1. Asia's innovation systems in transition: an introduction

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INTRODUCTION

Economies in transition has become the standard term for former centrally planned economies in Eastern Europe, the former Soviet Republics and Asia. This reflects the general connotation of *transition* as referring to a process where there is a change of an object, concept or system *from one state to another*. We have borrowed this term for the title of this book – *Asia's Innovation Systems in Transition* – to capture what is going on in a number of Asian countries, well aware that most of them have never been centrally planned economies. We did so because we think that *transition* captures quite well what is going on in the different national innovation systems analysed in this book.

The transition we refer to is a process where one constellation of institutions is turning into a different constellation of institutions. With institutions we mean norms, rules and conventions, formal and explicit as well as informal and implicit. Institutions are layered into organizations and into the minds of people, and they are slow to change. In our context the institutions in focus are those related to the production, diffusion and use of knowledge. The transition may, as in the standard use of the term, involve a different balance between market, state regulation and collective versus private property.

But they may also reflect a change in the relationship between knowledge producers and knowledge users or the emergence of a new mode of innovation. In some of the national cases presented below, this kind of change has already taken place over the last decade; in others they are on the policy agenda and attempts are made to move further ahead. But there are also cases, such as Indonesia, where the need for a transition is obvious but where it remains blocked by established power structures and by institutional inertia.

We see a specific value in combining *transition* with an innovation system perspective both in general, and in the specific context of the Asian economies. In general, it is a way to enrich our understanding of innovation systems. The focus is not on how systems are structured at a specific moment but rather on how they go through qualitative change when exposed to a combination of external transformation pressure and growing internal contradictions.

Second we believe that the transition perspective may be seen as a necessary complement to prevailing ideas of *catch-up economic growth*. Catching-up refers to quantitative growth and it may hide the fact that in order to keep growing, national systems from time to time need to go through a process of qualitative change affecting institutions, organizations and relationships between organizations. If this is not well understood it remains a mystery why certain countries, such as Japan, may be caught in growth traps or run into serious sustainability problems, as China, when investing more resources within their old growth model.

Third, and specifically for Asia, the transition perspective challenges the idea that some Asian systems are to be seen as 'models' that can be used as benchmarks for copying by other developing countries. If anything, they are moving targets and what will determine their future performance is not so much their current characteristics, it is rather their capability to make the transition to a new state. We will also show that while they have in common the fact that they are in transition, the transition challenge is quite different in, for instance, Japan, China and Thailand.

Not all the chapters are explicit on all these dimension of the transition process but they give interesting examples that help to understand how transition problems in innovation systems work themselves out in real life. Thus apart from, in their own right, being interesting empirical contributions to understanding what is happening in Asian innovation systems, the chapters in this book also help to fill a gap in the theoretical literature.

INNOVATION SYSTEMS

The combination of elements forming the national systems of innovation (NSI) concept makes it highly 'dialectical'. Innovation signals discontinuity while 'system' tends to be associated with a stable structure. Some have argued that the most dubious element of the concept is 'national' since it brings in, *ex ante*, a level of analysis that might not be the most adequate for understanding the process of innovation. In contrast to this we believe that it has become even more important to be explicit about the national dimension as 'globalization' becomes a major trend. To cope with the

problems connected with globalization calls for an understanding of the historical role of national systems. The analysis of how various countries differ in terms of institutional set-ups supporting innovation and learning is important in this context.

Rather we see as more problematic the standard use of the term 'system'. The system appears in different social and academic discourses. There is a tendency to think about a system as a stationary self-reproducing set of elements with interrelationships. This is reflected in much of the literature on innovation systems. The result is that there is much focus on prevailing institutions and structures and less on qualitative change in the structure and in the institutional set-up. Empirical analysis is often an attempt to describe the system in terms of structure, institutions and organizations as well as the interrelationships between organizations with little concern for how it changes.¹

INSTITUTIONS AND DEVELOPMENT

That the institutional set-up is a fundamental dimension of the national innovation system is not a controversial issue and from the very beginning the literature on 'innovation systems' takes this as fundamental starting point (Freeman, 1982; Lundvall, 1985).

Some of the first attempts to link explicitly the economic literature on institutions to innovation systems were by Björn Johnson (1988 and 1992). One of his basic points was that the uncertainty that characterizes innovation makes it even more necessary to include institutions in the analysis when the focus is on innovation and innovation systems. Rational choice referring to well-defined alternatives cannot explain what comes out of a process where outcomes are by definition unknown. Therefore institutions understood as rules, norms and habits are crucial for the outcome of what individuals decide and do in relation to innovation.²

There is a new tendency in international organizations that work on development issues to focus on institutions as perhaps the most important development factor. This tendency is interesting and useful but the focus remains narrow and one may wonder if the relatively narrow spectrum of institutions, which have been in focus, really can explain so much of the development process as it is claimed.

According to the World Bank (2002: 8), institutions have three main objectives: they channel information about market conditions, goods and participants; they define and enforce property rights and contracts; and they regulate competition. Within this framework, transaction costs that determine market opportunities typically stem from insufficient information,

incomplete definition and enforcement of property rights, and barriers to entry to markets. These problems, as excessive transactions costs in general, have to do with inadequate institutions. Improved institutions that prop up market exchange and raise returns would support development.

In recent publications also IMF emphasizes the importance of institutions for growth. Sometimes institutions are even referred to as 'root causes' of economic development. Sometimes the power acknowledged to institutions is quite impressive. IMF (2003) for example concludes that if the quality of institutions in sub-Saharan Africa were to 'improve to the levels in developing Asia', per capita income would rise by 80 per cent, and if its institutions 'rose to world average levels' the average per capita economic growth rates would become 2 per cent higher. Like the World Bank, the IMF focuses on a narrow range of market-supporting institutions related to the security of property rights, good governance and measures to restrict corruption.

Well-functioning markets are important for development and so are uncorrupted civil servants and efficient regulation procedures in the economy. The problem is that this narrow view does not consider the crucial question of how institutions may support learning and innovation (except for the role of the formal school system, which belongs to the 'established' growth factors). The impact on learning and innovation of, for example, labour market institutions, financial institutions, economic policy regimes and a host of norms supporting (or undermining) a learning culture need to be analysed. We believe that in the current context of the globalizing learning economy this is a serious limitation (Arocena and Sutz, 2000).

UNDERSTANDING THE TRANSITION OF INNOVATION SYSTEMS

In what follows we will define transition as *radical institutional change*. To understand the mechanisms that increase the pressure for transition of innovation systems we need to find a way to link changes that take place outside the system to what goes on inside. There are two mechanisms that work simultaneously that together may undermine the performance of innovation systems.

One mechanism refers to situations where the environment changes so that the prevailing institutional set-up becomes ill-suited for the problems that the environment raises: we might refer to this as emergence of contingency mismatch.³ The other mechanism refers to situations where endogenous economic growth within the system makes it reach limits for further economic growth – we might refer to this as emergence of inherent limits

to growth. The successful catching-up process may be a process outgrowing the old national institutional set-up. To overcome mismatch and limits to growth radical institutional change (transition) is necessary.

One example of the first type could be the success and stagnation of the British economy as the technological environment changed, so that the most promising technological opportunities changed from mechanical engineering toward chemistry and electrical engineering. The old system was not geared to the new technological opportunities and characteristics of the US and the German systems were more in tune with the new opportunities. Japan may be taken as an example of how limits to growth are inherent in a successful growth model. The Japanese model was highly successful in catching up but it is less successful in operating at the frontier of science-based technologies. A different type of inherent limits to growth linked to sustainability is now becoming increasingly visible in China's innovation system.

In both cases the key barrier is 'institutional'. Even when major policy efforts are made and new organizations – such as science parks and technological institutes – are established, the institutional setting may be slow to follow the changes taking place. The recent public policy efforts in Thailand may be confronted with such problems. Old ways to do things do not disappear just because the formal organizational framework is modernized.

We use the innovation system concept in this book because we believe that studying transition through this 'focusing device' is useful for theoretical as well as practical purposes. It helps us understand why transition is difficult; it has to involve changes, not only in a single institution but rather in constellations of interconnected institutions sometimes supporting each other.

THE GLOBALIZING LEARNING ECONOMY AND THE EXTERNAL TRANSFORMATION PRESSURE

All national systems are exposed to changes in the environment. These changes relate to growing importance of knowledge and learning on the one hand, and the increasing international interdependence on the other hand.

There is growing agreement that knowledge is now at the very core of economic welfare and development. Nations, regions, industries and firms with a faster rate of growth are those that successfully manage to generate and apply knowledge. The OECD, for example, has consistently stressed the move toward a *knowledge-based economy* (Foray and Lundvall, 1996).

However, we have preferred to refer to the 'learning economy' (Lundvall and Johnson, 1994) because we believe that this captures better the dynamics of our age.

The concept is based upon the hypothesis that over the last decades an acceleration of both knowledge creation and knowledge destruction has taken place. Individuals and institutions need to renew their competencies more often than before, because the problems they face change more rapidly. And at the same time the segments of society affected by accelerating change have grown considerably. Therefore, in a wide set of economic activities, what constitutes success is not so much having access to a stock of specialized knowledge. The key to success is, rather, rapid learning and forgetting (when old ways of doing things get in the way of learning new ways).

Another major trend is so-called globalization. In recent years the interconnections between geographically different parts of the world have considerably increased and this has also multiplied the learning opportunities. But globalization is not a completed process. In some areas such as markets for financial assets it has gone a long way while in others related to competence building and innovation, national borders still remain. While some parts of the economy are at the core of the current trends, others have been marginalized. We have therefore preferred to refer to a 'globalizing' rather than to a 'global' economy, to stress that the current state of the world remains far from one characterized by a truly global economy and society.

It is important to emphasize that the 'learning economy' and the 'globalizing economy' are interconnected. A circular process has taken place. On the one hand, the development of an integrated world economy has allowed agents to acquire information, expertise and technology at a faster pace and often at lower costs than in the past. On the other hand, the current globalization has been nurtured by a generation of new technologies. The major technological advances of the last quarter of a century have in fact occurred in fields that allow the production, communication, transmission and storage of information. ICTs have in other words acted as the material devices to allow globalization to occur. Finance, production, media and fashion would not be as global as they are today without the generation of new technologies. In this sense, the 'learning' and 'globalizing' dimensions of the world economy strongly reinforce each other (see Archibugi and Lundvall, 2002).

An important element in this new context is that competition, as well as learning, has become more global and more intense in most parts of the economy. This is true especially in markets related to information technology: they are at the same time the carriers for the transmission of new knowledge, those where the rate of change is faster and those where

competition has become extreme. But the production of traditional manufactured products such as textiles, toys and ships has also experienced a more intense competition, and substantial parts of these industries have moved out of Europe, Japan and North America to other parts of the world. Service-related activities such as shipping and software engineering are getting more and more exposed to global competition. Now, also traditionally protected and regulated areas (telecommunication, collective transport, public utilities, health and education), are becoming strongly exposed to competition.

IMPLICATIONS FOR EMERGING ECONOMIES

The globalizing learning economy offers both new opportunities and new threats for emerging economies. Several of the Asian economies have become more integrated in the global value chains that constitute an important characteristic of the globalizing learning economy and this has helped them to achieve high growth rates. This contrasts with the majority of the Latin American economies where the opening up of the national economies has seen more destruction of capabilities than stimulation of economic growth in its wake. Africa has largely been left out of the globalization game and this has gone hand in hand with stagnation or growing poverty.

There are many possible explanations for these major regional differences in the response to 'globalization'. A simple explanation is that there are certain prerequisites that need to be present in order to benefit from being integrated in the world economy. The first is skilled people and technological capability. The second is a certain degree of political control over the process of internationalization. The third is coherence in society with acceptance of certain rules of the game so that not everyone in society goes after immediate private benefit – legally or illegally. These factors may not be sufficient but they seem to be necessary.

Not all of the Asian countries studied here have all these prerequisites. Indonesia is not strong in any of the three dimensions. But it is interesting to note that those countries that have established the necessary prerequisites have responded differently to the opportunities. To some degree this reflects different levels of economic development but there are also other factors at play. The size of the economy, the economic system as well as unique historical factors have defined different transition challenges for each single national system.

In Japan the transition challenge is to build new institutions that support radical innovation in new advanced fields of science such as bio- and

nanotechnology. In China it is to build institutions that help firms out of an imitative mode in many fields of technology but also to build institutions that make growth sustainable in social and ecological terms. In India the challenge is to transfer the successful institutional set-up in software and information technology to other sectors.

The switch might be incremental or radical (sometimes referred to as discontinuous) but where institutional economics usually stresses the incremental nature of institutional transitions, several Asian countries are united in having experienced radical institutional transition several times in the last couple of decades. Firstly, this was either during the rapid transition from predominantly agricultural economies to manufacturing economies (and in some cases even high-tech economies) or during the transformation from closed to rather open economies. Secondly, the recent financial crises in Asia also initiated a wave of institutional transitions.

THE STRUCTURE OF THE BOOK AND THE CONTENT OF THE CHAPTERS

The book may be seen as constructed from three different parts. The first part, is about 'Asian Countries entering knowledge-based competition'. It shows how national systems through different mechanisms have been able to upgrade their production structure and move away from low-wage competition. All the three chapters emphasize the spatial dimension of innovation and knowledge. Chapter 2 looks at the need to build and build upon specialized capabilities at the regional level when it comes to enter knowledge-based competition. Chapter 3 analyses the role of the Indian diaspora in attracting FDI to the Indian ICT sector. Chapter 4 is explicitly about the need for strategies to bridge international, national and regional systems of innovation.

While the three chapters in the first part all draw upon empirical illustrations the next four chapters about 'Asian innovation systems in transition', are in-depth case studies of four innovation systems in Asia. Chapter 5 on Thailand gives a rather optimistic picture of government attempts to establish the prerequisites for a transition to a new trajectory. Chapter 6 looks at the historical roots of the Hong Kong innovation system and shows how the current problems and opportunities of transition can be traced far back. Chapter 7 on the Indonesian system brings out many of the factors that make transition especially difficult – segmentation of society, economics and politics and the ethnic issues are among the most serious problems. Chapter 8 is about the Korean system and especially about why it has been successful for so long. But also in this case there is

a growing need for transition toward an innovation mode that puts a premium on creativity.

The third part of the book, 'Science-based innovation in Asia and the need for policy learning', brings together three national studies that focus on science-based innovation and a chapter on policy learning in China. Chapter 9 by Odagiri uses biotechnology to illustrate the kind of transition toward a more science-based innovation mode that now takes place in Japan. Chapter 10 gives a detailed presentation of how the institutional framework supported the growth of the Indian software industry and discusses how far lessons can be drawn for the new ASEAN countries (Vietnam, Laos, Cambodia and Myanmar). Chapter 11 shows how the public authorities in interaction with transnational companies have shaped a framework that has fostered the growth of the high-technology industry in Singapore. Finally, Chapter 12 is about the use of the innovation system concept as a support for policy learning, and it uses experiences from China to show how central governance needs to be complemented with regional authority and governance.

ASIAN COUNTRIES ENTERING KNOWLEDGE-BASED COMPETITION

Chapter 2, by Tilman Altenburg, 'Opportunities for Asian countries to catch up with knowledge-based competition', uses case study material from electronics and shrimp farming to illustrate how the less developed economies in Asia gradually can move from low-wage and natural resource competition to knowledge-based competition. He argues that this kind of transition calls for a coordinated effort of a multitude of private and public agents in the national innovation system, with central and regional government playing important roles. A common effort to build local specialization in terms of production and capabilities is crucial. Building infrastructure and attracting foreign direct investment supporting the specialization is important and so is a strong focus on the absorption of knowledge from abroad in the strategic areas. Altenburg points out that the barriers to entry in terms of investment in R&D are very high in most high-technology sectors and this is one reason why he sees an incrementalist strategy where the starting point is the prevailing specialization pattern as the most realistic for countries such as Thailand, Malaysia, Indonesia and Burma.

But he mentions the software sector as one possible exception, and this connects his chapter to Chapter 3, 'Transnational communities, offshore outsourcing and offshore subsidiaries: the case of the Indian IT service

industry' by Jan Vang and Mikkel Lucas Overby, where the Indian ICT industry is used as an illustrative case. The chapter is about the role transnational communities play as agents that can promote economic development in their country of origin. The authors challenge the brain drain hypothesis as well as the interpretation of transnational communities as equalizing a 'brain gain'. They develop a dynamic interpretation, suggesting that transnational communities are crucial for reducing uncertainty related to foreign investments in their country of origin especially in the initial phases of industrialization. However, the advantages diminish over time due to improved institutional regulation and management competencies of the firms in both the host and home countries of the transnational communities. The contribution is illustrated by a case analysing how the importance of the Indian transnational community as agents of economic development in their home country changes during the course of evolution of the Indian IT service and software industry.

Chapter 4, 'Effectively linking international, national and regional systems of innovation: insights from India and Indonesia', by Martina Fromhold-Eisebith, is about how innovation systems on different geographical scales can be interlinked and coordinated in order to promote economic development. The chapter first depicts major conceptual features of the NSI, RSI and ISI approaches. Then it develops ideas about how different system scales could logically be linked in order to constitute a scale-bridging systemic complex that may be termed 'National Super-system of Innovation' (NSSI) which combines ideas of the three notions in complementary ways. Then the arguments are illustrated by examples from India and Indonesia. India – more implicitly than explicitly – selectively profits from scale-crossing system constellations; Indonesia hardly does, although possessing some good potential. The Indonesian case shows particular deficits in utilizing its RIS potential in ways that would be necessary for a functional NSSI.

ASIAN NATIONAL SYSTEMS IN TRANSITION

Chapter 5, 'Thailand's national innovation system in transition', by Patarapong Intarakumnerd, is about how a latecomer country's innovation system can be transformed from being weak and fragmented to become stronger and more coherent. It is argued that Thailand's national innovation system is in transition. Passive firms characterized by slow technological learning, ineffective and incoherent government policies, isolated education and training institutes, technologically unsupportive and risk-averse financial institutions, low-capacity trade/industry associations and

an unfavourable institutional context have been perpetuated for the past fifty years of Thailand's industrialization. These have now begun to change due to two key factors. First the new government has initiated a major policy shift and implemented a management style significantly different from those in the past. Second, the recent economic crisis has had a strong and sometimes positive impact on key actors in the NIS. But the author also recognizes that the transformation is slow and difficult. Above all, it is difficult to change the mindsets and routines of some actors. A longer time-frame is needed for serious examination regarding whether the extent of these changes is large enough to make significant impacts on Thailand's innovation capabilities and long-term competitiveness.

In Chapter 6, 'Hong Kong's innovation system in transition: challenges of regional integration and promotion of high technology', by Erik Baark and Naubahar Sharif, it is shown how a system of innovation has been emerging in Hong Kong during the past century. Hitherto, however, technological innovation has not been regarded as an important element of Hong Kong's developmental experience. Technological innovation has only recently started to attract serious attention in Hong Kong, where the government in 1998 launched a new strategy in pursuit of knowledge-intensive economic growth. The authors also point to a need for a clear awareness of the opportunities and limitations of a more active role of the government in the shaping of future innovation in Hong Kong. They identify a range of areas where private and public initiatives to develop innovative capabilities coexist. In some cases, these initiatives appear to be mutually supporting. In other cases, public policies seem to be preoccupied with serving narrow business interests or even contradict the professed ambitions of promoting innovative industries. In other words, the role of government needs to be more solidly grounded in the principles of comprehensive and coherent policy-making that have been informed by innovation systems research (see, for example, OECD, 1997; 1999 and 2002).

In, Chapter 7, 'The Indonesian innovation system at a crossroads', by Peter Gammeltoft and Erman Aminullah, it is shown that one of the most conspicuous features of the Indonesian innovation system as it evolved under the 32-year rule of President Soeharto, was its segmentation. The end of Soeharto's rule in 1998 brought a series of economic, political and social reforms. The chapter shows that Indonesia is at a crossroads, having to come to grips with two major impetuses for reform: one is the multi-dimensional domestic reform process, the other is the one induced by what is commonly referred to as 'globalization'. The authors point to the need to avoid excessive (borrowed) capital investment and to shift focus from mere economic growth to techno-economic development. They point to the corporate structure as a serious constraint and they argue that future

Indonesian economic development requires a shift in the mindset of industrial leaders from mere economic to techno-economic perspectives. This will require a stepping up of industrial R&D, and government needs to engage in: restoration of the technological infrastructure, strengthening the linkages between public research institutions and industry, and better enforcement of competition in the economy.

Chapter 8, 'Performance and sources of industrial innovation in Korea's innovation system', by Kong-Rae Lee, makes an attempt to isolate the crucial factors behind the success of the Korean innovation system but also the weak elements that call for a re-orientation of the system. At the macro level factors such as hardworking people and aggressive learning, export-oriented strategy, sequential capability, heavy investment in R&D activities and the active role of government have been important. But there is also a unique strategy of 'crisis learning'. At the meso level the crucial success factors vary by industry. Exploitation of 'economy of speed' may be the most important in the semiconductor industry – R&D support of GRIs for the mobile telecom service industry and aggressive learning and in-house development of production technology for the automobile industry. Although Korea's innovation system has showed good performance in industrial innovation, it also has weaknesses calling for shifts in the strategy. Among the obstacles to strengthen innovation of Korea's industry are identified: low social trust, labour unrest, lack of flexibility in the education system, immobility of professional manpower, unbalanced regional innovation, underdevelopment of innovation management and rigid management of public R&D institutes. For Korea it is a challenge to overcome these drawbacks in order to strengthen the creative capability of the national innovation system.

SCIENCE-BASED INNOVATION IN ASIA AND THE NEED FOR POLICY LEARNING

Chapter 9, 'Advance of science-based industries and the changing innovation system of Japan', by Hiroyuki Odagiri, also indicates a transition from one trajectory to another. With the decline in demand in existing industries, intensifying technological competition on a global scale, and the rapid progress of scientific knowledge, Japan now aims at advancing *science-based industries*. Accordingly, Japan's national innovation system is changing. In part, it is a spontaneous change occurring in response to changing market needs. But it is also a consequence of conscious policy efforts to change the institutional, legal and policy frameworks so they become better adapted to these kind of industries. This chapter, taking

biotechnology as a case, shows how technological changes, socio-economic changes, and institutional changes interact with each other, creating a new and yet path-dependent national innovation system. The financial system of Japan, characterized by a close bank–firm relationship and the presence of stable shareholders, has been complementary to the labour system characterized by a long-term worker–employer relationship. And this system has been conducive to the accumulation of firm-specific human skills and the close intra-firm (and intra-group) information sharing, which made cumulative technological innovation easier. Still, to promote new industries and new firms, the economy needs to foster reallocation of talented people through external markets (as opposed to internal labour markets) and the supply of more venturous funds (for which banks lack comparative advantages).

Chapter 10, ‘National innovation systems and India’s IT capability: are there any lessons for ASEAN newcomers?’, by Nagesh Kumar and K.J. Joseph, traces the factors that have led to the build-up of substantial IT capability by India. It is shown that the national system of innovation supporting IT capability may be seen as an outcome of government policies. These included development of a system of higher education in engineering and technical disciplines, creation of an institutional infrastructure for S&T policy-making and implementation, building centres of excellence and numerous other institutions for technology development. In addition, the institutional interventions like the setting up of software technology parks were highly helpful for IT exports. The chapter also draws lessons from the Indian experience for the new members of ASEAN, viz. Cambodia, Laos, Myanmar and Vietnam in their attempt to establish national capabilities in ICTs. The chapter shows that in these countries, with the possible exception of Vietnam, the prerequisites for building such capabilities are still very weak. But the author also argues that much could be learned from India when it comes to facilitating their leapfrogging. The chapter underscores the opportunities and potential for cooperating with India in developing their IT capabilities.

In Chapter 11, ‘Innovating for global competition: Singapore’s pathway to high-tech development’, Henry Wai-chung Yeung examines the experience of Singapore, a city-state in Southeast Asia, in harnessing the positive benefits from cluster development for high-tech industrialization. Specifically, it provides empirical evidence from several surveys and interviews with foreign and local firms and institutions conducted between 1999 and 2000 to show how the state in Singapore has been highly active in developing R&D capabilities through science parks, harnessing the SME advantage through reverse technology flows to foreign TNCs and nurturing cluster development in the chemical industry. Taken together, these cases point to

the importance of state institutions and foreign TNCs in chartering a peculiar pathway to high-tech development in Singapore.

In Chapter 12, 'Policy learning as a key process in the transformation of the Chinese innovation systems', by Shulin Gu and Bengt-Åke Lundvall, the idea of innovation systems is linked to economic development and especially to policy learning in a developmental context. The authors emphasize the evolutionary and systemic foundation of the innovation system's approach. In the second part of the chapter these general points are illustrated in relation to three important policy themes in China: regional development, university–industry linkages and transformation of innovation systems. If anything, policy learning is more demanding in development countries than it is in the rich parts of the world. A characteristic for the economic development process is that from time to time a new trajectory needs to be opened up. This calls for initiatives at the central level but in order to be successful there must follow a rather long period of adaptive learning at all levels of the innovation system. Neither over-centralized systems that leave no autonomy at lower-level policy learning nor decentralized ones that lack the central governance mechanism necessary to initiate radical change will be able to cope with this double challenge.

THE CHALLENGE OF TRANSITION IN THE DIFFERENT INNOVATION SYSTEMS

As can be seen, there has been radical institutional change in several of the innovation systems studied in this book. Today there are new transition challenges that are different for each system. For India it is a major challenge to replicate the success story in software in other sectors in order to get the system on to a catch-up trajectory where economic growth rates become higher than population growth. The growth in China is still very much based upon massive investment, foreign technology and low-wage competitiveness. A change toward indigenous technological capabilities and innovation remains to be realized. While the concentration of political will-power at the central level may be seen as something that makes transition more realistic, the uneven regional development in both of these big countries calls for more efficient and stronger regional governance. Another big country, Indonesia, seems to have even bigger problems with governance. The segmentation of society, politics and economics and the negative impact of ethnicity contribute to making the innovation system incoherent and to undermining the coordination necessary to establish a common development trajectory. Here the necessary transition is difficult to manage.

Japan is already a highly developed economy and its transition problems relate to what should come after a successful catch-up strategy has been realized. The institutional characteristics that served the Japanese innovation system so well for several decades – long-term inter-firm relationships, patient capital and long-term employment contracts – are now increasingly seen as hindering the growth in some of the new science-based sectors. These institutions are now under pressure from markets and also critically reassessed and reformed by government. It is not the first time that former success makes the transition especially difficult. Freeman (2002) gives a series of historical examples of which the historical loss of industrial leadership for England in the twentieth century is of course the most obvious.

For the smaller countries in the region that have not yet come very far in terms of catching up and where knowledge-intensive production remains marginal (Malaysia, Vietnam, Cambodia) it is still somewhat of an open question as to what kind of transition it is possible to realize. Some contributions in this book give examples of successful incremental change where the existing specialization in low-wage products has been taken as a starting point but then has been combined with an upgrading through the build-up of a national and regional knowledge infrastructure. If this can be combined with a kind of leapfrogging in fields such as software industry, remains to be seen.

Thailand is an interesting intermediate case where the government under rather adverse conditions has made efforts to promote knowledge-based economic development through a set of coordinated initiatives. It will be interesting to see whether or not these initiatives are sufficient to open up a new trajectory. If they were to succeed, lessons could be drawn for other countries in the region who are in similar conditions.

Hong Kong and Singapore are small countries that have witnessed very rapid growth over the last decade. But even these small Asian tigers may have to enter into a transition process. The focus has been more on successful commerce than on promoting innovation, and this focus might not be sustainable in the context of the globalizing learning economy. Korea has a stronger knowledge base and has been successful in catching up on the basis of technology efforts. But in some respects it may be moving into a situation similar to that in Japan. There is a need to adopt new institutional frameworks that promote creativity and indigenous innovation.

Even these countries have different transition experiences; a tentative conclusion can be drawn as follows. Two major factors can contribute in upgrading a national innovation system. Internal factors, namely improving capabilities of key actors of the system and changing patterns of interaction between actors, can lead and sometimes pressure other actors in the system to change accordingly. For example, the governments of Hong Kong,

Thailand and Singapore spearheaded the transformation to the knowledge economy and encouraged other actors in the systems to follow. However, the systemic natures of development processes emphasized in the innovation systems approach means that the weakest node in the system can result in systemic failures.

Hence, for example, a government initiated procurement project is unlikely to result in the expected goals unless firms in the private sector are prepared to undergo transformation in the internal organization and external collaboration in ways matching the requirement of a modern learning economy. In the case of China, authoritarian Chinese leadership styles can prevent the needed change. Second is the change, in the external environment that would affect all actors in the system to change, such as Thailand's economic crisis in 1997 and Japan's decade-long recession. But while externally generated 'creative destruction' of inefficient innovation systems can provide the needed 'kick' to change the path of the innovation system in the right direction, it can also result in a vicious circle, resulting in increased poverty, de-industrialization and political conflicts.

LESSONS TO BE LEARNT

Another reason to apply the innovation systems perspective is that it helps to avoid naïve borrowing of 'best-practice' policy across national borders. What seems to work well in one systemic context might not do so in another. Asian NIEs' experiences with high growth have been used to launch a general campaign for attracting foreign investment. In this campaign, too little attention has been given to how the incoming foreign capital has been linked up with local strengths and needs in the different cases. Some of the important national differences in this respect can be understood by reading the chapters in this book.

While there are few specific policies and institutions that can be copied across national borders, there are still lessons that can be learnt from the experiences brought together in this volume. One lesson is that the debates about whether or not state intervention should play a role when it comes to promoting transition may be closed. When it comes to successful transition it is difficult to find one single case in this book where the public sector was not actively involved in institution building and policy. Public intervention is a necessary element both in establishing and renewing innovation systems.

This is not to say that state intervention has always been for the best. There are several examples in the book where it is clear that governments have slowed down or derailed necessary reform. Sometimes this has happened because the state was too much influenced by partial interests,

and sometimes incompetence and corruption within the public sector has been part of the problem. But, even so, it is quite clear that in the absence of the state initiatives little successful transition would have taken place. So what is needed is to get the state to do the right thing. This has to do with social capital and/or the relative autonomy characterizing the so-called developmental state in the sense in which these concepts have been developed by Woolcock and Wade. What is needed, among other things, is a combination of autonomy and social integration among government officials.

There are other lessons that have to do with issues that seem to cut across national systems. In several of the countries studied in this book there seems to be a need for strengthening the regional dimension of economic development. This is strongly argued in the cases of Indonesia and Thailand. Also in China there seem to be strong needs to strengthen regional institutions and, not least, the governance capabilities of regional authorities. The balance between decentralization and centralization is, however, a delicate one. A high degree of decentralization carries the danger that regions compete against each other, and a 'race to the bottom' starts. Thus, instead of benefiting from the advantages of decentralization (for example local knowledge, increased incentives, and so forth) needed for industrial upgrading, the regions can engage in an even more ruthless price-competition.

Another crucial issue for countries aiming at knowledge-based economic development is how to promote the collaboration between universities and industry. This theme is addressed in several of the chapters. This focus is understandable in a situation where knowledge and competence is seen as a scarce resource. The example of India's software industry shows that investment in science and technology has a potential for stimulating growth. The unique Chinese pattern with new venture companies often owned by universities may be seen either as a model or as reflecting the weak absorptive capacity of the Chinese firms. It is important to take into account the different roles that universities play in the overall innovation system. Focusing on its capacity to give rise to concrete innovations is not a good idea if the most important role is to contribute to training and basic knowledge. Moreover, tying the universities too close to the immediate needs of the industry may prevent them from responding to the long-term needs of the industry.

A largely neglected dimension of development research conducted within the innovation systems approach has been the role that minorities and diasporas play as agents of economic development. Several of the chapters address these issues. In the chapter on Thailand and Indonesia the crucial role of the Chinese minority in business is of fundamental importance for understanding the innovation systems. In the chapter on Hong

Kong the origin of most of the population in mainland China is referred to as a key to explain the rapid growth of the Pearl River region. And in the chapter by Vang and Overby it is shown that Indian presence in the US IT business has been crucial for the location of transnational US firms in India.

THE END OF DEVELOPMENT RESEARCH?

But 'transition' is not a process relevant only for less developed countries in Asia or elsewhere. We believe that a similar volume entitled 'Europe's innovation systems in transition' might need to be written. And many of the basic concepts used in this book would be as useful for the one on Europe. Hereby we also imply that the idea that there should be a specific field of research called 'development research' might have become obsolete. The current ongoing rapid transformation of all economies, rich and poor, in the context of global competition undermines the assumption that there are mature modern economies where certain theories should be applied, and some others where underdevelopment calls for a different kind of theory. At first sight, this might sound like a threat for scholars who have been insiders in development research for many years, but actually they should rejoice because what is happening is actually that many of their tools and methods are now becoming as needed for developed economies as they are for less developed economies.

When analysing the economy of a rich country there has been a tendency to assume that institutions and social aspects could be neglected because markets and competition had been fully developed into 'maturity' leaving us with the option to use the tools of 'pure economics'. Only when we look at less developed countries would there be a need to reflect upon 'institutions' and 'culture' – and then as a kind of 'friction' that needs to be taken into account when designing strategies for economic development. We think that this view of the world is fundamentally wrong. In the current context of globalization where knowledge and learning becomes increasingly important, 'transition' and 'transformation' of socio-economic systems are ubiquitous processes to be found in the North and West as well as in the South and East.

NOTES

1. This is true both for many of the national case studies presented in chapters in Nelson (1993). It is also to some degree true for the more analytical chapters in Lundvall (1992).

- Freeman's historical work on innovation systems is much more about transition (Freeman, 1997; 2002).
2. Later Johnson and Edquist developed the distinction between organizations and institutions in relation to innovation and innovation systems (Edquist and Johnson, 1997). While specific organizations may be seen as 'incarnations' or 'containers' of institutions – such as patent offices incarnating intellectual property rights or as universities housing a specific knowledge production mode – they should not be defined as institutions.
 3. This concept is inspired by the organizational and managerial literature on organization situational and contingency fit and misfit (Donaldson, 2001; Gresov, 1989; Burton and Obel, 1998). Similar ideas are developed in the work by Christopher Freeman (1997 and 2002) where he discusses the emergence of mismatch in historical perspective.

REFERENCES

- Archibugi, Daniele and Bengt-Åke Lundvall (eds) (2001), *The Globalising Learning Economy: Major Socio-Economic Trends and European Innovation Policy*, Oxford: Oxford University Press.
- Archibugi, D. and B.-Å. Lundvall (eds) (2002), *The Globalizing Learning Economy*, Guildford and King's Lynn: Oxford University Press.
- Arocena, Rodrigo and Judith Sutz (2000), *Interactive Learning Spaces and Development Policies in Latin America*, DRUID working papers, No. 00-13.
- Burton, R.M. and B. Obel (1998), *Strategic Organisational Diagnosis and Design: Developing Theory for Application*, Boston, MA: Kluwer Publishers.
- Donaldson, L. (2001), *The Contingency Theory of Organisations*, Thousands Oaks, CA: Sage Publications.
- Edquist, C. and B. Johnson (1997), 'Institutions and organisations in systems of innovation', in C. Edquist (ed.), *Systems of Innovation: Technologies, Institutions and Organisations*, London: Pinter.
- Foray, D. and B.-Å. Lundvall (1996), 'The knowledge-based economy: from the economics of knowledge to the learning economy', in D. Foray, and B.-Å. Lundvall (eds), *Employment and Growth in the Knowledge-based Economy*, Paris: OECD Documents.
- Freeman, C. (1982), 'Technological infrastructure and international competitiveness', Draft paper submitted to the OECD ad hoc group on Science, technology and competitiveness, August, mimeo. Now as Freeman, C. (2004) 'Technological infrastructure and international competitiveness', *Industrial and Corporate Change*, **13** (3).
- Freeman, C. (1995), 'The national innovation systems in historical perspective', *Cambridge Journal of Economics*, **19** (1).
- Freeman, C. (1997), 'Innovation systems: city-state, national, continental and sub-national', mimeo, paper presented at the Montevideo Conference, University of Sussex, SPRU.
- Freeman, C. (2002), 'Innovation systems: city-state, national, continental and sub-national', *Research Policy*, **31**.
- Gresov, C. (1989), 'Exploring fits and misfit with multiple contingencies', *Administrative Science Quarterly*, **34** (3), 431–54.
- IMF (2003), *World Economic Outlook: Growth and Institutions*, April, Washington: International Monetary Fund.

- Johnson, B. (1988), 'An institutional approach to the small country problem', in C. Freeman and B.-Å. Lundvall (eds), *Small Countries Facing the Technological Revolution*, London and New York: Pinter Publishers.
- Johnson, B. (1992), 'Institutional learning', in B.-Å. Lundvall (ed.), *National Innovation Systems: Towards a Theory of Innovation and Interactive Learning*, London: Pinter Publishers.
- Lundvall, B.-Å. (1985), *Product Innovation and User-Producer Interaction*, Aalborg: Aalborg University Press.
- Lundvall, B.-Å. (ed.) (1992), *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter Publishers.
- Lundvall, B.-Å. and B. Johnson (1994), 'The learning economy', *Journal of Industry Studies*, 1 (2), 23–42.
- Nelson, Richard R. (ed.) (1993), *National Systems of Innovation: A Comparative Study*, Oxford: Oxford University Press.
- OECD (1997), *Industrial Competitiveness. Benchmarking Business Environments in the Global Economy*, Paris: OECD.
- OECD (1999), 'The knowledge-based economy: a set of facts and diagrams', Document presented at the 1999 Ministerial Meeting on Science and Technology Policy, Paris: OECD.
- OECD (2002), *Dynamising National Innovation Systems*, Paris: OECD.
- World Bank (2002), 'Building institutions for markets', World Development Report 2002, Washington, DC: Oxford University Press.