

Economic Development and the National System of Innovation Approach

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Introduction

“One major academic aim of the conference is to enrich and enhance the quality of innovation research by applying some of its fundamental concepts such as 'innovation systems', 'competence building' and 'interactive learning' to issues at the core of economic development. It is well known that applying a theoretical framework outside the arena where it was first developed may bring fundamental new theoretical insights”.

In this paper we will try to substantiate what is referred to in the above text taken from the conference web-site for the first Globelics conference. We will try to demonstrate that the application of the innovation system concept on economic development makes more visible some general weaknesses of the concept and gives strong incentives to develop it further. In the development context it becomes clear that we need to understand better the formation of as well as the openness of national systems and the role of power relationships as well as the broader institutional context supporting competence building.

Common roots

The history and development of the innovation system concept indicates that it can be useful for analyzing less developed economies. Some of the basic ideas behind the concept 'national systems of innovation' go back to Friedrich List (List 1841) and they were developed as the basis for a German 'catching-up' strategy. His concept 'national systems of production' took into account a wide set of national institutions including those engaged in education and training as well as infrastructures such as networks for transportation of people and commodities (Freeman 1995).

List's analysis focused on the development of productive forces rather than on allocation issues. He was critical and polemic to the 'cosmopolitan' approach of Adam Smith, where free trade was assumed always to be to the advantage of the weak as well as the strong national economies. Referring to the 'national production system', List pointed to the need to build national infrastructure and institutions in order to promote the accumulation of 'mental capital' and use it to spur economic development rather than just to sit back and trust 'the invisible hand' to solve all problems. It was a perspective and a strategy for the 'catching-up' economy of early 19th century Germany.

¹ This paper overlaps with Charles Edquist: "National Systems of Innovation", Chapter 7 in *Handbook of Innovation*, edited by Fagerberg, Mowery and Nelson, to be published by Oxford University Press in 2004, and with Björn Johnson and Bengt-Åke Lundvall: "National Systems of Innovation and Economic Development", chapter 1 in *Putting Africa First – The Making of African Innovation Systems*, edited by Muchie, Gammeltoft and Lundvall, to be published 2003 by Aalborg University Press.

The first written contribution that used the concept 'national system of innovation' is, to the best of our knowledge, an unpublished paper by Christopher Freeman from 1982 that he worked out for the OECD expert group on Science, Technology and Competitiveness (Freeman 1982: 18). The paper, titled 'Technological Infrastructure and International Competitiveness', was written very much in the spirit of Friedrich List, pointing out the importance of an active role for government in promoting technological infrastructure. It also discusses in critical terms under what circumstances free trade will promote economic development.

It is also interesting to note that while the modern version of the concept of national systems of innovation was developed mainly in rich countries (Lundvall 1992; Nelson 1993; Edquist 1997) some of the most important elements going into the combined concept actually came from the literature on development issues in the third world. For instance the Aalborg version (Andersen and Lundvall 1988) got some of its inspiration concerning the interdependence between different sectors from Hirschman (1958) and Stewart (1977). Other encouragements come from Myrdal (1968

The idea that institutions matter for the performance of the economy that is central in the innovation system approach (Johnson 1988) was originally more generally accepted for 'less developed countries' than for full blown market economies where the market was assumed to solve most problems in an institution-less world (Myrdal, 1968). As we shall see below the importance of institutions for economic development has got new attention recently for example in the contributions of IMF and the World Bank.

To apply the NSI-concept to developing countries may therefore be seen as a kind of 're-export'. Gunnar Myrdal's ideas, inspired by Veblen and developed in 'Asian Drama' (1968), of positive and negative feedback, of cumulative causation, of virtuous and vicious circles and of the importance of institutions, are all easily reconciled with the idea of innovation systems and have to some extent inspired its development. However, in spite of all these connections between the innovation system concept and economic development it is not directly applicable on the countries of the South. Especially, it would be problematic to apply a narrow definition of the innovation system.

Different definitions of innovation systems.

Systems of innovation may be delimited in different ways; spatially/geographically, sectorally, and according to the breadth of activities they consider.

Geographically defined innovation systems may be local, regional, national and supranational. This type of delimitation presumes that the area in question has a reasonable degree of 'coherence' or 'inward orientation' with regard to innovation processes.

'Sectorally' delimited systems of innovation only include a part of a regional, national or international system. They are delimited to specific technological fields (generic technologies) or product areas. They can be, but are not necessarily, restricted to one sector of production. Both 'technological systems' (Carlsson and Stankiewicz, 1995) and 'sectoral innovation systems' (Breschi and Malerba, 1997) belong to this category.

It is, of course, not self-evident what a sector is, and the specification of sectoral boundaries is particularly difficult with regard to new sectors or sectors going through radical technological shifts. Neither is it obvious how territorially defined systems of innovation should be defined in practice and it may be very difficult to give empirical meaning to the notions of 'coherence' and 'inward orientation'. Whether a system of innovation should be spatially or sectorally delimited – or both – depends on the object of study. All the approaches mentioned above may be fruitful – but for different purposes or objects of study. Generally, the different SI approaches complement rather than exclude each other.

There are also different ways of thinking of innovation systems in terms of the breadth of activities and institutions considered. It is obvious, for example, that different authors mean different things when referring to a national system of innovation.

Authors from the US with a background in studying science and technology policy, tend to focus on 'the innovation system in the narrow sense'. The NSI-concept is seen as a broadening of earlier analyses of national science systems (see for instance the definition given in Mowery and Oxley 1995: 80). The focus is upon the systemic relationships between R&D-efforts in firms, S&T-organizations, including universities, and public policy. The relationships at the centre of the analysis are the ones between knowledge institutions and firms and the focus is on high tech-sectors. This narrow approach is not so different from the 'triple helix' concept where universities, government and business are seen as the three important poles in a dynamic interaction (Etzkowitz and Leydesdorff 2000).

The Freeman and the 'Aalborg-version' of the national innovation system-approach (Freeman 1987; Freeman and Lundvall 1988) aims at understanding 'the innovation system in the broad sense'. The definition of 'innovation' is broader. Innovation is seen as a continuous cumulative process involving not only radical and incremental innovation but also the diffusion, absorption and use of innovation. Second, a wider set of sources of innovation is taken into account. Innovation is seen as reflecting, besides science and R&D, interactive learning taking place in connection with on-going activities in procurement, production and sales.

To a certain degree, these differences in focus reflect the national origin of the analysts. In small countries such as Denmark, as in developing countries, it is obvious that the competence base most critical for innovation in the economy as a whole is not scientific knowledge. Incremental innovation, 'absorptive capacity' and economic performance will typically reflect the skills and motivation of employees as well as manifold inter and intra organization relationships and characteristics. Science-based sectors may be rapidly growing but their shares of total employment and exports remain relatively small. In the US, aggregate economic growth is more directly connected with the expansion of science-based sectors. In these sectors big US-firms have an international lead and they introduce radical innovation in areas where the interaction with science is crucial for success.

Common characteristics

While there are competing conceptions regarding what constitutes the core elements of an innovation system, it might still be useful to see what the different definitions have in common.

A first common characteristic is the assumption that national systems differ in terms of specialization in production, trade and knowledge (Archibugi and Pianta 1992). The focus is here upon the co-evolution between what countries do and what people and firms in these countries know how to do well. This implies that both the production structure and the knowledge structure will change only slowly and that such change involves learning as well as structural change.

A second common assumption behind the different approaches to innovation systems is that elements of knowledge important for economic performance are localized and not easily moved from one place to another. In a fictive neoclassical world where knowledge equaled information and where society were populated with perfectly rational agents, each with unlimited access to information, national (or local) innovation systems would be an unnecessary construct. A common assumption behind the innovation system perspective is that knowledge is something more than information and that it includes tacit elements (Polanyi 1966). Important elements of knowledge are embodied in the minds and bodies of agents, in routines of firms and not least in relationships between people and organizations (Dosi 1999).

A third assumption central to the idea of innovation systems is a focus on interactions and relationships. The relationships may be seen as carriers of knowledge and interaction as processes where new knowledge is produced and learnt. This assumption reflects the stylized fact that neither firms and knowledge institutions nor people innovate alone. Perhaps the most basic characteristic of the innovation system approach is that it is 'interactionist'.² Sometimes characteristics of interaction and relationships have been named 'institutions' referring to its sociological sense – institutions are seen as informal and formal norms and rules regulating how people interact (Johnson 1992, Edquist and Johnson, 1997). In a terminology emanating from evolutionary economics and the management literature 'routines' are regarded as more or less standardized procedures followed by economic agents and organizations when they act and when they interact with each other (Dosi 1999). This is a major dimension in which different national systems approaches tend to be in agreement with each other. While neoclassical theory in its ambition to become a general theory imposes one general rule of behavior (utility and profit maximization) on all agents, independently of time and space, the institutional approach recognizes that the history and context makes a difference when it comes to how agents interact and learn.³

² Actually the NSI-approach has much in common with the methodological perspectives of the social psychological pragmatist school of Chicago and not least with the ideas of George Herbert Mead (Mjøset 2002).

³ Concepts such as institutions and routines are useful in a theoretical context but they are somewhat elusive when it comes to empirical and historical studies. It is easier to track the history of R&D-departments, universities and professional training of engineers than it is to capture changes in how people interact and communicate. But the aim for a full-blown analysis of innovation systems remains to understand how international differences in both the tangible technological infrastructure and behaviour affect innovation outcomes.

The rapid diffusion

The diffusion of the SI approach has been surprisingly fast. It is widely used in academic circles. The approach also finds broad applications in policy contexts – by regional authorities, national governments, as well as by international organizations such as the OECD, the European Union, UNCTAD and UNIDO.⁴ The approach appears to be especially attractive to policy-makers seeking to understand differences between economies with regard to innovation processes, and searching for ways to support technological change and other kinds of innovation. Several characteristics of the system of innovation approach contribute to its relevance for policy makers in the North as well as in the South.

It places the focus on innovation and learning processes. This reflects the understanding that innovation is a matter of producing new knowledge or combining existing (and sometimes new) elements of knowledge in new ways as well as diffusing and utilizing it. Thereby the SI approach distinguishes itself from approaches where technological change and other innovations are regarded as exogenous.

It adopts a holistic and interdisciplinary perspective. It is ‘holistic’ in the sense that it tries to encompass a wide array—or all—of the determinants of innovation that are important and in the sense that it allows for the inclusion not only of economic factors but also of organizational, social and political factors. It also encompasses the whole range of different innovations; minor as well as major technical as well as organizational, etc. It is ‘interdisciplinary’ in the sense that it brings together perspectives from different (social science) disciplines.

The SI approach employs historical and evolutionary perspectives. Processes of innovation develop over time and involve the influence of many factors and feedback processes and they are often path dependent. Because of this evolutionary perspective illustrative and instrumentally useful comparisons between different innovation systems can be made, while it is obvious that an ‘optimal’ or ‘best practice’ system of innovation cannot be specified.

The approach emphasizes interdependence and non-linearity. This is based on the understanding that firms normally do not innovate in isolation but interact more or less closely with other organizations, through complex relations that are often characterized by reciprocity and feedback mechanisms in several loops. This interaction occurs in the context of institutions—e.g., laws, rules, regulations, norms and cultural habits. In fact, the central role of institutions is emphasized in practically all specifications of the concept of innovation systems.

These four characteristics may be seen as advantages associated with the systems of innovation approach, which partly explain its rapid diffusion. The fact that these characteristics clearly also seem to be increasingly important in development thinking may also encourage its diffusion into development theory and policy.

⁴ In Sweden, a public agency has even been named after the approach, i.e. The Swedish Agency for Innovation Systems (VINNOVA). The practice of VINNOVA is also strongly influenced by the SI approach.

Some controversial and critical characteristics of the innovation system approach

The system of innovation approach is also associated with problems and weaknesses. For example, there is still some basic confusion regarding central concepts. One example is the term institution, which is used in different senses by different authors – some referring to social norms, such as trust, while others refer to types of organizations, such as universities.

Another example is that there is no agreement among scholars systems of innovation regarding what should be included in and what should be excluded from a ‘(national) system of innovation’. At can also be pointed out that ‘systems of innovation’, is not a formal theory, in the sense of providing propositions as regards established and stable relations between well defined quantitative variables.

There are different attitudes and strategies in relation to the conceptual ambiguities and the theoretical status of the systems of innovation approach. One position is to consider it to be an advantage that the concept of national system of innovation is broad and flexible enough to serve as a framework for organizing knowledge.⁵

Another position is to argue that the NSI approach is ‘under theorized’ and needs to be made more precise in its terminology and in its definition. The problems mentioned are then regarded as weaknesses and it is argued that conceptual clarity should be increased. Ambiguities should be sorted out and the approach should be made more ‘theory-like’. Its degree of rigor and specificity should be increased, e.g. with regard to statements about relations between variables.⁶

Maybe we do not have to choose between flexibility and breadth on the one hand and rigor and formalism on the other. Innovation systems thinking may productively continue to thrive as appreciative theory while at the same time it draws upon elements of formal theory. The following quote may be interpreted in this way:

“The concept is rather broad so although it can be translated into manuals for studies of concrete national systems of innovation, it is not in its present form easily integrated into any theoretical discourse. The pragmatic and flexible character of the concept may be seen as a great advantage since it makes it useful for practical purposes. At the same time we believe that efforts should be made to give the concept a stronger theoretical foundation through additional work in the neo-Schumpeterian and evolutionary economic tradition to make the concept of national innovation systems better suited as a tool for theoretical economic analysis.” (Lundvall et al 2002: 221).

A more radical position would be to argue that social science will never become formalized ‘general theory’ and that the attempts to reshape it into such a type of

⁵ One statement that might be interpreted to support this view is the following: “The pragmatic and flexible character of the concept may be seen as a great advantage since it makes it useful for practical purposes.” (Lundvall et al 2002: 221) Another one is: “...heuristic concepts and focusing devices such as national systems of innovation may play a major role since they offer a broad and flexible framework for organizing and interpreting case studies and comparative analyses.” (Lundvall 2003: 9)

⁶ Such a view has, for example, been expressed by the OECD: “there are still concerns in the policy making community that the NIS approach has too little operational value and is difficult to implement” (OECD 2002: 11)

theory is doomed to lead both to inconsistency and disappointments. Seen from such a perspective the kind of comparative historical approach implicit in innovation system research may actually be seen as close to the ideal for how to build cumulative understanding of socio-economic phenomena (Mjøset 2002).

In the present context, it seems safe to conclude that it is the flexibility, breadth and pragmatism of the innovation system approach in combination with its ability to focus on what seems to be increasingly important, i.e. learning and innovation, more than its formal theoretical rigor, which has inspired its diffusion into development thinking. It remains to be seen, of course, if this is useful or not.

New Tendencies in development thinking

Under all circumstances the approach needs to be adapted to the specific needs of developing countries. One way to do this is to look at three recent tendencies in development thinking:

First, there is an increasing focus on capabilities rather than resource endowments as the main instruments and values in development. This tendency can be exemplified by work by Amartya Sen.

Second, you can observe a new focus on knowledge as the perhaps most crucial resource driving development. This can be illustrated by several recent reports from the World Bank.

Third, there is a tendency to underline the primary importance of institutions as the 'root causes' of development dwarfing the importance of all other factors such as geography and policies. Both the World Bank and the IMF has recently underlined this view.

We will now demonstrate how these three dimensions may be integrated into the NSI-approach and vice versa how this results in a broadening of the approach that makes it more relevant for development studies. Integrating them helps us to form a new perspective on development, which is already implicit in the broad version of the national innovation system approach.

The three tendencies are quite interesting since each of them represents a broadening of the more narrow economic views on economic development. At the same time they are myopic when seen from the perspective of 'innovation systems in the context of the learning economy'.

The capability approach introduces and underlines several capabilities (or 'freedoms' in the language of Sen) but more or less disregards learning capabilities. The World Bank focuses on knowledge and its diffusion from the North to the South but seems to underestimate the role of learning and innovation processes in the North and particularly in the South for knowledge creation and utilization. In a related manner the new interest in institutions of the IMF gives little attention to the institutions supporting learning and innovation. Bringing the three perspectives into the theoretical framework of innovation systems in the learning economy confirms that institutions are crucial for economic development. But what comes out, as the most

significant institutions, will be different when focus is moved toward innovation and competence building.

A Capability Based Approach

Amartya Sen (1999) presents a capability-based approach where development is seen as an expansion of the substantive freedoms that people enjoy. Substantive freedoms are defined as the capabilities people have to live the kind of lives they have reason to value. They include things like being able to avoid starvation and under nourishment, diseases and premature mortality. It also includes the freedoms of being literate, able to participate in public life and in political processes, having ability and possibility to work and to influence one's work conditions, having entrepreneurial freedom and possibilities to take economic decisions of different kinds. Enhancement of freedoms like these is seen as both the ends and means of development.

This way of looking at development refers to the capabilities people have to act and to choose a life they value, rather than to their level of income and possession of wealth. Poverty, for example, is in this perspective more a deprivation of basic capabilities than just low income. Human capabilities rather than resource endowments are the fundamental factors of development.

There is a strong institutional dimension in this. Capabilities depend on institutions, i.e. on the political, social and economic arrangements of society. To build, sustain and improve capabilities processes of organizational and institutional change are required. Accumulation of wealth is not enough. When one tries to create institutions, suitable for development, one needs to focus not only on how to 'break down the barriers of caste, color, religion, ethnic origin, culture, language, etc.' (Myrdal 1968) but also on how to liberate and improve human capabilities. Development depends on interconnected instrumental freedoms rooted in political, social and economic institutions.

Another aspect of Sen's approach is that from the instrumental point of view the different freedoms – political freedoms, economic facilities, social opportunities, learning opportunities and so on – are linked and feed upon each other. Political participation depends on education and trust; education and training depends on income and social security; economic facilities depend on health care, education and participation, etc. This has to do with the systemic character of the institutional set-up, which is an important aspect of Sen's way of thinking about development.

The Missing Capability

Sen's approach fits well into a system of innovation approach. It is noteworthy however that learning and innovation capabilities generally do not seem to be explicitly included in this or other capability based approaches to development.

A similar 'omission' seems to be common also in approaches, which otherwise have a focus on information and knowledge. Expressions like 'information divides', 'technology divides' and 'knowledge divides' between North and South have become

common and accepted by dominating policy actors such as the World Bank⁷. This is an important shift from earlier positions. As an aspect of a capability based development concept, however, it may be more important to identify and analyze the learning and innovation divide between North and South. Knowledge may indeed be viewed as a central resource and development factor, but what matters most may be the capability to produce, spread and utilize it. The learning divide, more than the technology divide, may, thus, be the crucial factor in the North/South relationship, which development policies have to take into account (Arocena and Sutz 2000).

This should not be misunderstood. There is an enormous amount of learning in the South and there is no reason to assume that individual capabilities to learn are different between the North and the South. What we primarily refer to here, however, is the infrastructural, institutional and organizational underpinnings of learning. Furthermore, we focus on learning related to technological and organizational capabilities suitable to establish and defend competitive positions on the world market.

The developmental value of learning capabilities is closely related to the connection between learning and innovation. In economic terms development depends on technical and organizational change brought about by continued processes of innovation. Innovations introduce technical and organizational knowledge into the economy. They are important means in the process of development. We can think of them as 'learning results' contributing to the removal of 'unfreedoms' like ignorance, lack of learning opportunities and lack of economic opportunities and we can think of them as contributing to the enhancement of substantive freedoms like the capability to work, communicate, learn and to participate democratically in political processes.

We can also think of learning processes as forming the preconditions for innovation; learning does not always result in innovation, but without learning there would be no knowledge to introduce into the economy as innovation. Technological capabilities of firms, for example, develop over time as a result, not only of firm specific learning but also of different kinds of interaction, co-operative as well as competitive, between firms and other organizations. Capability building involves interactive learning by individuals and organizations taking part in processes of innovation of different kinds.

The learning capability is thus one of the most important of the human capabilities. It does not only have an instrumental role in development but also, under certain conditions, substantive value. When learning takes place in such a way that it enhances the capability of individuals and collectives to master and co-exist with their environment it contributes directly to human wellbeing. To be able to participate in learning and innovation at the work place, for example, may be seen as 'a good thing' contributing to a feeling of belonging and significance.

When we say that the learning capability is missing from the capability based approach it is, admittedly, not entirely true. The importance of R&D capacity (which may be regarded as a kind of learning) for development is widely recognized. Many OECD countries have, for example, programs for research capacity enhancement as

⁷ Several of the latest World Development Reports from the World bank have focused on knowledge. For example the 1998/99 report states that: "This World Development Report proposes that we look at problem of development in a new way – from the perspective of knowledge"

part of their development support. It is well known that research capacity is unevenly distributed between countries and that developing countries largely lack such capacity. In most countries in the world today little R&D is carried out and most of this is performed in public organizations. Most of these countries are poor and medium-income countries. Those few countries that do a lot of R&D are all rich, and much of their R&D is carried out by private organizations. This includes some large countries, such as the USA and Japan, but also some small and medium-sized countries such as Sweden, Switzerland and South Korea. There are also some rich countries with less R&D-intensive production, e.g. Denmark and Norway.

It is also true that the capability-based approach, like most other approaches, emphasizes the importance of education and training. Inadequate schooling and vocational training are widely considered to be main barriers for development in large part of the South.

What is missing in the capability based approach, as well as more generally in development theory, is a focus on learning capabilities as a whole; the many different kinds of learning, which are going on in society, i.e. in rural areas, villages, firms and organizations in the public sector as well as the private. Only a part of this takes place in the formal education system or in the research system. What needs to be understood is how and to which extent individuals, communities, firms and organizations are geared to learning and innovation, either by themselves or in interaction with others. Is there a 'learning culture'? Is there an adequate institutional underpinning of learning? As more and more countries in the North are developing towards 'learning societies' and economic change accelerates, it becomes more and more important to focus on the knowledge infrastructure and learning in a generic way, to understand how broadly based learning capabilities are formed and developed.

Institutions and development

We have seen that Sen's capability based approach regards the importance of a broad spectrum of interrelated institutions. We have also mentioned that there is a new tendency of focusing on institutions as perhaps the most important development factor. This tendency is interesting and useful. One may wonder, however, if the relatively narrow spectrum of institutions, which are in focus, really can explain so much of the development process as it is claimed.

According to the World Bank (2002: 8), institutions have three main objectives: They channel information about market conditions, goods, and participants, they define and enforce property rights and contracts and they regulate competition.

Within this framework, transaction costs that determine market opportunities typically stem from insufficient information, incomplete definition and enforcement of property rights, and barriers to entry to markets. These problems, as excessive transactions costs in general, have to do with inadequate institutions. Improved institutions that prop up market exchange and raise returns would support development.

Admittedly, there is a tendency to draw a broader range of institutions into the picture, for example in the World Development Report from 2003, which for example

discusses the importance of balancing different interests with the help of institutions that have to do with transparency, voice and forums for negotiation (World Bank, 2003). This report also takes a broad and dynamic view of how institutions are formed. Especially the feedbacks between institutions and policies are discussed. Still, the main focus remains on transactions costs and markets.

In recent publications also IMF emphasizes the importance of institutions for growth. Sometimes institutions are even referred to as 'root causes' in economic development (Acemoglu, 2003). Some times the power acknowledged to institutions is quite impressive. World Economic Outlook from April 2003 (IMF 2003) for example concludes that if the quality of institutions in sub-Saharan Africa were to 'improve to the levels in developing Asia', per capita income would rise by 80 per cent and if its institutions 'rose to world average levels' the average per capita economic growth rates would become 2 per cent higher. The question of how to close these 'institutional gaps' (Johnson and Lundvall 1992) is not discussed very much by the IMF, however. Like the World Bank, IMF focuses on a narrow range of market supporting institutions related to the security of property rights, good governance and measures to restrict corruption.

We are not arguing here that well functioning markets are not important for development, far from it. Neither do we deny the importance of uncorrupted civil servants and efficient regulation procedures in the economy. There is evidence that entrepreneurship and innovation in many developing countries are severely hampered by red tape and slow and costly regulation. Often the business regulation is a legacy of colonialism rather than of the present needs of country in question (World Bank, Doing business in 2004). The point, however, is that the crucial question of how institutions may support learning and innovation is not raised (except for the role of the formal school system, which belongs to the 'established' growth factors). The impact on learning and innovation of, for example, labor market institutions, financial institutions, economic policy regimes and a host of norms supporting (or undermining) a learning culture are not analyzed.

Innovation systems and development.

As a way of summarizing these critical observations on some new tendencies in development thinking one might say that even if both institutions and knowledge seem to be moving into the center of the stage the question of how they interact and co-evolve shaping learning and innovation and driving the process of development is not explicitly raised.

It seems to us that the broad definition of national systems of innovation may be useful in this context. This would, of course, include a broad definition of innovations themselves. A wide definition of innovation should be used including product innovations (both material goods and intangible services) as well as process innovations (both technological and organizational ones). In innovation studies there has traditionally been a tendency to focus much more on material and technological innovations than on non-technological ones. Service product innovations and organizational process innovation have been relatively neglected. There are strong reasons to use a comprehensive innovation concept and give more attention to non-technological kinds of innovation. Included in the broad approach would also be a tendency to transcend the more common definitions and move toward an even

broader concept such as 'systems of competence building and innovation' rather than just 'systems of innovation'.

A broad definition of national systems of innovation fits well with both the new focus on capabilities and the focus on institutions since it implies that a broad spectrum of socially based inter-linked capabilities is necessary for efficient innovation processes or for well performing innovation systems. The concept of innovation systems may, thus, be a tool for understanding the relations between different kinds of capabilities and between the constitutive and instrumental aspects of freedoms in developing countries. We can think of well performing innovation systems as contributing to the removal of unfreedoms like ignorance, lack of economic opportunities and poverty and we can think of them as contributing to the enhancement of substantive freedoms. The viewpoint taken here is that improving learning and innovation capabilities is not only a question of more resources for education and research (more and better schools and universities, etc.) but also of shaping and reshaping a broad set of institutions in order to support interactive learning and innovation broadly in many parts of society including the individual families, communities, firms and organizations.

The introduction and utilization of knowledge into the economy (and into the society at large) cannot be realized just by giving citizens access to flows of information through IT-networks. It requires active and interactive learning by individuals and organizations taking part in processes of innovation of different kinds. The efficiency of these learning activities and, hence, the performance of the innovation systems depends of economic, political and social infrastructures and institutions. It also depends on past experiences as they are reflected in the tangible and intangible aspects of the structure of production and on values and policies.

We have argued here that there are good reasons for using a broad concept of innovation system in connection with development analysis especially when focusing on countries in the South. A narrow innovation system concept focusing on the research and development system and on high tech and science-based innovations may be quite adequate for some purposes in the North but it does not make much sense in the South. There are several reasons for this.

In a relatively well-developed and 'complete' national system of innovation it may be less problematic to analyze a specific subsystem. If there are adequate knowledge infrastructures and intellectual property rights and if there are good networking capabilities and high levels of trust, there is also an adequate basis for an efficient research and development system. It may then be quite possible to analyze the details of this subsystem without worrying too much about the connections to, and character of, the rest of the innovation system. But this is typically not the case in the South, which makes a broad approach preferable.

Another reason is that the need and opportunity to build on local knowledge and traditional knowledge may be relatively bigger in the South than in the North. The existence, character and usefulness of this knowledge may not be well known to national and international firms and policy makers. It is therefore vital to underline the importance of tacit knowledge and to draw attention to the need not to lose large parts of mostly not codified and undocumented local competencies. Local knowledge is easily forgotten when economies in a quick tempo are opened up to international

competition and societies accordingly restructured. A broad concept of innovation systems helps you to see the importance for development of *different* kinds of knowledge and the ways they complement each other.

Weaknesses in the Innovation Systems Approach.

Above, when discussing the diffusion of the systems of innovation approach we also pointed out a number of its weaknesses. When applied to countries in the South it is even more important to be aware of some weaknesses of the innovation system approach, as it has been used so far. Some of these have directly to do with the fact that it has mostly been applied to the North. It has been used mainly as an ex-post rather than as an ex-ante concept. It has been used to describe and compare relatively strong and diversified systems with well developed institutional and infrastructure support of innovation activities. Usually the perspective has been that innovation processes are evolutionary and path dependent and that systems of innovation evolve over time in a largely unplanned manner.

The system of innovation approach has not, to the same extent, been applied to system building. When applied to the South the focus ought to be shifted in the direction of system construction and system promotion and to the fact that innovation policy is a conscious activity that can supplement the spontaneous development of systems of innovation. Furthermore, the relationships between globalization and national and local systems need to be further researched. It is important to know more about how globalization processes might affect the possibilities to build and support both national and local systems of innovation in developing countries.

Another important weakness of the system of innovation approach is that it is still lacking in its treatment of the power aspects of development. The focus on interactive learning – a process in which agents communicate and even cooperate in the creation and utilization of new economically useful knowledge – may lead to an underestimation of the conflicts over income and power, which are also connected to the innovation process. Interactive learning and innovation immediately sounds like a purely positive sum game, in which everybody may gain. In fact, there is little learning without forgetting. Increasing rates of learning and innovation may lead not only to increasing productivity but also to increasing polarization in terms of incomes and employment. It may be more common in the South than in the North that interactive learning possibilities are blocked and existing competences destroyed for political reasons related to the distribution of power.

It is thus clear that the innovation system approach needs to be adapted to the situation in developing countries, if it is to be allied to system building. It seems also clear, however, that the holistic and systemic character of the approach and its focus on production based tacit knowledge and on learning by doing, using and interacting should make it possible to implement such adaptations.

Concluding remarks

To apply the concept of a national innovation system to the South may in some cases be seen as something of a provocation. In some countries many people suffer from fundamental problems having to do with insecurity, poverty and diseases and here it might seem irrelevant to focus on fancy concepts such as innovation and competence building. To a certain degree we accept this view. There is even a risk that for policy

makers the use of new fancy development concepts becomes a cover up for not tackling other more fundamental problems.

If new institutions have to be built it might be better to start with a focus on creating order and basic living conditions. This may seem as a precondition for people's incentives and opportunities to engage in learning new competences and be innovative. In order to be able to build competence and innovate it is important to establish institutions that enhance order, trust and predictability in the life of individuals and in the workings of firms and other organizations.

On the other hand there is little doubt that the long term effort to promote economic development needs to be oriented towards competence building and innovation also in what may appear to be a dismal situation. To mobilize existing technology and knowledge when building new production capacity is necessary in order to make production competitive in the global economy. To constantly and gradually upgrade technological capabilities is necessary in order to remain competitive. This implies a need for mobilizing people in processes of education and life-long learning. The intelligent use of information technology offers new opportunities in all these respects but it will only take place if the infrastructure is built.

But perhaps what seems like a contradiction may be eased by a double focus on basic living conditions and competence building. Building institutions to create order and stable living conditions is necessary to give people the opportunity and incentives to engage in learning new competences. But such institution cannot be built without engaging people in competence building and learning. Learning and innovation is not a luxury but necessary and basic processes, which have to be parallel to and interact with poverty alleviation. And this is not so out of reach, as it may seem. Innovativeness is a basic condition for daily survival in many poverty stricken areas in the South.

There is another double focus, which needs be taken into account. The South is rich in competences and skills and some of them may be used to produce attractive goods for the world market. There is a need to map, develop and utilize such skills and find ways to utilize local knowledge. But in order to eradicate poverty and to engage in social and economic development it is not sufficient to produce on the basis of such skills and knowledge. 'Borrowing' and adapting technologies that the technological lead countries control today is an important key to development. The combination of reverse engineering, licensing, sending scholars abroad, inviting foreign firms and experts and engaging in international scientific collaboration may be difficult to achieve but all these elements need to be considered in building the national innovation system. It is a major challenge when building national systems of innovation to develop national strategies that make it possible to select technologies and institutions from abroad that support innovation and competence building.

Finally we would refer back to the introduction to the paper and argue that several of the new ideas for developing the innovation system concept so that it becomes more useful for development strategies will enrich the concept and make it more useful also in the context of developed countries. The more dynamic perspective where it is a question of understanding the creation, evolution and reconstruction of innovation systems rather than just the way they function is certainly useful. To be more explicit

on the conflicts that are involved in innovation and learning processes is another useful correction of a too harmonious starting point. Finally, the potential and the limits of 'national' perspectives may become more clearly understood when we focus on countries where the nation state is heterogeneous, weak and exposed to strong post-colonial influences from international organizations dominated by the big rich countries.

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