in order to improve their employment opportunities. In the Framework Act amended in 2008, the goal of nurturing creative human resources was added to the roles of organizations responsible for promoting S&T culture.

Third, in addition to general provisions for the nurturing and utilization of S&T human resources, target groups to be nurtured were specified under the Framework Act on S&T (2001). For example, provisions for nurturing women and the gifted in science were included. The Framework Act amended in 2010 stipulated a provision for the designation of organizations responsible for early education for the gifted in science.

5. Expanding S&T Investment and Improving its Efficiency

Provisions related to S&T investment are included in the comprehensive S&T plan under the three Acts: the S&T Promotion Act (1967), the Special Act on STI (1997), and the Framework Act on S&T (2001). All three have similar stipulations regarding the expansion of public investment in S&T and measures to secure R&D funding through various financial sources.

First, provisions related to expanding S&T investment were laid out in the S&T Promotion Act amended in 1991. The roles of the government specified in the Special Act on STI (1997) included: continuing efforts to increase public R&D investment; reflecting targets for public R&D investment in the Five Year Plan for STI, establishing an Investment Plan for Public R&D, and submitting its progress report to the National Assembly; and making efforts to increase the ratio of S&T-related budgets in the education, defense, agriculture, environment

and social overhead capital (SOC) sectors. As for increasing S&T investment, the Framework Act (2001) also had stipulations providing that the government shall make efforts to secure the funding necessary for facilitating S&T development; that the government shall reflect targets for public R&D investment and an implementation plan within the S&T Master Plan; and that local governments shall strive to increase the ratio of R&D within their budgets. The Amendments to the Framework Act enacted in 2014 stipulated that the government shall develop measures for inducing private investment. In sum, the Framework Act on S&T is distinctive as it laid out specific provisions for strengthening the responsibilities of the government in securing R&D funding; specifying the roles of the central government in expanding private R&D investment and the roles of local governments in their R&D budgets; and highlighting efforts for the effective execution of R&D investment.

Second, stipulations as to establishing an S&T Fund to secure funding resources for R&D can be found in the S&T Promotion Act (1967). Following the Amendments to the S&T Promotion Act in 1991, the S&T Fund was renamed the S&T Promotion Fund. The Special Act on STI (1997) newly stipulated that the S&T Promotion Fund would be expanded, and it also added a provision for the establishment of a new S&T Culture Fund. The Special Act on STI, amended in 1999, laid out a new provision for issuing a technology development lottery so that its resources could be streamed into the S&T Promotion Fund. The S&T Culture Fund was integrated into the S&T Promotion Fund under the S&T Promotion Act as amended in 2000[4]. Such measures expanded financial resources for the R&D Promotion Fund and contributed to the broader usage of the fund. The provision as to the S&T Promotion Fund under the S&T Promotion Act was incorporated into the Framework Act on S&T (2001).

V. Conclusion: Milestones of the Basic Acts on S&T and the Future Outlook

This study analyzed the evolution of S&T related norms, from the S&T Promotion Act through the Special Act on STI to the Framework Act on S&T, in five dimensions: the establishment of the comprehensive S&T plan; the establishment of the coordination system for S&T policies; the implementation of national R&D programs and the diffusion of R&D outputs; the management of S&T human resources; and lastly, the expansion of S&T investment and the

4 The S&T Promotion Act (1967) and the Special Act on STI (1997) were first integrated into the Framework Act in 2001.

improvement in investment efficiency. These dimensions are distinctive characteristics that can be found consistently over the evolution of S&T-related legislation in Korea. This study gives the following implications in theory and practice.

First, the scope of the S&T policy has been continuously expanded. Responsibilities for implementing S&T policies were gradually expanded from the central government to local governments. Enhancing the science and technology policy capacity of local governments will remain an important task in the future. The scope of the comprehensive S&T plan has been gradually expanded and includes the following issues; the promotion of S&T related inventions; the protection and nurturing of intellectual property; the expansion of S&T research facilities and equipment; the facilitation of S&T commercialization and technology incubation; the identification and implementation of new national growth engines; addressing societal and economic challenges using S&T; the security and safety management of S&T; and the relaxation of S&T regulations.

Second, the coordinating body for S&T policies has been continuously reformed to improve the integration and coordination of S&T policies. In particular, in the past 20 years, the organizational form of the National Council on S&T has varied according to the government, which changes every five years. In some cases, the National Council on S&T was installed as an independent organization with strong authority. Conversely, there were cases where the authority was weak, and the functions of the line ministries were relatively large. In the current government, provisions regarding the function and roles of the coordinating body for S&T policies have been moved within the Presidential Advisory Council on Science and Technology Act. Despite its frequent restructuring, the function of the coordinating body for S&T policies has been elaborated over time. The primary task of the coordinating body for S&T policies has been and remains to adjust the budget of the ministries that carry out R&D programs. In addition, it reviews the Comprehensive Plan and evaluates the performance of R&D programs carried out by S&T concerned ministries.

Third, national R&D programs have been a critical policy tool for Korean S&T policy. They were started in 1982 by the Ministry of Science and Technology. After that, various ministries implemented their own national R&D programs individually, and R&D competition among S&T-concerned ministries began in earnest in the 1990s. National R&D programs induced an increase in the R&D budget of the Korean government. With this in the background, national R&D programs have shifted their emphasis from the expansion of R&D investment to the utilization and diffusion of results. In addition, regulations were added to stimulate the innovation activities of the private sector.

Fourth, when it comes to the promotion of S&T human resources, the S&T Promotion Act (1967) and the Special Act on STI (1997) commonly highlighted provisions on matters related to support for the S&T workforce. More detailed stipulations related to human resources management were developed in the Framework Act on S&T (2001). The S&T education expanded support for science and engineering fields, and technical training and re-education were included in the comprehensive S&T plan to foster human resources. Policies such as rewards, financial supports, and the registration of scientists and engineers were used to support scientists and engineers. In the Framework Act, human resource development was further modernized by supporting women scientists and the gifted.

Lastly, one of the unique approaches of the Korean government has been that it made efforts to secure a sufficient budget for science and technology. The Special Act on STI (1997) aimed to stipulate the government's obligation to increase science and technology expenditure in the law. In addition, as a practical policy tool, the Science and Technology Promotion Fund was established to expand science and technology resources. As of 2021, the S&T Promotion Fund provides support for research and academic activities; human resources training and international exchanges; S&T-related institutions and organizations; and the promotion of venture and new technology businesses (Framework Act, Article 22 (3), 2021).

From the overall examination of the evolution of S&T-related legislation over the last fifty years, it is found that the scope of the Basic Acts has been continuously extended to cover the whole spectrum of S&T policies. Under the S&T Promotion Act (1967) and the Special Act on STI (1997), the focus was given to establishing the S&T promotion plan, facilitating R&D, and creating a financially enabling environment by such measures as securing funding resources and increasing investment for S&T. However, since the Framework Act on S&T (2001), the focus of S&T legislation has changed to direct S&T policies in response to policy demands according to changes in the S&T environment. In sum, S&T Basic Acts have been amended to regulate the whole cycle of S&T more broadly, from S&T infrastructure-building, the promotion of S&T, and the diffusion and commercialization of R&D outputs, to preventing the negative side-effects of S&T.

When it comes to the composition of the Basic Acts, while the S&T Promotion Act and the Special Act on STI were formatted as single lists of Articles without chapters or sections, the Framework Act on S&T had a more complete and coherent structure of overall norms and was structured in chapters. Still, some areas need to be improved in the current Framework Act on S&T. Since replacing the S&T Promotion Act and the Special Act on STI, the Framework Act on S&T was found to have a somewhat distracted and dispersed composition of articles, suggesting a need for the Framework Act to be aligned

more systemically and sequentially.

In addition, the Framework Act is found to have had inappropriate provisions in terms of the implementation and management of S&T policies beyond its role of providing policy directions and principles, which has led to frequent amendments (33 times by 2021) since its enactment in 2001. The National R&D Innovation Act, which came into force in 2021, suggests a way forward in addressing this problem. It has incorporated a wide range of specific provisions from the Framework Act. In so doing, it has provided a helpful example of the division of labor between the Framework Act and individual S&T Acts. It would be suggested that the Framework Act should govern the overall policy direction and coordination mechanism, and specific provisions for particular matters should be regulated through individual Acts.

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