2018/19 Knowledge Sharing Program (KSP) with Mexico

October 8th (Mon.), 2018
Mexico City, Mexico

Ministry of Economy and Finance

KDI Korea Development Institute

AMEXCID
AGENCIA MEXICANA DE COOPERACIÓN INTERNACIONAL PARA EL DESARROLLO

Contents

1 2018/19 KSP with Mexico

2018/19 KSP with Mexico: Background

Background – Knowledge Sharing Program (KSP)

In the 21st century, knowledge is recognized as the key to building legal, political, and institutional foundations to enable sustainable development. In this light, Korea's own experience can be an invaluable asset for achieving development and growth for the global society. From 2004, the Ministry of Economy and Finance ("MOEF") and Korea Development Institute ("KDI") launched a comprehensive consultation project called the Knowledge Sharing Program ("KSP") to assist partner countries in key policy areas by sharing Korea's specific development knowledge and experience. It is a knowledge-intensive economic cooperation program designed to share Korea's development experience with partner countries. It offers comprehensive policy consultations tailored to the needs of partner countries encompassing in-depth analysis, policy consultation, and training opportunities. Since its launch in 2004, KSP has been conducted for over 990 research topics in 64 countries around the world.

2018/19 KSP with Mexico

Based on the importance of strategic bilateral relationship between Korea and Mexico, Knowledge Sharing Program (KSP) with Mexico was first initiated by the G20 Finance Minister Meeting in 2012. From 2012 to 2017/18, 19 policy consultation projects were completed as a means of strengthening bilateral economic cooperation between two countries with a wide range of topics covering from Industrial Policy, Education and so on.

For the seventh year of long-standing cooperation, the 2017/18 KSP with Mexico was implemented under the main theme of "Strategic Technology Planning for the National Polytechnic Institute of Mexico" with the aim of achieving sustainable development. Indeed, Mexico has been of great importance in the global value chain as a manufacturing base. However, the mid- and long-term economic prospects of the country are uncertain due to lack of in-country S&T capacity in meeting the needs of the market. In turn, this constraint makes Mexico's economy more vulnerable to external shocks, such as volatile global economic environment and changed political landscape. In this context, the Instituto Politécnico Nacional ("hereafter "IPN"), a leading higher education in Mexico, cooperated with qualified Korean experts for 10 months to identify the current status of strategic technology planning in Mexico and relevant capability of IPN so that they can come up with the most appropriate recommendations for IPN (refer to "Appendix. Executive Summary").

For the consecutive second year, the 2018/19 KSP with Mexico will be implemented under the main theme of "Strategic Technology Planning for Instituto Politécnico Nacional". It consisted of three sub-topics: 1) lmplementing Technology Foresight Pilot Project for Strategic Sector in IPN and Mexico; 2) Implementing Technology Prioritization Pilot Project for Strategic Sector in IPN and Mexico; and 3) Implementing Core Technology Roadmapping Pilot Project for Strategic Sector in IPN and Mexico and 4) Study on Linkage between Policy Direction for Science & Technology and R&D Investment Practice of Public & Private Sector in Mexico. Throughout the 2018/19 KSP with Mexico, KSP team will seek a way for strengthening in-country innovation capacity, while also opening up opportunities for economic cooperation between Korea and Mexico in the realm of science and technology.

2018/19 Mexico KSP Team	
Korean Side (project management)	**Mexico Side (project management)**
- Senior Advisor: Dr. Hyunghwan JOO (Former Minister, Ministry of Commerce, Industry and Energy) - Principal Investigator: Dr. Dong Hoon OH (CEO, Wisenglobal) - Program Manager: Dr. Chang Jae LEE (Senior Fellow, KDI) - Program Officer (Coordinator): Ms. Gyul HWANG (Research Associate, KDI)	- Project Supervisor: Dr. Luis Alfonso Villa Vargas (Secretary for Extension and Social Integration, IPN) - Project Coordinators: 1) Mr. Santiago Reyes (Coordinator for Academic Cooperation, IPN) 2) Dr. Miguel Ángel Lopez Flores (Director of TechnoPoli, IPN) 3) Ms. Rocio Garcia (Head of National and International Affairs of the Coordination for Academic Cooperation, IPN) * Mexio KSP Coordinator: Ms. Lorena Garcia (Head of the Department of Cooperation with Asia-Pacific, AMEXCID)

Topic	*Creation of Capacities for the Implementation of a Strategic Technological Plan at Instituto Politécnico Nacional of Mexico*	
Technology Sector of Interest	*IoT Technology in Transport Sector*	
Sub-topics	**Korean Experts**	**Advisors**
Development of Capabilities at TechnoPoli for Technology Foresight	Dr. Sun Hark BONG (CEO, TBNA)	1) Dr. Marco A. Ramírez Salinas (Director of Computing Research Center, IPN) 2) Dr. Miguel Ángel Lopez Flores (Director of TechnoPoli, IPN)
Pilot Project for R&D Priority Setting in IoT of Mexico	Dr. Kyoowon SUH (Professor, Hallym University)	1) Dr. Itzamá López Yáñez (Director of Center for Technological Innovation and Development in Computing, IPN) 2) Dr. Gerardo Ángeles Castro (Deputy Director of Specialized Technology Services in the Technological Development Unit, Technopoli, IPN)
Implementing Core Technology Roadmapping Pilot Project for Strategic Sector in IPN and Mexico	Dr. Yu Han JUNG (Professor, Chung-Ang University)	1) Dr. Jose Mireles Jr (Professor, Electrical and Computing Department of the Institute of Engineering and Technology (IIT) of the Autonomous University of Ciudad Juarez (UACJ)) 2) Dr. Hugo Necoechea Mondragón (Coordinator of Research and Postgraduate Networks, IPN)
Study on Linkage between Policy Direction for Science & Technology and R&D Investment Practice of Public & Private Sector in Mexico	Dr. Dong Hoon OH (CEO, Wisenglobal)	1) M. en C. Víctor Álvaro Gutiérrez Martínez (President of the Commission of Innovation and Technology for Competitiveness and Vice President of Ecosystem of High Technology and Creative Industries, of the Confederation of Industrial Chambers of the United Mexican States (CONCAMIN)) 2) Dr. José Luis de la Cruz Gallegos (General Director of the Institute for Industrial Development and Economic Growth A.C.) 3) Mtra. Xóchitl Díaz Rosa (Strategic Planning Advisor of the General Directorate, IPN)

2 Launching Seminar : Schedule

- Date and Time: 09:30~15:00, October 8th, 2018
- Venue: The Ministry of Foreign Affairs (AMEXCID), Mexico

	Time		Program	Note
Opening	09:30-09:40	'10	Welcoming Remarks	Dra. Martha NAVARRO (Director General of Technical and Scientific Cooperation, AMEXCID)
	09:40-09:50	'10	Opening Remarks	Dr. Hyunghwan JOO (Senior Advisor, Former Minister, Ministry of Commerce)
	09:50-10:00	'10	Congratulatory Remarks 1	Mr. Wonil (Francisco) NOH (Councilor, Embassy of the Republic of Korea in Mexico)
	10:00-10:10	'10	Congratulatory Remarks 2	Dr. Luis Alfonso VILLA VARGAS (Secretary of Extension and Social Integration, IPN)
	10:10-10:20	'10	Photo session	Distinguished guests
	10:20-10:30	'10	Presentation on Pilot Study Plan	IPN
	10:30-10:40	'10	Presentation on Overall Research Plan	Dr. Dong Hoon OH (CEO, Wisenglobal)
Topic 1	*"Implementing Technology Foresight Pilot Project for Strategic Sector in IPN and Mexico"*			
	10:40-11:10	'30	Presentation	Dr. Sun Hark BONG (CEO, TBNA)
	11:10-11:20	'10	Q&A	-
Topic 2	*"Implementing Technology Prioritization Pilot Project for Strategic Sector in IPN and Mexico"*			
	11:20-11:50	'30	Presentation	Dr. Kyoowon SUH (Professor, Hallym University)
	11:50-12:00	'10	Q&A	-
Topic 3	*"Implementing Core Technology Roadmapping Pilot Project for Strategic Sector in IPN and Mexico"*			
	12:00-12:30	'30	Presentation	Dr. Yu Han JUNG (Professor, Chung-Ang University)
	12:30-12:40	'10	Q&A	-
Topic 4	*"Study on Linkage between Policy Direction for Science & Technology and R&D Investment Practice of Public & Private Sector in Mexico"*			
	12:40-13:10	'30	Presentation	Dr. Dong Hoon OH (CEO, Wisenglobal)
	13:10-13:20	'10	Q&A	-
Closing	13:20-13:30	'10	Closing remarks	MSc. Santiago Reyes Herrera (Coordinator for Academic Cooperation, IPN)
	13:30-15:00	'90	Official Luncheon	-

*Consecutive Spanish-Korean Interpretation will be provided for Dr. Jong's presentation (Topic 3), and Q&A sessions if needed.

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3 Topic 1

"Development of Capabilities at TechnoPoli for Technology Foresight"

Biography

Dr. Sun Hark BONG
CEO, TBNA, Inc.

sunhark@tbna.co.kr

- Ph.D. in Management Engineering, Graduate School of Management, KAIST (Korea Advanced Institute of Science and Technology)
- CEO, TBNA
- Senior Consultant, Business Consulting Department, Knowledgeworks
- Research Fellow, Policy Development Team, Presidential Committee on Balanced National Development

Knowledge Sharing Program

2018/19 Mexico KSP

" Development of Capabilities at TechnoPoli for Technology Foresight "

Sun Hark, Bong (TBNA, Inc.)

Ministry of Economy and Finance

KDI Korea Development Institute

IPN

AMEXCID AGENCIA MEXICANA DE COOPERACIÓN INTERNACIONAL PARA EL DESARROLLO

Contents

Ⅰ. Background of Research

- **For the effective building up the capability of strategic technology planning of IPN, "development of technology foresight system" study was done during the KSP 2017-2018.**
- **In the study of KSP 2017-2018, following recommendations were developed:**

Delphi based technology foresight model, processes, methodologies in each processes, and organizational structure for technology foresight study implementation by Technopoli, IPN based on the analysis of Mexico's situation and lesson-learned from Korea

- **In the KSP 2018-2019, development of the institutional capacities at TechnoPoli for technology foresight (hereafter "TF") will be attempted for successful TF capability building of TechnoPoli, IPN.**

Ⅱ. Research Objective

- **Pilot Project Implementation of TF Study in the Transportation Sector by Application of IoT Technology**
  - Development of future technology pool within 5~10 years and Identification of the key future technologies for Mexico in the transportation sector by application of IoT technologies
  - Joint project implementation with and key persons from the IPN and Korean delegation for the transportation sector of Mexico
  - Key persons from the IPN implement TF study with an initiative for writing each documents, analyzing trend, running committees, doing a Delphi survey and writing final report of TF study
  - Korean delegation monitors and consults the each activity of key persons from the IPN

Ⅲ. Research Plan

Pre-Foresight
(~Oct. 18)

Dev. of Future Tech. Pool
(Nov. 18 ~ Jan. 19)

Identification of Key Future Tech.
(Feb. ~ Mar. 19)

- **TF Project Planning (institutional structure, expert pool, activities, deliverables and duration)**
- **Trend Analysis in the Transportation Sector by Application of Iot Technology**
- **Development of Future Technology Pool for Mexico**
  - A part of future technologies could be used for the pilot project of priority setting and roadmapping
- **Selection of Important Future Technologies**
- **Identification of the Characteristics of the Key Future Technologies based on the Delphi Technique**
- **Analysis and Report the Delphi Study Result**

Ⅳ. Korea Experience

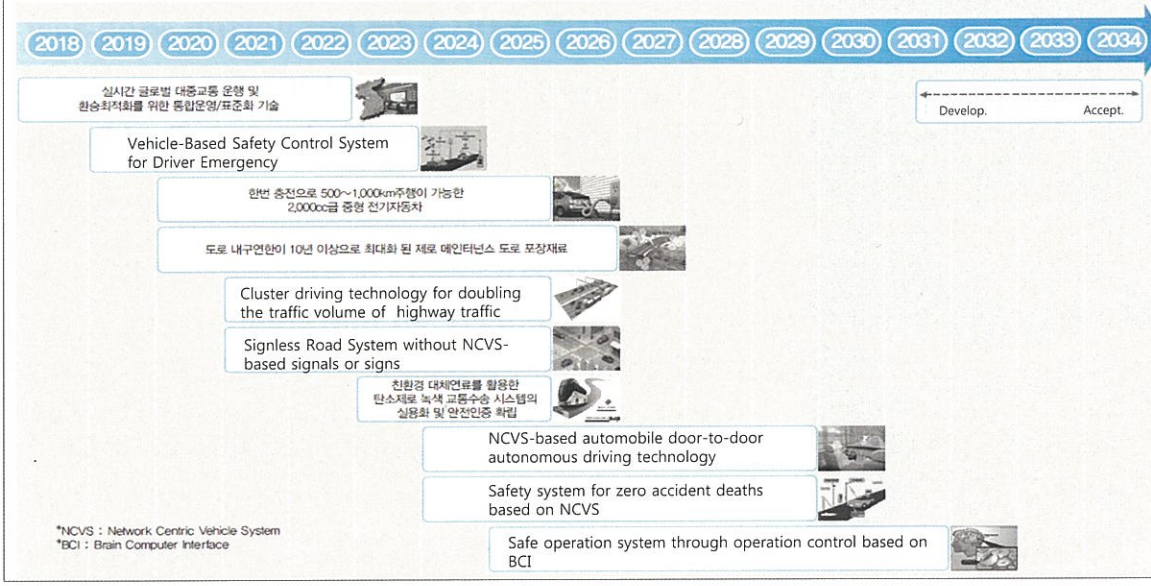
- **National Science and Technology Foresight (5th,'16~17)**
  - Construction and Transportation Sector

Future Technologies	Time of realization	
	Development	Acceptance
Control system that optimizes traffic flow in city through two-way communication between road infrastructure and vehicle and automatic signal control	2018	2020
Technology that detects local weather changes such as heavy snowfall and fog and provides information to vehicles in operation, and automatically takes measures to improve the grounding power and secure visibility	2017	2019
Automatic adjustment system of the speed of the vehicle according to road type (curve, slope, etc.), condition (eg, grounding force) and road personality	2019	2022
Adaptive incident management system technology that monitors the driving condition of the vehicle through the sensor installed on the road and detects the abnormality of the vehicle and informs the driver and control center of the vehicle	2019	2020
Technology that monitors the safety of a core driving device by itself in real time and transmits an avoidance warning signal to a nearby vehicle and a traffic control system in the event of a problem	2018	2020

Ⅳ. Korea Experience

- **Technology Foresight 2040: Land, Infrastructure and Transport (2013)**

  - Transportation and Logistics Sector



Ⅴ. Expected Outcome

- **Necessary Technology Pool in the Transportation Sector for Mexico**
- **TF Study Report in the Transportation Sector by Application of IoT Technology**
- **Guideline and Methodologies for TF Study in the IPN**
- **TF Study Expert in the IPN**

V. Conclusion

- **Discussion Agenda: Scope in Detail for Pilot Project**
  - Automobile only
  - Including other vehicles such as train, airplane
  - Management of transportation infrastructure such as road, railway, bridge, etc.
- **Suggestion for Successful Pilot Project Implementation**
  - Appointment of dedicated internal staff in the IPN as a key person who implement TF study with an initiative for this pilot project
  - It is recommended that present or future role of dedicated staff in this pilot project could be technology foresight and future planning

4 Topic 2

"Pilot Project for R&D Priority Setting in IoT of Mexico"

Biography

Dr. Kyoowon SUH
Professor,
Hallym University

kyoowon.suh@gmail.com

- Ph.D.& M.A., Business Engineering, KAIST
- B.A., Financing, Hallym University
- Project Manager, Center of Human-centered Interaction for Coexistence, Korea Institute for Science and Technology (KIST)
- Senior Researcher, Korea Evaluation of Industrial Technology

Knowledge Sharing Program

2018/19 Mexico KSP

"Pilot Project for R&D Priority Setting in IoT of Mexico"

Kyoowon, Suh (Hallym Univ. of Korea)

Ministry of Economy and Finance

KDI Korea Development Institute

IPN

AMEXCID AGENCIA MEXICANA DE COOPERACIÓN INTERNACIONAL PARA EL DESARROLLO

Contents

Ⅰ. Background of Research(1/2)

KDI Korea's Leading Think Tank

2. Theory of R&D Priority 2.1 Meaning of Priority Setting

Definition and Purpose

Prioritization involves three important questions:

- First question is "what do we develop first?" This has a strong point in emphasizing mutual linkage between R&D actors and focusing on internal logic and development direction of S&T.
- Second is the question of "how to develop." This emphasizes the formation of interaction among the various participants, and focuses on economic and social needs and political demands.
- "Who should be the player of R&D" is also an important question: Should we develop this technology on its own? Will we secure this technology from outside? Will this study be conducted through collaborative research with external researchers (including international cooperation)?

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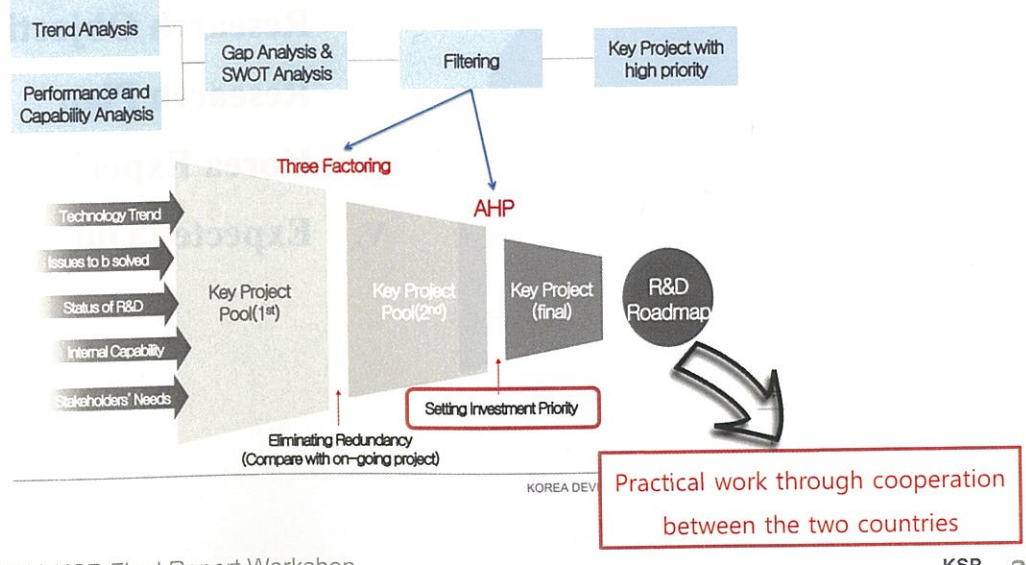
Source : 2017/2018 KSP Final Report Workshop

Ⅰ. Background of Research(2/2)

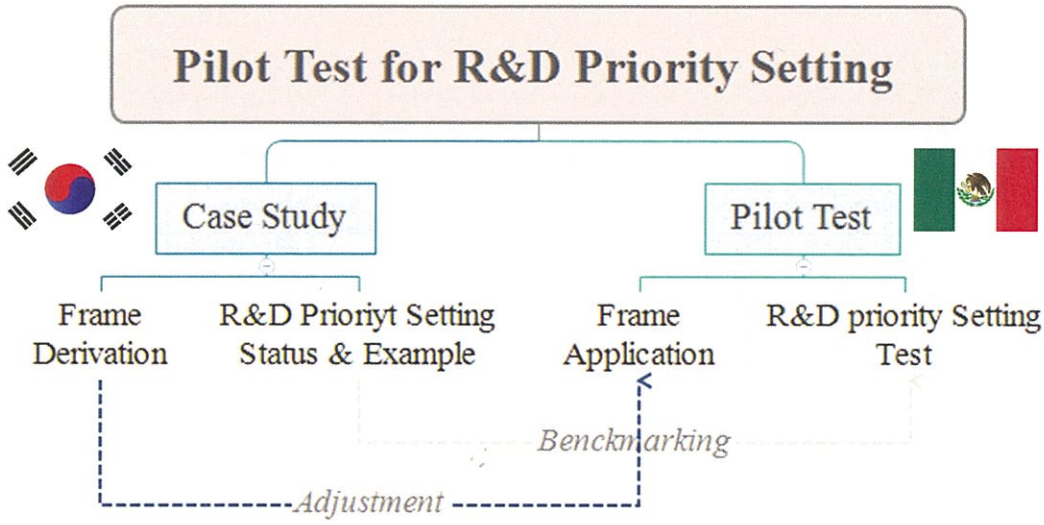
KDI Korea's Leading Think Tank

5. Suggestions Process

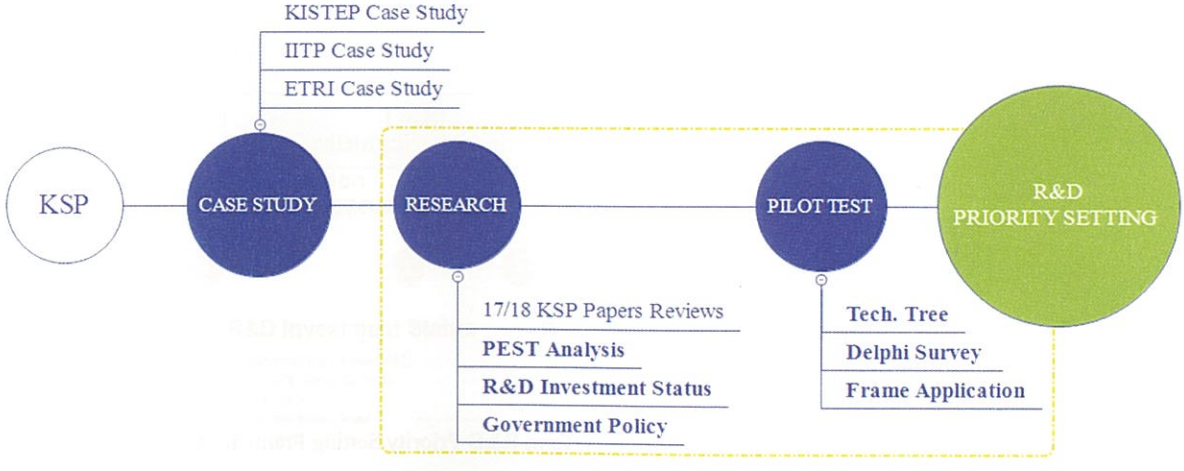


Source : 2017/2018 KSP Final Report Workshop

Ⅱ. Research Objective



Ⅲ. Research Plan



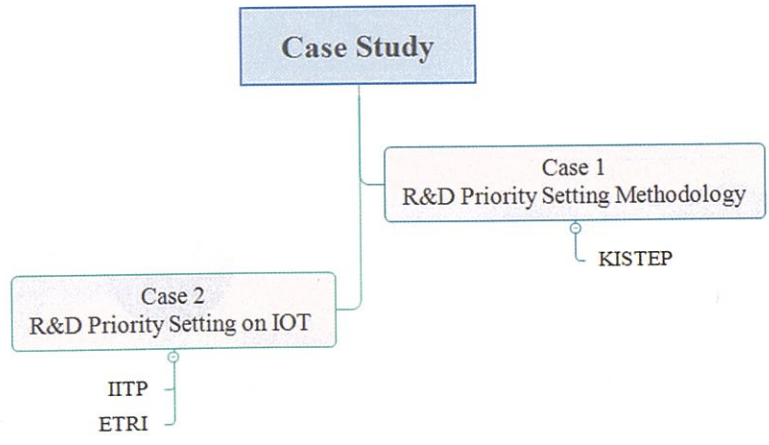
- Participants
  - ✓ KyooWon, Suh
  - ✓ Mexico Expert of IPN
- Bilateral Collaboration

Ⅲ. Research Plan

MONTHLY SCHEDULE

	Topic	Due	Participants	Notes
01	Review Case Study Of Korea	2018.11	KyooWon, Suh	
	Decision of Strategic Fields for Pilot Test	2018.11	IPN	*Meeting*
	Setup Methodology of R&D Priority Setting	2018.12	KyooWon, Suh	
02	Research of Current Status of Strategic Fields	2018.12	KyooWon, Suh	
	Delphi Survey for R&D Priority Setting	2019.01	IPN	*Meeting*
	Report Mid-term Results	2019.01	All	
03	Data Collection and Analysis	2009.01	All	
	Application to frame for R&D priority setting	2009.02		
	Deduction of R&D priority setting	2009.04		*Meeting*
04	Report Final Resutls	2009.05	All	Workshops
	Manual for R&D priority setting	2019.05		

Ⅳ. Korea Experience



Case 1

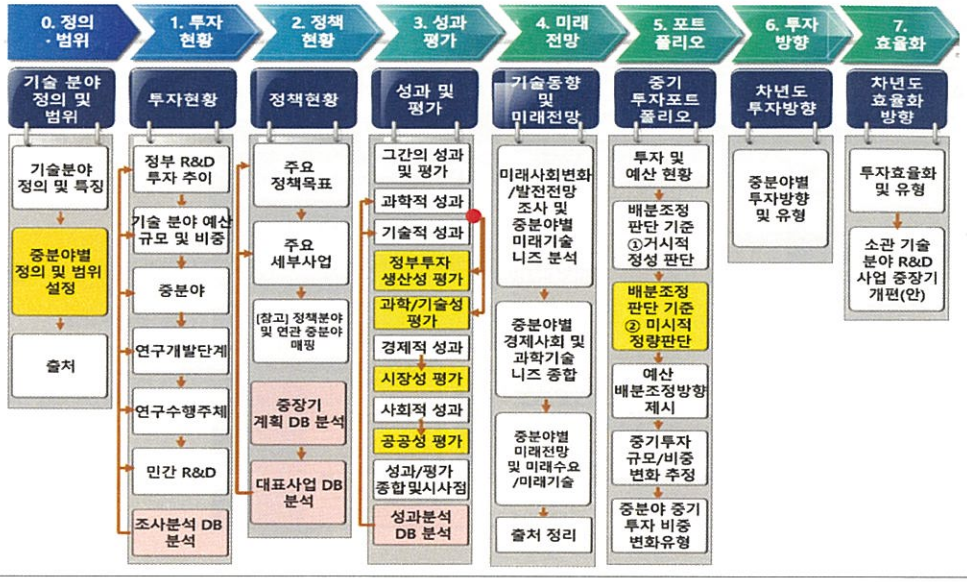
- A Study on the Development and Applications of Mid-Term R&D Priority Setting Frame for Government R&D Investments
  (KISTEP : Korea Institute of S&T Evaluation and Planning)

Case 2

- Tech. Level Evaluation of 4th Industry Revolution
  (IITP : Institute for Information & Communication Technology Promotion)
- IoT in Transportation R&D Priority Setting"
  (ETRI : Electronics and Telecommunications Research Institute)

Ⅳ. Korea Experience

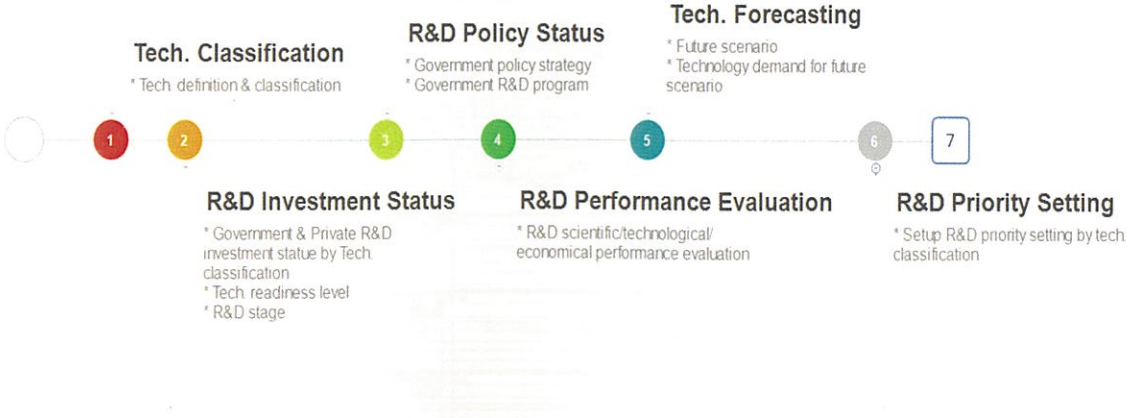
▪ Case Study 1 : Methodology for R&D Priority Setting



Ⅳ. Korea Experience

▪ Case Study 1 : Methodology for R&D Priority Setting

(Simplification)

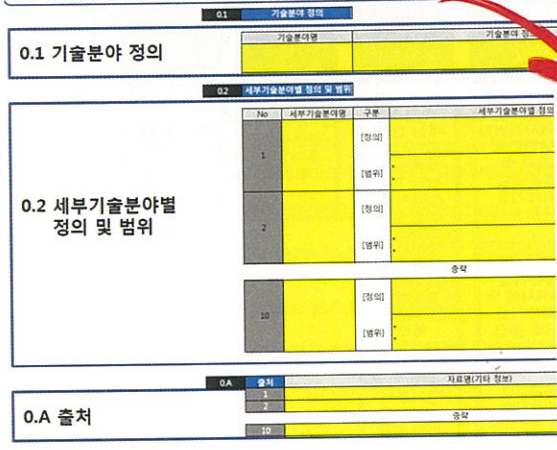


Ⅳ. Korea Experience

▪ Case Study 1 : Methodology for R&D Priority Setting

[0] 기술분야 정의 및 범위

투자전략 수립 대상 기술분야를 정의하고 범위를 설정하는 단계로,
해당 기술분야의 하위 세부기술분야를 선정하고, 세부기술분야별 정의와 범위를 설정



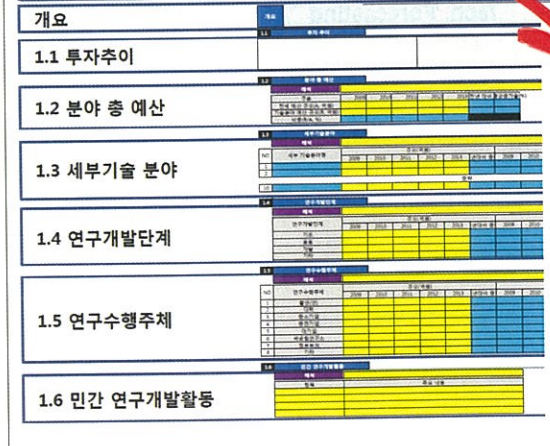
- Technology Definition and Scope
  - Technology Definition
    - Technology Name
    - Definition
  - Definition and Scope by technology classification
    - Technology Name
    - Definition
  - Source

Ⅳ. Korea Experience

▪ Case Study 1 : Methodology for R&D Priority Setting

[1] 투자현황

해당 기술분야에 대한 전반적인 투자현황을 분석하는 단계로,
정부연구개발사업 조사·분석 정보를 토대로 정부R&D의 <투자 추이>, <분야 총 예산>, <세부기술 분야>,
<연구개발단계>, <연구수행주체>등의 항목으로 구분하여 분석하고, 민간의 연구개발활동을 조사하여 정리



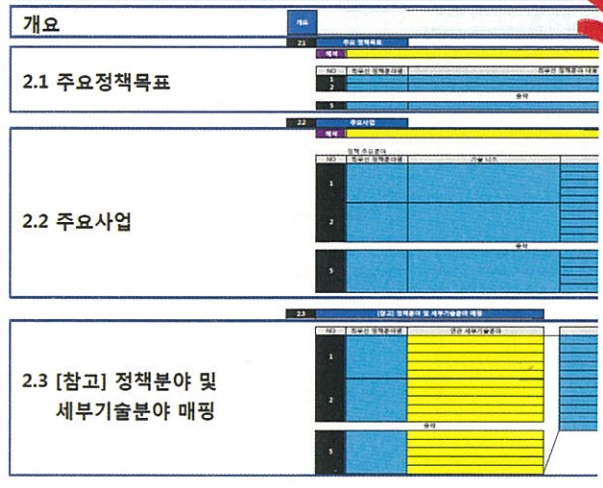
- R&D Investment Status
  - R&D Investment Budget
    - Total Budget
    - By Tech. Classification
    - By Public/Private
    - By R&D Stages
  - Source

Ⅳ. Korea Experience

▪ Case Study 1 : Methodology for R&D Priority Setting

[2] 정책현황

해당 기술분야에 대한 전반적인 정책현황을 조사·분석하는 단계로,
정책현황 세부 조사·분석DB(2a, 2b)를 통해 <주요정책목표>와 연관 <주요사업>을 선별



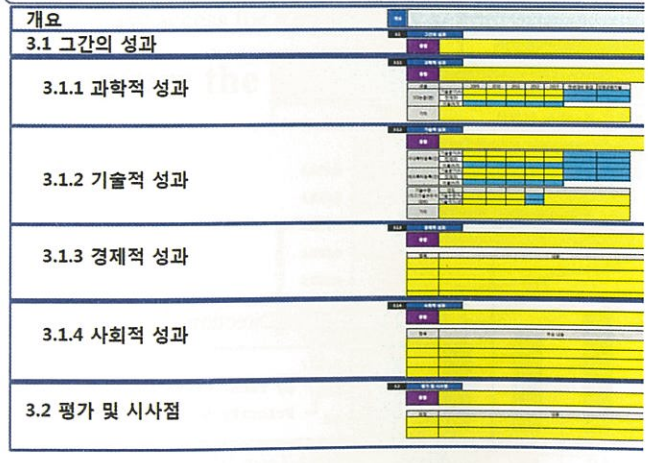
- R&D Policy Status
  - Major R&D Policy
  - Main R&D Program
    - Tech. Fields
  - Matching with Tech. Classification
  - Source

Ⅳ. Korea Experience

▪ Case Study 1 : Methodology for R&D Priority Setting

[3] 성과 및 평가

해당 기술분야에 대한 성과현황을 분석하는 단계로, 정부연구개발사업 성과분석DB(3a, 3b)를 토
<과학적/ 기술적/ 경제적/ 사회적> 측면의 성과 분석을 거쳐 성과 전반에 대한 평가 및 시사점 제시



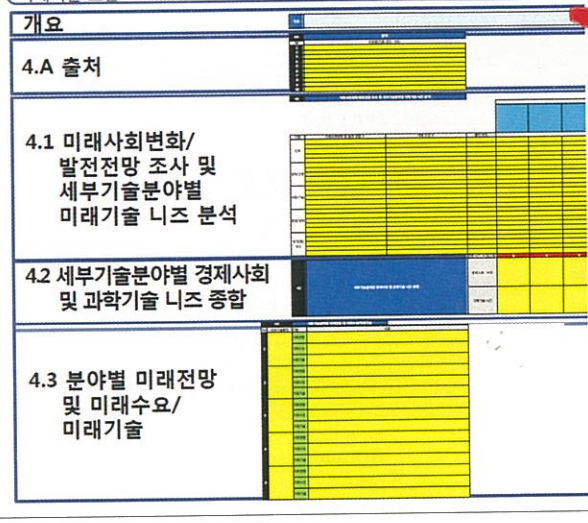
- R&D Performance Evaluation
  - Scientific Performance
  - Technical Performance
  - Economic Performance
  - Social Performance
  - Source
    - By Tech. Classification

Ⅳ. Korea Experience

▪ Case Study 1 : Methodology for R&D Priority Setting

[4] 기술동향 및 미래전망

해당 기술분야에 대한 기술동향 및 미래전망을 종합적으로 조사·분석하는 단계로,
미래사회변화 및 발전전망 조사를 통해 세부기술분야별 미래기술 니즈를 분석하고, 이를 토대로 미래수요와 미래기술 도출



Technology Forecasting

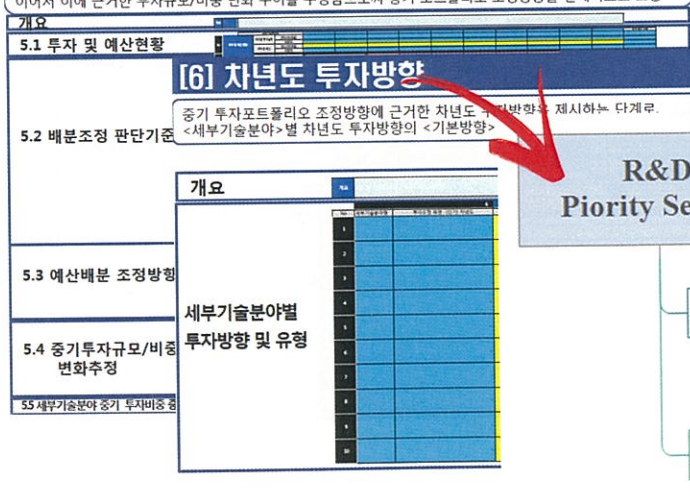
- Technology Trends
- Technology Forecasting
  - By Tech. Classification
- Technology Demand Analysis
- Source

Ⅳ. Korea Experience

▪ Case Study 1 : Methodology for R&D Priority Setting

[5] 중기 투자포트폴리오 조정방향

세부기술분야별 중기 기간 동안의 투자 조정방향 및 근거를 제시하는 단계로,
<정책적/경제사회적/과학기술적 관점>의 배분조정 판단기준에 따라 세부기술분야별 중요도와 판단근거를 제시하고,
이를 토대로 예산배분조정방향을 <투자조정/효율화> 관점에서 <중장기/단기(차년도)>로 구분하여 도출.
이어서 이에 근거한 투자규모/비중 변화 추이를 추정함으로써 중기 포트폴리오 조정방향을 선제적으로 조망



[6] 차년도 투자방향

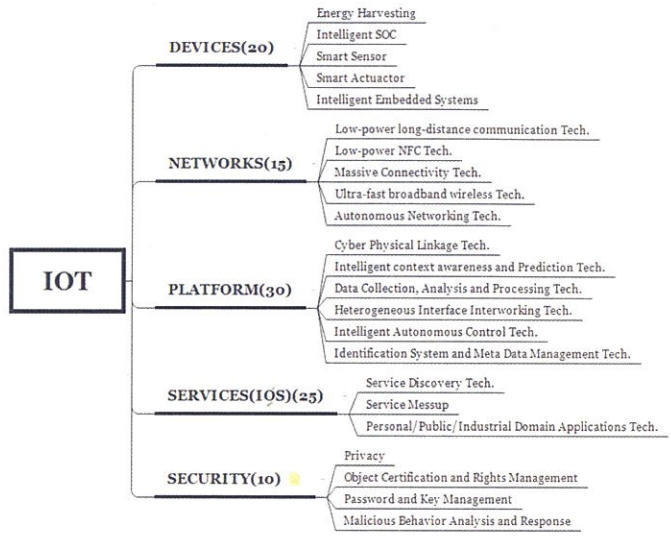
중기 투자포트폴리오 조정방향에 근거한 차년도 투자방향을 제시하는 단계로,
<세부기술분야>별 차년도 투자방향의 <기본방향>

R&D Piority Setting

- R&D Investment Direction
  - By Tech. Classification
  - Priority Setting Criteria
- Short-term/Mid Term Investment Portfolio

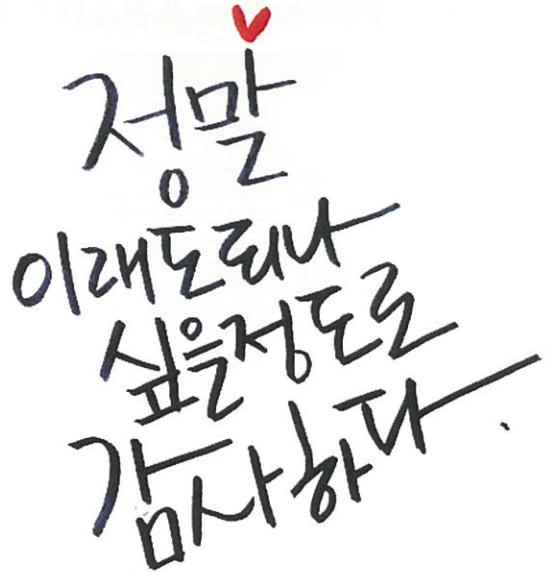
Ⅳ. Korea Experience

- **Case Study 2: Tech. Level Evaluation & R&D Priority Setting of IoT**



Ⅴ. Expected Outcome

- **Increase effectiveness and effectiveness of R&D priority setting in IPN/Mexico**
  - ✓ Diffusion of pilot test results to other strategic fields
  - ✓ Easy access for R&D priority setting using frame (manual)
- **Capture the potential of industrial IoT Market strategically**



Estoy muy agradecido por esto

I am so grateful that I can do this.

KSP
KNOWLEDGE SHARING PROGRAM

5 Topic 3

"Implementing Core Technology Roadmapping Pilot Project for Strategic Sector in IPN"

Biography

Dr. Yu Han JUNG
Professor, Chung-Ang University

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- Ph.D., Science & Technology Studies, Korea University
- M.A., Business Administration, Hong-Ik University
- Chief Officer, Institute of Industrial Technology (KITECH)
- Senior Consultant, TechnoValue.ltd.

Knowledge Sharing Program

2018/19 Mexico KSP

"Implementing Core Technology Roadmapping Pilot Project for Strategic Sector in IPN"

Yu Han, Jung (Chung-Ang Univ.)

Ministry of Economy and Finance

KDI Korea Development Institute

AMEXCID AGENCIA MEXICANA DE COOPERACIÓN INTERNACIONAL PARA EL DESARROLLO

Contents

Ⅰ. Background of Research

- Last year, IPN conducted a study on strategic technology planning for effective technology development.
- Through this, various methods for TRM, technology prediction, and technology selection were shared with Korean researchers.
- In this joint research, following the last research, we are aiming at the technical planning required in actual field.
- KSP 2018-2019 expects to increase the technology strategy capability of TecnoPoli and IPN through the creation of IOT TRM in the transportation sector.

Ⅱ. Research Objective

- TRM Demonstration of IOT in the Transportation Sector

- To share the experience of the Korean government in the process of IPR's actual TRM creation, and to push for the continuous linkage / cooperation of the KSP project last year

- Specific goals are as follows.

① Analyze and advise on the contents of TRM of IOT in the transportation sector prepared by IPN.

② Establishment of technical roadmap and implementation capability specific to IPN's TRM creation and implementation plan in accordance with other technology strategies.

- To this end, IPN and Korean researchers will conduct a review of the various technologies needed to make a TRM.

Ⅲ. Research Plan (1/3)

Why TRM?

Considerations when make a TRM

Make a TRM

- **A document that illustrates the pathway that sets goals that want to go to a certain future time point and how to achieve those goals through a consensus process based on expert knowledge and knowledge in a specific technology field**
- **We need to check and share with you before work.**

- Confirm Reason for Creating TRM for IPN

- Identify the basic issues of TRM creation

- Technology development & strategic use of tech.

- Not Paper, But Learning Process for the Group

- Communication Tool for the Stake Holders

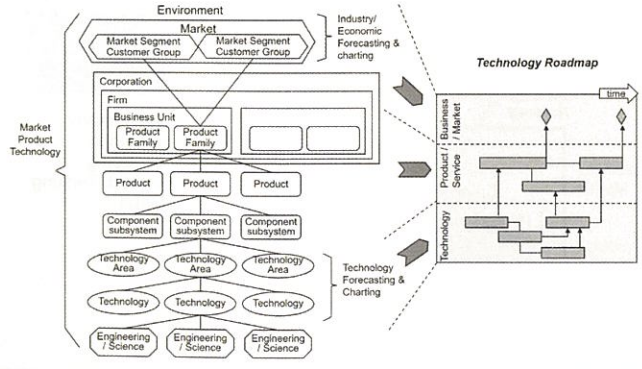
Ⅲ. Research Plan (2/3)

Why TRM?

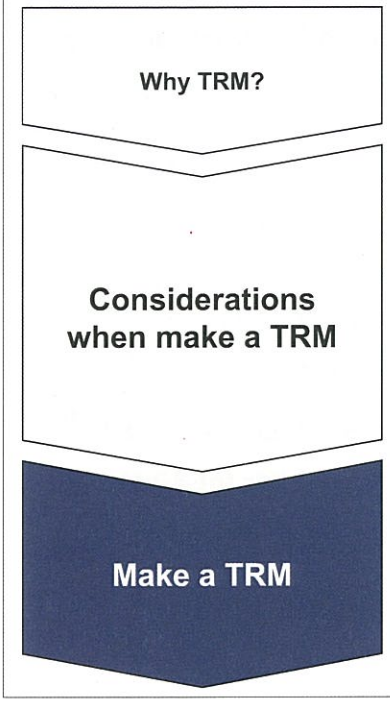
Considerations when make a TRM

Make a TRM

- **TRM is Needs-Driven Technology Plan**
  - **Not Tech. Driven, But Market Driven**
  - **We must approach it from an integrated perspective.**
- **Required for Technology Roadmapping**
  - **How to identify needs and core tech. (Dr. Bong)**
  - **How to identify, analyze, and select tech. (Dr. Seo)**
  - **How to organizing R&D, Budget, Time to market (Dr. Jung)**

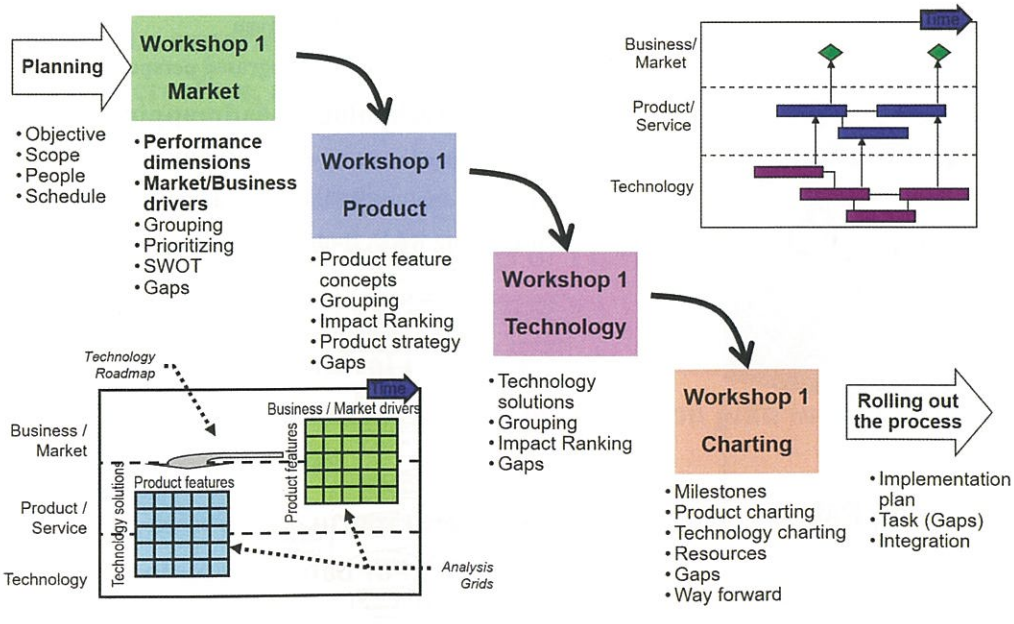


Ⅲ. Research Plan (3/3)



- **First of all, We must consideration of Clarification of Purpose**
- **Determination of TRM Charting Method**

[reference] Standardized TRM Process



Ⅳ. Korea Experience

<< IoT Core Technology Roadmap >>

Ⅴ. Expected Outcome

- **Build Up Vision of IoT Technology in IPN (or Mexico)**
- **TF study report in the transportation area by application of IoT technology**
- **Guideline and methodologies for TF study in the IPN**
- **TF study expert in the IPN**

V. Conclusion

▪ Factors for the Success of this Study

1) Confirm of scope in detail for pilot project (only vehicle ?)

2) Specific work schedule between IPN TF and Korean researchers
(Refer to standardized TRM Process)

3) Most of all, With the interest of decision makers

6 Topic 4

"Study on Linkage between Policy Direction for Science & Technology and R&D Investment Practice of Public & Private Sector in Mexico"

Biography

Dr. Dong Hoon OH
CEO, Wisenglobal

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- Ph.D. in History and Philosophy of Science, Seoul National University
- Present. CEO, Innovation Engineering Laboratory
- Present. Partner, Technovation Partners, Co.
- Director General, Office of S&T Policy & Planning (KISTEP)
- Project Manager (Consultant), OECD, France

Knowledge Sharing Program

2018/19 Mexico KSP

"A Study on the Linkage between S&T Policy Direction and Public-Private R&D Investment in Mexico"

Donghoon OH
(Wisenglobal Ltd. Co.)

Ministry of Economy and Finance

KDI Korea Development Institute

IPN

AMEXCID AGENCIA MEXICANA DE COOPERACIÓN INTERNACIONAL PARA EL DESARROLLO

Contents

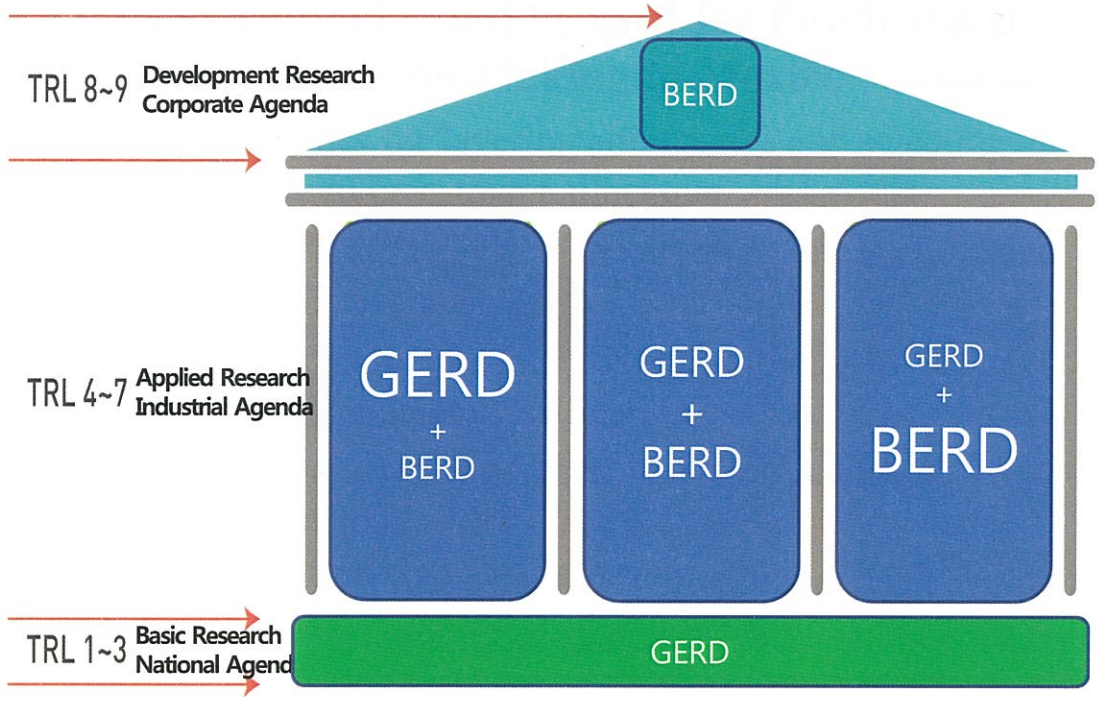
Ⅰ. Background of Research

- **Successful Completion of the Previous Project**
  - Improve IPN's S&T strategic technology planning capability.
  - Implement technology foresight, priority setting, and TRM.
- **Need the Pilot Project for Practical Application**
  - TechnoPoli's practice of the pilot project for Mexico
  - Share knowledge, hands-on experience between Korea and Mexico for successful practice of IPN's TechnoPoli in the future.
- **Need to Make an Efficient Investment Portfolio**
  - Set up an effective investment framework to enhance GERD.
  - Strengthen the link between government policy and BERD for the successful implementation of the established national technology development plan.

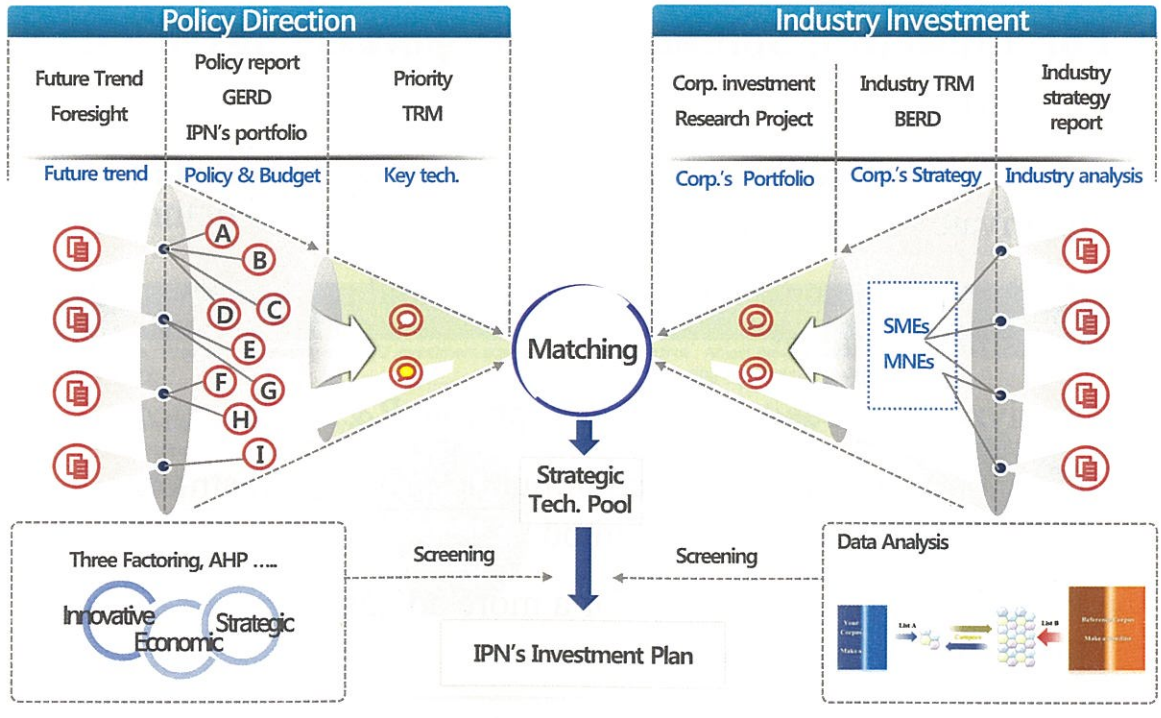
Ⅱ. Research Objective

- **Provide a Model for Linking Mexico's S&T Policy with Public/Private R&D Investment**
  - Apply the technology foresight, TRM, priority setting methodology and fruits derived from the previous researches.
  - Strengthen the link between Mexican science and technology policy and public / private R&D investment.
  - Analyze Korean public and private R&D investment strategies based on S&T policy.
  - Provide an appropriate model for the situation in Mexico based on Korea's experience.

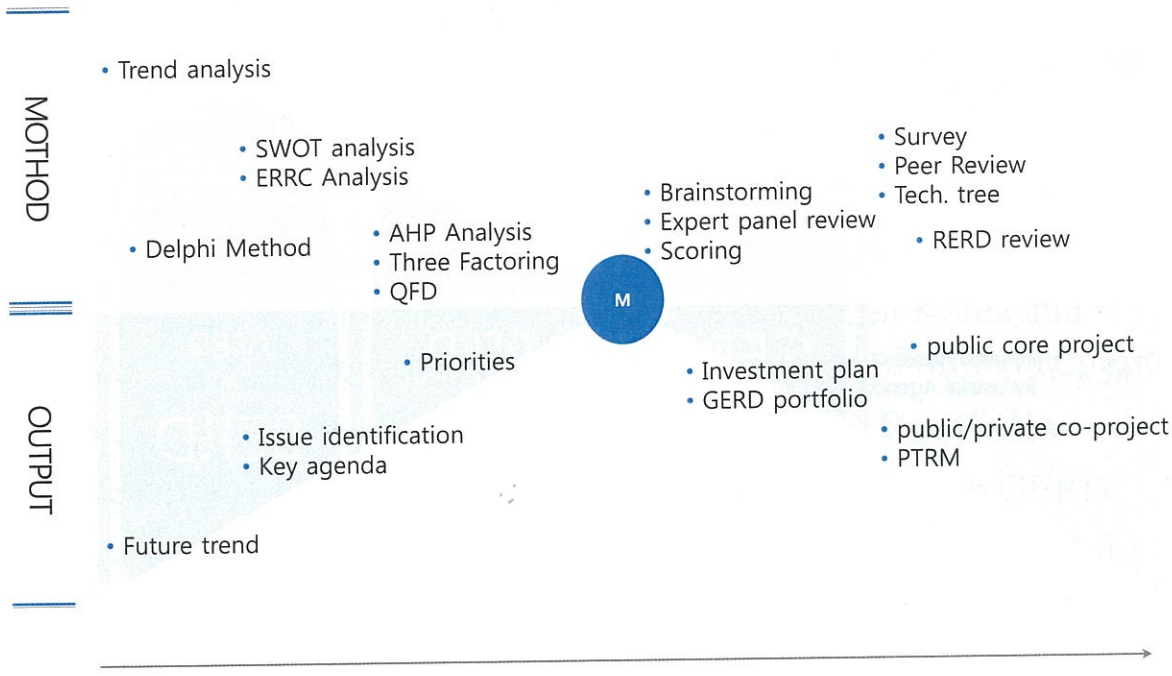
Ⅲ. Research Plan (Concept)



Ⅲ. Research Plan (Approach)



Ⅲ. Research Plan (Methodologies)



Ⅲ. Research Plan (Scope)

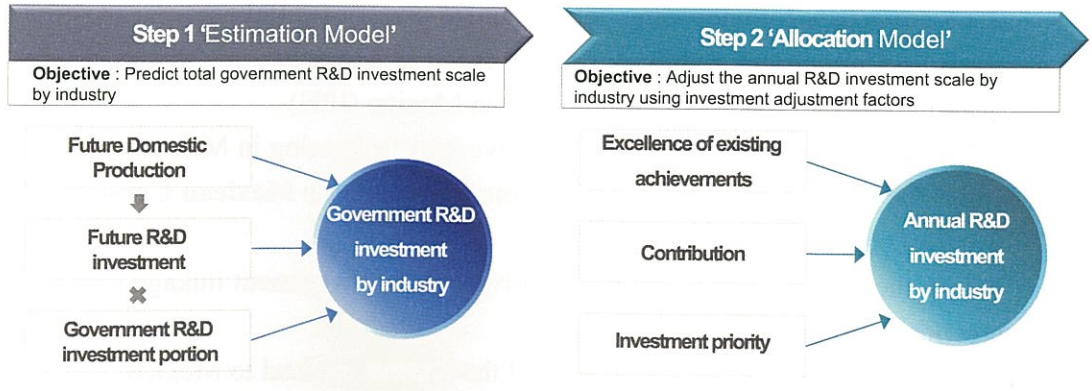
- **For a Practical Solution, this Report Covers Followings:**
  - Identify the necessity of linkage between S&T policy and public & private R&D investment
  - Review of Korean cases of S&T policy and public-private R&D investment linkage.
  - Analyze the capacity of public & private R&D in Mexico
  - Develop a model for Mexico of public-private investment linkage based on Korean method
  - Provide policy suggestions for a more advanced public-private investment of Mexico

Ⅳ. Korean Experience (Methodologies)

- **Kinds of Method could be used for Public R&D Investment Decision Making in Mexico**
  - (AHP) Techniques for layering alternatives and selecting the best alternative to investment allocation
  - (Delphi) Techniques to systematically investment allocation from a group of specialists
  - (Portfolio Matrix) A technique for analyzing portfolios according to a couple of classification criteria
  - (System Dynamics) Using 'stock' and 'flow' concepts, R&D investment decision
  - (CGE) Using GDP, make the R&D investment decision of each industry

Ⅳ. Korean Experience (An Example of Approach)

- **One of the Public R&D Investment allocation method in Korea can be useful to Mexico**
  - Modified 'Estimation Model' and 'Allocation Model' based on quantitative method to suit Mexican situation



V. Expected Outcome

- **Model for Linking Mexico's S&T Policy with Public/Private R&D Investment**
  - A practical solution for a strategic investment of GERD
- **Provide the Foundation for Building a More Advance d Investment Model in the Future**
  - IPN should make efforts to create more refined and optimized models by further improving the model presented in this project.
- **Improve the Effectiveness and Efficiency of Public R&D**
  - Ultimately contribute to the creation of growth engines by raising the efficiency and effectiveness of national R&D investment in Mexico

V. Expected Outcome (Tentative table of content(TBD)

V. Conclusion

- **Close Cooperation for the Success of Pilot Project**
  - Korean researchers + Local experts + IPN + Industry
- **Practice by IPN Experts is Most Important**
  - Practice generates key values and hands-on experience
- **Practical Solution for the Future Implementation**
  - Model + Player + Tips for good implementations

Appendix

Executive Summary of 2017/18 KSP

Growing attention has been devoted to the issue of technology planning to enhance accountability, effectiveness, and efficiency of R&D investment of public resources. Mexico is also trying to establish an effective technology planning system that is suitable to the situation in Mexico. The Mexican government hopes to learn lessons from Korea's experiences in technology planning. The National Polytechnic Institute (IPN), as a higher education and research organization, is interested in contributing to the achievement of national S&T goals. IPN wants to make an effective technology planning system including technology foresight, priority setting for R&D and technology roadmap (TRM).

The aim of technology planning is to decide the goal, subject, cost, and timing of the technology to be developed by reviewing the socioeconomic needs and policy considerations based on technology information. Prioritization of R&D, therefore, is a critical step in the process of strategic technology planning for efficient use of limited resources. Strategic technology planning could be divided into several stages: technology intelligence, technology foresight, priority setting, and technology roadmap. Technology intelligence includes S&T level analysis, R&D capacity analysis, STEEP (Social, Technological, Economic, Environmental and Political) analysis, and market analysis. Technological planning includes S&T foresight, TRM, and R&D priority setting that are covered in this project. In order to achieve good results of priority setting, preliminary analyses of social, technological, national strategy, and economic aspects should be done as well.

The purpose of technology intelligence (TI) is to collect and analyze technology-related information needed for technology and business decision-making in companies and organizations. TI aims to capture and disseminate the technological information needed for strategic planning and decision making. Because of the speed of technology change and the changing global business environment, TI has been becoming increasingly important. At the national level, TI includes S&T level and capacity analysis, mega-trend analysis, market analysis, and R&D investment analysis.

Technology foresight is a process of comprehensively examining the future of science and technology and the socio-economic change in the future from a long term standpoint in order to select research areas that are expected to produce the greatest socio-economic benefits (OECD, 1996). Also it is a means for presenting the mid- to long-term vision of technology. Furthermore, it derives the problem to solve from technological point of view, which is based on the needs of the future society.

The purpose of R&D priority setting is to compile the R&D promotion ranking or resource allocation plan by comprehensively considering the competence of the technology development entity, given the circumstances, technological importance, and socio-economic ripple effects of technology. In the case of government research, public concern or benefit of the technology is one of the most important factors in setting priorities.

The technology roadmap (TRM) is a kind of guide map for developing and securing core technologies. It is a tool to effectively integrate and express various viewpoints of strategy, technology, and products and to effectively eliminate functional barriers that are placed between different technologies. TRM is often classified as either a market-driven model or a technology-push model. The market-driven model expresses the path of the market, product, and technology as a roadmap. Market needs are very important in this case. In the case of the technology -push model, the new technology creates a new market by taking the path of technology → product → market.

Among these steps, the procedure of technology road mapping and prioritization may be reversed. In the first case, we can make TRM first and then set priorities. We can make a TRM that is based on the future goals that we hope to accomplish. We then set the R&D priorities according to our capabilities and resources. On the contrary, there could be another case where prioritization is done first and then the TRM could be made. In other words, technology foresight determines the technology to be developed in the future. After that, core technologies should be strategically selected in terms of the strategic goals of technology, urgency of development, technology level, and technology development capacity. Then, TRM could be drawn according to those priorities, including technology acquisition means, performers, time, product, and resources.

Technology Foresight

This study introduces the effective implementation plan for building up the technology foresight (hereafter "TF") system of TechnoPoli in IPN based on evidence of Mexico and implications from the Korean experience.

TF emphasizes action-orientation for priority setting activities to achieve future goals, but technology forecasting has more emphasis on accuracy of results of prediction and quality of information for decision making. In fact, TF is the third generation of technology forecasting (Georghiou, 2003; UNIDO a, 2005). TF is an attempt to draw the future of technology development that has a key role for the development of society in the direction that we desire, with the interaction between technology and society in mind.

A wide range of methods is applicable to TF from qualitative methods such as literature review, expert panel, and brainstorming, to quantitative methods such as simulation modeling and bibliometrics. However, popular methods for TF to be used widely are trend extrapolation, simulation modeling, Delphi technique, expert panel, future wheel, cross impact analysis, and the scenario planning method.

In fact, Mexico had a tradition of foresight and future research and led the foresight study as a pioneer in the region of Latin America. Mexico had been introducing some of the first books and exercises in the 1970s and leading the first Latin initiative to promote the integration of foresight effort. But Mexico lost this leadership during the 1990s and now has an endeavor to recover it (Georghiou et al., 2008). Mexico still has not organized foresight efforts into a fully-fledged national foresight program, so usage of TF studies is not common to Mexican organizations such as private companies, research institutes, and the federal and state governments.

14 studies related to the foresight made in Mexico and foresight studies especially focused on the technology perspectives such as technology prospect, technology forecasting, and technology foresight were found. These research projects were relatively small in comparison with the GDP scale and industrial competitiveness of Mexico. Furthermore, major foresight studies focused on the technology perspectives appeared in the 2010s in Mexico.

IPN has some strength in TF-related capability from its long history of business and technology intelligence service of UPDCE, TechnoPoli, and CIBET. IPN also has a strong DB (database) of science and technology personnel and information system for this business and technology service. The DB of science and technology personnel belonging to IPN is actively used and is updated live for various IPN services. IPN also has a substantial external network for the extension of its science and technology personnel and information system.

Korea has various organizations that conduct TF studies, such as the central government, regional governments, government-funded research institutes, public research institutes, and private companies. The central government establishes laws, and the regional governments establish municipal ordinances and rules to accomplish the legal basis to safely conduct the TF study. The government-funded research institutes and the public research institutes have no duty to conduct the TF study based on the articles of association like the regional governments. However, they conduct the TF study of the related fields of technologies as one of their activities to establish a medium-and long-term development strategy every 3 to 5 years. In particular, the government-funded research institutes propose medium-and long-term development strategies during the process of approval of management performance plans by the government during a 3 to 5-year term of the chief of the institutes. Also, each government-funded research institute conducts the TF study to explain its roles and functions to the public during the change of the government administration or every 10 years. Like the government-funded research institutes and the public research institutes, the private companies also conduct the TF study of related fields of technologies as one of their activities to establish a medium and long-term development strategy or to find a new business or a new field for investment.

For the implementation of effective TF study from TechnoPoli in IPN, this report suggests several directions from the analysis of the current situation of TF in Mexico, as previously discussed. First of all, this report recommends that 5 years is a suitable time span for TF in Mexico. Also, this report recommends that the intersection of the competitive area of IPN and national strategic industry for Mexico is suitable as the target technology area to be studied in the foresight study. This report also suggests that the study on the future technology should be excluded in place of more focus on the key technologies for problem solving for the industry and society in IPN and Mexico within 10 years. Finally, it is suggested that sophisticated S&T trend analyses, such as big data analysis and advanced bibliometric analysis, should also be replaced by literature review.

This report suggests a stage model that consists of stages for development of a necessary technology and identification of a promising technology. Also, this report suggests the institutional structure of the TF study for TechnoPoli in IPN.

It consists of a headquarter of IPN, extension and social impact secretary, TechnoPoli, and 3 committees: an advisory committee, executive committee, and technology committee. The advisory committee should be set up to establish legitimacy for the TF study, to support the execution of the TF study, and to implement the results of the TF study. The executive committee will have the role of important decision making at each stage of the TF study and confirming the results of the study. Technology committees will be set up along with target technology areas. For effective implementation of the TF study, more than $150,000 is recommended as a budget for each target technology area. This includes all of the costs needed, such as operation costs of the 3 committees, operations costs of activities of TechnoPoli by the dedicated human resources, and operation costs of web-based survey system. Finally, there is no further need for any information system acquisition because TechnoPoli has enough internal information service systems for business and technology intelligence and also has an external network for information service.

R&D Priority Setting

The purpose of this study is to strengthen IPN's capabilities of technology planning. It is expected that efficiency and effectiveness of R&D investment will be enhanced if IPN's strategic technology planning capability is increased. This project, therefore, aims to help Mexico's socio-economic development by enhancing the quality of R&D results. In order to reach these goals, the study has 2 following objectives: firstly, to understand the aim, structure, practice, and application of Korean R&D priority setting and draw policy implications and lessons; secondly, to provide suggestions to Mexico for a more advanced practice of R&D priority setting in order to enhance the efficiency and effectiveness of research and technology development activities in IPN by providing detailed information and knowledge that are based on the Korean experience.

To accomplish the above-mentioned objectives, the study consists of 4 modules. The aim of the first module is to provide a theoretical review of R&D priorities. The second is to summarize the policy implications and lessons from Korea's experience. The third is to understand Mexico's S&T system and R&D priorities. It is essential to understand Mexico's S&T system and R&D activities in order to propose policy suggestions for Mexico. Finally, the fourth module aims to provide some suggestions for setting up the R&D prioritization system for IPN in the Mexican environment of S&T. The study therefore covers 4 tasks as follows: Theory of R&D Priority Setting; Experience and Lessons of R&D Priority Setting in Korea; Review of the S&T System and Capacity of Mexico for R&D Priority Setting; and Suggestions and Solutions for Mexico.

The Analytical framework used in this study is an overarching meta-evaluation framework. Each PS system can be regarded as being composed of 5 main areas: i) paradigm, ii) resources, iii) implementation, iv) utilization, and v) environment. This report proposes principles and suggestions for a more advanced PS according to this framework. The report also provides an advanced PS model for IPN according to this framework.

In Korea's case, there are a few lessons to be learned in order to effectively set R & D priorities. First of all, there need to be an effective system and efficient procedures to set priorities for a clear purpose. Second, strategic technology planning is a matter of resource allocation, which means resources are concentrated on promising areas rather than on equal research support. Therefore, continuous interest and support from top decision makers is very important. If not, it will stay in the plan and will be difficult to actually execute. Third, it is necessary to build an independent organization to take charge of strategic technology planning. Researchers involved in individual research and development are likely to represent their own interests. It is therefore desirable to have an independent and professional organization free from conflict of interest issues. Fourth, there are many considerations for prioritization. Theoretically, these cannot reflect all of the many influencing factors. Therefore, it is very important to use various methods integrally; in other words, "one does not fit all." Fifth, priority should be set based on scientific method and data as much as possible, but it is also the product of political negotiations among the people involved. Therefore, the result is not an absolute standard. In the end, it is very important to have process of reaching consensus, so that stakeholders can fully accept and actively cooperate with the plan after R&D priority, has been set.

IPN needs to reach a consensus on key research fields with a top-down approach, considering its missions. At the national level, it is necessary to establish an adjustment system of R&D investment for technology foresight, TRM, and setting priorities. R&D management and resource allocation policies based on performance-based management (PBM) should be established at the IPN level, and this work should be steadily promoted for at least 5 years.

In order to increase the acceptability of IPN people for differentiated resource support, there is a need for mutual agreement among the members to ensure that sufficient compensation will be provided for IPN research units and researchers with excellent performance.

It is necessary to establish a department to analyze, coordinate, and evaluate IPN's research activities as a whole so that the planning, execution, and evaluation activities of R&D can be carried out in a comprehensive and systematic manner. If it is hard to start right away, a temporary organization (task force team) should be organized. It is also necessary to establish a coordinating body (committee/ council) within the IPN to deliberate and make decisions on budget adjustment and prioritization. In this case, the IPN president needs to lead the committee.

A data collecting and sharing system is needed to objectively analyze R&D investment, evaluation information, investment priorities, activities, outputs, and benefits for beneficiaries. If a research fund costs more than a certain amount, it is obligatory to submit a "technology development plan report." The relevant laws and regulations must contain provisions that define specific actions for strategic technology planning and evaluation.

It is necessary to invest about 5% of IPN's total research expenses in activities related to technology planning, such as technology foresight, roadmap, and priority setting. In 2018, approximately 4 to 5 dedicated personnel members will need to be deployed to implement the actual strategic technological plan.

The results of the proceedings should be reported directly to the Director General of IPN. It takes about 1 year to conduct a pilot project, but it may take 6 months to accelerate the accumulation of experience by working more intensively. It could be necessary to set detailed priorities for the 6 sectors for the current Mexican economic development.

Therefore, it needs to present a concrete and detailed implementation plan for how we can achieve the desired goals. The figure could be a frame of IPN for setting priorities. Results should never suggest just directions, but should be specific enough to allocate resources accurately. Strategic implementation of budget execution for years should follow the priority setting. It is required to monitor, assess, and receive feedback on the effect of the strategic investment allocation.

TRM

Throughout the years, Mexico has been growing as a production base for global companies in North America. However, due to the strengthened re-shoring and protective trade policies in major trading partners such as the United States, Mexico has come to face a situation in which it needs to reinforce its future industry competitiveness. Therefore, in order to prepare for the fourth industrial revolution, Mexico needs to advance its science and technology innovation system to foster new growth engines and strengthen industrial competitiveness by introducing a sophisticated technology planning and R&D management systems.

Although IPN is making efforts to provide technical and market information through TechnoPoli, it still lacks the maturity in practical skill and experience for technical planning as a whole.

Therefore, this study shares the knowledge and experiences of R&D projects and methodologies that were based on the Technology Roadmap of Korea. Moreover, it proposes a TRM methodology that can be practically used.

The purpose of this study is to introduce methodologies of technology roadmapping reflecting Mexico's technology planning capability and conditions, so that the major R&D organizations in Mexico, such as IPN, can utilize it. It is intended to share TRM-based technology planning cases in the public and private sectors of Korea and pass on methodologies and processes that can be used from a practical perspective.

This study is mainly composed of a theoretical review of technology road mapping, case study of TRM applications in public and private sector in Korea and major industrialized countries, analysis of the technology planning capacity and situation in Mexico, and TRM-based technology methodology and suggestions.

According to a report by the local consultant, Mexico's science and technology innovation system operates in relation to LCyT (the Science and Technology Law) and PECiTI (The Special Program for Science Technology and Innovation). The CONACYT, a committee under the Ministry of Education, serves as a control tower of science and technology innovation policy. On the other hand, there are very few examples of establishing science and technology policies and running technology roadmap-based technology planning systems in major organizations. Some institutions are trying to develop roadmaps, but the general judgement is that they lack systemicity, usability, and specificity.

The theoretical review section of the technology roadmap presents the concept and definition of technology road mapping, the importance of TRM for improving the systematic and efficiency of R&D investment, and the underlying process. This study proposes various types of and differences in technology road mapping used in the public and private sectors by presenting many application cases of technology road mapping in Korea and developed countries. Some examples from developed countries include the U.S. National Aeronautics and Space Administration (NASA)'s Technology Roadmap and the EU's Energy Technology Roadmap. In the case of Korea, the National NBIC's Convergence Technology Map (2008) and the SMEs Technology Roadmap (2016) were introduced as examples in the public sector, and L's TRM case was introduced for the private sector. Based on these cases, considering the reality and capability of IPN, TRM methodology and process are presented in Chapter 5 with examples and templates. The study concludes with policy recommendations to improve Mexico's technology plans.

Taking into consideration the increasing complexity in technology trends and state-of-the-art technology in the age of the Fourth Industrial Revolution, a national science and technology system should be strategically planned and create economic and social added value through convergence. Therefore, it is very important to implement R&D mechanism that can closely link science and technology policy, planning, R&D investment, and R&D performance utilization. Systematic technical planning, such as TRM, improves the productivity of R&D investment and creates many jobs and competitive enterprises as guidelines for enhancing national R&D accountability. In order to proliferate the technology planning method, it is critical to make a policy effort, such as providing law and institutional strategy, training professionals, and continuously implementing and encouraging learning. In particular, strategic investment is needed to enable the leading R&D institutions of Mexico, such as IPN, to rapidly increase their technology planning capabilities and to share them with more diverse public and private R&D actors.