KISTEP envisions and strives to create pathways towards a sustainable future.

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Foreword

KISTEP strives to enhance quality of life through mission-oriented R&D and prepare for the future by promoting strategic technologies and digital platforms.

The year 2021, in which KISTEP marked its 22nd anniversary, was also a memorable year for KISTEP.

We plotted the future for S&T by preparing for the establishment of the 7th Science & Technology Basic Plan (2023-2027), that includes the direction of the next government’s S&T policy, and conducting a technology impact assessment on autonomous driving technologies above level 4. By announcing the KISTEP 10 emerging technologies that will lead the “carbon neutral era” and the 2050 Carbon Neutral Technology Innovation Strategy Roadmap, we have again put ourselves at the forefront to fight against climate change and energy crises. We emphasized the role of S&T in enhancing quality of life for the public by establishing the Platform on Science and Technology Policy for Social Problem Solving, discovering outstanding achievements in the field of social problem-solving R&D, and holding a social tech fair. We have joined the efforts of humanity to address global challenges through the “Science and Technology Diplomacy Forum” and the “Science and Technology Diplomacy Academy”.

In order to establish an R&D system of autonomy and responsibility, we supported the full revision of the Act On The Performance Evaluation And Management Of National Research And Development Programs (to be implemented Jul. 2022), completed the development of the Pan-Ministry Integrated Research Support System (IRIS), and officially began its operation from January 2022.

We supported the R&D budget allocation and coordination for 23.5 trillion won in 2022. We established the 1st National R&D mid- to long-term Investment Strategy (2023-2027), and helped increase the potential for success and investment efficiency of the project through visiting program consulting on 166 national R&D programs in 20 ministries.

We reviewed the adequacy and efficiency of R&D finances through 18 preliminary feasibility studies (total program cost of KRW 14.5 trillion) and 4 adequacy reviews (total program cost of KRW 1.8 trillion). At the end of the year, based on the year’s in-depth research and analysis, we proposed 15 issues that our society should consider together in 2022 as the “KISTEP Think 2022 Innovation Agenda,” taking pride in our role as the Think-Tank of Science and Technology innovation policy.

We are now faced with many new challenges for national R&D system.

We are required to “redesign the S&T system” to enhance the quality of R&D in order to address various social challenges such as ultra-low growth, unemployment, the pandemic and epidemics, climate change, and the food and energy crisis. It is necessary to develop policies on preparing a mission-oriented R&D system, innovation led by the private sector and the region, strengthening the R&D investment strategy, and promoting the utilization of research achievements through industry-academia-research convergence and cooperation. KISTEP will also strive to bring the national R&D system to the next level to realize the government’s policy tasks.

This annual report includes the achievements of KISTEP researchers who have dedicated themselves at the forefront of S&T innovation policies. I hope this annual report will serve as an opportunity for researchers and the public to better understand KISTEP. Thank you.

Byung-Seon Jeong
President of KISTEP
• Improving the effectiveness of R&D investment through expertise in S&T policy planning and R&D evaluation
• Contributing to the development of innovative growth engines by identifying future agendas and strategies
Established the CSTP, an affiliated organization of KIST

Reorganized the CSTP and renamed it STEPI

Established KISTEP

1987

1993

1999

2001

2005

2007

KISTEP assumed full responsibility in supporting NSTC newly launched as a permanent agency with a strengthened mission

- KISTEP’s affiliation was transferred to the NSTC from the Ministry of Education, Science and Technology (MEST)
- KIRD’s affiliation was transferred to the National Research Foundation (NRF) of Korea

2011

2013

KISTEP’s affiliation was transferred to the Ministry of Science, ICT and Future Planning (MSIP) from NSTC

2016

2019

2020

Reorganized and expanded the functions of KISTEP

- Strengthening planning function for government R&D programs

Ranked “Excellent” in mission-oriented GRI evaluation

20th Anniversary of KISTEP

KIRD’s affiliation was transferred to KISTEP

- Changed name to the Korea Institute of Human Resources Development in Science and Technology

Affiliated organization (KIRD)

Established Korea Institute of R&D Human Resources Development (KIRD), affiliated with KISTEP

2007

Established the CSTP, an affiliated organization of KIST

Redirected KISTEP’s main functions to strategic planning, coordination and evaluation of government R&D

Directorate of Future Technology Strategy

Office of Strategy Planning

Planning and Management Division

General Affairs and IT Division

Auditor

Affiliated organization (KIRD)
Human Resources

Total researchers: 295
Male: 60
Female: 40
(As of Jan. 2022)

By Position

- Executive: 1
- Researchers: 205
- Professional management officers II: 56
- Professional management officers I: 20
- Public service officers: 13

By Degree

- Bachelor or below: 49 (16.6%)
- Master’s: 94 (31.9%)
- PhD: 152 (51.5%)

Budget

Total budget: 74,464 million won

Revenue

- Government contribution: 55%
- Own income: 43%
- Other: 2%

Expenditure

- Research expense: 49%
- Personnel expense: 41%
- Operating expenses: 7%
- Other: 3%
Publications

- 62 Publications
  - Issue Paper: 20
  - Statistics Brief: 20
  - Technology Trend Brief: 16
  - KISTEP Int: 4
  - R&D Beyond: 1
  - ARP: 1

Online Events

- 2021 Joint Briefing on Government R&D Programs by Ministries
- The 21st anniversary ceremony
- 2022 Online public hearing on national R&D investment direction and standards
- Moneytoday global conference K.E.Y.(knock around, be Educated, Yield everything) PLATFORM 2021
- Research ethics guideline discussion
- 2021 “Level 4 or higher autonomous driving” technology impact assessment open forum
- 2021 social problem solving R&D performance technology presentation social tech fair
- “SEE–KISTEP, Think 2022” Science and Technology Innovation Policy Discussion
- Ceremony to inaugurate Byung-Seon Jeong as the 10th president of KISTEP
- The 130th-141st KISTEP Wednesday Forums
- The 1st-9th National Innovation System (NIS) Colloquium

Activities

- 28 events

International Cooperation

- The 13th KISTEP–ISTIC S&T Innovation Training Program
- The 1st-2nd Science and Technology Diplomacy Forums
- The 1st-2nd Science and Technology Diplomacy Academies

Giving back to the Community

- Blood donation campaign
- Delivering sponsored items for the “House of Peace” in Jincheon and “Kottongnae (Flower village) Children’s Welfare Facility” in Eumseong

- 2 events
Leading Global STI Think Tank, KISTEP

KISTEP establishes a platform for effective networking and knowledge exchange in STI with diverse international communities, countries, and organizations. Also, KISTEP provides STI policy training programs to share experiences on STI-driven national development to promote inclusive growth.
Research Achievements

Established in accordance with the Framework Act on Science and Technology, KISTEP is Korea’s only S&T policy think-tank, and provides in-depth research results across the national R&D systems, including national S&T policy planning and future strategies, survey, analysis and evaluation of national R&D programs, budget allocation and coordination of government R&D programs, and preliminary feasibility studies of government R&D projects.
Technology Foresight and S&T Policy Planning

Technology foresight and future strategies

1. Strengthening ability to respond to future challenges through strategic technology foresight

- The development and analysis of future technologies to cope with anticipated issues over the next 25 years (~2045) through the second year for the 6th National S&T Foresight
  - After deriving 241 future technologies* and 15 future innovation technologies,** the timing of technology realization, technology spread point, technological competitiveness, importance, and government plans were analyzed.
  * Digital transformation, Manufacturing & material, Human/life, Disaster, Security pioneering, Energy environment
  ** Fully autonomous aircraft, fully autonomous vehicles, customized vaccines, hydrogen energy, super-personalized artificial intelligence, biochip, complex disaster response system, quantum cryptography communication technology, artificial intelligence semiconductor, autonomous work robot, small nuclear battery, disaster prediction, carbon neutral fuel, carbon cycle monitoring technology, cell reprogramming technology

- Analyzing the impacts of new technologies on the economy, society, culture, and environment
  - Conducting a technology impact assessment on level 4 or higher autonomous driving technology

- Conducting the 2022 technology level evaluation
  - Conducting research to improve the technology level evaluation methodology and deriving improvement plans for conducting the 2022 main survey
  - Evaluating Korea’s technology level and technology gaps compared to major countries (US, EU, China, and Japan)

- Revision of feasibility assessment of the Korea National Science and Technology Standards Classification Codes (K-NSCC) and preparation of next revision
  - Study on the implementation plan for the improvement direction of the classification system after monitoring the basis of candidate classification and impact

- Selecting and announcing KISTEP 10 Emerging Technologies that have large economic and social ripple effects
  - Discovering technologies emerging within the next 10 years that can respond to major issues that may arise in our society
  - Selecting the "carbon neutral era" as the theme for 2022, and identifying emerging technologies to contribute to the goals of 2030 National Greenhouse Gas Reduction

2. Policy for fostering growth engines in materials, parts and equipment, and multi-ministerial joint research planning

- Planning, management, and operation of growth engine development and strategy
  - Setting the direction and goal of the next growth engine policy*, discovering candidate fields**
  * Deriving a future vision for 2030 based on future forecasting, and setting the vision and goal of the growth engine policy through growth path analysis
  ** Organizing a committee to identify candidates for the next growth engines, evaluating the next candidate growth engine technologies, and identifying the final candidates (technology, product services, and industry)

- Identifying future leading materials, parts and equipment items and establishing R&D strategy
  - As a follow-up measure to the "Materials, parts and equipment R&D Advancement Plan", providing support for the establishment of the "R&D Promotion Plan for Future Leading Items for Materials, Parts and Equipment"
  - Review for Materials, parts and equipment Preliminary Feasibility Study, and operation support Special Technology Committee and Policy Regulation Working Committee for materials, parts and equipment

- Selection and enhancement of multi-ministerial joint planning programs
  - Discovering the theme of Bottom-up, top-down multi-ministerial joint planning research project
  - Diversifying the topics of multi-ministerial R&D programs and strengthening program performance management

- Conducting research on environmental changes and countermeasures against future uncertainties
  - Collecting and analyzing issues that will be important in the future related to S&T, and strengthening the preemptive response capability to key issues

- Establishing 2060 Carbon Neutral Technology Innovation Strategic Roadmap
  - Preparing carbon neutral technology classification system and selecting key technologies
3. Identification of the S&T innovation policy agendas

- Conducting in-depth research on the innovation agenda to advance the national innovation system
  - Presenting the vision of S&T-based country with enhanced quality of life for citizens and identifying 10 innovation agendas
- Identifying KISTEP Think 2022 15 S&T innovation policy agendas
  - Identifying a full-scale agenda from 2021 after the pilot implementation in 2020, and reflecting it in the next year’s research planning in order to strengthen the role as the STI policy think tank
  - Selecting final 15 agendas through survey and consultation with the public, industry, academia and research experts on the five key agenda candidates

4. Research on the National Innovation System (NIS) Advancement Strategy

- Study on the current status and development plan for S&T administration system
  - Suggesting directions and tasks to strengthen the overall functions of S&T innovation policy in response to changes in the domestic and foreign innovation environment (the era of technological hegemony, climate change, activation of innovation ecosystem, population decline, etc.)
- Study on national R&D strategies in response to the U.S.-China competition for technological hegemony
  - Suggesting countermeasures to the competition for technological supremacy between the US and China by establishing S&T sovereignty and sustainable foundation for the Korea-US alliance
- Study on the improvement of the openness in NIS
  - Proposing an open innovation model to enhance openness in NIS and suggesting a plan to improve the flexibility of innovation elements
- Study on the promotion of national R&D technology commercialization from the NIS perspective
  - Presenting strategic plan related to the advancement of technology commercialization by identifying key issues in each R&D stage of National R&D technology commercialization, and key areas for improvement

5. Operation of NIS policy colloquium and publication of issue papers and policy briefs

- Held NIS Policy Colloquium 7* times
  - S&T innovation governance, Korea-U.S. S&T alliance strategy, etc.
- Publishing 20 KISTEP issue papers*
  - KISTEP 10 Emerging technologies in the contactless era, innovation strategies to China in the era of technological hegemony, etc.
- Publishing 15 KISTEP policy briefs*
  - Davos 2021 agenda and the future of S&T, changes to the future of S&T innovation policy caused by COVID-19, etc.

6. Cooperation and public relations

- Policy cooperation with relevant organizations and communication
  - MOU agreement signing for establishment of S&T policy network
    - National Library of Korea, Jeonju Office of Education, Dankook University, KIRD, Chungnam Innovation Agency of Science and Technology, etc.
- Promoting research achievements of KISTEP
  - Online and offline promotion for major activities and research achievements
  - Support for media publicity and coverage (684 press reports in total) of major events and research results (reports, briefs, etc.)
  - Major DB management related to public relations, such as institution historical records and policy customers

Support for the national S&T innovation policy establishment

1. Management of S&T Basic Plan implementation

- Support for "The 4th S&T Basic Plan (2018~2022)”, 2021 performance review and the establishment of the 2022 implementation plan
- Support for Conducting a preliminary study to establish "The 5th S&T Basic Plan (2023~2027)”, and preparing to establish the basic plan* * Monitoring the performance of the 4th S&T Basic Plan and identifying major issues, including an analysis of changes in the internal and external policy environment

2. Improving ability to fulfill the National R&D innovation plan

- Performance review of 3 strategies, 7 tasks, and 15 detailed tasks according to "National R&D Innovation Plan (2018)”, and "Amendment of National R&D Innovation Action Plan (2021-1)",
- Management and performance analysis of R&D innovation in public research institutes

3. Survey and analysis of basic S&T policies and mid- to long-term plans for each sector

- Survey on the status and analysis of ministries’ mid- to long-term plans established and implemented in the previous year
- Conducting a survey on annual performance on the plan subject to research and analysis, and an in-depth analysis of the project to be terminated
- Review of policy analysis (evaluation) methodology to enhance the effectiveness of mid- to long-term plan research and analysis
- Establishment and operation of a policy review system for selecting projects subject to preliminary feasibility study
Decision-making for comprehensive coordination of S&T policies, and support for the operation of deliberation and advisory organizations
- Diversifying agenda identification channels for the efficient operation of S&T-related ministerial meetings, and strengthening support to secure the effectiveness of agendas
- Support for the operation of S&T-related ministerial meeting & working-level coordination meeting; steering committee & policy coordination committee of the S&T advisory council; and basic research promotion committee & meeting
- Support for the operation of policy forums related to S&T innovation to cope with current and pending S&T policy issues

Support for responding to current S&T innovation policy issues
- Support for the preparation of 'Strategy for Selection, Promotion, and Protection of National Strategic Technologies,' and 'Special Act on the Promotion of National Strategic Technologies,' to deal with competition for technological hegemony

Published S&T yearbook

Survey and analysis of S&T policy trend
- Research, analysis, and information service for domestic/foreign S&T policy and technology trend
  - Trend issue analysis, operation of global S&T policy trend service (ICT)
  - Comprehensive Survey of National Science & Technology Perception in 2021

3. Regional S&T innovation policy planning

Policy and program planning to establish region-led R&D system
- Support for performance review of comprehensive plan for the promotion of regional R&D, establishment of 2021 Implementation Plan, operation of the Committee on Regional S&T Promotion
- Study on plan for strengthening regional R&D innovation capability and the development of regional R&D system
- Planning R&D cluster demonstration test bed model

Establishing statistics system for regional R&D survey and analysis
- Conducting regional-led R&D programs and performance research and analysis
- Setting the policy and institutional direction of regional S&T policies required by local governments
- Collecting statistical information and conducting a survey related to regional S&T by 17 local governments to promote region-led customized R&D policies

4. Policy planning for Human Resources for S&T

Human Resources for S&T development and support policy planning
- Identifying innovation tasks for science & engineering university as follow-up tasks of '4th National Basic Plan for Human Resources in S&T (2021~2025), and preparing 'Science & Engineering University Innovation Plan'
- Preparing measures to protect core technical talents of universities and research institutes
- Promoting the revision of the 'Special Act On Support Of Scientists And Engineers For Strengthening National Science And Technology Competitiveness,' to secure key talents in the field of S&T growth engines, in consideration of the low birth rate & aging of the population, and the intensifying global competition for technological hegemony
- Preparing plans to derive new future jobs and revitalize jobs for each of the 'BIG 3' fields by researching and promoting measures to discover promising new jobs in the digital and contact-free fields

Advancement of Human Resources for S&T statistics
- Conducting 'Survey on the development, utilization and treatment of science and engineering human resources,' which annually tracks the employment status, utilization, and career paths of key science and engineering human resources, such as PhDs in science and engineering, technical engineers, and persons in charge of research
- Deriving demand indicators related to S&T personnel, discovery and selection of new domestic and international supply indicators, and update of existing indicators

Operation of Human Resources for Science & Technology Policy Platform (HPP)
- Publishing statistics and policy information related to S&T talent and providing services through comprehensive information system
- Providing the latest contents through constant monitoring and update of Human Resources for S&T policy and statistical information
- Promoting system improvement including public service quality improvement and contents upgrade

Establishing statistics system for regional R&D survey and analysis
- Conducting regional-led R&D programs and performance research and analysis
- Setting the policy and institutional direction of regional S&T policies required by local governments
- Collecting statistical information and conducting a survey related to regional S&T by 17 local governments to promote region-led customized R&D policies

Survey and analysis of S&T policy trend
- Research, analysis, and information service for domestic/foreign S&T policy and technology trend
  - Trend issue analysis, operation of global S&T policy trend service (ICT)
  - Comprehensive Survey of National Science & Technology Perception in 2021

2. S&T policy planning to solve social problems

Establishment and implementation of an annual action plan for 'The 2nd Comprehensive Plan for Solving Social Problems based on the S&T (2018~2022), and consulting support through implementation performance and on-site evaluation

Strengthening field-applied social problem solving R&D including enactment and implementation of 'Social Problem Solving R&D Guidelines for Spreading Field Application',
- Preparing classification criteria for high social demand, high consumer participation, and high field applicability projects among social problem solving R&D programs
- Support for guideline-based budget deliberation to strengthen on-site applicability of social problem solving R&D programs

Establishing 'Platform on Science and Technology Policy for Social Problem Solving (website, SNS, newsletter), accumulating policy trends and relevant data through public services

Holding the 1st social tech fair* to discover the outstanding results of social problem solving R&D and building an ecosystem for public-private partnership social problem solving
* Holding technical briefing on 36 achievements and supporting follow-up meetings with matching companies for the purpose of solving social problems and enhancing public perceptions of the achievements through exchange and cooperation between social problem solving R&D achievements and technology consumers.
Support for the operation of the Special Committee on Future Talent
- Identification of the Human Resources for S&T policy agenda by supporting the operation of the Special Committee on Future Talent and meetings for consultation and deliberation on agendas in the field of national S&T talents
- Support for holding an appointment ceremony of 19 private members to the 2nd term of Special Committee on Future Talent

5. Strengthening the S&T Diplomacy capacity as a global leading think tank

- Study on establishment of S&T diplomacy governance
  - Study on the revision of the regulations/laws and the establishment/operation plan for governance to promote pan-ministry S&T diplomacy
  - Study on the role and function of S&T Diplomacy Center for systematic support of pan-ministry S&T diplomacy
  - Review of the establishment of a comprehensive S&T diplomacy/international cooperation plan
  - Study on the development of a performance evaluation methodology for S&T diplomacy and international cooperation
  - Planning and operating a Science and Technology Diplomacy Forum* & the Science and Technology Diplomacy Academy**
    * Held twice to raise awareness of S&T diplomacy and to build knowledge sharing network between S&T community and the diplomatic community
    ** Operated online and offline in parallel to enhance S&T diplomacy capacity and nurture S&T diplomacy experts

- Establishment of S&T diplomacy strategy and agendas to address major global issues
  - Study on S&T diplomacy strategy related to major global issues and risks such as technological hegemony and carbon neutrality
  - Identifying S&T cooperation agendas to strengthen climate and energy competitiveness through policy analysis and focus group interviews
  - Identifying an international joint research agenda to participate in achieving carbon neutral goals in the international community, secure climate leadership, and enhance the competitiveness of carbon neutral technology
  - Identifying S&T diplomacy agendas for major countries* and developing strategies for the association of EU Horizon Europe
  - Identifying international joint research agendas and supporting the S&T Joint Committee for partner countries such as Italy, Sweden, Slovakia, UK, Hungary, and Brazil
  - Study on the “S&T Official Development Assistance (ODA) Statistical System*” for strategic S&T ODA programs, and study on S&T ODA strategy for major partners such as Egypt
  - Marker-based “S&T ODA Statistical System” and through the operation of TF with relevant ministries and agencies such as the Ministry of Science and ICT and the Ministry of Foreign Affairs
  - Study on S&T ODA strategy for 3 countries: Egypt, Ukraine, and Kyrgyzstan

- Study on S&T diplomacy trends and information analysis
  - Study on S&T diplomacy statistical system, including the identification of statistical data and indicators in the area of domestic and foreign S&T diplomacy and international cooperation
  - Study on the establishment of an S&T international cooperation scoreboard to enhance the sustainability and consistency of S&T diplomacy and international cooperation statistics

- Study on the Establishment of Global Platform for S&T Innovation
  - Organizing the 13th KISTEP-ISTIC S&T Innovation Training Program (Aug. 2021)* for senior policymakers in developing countries
  - Real-time online education & training through the establishment of an online education & training platform (LMS) in response to COVID-19
  - Joining the Trilateral S&T Policy Seminar for strengthening strategic partnerships among S&T policy institutes of Korea, China, and Japan through discussion on major S&T innovation issues and research highlights
  - Continuous participation and activities including international forums, seminars, and academic conferences* to strengthen the global S&T innovation capacity and establishing cooperation
  - Establishing the international cooperation network through participation in US-Korea Conference (UKC) 2022, Canada-Korea Conference (CKC) 2022, Europe-Korea Conference (EKC) 2022, and Asia-Korea Conference (AKC) 2022

- English S&T policy publications as a platform for international cooperation
  - Strengthening networks with overseas policy stakeholders by publishing S&T policy publications such as KISTEP R&D and Beyond, and Asian Research Policy
Survey, Analysis, and Evaluation of Government R&D Programs

1. Government R&D performance evaluation
   - Laying the foundation required to implement "The 4th Basic Plan for Evaluation of R&D Performances (2021~2025)"
     - Establishing and reviewing "Strategic Plan for Programs" for consistent performance evaluation throughout the entire R&D cycle
     - Simplifying meta-evaluation to enhance the autonomy of program performing ministries
     - Establishing "Government R&D Performance Evaluation Information System" for efficient R&D program evaluation and share evaluation results to the public
   - Revision of "Act On The Performance Evaluation Of Government Research And Development Programs"
     - Support for full revision for legislation of the "performance evaluation of autonomy and responsibility" under the "The 4th Basic Plan for Evaluation of R&D Performances (2021~2025)"

2. Production/Analysis/Utilization/Spread of national R&D and S&T statistics
   - Producing and collecting 2020 National R&D Statistics
     - Presenting survey and analysis results of 2020 national R&D programs and proposing agenda for 2021 implementation plan
     - Statistical analysis of 2020 national R&D programs performance
     - 2020 R&D activity survey and announcement of the results, notification to OECD
   - S&T competitiveness statistics analysis and support for S&T policy decision making
     - Derivation of national Composite Science and Technology Innovation Index (COSTII) and regional Composite Science and Technology Innovation Index (R-COSTII)
     - Enhancing the utilization and public relations through domestic and foreign conferences, briefing sessions, and lectures
     - Support for evidence-based policy discussions and decision-making processes through the publication of the S&T Statistical White Paper and 100 Main S&T Indicators booklets
     - Improvement of S&T innovation data utilization and distribution
     - Establishment and advancement of support service for S&T policy support service (K2Base)

3. Efficient planning and operation of national R&D management regulation
   - Promoting "National Research And Development Innovation Act" and promotion of R&D regulation reform
     - In accordance with the enforcement of the Act, operating ① briefing session, ② production and distribution of materials and manuals ③ regular online Q&A system to enhance understanding for researchers
     - Preparing "2021 National R&D Administration Regulation Improvement (draft)" (Articles 29~30 of the Act)
     - Establishment and operation of the Research Rights Protection Committee to ① protect researcher rights and interests, and ② prevent research fraud, while reviewing the appropriateness of sanctions
   - Reviewing and enhancing efficiency of research management system
     - Preparing a detailed plan to evaluate the research support system pursuant to Article 25 of the "National Research And Development Innovation Act"
     - Calculating indirect cost notice ratio for 2021 national R&D programs
     - Review of support regulations for student researchers by institute, survey on payment of student labor costs for 1st semester in 2021, survey on recognition of student labor costs, etc.
     - Strengthening the planning and evaluation capacity and research administration services of specialized institutes
   - Study on regulation reform according to the regulation change for government-affiliated institute evaluation
     - Conducting institutional operation evaluation, institution operation plan and research program plan review, and interim consulting according to the regulation change for government-affiliated institute evaluation
     - Research on the improvement of the government-affiliated institute evaluation system through research on the redesign of institute evaluation, and the improvement of the customized evaluation system for government-funded research institutes
4. National R&D performance management, utilization, and distribution

Utilization and distribution of research outcomes
- Establishing a 2021 implementation plan focused on strengthening the organizational capacity to utilize and distribute research outcomes according to the Act on The National Research And Development Innovation Act.
- Distribution of guidelines for Establishment of Research Performance Management and Utilization Plans for Universities and Government-Funded Research Institutes, and research and analysis of plans for each institute.

Enhancing the role of research management specialized institutions and research performance
specialized institutions
- Conducting a 2021 survey and analysis of research & management specialized institutions.
- Conducting a 2021 R&D Program Research Results Utilization Survey.

Discovering, spreading and promoting excellence achievements
- Selection, promotion, and spread of the Top 100 Excellent National R&D Achievements.
- Identifying achievements and follow-up support for ‘Pan-Ministry Relay Race of Excellent R&D Achievements’.

Regulation reform and performance analysis
- Conducting research on In-depth Analysis of government R&D Registration and Deposit Research outcomes.

Integration of research support systems across ministries

1. Establishment of researcher-oriented Pan-Ministry Integrated Research Support System (IRIS)

Establishment of Pan-Ministry Integrated Research Support System (IRIS) based on standardized procedures and formats of the National Research And Development Innovation Act.
- Completed functional development for each system based on the promotion plan to build an integrated research support system.
- Third round of integrated tests for each user (for institutions and researchers) and the operation of a pilot program for the R&D program group of pan-ministerial full-cycle medical devices.

Strengthening the foundation for an integrated customer service system to ensure service stability in preparation for full-scale IRIS system operation
- Production and distribution of national R&D programs research and management standard manuals (for working-level officials in ministries and specialized institutions) and user manuals (for researchers).
- Expanding the operation scope of the call center from the National Researcher Information (NRI) to the entire IRIS system service, and establishing its operation plan.
- Creating online education contents about IRIS user manual for researchers, and establishing an operation plan for the education program.

Establishing a continuous communication and feedback system with researchers and specialized institutions by repeating the process of sharing the status of IRIS implementation of all stages, collecting and reflecting their opinions.
- Conducting specialized institute Briefings, Online Survey, specialized institute meetings.
- Establishment of cooperation plan for IRIS operation for rapid embeddedness in research sites.

2. Integrated support for customized national R&D planning and management

Development of performance evaluation integrated management system registration and management services
- Development of evaluation system for programs and institute in accordance with the Act on The Performance Evaluation And Management Of National Research And Development Projects and the Enforcement Decree of said law.
- Reflecting the improvement of the performance evaluation system by efficiently supporting the evaluation & management of R&D programs and strengthening online evaluation support through monitoring program performance.

Strengthening response to national R&D comprehensive coordination support services, including the establishment of Regional Science & Technology Information Service (RTIS) and provision of regional R&D statistical information through the services.

Efficient collection and systematic management of information related to national R&D program planning evaluation & management expenses through integrated registration and management service establishment and pilot operation of planning, evaluation, and management expenses.

Expanding the provision scope and improving functions of national R&D planning & management support services
- (Mid-to long-term plan budgeting) Expanding full-cycle information between national R&D programs budget, execution and performance, establishing mid-to-long-term plans in the field of S&T, and upgrading the operation & management of registration services.
- (National & integrated notification) Improving the efficiency of notification of national R&D program information management by the development of an API linked to the public announcement of the Ministry of Security and Public Administration and adding/improving administrator functions.

Strengthening response to national R&D comprehensive coordination support Services
- Sanction information inquiry) In accordance with the enforcement of the National Research And Development Innovation Act, maintenance and functional development of sanctions information registration & management items, establishment of sanctions information disclosure menus, enhancement of user convenience and information access, and upgrade of manager functions such as detailed statistical analysis.
- (Platform on Science and Technology Policy for Social Problem Solving) New administrator functions such as strengthening user-oriented functions, displaying the latest posts, and providing a function to edit the order of exposure cards.
3. Advancement of high-quality data-based S&T policy support service

■ Policy · technology trends
- Expansion of the utilization of high-quality policy and technology trend information, including the expanded collection and provision of research results from government-funded research institutes in connection with the National Knowledge Information System (NKIS)

■ S&T statistics
- Real-time collection · provision and expansion of the scope of S&T-related statistical information, and introduction of microdata maintenance and visualization functions for detailed statistical analysis services

■ SIMS, R&D data request, classification system–based R&D analysis
- Enhancing the efficiency and openness of national R&D standard information by expanding the target of opening national R&D information and simplifying the data request procedures

■ Technology transfer · commercialization information
- Enhancing the utility for users, including the utilization and spread of necessary information and information update, by opening and providing information related to technology transfer and commercialization to relevant institutes

■ National R&D acts and manual
- Expansion and service improvement for legal, manual revision data and legislative/administrative notice information related to national R&D and S&T
1. Budget allocation and coordination of government R&D programs
   ■ Held the 2021 Joint Briefing on Government R&D Programs by Ministries (online).
     - Enhancing the accessibility and understanding of the contents and plans of the programs and
       promoting the program performed by each ministry by holding a joint government R&D briefing
       session with all ministries
     - Live online broadcasting to curb the spread of COVID-19, participated in by approximately 24,000
       people (increase of 15,600 compared to the previous year)
   ■ Preparing the 2022 Government R&D Investment Direction and Standards
     - Presenting the basic principles of government R&D investment and investment directions for each
       major policy and field
     - Suggesting the investment direction for each detailed field of 11 major technology fields
   ■ Visiting program consulting
     - Consulting on budget deliberation standards including program feasibility, suitability, and program
       content adequacy
     - For a total of 166 programs from 20 ministries (150 new, 9 collaboration, 7 linked programs)

2. Analysis on R&D investment efficiency issues
   ■ Establishment of R&D investment efficiency plan by technology sector
     - Establishing plans to improve the investment efficiency of government R&D programs by each
       technology/policy field
   ■ Establishment of the National R&D Mid–To-Long-Term Investment Strategy (2023~2027)
     - Comprehensive plan that supports the implementation of the S&T Basic Plan and encompasses
       mid–to long-term plans for each ministry and technology sector
     - Research and analysis of R&D investment issues such as policy, technology, environment, and
       future prospects for systematic and efficient establishment as the first legal plan for mid–to long–
       term investment strategy
     - Confirming the mid–to-long-term investment strategy establishment system, organizing and
       operating the Establishment Committee to derive interim results of each division agenda, and
       review by the executive committee
   ■ Implementation performance review for R&D Investment System Innovation Plan
     - Deriving the implementation progress and supplementary tasks of innovative plan and applying the
       results to the 2023 Government R&D Investment Direction and Standard for budget allocation and
       coordination
     - Newly proposing 10 tasks in consideration of changes in the internal and external policy environment
       * Establishment of R&D investment strategies for each policy field, support for cutting-edge strategic technology
       area, and expansion of public-private R&D collaboration
   ■ Improvement of support system for R&D planning—evaluation—management expenses
     - Organizing the expense structure into an integrated planning—evaluation—management expenses
       program by institute and by accounting (general, fund, etc.), and improving the deliberation system
   ■ R&D investment recommendation for public institutes
     - Recommendations for 39 public institutes that are operating corporate subsidiaries (research institutes)
       or have R&D functions
     - Activating R&D investment from public institutes to strengthen technological capacity in public sector
       and lead public R&D investment
3. Study on strengthening R&D investment strategic planning capacity

- Operation of national research infrastructure (3N) for materials, parts, and equipment
  - Organizing “3N” Steering Committee for the activities and operation of National Research Infrastructure (3N) in the field of materials and parts and equipment, and performing the role of general assistant and executive secretary
  - Amendment of the Directive, which is the basis for the establishment and operation of 2021 3N operation plan and the steering committee

- Global R&D investment trends analysis
  - Comparing and analyzing R&D investment trends, policies, and global issues in major countries such as the United States, China, Europe (27 countries), Germany, and Japan

- Identifying core technologies for the response to the infectious disease crisis, and establishing a support plan for government R&D
  - Design of element technology classification system for each field of infectious disease research (diagnosis, treatment, vaccine, quarantine)*
  - Proposal of a support strategy for the entire R&D cycle to secure core technologies to respond to new infectious disease crisis

- Deriving key areas of green and white biology and establishment of government support direction

- Support plan for win-win cooperation between large firms and SMEs
  - Identifying the issues related to win-win cooperation in industry and deriving practical open innovation promotion plan
  - Solving technical problems and proposing a policy direction that enables the distribution of open type innovation outcomes

- Identifying R&D technology demand and support plans for each of 4 major fields*
  * Strengthening the D.N.A. (Data, Network, AI) ecosystem, advancing contact-free infrastructure, digitalizing S&O, fostering new hyper-connected industries, etc.

- Enhancing the effectiveness of the Digital New Deal policy and seeking R&D support strategies for spreading the achievement

- Improvement of investment efficiency for national big science R&D full-cycle
  - Through analysis of major issues in the field of big science, preparing efficient R&D direction and suggesting measures to improve investment efficiency

- Building a data-based R&D budget allocation and coordination system
  - Operation of the Disaster and Safety R&D Information Portal, for the effective promotion of demand-based disaster and safety R&D
  - Development of support system for efficient budget allocation and coordination

- Organizing and holding KISTEP Wednesday Forums
  - An open forum broadcast live on YouTube that contributes to strengthening the KISTEP brand
  - Identifying policy measures through an assessment of pending issues and challenges in the S&T field

- Publication of Technology Trend Brief
  - In-depth analysis and publication of the latest trends in major technology and policy areas to establish short-term and mid- to long-term investment strategies
  - Utilizing the brief to identify key issues for R&D budget allocation and coordination, and providing it to KISTEP policy stakeholders

Government R&D budgeting support

1. Study on government R&D budgeting support and strategic reinforcement

- Deriving top 10 government R&D agendas and support for budgeting

(Top 10 Agendas)

① Infectious disease, ② Materials, parts and equipment, ③ Korean New Deal, ④ BIG 3 (three key industries), ⑤ National tasks (basic research, SME R&D), ⑥ Nurturing talents, ⑦ Next DNA, ⑧ Public safety, ⑨ Aerospace, ⑩ International cooperation

- Preparing a draft for government R&D regulation reform
  - Preparation of management plan to introduce total program cost management for government R&D programs
  - Preparing a draft for regulation reform for planning, evaluation and management expenses in research management institute

- Study for advancing the R&D budgeting process
  - Research on the establishment of a policy basis for strategic R&D budgeting, establishment of an economic effect prediction, and measures to advance the budget system of government-funded research institutes
- Publication of "Government Research and Development Budget: FY 2021", a book providing an overview of the government R&D budget, the process of changing the budgeting system, and the current status of the 2021 government R&D budget.

- Establishment of a communication network to improve government R&D efficiency and identify the next year's issues:
  - (Experts seminar) Identifying trends and major issues to support the advancement and improvement of R&D investment through expert seminars.
  - (Gathering opinions and feedback) Enhancing the process rationality and validity by effectively collecting opinions from diverse groups such as industry, academia, and research experts, R&D budget policy stakeholders, and the general public.
Preliminary Feasibility Study of Government R&D Programs

1. Conducting preliminary feasibility studies of government R&D programs
   - Conducting overall tasks to review the adequacy of the preliminary feasibility studies of government R&D programs and program plans
     - Deriving rational and objective adequacy review results of the preliminary feasibility study and program plan and using the results as base data in budgeting for the next year
     - Publishing research result report on the website in accordance with the standards for handling information disclosure
   - Conducting target selection for preliminary feasibility study
     - Enhancing efficiency of the preliminary feasibility study and the target selection by preparing internal guidelines for target selection, and strengthening communication with ministries
   - Conducting program feasibility study in the field of defense R&D
     - Strengthening capacity as a preliminary feasibility study specialized institute covering all national R&D sectors by conducting defense R&D program feasibility study
     - In addition to the KIDA, a partial amendment to the "Defense Acquisition Program Act," which includes the new designation of KISTEP as a legal investigation agency for defense R&D program feasibility studies, was proposed and passed the main session of the National Assembly

2. Strengthening the reliability of preliminary feasibility studies of government R&D programs
   - Establishment of "Detailed Guidelines for Preliminary Feasibility Studies of Government R&D Programs"
   - Publication of a completely revised and expanded edition of the detailed guidelines in accordance with the consignment transfer of preliminary feasibility study
   - Research for preliminary feasibility study analysis methodology in R&D sector
     - Conducting research to advance the preliminary feasibility study analysis methodology
     - Reflecting the improvement of preliminary feasibility study regulation and the revision of detailed guidelines
   - Conducting preliminary feasibility study training for R&D sector
     - Organizing training programs for stakeholders to enhance the understanding of the role and function of the preliminary feasibility study system in the R&D sector
   - Strengthening research capacity by holding R&D pre-analysis colloquium
     - Holding a colloquium involving industry, academia and research experts to identify measures to enhance the objectivity and reliability of the analysis results
     - Promoting networking activities such as a technology and industrial trend seminar to improve the understanding of the latest technology trends and enhance expertise of project manager of preliminary feasibility study
Taking a step into the future

Major Research Projects

Study on Identification of "KISTEP Think 2022 Agenda" for National Science and Technology Innovation and R&D Development Strategy

Study on the Establishment of Global S&T Innovation Platform in 2021

2021 Technology Assessment

The 6th Science and Technology Foresight (2nd year)

Study on Risk Issues and Response Strategies related to Digital Transformation

Study on the Selection of KISTEP 10 Emerging Technologies in 2022

2021 Self and Meta-evaluation of Government R&D Programs

2021 Survey and Analysis of National R&D Programs

Study on the establishment of 2050 carbon-neutral technology roadmap

Study on the Establishment of the 1st Government R&D Mid- To Long-Term Investment Strategy (2023-2027)

Evaluation on Government-funded research institutes in 2021

Development and Establishment of Government R&D Research Support Integrated System

Study on the establishment of Strategies and Systems for S&T diplomacy

Establishment and Operation of System for Fostering Human Resources in S&T

Preliminary feasibility study of 2021 government R&D programs

2021 Composite Science and Technology Innovation Index (COSTII)
Study on Identification of “KISTEP Think 2022 Agenda” for National Science and Technology Innovation and R&D Development Strategy

Principal Investigator: Byoung-Ho Son, Seok-Ho Son

This study aimed to identify the policy agenda necessary to respond proactively to changes in the surrounding environment, such as the increasing demand to tackle climate change and infectious diseases, the intensifying competition for technological hegemony, and the accelerated transition to the digital era.

- In particular, this research topic was selected since KISTEP has to explore, analyze, and present countermeasures as a national STI policy Think Tank.

(Identification of Issues) We conducted a big data-based keyword analysis (language network, topic modeling, word cloud, etc.) to comprehensively and systematically identify various change factors that affect STI innovation policies, such as the economy, industry, social culture, and the international situation.

(Identification of candidate agenda) We analyzed the issues caused by environmental changes, set the direction for future STI innovation policies, and proposed specific policy tasks that require implementation.

We tried to improve the reliability of the research results by involving a larger extent of stakeholders (organizing and operating external advisory councils, collecting expert opinions, and surveying the demand of major departments in KISTEP, etc.) in consideration of the increase in the complexity of the design and application of STI innovation policies and the diversification of related fields.

(Selection of agenda) With the proposed policy agenda as candidates, we conducted a separate expert agreement process (advisory committee, KISTEP internal expert discussion, etc.) along with a survey to select an agenda with a high ripple effects and urgency in 2022.

Securing global STI leadership in the Pax Technica era

- Establishing STI strategies for a sustainable economy
- Strengthening digital infrastructure for technological innovation
- Ensuring the 2030 SDGs and digital infrastructure

Realizing a healthy, safe, and inclusive society for all citizens

- Protecting the vulnerable as they innovate
- Promoting new innovation paradigms and policies
- Enhancing the capability and safety of society

Advanced innovation system in the era of 100 trillion won R&D expenditure

- Strengthening the research and development system in the era of 100 trillion won R&D expenditure
- Improving the competitiveness of the research and development system
- Ensuring the expansion of the research and development system

Fostering and utilizing human resource for STI in the era of the population decline

- Fostering and utilizing human resources to overcome social problems
- Promoting the utilization of human resources
- Enhancing the competitiveness of human resources

Guidelines for S&T Innovation Policy

Considering the international environmental changes and emerging issues, we have identified and announced 15 S&T innovation policy agendas in 2022.

The research findings of this project have been presented online and offline through the KISTEP Think 2022 Discussion on S&T Innovation Policy and have been discussed in media outlets such as Money Today, Digital Times, Herald Economy, eNews Today, and iNews.

- It also received positive assessments for a timely presentation of S&T innovation policy agendas that require urgent implementation in line with changes such as the inauguration of a new government.

In addition, the main contents of the 15 S&T innovation policy agendas were introduced in the 1st KISTEP Issue Paper and KISTEP Think 2022 and delivered to KISTEP policy stakeholders, including experts in various fields.

Research that aims to select innovation policy agendas must be very extensive and deals with vast amounts of knowledge and information not only related to STI but also to economy, industry and society. As such, there is a limitation that the results cannot encompass detailed strategies for actual implementation to achieve the desired policy effect. In the future, KISTEP plans to continue in-depth research on the proposed 15 agendas by incorporating them into research projects.
Study on the Establishment of Global S&T Innovation Platform in 2021

Principal Investigator: Henna Kim

Research Objective

This study aims to strengthen KISTEP’s global competitiveness as a S&T think tank and continue to expand the international cooperation network.

- It aims to establish a global platform to share major pending issues and innovation strategies in the field of S&T policy and expand our network with relevant foreign organizations.
- Through the operation of S&T innovation training programs for developing countries, we tried to share development experiences of Korea based on S&T and expertise in S&T innovation/R&D management system.
- Also, it aims to strengthen communication channels with related overseas agencies and policy stakeholders through the promotion of KISTEP’s major research results and activities.

Research Process

- (Global platform) We established a network with leading global institutes and identified the agenda for international cooperation in S&T.
  - Through the Trilateral S&T policy seminars among Korea, China, and Japan, we established a close cooperation system with relevant organizations in major countries and identified new partner institutes such as the US Department of Homeland Security, KACST in Saudi Arabia and the Czech Research and Innovation Center.
  - We actively participated in discussions on global issues through international forums, seminars, and academic conferences, and identified agenda for S&T international cooperation.
- (Training program) Based on the expertise of KISTEP, we organized and operated S&T innovation training programs for developing countries.
  - Since 2009, we have been organizing S&T innovation training programs for high-level government officials and S&T policy makers in developing countries in cooperation with the Science and Technology Innovation Center (ISTIC) under the Auspices of UNESCO.
  - We established a curriculum for the training program focusing on the Korean S&T innovation system, such as technology foresight, establishment of S&T Basic Plan, R&D budget allocation and coordination, and R&D program evaluation.
- (Promotion of research achievements) We promoted KISTEP’s major achievements and activities to relevant overseas organizations and policy stakeholders.
  - We shared KISTEP’s major research achievements with the international community through the publication of English reports and promotional materials.
  - In addition, we regularly updated and operated the KISTEP English website and SNS account, and published English KISTEP Newsletters to share KISTEP’s major activities.

Research Achievements

- ▶ (Promotion of research achievements) We promoted KISTEP’s major achievements and research strategies in the field of S&T policy and expand our network with relevant foreign organizations.
- ▶ (Training program) We held the 13th KISTEP-ISTIC S&T Innovation Education & Training Program to transfer the expertise and experience of Korean S&T planning, coordination, and evaluation to a total of 19 participants from 15 counties.
- ▶ This year’s program was held using an online education management system in response to COVID-19, and real-time online sessions were operated to share the current status of S&T innovation policies in participating countries.
- ▶ (Promoting research achievements of KISTEP) We promoted KISTEP’s research achievements and key activities to strengthen KISTEP’s international competitiveness and credibility.
  - We translated the KISTEP Annual Report, KISTEP 10 major future key technologies, and 100 major S&T statistics into English and provided them to overseas policy stakeholders to share major research achievements in KISTEP.
  - We have activated communication with related overseas organizations and policy stakeholders by producing new KISTEP English leaflets, managing English websites, operating SNS accounts, and planning English newsletters.
- ▶ Through continuous cooperation with overseas S&T innovation-related organizations, we will expand our network and establish a response system for the global S&T agenda. In addition, we hope that we can contribute to strengthening S&T innovation capability in developing countries through the continuous operation of education & training programs for them and enhance our international status as a specialized S&T innovation institution.

Expected Effects and Future Plans

- ▶ We identified international cooperation agenda with Korea-China-Japan S&T Policy Institutes.
- ▶ Five relevant organizations, including Korea (KISTEP, STEPI), China (CASTED, CASIESD), and Japan (KISTEP), discussed major S&T innovation issues, research achievements and future cooperation plans.
- ▶ In addition, we established a network with related organizations in the United States, Saudi Arabia, Canada, Malaysia, and the Czech Republic, and laid a foundation for cooperation in S&T innovation policies.
- ▶ Through continuous cooperation with overseas S&T innovation-related organizations, we will expand our network and establish a response system for the global S&T agenda. In addition, we hope that we can contribute to strengthening S&T innovation capability in developing countries through the continuous operation of education & training programs for them and enhance our international status as a specialized S&T innovation institution.

International cooperation in S&T is essential, not optional
2021 Technology Assessment

Principal Investigator: Donggi Lee

Research Objective

■ This study aims to assess the overall impact of S&T development on the society and present proactive policy countermeasures.
  ▶ This study aims to identify a desirable development direction from the beginning of technology development and policy establishment by drawing up policy considerations that can maximize the positive impacts and minimize the negative effects of S&T on the economy, society, culture, ethics, and the environment.

■ (Selection and preliminary analysis of the technology subject to evaluation) We selected the technology to be assessed, determined the definition and scope of the target technology, and derived the assessment direction and issues in advance.

■ (Expert evaluation) We conducted an evaluation on the subject through a technology assessment committee composed of technology experts in each field, and experts in the humanities and social sciences.

■ (Collecting opinions from the public) We have drawn recommendations from the public’s point of view by operating a public forum and collecting opinions from Internet bulletin boards.
  ▶ In addition, we held a joint meeting of the Technology Assessment Committee and the Public Forum to ensure an exchange of opinions among experts and the public.

■ (Open discussion) We presented the evaluation results and collected opinions from the public through live broadcasting.

■ Based on the opinions from the Technology Assessment Committee, the public forum, the bulletin boards, and the public discussion, we discussed the positive and negative impacts of autonomous driving of level 4 or higher level.

■ We comprehensively presented ripple effects in the areas of economy, society, culture, ethics, law, and environment, and drew up policy measures for each field.

■ We completed our reporting of the results to the steering committee of the National S&T Advisory Council and notified the relevant ministries.
  ▶ The relevant ministries will make efforts to reflect the results in research planning for national R&D programs under their jurisdiction in the future, or to come up with measures to minimize the negative impacts.

Research Achievements

Through technology assessment, the impact of new technologies with great ripple effects can be reviewed in advance and used as basic data for establishing S&T policies and mid- to long-term plans.
  ▶ In particular, it is possible to understand the value of technology from a macro perspective and establish S&T policies from a public interest perspective.

In addition, it is expected that it will be an opportunity to enhance the public understanding of S&T policy and social acceptance of technology through an assessment of the impact of new technologies on society.

Expected Effects and Future Plans

Technology assessment is the bridge between S&T and society.
The 6th Science and Technology Foresight (2nd year)

Principal Investigator: Changhyun Park

Based on the Framework Act on Science and Technology (Article 13 and Article 22 of the Enforcement Decree of the same Act), the Science and Technology Foresight is conducted every 5 years, with the aim of collecting data necessary for establishing S&T policies by predicting future demands of the society.

Specifically, we predicted and analyzed future technologies that are expected to emerge in all fields of S&T based on the prospects of future society within the next 25 years (~2045) considering internal and external environmental changes.

We derived a candidate group of future technologies through an integrated analysis of Demand Pull to address the demands of the future society and the Technology Push that will emerge with the S&T development.

Based on the candidate group of future technologies, we identified 241 future technologies and analyzed future technologies through a 2-round Delphi survey of experts in each technology.

Also, we derived 15 future innovation technologies and analyzed the technology spread points through the 2-round Delphi survey.

The results of the 6th Science and Technology Foresight will be utilized to establish the 5th S&T Basic Plan and mid- to long-term plan.

In addition, we would like to contribute to the development of S&T policy planning with a higher level of future-responsiveness by deriving future technologies that reflect social and economic demands for the future society and prospects for S&T development.

By presenting the desirable image of the future that the development of S&T can bring, we would like to raise social interest in S&T and spread the results of the Science and Technology Foresight.

We plan to produce the future image of technology realization in scenarios and illustrations; publish it as a booklet; post English translations of our materials; and organize domestic and international academic conferences, and joint press with the Ministry of Science and ICT.

The Science and Technology Foresight is a compass to prepare for the future society.
We wanted to embody the ambivalence regarding the digital transformation, and present a policy direction to counter the adverse effects.

- Digital transformation acts as a useful tool to improve economic/social development and living convenience, but it has other sides that can have a negative impact.
  - (Positive impact) Evolution of economic system, replacement of simple labor, increased speed and objectivity of decision-making, improvement of productivity, quality improvement, increased operational efficiency, etc.
  - (Negative impact) Misuse of personal information, security risks, poor system reliability, poor sustainability, widening economic gaps, increasing social conflicts, ethical problems, etc.

While the government is actively pursuing policies that promote digital transformation to secure national competitiveness and technological hegemony, we are far behind when it comes to understanding digital transformation-related risk issues and implementing policies to prevent the risks.

We embodied the concept of digital transformation and future risk issues with a focus on artificial intelligence, and presented future policy directions along with related surveys.

- Through a literature review, we analyzed the concept of digital transformation and its ripple effects.
- Through a Big Data Analysis (Embedded Topic Modeling) of related media articles, we identified detailed issues of domestic and international dysfunction in digital transformation that have recently been discussed.
- We conducted a survey (with 1,824 people) to obtain data on a comprehensive awareness level of digital transformation.
- We analyzed the policy trends of domestic and major countries in their response to dysfunction in digital transformation.
- Finally, we presented policy measures at each regulatory level along with a legal review of dysfunctional digital transformation policies.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Regulatory Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy measure 1: Ethical approach by expert</td>
<td>Low</td>
</tr>
<tr>
<td>Policy measure 2: Establishment of certification system</td>
<td>High</td>
</tr>
<tr>
<td>Policy measure 3: Personal rights setting</td>
<td></td>
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<tr>
<td>Policy measure 4: Direct administrative regulation setting</td>
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</table>

There are some shortcomings in the level of description of future social risk issues related to digital transformation.

- As this study collected and analyzed large-scale media articles quantitatively related to dysfunction in digital transformation, and specified the detailed risk issues of digital transformation, it allows us to systematically capture detailed risk issues currently under social discussion.
- However, because the analytical data is limited to media articles, details of current issues can be reviewed but details of risk issues based on prediction are relatively less reflected.
- Therefore, in the future, we want to derive future risk issues related to digital transformation by utilizing more diverse data, and specify the necessary areas for policy response.

Response to the dysfunction of digital transformation is a necessary prophecy.
Study on the Selection of KISTEP 10 Emerging Technologies in 2022

Principal Investigator: Donggi Lee

Research Objective

- By selecting future emerging technologies, this study aims to highlight important issues in our society and the future direction of S&T.
- As the transition to a digital society begins in earnest and accelerates, competition for technological hegemony is intensifying around the world, with social change and industrial restructuring taking place.
- For continuous growth in this changing environment, it is necessary to identify and develop emerging technologies that anticipate changes in future society and drive the S&T development.
- With the acceleration of the energy transition towards carbon neutrality, a major transformation is expected in the Korean society in 5 to 10 years, and thus we selected technologies that can contribute to achieving the goal of 2030 National Greenhouse Gas Reduction* and conducted an in-depth analysis for each technology. *40% reduction in greenhouse gas emissions compared to 2018

Research Process

- We first selected technical or social-economic issues that will emerge as important issues in the future society.
- We found candidates for future issues and evaluated their priority by analyzing domestic and overseas future technology-related trends and technology foresight reports.
- We identified future technology groups that have a great influence on the selected future issues, evaluated their conformity with the future issues, and selected the final 10 emerging technologies.
- Finally, we conducted an in-depth analysis of each of 10 emerging technologies.
- We identified policy, technology and industry trends in domestic and major countries and presented technological challenges and policy suggestions.

Research Achievements

- Identification of future issues: We found five candidates* for future issues through a survey of the domestic and international literature and by collecting opinions from experts, and conducted a survey of future forecasting experts and KISTEP policy stakeholders to confirm the "carbon-neutral era" as a future issue.
  * Megalopolitanization, aging society, space industry era, carbon neutral era, platform economy
- Selection of technology candidates: In order to identify the emerging technologies related to future issues, the technology candidates were selected based on the expected time of technology distribution derived from the “Core Technologies for Carbon Neutrality” announced in August 2021.
- Selection of 10 emerging technologies: The ten emerging technologies were selected in consideration of discussion with technology foresight experts and written evaluations (Table).

Expected Effects and Future Plans

- KISTEP 10 Emerging Technologies in 2022 have a complementary relationship with other technologies and are expected to create positive synergies to contribute to the goal of 2030 National Greenhouse Gas Reduction.
  - For the rapid realization and development of the future key technologies, it is necessary to improve the related laws and regulations, foster human resources, and establish infrastructures.
  - The results of this study can be used by researchers for technology development and R&D program planning, and can be used as promotional materials for the public to overview the changes and the role of S&T in future society.

10 Emerging Technologies

<table>
<thead>
<tr>
<th>Emerging Technologies</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon capture and utilization</td>
<td>Technology to capture CO2 from the gases generated during industrial processes and to convert them into fuels or chemical products</td>
</tr>
<tr>
<td>Bio-based new materials/products manufacturing technology</td>
<td>Technology to reduce greenhouse gas emissions by converting petrochemical based basic/applied new materials and plastics into biomass-derived basic/applied new materials and plastics</td>
</tr>
<tr>
<td>Low-carbon production of iron and steel</td>
<td>Technology to lower CO2 emissions by reducing carbon use necessary for the reduction in blast furnaces and by increasing the use of scrap instead of iron ore</td>
</tr>
<tr>
<td>High-capacity and long-life secondary batteries</td>
<td>Green batteries technology for electric vehicles and ES(Energy Storage) system including lithium batteries, secondary batteries management, battery module/stack/system</td>
</tr>
<tr>
<td>Clean hydrogen production</td>
<td>Technology to produce hydrogen in concert with the technology to capture CO2 from natural gas, naphtha, and LPG or through water splitting that uses renewable energy power</td>
</tr>
<tr>
<td>Ammonia fueled power generation</td>
<td>Technology for carbon-free power generation that uses clean fuels (hydrogen and ammonia) and for step-by-step increases in the percentage of ammonia in the mixture of ammonia and other fuels for power generation</td>
</tr>
<tr>
<td>Grid integration system</td>
<td>Technology to solve the instability of the electricity system caused by variability of renewable energy and increase in the number of electric vehicles charging stations, to assure electric power quality, to improve efficiency in converting distributed energy, and to advance the integration of the electrical grid</td>
</tr>
<tr>
<td>High-efficiency solar cells</td>
<td>High-efficiency solar cells to break the efficiency limit, such as perovskite solar cells, tandem solar cells, and multi-junction solar cells</td>
</tr>
<tr>
<td>Large scale offshore wind power system</td>
<td>Technology to install and operate the large scale offshore wind power system</td>
</tr>
<tr>
<td>Recovery of useful resources (rare earth elements)</td>
<td>Technology to collect, separate, sort out, and recover rare earth elements</td>
</tr>
</tbody>
</table>

(KISTEP 10 Emerging Technologies in 2022)
This study aims to evaluate R&D activities for government R&D programs and government-funded research institutes based on their achievements to increase the efficiency and accountability of R&D investments and ensure the effectiveness of relevant R&D policies.

In accordance with the Act on Performance Evaluation and Performance Management of government R&D programs, we conducted a meta-evaluation of government R&D program and government-funded research institutes and came up with ways to improve the evaluation system.

- The R&D program was autonomously evaluated by the ministry (self-evaluation) and an adequacy review on the results (meta-evaluation) was conducted.
- To ease the evaluation burden on ministries, we selected the target program on a 3-year cycle, and excluded programs subject to final and in-depth evaluation.
- To improve R&D investment efficiency and responsibility of the government-funded research institutes, we conducted an evaluation of research results and institutional operation performance.

We conducted a meta-evaluation of 79 sub-programs in 17 ministries and came up with improvement measures for the program evaluation system.

- The ministry evaluated the R&D activities (self-evaluation) autonomously and KISTEP in cooperation with MSIT conducted an adequacy review twice (meta-evaluation) on the results.
- We conducted a government-funded research institute evaluation (meta-evaluation) of a total of 10 institutions, including the Korea Brain Research Institute (KBRI) and the Electronics and Telecommunications Research Institute (ETRI).
- In the meta-evaluation, we assessed the adequacy of the procedures and operation results of self-evaluation.

We intend to link the results of the project evaluation (meta-evaluation) with the allocation and coordination of the project budget, induce the restructuring and improvement of the project, analyze the economic and social effects, and provide feedback to support policy establishment.

Based on the results of the institutional evaluation (meta-evaluation), we plan to address the problems in project and institutional operation, and to link with institution specific duty adjustment, incentives for institution head and employee.
The survey and analysis of national R&D programs, which has been promoted as a pilot project since 1999, is a representative research project in the history of KISTEP.

As the size of government R&D investment continues to increase, requests for a systematic survey and analysis and objective data on the current status of government R&D programs has continued to increase. To address these needs, we are conducting national R&D program survey and analysis project based on the Framework Act on Science and Technology.

This year, in addition to calculation of the 2020 national R&D program survey and analysis statistics, we tried to organize the current government R&D investment results and derive policy implications.

Looking at the size of the government R&D execution in 2020, the total execution was 23.8,803 trillion won, an increase of 15.8% from the previous year (20.6 trillion won in 2019).

This is a 15.8% increase compared to 2019, which opened the era of a 20 trillion won (20,625.4 billion won) investment in government R&D programs. This is the highest increase in the past 15 years and the largest execution in history.

Looking at the current status of 2020 government R&D execution from a policy perspective, it is considered that the current government actively supports major national tasks and related policies, such as revitalizing researcher-led basic research, expanding R&D to strengthen the competitiveness of SMEs, and narrowing the R&D gap between the metropolitan and regional areas.

First of all, the 2020 execution amount of the “Researcher-Led Basic Research Program” was 2 trillion won, a significant increase (18.3%) compared to the execution amount of 1.7 trillion won in the previous year, and an increase of 16.6% during the current administration (2017–2020), which is about 5.5 times higher compared to the average annual growth rate of 3.0% of the former administration (2013~2016).

Also, as a result of the government’s continued efforts to strengthen the R&D competitiveness in SMEs, the era of 3 trillion won SME R&D was opened in 2017 under the current administration, and 3.9753 trillion won was invested in 2020, indicating that we are facing the era of 4 trillion won R&D for SMEs.

In terms of balanced development of R&D among regions, the proportion of regional R&D execution surpassed that of the metropolitan area after the inauguration of the Moon administration, and this tendency was increased in 2020. In terms of the size of execution by region, provinces (excluding Daejeon) accounted for 39.6% with 8.9 trillion won, while the metropolitan area (Seoul, Gyeonggi, and Incheon) was 7.2 trillion won (31.7%). It was analyzed that the concentration of R&D investment and innovation capability in the metropolitan area is continuously being reduced, as the Moon administration’s policy of balanced development among regions is actively reflected.

We plan to conduct various surveys and analyses so that national R&D program survey and analysis will continue to contribute to evidence-based policymaking.

The survey and analysis of national R&D programs is the signature brand for KISTEP.
Various policies have been announced since the 2050 Carbon Neutral Declaration (Oct. 2020), but as the concept and scope of carbon-neutral technologies are not settled and some of the key technologies are different. Thus, this study aims to identify a strategic direction for technological innovation to achieve carbon-neutral goals along with systematic research and analysis of carbon-neutral technologies.

This study aims to review the carbon neutrality-related policies announced by the Ministry of Science and ICT and the Ministry of Trade, Industry and Energy to prepare a carbon-neutral technology classification system, operate a group of experts to select core technologies, and establish a strategic roadmap for carbon-neutral technology innovation.

Based on the cooperation system between the Ministry of Science and ICT and KISTEP, we produced basic data through various quantitative and qualitative analyses and collected opinions through meetings with technical divisions, working groups, and companies.

We operated five technology divisions, including energy conversion, industry (including CCUS), transportation, urban development and ICT, and the environment; and operated a working group of approximately 200 people to establish a "carbon-neutral technology innovation strategy roadmap.".

Also, as a result of the government’s continued efforts to strengthen thThrough a carbon-neutral R&D demand survey, R&D investment analysis, patent and publication analysis, AHP, and Delphi survey, we selected key carbon neutral technologies and established a technology development path up to 2050.

We selected 39 key technologies that the government should prioritize.

First, we presented the carbon-neutral technology classification system systematically, and analyzed in detail the timing of social spread and technological maturity for each technology. We selected 39 key carbon neutral technologies and established a technology development path up to 2050.

We investigated policy, technology, and industry trends for each technology subject to the roadmap; identified the current status in Korea through a SWOT analysis; and presented short-term and mid- to long-term goals, technology development plans, and commercialization strategies.
As the Framework Act on Science and Technology was revised, this study aims to propose a draft of the ‘1st National R&D Mid- to Long-Term Investment Strategy (2023-2027).’

Korea’s total R&D investment (government + private sector) is the fifth-largest in the world, having grown to more than 100 trillion won. It is time to devise a national R&D investment strategy that considers the rapidly changing economic and social environment in order to enhance the strategic impact and efficiency of R&D investment, along with the expansion of the R&D budget, and to implement S&T policies without any setbacks. To this end, this study aims to suggest the vision, goals, and strategies for Korea’s R&D investment over the next 5 years.

We analyzed the issues and challenges related to domestic R&D in various perspectives, and identified major agendas to consider when establishing mid- to long-term investment strategies.

Through the analysis of domestic and foreign policy trends and the research on future prospects, we investigated the issues of R&D investment from various points of view, including chronic problems with the R&D system that have been highlighted in the past and uncertain issues that may come in the future.

We also gathered opinions on the challenges and future directions of R&D in Korea through surveys of S&T stakeholders, interviews, and group interviews with industry, academia, and researchers.

Based on the results, we selected a total of 11 major areas through expert discussions, and suggested tasks and solutions for mid- to long-term investment strategies.

A total of 136 private sector experts made collective efforts to establish mid- to long-term investment strategies.

We organized and operated a mid- to long-term investment strategy establishment committee led by private sector experts from industry, academia, and research institutes, and identified the goals and tasks of national R&D investment over the next five years.

In particular, we came up with strategic tasks, including national strategic technologies, suggestion for regulation reform to enhance the effect of R&D investment, and measures to strengthen the innovative ecosystem in Korea.

To support the government’s S&T policy from a macro-investment perspective, we plan to revise and supplement the mid- to long-term investment strategy in 2022 by reflecting the national agenda of the new government and the 5th S&T Basic Plan. In the era of fierce competition for technological supremacy, we will strive to establish a national R&D investment strategy that is the basis for securing future-leading S&T competitiveness.
Evaluation on Government-funded research institutes in 2021

Principal Investigator: Yee Kyoung Kim

This study aims to strengthen the institutes’ mid- to long-term development capacity through a full-cycle evaluation of institutional operation and research programs considering the role & responsibility (R&R) and research objective of the government-funded research institutes.

- A total of 16 research institutes under the Ministry of Science and ICT were subject to evaluation, among which KISTEP serves as an evaluation agency for 12 institutes.

<table>
<thead>
<tr>
<th>Type (number of institutions)</th>
<th>Institutes subject to evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D</td>
<td>Institute for Basic Science, Korea Institute of Radiological and Medical Sciences, National Institute for Mathematical Sciences, Korea Institute of Advanced Study, Korea Brain Research Institute</td>
</tr>
<tr>
<td>Education/Fostering talents</td>
<td>KISTEP, GST, DGIST, UNIST, UST</td>
</tr>
<tr>
<td>Supporting</td>
<td>KISTEP, National Nanofab Center, Korea Advanced Nanofab Center, Commercialization Promotion Agency for R&amp;D Outcomes, Korea Institute of Human Resources Development in SAT</td>
</tr>
</tbody>
</table>

Institutional evaluation is conducted through a self-evaluation and a meta-evaluation system. The Ministry of Science and ICT (1st Vice Minister) conducts a self-evaluation of the 16 institutes under its affiliation, and the S&T Innovation Division, MSIT checks and evaluates the adequacy of this self-evaluation (meta-evaluation).

In 2021, KISTEP’s institutional evaluation team conducted a total of 7 self-evaluations and reviews of institutes under the Ministry of Science and ICT, including an institute operation plan review (3 institutes), a research program plan review (3 institutes), and an institute operation evaluation (1 institute).

<table>
<thead>
<tr>
<th>Category</th>
<th># of institutes</th>
<th>Institutes subject to evaluation/reviews in 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institute operation plan review</td>
<td>3</td>
<td>National S&amp;T Research Institute (NST), National Institute of Mathematical Sciences (NIMS), Korea Advanced Institute of Science and Technology (KAIST)</td>
</tr>
<tr>
<td>Research project plan inspection</td>
<td>3</td>
<td>National Council of S&amp;T, National Institute of Mathematical Sciences (NIMS), Korea Advanced Institute of Science and Technology (KAIST)</td>
</tr>
<tr>
<td>Institute operation evaluation</td>
<td>1</td>
<td>Korea Brain Research Institute (KBRI)</td>
</tr>
</tbody>
</table>

- In the institute operation evaluation of the Korea Brain Research Institute, it received an “Excellent” grade in the sense that it is growing as a national research institute, as it created a researcher-oriented, performance-generating environment that enabled immersion in research and strived to establish its status through foreign cooperation.

The evaluations on government-funded research institutes are nutrients for strengthening research capacity of research institutes.
It has been continuously pointed out that different R&D regulations and systems impose an unnecessary administrative burden on researchers and hinder their research commitment. Also, the demands to overcome inefficiencies in research management and for continuous innovative growth and improvement of the structuring of government R&D have been increasing.

To this end, based on standardized R&D regulations and work procedures, this study aims to integrate and reorganize the research task management system to establish a researcher-oriented research environment, and maximize the efficiency of national R&D programs by strengthening the capabilities of specialized institutes.

- (Basic direction) As an R&D regulation innovation hub, KISTEP has tried to establish a network system with ministries, institutions, and research sites to reflect the actual demand in the pre-development stage.

- (Committee) We established and operated the "PMS Working Group" consisting of in-house researchers and experts from each institute, and established cooperative systems for program, including meetings with ministries and specialized institutes.

- Also, to enhance the momentum of the program, we urged each participating institute to form a communication channel so that discussions on the standardization of research forms and research procedures, and the establishment of system functions, can be conducted in parallel.

- (Collecting opinions) By sharing the current status of progress with research sites through briefings, meetings, and surveys, we tried to continuously enhance interest in and understanding of the program by taking the lead in presenting opinions and participating directly.

We have established and completed pan-ministry Integrated R&D Information System (IRIS), which consists of a Project Management System (PMS), a National Researcher Information (NRI), and Real-Time Cash Management System (RCMS), and we have opened a new official service from January 2022.

- We have organized modular functions that consider the standard work procedures and the characteristics of each institute’s programs to provide a flexible research support environment for researchers and specialized institutes through customized services.

IRIS is the Innovation Hub of national R&D
Study on the establishment of Strategies and Systems for S&T diplomacy

**Research Objective**

- This study aims to raise the awareness and capacity of S&T diplomacy by conducting research to promote a more strategic and systematic approach to S&T diplomacy and international cooperation at the national level.

- In particular, this study establishes the strategy for S&T diplomacy and international cooperation by identifying the roadmap and agenda for S&T cooperation in major countries and preparing pan-ministerial governance. Also, it aims to promote evidence-based S&T diplomacy and international cooperation and revitalize the network between the main actors in S&T diplomacy by providing a forum for the domestic S&T community and the diplomatic community to engage in joint discussions.

- (Strategy/Systematization) In cooperation with the Ministry of Science and ICT, we enhanced the strategic nature of S&T diplomacy by selecting target countries in consideration of global issues related to S&T diplomacy, and policy demands, and then identifying an agenda for S&T cooperation.

- In particular, this study establishes the strategy for S&T diplomacy and international cooperation by identifying the roadmap and agenda for S&T cooperation in major countries and preparing pan-ministerial governance. Also, it aims to promote evidence-based S&T diplomacy and international cooperation and revitalize the network between the main actors in S&T diplomacy by providing a forum for the domestic S&T community and the diplomatic community to engage in joint discussions.

- (Strategy/Systematization) In cooperation with the Ministry of Science and ICT, we enhanced the strategic nature of S&T diplomacy by selecting target countries in consideration of global issues related to S&T diplomacy, and policy demands, and then identifying an agenda for S&T cooperation.

- We investigated S&T innovation governance, major policies and strategies, R&D trends, and achievements in major countries such as Sweden, the UK, and the EU, and analyzed the synergies and the strengths & weaknesses to strengthen the S&T diplomacy strategy by identifying cooperative agendas and strategies.

- In terms of S&T ODA, we also prepared the foundation for promoting more strategic S&T diplomacy and international cooperation by upgrading the "Science and Technology and ICT ODA Statistical System "and conducting research on S&T ODA strategies for partner countries such as Egypt.

- In addition, through an in-depth analysis of S&T diplomacy and international cooperation systems in major countries, we studied measures to establish pan-ministerial S&T diplomacy and international cooperation governance and prepared basic data for systematic S&T diplomacy and international cooperation at the national level.

- (Laying the foundation) We strived to raise the awareness of S&T diplomacy, foster talents, and lay the groundwork to promote evidence-based S&T diplomacy and international cooperation.

- We organized and held the "Science and Technology Diplomacy Forum" to share and discuss major issues in S&T diplomacy to revitalize the network between the S&T community and the diplomatic community, and raise a greater awareness of S&T diplomacy.

- Through a survey on the current status of domestic and foreign S&T diplomacy, education & training programs, and the development of curriculum and educational contents, we operated the "Science and Technology Diplomacy Academy" to enhance capacity of domestic experts and foster new talents in S&T diplomacy and international cooperation.

**Research Process**

- Through the survey and analysis of statistics and indicators related to domestic and foreign S&T diplomacy and international cooperation, we established an S&T diplomacy statistics system and prepared the foundation to promote evidence-based S&T diplomacy and international cooperation.

- We led a paradigm shift from activities oriented around international cooperation in S&T to S&T diplomacy.

- We established the foundation for a paradigm shift from the current pursuit of S&T cooperation to leading S&T diplomacy.

- Notably, we devised a top-down strategy rather than a bottom-up strategy for S&T cooperation to strengthen the strategy of S&T diplomacy and international cooperation.

- This study also contributed to raising awareness of S&T diplomacy, and fostering expertise in S&T diplomacy.

- The "Science and Technology Diplomacy Forum" has raised awareness of S&T diplomacy by involving the domestic S&T community, the diplomatic community, and the public and sharing major issues in S&T diplomacy at home and abroad, and seeking future direction.

- In addition, the "Science and Technology Diplomacy Academy" contributed to the development of S&T diplomacy expertise by planning and operating education & training programs for domestic experts in S&T diplomacy and international cooperation.

**Research Achievements**

- As the importance of S&T diplomacy increases in the era of technological hegemony, we will try to contribute to the national interests based on S&T diplomacy by promoting and supporting more strategic and systematic S&T diplomacy.

- Recently, as we enter the era of technological hegemony in which the competition between countries is intensifying, focusing on high technologies such as semiconductors and artificial intelligence, major countries tend to combine S&T with diplomacy to secure their own interests and capabilities.

- Notably, we devised a top-down strategy rather than a bottom-up strategy for S&T cooperation to strengthen the strategy of S&T diplomacy and international cooperation.

- The "Science and Technology Diplomacy Forum" has raised awareness of S&T diplomacy by involving the domestic S&T community, the diplomatic community, and the public and sharing major issues in S&T diplomacy at home and abroad, and seeking future direction.

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**In the era of technological hegemony**

Science and Technology Diplomacy is now the answer
Establishment and Operation of System for Fostering Human Resources in S&T

**Principal Investigator: Hyejung Joo**

**Research Objective**

- This study aims to advance the policy planning and performance distribution system related to human resources in S&T, which are rapidly changing due to increased future uncertainties and the development of advanced technologies.
- In accordance with the establishment of the 4th Basic Plan for Human Resources in S&T (HRST), we identified key policy issues, prepared implementation plans, checked implementation, and produced and spread various contents related to HRST policies and statistics through the operation of a comprehensive information system for HRST policy.

**Research Process**

- (Analysis and identification of HRST policy issues) To establish an innovation support plan for science and engineering universities, we organized and operated a pan-ministerial collaboration system and a private advisory committee to reflect the perspectives of various policy stakeholders. Also, in order to revise the Special Act On Support Of Scientists And Engineers For Strengthening National Science And Technology Competitiveness, the deficiencies and actual effects in the legal system were investigated.
- (Establishing implementation plan) To implement the major tasks of the basic plan for human resources in S&T, we established the 2021 Performance review and 2022 Implementation Plan via consultation and coordination among the relevant ministries and local governments.
- (Operating comprehensive information system) We promoted the use of the platform, including establishment of a regular monitoring system for the latest domestic and foreign statistics and policies related to HRST, providing customized information for users, and publishing newsletters.

**Research Achievements**

- We assessed government support and various performance for science and engineering universities, and supported the establishment of the “Innovation Support Plan for Science and Engineering Universities” by identifying priority tasks such as education innovation, strengthening research competitiveness, and revitalizing industry-academic cooperation.
- We promoted the revision of the Special Act On Support Of Scientists And Engineers For Strengthening National Science And Technology Competitiveness to foster talents in the field of S&T growth engines, in consideration of the low birth rates, aging population, and intensifying competition for global technological hegemony.
- We newly established or supplemented necessary provisions including database establishment for HRST, special cases for research-oriented universities, and utilization and support for highly experienced scientists and engineers.

**Future Plans**

- We will support follow-up plans so that the innovation of science & engineering universities and the revision of the Special Act On Support Of Scientists And Engineers For Strengthening National Science And Technology Competitiveness established this year can be practically implemented. Also, we will prepare effective policies based on policy demand and statistics by identifying timely issues related to HRST according to environmental change; and make a range of efforts to strengthen the growth and utilization of HRST.

**Fostering HRST is**

**Competitiveness in the era of Technological Hegemony**
Preliminary feasibility study of 2021 government R&D programs

Principal Investigator: Hyun Yim

Research Objective

- While maintaining the principle of improving the efficiency of financial management through a preliminary feasibility study of large government R&D programs, we supported the strategic promotion of innovative and challenging ideas to address problems that need to be solved in a timely manner.
  - This study contributes to improving the efficiency and soundness of financial management by ensuring the transparency and fairness of national R&D programs through verifying the feasibility of large-scale financial investment in advance.
  - As there are a wide variety of problems to be solved and an array of approaches, we are carrying PFS by applying a flexible yet professional investigation system by reflecting the atypical characteristics of R&D programs.
  - However, in recent years the scale of programs tends to be increasing, as well as the programs involve multiple ministerial actors rather than a single ministry, so it is not easy to derive the results in a timely manner.

- As the proportion of highly complex national R&D programs such as super-large, multi-sector, multi-ministerial has increased, we have made efforts to strengthen the expertise of the preliminary feasibility study.
  - As a preliminary feasibility study has been initiated and is underway on the mega R&D programs in the field of carbon neutrality and technological hegemony, we have designated a research specialized center to gather various opinions from national institutes or committees and reflect them in the research for consistent feasibility study.
  - As the proportion of highly complex government R&D programs has increased, we are organizing an external advisory committee according to the scope and needs of the research in order to strengthen the expertise of the preliminary feasibility study.

- We have contributed to improving the efficiency of R&D budget execution by conducting 18 preliminary feasibility studies of government R&D programs and 4 program plan adequacy reviews.
  - Preliminary feasibility study of 18 government R&D program was completed, and the study concluded that 10 (55.6%) programs to be implemented and 8 (44.4%) programs not to be implemented.
  - The total program cost (requested) of the above programs for which the preliminary feasibility study was completed was 14,5029 trillion won, and the program cost adjusted through the study was 7,6210 trillion won, accounting for 52.6% of the total program cost (requested).
  - Also, the total program cost (requested) of the 4 programs that completed the adequacy review of program plan was 1,7884 trillion won, which was reduced by 346,4 billion won.

- Currently, we have prepared a preliminary feasibility study system for large-scale and complex programs such as carbon neutrality, space, national defense, climate/weather, etc. and are conducting efficient and objective research.

Research Process

- Expected Effects and Future Plans
  - We want to continue research to improve the preliminary feasibility study system along with efforts to enhance the expertise, objectivity and consistency of preliminary feasibility study results of government R&D programs.
    - To more reasonably estimate the economic ripple effect of the challenging and innovative R&D programs, we plan to explore and identify various research methodologies.
    - In particular, we will continue to apply new research methodologies to research practice, including the introduction of the stranded assets concept to estimate mid- to long-term R&D ripple effects in the carbon neutrality, weather & climate, and energy sectors.

The preliminary feasibility study is the cornerstone of effective R&D system
To enhance S&T innovation capacity, which is becoming more important to national competitiveness, this study aims to provide an objective and quantitative assessment of the level of national S&T innovation capacity.

- Specifically, this study aims to measure the level of innovation capacity of Korea, identify strengths and weaknesses, and provide OECD countries with basic data that can be used for STI policymaking.

- We conducted an in-depth review and improved the existing evaluation models.
  - We tried to improve the reliability of the evaluation by replacing discontinued indicators and reorganizing the data of indicators.
  - We also investigated the availability of indicators in candidate countries and added the countries subject to evaluation.

- We collected data of indicators, processed the data using statistical techniques, and derived and analyzed the evaluation results.
  - We calculated, compared, and analyzed the scores and ranks of the S&T innovation capacity indexes of 36 OECD countries based on 5 major fields, 13 items, and 31 indicators.
  - We identified the characteristics of S&T innovation capacity by country through trend analysis and derived the strengths and weaknesses of sectors, items, and indicators for Korea and each country.

- In addition, we conducted in-depth analysis considering issues such as patent analysis of 4th Industrial Revolution technologies and comparison of S&T innovation capacity among Korea, China, and Japan.

- In 2021, Korea’s S&T innovation capacity was ranked 5th among the subjects of evaluation, 3 steps higher compared to the previous year.
  - This is the highest ranking ever since the beginning of the COSTII evaluation.
  - In the activity sector, a traditionally strong area, Korea rose from third to 2nd; the resource and network sectors were ranked 5th and 6th, respectively; while in the performance (13th) and environmental (22nd) sectors Korea was ranked relatively low, in the middle and lower ranks, indicating that improvement is required.

- Expected Effects and Future Plans
  - We hope that it can serve as basic data for evidence-based S&T innovation policy by building time series data related to S&T innovation capacity and continuously providing analysis results.
  - Also, we will continue to improve the measurement of innovation capacity by steadily checking models and improving the indicators and models in line with changes in the innovation environment.

Composite Science and Technology Innovation Index is a standard for overcoming limitations
As a Think-Tank that leads an S&T-oriented society, we will do our best to study S&T innovation policy, reorganize the R&D system so that researchers can research enthusiastically, and serve as a bridge connecting the R&D achievements to improvements in quality of life.
Joint Briefing on Government R&D Programs

Jan. 18, 2021

2021 Joint Briefing on Government R&D Programs by Ministries, co-hosted by 10 government ministries, including the Ministry of Science and ICT, the Ministry of Trade, Industry and Energy, and the Ministry of SMEs and Startups, and organized by KISTEP, was broadcast live online via a web page and live broadcasting support platform. The joint briefing was held to guide industry, academia and research researchers and experts to the main contents and detailed implementation plans of R&D programs of ministries for the 2021 government R&D budget (27.4 trillion won) finalized in the National Assembly.
The Ministry of Science and ICT and KISTEP held an online public hearing on "2022 National R&D Investment Direction and Standards." The first part of the public hearing featured presentations on the investment direction, panel discussions, and Q&A session, and the second part featured presentations of detailed investment directions for six technology areas and Q&A session.
Sang-seon Kim, president of KISTEP, participated in the Money Today Global Conference K.E.Y. PLATFORM 2021, and presented the "Next Normal Era led by Science and Technology." He defined the next normal era after Covid-19 and explained that the government focuses its resources on strengthening R&D in bio-health industry, the Korean New Deal, strategies to upgrade materials, parts and equipment, and 2050 carbon neutrality, which will be a foundation to turn crisis into opportunities.
The 1st Science and Technology Diplomacy Forum

May 13, 2021

The first Science and Technology Diplomacy Forum, hosted by the Ministry of Science and ICT and organized by KISTEP, was held on May 13, 2021. This forum was held to discuss the meaning of Science and Technology Diplomacy, the current status and challenges, and the future direction. The program started with the opening remarks of ▲ Vice Minister of MSIT (Hongtaek Yong) and the congratulatory remarks of ▲ President of KISTEP (Sang-seon Kim). The first session overviewed the present and future of Science and Technology Diplomacy by ▲ Professor Seung-hwan Kim at Pohang University of Science and Technology, followed by the second session on current Science and Technology Diplomacy in Korea. The second session included presentation by ▲ Director General at KISTEP (Soon-Cheon Byeon) and panel discussions and Q&A sessions under the theme of Korea’s science and technology diplomacy and international cooperation achievements and tasks.
KISTEP hosted the 13th KISTEP-ISTIC S&T Innovation Training Program online in collaboration with the International S&T Innovation Center under the Auspices of UNESCO (ISTIC). A total of 19 S&T policymakers from 15 countries in Asia (Malaysia, Cambodia, Indonesia, etc.), Africa (Nigeria, Uganda, etc.), and South America (Brazil, Peru, etc.) participated in this program, which marked its 13th year. The online program covered Technology Foresight; S&T Basic Plan; Human Resources in S&T Policy; R&D Program Budget Allocation and Coordination; R&D Performance Management and Utilization; and S&T Innovation Measurement. Also, there were real-time online Q&A session with lecturers and country STI report, presented by participants.
The 2nd Science and Technology Diplomacy Forum

Nov. 23, 2021

The 2nd Science and Technology Diplomacy Forum, hosted by the Ministry of Science and ICT and organized by KISTEP, was held on Nov 23, 2021. This forum was organized to discuss the strategies to cope with science and technology diplomacy in the era of technological hegemony. The forum was hosted by Jinha Kim, Director of KISTEP Center for International Cooperation Policy, starting with the opening speech by Hongtaek Yong (Vice Minister of Science and ICT), congratulatory remarks by Hyangja Yang (member of the National Assembly), congratulatory remarks by Jong-moon Choi (Vice Minister of Foreign Affairs), and welcome speech by Sang-seon Kim (President of KISTEP). There were two presentations: ‘the significance of technology hegemony and major issues and implications in the international community’ by professor Won-joon Kim of KAIST and ‘the challenge and opportunity of Korean science and technology diplomacy in the era of technology hegemony’ presented by professor Jong-il Lee of SUNY Korea.
Ministry of Science and ICT and KISTEP held the “2021 Social Problem Solving R&D Performance Presentation Social Tech Fair.” The social tech fair started with the opening ceremony, and technical briefing sessions lasted for three days. The opening ceremony of the social tech fair began with a welcoming speech by Kyung-soo Lee (head of the Science and Technology Innovation Division at the Ministry of Science and ICT) and the opening speech by Sang-seon Kim (president of KISTEP).

In the special lecture, Byung-gun Kim, director at Korea Institute of Procurement (KIP), presented social R&D’s public and innovation procurement plan, and Jung-tae Kim, CEO of MYSC, discussed social R&D on the perspectives of acceleration of impact investment. In addition, to introduce public–private cooperation in the social R&D field, the lecture was conducted with the presentation of Dong-woo Kang, CEO of ARTWA, and Hyung-soo Kim, CEO of Tree Planet.
KISTEP held the “SEE KISTEP Think 2022 S&T Innovation Policy Forum” on Dec 7–9, 2021. This event was organized in order to highlight research achievements of KISTEP in 2021 and to suggest 15 innovation agendas in 2022 based on in-depth analysis of prospective environmental changes related to S&T and innovation. The event was broadcasted live through KISTEP’s Youtube channel. The offline event took place at KISTEP(Dec 7–8) and El Tower Oce Hall(Dec 9).
The KISTEP Issue Paper explores and analyzes the latest issues in Science and Technology policy research, and presents in-depth implications and policy alternatives.

The Statistics Brief provides recent statistics related to S&T, sharing insights into the fundamental data required for S&T policy planning and decision-making processes.

The Technology Trend Brief aims to improve our understanding of technology by examining R&D, industry, policy and investment trends related to technology, and offers implications for Korea’s R&D investment policies.

The Technology Foresight Brief analyzes future issues in S&T with the aim of discovering environmental changes in response to future uncertainties and identifying countermeasures.
KISTEP InI

(Inside and Insight)

The policy magazine KISTEP InI offers an in-depth analysis of domestic and international S&T policies and issues in various fields of S&T. It is published four times a year and features a range of contents that include expert columns and an overview of KISTEP publications.

Asian Research Policy

(ARP)

Asian Research Policy is published biannually and is devoted to the publication of high-quality research articles that provide an authoritative source of policy information on science and technology. It covers national S&T planning, analysis and evaluation of national R&D programs, and strategies on R&D budget coordination and distribution. The aim of Asian Research Policy is to enhance the national R&D system by establishing channels of communication between academics, research experts and policymakers.

KISTEP R&D and Beyond

KISTEP R&D and Beyond covers current issues in policies and presents the major research accomplishments of KISTEP to strengthen policy networks with international partner organizations.
Key Action Plans in 2022

- Supporting the establishment of strategies for fostering and protecting national strategic technology
- Supporting the establishment of a carbon-neutral R&D strategy
- Science and Technology Foresight, Technology assessment and Technology level evaluation
- Supporting policy for growth engine in materials, parts and equipment, and multi-ministerial joint research planning
- Establishing S&T diplomacy and international S&T cooperation strategies

S&T Policy Planning and Coordination

- Technology Foresight and Future Strategies for S&T

Investment Strategy and Budget Allocation & Coordination of Government R&D Programs

- S&T Innovation policy planning and coordination
- S&T policy planning to solve social problems
- Regional S&T innovation policy planning
- Planning Human Resources in S&T policy
- Analysis & strategic research on the advanced National Innovation System (NIS)
- Budget allocation and coordination of government R&D Programs
- Analysis on efficiency of R&D investment
- Study on strengthening R&D investment strategic planning capacity

Survey, Analysis, Evaluation and Performance Distribution of Government R&D Programs

- Conducting preliminary feasibility study of government R&D programs
- Establishing and revising the guidelines of preliminary feasibility study to improve the system
- Supporting government R&D budgeting process

Government R&D Performance Evaluation

- Preliminary Feasibility Study of Government R&D Programs & Supporting R&D Budgeting
- Production/Analysis/Utilization/Spread of national R&D and S&T statistics
- Strengthening the foundation of regulation innovation in national R&D system
- National R&D performance management, utilization, and distribution

Integration of research support systems across ministries

- Establishment of researcher-oriented Pan-Ministry Integrated Research Support System (IRIS) development and phased operation transition
- Integrated support for customized National R&D planning and management