

2017/18 Knowledge Sharing Program (KSP) with Mexico I

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Mexico City, Mexico

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Summary

This report has a goal to conduct the investigation on the current situation of the environment for technology foresight study in Mexico and suggest the effective technology foresight system for the TechnoPoli in the IPN. This report introduces the effective implementation plan for building up the technology foresight system of the TechnoPoli in the IPN based on evidence of Mexico and implication from the Korean experience.

Technology foresight has an emphasis on the action-orientation for the priority setting activities to achieve the goal of future, but technology forecasting has more emphasis on the accuracy of the results of prediction and quality of information for decision making. In fact, technology foresight is third generation of technology forecasting (Georghiou, 2003; UNIDO a, 2005) By Georghiou(2003). Technology foresight is an attempt to draw the future of technology development that have 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 are applicable to technology foresight from qualitative method such as literature review, expert panel, and brainstorming to quantitative method such as simulation modeling, bibliometrics. But, popular methods for technology foresight, to be used widely, are trend extrapolation, simulation modeling, Delphi technique, cross impact analysis, and scenario planning method.

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

There were 14 studies related to the foresight made in Mexico and foresight study especially focused on the technology perspectives such as technology prospect, technology forecasting and technology foresight was not enough. Furthermore, major foresight studies focused on the technology perspectives is appeared in 2010s in Mexico.

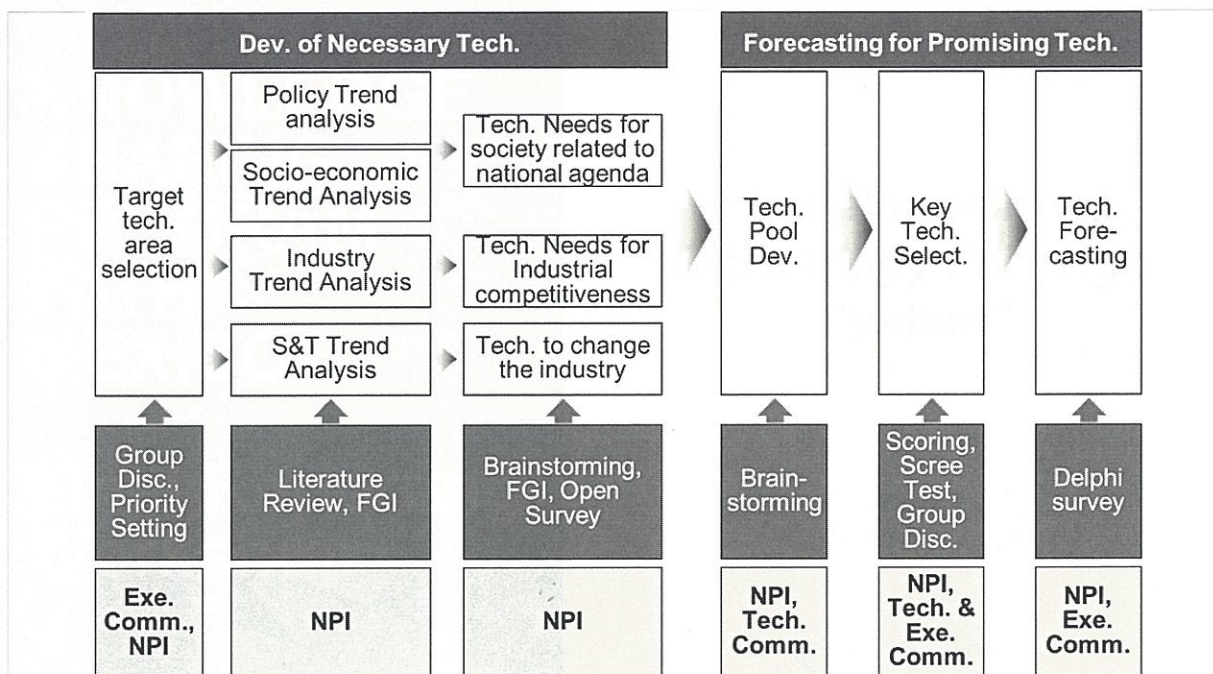
IPN has relevant strength of technology foresight related capability from his long history of business and technology intelligence service of UPDCE, TechnoPoli, and CIBET. IPN also have good DB of science and technology personnel and information system for this business and technology service. DB of science and technology personnel belongs to IPN is not just dead DB but active DB which is lively updated and actively used for various service of IPN. IPN also has an enough external network for extension of science and technology personnel and information system.

South Korea has various organizations that conduct the technology foresight study, such as a central government, regional governments, government-funded research institutes, and public research institutes, 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 technology foresight study. The government-funded research institutes and the public research institutes have no duty to conduct the technology foresight study based on the articles of association like the regional governments. However, many government-funded research institutes and the public research institutes conduct the technology foresight study of the related fields of technologies as one of their activities to establish a medium-and long-term development strategy in every three to five years. Especially, the government-funded research institutes propose the medium-and long-term development strategy during the process of approval of management performance plan by the government during a three to five years term of the chief of the institutes. Also, each government-funded research institute conducts the technology foresight study to explain their roles and functions to the public during the change of government regime or every ten years. Like the government-funded research institutes and the public research institutes, the private companies also conduct the technology foresight 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 technology foresight study from TechnoPoli in the IPN, this report draws several implications from the analysis of current situation of technology foresight in Mexico as previously discussed. With these implication, this report recommends that 5~10 years in the technology area related to the strategic industries for Mexico is suitable to time span for technology foresight in Mexico and target technology area to be studied in foresight study is intersection of competitive area of IPN and national strategic industry. This report also suggests that study on the future technology could be excluded and more focus on the potential 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 analysis such as Big data analysis and advanced bibliometric analysis could be also replaced by literature review.

This report suggests two stage model consists of development of necessary technology stage and forecasting of promising technology stage. Also, this report suggests the institutional structure of technology foresight study from TechnoPoli in the IPN.



Note: compiled by the author.

It consists of headquarter of IPN, extension and social impact secretary, TechnoPoli, and three committees, which is advisory committee, executive committee, technology committees.

Advisory committee should be set up to getting a legitimacy for technology foresight study and support of the execution of technology foresight study and exploitation of results of technology foresight study. Executive committee will have a role of important decision making of each stage of technology foresight study and confirmation of results of technology foresight study. Technology committees will be set up along with target technology areas.

For effective implementation of technology foresight study, more than \$150,000 is recommended as a budget for technology foresight study in each target technology area. It includes all of cost to be carried out for technology foresight study such as operation cost of three committees, operations cost of activities of TechnoPoli by the dedicated human resources, operation cost of web-based survey system, et al.

Finally, there is no further needs of any information system acquisition because TechnoPoli has enough internal information service system for business and technology intelligence and also has an external network for information service.

**2017/18
KNOWLEDGE
SHARING
PROGRAM
WITH
MEXICO**

**Final Reporting
Workshop**



***“Development of
Technology Foresight
System”***

**Dr. Sun Hark Bong
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April 24th, 2018



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- 1. Concept of Technology Foresight**
- 2. Current Situation of TF in Mexico**
- 3. Korean Experience of TF**
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1. Concept of Technology Foresight

- **Technology Foresight: process for bringing together scientist, industrialist, government officers and others to identify the areas of emerging technologies likely to yield the greatest economic and social benefits**
- **Coevolution of S&T with social change**

	Technology Forecasting	Technology Foresight
Aim	exact prediction of future of technology and its impact	setting the goal for the future and executing of activities to achieve it
Player	R&D personnel (Scientist and Engineer)	R&D personnel, Social Scientist, and Government Officer
Usage	Communication of information and learning	Decision making and resource allocation for action

- **Proficiency of Self-fulfillment**
 - **Consensus building within players and active usage of its results to R&D activity is more important**

2. Current Situation of TF in Mexico

- **IPN has related resources and experience for technology foresight study**
 - **Business and technology intelligence activities, information system and DB in Technology Observatory, S&T expert searching experience**
- **Use of external expert for TF is also available**
 - **Experience of foresight: PEMEX and PROTEAA(tech.), CONACYT (future), FUMEC(market)**
 - **CONACYT has S&T expert DB in Mexico**

3. Korean Experience of TF

- TF study at the various level is executed since 1990s
 - 1st TF study is done 1992 by STEPI for the nation

	Nation	Central Gov.	Regional Gov.	R&D Institute
Legal Basis	Framework Act on S&T	Law related to S&T	Municipal ordinance/rule related to S&T	None
Agency/ Dept.	KISTEP	Affiliated R&D management organization	Affiliated S&T related organization	Dept. related to planning or technology policy
Usage	Resource allocation and R&D planning	Resource acquisition, allocation and R&D planning	Resource acquisition, allocation and R&D planning	Resource acquisition, allocation and R&D planning

3. Korean Experience of TF (cont.)

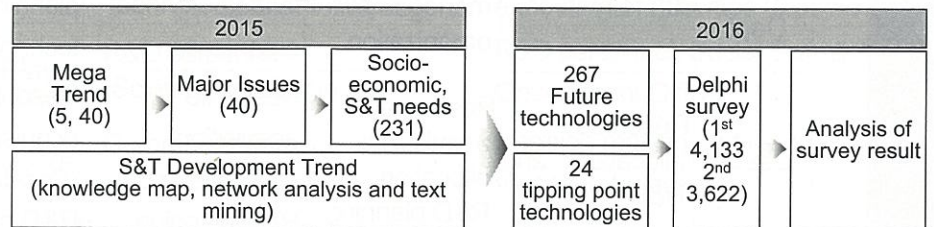
- Stage approach using PEST and Delphi under the control of the committee at the various level

	Nation	Central Gov.	R&D Institute
Institution	NSTC	Ministry of LIT	ETRI
Institutional Structure	Executive, emerging tech., future foresight committee	Executive committee, Expert Working group	-
Agency	KISTEP	KAIA	ETRI TF dept.
Step	Trend analysis → emerging tech. selection	Trend analysis → emerging tech. selection	Future foresight → emerging tech. selection
Method	Bibliometric, Big Data, PEST, Delphi	Bibliometric, Big Data, PEST, Delphi	PEST, FGI, Delphi
Implementation	Co-working (15 staffs, part time)	Outsourcing (1~2 staffs, part time)	Co-working (1~2 staffs, part time)

3. Korean Experience of TF (cont.)

- The National Science and Technology Foresight

- 5th TF study is done in 2015~2016
- to explore socio-economic and S&T trends and identify emerging technologies that have high potentials (the time of realization, its importance, measures for realization, and its tipping point)
- Two stage study is performed

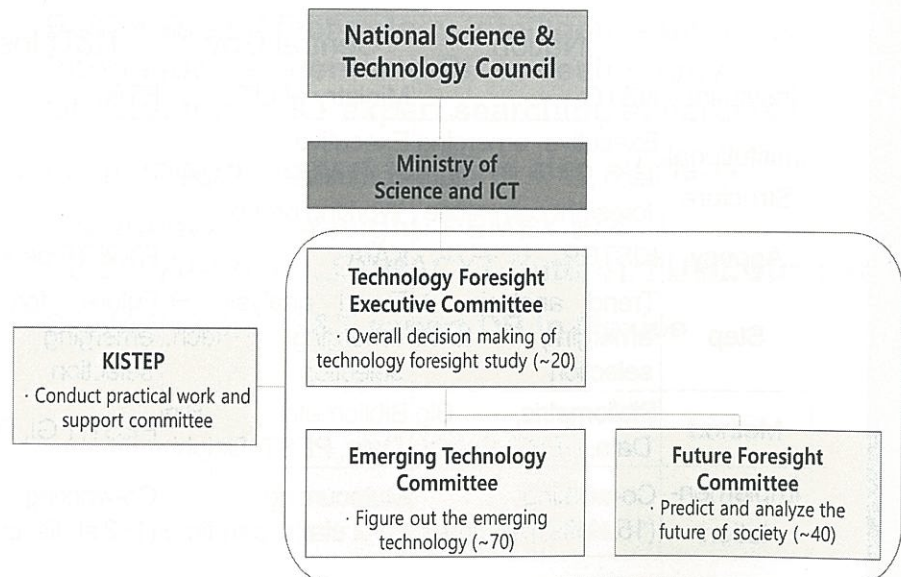


- Results are used to 4th national framework plan on S&T (18~22) and disseminated to public

3. Korean Experience of TF (cont.)

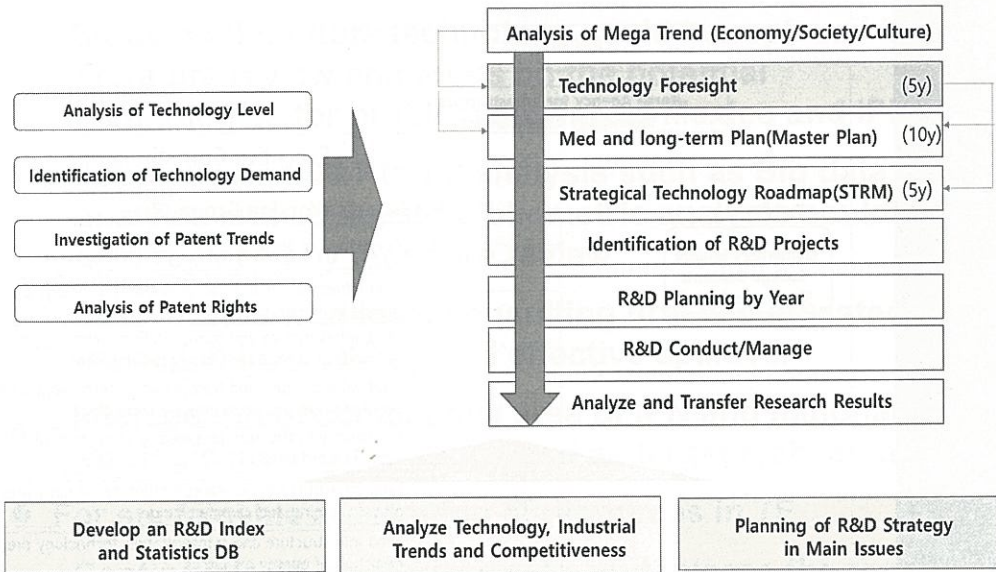
- The National Science and Technology Foresight

- Institutional Structure



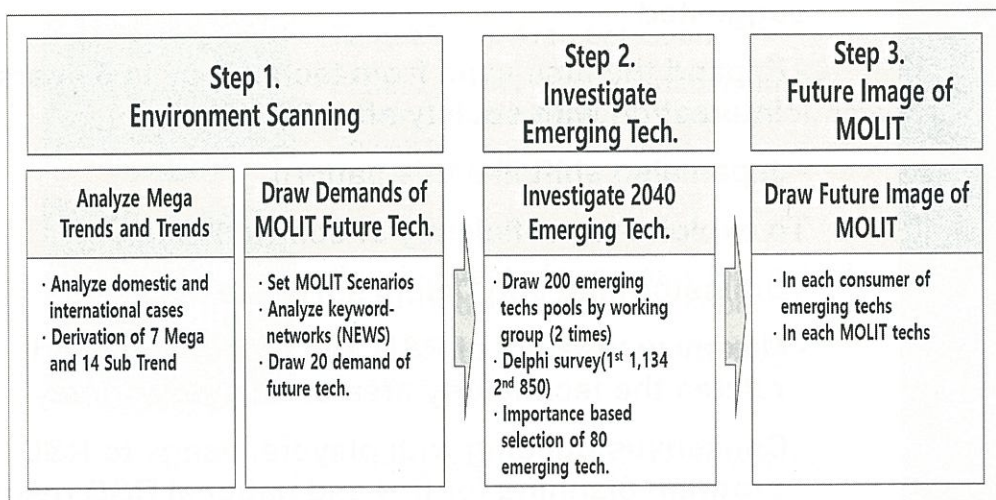
3. Korean Experience of TF (cont.)

● Technology Foresight 2040: Land, Infrastructure, Transport



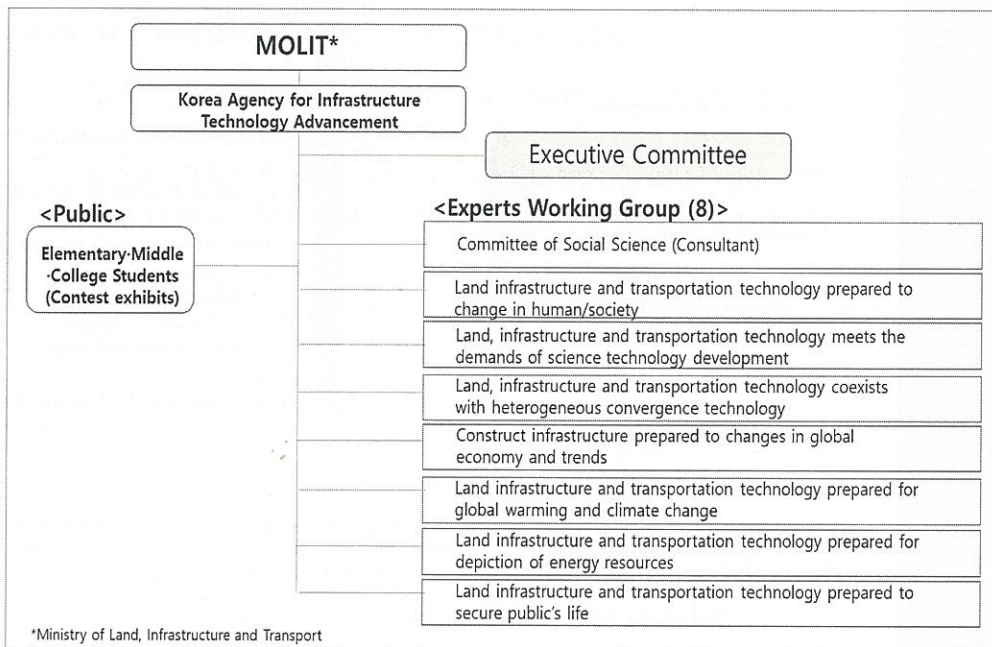
3. Korean Experience of TF (cont.)

● Technology Foresight 2040: Land, Infrastructure, Transport



3. Korean Experience of TF (cont.)

● Technology Foresight 2040: Land, Infrastructure, Transport



4. Implication for IPN

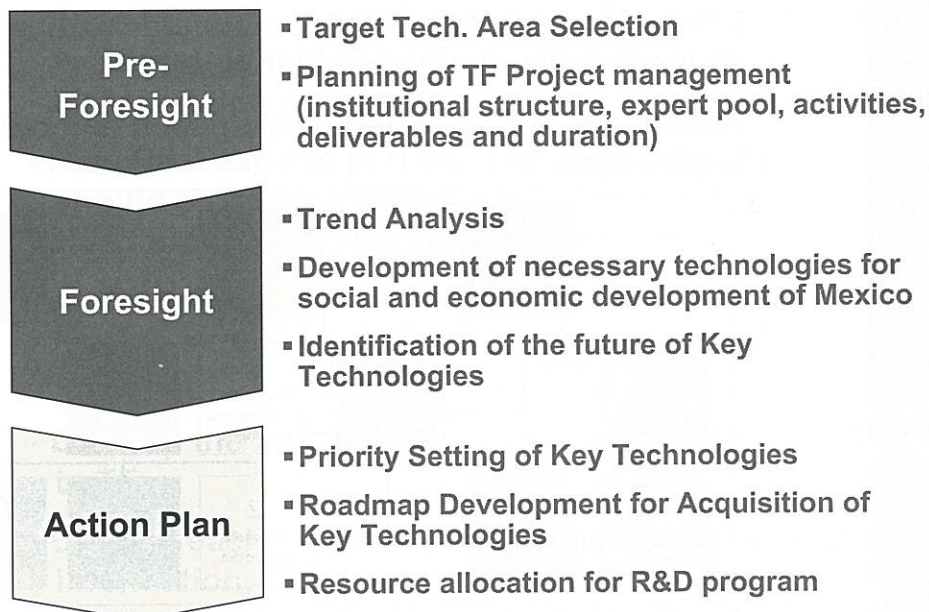
- Focus on the technology with 5 years time span is suggested
 - Expand the time span from technology in 5 years to interaction with society after 30~40 years
 - Japan also shift like this pattern
- To exploit the proficiency of self-fulfillment
 - Brainstorming and Delphi survey is necessary
 - Maximize the pool of R&D and industrial expert related the technology area of TF study survey
 - Consensus building with players, usage to R&D program planning for IPN and national R&D resource allocation, and communication to TF players
 - Government officers and stakeholder should be included in the TF players

4. Implication for IPN (cont.)

- For initial successful TF study launching
 - Study on the future technology could be replaced by literature review and focus on the potential technologies for problem solving of Mexico and IPN
 - Sophisticated S&T trend analysis such as Big data analysis and advanced bibliometric analysis could be also replaced by literature review
 - Cooperation with local consulting firm is suggested for capability building and effective spillover
 - Intersection of competitive area of IPN and national strategic industry is suggested as target tech. area
- For sustainable acquisition of resources in TF
 - Continuous TF study execution and release the result

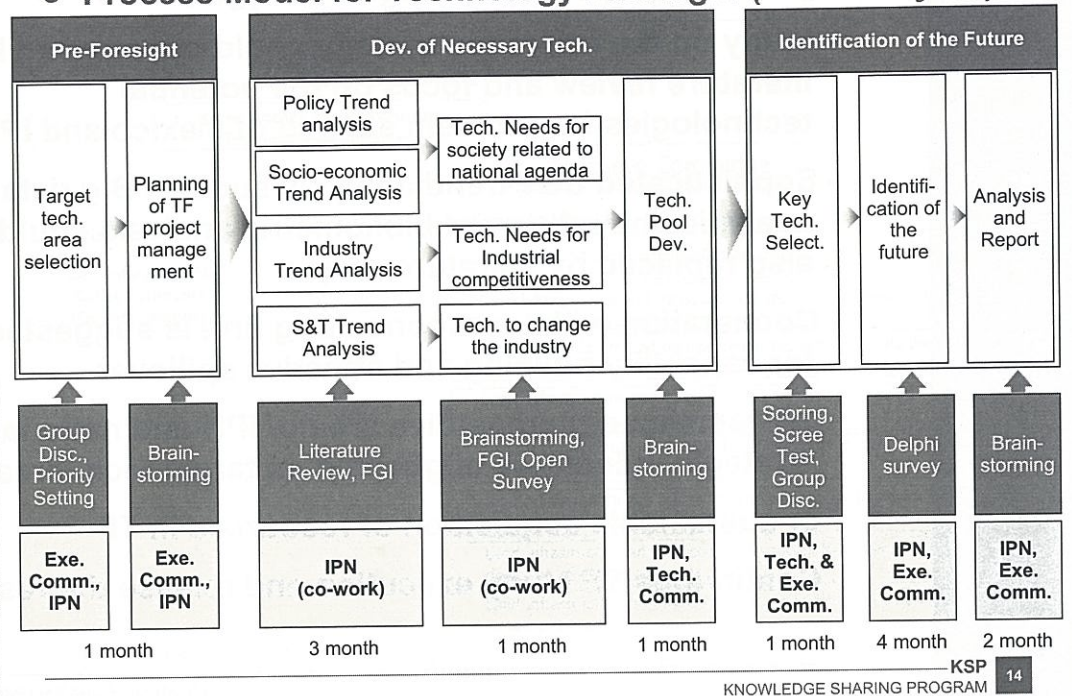
5. Implementation Plan for TF Study

- Technology Foresight Processes Policy Making



5. Implementation Plan for TF Study (cont.)

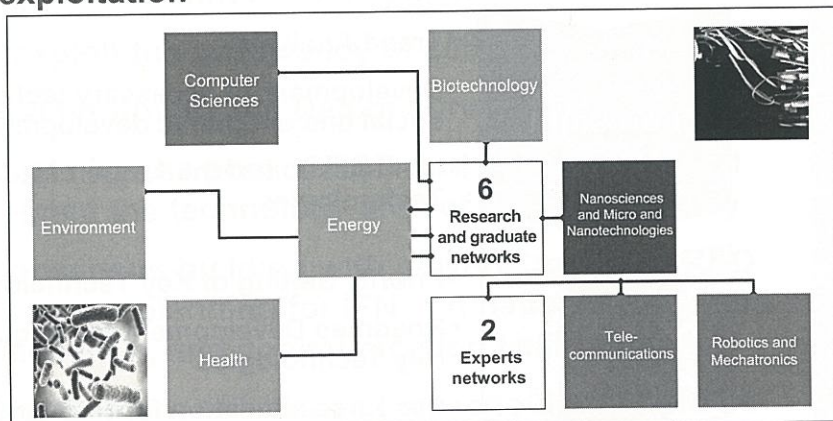
● Process Model for Technology Foresight (around 1 year)



5. Implementation Plan for TF Study (cont.)

● Selection of Target technology area

- Intersection of competitive area of IPN and national strategic industry such as Bio tech., ICT
- Advantage to S&T expert participation and result exploitation

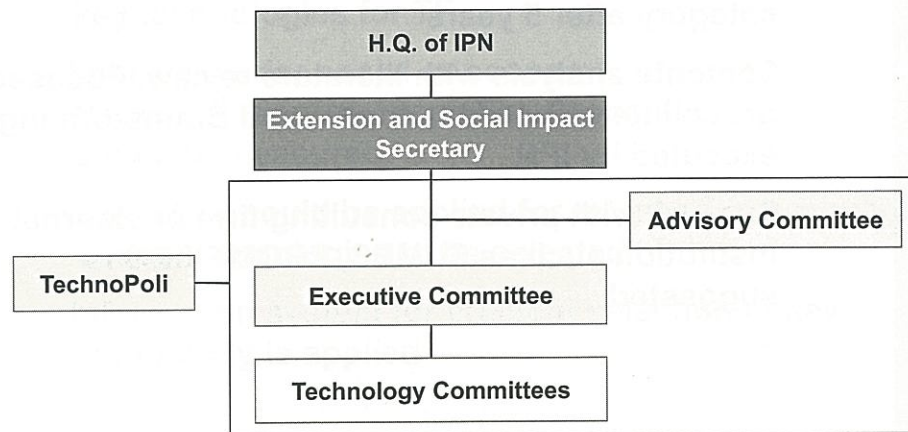


Source: Research and Expert Networks of IPN in the IPN introduction Material(2017)

5. Implementation Plan for TF Study (cont.)

● Institutional Structure

- Advisory Committee for legitimacy and support (opinion leader of S&T, Gov., and public media such as CONACYT)
- Technology Committees with each tech. areas



5. Implementation Plan for TF Study (cont.)

● Development of Expert Pool

- Experts pool used by TechnoPoli, UPDCE and CIBET is integrated and classified by national technology classification scheme
- Also R&D experts participated in R&D project of IPN should be derived with cooperation of IPN Headquarter and merged to experts pool
- At the selected tech. area, related R&D personnel in Mexico should be derived by the courtesy of CONACYT
- Develop the full set of expert pool to be participated to TF
- Contact each expert in pool to update the contact information, to introduce the TF study, and to confirm the willingness of participation



5. Implementation Plan for TF Study (cont.)

- **Trend Analysis**
 - **PEST (Policy, Economic and Environmental, Social, Technological) Analysis should be executed in each technology area**
 - **Main goal is building-up the future of Mexico in each category after 5 years**
 - **Contents analysis with literature review, Focused group interview with experts, and Brainstorming is executed by IPN**
 - **Co-work with private consulting firm or external institution such as FUMEC, PROMEXICO is suggested**



5. Implementation Plan for TF Study (cont.)

- **Development of Necessary Technologies**
 - **Derivation of possible technological measures, alternatives for the future in each category**
 - **Development of full set of necessary technologies by merging and separating each technology**
 - **Brainstorming and FGI with experts supply side (i.e. science and technology experts) is executed by IPN**
 - **Unit of technology is product, system or facility for the fulfillment of social, economic want (desire) of human**
 - **More specification and narrow-down of technology for development should be done at the action plan phases**



5. Implementation Plan for TF Study (cont.)

- **Selection of Key Technologies**
 - Technology for TF is selected within each technology committee and confirmed by executive committee
 - Methodology for priority setting is applicable for draft development and group discussion for finalizing the key technologies for TF
 - Importance for social or economic prosperity of Mexico, Resource capability, Probability of success could be measured
 - Scree test could be applied for to cut-off the number of key technologies to be selected
 - Information system for efficient selection of key technology is applied



5. Implementation Plan for TF Study (cont.)

- **Identification of the Future of Key Technology**
 - Development of survey questionnaires for the importance, competitiveness, time of realization, policy measure to realization of each technology
 - Pilot test of questionnaires with more or less 10 persons in each technology area
 - Development of web-based survey system for the Delphi survey
 - Series of Delphi survey is executed by relevant experts (survey participation e-mail → 1st round e-mail → 2nd round e-mail → nth round e-mail)
 - Results of survey in previous round is provided after 2nd round to participant experts by revision of web-based survey system

5. Implementation Plan for TF Study (cont.)

- Identification of the Future of Key Technology (cont.)
 - Round is stopped if stability of response of each participant experts is sufficient (coefficient of variation is less than 0.8)
 - Response rate by final round should be bigger than 60% (U.S. 50~60%, Japan 70%, Korea 80%)
 - Analysis of the results of Delphi survey
 - Co-work with private consulting firm or external institution such as FUMEC, PROMEXICO is suggested for the analysis of survey results
 - Report the results of Delphi based TF study to executive committees

Gracias!

