

Focus group Progress report

National Innovation Systems in Catching-up Economies

Rationale

1. The acquisition and creation of technological capabilities are basic requirements for the continued growth and development of the national economies. The patterns of technological development, however, will be different according to each nation's specific economic situation and overall social environment. The differences between developing and developed economies are a salient example. One of the great differences for the catching-up economies is the availability of the stock of advanced technology to draw on. The catching-up economies in general can be characterized as being faced with two tasks: first, fully utilizing late-comer advantages which enable to catch up more advanced economies, say, in terms of economic performances; and second, building-up indigenous science and technology bases for supporting economic performances. Since, in addition, the catching-up economies are lacking some of prerequisite conditions for economic growth, complementary role is required by the government or from other sources.

2. The catching-up economies have shown development strategies and growth trajectories different from those of fore-runners. All the catching-up economies have shown more rapid economic growth and structural changes in a rather short span of times. Sooner or later, however, these catching-up economies will face the ceiling of the prevailing economic regimes and feel the necessity of building own indigenous science and technology bases. Here some fundamental questions arise: 1) under what conditions will the less advanced economies be able to catch up with the more advanced economies in terms of, say, economic performances? 2) when will the late-comer advantages be no longer maintained and approach the ceiling? 3) what are the difficulties faced by the catching-up economies, in particular in the era of globalization and information and communication technology revolution? 4) what are the requirements/conditions for the catching-up economies in order to successfully transform from imitating economies to innovating economies?

3. The NISs of the countries in question share some characteristics: they are economies that have been (and still are) 'catching-up' vis-a-vis technologically more advanced nations. Their growth trajectory in the past has been mainly determined by the import of technology in various forms. It seems that a) the conditions under which the inflows of technology can be exploited have been changed and increasingly need 'matching' efforts on the side of the recipient countries, b) that the potential to exploit this type of growth trajectory itself has reached some limits and warrants change in the NIS towards more genuine innovation efforts.

Operational schemes for international comparison

4. The following tasks and indicators were proposed by the lead country before the Seoul Workshop on October 15, 1997. (The indicators are attached at the end of the document.)

TASK 1: Description of the growth trajectory of the economy

Indicator 1: Macroeconomic setting

The first task is to characterize the national innovation systems in the catching-up economies. It is postulated that the more remote from the frontier of the technology trajectory, the faster the catching-up process. But, as is mentioned earlier, in order for this postulate to be meaningful, the question of under what conditions this is possible should be addressed. Careful description and comparison of the social/economic/technological conditions of economies in question from the beginning of the catching-up process to the present states will be the starting point. Description on and comparison of the overall

growth trajectory and strategy will be the key aspect, and structural differences and similarities as well will be carefully described. This first part will enable to specify some stylized facts of the catch-up economies.

TASK 2: Structural characteristics of the national innovation systems

Indicator 2: Industrial structure

Indicator 3: Science and technology system

Indicator 4: Linkages

Indicator 5: Education and training

Indicators 2, 3, 4 and 5 correspond to OECD NIS focus groups (innovation cluster, institutional mapping and human resources). In addition, we have to pay more attention to the process of building technological capability in each country.

TASK 3: Absorption of technology from abroad

Indicator 6: International knowledge flows

Main focus is to identify international transfer factors and the role of foreign technologies in relation with indigenous R&D efforts. The modes of technology transfer, regardless of quantifiability, should be listed comprehensively, and the effect of technology transfer will have to be dealt with. Some important issues such as adaptive/absorptive capacity of recipient firms, government's role in assisting the adaptive/absorptive capacity will be tackled. In the process, the interaction between these economies in question and the source countries of technology will have to be handled.

TASK 4: Comparison of overall performance

Indicator 7: Sources of learning --- maybe (mostly) qualitative explanation based on other indicators

Indicator 8: Performance indicators

Each country note should pay more attention to indicator 7. Performance comparison based on indicator 8 will be done by using OECD data base.

TASK 5: New challenges and the role of government

Indicators 9 & 10: Mainly qualitative description

This part will deal with the question of why these catching-up NISs in question can no longer maintain the past development strategy, how to transform from imitation to innovation, what the difficulties are and what the tasks for successful transformation. What kind of problems/bottlenecks NISs in catching-up economies face? What causes? How to overcome? What role should/can the government play in coping with the new challenges?

Progress made

5. Seoul workshop: On October 15, five OECD member countries, Korea, Austria, Spain, Mexico and Hungary, and Taiwan have gathered in Seoul to have a workshop to discuss what role have national innovation systems played for sustained economic development. The workshop began with introduction of OECD's NIS project by Mr. Jean Guinet (OECD/DSTI). The OECD's on-going project is to attempt to operationalize the idea of national innovation system through the collection and analysis of quantifiable indicators with several focus groups: institutional mapping, human resource mobility, inter-firm collaboration, structure and behavior of intra-firm innovation, and NISs in catching-up economies. Dr. Joonghae Suh (STEPI, Korea) gave a brief introductory report of the 'catching-up' group on organization

of work, task, indicators and so on. During the first session, three experts had made presentations on the conceptual framework. As regards to the firm dynamics in the catching-up process, Prof. Linsu Kim(STEPI) showed a conceptual framework which is believed to be very useful in investigating the process of technological learning in catching-up economies. Prof. Christian DeBresson(Univ. of Quebec in Montreal and Tsinghua Univ., Beijing) presented some results from a comparison of innovative systems in 10 OECD countries. Most of workshop participants agreed that his research results are also very valuable for the problems of catching-up economies. Taking examples from the Spanish industry, Prof. Santiago M. Lopez (Univ. of Salamanca, Spain) talked about innovation path and levels of technological convergence. The workshop concentrated on comparing the role of national innovation systems for the sustained economic growth during the catching-up process. Six country notes presented during the second session showed similar and different roles of national innovation systems of participating countries. The national representatives of the participating countries for this workshop were: Mr. Gernot Hutschenreiter (Austrian Institute of Economic Research), Dr. Luis Sanz-Mendez (CSIC Institute for Advanced Social Studies, Spain), Prof. Jorge Fernandez (Mexico), Prof. Keun Lee (Seoul National University, Korea) and Hang-Sik Park(OECD/DSTI), Prof. Raykun R. Tan(National Central University, Taiwan), and Mr. Ferenc Kleinheincz (National Committee for Technological Development, Hungary). The research team for catching-up NIS agreed to concentrate on small number of tractable core questions with readily available data and indicators.

Further works

6. The following is the candidate list of common core indicators and common core issues to be addressed by the country notes of participating countries. The participating countries will pay more attention to more pertinent issues to their own judgments.

<Guidelines for further works for country reports>

A. Common core indicators

A common set of indicators (especially macroeconomics and trade statistics) will to be developed by Austria in cooperation with Korea (cf. the Austrian presentation at the Seoul Workshop). Country notes could supplement such core (cf. the presentation by Taiwan at the Seoul Workshop), with an effort to select indicators suggested by the lead country.

B. Common core issues to be addressed

Countries should : 1) analyze their catching-up process in retrospect (development phases should be identified and characterized (cf. the good Korean model- two presentations at the Seoul Conference and Workshop) ; and 2) identify current challenges and discuss policy options, focusing on the need to correct present weaknesses in their NIS (again Korean presentations at the Seoul Conference and Workshop are good model). In doing so they should try to address the following core questions:

- Growth composition: Using the growth accounting conceptual framework, different phases of the catching-up processes might be characterized (not necessarily in a quantified form) by variable relative contribution of capital stock, labor, capital quality (a measure of best practice technology diffusion and adoption), labor quality (e. g. educational attainment), and total factor productivity (a measure of technological and organizational innovation)
- Framework conditions (macroeconomic conditions, and regulatory framework, especially regarding trade, investment, IPRs, etc. – (presentations by Mexico and Spain at the Seoul workshop are good examples of how the impact of macroeconomic conditions on catching-up processes could be discussed). Sociocultural conditions would also deserve some attention (work-related values, labor relations – e.g. the importance of social partnership in Austria, as explained at the Seoul workshop).
- The role of regional integration (e.g. EU or NAFTA) could be included, if necessary.
- The role of competition in strengthening national capabilities (e.g. the respective role of different types of exposure to competition : competition on domestic markets; "imported" competition from trade opening and foreign direct investment; "export-driven" competition).
- Development and learning strategy (e.g. import substitution/export promotion: coupling indigenous to international learning processes)
- Respective and evolving role of different modes of technology and know-how acquisition from abroad (capital goods, licensing, foreign direct investment, personnel mobility, etc.)
- Industrial structure and corporate governance (respective role of large/smaller firms; links between industrial and financial capital)
- Investment and investment financing patterns (physical and immaterial investment, such as R&D or training)
- Stages in building a complete innovation system, including all networking infrastructures.
- Role played and main policy tools used by the government.

7. Taiwan is planning to hold two day workshop on national innovation systems in April, 1998, which will be organized by the National Science Council, Taiwan. The first day session of the workshop will focus to review general frameworks and approaches about national innovation systems. The second day will be devoted to make intensive discussions on country notes from the participating countries in this group. The April workshop will help to prepare the final version of the results in this group, which will be completed by the end of next June, and the result will be reported to OECD.

<Appendix> *COMPARATIVE INDICATORS*

1. Macroeconomic setting and the growth trajectory of the economy

1.1 Indicators of catching-up growth: (per capita) GNP growth (rate), export growth, the growth of labor force, changes in industrial structure and composition, etc.

1.2 Development strategy : "country-specific aspects, export-orientation / import substitution, large firms vs. SMEs, government/industry relations

1.3 Internationalization

1.4 Government policy framework: The development of market and , currently, "framework conditions" : OECD, TPJ, 1996. If any, social, political, and geographical context will be included as well.

2. Industrial structure

- The industrial specialization pattern reveals strengths and weaknesses in technological capabilities

- Identifying "development blocks" : Lundvall (1992)

* Taxonomy: Pavitt(1984), OECD

* Innovation clusters

* Export performance and structure as indicators of technological competence : Lall (1997)

3. Science and technology system

- The evolution of R&D system: description according to official statistics

- Identifying actors and their changing roles

R&D intensity

Performance of R&D in major sectors

R&D in firms by industrial sector and size of firm

R&D in higher education sector by broad disciplines

R&D in government research institutes and government agencies

4. Linkages

- Mapping knowledge flows in NISs

- Institutional mapping focusing on domestic linkages

- Identifying domestic transfer factors: Joint industry activities, Public/private interactions, Technology diffusion

5. Education and training and the formation of learning organization

- Human capital base : domestic / foreign

- The process of the formation of learning organization

- What factors have been most influential in the formation of learning organization

Human resource development / training of engineers, Work organization

6. International knowledge flows

- Identifying international transfer factors

- Globalization of R&D

Channels: licensing, FDI, capital goods imports, networking(strategic alliances), etc.

The role of foreign technologies / the relation with indigenous R&D efforts

Cf.: D. Archibugi and J. Michie, "The globalization of technology: a new taxonomy," in *Technology, globalization and economic performance*, D. Archibugi and J. Michie, eds., Cambridge University Press, 1997, chapter 6.

7. The sources of learning

8. *Performance indicators* : OECD, *Technology and Industrial Performance*, 1996.

Productivity; employment; international competitiveness

9. (New) challenges

- globalization

- knowledge-based economy

10. The role of government