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Concluding Chapter: Globalisation and Innovation Policy

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Abstract

The concluding chapter of the "Small Country Innovation Systems" book develops a comparative analysis that deals with only a very few of the many issues addressed empirically by the ten country case studies. The concluding chapter focuses to some extent on issues related to globalization, but devotes most of its attention to innovation policy. The chapter is intended as a contribution to the comparative analysis of NSIs, conceived in the spirit of 'appreciative theorizing'.

Keywords: : Globalization, Innovation Policy, comparative analysis

Concluding Chapter: Globalisation and Innovation Policy

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Contents

1 Introduction[1]

We argued in the introductory chapter that comparisons of the ten national systems of innovation (NSIs) addressed in this volume are facilitated by an agreed-upon conceptual and theoretical framework as well as the use of a common table of contents in the country studies. Both the framework and the common table of contents were presented there.

In this chapter we will largely limit ourselves to addressing two issues on a comparative basis:

- The role of growth and globalization for small NSIs
- Innovation policy – which will be dealt with most extensively

Many other kinds of comparisons can be made on the basis of the case studies included in this anthology. However, making such comparisons will largely be left to the readers of this book, for whom the choice of issues for comparison, the selection of countries and the manner of comparison will naturally be governed by particular backgrounds, interests and objectives. By incorporating case studies of the ten NSIs into this volume we have simply provided a basis for pursuing these various kinds of comparisons.

Before dealing with these two issues, however, we will begin with a few general remarks on issues related to the activities-based framework presented in the introduction, concentrating on its usefulness for comparing NSIs (Section 2). Subsequently, we will address methodological issues regarding comparison between NSIs (Section 3) and then

present a classification of the ten NSIs, identifying different contexts of growth and globalization (Section 4). Thereafter, we will conduct an extended discussion of innovation policy issues, carrying out a comparative analysis of innovation policy in the ten NSIs (Section 5). Finally, we will present some 'telegraphic' conclusions (Section 6).

2 General remarks – theory and policy

In the country chapters it has been shown that the ten national systems of innovation are considerably different with regard to the propensity to innovate (or innovation intensity) – in terms of different kinds of innovations (product, process, radical, incremental) and the sectors in which these innovations occurred, etc. This is one possible comparison which, in its details, will not be spelled out in this chapter. Here, the main focus will instead be on innovation policy in the context of a globalising learning economy.

In the introductory chapter we presented the conceptual and theoretical approach, which we called an activities-based framework for analysing and comparing systems of innovation. Before entering into the discussion of globalisation and policy, we want to present a few general remarks related to issues raised in the introductory chapter.

The specification of a common set of key concepts and utilisation of the same model table of contents in all country chapters means that they have all addressed the same issues and activities in similar ways – with, as we have previously noted, some interesting variations.[2] As a consequence, direct comparisons between the various cases are facilitated. And, as a further consequence, it should also be easier to draw conclusions from such

comparisons and to generalise to other 'small country' NSIs. Generating conclusions and generalisations on this basis might be thought of in terms of drawing lessons for theory and policy from the cases. But in that connection it is important to be cautious about the kinds of lessons that can be learned.

When it comes to drawing lessons for theory, it is essential to bear in mind that theories about systems and processes of innovation still remain very much at the level of what Nelson and Winter (1982) referred to some twenty-five years ago as appreciative theorising. Such analyses are, to a large extent context-based. Appreciative theorizing stays close to empirical matter, providing interpretation and guidelines for further exploration; it also has a rather partial focus, and develops causal arguments in a selective way (Edquist, 1997, p. 28). Both evolutionary economics and the systems of innovation (SIs) approaches have been inspired by appreciative theorizing'. SIs approaches, in particular, rely to a large extent on grounding theory development in cases. To do so is not a matter of relating cases to law-like propositions of a formal theory, but rather one of remaining sensitive to how particular cases do not fit into larger theoretical assertions, paying close attention to contexts, and, in comparative analysis, 'constructing new contextual statements in order to link cases' (Ashford, 1992, p. 4).

The application of this approach in innovation studies has been described as 'building descriptive theory', by proceeding from careful observation, through classification into frameworks or typologies, to defining relationships between attributes of the phenomena and observed outcomes (Christensen, 2006, pp. 39-40). In this process, examining how phenomena vary across contexts is important for testing classifications and the hypotheses developed to explain them, since this is 'most often … done by exploring whether the same

correlations exist between attributes and outcomes in a different set of data from which the hypothesized relationships were induced' – i.e., a different empirical context or type of case. Where such research reveals outcomes for which the theory cannot account, 'anomalies give researchers the opportunity … to define and measure the phenomena more precisely and less ambiguously, or to categorize the data better – so the anomaly and the prior association of attributes and outcomes can all be explained'. (Ibid., p. 40).

It follows from these considerations that it is important to investigate contexts in a systematic way. In comparative case study research, therefore, the analytic strategy of focussed, controlled comparison is 'to formulate the idiosyncratic aspects for the explanation of each case in terms of general variables, in order to 'find ways of describing and explaining individual cases that render them comparable' (George, 1979, pp. 46-47). In testing hypotheses, the object is to apply general explanatory theories to relevant cases in order to produce 'typological' theory – generalizations relating to specific types of contexts. Such theory is especially valuable for policy-makers because it 'enables them to make more discriminating diagnoses of emerging situations' (ibid., p. 59).

In the Ten Countries Project, we have engaged in building descriptive theory, as in Section 5 of this chapter. Although we have not reached the stage of hypothesis testing, we have nevertheless also engaged in structured, controlled comparison by using the same concepts, the same theoretical approach, and the same format for describing ten different NSIs. We have thus laid the foundations for policy-relevant typological theory about how innovation performance varies systematically according to differences in – or different types of – contexts.

The emphasis on context, including historical background, also leads to some important limitations concerning possibilities to draw lessons for policy. Perhaps the most important of these qualifications concerns the pitfalls of identifying widely transferable best practice models. Direct imitation or copying of such models is rarely successful, particularly when crucial differences in context are not taken into account. Innovation policy, especially, can therefore not simply be reduced to institutional borrowing, i.e. copying institutions. It must instead remain essentially a matter of institutional learning, i.e. adapting to the national or local context. (Lundvall and Borràs, 1997, p. 62).

This argument has been forcefully re-stated in the introduction to a recent volume on Asia's Innovation Systems in Transition (Lundvall et al., 2006). In their introduction, the editors reason that an innovation systems perspective 'helps to avoid naïve borrowing of 'best practice' policy across national borders' – an effort that often fails, since 'what seems to work well in one systemic context might not do so in another' (ibid., p. 16). They go on to claim, though, that although highly specific copying is seldom feasible, it is still possible to draw policy lessons of a more general character. There is much that can be learned, for example, about the importance of public intervention for promoting innovation and economic change, as well as the conditions under which it should (or should not) take place, the manner in which it ought (or ought not) to be implemented, the types of problems that policy should (or should not) address, and so forth. (ibid., pp. 17-18) These are the kinds of conclusions that we attempt to draw from the comparative analysis of innovation policy carried out in the later sections of this chapter.

The activities-based conceptual and theoretical framework developed and used in this book differs from traditional SIs approaches, which have focussed on the constituents of

systems of innovation (institutions, organisations, interactions). Instead, it develops a central focus on the activities in SIs – i.e. the factors that influence the development and diffusion of innovations. By focussing on what 'happens' in the systems, an activities-based approach provides a more dynamic perspective than does focussing on the constituents. This does not mean, however, that constituents are ignored. In the case studies presented in this book, the ten activities outlined in the introductory chapter were used as points of entry into the analysis of NSIs – but for each activity this analysis also addressed the relevant organisation, institutional frameworks, and relations. In this respect, an additional virtue of the activities-based approach is that it enables us to capture the 'many ways countries may develop … to organise … 'functionally equivalent' activities' (Kogut, 1993, p. 7).

The activities-based approach to innovation is certainly a broad one, and is, in this sense, more in line with the broad approaches to conceptualising NSIs advanced by Lundvall (1992) and Edquist (1997) than with the narrow approach propounded by Nelson (1993) – as discussed in the introductory chapter. Evidence from the ten countries investigated in this project also generally favours a broad perspective on NSIs, rather than a narrow one. Most of the ten activities have been shown to matter for innovation processes in most of the ten countries.

One reason why an activities-based approach is advantageous is that it provides an explicitly multi-dimensional view of the determinants of innovation processes. This is important for innovation theory as well as for innovation policy – which are certainly related to each other. For example, explicitly addressing ten (albeit hypothetical) determinants excludes one-dimensional thinking such as that represented by the Barcelona Declaration of the EU.[3] Hence, we argue that an activities-based approach is useful in

securing a sufficiently broad perspective when it comes to determinants of the development and diffusion of innovations – and therefore facilitates an appropriate, i.e. multidimensional, perspective with regard to analysis as well as to policy.

Drawing attention to the multiplicity and variety of activities that influence processes of innovation within NSIs naturally leads to a focus on the coordination of these activities. If we consider briefly two of the main frameworks that have been applied in recent comparative work on innovation – namely, varieties of capitalism (VoC) (Hall and Soskice, 2001) and business systems (Whitley, 2002) – we find that one of the main characteristics they have in common is a focus on the co-ordination of multiple kinds of activities.

In the case of the VoC approach, this focus is made explicit and underlined by the ideal-typical distinction drawn between coordinated market economies (CMEs) and liberal market economies (LMEs). As explained by the proponents of this approach, the central idea is that 'national political economies can be compared by reference to the way in which firms resolve the co-ordination problems they face' in five spheres: industrial relations, vocational education and training, corporate governance, inter-firm relations, and employment relations (Hall and Soskice, 2001, p. 8). In LMEs, the dominant co-ordination mechanisms are 'corporate hierarchies and competitive market arrangements', whereas in CMEs 'firms depend more heavily on non-market relationships' (ibid.).

The business systems approach complements the VoC approach, sharing its fundamental emphasis on co-ordination, but pointing to important variations within the two broad VoC in both national institutional frameworks and firm strategies and structures (Whitley, 2002, p. 499). Further, proponents of this approach argue that the comparative analysis of innovation processes also needs to take into account 'variations in the organization and

control of national public science systems [that] constitute an important part of the institutional environment explaining differences in prevailing patterns of technological development between countries' (ibid., p. 500).

As stressed by both of these approaches, co-ordination is governed by the institutional environment and achieved through reliance upon institutions as co-ordination mechanisms.4 This emphasis on institutions accords well with SIs thinking, which 'has emphasised the essentially context-bound nature of technological change … especially in terms of the relevance that the institutional set-up has for innovative performance' (Borrás, 2004, p. 427). However, the SI approaches also differ from these approaches in some important respects. Whereas both the VoC and business systems frameworks have a very wide scope, SI approaches have maintained a primary focus on innovation. Another distinguishing feature of SI approaches is that they remain more open-ended, due to their stronger commitment to appreciative theorising.

Hollingsworth sums up the position taken by the SI approaches as follows: 'since we do not presently have an adequate theory on how institutions, firms and technologies co-evolve, we are not at a stage to test a set of hypotheses that flow from some well defined model' Hollingsworth (2007, p. 597). This statement certainly applies also to the current state of knowledge about how activities influencing innovation are coordinated within NSIs; the present level of knowledge does not permit us to formulate a set of hypotheses that can be tested. The comparative analysis of innovation policies that we conduct in Section 5 of this chapter may be considered partly as a contribution to the further development of knowledge on this topic.

As indicated, we have regarded the ten activities outlined in the Introductory Chapter as constituting a set of factors hypothetically influencing innovation processes. In the NSI case studies the authors have tried to find out whether or not this perspective is valid – and, if so, to what degree – for the various activities in the specific countries. And, as we have commented above, the case studies have demonstrated, for most countries, that most of the ten activities have exerted a significant influence on the extent and direction of innovation.

Of course, the case studies have also shown that the relative importance of specific activities vary widely across countries. For example, demand-side activities aimed at the formation of new markets have been very important for innovation in Singapore and a number of other countries, but in Hong Kong the stimulation of demand has been largely neglected as a policy measure, due to the continuing prevalence of a laissez-faire attitude. The case studies have also shown that the quantity of each activity and the efficiency with which it is performed vary considerably among NSIs. Sweden, for instance, is an exceptionally strong performer with respect to investing in research and development (R&D) and education as knowledge inputs into innovation processes. However, the country's performance with respect to innovation outputs is low, given the amount of resources invested. In contrast, this pattern is almost completely reversed in Ireland, where high levels of growth and innovation are associated with low levels of R&D investment.

The case studies have further indicated that both the pattern of activities and the institutional and organisational arrangements – i.e., the set-up of organisations performing these activities and the set-up of institutions influencing those organisations – vary across NSIs. In the comparative analysis carried out in this chapter, we will focus on the diversity with respect to activities, organisations and institutions in NSIs, along with the issue of co-

ordination, which we have identified above as a key issue for comparative research on SIs. The empirical focus and point of entry for this analysis is, as noted previously, innovation policy.

3 Comparing NSIs

In the literature on NSIs, there has been an ongoing tension between, on one hand, demands for a more structured conceptual framework that would facilitate systematic comparisons and, on the other hand, insistence on recognising the unique character of individual SIs. The first position is well represented, for example, in various contributions on 'benchmarking' by Niosi and colleagues (Niosi, 2002; Niosi and Bellon, 1994; Niosi et al., 1993), and it has also been adopted by the OECD (1997). The second position has been championed by, among others, Miettenin (2002) who argues for a more contextually oriented approach to describing SIs, based on the principles of historicity, industrial specificity and geographical specificity.

In the Ten Countries Project, we tried to strike a balance between these opposing views of how to study NSIs. On one hand, we paid close attention to quantitative data (on, e.g., educational attainment of the labour force, industrial structure, and globalisation) and performance indicators for growth, scientific activity (publication), patenting, and innovation. Community Innovation Survey II data was used extensively in descriptions of the European NSIs, and parallel data sets were used for their Asian counterparts.[5]

As we have explained above and also in the Introductory Chapter, the common format developed for the country studies, and particularly its largest component, addressing the activities that influence innovation, represents the application of a structured conceptual and theoretical framework based on the activities-based approach developed in Edquist (2005) and Edquist and Chaminade (2006). On the other hand, however, we also required each national study to take the NSI's historical background into full account, mainly based on qualitative information. We also asked for an assessment of the NSI's particular strengths and weaknesses, as well as its past accomplishments and future challenges in innovation policy. Perhaps most importantly, we encouraged contributors to identify for each NSI a central issue, problem or paradox that illuminated its essential character – and these 'puzzles' have provided central themes in each of the country case studies.

Comparative research requires a sound rationale and clearly defined criteria for case selection. We have addressed these issues in the introductory chapter by comparing our sample of cases with the wider range of countries represented in Nelson's (1993) anthology on NSIs. There we explained that the ten NSIs included in the Ten Countries Project reflected a consistent rationale through our selection of countries by:

1) A focus on (relatively) small, dynamic, high-income economies

2) The inclusion of both 'late industrializing countries' and 'newly industrialized countries' or NICs.

In the comparative analysis of innovation policy that we present in Sections 4 and 5 of this chapter, we implement the case-based approach to comparison as follows. First, prior to focussing on the identification of patterns in innovation policy, we systematically map national contexts. We begin with an overview of growth in gross domestic product (GDP)

per capita over time. In this part of the analysis (Section 4) we address growth profiles, as well as the processes and mechanisms by which economic growth has been achieved. We also relate the growth patterns to issues of globalization -- i.e. to another important contextual dimension. What results from this examination is a classification of the ten countries into two main groups and an elaboration of some key differences in 'political economy' between these two groups.

Subsequently, the discussion turns to innovation policy itself (Section 5). Our examination of national patterns in innovation policy and policy-making is informed by a theoretical discussion that focuses the analysis by addressing general policy rationales and the specific issues of selectivity and coordination. For each of these themes, we relate relevant evidence from the country case studies to particular theoretical arguments. These arguments enable us to identify general patterns of innovation policy and to examine the distribution of these patterns across countries. Where these distributions correspond to our classification of the ten countries, we are able to develop a context-based explanation of the differences among them. In the final section (Section 6), we sum up the main conclusions of the analysis.

4 Growth and globalization

The countries included in this book can, of course, be classified in a number of ways. To begin with, they can naturally be divided into European and Asian countries. This

classification would be similar to dividing the countries into earlier and more recent industrializers – or, again, similar to a division between countries that are trying to stay ahead and countries that are trying to catch up in economic growth. In recent years, though, Ireland would be an exception in the last two dimensions.

4.1 Fast versus slow growth countries

The patterns of economic growth related to the ten NSIs included in this book are shown in Figure 1. The figure, which depicts growth in GDP per capita over the 1950-2005 period, shows a clear separation between two groups of countries, with a marked shift in the growth patterns of each group occurring around 1970-75.

Our analysis is especially concerned with the patterns of growth for the countries during more recent decades, and it is therefore appropriate here to characterize the two groups of countries according to their growth patterns over the past 30 years – i.e., from 1970/75 to 2005. We can thus distinguish between a first group of five countries marked by 'slow growth' and a second group of five countries that have exhibited 'fast growth'. The first slow growth group includes the countries of Denmark, Finland, the Netherlands, Norway and Sweden. The second fast growth group includes the countries of Hong Kong, Ireland, Korea, Singapore and Taiwan.

Figure 1 also shows that the two groups had different growth profiles prior to 1970/75, when the general pattern was almost reversed. During that earlier period, the growth trajectories of the slow growth countries were generally quite strong, whereas, with the

notable exception of Hong Kong, those of the fast growth countries were relatively flat compared to their later profiles.

This grouping of the ten countries is neither surprising nor controversial, corresponding as it does to the well-known distinction between 'catching up' economies and those that are either 'falling behind' or risk doing so (Abramowitz 1986, 1994). In fairness to the first group of slow growth countries, though, they generally appear to have been holding, and in some cases improving, their positions in recent years, rather than losing ground. On the whole, the difference between the countries in terms of GDP per capita has decreased during the period.

Finland provides a case in point of slow growth dynamism.[6] Since this country is usually identified as a highly successful example of innovation-based growth, it may be astonishing to some that Figure 1 shows very similar levels of GDP per capita relative to the USA for Finland in both 1975 and 2005.[7] Therefore Finland is classified as a slow-growth country. However, the historical circumstances must be taken into account – particularly, the depression of the early 1990s. As discussed in the Finnish chapter, this crisis was due to an over-heated economy, a large current-account deficit, and drastic decline of the Soviet/Russian export market – all of which made export of new products to western markets imperative for recovery. Further, recession in Western countries and limited growth potential in mature industries meant that Finland's recovery would depend mainly on high-tech exports by its emerging electronics industry, which by 2000 contributed as much as 1.5 percentage points to the Finnish GDP growth rate.

More generally, the evidence from various country studies serves to highlight that growth has been closely related to globalization. Thus, the reversal of growth patterns for

the two groups of countries that is depicted in Figure 1 coincides with and reflects the significant increases in international flows of capital and technology that occurred during the later decades of the post World War II (WWII) period (Fagerberg and Godinho, 2005, pp. 521-530). With regard to the newly industrialized fast growth countries, the evidence also shows that rapid economic growth has depended, for the most part, on successful entry into one and the same global growth sector – i.e., the electronics and information and communication technology (ICT) industries. However, as we will discuss in the following sub-section, their entry into this sector has been achieved by very different means and followed divergent paths. With regard to slow growth countries, the country studies show that they have been characterized by very different sectoral specializations and technological trajectories during different parts of the post-WWII period. In all cases, however, the historical accounts indicate that these late industrializing countries in Europe originally caught up by targeting growth industries of the time and developing strong export orientations (cf. Fagerberg and Godhino, 2005, pp. 516-518).

4.2 Mechanisms and instruments

The fast growth countries in this book can all be categorized as newly industrializing countries (NICs) – including the 'Celtic tiger', Ireland. Their rapid economic growth can largely be explained by reference to Lall's (2000) analysis of Asian NICs, particularly Korea, Singapore, and Taiwan. In those three countries, and also in Ireland, the state played an important role in stimulating and supporting rapid growth based on entry into especially

dynamic industrial sectors, particularly through policies for education (especially in engineering), targeting production for export and rewarding high export performers, and supporting R&D and innovation. Hong Kong is an important exception, though. There, the colonial state supported neither entry into new industrial sectors nor innovation based on R&D.

However, as also noted by Lall (2000) for earlier decades of the post WWII period, there were significant historical policy differences, as well as similarities, among three of the 'tigers'. Singapore, for example, relied more heavily on inward foreign direct investment (FDI) to industrialize than did either Taiwan or Korea, which both used protectionist measures to nurture their 'infant' indigenous electronics industries. Our country studies indicate that Ireland has followed much the same path as Singapore, though it first pursued protectionist policies, abandoning them in the late 1950s. In Hong Kong the colonial government was also eager to attract FDI, though not necessarily in order to support industrialisation.

Country studies for the fast growth group also indicate that these catching up economies have historically displayed considerable diversity with respect to industrial structure (in terms of size composition of firms in the country – as opposed to specialization among production sectors). Large, diversified business groups, or chaebols, were fundamental to industrialization in Korea, but the key actors in this process in Hong Kong and Taiwan were indigenous small and medium-sized enterprises (SMEs) of the family firm type. A further contrast is provided by the cases of Ireland and Singapore, where foreign multinational corporations (MNCs) were the main agents of industrialization.

The country studies also indicate that there have also been important differences with regard to specific instruments employed in state policies for economic growth. Countries' choices concerning policy instruments appear to have been partly determined by the differences with respect to size composition of firms. Thus, Korea during the 1970s relied primarily on 'directed credit' (state credit rationing) to guide the chaebols – i.e. the instrument used was adapted to large firms. During the 1980s and 1990s, however, dynamic growth in Korea was more directly driven by large firms, and governmental efforts shifted to providing support for this process in the form of R&D and educational infrastructure. In contrast, both Taiwan and Hong Kong relied on so-called intermediate organizations with mixed public and private-sector participation to nurture the development of small indigenous firms, although they accomplished this in very different ways. In Taiwan, especially, policy initiatives focused on the build-up of R&D infrastructure and the creation of state-owned firms to support nascent light manufacturing industries further downstream. Ireland and Singapore, which, like Hong Kong, adopted free trade policies beneficial to foreign MNCs, made themselves attractive locations for production units of foreign firms by pursuing competence building to develop skilled labour forces via public-sector vocational education and training, polytechnic institutes and universities.

The five slow growth countries in this study are late industrializing Northern European countries that first caught up with the leading industrial economies during the late 19th and early 20th century, following the example of Germany (Abramowitz, 1994). In both the Netherlands and Denmark, early specialization in agriculture and services strongly influenced this process. Denmark developed a diversified export-oriented agro-industrial complex, and more recently has also created new clusters, such as within hearing aids,

based not only on traditional industries but also in interaction with the provision of public services (e.g. health care). SMEs with extensive networks have been more important than large firms in Denmark. In the Netherlands, the adoption of technologies from abroad, dependence on foreign markets, and historical involvement in international trade bred strong reliance on exports and large global companies of Dutch origin (such as Phillips, Shell, and Unilever). In this respect the Netherlands is similar to the Swedish case, with a considerable number of large and internationalizing firms of a national origin.

Sweden, Finland and Norway provide examples of late but rapid industrialization – in the second half of the 19th century – in forestry, metals and in engineering related to resource extraction and processing. In the latest decade there has been an increase of export specialisation in R&D intensive sectors in Sweden and Finland. In Sweden, state infrastructure and technology projects were used extensively to support industry development during the 1960's and 1970's. In Finland, the state participated actively in developing the industrial base, contributing to a late but rapid build-up of new technologies and industries aimed at export markets beginning in the late 1970s and continuing into the 1980s. A similar path was followed by Norway, but with a much stronger concentration on the extraction of natural resources and without a strong profile in high-technology industries. Norway used major state infrastructure projects, as in Sweden, as well as employing state-led finance, to support industrial development.

Concerning the main instruments of public policy in the slow growth countries, there was a considerable reliance upon state-owned firms, which led the development of key sectors in Finland during the early decades of the 20th century and in Norway in the post-war industrial build-up and consolidation period, from 1945 until the 1970s. State-owned

organisations, in the form of public utilities and public service providers in, for example, health care, were also important in Denmark and Sweden during most of the 20th century. In these two countries, public technology procurement was (along with other demand-side measures such as regulation) an important means of creating new technological clusters – and, in Sweden, developing the technological capabilities of large industrial firms, such as ASEA/ABB and Ericsson. The Netherlands diverges from the Nordic countries in this respect. More generally, though, state-led economic development necessitated by late industrialization (Gershenkron, 1962) is clearly a common characteristic of all of the slow growth countries, particularly the Nordic ones.

4.3 National versus sectoral systems of innovation

In the introductory chapter, we discussed the dichotomy between the broad and narrow versions of the SIs approach, and we noted that different authors have different views on the appropriateness of a narrow versus a broad definition of NSIs. Along another dimension Nelson and Lundvall also expressed fundamental differences of opinion concerning whether national systems will continue to be important even under conditions of increasing globalization and regionalization. These, of course, are trends that may challenge the coherence of national systems.[8]

According to Lundvall, 'both globalization and regionalization might be interpreted as processes which weaken the coherence and importance of national systems' (Lundvall, 1992, p. 3). However, he believed 'that national systems still play an important role in

supporting and directing processes of innovation and learning.' (Lundvall, 1992, p. 3) Hence, he argued that NSIs would continue to pursue distinctive national trajectories, even under the homogenising influence of globalisation processes. One of his arguments for this is that interactive learning and innovation will be easier to develop 'when the parties involved originate in the same national environment – sharing its norms and culturally based system of interpretation.' (Lundvall, 1992, pp. 3-4)

In contrast, Nelson and Rosenberg (1993), in the introduction to the Nelson book, expressed considerable scepticism about the overall coherence or consistency of NSIs. They argued that the 'system of institutions supporting technical innovation' is very different between sectors of production, such as pharmaceuticals and aircraft. Moreover, they stressed that in many sectors, including the two mentioned, 'a number of the institutions are or act transnational' (Nelson and Rosenberg, 1993, p. 5) On this basis, Nelson and Rosenberg questioned whether the concept of a national system makes sense. One implication of this line of reasoning is that NSIs may ultimately be largely reducible to ensembles of increasingly trans-national sectoral SIs (SSIs) that would tend to look more and more the same in different countries. These two authors thus expressed fundamental differences of opinion concerning the coherence of NSIs.

Malerba is also addressing the relations between sectoral systems and national systems in reporting a major international project on SSIs. He stresses that 'major differences exist between sectors', but also that 'differences in national systems matter, and they affect some of the features that a sectoral system may take on in a country.' (Malerba, 2004, p. 34). The main theoretical issue, related to the different perspectives advanced by the national and sectoral schools, concerns the character and coherence of NSIs – i.e., the question of

whether or not they exhibit truly systemicproperties at the national level, even in the context of increasing globalisation.

The country studies have shown that economic growth can be based on different patterns of sectoral specialisation (composition of production across sectors) and trajectories of technology development. Significantly, most of our ten countries have moved (at least in some periods), or attempted to move, in the direction of greater specialisation in rapidly expanding R&D intensive (high-technology) sectors, in order to achieve or maintain high rates of economic growth.[9] However, the countries most successful in the attempt to enter high-tech growth sectors in recent decades have been the fast growth countries. These countries, moreover, have accomplished their respective entries into (in almost all cases) the same high-tech sector (i.e., electronics) in very different ways. Some, like Korea and Taiwan, have focused on developing domestic firms capable of competing globally; others, like Ireland and Singapore, have focused on attracting foreign MNCs and promoting 'innovation by invitation'. On the whole, the fast growth countries have been specialised to a larger extent than the slow growth countries in rapidly expanding high-technology sectors.

Further, the evidence on globalisation effects reveals a growing diversity in the technological trajectories that both fast growth and slow growth countries have chosen to pursue, even within the same sectors. In ICT manufacturing, for example, Sweden has increasingly become a centre for R&D and design (and located production facilities abroad in many sectors of production). Taiwan has mastered and refined sophisticated production technologies. Hong Kong, on the other hand, has focused on 'brokering' between Mainland China and foreign firms through co-ordination. This means adding high-value-added

services to regionally based international production networks in a wide range of production sectors. Both Denmark and The Netherlands have developed strengths in biotechnology, but while the former has benefited from international collaboration, the latter has been doing so to a lesser extent.

Rather than converging, then, the NSIs in our study have established distinctive roles within an increasingly differentiated international division of labour. Moreover, these roles tend to be consistent across sectors, as demonstrated by the cases of countries as widely different as Sweden and Hong Kong. In these respects, our findings on how globalisation has affected NSIs by reinforcing and accelerating national patterns of specialisation both within and across sectors corroborate – and are corroborated by – recent research on international performance within SSIs (Coriat et al., 2004; Malerba, 2004). Thus, there is considerable evidence to indicate that globalisation does not erode NSIs or render them incoherent. Rather, evidence from the ten countries investigated in this project generally favours the view that 'national systems still matter', indicating that national characteristics and strategies have been crucial in processes of globalisation.

It could be added that the case studies in this book, as well as in Nelson (1993), indicates that there are sharp differences between various national systems with regard to propensity to innovate, the importance of different activities as determinants of the development and diffusion of innovations (e.g. in terms of institutional and organisational set-up), etc. In addition, public innovation policies are still mainly designed and implemented at the national level – and the policies differ sharply between countries with regard to objectives, characteristics, instruments and consequences for performance. (Edquist, 1997, p. 12)

Hence, we believe that NSIs are not reducible to ensembles of SSIs. However, with regard to the creation of diversity and dynamics in the national systems, the picture is different. In this respect, the emergence and development of new product areas and new SSIs is an absolutely crucial element. We will return to this issue in the next section on innovation policy issues. Here, our summary conclusion is that national systems as well as sectoral systems will remain crucial constructions for the foreseeable future – but for partly different 'purposes'.

Before proceeding to the next section, however, we will briefly underline the importance of the sectoral perspective. For illustration, we refer to three quotes from the country chapters on Taiwan, Ireland and Korea:

- Taiwanese policy is 'actively promoting' FDI in high-tech industries (Balaguer, et al., this volume, Section 7.1).
- Irish-owned industry has 'grown relatively quickly by international standards, it has experienced significant upgrading in terms of skills and R&D performance, and it has generally had higher growth rates in high-tech sectors than in more traditional industries.'(O'Malley et al., this volume, Section 2.2).
- 'Korea's pattern of catching up can be described as 'catching up by specializing in new industries' - that is, the ICT industries.' (Lim, this volume, Section 6)

5 Innovation policy issues

The issue of innovation policy was briefly mentioned in Section 4 of the introductory chapter. In the country chapters, we have dealt with innovation policy in two (different) ways: policies pursued and policy proposals for the future. In what follows, we will compare innovation policies across the various countries.

In order to lend greater depth to this comparison, and also to provide it with a thematic structure, we will integrate our empirical account of differences and similarities in innovation policy with a theoretical discussion of innovation policy. In this discussion, we will first address rationales for innovation policy, and then take up the specific issues of selectivity and coordination. For each of these three themes there will be a corresponding discussion of the empirical patterns of innovation policy found in the ten country chapters.

5.1 Rationales

A common basis for public policy intervention is the identification of a 'market failure' that is supposed to be corrected through the intervention from the public sphere. As discussed elsewhere (e.g. Edquist, 1997; Edquist, 2001), a market failure in mainstream economic theory implies a comparison between conditions in the real world and an ideal or optimal system. However, innovation processes are path dependent over time, and it is not clear which path will be taken as they have evolutionary characteristics. We do not know whether the potentially optimal path is being exploited. Moreover, the system never achieves equilibrium. For these reasons, the notion of optimality is irrelevant in an innovation context. It follows that we cannot specify an ideal or optimal system of

innovation and, therefore, comparisons between an existing system and an optimal system are not possible. As a corollary, it is not meaningful to talk about optimal policies and the notion of market failure loses its meaning and applicability (Edquist, 2001).

Instead of market failures, researchers and policy-makers following a systemic approach often speak of 'systemic problems'. The criteria for policy intervention proposed here are, first, that there exists a systemic problem not spontaneously solved by private actors and market forces (i.e., private organisations fail to achieve the public policy objectives) and, second, that the public agencies must have the ability to solve or mitigate the problem (Edquist, 2001). This means that these systemic problems have to be identified, which can be done through empirical analyses comparing different systems of innovation with each other (Edquist and Chaminade 2006).[10]

An important focus of the systemic approach is the complex interactions that take place among the different organisations and institutions that constitute the SI. From this perspective, policy makers need to intervene in those areas where the system is not functioning well. The rationale for innovation policy should therefore be based on systemic problems rather than on market failures. The policy discussion at each point should focus on changes in the division of labour between the private and the public spheres and on changes in those activities already carried out by the public agencies. This includes adding new public policy activities as well as terminating others – and changing some. Terminating activities carried out by public organisations is not the least important (Chaminade and Edquist, 2006; Edquist, 2001).

As also argued elsewhere (Edquist and Chaminade, 2006), the activities based framework for analysing SIs, outlined in Section 2.3 of the introduction to the book, can

fruitfully be used for innovation policy purposes. The activities that influence innovation processes in SIs provide a useful point of entry into policy analysis. Thereafter, one can identify the organisations performing the ten activities and examine the relations among them as well as the institutions constituting constraints for the organisations when they pursue the innovation processes. When part of an activity is performed by a public organisations, it is a matter of innovation policy – and most activities have a policy element.[11]

Often, there is not a one-to-one relation between organisations and activities. A certain kind of organisation can perform more than one activity, e.g. universities carry out research as well as teaching. Many activities can involve more than one category of organisation, e.g. R&D is performed by universities, research institutes (public and private) as well as firms. With respect to innovation policy, we can analyse the division of labour between private and public organisations with regard to the performance of each of the activities in innovation systems and determine whether this division of labour is justified or not.

As noted above, one of the main differences between conventional (or mainstream economics) and systemic approaches to innovation policy is that the conventional approach begins by trying to define an ideal or optimal economic system, whereas the systemic approach compares existing systems with each other. These two approaches tend to define 'failures' or 'problems' very differently, and they also recommend different overall strategies for problem-solving.

In all ten of the NSIs covered by this study, policy-makers have, without exception, proclaimed the adoption of the SIs approach as a framework and guide for the design and implementation of future innovation policy. However, this wide acceptance might merely

reflect a general tendency within the policy-making community to follow current 'trends'. Thus, what adoption of the SI approach might mean for the design and implementation of innovation policy within specific national contexts certainly remains far from clear – and policy-makers often might not even know themselves. There are widely differing views among and within national policy-making communities on what innovation policy consists of, and the same might also be said of the SIs approach, which is often used 'more as a label than an analytical tool' (Edquist, 2005, p. 202). These points are illustrated below.

Norway currently faces 'the issue of deciding between a broad approach versus a more targeted approach' to innovation policy (Grönning et al, this volume, Section 7.3). However, the broad approach taken in Norway remains vague as to specific policy measures, expresses an underlying philosophy of 'general upgrading', avoids setting priorities, and reverts at least partially to a linear view of the innovation process. All of this is highly incompatible with a SIs approach, as demonstrated by the critical analysis developed in the Norwegian chapter, which proposes a much more 'targeted' kind of innovation policy for Norway.

In the Netherlands, the Ministry of Economic Affairs has explicitly adopted a systems perspective, initiated many activities inspired by SI approaches and the Porterian cluster concept, and seriously addressed the notion of so-called 'systemic failure'. At the same time, though, 'ideas from traditional economic analysis on market failure and how to address it continue to play a role in innovation policy' within the Ministry of Economic Affairs. In subsidy schemes and export promotion measures connected to innovation policy, 'competition policy has become an aim … and the relation between competition and innovation is now one of the focal points.' Further, 'it seems clear that too much emphasis

on competition as a way to stimulate innovation may be contra-productive'. (Verspagen, this volume, Section 7.2)

In Denmark, too, there are indications of a similar confrontation between policy rationales. On one hand, current economic policy debates reflect a 'more or less implicit assumption in much of mainstream economic policy debate that high taxes and a large public sector constitute a weakness'. On the other hand, there has been considerable effort to improve certain aspects of the NSI, but very little appreciation of its real strengths. For instance, 'there has also been a stronger interest in understanding and developing the 'knowledge-based economy', but … [with] … a bias in the direction of formal knowledge and too little understanding of the importance of learning by doing, using and interacting (DUI-learning)' (Christensen et al., this volume, Section 7).

Similar observations can be made about Sweden, Norway and even Finland. Thus, the overall picture of innovation policy rationales that emerges for the slow growth countries is one of fragmentation, debate, and a lack of consensus. As in Denmark, many policies in these countries seem to be motivated by an urge to 'follow the leaders' in a given area of activity, rather than by trying to determine whether or not there is actually either a market failure or a systemic failure – whatever these terms mean for different people.

For the fast growth countries, the picture is one of greater consensus, more pragmatism, and less debate about rationales. Thus, the Singaporean chapter does not directly discuss policy rationales, and neither does the Taiwanese chapter. However, they do present their own accounts of potential or actual system failures. The Taiwanese chapter also indicates that innovation policy has assumed an extremely important role in the Taiwanese NSI. It emphasises 'the key role of policy leading the process of systemic upgrading'. (Balaguer et

al., this volume: Section 1), And it adds, ‘By the early 1980s, many policymakers in Taiwan had become conscious that the market price mechanisms were too slow to propel the kind of development that Taiwan needed.’ (ibid., Section 4.3.3)

The Hong Kong chapter notes that ‘policymakers have explicitly integrated the SIs approach as an aid to overall policy discussion and implementation', but it also states that ‘Lateness in tackling and introducing innovation policy and subsequently weak implementation have left many initiatives fragmented and ineffectual’ (Baark and Sharif, this volume: Section 7). The Korean chapter also describes a situation of extreme fragmentation of innovation policy among separate policy fields, which it illustrates by explaining that ‘The science and technology policy has mainly been driven by the perspectives of the science and engineering fields, and has ignored the economic and social aspects involved in the process of innovation’ (Lim, this volume, Section 7). Only in Ireland has innovation policy apparently been guided to any significant extent by an explicit analysis of systemic failures – as in the case made by Forfás for adopting systematic initiatives to strengthening innovation networks in Ireland (O’Malley et al., this volume, Section 7).

With the partial exception of Ireland, policy-makers in the fast growth countries, like their slow growth counterparts, display a general lack of clarity about the economic rationales for innovation policy interventions. Given the rather diffuse and uneven development of innovation policy in both sets of countries, though, it could certainly be argued, as in the Hong Kong chapter, that these and other NSIs could ‘benefit from an approach … whereby policy initiatives are better coordinated and understood in terms of a larger conceptual framework’ (Baark and Sharif, this volume, Section 7).

5.2 Selectivity

One of the main differences between conventional (or mainstream) and systemic approaches to innovation policy is reflected in current debates on non-selective versus selective innovation policies. In this respect, current understandings of innovation policy are divided into two main camps. A non-interventionist 'laissez-faire version … [which] signals that the focus should be on 'framework conditions' rather than specific sectors or technologies' competes with a ''systemic' version … [for which] a fundamental aspect … becomes … reviewing and redesigning … the linkages between the parts of the [innovation] system' (Lundvall and Borrás, 2005, p. 611). From the systemic perspective, innovation policy – like most other public policy – is naturally selective, since even policies that try to avoid 'picking winners' by addressing market operations in general tend in practice to favour certain sectors. As we will see below the existing power structure often tends to preserve 'the existing structure of production' and already established technological trajectories (Edquist, 2001, pp. 224 – 225). However, other parts of the power structure can, of course, also favour new and emerging sectors of production and the development of new technological trajectories. Some examples that point to selectivity are the following.

Any public policy which is intended to solve or mitigate a societal problem must focus on the nature of the problem and on its causes – and in this way be selective. R&D policy instruments involve public financing of research, which means allocating economic resources between different research fields. An increase in public funding of R&D with 1

billion (Swedish Crowns or Euros) necessitates a decision about in which field of R&D the additional resources should be used. Should they be used for electronics research or for research in the life sciences? Decisions are typically made in complex political and administrative institutional set-ups, in the understanding that those allocations will serve to stimulate and enhance levels of innovative and knowledge capacity of the economy, in areas where private investment was not enough. Another instrument of innovation policy, such as a tax deduction for R&D expenditures by private firms, tends to favour those firms that have (large) R&D expenditures, and industries with a high R&D intensity. It is, therefore, also a selective instrument (Borrás, Chaminade and Edquist, 2007, forthcoming)

Another conventional instrument of innovation policy is public technology procurement, which focuses upon a certain function, such as air strikes, transportation of high-voltage electricity, or telecommunications exchange. Through this instrument, government or the public sector subsidizes the development of a system that can fulfil this function – i.e. a public agency pursues public innovative (or technology) procurement. Hence this instrument is highly selective. The list of examples could be made much longer, but it shows that public policies are normally selective in one sense or another. They may be selective with regard to problems, regions, sectors, products, firms, instruments, etc. (Borrás, Chaminade and Edquist, 2007, forthcoming)

When uncertainty and risk are high, the danger that private actors will under-perform relative to public policy objectives is particularly great. For example, private actors might under-invest in basic R&D (Arrow, 1962) or they might not invest at all in activities of great social return but low individual return (e.g., some drugs). High uncertainty might also prevent the emergence of innovations. Empirical evidence suggests that large-scale and

radical technological shifts rarely take place without public intervention. Carlsson and Jacobsson (1997) have shown this for technological breakthroughs in electronics, semiconductors, and genetic engineering in the USA and Sweden. Mowery (2005) has shown that publicly funded R&D in combination with public technology procurement has played a crucial role in developing new high-tech sectors in the USA (and thereby in the world). Examples are computer hardware, computer software, large aircraft, biotechnology, and the Internet. Hence public intervention seems to be the rule in new fields and industries, i.e. for the early development of new SSIs. The new fields mentioned above are also those where large-scale and radical technological shifts have taken place. Such shifts seem rarely to have taken place without public intervention. (Carlsson and Jacobsson, 1997; Mowery, 2005). On the other hand, incremental innovations in established and mature sectors seem to take place mainly on the basis of private initiatives and funded by private organisations. Examples could be gradual improvements of ball-bearings during the past century or the improvement of integrated circuits during the last 30 years.

Many mainstream economic analysts claim that innovation policy 'should be' neutral and they sometimes even believe that policies are neutral. They even seem to pretend that some selective policies are neutral (such as tax breaks for R&D expenditures). We argue, however, that innovation (and other) policies are normally not neutral, because they naturally entail a selection. We even claim that they can not possibly be neutral in any genuine sense – if they are to solve or mitigate specific problems.

The acceptance that most innovation policies are selective makes it possible for us to transcend the sterile debate about whether or not policies are, or should be, neutral. A much more relevant and interesting issue to address is in what way, or in what sense (innovation)

policies are or should be selective. This is just what has been done in countries such as Korea and Taiwan. Policy-makers in these countries have accepted the idea that they are trying to 'pick winners' and avoid 'subsidizing losers'. This is very similar to what private firms are trying to do – i.e. to bet on winning products and concepts.

Globalization adds an additional dimension to the discussion on selectivity, particularly when resources invested in innovation might not generate externalities in the country or region but somewhere else. As Archibugi and Iammarino (1999) acknowledge, with increasing globalization, 'the choices of public actors are strongly limited by processes they are not entirely in control of' (ibid., p. 326). Should the government encourage (subsidise) foreign firms to establish R&D labs in their country or should they instead support R&D in domestic firms (that might later leave the country)? How can the government select those interventions that might have a large positive impact in their territory when innovation activities are becoming increasingly global? (Borras, Chaminade, and Edquist, 2007, forthcoming)

Let us now return to the question then becomes in which direction or in which respects the innovation policy is – or should be – selective? Most large firms, and sometimes also the labour unions, in established sectors of production pursue lobbying intended to make public actors support their own sectors and firms.[12] New and nascent sectors normally do not include strong actors and can therefore not pursue lobbying in an effective way. However, public innovation policy intervention is generally more justifiable in new sectors or in new operations in established sectors, since 'problems' that are not solved or mitigated by private organisations are more frequent in these contexts.[13] Such interventions are also more justified for radical innovations, as compared to incremental ones, and for early stages

of innovation processes, rather than later stages in those processes. (Borras, Chaminade, and Edquist, 2007, forthcoming)

Because strong vested interests are often associated with mature industrial sectors and established technological trajectories, lobbyism often seems to work for an innovation policy that should not be pursued.[14] Instead the support should be channelled to operations and sectors where risk and uncertainty are greatest, where uncertainties are too large for private organisations to invest, i.e. where the public policy action would really be a complement to private actors and not a substitute or duplicate to them. Innovation policy should play the role of a midwife – not provide support towards the end of life. This requires that policy-makers and politicians have a sophisticated analysis at their disposal, as well as a high degree of integrity, to counter-balance private lobbyism and a considerable amount of power. There are seldom strong private lobbyists for the solutions of the future!

Let us now return to innovation policy in a more 'practical' context. As we have briefly indicated before, innovation policy, in the context of this book, may mean two different things:

- The policies that have historically been pursued in the ten countries during recent decades (how policy has been formulated, the content of policy, how policy has been implemented and what consequences it has had)
- Identifying either problems that are currently not solved or mitigated by private organisations (mainly firms) or opportunities currently not exploited by private actors (since if such problems or unexploited opportunities can be identified, they should be subject to future innovation policy).[15, 16]

With reference to these issues, the evidence from the ten country chapters included in this book provides strong support for the view that innovation policies are normally selective rather than neutral. Let us now illustrate this by means of examples from the country case studies.

The findings from our case studies generally indicate that the main challenge facing NSIs is that of creating diversity – i.e., escaping lock-in into well-established production specialisations and technological trajectories by launching new alternatives. In contrast, the more familiar problems of providing adequate factor inputs and ensuring competitive framework conditions – which are typically emphasized by the supposedly neutral or non-selective policies proposed on the basis of a laissez faire approach to innovation policy (Lundvall and Borrás, 2005, p. 611) – appear to be issues whose solution is much easier.

Ireland has excelled in ensuring positive framework conditions and abundant factor inputs such as human capital and finance well adjusted to the needs of innovative firms. Despite these successes, Irish policy-makers are concerned to reduce Ireland's present degree of dependency 'on … the willingness of external companies to continue to transfer technology to Ireland' and strengthen Ireland's indigenous innovative capability (O'Malley et al., this volume, p. Section 6). In this connection, building up basic R&D capabilities within the public sector and strengthening absorptive capacity among private sector SMEs through upgrading labour force skills are fairly simple tasks. The challenge of improving the innovative capability of domestic firms by increasing the degree of interactivity and networking within the NSI is a much more difficult task. As noted in the Irish Chapter, policy-makers lack previous experience in, and instruments for, addressing this problem,

since until now ‘no systematic initiative has been adopted for strengthening innovation networks in Ireland’ (ibid., Section 7.2).

Turning to the slow growth countries, the evidence from both Sweden and the Netherlands support the view that innovation policies are normally selective. Historically, Swedish innovation policies have reinforced the dominance of large firms and industries characterised by low innovation intensity, and have also supported high levels of investment in education and R&D. More recent policies have emphasised providing support to start-up firms in science-based sectors. However, other so-called neutral policies – for example, corporate taxation, labour market policies and a plethora of liberalisation initiatives – have promoted the globalisation of Sweden’s major industrial firms while maintaining their dominant position within the national economy. New firms and new industries have therefore developed slowly, since terms favourable to incumbent actors have been created by policy. Herein lies a possible explanation for the rather slow diversification of Sweden’s technology profile.

In the Netherlands, past and present policies, directed towards increased competition, on one hand, and higher levels of public-private interaction, on the other, seem too broadly framed to accomplish a fundamental reorientation of the NSI. The main question concerning interaction in the Netherlands’ NSI, e.g., is arguably not one of ‘how much’? but rather ‘what kind’. As argued in the chapter on the Netherlands, from an SI perspective ‘it might make (more) sense to look at the interaction between the university system and the public research organizations’ than to ‘propose measures to stimulate interaction between university research and private firms’ (Verspagen, this volume, Section 7.2). The latter type of policy measure has been pursued for some time in the Netherlands, without any clear

effect; in contrast, the former could address problems of coordination, gaps in funding, and a problematic focus of specialized public research institutes on 'relatively old specializations, such as civil water works and ship-building' (ibid.).

Strong support for the proposition that innovation policies are necessarily selective policies – and also clear indications of the problems entailed in developing and implementing selective policies – emerges from one of the fast growth countries. Korea exemplifies the limitations of policies addressing the market in general. Liberalisation was a necessary response to the financial crisis of the 1990s, and involved the introduction of reforms that were both wide-ranging and comprehensive. However, Korean policy-makers apparently underestimated the difficulties of implementation, as evidenced, e.g., by the relative underdevelopment of new arrangements for financing innovation.

As stated in the Korean chapter: 'The financial system is new and it is not sufficiently well developed to channel financial resources to those firms that display good performance, because there is a limited pool of knowledge evaluating the credibility and performance of firms. Banks and other organizations are reluctant to take risks in making loans, and their hesitance is reducing firms' investments.' (Lim, this volume, Section 7.1). Further, continuing problems with the output and organisation of both public education and public sector R&D indicate that the extent and pace of reform have not been sufficient and may need to be increased considerably in certain areas. Arguably, Korea requires strategic systemic initiatives for coordinating diversity creation efforts to counter-balance the strong selection pressures exerted by increased competition on both domestic and global markets. Thus, the Korean chapter concludes as follows:

> Finally in the ever more globalized world, strengthening the capabilities of small firms, who are increasingly vulnerable to international competition, will be crucially important for future policy. … In order to resolve the chronic problems of small firms, future innovation policy needs to find strategic ways of enhancing the technological capabilities of small firms and the networking of small firms with domestic and international actors for knowledge and market access. The importance of strategic policies to ensure that the poor competencies of small firms do not become a barrier to upgrading the competitiveness of the nation cannot be over-emphasized. (Lim, this volume, Section 7.3)

The Taiwanese case illustrates the difficulty of designing selective policies. Historically, innovation policies implemented in Taiwan during the 1970s and 1980s succeeded in fostering competitive original equipment/design manufacturing firms in ICT manufacturing. Many aspects of the NSI have been geared to this effort – e.g., the public sector's role in building competences in strategic areas through a variety of mechanisms for technology diffusion and learning. However, the past achievements of Taiwanese innovation policy have also contributed to current problems of lock-in. To date, the change of Taiwan's technology profile has mainly been confined to advances in semiconductors and electronics in a more general sense. But even to consolidate and extend the gains made in this one sector, Taiwan currently faces the challenges of strengthening indigenous R&D and intellectual property rights (IPRs) of domestic firms as part of a more general effort to develop the broader and more comprehensive set of assets and capabilities now required for further progress. When it comes to addressing these problems through selective policy

measures, though, the Taiwanese government has increasingly limited room for manoeuvre. Thus, the Taiwanese chapter notes that:

> … as Taiwan has become an open economy, well integrated into world markets, the government's policy stance has become increasingly less interventionist. Although the selection of specific technologies and development targets remains a major policy goal, the conclusions of the last National Conference on Science and Technology, which determines the basic guidelines for national innovation policy, pointed to a more neutral direction for government, with particular emphasis on the fundamentals of innovation.' (Balaguer et al., this volume, Section 7.3).

The cases cited above are not exceptional, insofar as similar findings occur in other national studies. For instance, the Norwegian case supports the same conclusions as the studies of Sweden and the Netherlands, and the Singaporean case develops insights similar to those articulated in relation to Taiwan.

In Norway, past innovation policies were directed towards breaking out of the existing pattern of industrial and technological specialisation by focusing on selected science-based and information-intensive industries, and corresponding research fields. However, these policies were not supported by accompanying reforms in areas such as taxation – a specialised R&D tax credit scheme targeting small firms was only introduced rather recently, in 2002 – and they were also undermined by an economic downturn during the early 1990s. As a consequence of this crisis, 'public R&D policy towards the private sector changed'. Thereafter, 'Priority was no longer to be given to selected sectors. Although there were some main areas of focus … the new policy aimed at improving the general

performance in all firms that could have the potential to innovate.' (Grønning, et al., this volume: Section 7.2)

In the case of Singapore, innovation policies have evolved with the NSI, typically leading its development. But the achievements of past policies for 'MNC-leveraging economic development' – i.e., 'leveraging of foreign MNCs to jumpstart local economic and technological growth' – may have reduced policymakers' scope of action in recent efforts to build up indigenous innovation capabilities' (Wong and Singh, this volume, Section 7.2). Although the policy shift towards investment in R&D has had positive impact on R&D intensity and innovative performance, policies geared towards promoting high-tech entrepreneurship have not enjoyed similar success thus far.

To sum up, it is clear that in all of the ten countries there is strong evidence that the innovation policies that have been pursued have been selective. In different ways, all of the various country studies point clearly to problems requiring selective policies, or what may also be referred to as opportunities for the development of such policies. However, there are also some significant differences between fast growth and slow growth NSIs with respect to the extent to which they have actually developed and implemented selective policies.

When it comes to the actual performance of deliberately selective rather than so-called neutral or non-selective innovation policies, what distinguishes fast growth from slow growth countries is that the former have been much more active and also more successful in pursuing explicitly selective policies. This means that they have actually been selective in the 'right' direction.[17] It will be recalled from Section 4 that all of these countries have developed successful policies directed towards entry into the ICT and electronic sectors. In contrast, the slow growth countries have been more weakly committed to new growth

industries, and more attached to traditional ones. In at least some of the slow growth countries, however, there appears to be an ideological commitment to so-called neutral policies that has in effect ruled out the adoption of pursuing more selective policies in a conscious way – i.e. enhancing selectivity in the 'right' direction. The Netherlands and Norway provide very clear examples of this tendency. In other cases, such as Sweden, there may be a mix of both selective and supposedly neutral policies – in which, for Sweden, at least, the non-selective policies may counteract and even undermine the selective ones. Thus, there appears to be greater resistance to selective policy measures in the slow growth countries, and greater scope for developing and applying such policies in the fast growth countries.

In trying to explain these differences, we can point to an obvious contextual difference between the two groups of countries. As NICs, the fast growth countries have fewer mature industries that would stand to benefit from so-called neutral policies favouring the existing structure of production and already established technological trajectories. Hence, there are few particularly strong lobbies for so-called neutral policies (that actually supports existing industries and actors in a selective way). Even in Korea, the powerful chaebols have resisted neutral policies (e.g. liberalisation), since they have historically benefited from selective policies. The situation in the slow growth countries is, of course, just the opposite – i.e., established firms and industries have generally supported and benefited from so-called 'neutral' policies, rather than explicitly selective policies. Finland might be considered to constitute an exception in this regard. Selective policies to develop the ICT sector in Finland paid off during the late 1990s, but part of the explanation for their success lies in a severe economic crisis during the early 1990's that greatly diminished the lobbying

power of traditional industrial sectors and created greater scope for policy actions favouring the ICT sector.

5.3 Co-ordination

Another key difference between conventional (or mainstream) and systemic approaches to innovation policy concern the issue of coordination. As we pointed out in Section 2 above, coordination is a central theme in SI approaches, which lay great stress on how activities supporting innovation are coordinated by institutional frameworks. Coordination is also a vital concern for the systemic approach to innovation policy, since – as in the examples considered in sub-section 5.2, above – much research on innovation processes and systems points to 'tension or mismatch between different kinds of designed institutions that often represent different levels of policy-making' (Edquist et al., 1998, p. 38). Further, as explicitly recognized and underlined by the activities based framework outlined in the introductory chapter, SI approaches generally recognize the importance of complementarity within systems and therefore emphasize the importance of policy coordination. For example, 'the coordination of support for R&D with support for … other kinds of learning, which operate through different mechanisms' (Edquist et al., 2001, p. 155). Thus, one of the general policy implications of the SI approach is that it is important 'to integrate and co-ordinate policy areas like R&D policies, educational policies, regional policies, and even macro-economic policies when formulating innovation policies' (Edquist, 2001, p. 230).

Returning to the question of rationales for policy intervention, an emphasis on coordination can be regarded as fundamental for the systemic approach to innovation processes and innovation policies, whereas this is not the case for conventional (or mainstream) approaches. Thus, Metcalfe (1995) has highlighted the issue of coordination in elaborating a comparison between conventional or optimising approaches and evolutionary and systemic or adaptive approaches to innovation policy-making. In the optimising approach, which is informed by equilibrium economics, the 'favourite metaphor … is of the policy maker as a fully informed social planner who can identify and implement optima' for altering incentive schemes in order to change the behaviour of economic actors and thereby correct situations of market failure where 'social and private welfare [are] out of step' (ibid., p. 30). In contrast, the adaptive approach, based on evolutionary economics, does not presume 'that the policy-maker has a superior understanding of market circumstances or technological information; rather what s/he does enjoy is a superior coordinating ability across a diverse range of institutions' (ibid., p. 31). For the adaptive policy-maker, moreover, the central problem is not market failure but rather the 'evolutionary paradox that competitive selection consumes its own fuel, destroying the very variety which drives economic change' (ibid., p. 30). It follows that 'superior coordinating ability' must be harnessed to the cause of regenerating the diversity fundamental to economic progress by promoting and supporting 'experimental behaviour' on the part of economic actors.

Drawing upon the evolutionary economics tradition - as well as insights from institutionalist theories such as those that inform the VoC (Hall and Soskice, 2001) and business systems (Whitley, 2002) approaches discussed in Section 2 - Storper et al. (1998) have applied this reasoning to industrial policy for late-comer nations in the globalizing

learning economy as follows. Orthodox economic theory proposes macro-economic structural adjustment policies, accompanied by liberalization policies, as the alternative to traditional industrial policies, which cannot be practiced in the context of increasingly open markets and internationally mobile capital. However, structural adjustment offers no solutions for the creation of new wealth through 'mobilization of local competitive specificities such as technology and know-how, trust and culture' (ibid., p. 3). Such solutions depend, instead, on 'coordination-for-learning', where learning is understood to involve multiple kinds of actors and forms of activity, and to depend on institutional frameworks and relations among actors – an approach in which 'the role of the state as a catalyst for starting and sustaining coordination becomes crucial' (ibid., p. 5). This approach to industrial policy is, of course, highly consistent with the systemic approach to innovation policy and with the institutionalist orientation and emphasis on interactive learning fundamental to systems of innovation approaches. As Storper et al. emphasize, 'learning involves coordination over shifting terrain, where the agents and institutions involved must be reflective …. in order to alter their own parameters over time' (ibid., p. 6).

With these considerations in mind, we now turn to an examination of policy coordination in the ten countries represented in this book. Here, we will focus primarily on the consequences of past innovation policies, rather than examining how policy has been formulated, the content of policy, or how policy has been implemented. However, the analysis may also contribute to a more profound understanding of the existence of problems or opportunities as reasons for innovation policy intervention that were outlined in the preceding discussion of selectivity.

Sweden provides an instructive example of the problems of policy coordination in slow growth countries. Generally, Sweden's pattern of innovative activity reflects an ongoing imbalance between the supply of innovation inputs, particularly R&D, and innovation outputs. The 'Swedish paradox' refers essentially to low pay-off in terms of innovations from very large investments in R&D and innovation. This problem can be attributed to several causes; globalisation resulting in commercialisation of Swedish innovations abroad, ineffective technology transfer from research organisations to commercial application by firms and a sectoral allocation of R&D investment favouring industries with low innovation intensity. The dominance of incumbent large firms (MNCs) is a common thread in all these lines of explanation.

Sweden's extensive support for innovating firms and entrepreneurial start-ups has resulted in only modest rates of new firm creation and only moderate success in strengthening specialisation in fast growing high-tech industries. New firm creation and inter-firm networking remain dominated by large firms, and institutional arrangements (in e.g., labour markets and taxation) also sustain the dominance of large firms, many of them based in industries with low innovation intensity. There is considerable lack of coordination between policies related to the provision of constituents for SIs and policies with regard to support services for innovation firms.[18] The ultimate beneficiaries of the latter appear to be those least in need. Thus, the Swedish chapter points out that, despite a wide range of policies aimed at supporting the creation of new firms, the growth of these firms 'frequently seems to be enhanced by becoming part of a larger corporate structure through acquisition', and that despite numerous policies to support networking for small firms, innovation networks in Sweden are characterised by a 'rather high degree of vertical integration'

(Bitard et al., this volume, Section 4). The overall pattern of evolution in Sweden is one of gradual transition from an innovation system dominated by large mechanical engineering firms to one in which science-based and information-intensive sectors will feature more prominently, but large incumbent firms are unlikely to be easily displaced by new entrants.

Similar dynamics can be observed in two other slow growth countries. Norway exhibits little entrepreneurship in science-based and information-intensive sectors. Thus, extensive provision of support for innovating firms has brought poor results, due to the restrictive investment climate and structural rigidity bred by the dominance of large firms in the resource-extraction and transportation services sectors. Now that Norwegian policy makers have again shifted direction towards a more targeted approach, many questions remain as to how this new approach will actually be integrated with the earlier and ongoing emphasis on general upgrading to which it has been tied. As stated in the Norwegian chapter; 'In the case of general upgrading as the main and underlying philosophy, there is a need to further formulate the conditions under which general upgrading is to take place. In other words, if heterogeneity and multiple targets are at the core of strategy, instead of targeted approaches, based on a rationale that heterogeneity leads to increased output, this must be stated explicitly.' (Grønning et al., this volume, Section 7.2)

In Finland, public-sector support for innovation, networking arrangements, and institutional reforms have been geared mainly to the successful development and internationalisation of large firms such as Nokia. Entrepreneurial small firms have been much less well provided for – even though Tekes, an important R&D financing organisation, requires that SMEs must be included in the R&D networks they finance. For such reasons, the Finnish chapter points to the need for increased networking and

collaboration between low-tech and high-tech firms, as well as between large and small firms, combined with measures developing the innovative capabilities of small firms, such as 'development of financing of especially young, small, growth-oriented, R&D intensive and high-technology firms' (Kaitila and Kotilainen, this volume, Section 7.3).

In the Netherlands, despite very high performance with respect to knowledge inputs, innovative activity has levelled off and private sector R&D has begun to decline, at least in relative terms, implying diminishing demand for these inputs. A pattern of sectoral specialisation that de-emphasises manufacturing, together with globalisation effects, makes it difficult to improve system performance simply by increasing knowledge inputs. Instead, balancing supply and demand requires the Netherlands to gear inputs to emerging growth sectors.

The problems encountered in the Netherlands include low levels of entrepreneurship and inadequate interaction between universities and other public research organisations and private sector actors, reflected in low levels of knowledge transfer and research commercialisation. The overall pattern is one of an impasse bred by lock-in to institutional and organisational arrangements that serve incumbent firms in declining (or de-industrialising) sectors better than new entrants in emerging sectors. The Netherlands NSI appears to be a dual system. The universities, most research institutes, and many public research organisations cater primarily to large incumbent firms, well established but declining industries, and relatively old technological fields. In contrast, only a few public organisations provide inputs to new firms, industries and technologies. Also, creation of new firms, industries and technological innovation platforms is often poorly coordinated with corresponding forms of support, some of which are inadequately funded. Thus, the

chapter on the Netherlands argues for a fundamental re-orientation of several different kinds of innovation policies, in which coordination should be based on 'taking into account where the 'new economy' will have its focus in terms of technological development' (Verspagen, this volume, Section 7.1).

Denmark, like the Netherlands, has maintained essentially the same technological profile over the past two or more decades. Its current transition towards a more mixed mode of innovation combining a science and technology driven mode with the traditional mode based on doing, using, and interacting – i.e., 'a 'mode of innovation' dominated by small and medium-sized firms continuously making incremental innovations based on learning by doing, learning by using, and learning by interacting especially with customers and suppliers' (Christensen et al., this volume, Section 1) – has so far not entailed any major disruptions.

Against this background, though, recent policy appears to have led in a potentially disruptive direction that may actually become problematic, depending on the strength and focus of initiatives to bring about structural change through efforts to strengthen high-technology sectors by promoting university-industry interaction and the creation of science-based firms and industries. As the Danish chapter points out, measures aimed at stimulating activities in this area will probably require considerable adjustment to complementary or related sets of activities within the Danish NSI – through, e.g., close coordination and even integration with existing forms of university-industry interaction. In Denmark, where low-tech activities predominate and a large population of SMEs has only weak networking linkages with the universities, 'policies aiming at bringing the national system 'to the very top' in this dimension might not necessarily strengthen the system as a whole'. Other

technology transfer strategies 'such as life-long learning' might be more effective in strengthening the innovative capabilities of many firms and sectors (Christensen, et al, this volume, Section 7). More generally, policies aimed at promoting a transition to a 'science-based' mode of innovation are unlikely to succeed in Denmark without taking into account the wider socio-economic setting and other factors contributing to the successful operation of the Danish model.

Among the fast growth countries, Taiwan can be regarded as a leading example of a country whose economic success has depended on effective policy coordination, but which now faces new coordination problems. Taiwan's rising rate of investment in R&D has been characterised by the fast growth of business expenditure on R&D and a dramatic increase in patenting. Similarly, the strong expansion of Taiwanese post-secondary education has increasingly focused on ICT-related scientific, engineering and technical skills. Balance between supply and demand has been maintained, since these developments have been driven by the upgrading of firms in high-tech manufacturing sectors. These firms excel in production for high-tech markets, drawing their competitive advantage from manufacturing and process innovation skills.

As it reaches the limits of factory automation and the adoption of advanced production techniques as a competitive strategy, though, Taiwan now confronts mismatches between policies related to activities concerning 'constituents for SIs and policies related to activities concerning 'support services for innovating firms' (See Box 2 in Introductory Chapter). These problems reflect the need of existing firms to diversify, through product innovation based on independent scientific and engineering capabilities. For Taiwanese firms to break out of the trajectory that they have established for themselves as technology followers and

'second movers', it has become necessary to reform existing institutions for protection of intellectual property and develop forms of R&D collaboration that facilitate appropriation of innovation.

Similar patterns emerge in the cases of Singapore and Hong Kong, both of which have recently diversified their pattern of innovative activity. In Singapore, recent increases in indigenous R&D within targeted fields of science and technology have not been matched by the commercialisation of indigenous intellectual property in corresponding sectors – especially on the part of entrepreneurial high-tech start-up firms. Historically, Singapore has concentrated on developing labour force competencies and skills, and its main R&D inputs have come from technology-intensive foreign MNCs with local operations. Singapore has successfully reconfigured public and private innovation capabilities several times over the past decades, through institutional reforms and changes in the provision of support to innovating firms. However, there has been little recent private-sector response to the current build-up of support services targeting entrepreneurial high-tech SMEs. Prospects for developing indigenous R&D and innovation capability remain uncertain, and technological entrepreneurship in strategic sectors remains low, due to cultural factors (risk aversion), gaps in institutions and organisations (a lack of mechanisms 'bridging' R&D and seed investment) and the conservatism natural to a small domestic market.

In Hong Kong, support for innovating firms largely reinforces the dominant producer services trajectory by developing consultancy services and financing ICT projects, but incubation targets other nascent industries. This divided focus indicates possible future tension and conflict between established and emerging industries. As in Taiwan and Singapore, path dependency makes diversification difficult.

Korea, like Taiwan, has a history of developing the technological capabilities of its own large firms. Similar to other 'catching up' economies, Korea has matched supply- and demand-side activities by utilising imported technology to support a strong specialisation in rapidly growing export markets, especially for high-tech products. Increasing globalisation of both production and R&D by major Korean firms has meant, however, that efforts to upgrade domestic knowledge inputs will have to be coordinated with initiatives to strengthen the absorptive capacity and innovative capabilities of small domestic suppliers to these large firms.

Liberalisation and efforts to promote a more entrepreneurial economy in Korea have been fairly recent developments. Despite regulatory reforms and the reorganisation or creation of support functions suitable to new venture businesses, the economy continues to be dominated by large conglomerates. The chaebols have adapted poorly to liberalisation and continue to constrain innovation networks, in particular. Thus, a mismatch of organisations and institutions frustrates support for innovating firms. Generally, the Korean NSI is experiencing a difficult transition from large firm dominance and top-down government steering to entrepreneurship, open competition, and more interactive partnerships between government and industrial actors. In both the 'old' and the 'new' versions of the Korean NSI, small domestic firms have tended to be disadvantaged, but the latter benefits new venture businesses while threatening more traditional SMEs.

A similar problem arises in Ireland, albeit in relation to foreign, rather than domestic MNCs. In activities concerning 'constituents for SIs and activities concerning 'support services for innovating firms' (See Box 2 in Introductory Chapter), the Irish NSI has, on one hand, bolstered inward investment by embedding foreign MNCs within local or

regional clusters of inter-related firms. On the other hand it has promoted the formation of new firms, the development of innovative capabilities, and effective innovation networks within indigenous industries. Success in the latter type of effort appears to have depended greatly on the degree to which there has been a significant overlap with the former type. The predominance of foreign MNCs has ensured high overall consistency in Ireland's NSI, such that its main strengths are based on alignments of different kinds of activities that support this industrial order. Thus, e.g., foreign MNCs based in Ireland constitute important sources of demand for indigenous firms, whose innovation and growth performance has been improved by vertical linkage to them. Small indigenous firms in traditional industries outside this virtuous circle remain the NSIs weakest components.

To sum up the evidence on policy coordination, we can observe very different patterns in our two groups of countries. For the slow growth countries the overall picture consistently drawn by the country case studies is one of a problematic lack of policy coordination. In all of these countries, policies related to specific activities are often poorly aligned with one another and in some instances they even appear to be working at cross purposes. The case studies repeatedly point to mismatches, imbalances, inconsistencies, impasses and even immanent conflicts among specific policies related to particular fields of activity.

For the fast growth countries, the overall picture is instead one of past successes and emerging problems in the coordination of innovation policy. In all cases, successful entry into technologically dynamic growth sectors, particularly the ICT and electronics sector, has depended on effective policy coordination – for example, the close alignment of education and training with other policies designed to encourage foreign or domestic investments in the development of technological capabilities. In general, these countries all

provide highly instructive historical examples of 'coordination-for-learning'. However, they now face the problem of diversifying beyond established sectoral and technological specialisations – and, in this respect, they can be seen to have begun experiencing coordination problems that are essentially similar in nature to those that have for some time characterised the slow growth countries.

To develop an explanation for these differences between fast growth and slow growth countries we can refer to the same basic set of contextual differences that were found in sub-section 5.2 for differences with respect to selectivity. In the slow growth countries, policies designed to support new firms in emerging industries are to a large extent counter-acted by policies that sustain established firms and industries. This is especially the case for Sweden, Norway, and the Netherlands. There is also a parallel and over-lapping tug-of-war in innovation policy between large firms and SMEs, and another between 'traditional' small firms and 'science-based' ones. In Finland, the first type of conflict is evident, while the second is becoming more pronounced in Denmark. For all of these countries, though, the basic problem is that established firms and industries exercise strong inertia, constituting a powerful lobby for the maintenance of policies that work to their benefit. Policy-makers appear to have responded in many cases (especially Sweden, Norway and the Netherlands) by implementing completely different sets of policies for new firms and emerging industries – but what then results are serious gaps in coordination.

Turning to the fast growth countries, it can be argued that their past successes in policy coordination were at least partly due to the greater freedom of manoeuvre afforded by the lack of strong vested interests in policies aimed at maintaining the existing sectoral composition of production. In these countries, there is less overt conflict among policies

aimed respectively at old and new industries, since nearly all industries are relatively new, chronologically. Further, innovation policy has, as noted in Section 4, as well as earlier parts of this section, been concentrated to a much greater extent on the development of a much narrower range of high-technology growth industries. Thus, there tend to be fewer problems related to the coordination of policy across sectors. Of course, the fast growth countries do provide some evidence of conflicting policy interests among firms, occurring mainly along the axis of traditional versus science-based small firms, as in Korea and Ireland. More generally, though firms and governments in these countries appear to agree on the need to develop new innovative capabilities and 'rules of play'. In that respect, the fast growth countries may still have the advantage of greater scope for coordination.

Notwithstanding these considerations, we can also observe that the fast growth counties are now confronting new challenges with respect to the creation or regeneration of variety. As a consequence, they may therefore begin to experience coordination problems similar to those of the slow growth countries – as hinted at, for example, in the case of Hong Kong. Here, the relevant explanation from context does not concern the sectoral composition of production, the lobbying power of established versus emerging industries, or the relative age (or youth) of the institutional and organisational set-up. Rather, it concerns the countries' levels of technological development within their respective sectors of specialization – which have remained, at least until very recently, largely the same for the fast growth countries.

It has often been argued in the literature on innovation policy that it can be difficult to alter a country's specialisation towards high-technology sectors 'because technological and economic uncertainty increases with the complexity of the required competence' (Archibugi

and Iammarino, 1999, p. 329). The same argument, however, can also be applied to continued advance in such sectors. Many of the fast growth countries have mastered the production of electronics but now they require the development of new capabilities within these sectors – 'technological entrepreneurship', as in Singapore, or capabilities for product innovation based on independent scientific and engineering capabilities, as in Taiwan. To develop such capabilities, the fast growth countries can no longer concentrate on competence building and infrastructure development focussed on the build-up of production. Thanks in no small part to globalisation processes, they must now also address issues of IPR and domestic as well as global R&D collaboration. And, as highlighted in the case of Korea, they must also accomplish a transition towards more participatory policy-making based on interactive partnerships between government and industrial actors. In many respects, therefore, the fast growth countries must now contend with a much higher level of complexity in the coordination of innovation policies. In this sense, they increasingly resemble their slow growth counterparts.

6 Concluding remarks

We now formulate the main conclusions of the discussion in this chapter in terms of the following close to telegraphic statements.

- The performance with regard to the development and diffusion of innovations has been very different in the ten NSIs studied in this book. There is no doubt that the ten countries are quite different with regard to propensity to innovate. In Section 2,

for example, we contrasted the Swedish pattern of high innovation inputs versus low innovation outputs with the Irish pattern of low inputs versus high outputs. In other parts of this chapter, we have made note of contrasting patterns of specialization – for example, Norway's low-or-medium technology specialization vs. Finland's growing specialization in high-technology, or Hong Kong's focus on 'coordination' of production networks vs. Taiwan's focus on production.

- The activities based approach, presented in section 2.3 in the Introductory Chapter of this book, addresses the activities or determinants that, hypothetically, are important for the development and diffusion of innovations. This concerns the issue of why the countries are different with regard to propensity to innovate. The activities based approach to innovation is in line with the broad approach to conceptualising NSIs rather than with the narrow one – as also discussed in the Introductory Chapter. Evidence from the ten countries investigated in this project generally favours a broad perspective on NSIs, rather than a narrow one. We have shown that this approach is useful in the sense that all the ten activities listed in the Introductory Chapter influence the innovation processes in most of the countries and since it secures a broad and multidimensional perspective and thereby avoids mono-causality in analysis and policy. The activities-based approach also constitutes a dynamic perspective on determinants of innovation rather than the more static one offered by the traditional approach focussing upon constituents and components in SIs. Further, the activities-based approach also makes it easier for the SI approach to draw lessons for theory and for policy. With respect to policy, for

example, we have argued in Section 2 that drawing attention to the multiple activities that influence innovation naturally leads to a focus on the co-ordination of these activities, and in Section 5.3 that SI approaches generally recognize the importance of complementarity within systems and therefore emphasize the importance of policy coordination.

- In all ten of the NSIs covered by this study, policy-makers have, without exception, proclaimed the adoption of the SIs approach as a framework and guide for designing future innovation policy. What that means, however, for the design and implementation of innovation policy is certainly not clear – and policy-makers often do not even know themselves.
- We can distinguish between a first group of five countries marked by slow growth and a second group of five countries that have exhibited fast growth during the latest three decades. The first, slow growth group includes Denmark, Finland, the Netherlands, Norway and Sweden. The second, fast growth group includes the countries of Hong Kong, Ireland, Korea, Singapore and Taiwan.
- Innovation policy has been more important, at least in the sense of having had a higher profile, in some countries (Taiwan, Finland) than in others (Hong Kong and Norway). However, all of the countries in this study have formulated and pursued innovation policies, and it is not clear what difference the degree of importance attached to innovation policy has made for the actual performance of innovation by private economic actors. For instance, innovation policy may have had a much

higher profile in Sweden than in Denmark, but the Danish NSI might be considered to perform better than Sweden's.

- Innovation policies that have been practiced have been largely selective in all countries. This is simply because very few public actions that influence innovation processes can be neutral or non-selective. The important issue is therefore not whether policies are selective or not, but in which direction they are selective! Are they, for example, supporting existing sectors and firms or are they engines for change in this respect? On this score, we have observed that explicitly and consciously selective innovation policies have tended to be those that support the development of new firms, industries and technologies. Such policies have been pursued to a much larger extent, and more successfully, in the fast growth countries than in the slow growth countries. One apparent reason for this difference is the relative lack of strong lobbies in the fast growth countries for so-called non-selective or neutral policies – which could, in turn, be explained by the relative lack of established mature industries that would stand to benefit from neutral policies.
- With regard to the fast growth countries, the evidence also shows that rapid economic growth has depended, for the most part, on successful entry into one and the same global growth sector - i.e., the electronics and ICT industries. Policies for changing the sectoral composition of production have been crucial in these countries. On the whole, the fast growth countries have been specialising, to a larger extent than the slow growth countries, in rapidly expanding high-technology sectors. In Korea, Singapore, Taiwan and Ireland, the state played an important role

in stimulating and supporting rapid growth based on entry into especially dynamic industrial sectors, particularly through policies for education (especially in engineering), targeting production for export and rewarding high export performers and supporting R&D and innovation. The slow growth countries have been slower and more rigid when it comes to going into new sectors. In this sense, the (selective) policies of the fast growth countries have been more successful than the (also selective) policies in the slow growth countries? They have simply been selective in a different 'sense' or 'direction'.

- Some fast growth countries, like Korea and Taiwan, have attempted to enter the ICT industries by, developing domestic firms capable of competing globally; others, like Ireland and Singapore, have focused on attracting foreign MNCs and promoting 'innovation by invitation'.
- Arguments have been put forward that national SI's still matter in spite of the homogenising influence of increasing globalisation and, alternatively, that SSIs matter more. Rather than converging, the NSIs in our study have established distinctive roles within an increasingly differentiated international division of labour. Moreover, these roles tend to be consistent <u>across</u> sectors. Thus there is considerable evidence to indicate that globalisation does not erode NSIs or render them incoherent. Hence, evidence from the ten countries investigated in this project generally favours the national perspective.
- Hence, NSIs are not 'reducible to ensembles of SSIs'. However, with regard to the creation of diversity and dynamics in the national systems, the picture is different.

In this respect, the emergence and development of new product areas and new SSIs is an absolutely crucial element. Therefore, our summary conclusion is that national systems as well as sectoral systems will remain crucial constructions for the foreseeable future – but for partly different 'purposes'.

- As noted above, SI approaches generally recognize the importance of complementarity within systems and therefore emphasize the importance of policy coordination. With respect to this issue, we have observed that the slow growth countries commonly exhibit a problematic lack of policy coordination, whereas accounts of the fast growth countries attest to both past successes and emerging problems in the coordination of innovation policy. Our explanation for this difference has stressed that the historically superior performance of fast growth countries with respect to coordination was at least partly due to the greater freedom of manoeuvre afforded by the lack of strong vested interests in policies aimed at maintaining an existing sectoral composition of production. However, this reasoning is at best only plausible for the explanation of past successes. With respect to emerging problems, we therefore pointed to the increasing complexity of policy coordination required for further advance (i.e., movement up the value chain) within the sectors and technological trajectories that the fast growth countries have specialised in.
- In innovation policy, the difficult thing is to 'pick and support winners', but avoid 'supporting losers' (in terms of sectors, technologies and products). Despite arguments to the contrary, this is the challenge for innovation policy – as well as for

firm strategy. At the same time innovation policy measures should be a complement to what private organsiations do – and not duplicate or substitute what they can do. This often means new activities where uncertainty is very large. Innovation policy should play the role of a midwife – not provide support towards the end of life

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[2] See Section 4 of the introductory chapter of the book.

[3] The Barcelona Declaration is a follow-up of the Lisbon Agenda, which has the objective of transforming the EU to the most dynamic knowledge-based economy in the world, by using and transforming knowledge in the interest of growth and employment. The Barcelona Declaration is one-dimensional in the sense that it focuses exclusively on the R&D expenditures of the member countries – with the objective being that these should be 3 % of GDP. The Barcelona Declaration may also be questioned, since it focuses upon a measure of input into the innovation process, without addressing the efficiency with which these resources are being used, i.e. what the resulting innovation output is. In addition, some countries already have a R&D intensity higher than 3 % of GDP.

[4] These authors tend to include both rules of the game and players in the term institution. Please compare how this term is used by Freeman and by Lundvall as addressed in section 2.1 of the introductory chapter in this book.

[5] Some of these quantitative data are presented in Appendix 1: Statistical bases of comparison for ten 'small country' NSIs in this book.

[6] The discussion in this paragraph is based on the Finnish chapter in this volume (Sections 5 and 7).

[7] Of course, the absolute levels of GDP per capita for these years are quite different. In 1975, GDP per capita (in 1990 US dollars converted to 'Geary-Khamis' purchasing power parities) for Finland was $11 441

and in 2006 it was $23 191, having doubled over the 1975-2006 period. (Source: Groningen Growth and Development Centre and The Conference Board, Total Economy Database, January 2007, available at: http://www.ggdc.net.)

[8] The two differences between the approaches of Nelson and Lundvall discussed are here treated as separate issues – although there are certainly relations between them.

[9] Here, specialisation is measured in terms of change in production structure, not in terms of patenting.

[10] This means that the systemic approach consciously decreases the degree of rigour and formality. It specifies 'problems' on an empirical basis and in a pragmatic way – not by referring to a formal model.

[11] This is the reason why innovation policy is not considered to be a separate activity.

[12] This led to public subsidies to old sectors such as textiles and shipyards in Sweden in the 1970s and 1980s. The support to the shipyard industry absorbed 0.5 percent of the Swedish GDP over a 10 year period, but did not have any lasting results.

[13] Please see the discussion of rationales in Section 5.1.

[14] The support to the shipyard and textiles industries in Sweden is one example.

[15] As already mentioned, such problems and unexploited opportunities cannot be identified by comparing empirically existing NSIs with optimal or ideal ones (simply since no-one can specify an optimal SI). Hence the main methodology for identifying such problems and opportunities is to compare empirically existing SIs with each other.

[16] The rationale for dealing with these two aspects together is that they are partly related in the sense that an analysis of strengths and weaknesses of the NSI should be a basis for the formulation of future innovation policies. So should policies pursued earlier and the evaluation of these policies.

[17] Here, the 'right' direction refers to sectors with potential for growth based on further technology development. Naturally, these sectors may vary widely across countries. In Norway, some of the main sectors with high growth potential appear to be specialised supplier industries related to certain established and emerging sectors (including both high and low-tech industries).

[18] For the specification of these two categories see Box 2 in the Introductory Chapter: ‘Key activities in systems of innovation’.

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