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STI Policy for Sustainable Growth: A Korean Experience

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Abstract

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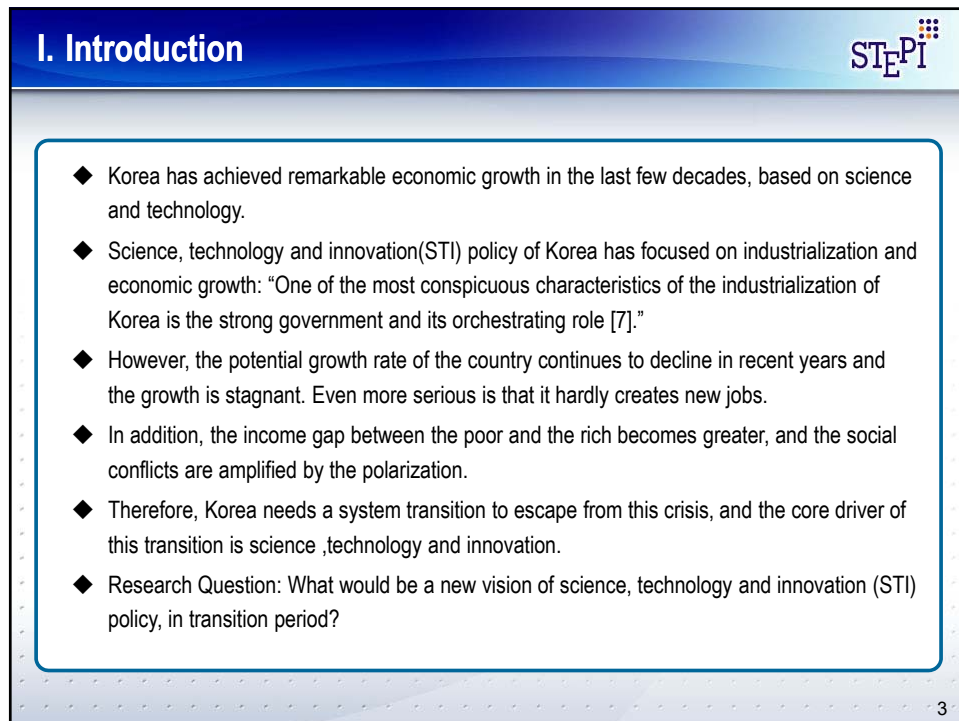
What would be a new vision of science, technology and innovation (STI) policy? Many countries have set economic development as the highest priority, such as GDP, GNI. Economic development is still important but now on STI policy needs a vision with more integrated perspective. This paper proposes "sustainable growth" as a new vision of STI policy. Sustainable growth includes economic sustainability, environmental sustainability, and social sustainability. Science and technology play a critical role to implement sustainable growth. In particular, there are increasing interest and demand for resolving emerging issues such as environment issues, aging issues, and polarization issues. Actually, many leading countries are trying to get sustainable growth and resolve social challenges based on science and technology. Korea is also expanding its science and technology investment to environmental sustainability and social sustainability, which has been mainly focused to economic sustainability. Since 2014, Korean government has implemented independent R&D program to meet the demand for social issues, as a multi-ministerial program. Lessons and implications will be introduced from the experience of this program. This paper concludes with recognizing need for transition to new STI system that has characteristics of openness, balance, and holistic view.



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I. Introduction

- ◆ Korea has achieved remarkable economic growth in the last few decades, based on science and technology.
- ◆ Science, technology and innovation(STI) policy of Korea has focused on industrialization and economic growth: “One of the most conspicuous characteristics of the industrialization of Korea is the strong government and its orchestrating role [7].”
- ◆ However, the potential growth rate of the country continues to decline in recent years and the growth is stagnant. Even more serious is that it hardly creates new jobs.
- ◆ In addition, the income gap between the poor and the rich becomes greater, and the social conflicts are amplified by the polarization.
- ◆ Therefore, Korea needs a system transition to escape from this crisis, and the core driver of this transition is science ,technology and innovation.
- ◆ Research Question: What would be a new vision of science, technology and innovation (STI) policy, in transition period?

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II. STI Policy in Transition ST_EPI

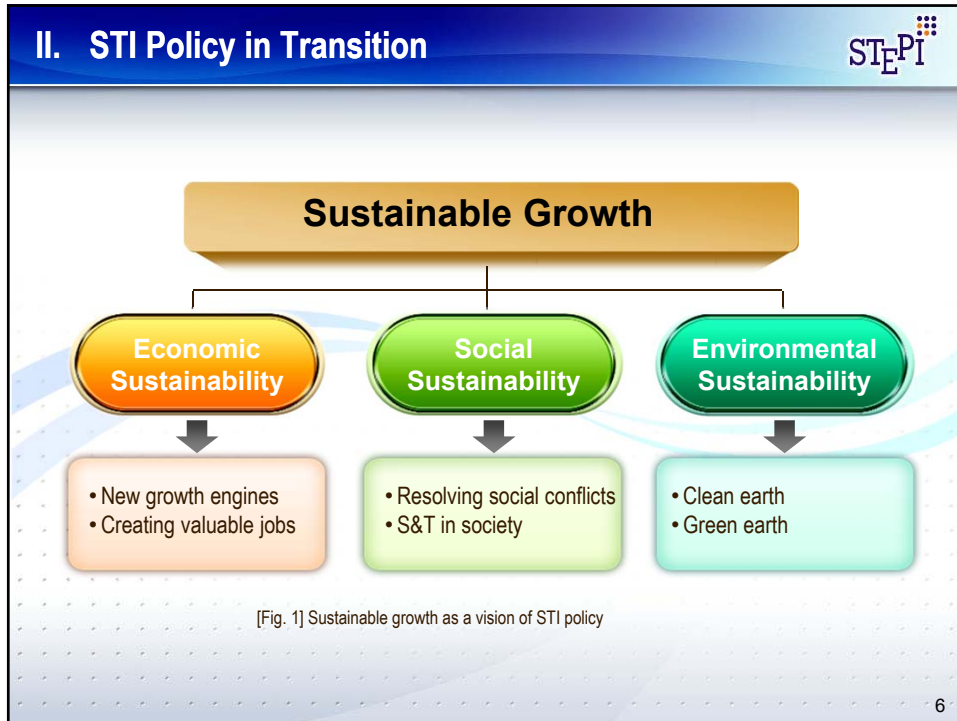
- ◆ Global trends in STI policy
 - Globalization of innovation: expansion of global value chain, increasing global mobility of human resources in science and technology, strengthening global innovation network ([6], [14], [15])
 - Contribution of innovation to sustainable growth: increasing role of innovation for economic recovery and job creation, increasing demand for the efficiency of public finances and restructuring innovation system, efforts to improve productivity for sustainable growth ([16], [17], [13])
 - Science and technology for social challenges: increasing green investment for environmental issues, rising role of technology for aging society, alleviating economic bipolarization based on ICT ([18], [16], [14])
 - Rapid changes in technology and industry: converging innovation between technology and non-technological innovation, emerging industries with innovative firms, strengthening global cooperation for competitiveness ([9], [16], [14])


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II. STI Policy in Transition ST_EPI

- ◆ What would be the keywords of new STI policy? ([11])
 - Creativity, social challenges, uncertainty, conversion, globalization and sustainable growth
- ◆ What would be the performance measures of new STI policy?
 - Economic indicators such as GDP per capita and GDP growth rate has been critical performance measures of innovation.
 - Not only economic indicators but more inclusive indicators such as quality of life, happiness, and sustainability would be considered as performance measures of innovation.
- ◆ What would be the vision of new STI policy?
 - New STI policy needs more integrative perspective with social and environmental issues as well as economic issues.
 - Then what we are expecting from STI is the “sustainable growth”.
 - Sustainable growth includes “economic sustainability”, “social sustainability”, and “environmental sustainability”.

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- ## III. S&T for Sustainable Growth
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- ◆ “Freedom from want, freedom from fear, and the freedom of future generations to sustain their lives on this planet” are the 3 grand global challenges for the 21st Century (UN Secretary General Kofi Annan, in his Millennium Report to the General Assembly) ([4])
 - ◆ Goals for a sustainability transition ([1])
 - To feed, nurture, house, educate and employ the world’s slowing but still growing human population, while
 - Conserving earth’s basic life support systems and biodiversity and
 - Reducing hunger and poverty.
 - Specific challenges in the “WEHAB” areas
 - ✓ Water, Energy, Health, Agriculture, Biodiversity
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III. S&T for Sustainable Growth STEPi

- ◆ “Science and technology (S&T) are increasingly recognized to be central to both the origins of sustainability challenges, and to the prospects for successfully dealing with them([2]).
 - S&T brought us the CFCs and depleted the ozone layer.
 - ✓ But S&T also have allowed us to continue meeting the needs that CFCs have fulfilled in a manner less damaging to the environment.
 - S&T is bringing about the increases in agricultural yields and distribution systems that have helped to keep the most of the world from famine... but only at the cost of significant environmental degradation.
- ◆ Promoting transitions toward sustainability in the 21st century will require much more than improvements in the production and effective use of science and technology but the latter will be essential components of most solutions ([2])

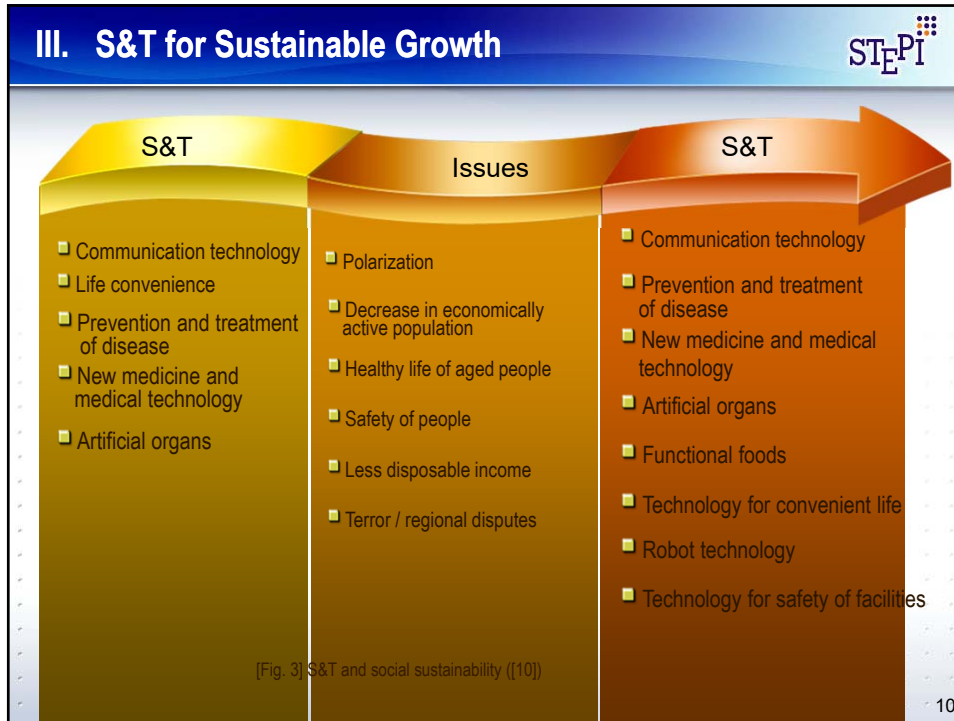
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III. S&T for Sustainable Growth STEPi


S&T	Issues	S&T
<ul style="list-style-type: none"> ■ Traditional manufacturing technology ■ Fossil fuel ■ Traditional traffic system 	<ul style="list-style-type: none"> ■ Coping with global warming ■ Competition for resources ■ Pollution and contamination ■ Destruction of ecosystem ■ Hydrogen economy 	<ul style="list-style-type: none"> ■ Reducing contamination ■ Biological diversity ■ Environment management ■ Forecasting disaster ■ Energy exploration ■ Energy efficiency ■ Geological exploration ■ Marine exploration ■ Space exploration

[Fig. 2] S&T and environmental sustainability ([10])

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III. S&T for Sustainable Growth



- ◆ Sustainability science: Advance basic understanding of the dynamics of human-environment systems (Definition from *Sustainability Science Program* at Harvard's Center for International Development)
 - to facilitate the design, implementation, and evaluation of practical interventions that promote sustainability in particular places and contexts
 - and to improve linkages between relevant research and innovation communities on the one hand, and relevant policy and management communities on the other
- ◆ ... brings together scholarship and practice, global and local perspectives from north and south, and disciplines across the natural and social sciences, engineering, and medicine ([3])
- ◆ it can be usefully thought of as "neither "basic" nor "applied" research but as a field defined by the problems it addresses rather than by the disciplines it employs
- ◆ it serves the need for advancing both knowledge and action by creating a dynamic bridge between the two ([5]).

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IV. Korean Experience on R&D Program for Social Challenges



- ◆ Korean government recognized that the contribution of S&T for quality of life and happiness of people need to be emphasized.
- ◆ For the most important criteria to select national strategic technology, 60.2% of respondents replied that it should be "quality of life". ([12])
- ◆ National Science and Technology Council approved "Action Plan to Resolve Social Challenges". (Dec. 2013)
 - Vision: S&T in society, Happy Korea
 - Goal: Sustainable & vibrant society, Safe & secure society, Harmonized society
 - Roadmap for 10 areas: health, environment, culture, safety, disasters, energy, inhabitation and traffic, family, education, social integration
- ◆ With Action Plan, "Science and Technology Basic Law" has been revised to add clauses that enable R&D program for social challenges. Government-Civilian Committee has been also organized for implementation.

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IV. Korean Experience on R&D Program for Social Challenges



- ◆ 10 Tasks for Social Challenges ([12])
 - Mobile payment fraud and privacy issues of big data
 - Food safety
 - Safe water supply from green algae
 - Prediction and mitigation of radiation damage
 - Early surveillance and response to infectious diseases
 - Prevention and treatment of cardiovascular disease and cerebrovascular disease
 - Integrated management of endocrine disruptor and development of alternative materials
 - Collection and treatment of food waste
 - Development and operation of smart traffic signal system
 - Technology development of meteorological observation and forecasting with respect to health and safety

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IV. Korean Experience on R&D Program for Social Challenges STePI

- ◆ Korean government has launched new R&D Program for Social Challenges in 2013. ([8])
 - The basic concept of new program is R&SD (Research & Solution Development) for resolving social problems.

[Table 1] Concepts of R&SD (Research & Solution Development) ([8])

	R&D	R&SD
Purpose	National strategy or economic growth	Improvement of quality of life
Goal	S&T competitiveness	Resolving social challenges
Perspective	S&T-oriented R&D	User-participated R&D
Implementation Actor	R&D organizations	R&D organizations and policy organizations
Results	Research outputs such as paper, patents	Application of technology and/or service in the field

- Objective of the program is to resolve social problems which are closer to everyday life, based on science and technology with an integrated approach of law, institution, and service delivery.
- R&D projects includes diagnosis and treatment of cancer, adolescent obesity, harmful chemical substances, safe water supply from green algae, ultrafine dust, etc.

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IV. Korean Experience on R&D Program for Social Challenges STePI

- ◆ 30 major issues were selected from social challenges taking into account the social environment and policy conditions. ([20]).
 - Issues were selected as results of survey of 2,000 people, review of expert group, and the discussion of related ministries.
- ◆ 10 issues were finalized as critical social challenges after evaluation with criteria of degree of threat to quality of life and importance of government role.
 - degree of threat to quality of life: hindrance of personal happiness and social seriousness
 - Importance of government role: possibility of S&T solution and necessity of government investment
- ◆ Preliminary planning was implemented by related ministries, user, and experts. Then cooperative planning was done by participant ministries to find solutions for each issue.
- ◆ Planned issues are in the process of R&D as multi-ministry R&D programs.

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V. Lessons and Policy Implications ST_EPI

- ◆ Korean R&D program for social challenges has been exposed several limitations in the process of implementation ([20]).
 - Lack of correct understanding and consensus building for the new concept of R&SD
 - ✓ Technology oriented approach rather than solution oriented approach for social issues
 - ✓ Lack of integrated view to find solution of law, institution, social acceptability, and delivery system as well as technology
 - Difficulties in cooperation among the ministries and expert group
 - ✓ Lack of experts who can do structural analysis of social issues and coordinate interest groups
 - ✓ Lack of experience for cooperative planning and implementation among ministries
 - ✓ Lack of methodologies to find integrative solution by multidisciplinary approach
 - Absence of inducing mechanism for active participation of related ministries
 - ✓ Insufficient budget for cooperative planning and lack of principle for budget allocation
 - ✓ Absence of extra budget for the implementation of R&SD projects

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V. Lessons and Policy Implications ST_EPI

- ◆ It is also recognized that there are several barriers of S&T policy for sustainable growth.
 - Emphasizing "technology push" by the S&T community
 - Lack of scientist and engineers working on sustainable issues
 - Small proportion of S&T investment for sustainability
 - Not having reliable data and statistics
 - Little collaboration of S&T and society
 - Not much S&T that are successfully applied in the real field
- ◆ Therefore, strategic approach is needed to implement S&T policy for sustainability([1]).
 - Solution-driven priorities are required. It should not be driven by priorities of the S&T community, and also not be confined to merely illuminating social problems
 - "Co-production" of usable knowledge is important through collaboration of users and producers "in place" and drawing on global research and innovation systems
 - Incentive structures are needed designed to engage the private sector in harnessing S&T for the provision of public goods and honor scientists and engineers who focus their work on urgently needed solutions for a sustainability transition

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V. Lessons and Policy Implications



- ◆ For the sustainable growth with S&T, global partnership is essential.([19])
 - Bridging the technological divide through access to technologies
 - ✓ promoting access to the knowledge base in those countries at the technological frontier for equitable global economic development
 - ✓ Trade rules, intellectual property rights and investment
 - ✓ international collaborative ventures and alliances in sectors of public importance, especially health and agriculture
 - ✓ STI partnerships
 - Bridging the technological divide by promoting inclusive innovation
 - ✓ mobilizing financial resources for technological development
 - ✓ Where markets are not strong, additional approaches are needed to bridge the gap (Example: neglected tropical diseases)
 - ✓ Data covering the three pillars of sustainable development needs to be collected, harmonized, managed and integrated

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V. Lessons and Policy Implications



- ◆ In conclusion, integration of S&T innovation policy and social innovation policy is recommended, for sustainable growth. It is a direction of transition in STI policy.
 - For the transition of STI policy, first of all, vision and strategy should be re-established.
 - And identify actors and their relationship in new innovation system.
 - Prepare innovation model for each social challenges, such as environmental issues, energy, social care system for aged people, resource reutilization, safety, etc.
 - It is also needed to define policy measures for implementation and establish governance structure in which policy makers, service organizations, NGOs, and S&T community are participating.
 - Under this governance structure, design new innovation platform with consensus of participants and interest groups.

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V. Lessons and Policy Implications ST_EPI

- ◆ New STI policy also needs to see innovation system as an organic whole, which means that is not just as a collection of parts but as an organic whole. And it is ever-changing system ([11]).
- ◆ Until now STI policy used to make target of local optimum solutions, that is economic growth. But new system should try to find global optimum solutions considering social sustainability and environmental sustainability, as well as economic sustainability.
- ◆ The desirable characteristics of new innovation system for sustainable growth are openness, flexibility, and balance.
- ◆ Holistic view of innovation policy is essential in new innovation system. New innovation policy needs integrative perspective considering S&T, social system, institution, industry and sustainable issues.

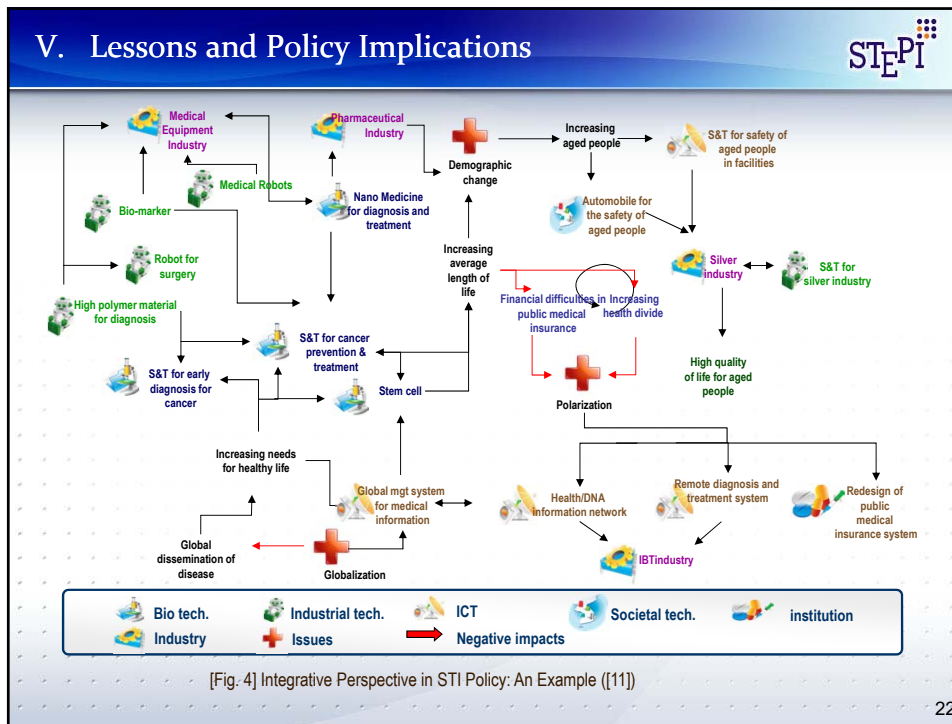
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V. Lessons and Policy Implications ST_EPI

[Table 2] New concepts of STI for sustainable growth

	STI for Economic Growth	STI for Sustainable Growth
Goal	Economic development	Quality growth with economic sustainability, environmental sustainability, and social sustainability
Main Actors	Firms, universities, and public research institutes	More diversified actors such as social corporations, NGOs, communities as well as firms, universities, and public research institutes
Main contents	Science and technology, R&D	Social and institutional innovation with S&T
Performance indicators	Economic indicators such as GNI, GDP, growth rate, etc.	Quality of life, degree of happiness, equitability etc. as well as economic indicators
Policy setting in STI system	Partial, local optimum solution	Overall, global optimum solution
Perspective	Component view as a combined system of parts	Holistic view as an organic whole

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