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Chapter 11

Innovation and Sustainable Development in Central America Policy Issues

Birgitte Gregersen, Bjørn Johnson, Jeffrey Orozco

1. Introduction

In this book the systems of innovation approach has been applied to different aspects of sustainable development in Central America. This implies a focus on learning and innovation as driving forces in development trends, at least in the beginning, a reduction in the emphasis given to other perhaps more traditional and well-known development factors such as trade, saving and investment, international capital movements, and income distribution. There is more to development than innovation. Selectivity in what you look at and in what you see is an inevitable companion to any theoretical approach. This is not in itself a problem, but rather a warning against theoretical myopia and one-sidedness when studying such a complex and encompassing process as sustainable development.

The same warning is relevant when studying development policies. To focus on the policy implications of innovation system approaches, as we do in this chapter,

is not meant to belittle other development policies that may seem to have small immediate effects on innovation. Furthermore, it is an argument for theoretically diversified approaches; policies that first seem detached from the innovation issue often later on turn out to have strong impacts on innovation processes.

However, at the same time as the innovation system approach narrows the perspective on development policies, it concentrates its attention on processes that are at the very center of development. Therefore, when we concentrate on policies that follow from systems of innovation approaches, it is in line with the increasing recognition of the key importance of knowledge and learning in the development process. In an increasingly innovation-driven capitalism, development policies and strategies must have a strong focus on innovation (Metcalf 2007).

This chapter is organized in the following way: In sections 2 and 3, the innovation systems approach is described briefly, first in general terms and, then, in connection to the South. In section 4, some policy implications of this approach are discussed. Then in section 5 the concept of policy learning is defined, and it is argued that sustainable development requires policy learning. Section 6 gives some examples of policy learning in relation to sustainable development in Central America, and, finally, section 7 provides some concluding remarks.

2. Innovation Systems Approaches

An innovation system approach to the study of innovation as an integrated part of the economic process encompasses the identification and analysis of all important factors affecting innovation. Clearly both the character of the firms and organizations and the quality of their interactions influence the innovation performance of the

system. One way of organizing these factors analytically is to distinguish between organizational factors, structural factors, and institutional factors.

How firms are organized and managed affects the patterns of communication within and between them and hence their capabilities for learning and innovating. It is, for example, possible to empirically identify different modes of innovation. Jensen et al. (2007) identify two ideal modes. One is based on production and utilization of codified scientific and technical knowledge, the STI-mode. Another builds on more experienced-based knowledge acquired through learning by doing, using and interacting, the DUI-mode. Different mixed forms containing elements from both the STI and the DUI forms also exist. In fact, firms that combine elements from both modes also seem to be the most innovative ones.

It is well known and documented that the distribution of technological opportunities and bottlenecks differ between production sectors and change over time. This leads to technological trajectories and implies that the specialization pattern of an economy; i.e., its structure of production and trade, affects its innovation performance. Economic structural factors of this kind do not, of course, totally determine innovation activities, but they clearly influence them.¹

Finally, almost all scholars of innovation systems stress the importance of institutional factors. This is not surprising since institutions can be thought of as something leading to regularities of behavior and patterns of communication and interaction. Institutions in this sense may be formal like laws and written regulations or informal like social norms and shared routines and habits, but in both

¹ Other structural factors like the ownership structure and the firms' size distribution are relevant as well.

cases they deeply affect how people, firms, and organizations communicate and interact. As a result, they also deeply affect the creation and utilization of new knowledge in the economy. The co-evolution of the economy and its institutions is a major factor in the shaping of innovation systems.

In the literature one can identify a narrow and a broad innovation system approach. The narrow approach concentrates on the public and private research and development system and on high-tech and science-based innovations. The broad approach elaborates on the observation that innovation processes have many sources and are broadly based in the economy. They often emanate from everyday economic activities like production and marketing, and they often take the form of minor improvements of products and processes. In the broad approach innovations are ubiquitous. Neither of these two approaches is in itself better than the other. However, in a context of sustainable development in the South, the broad version is most relevant. To focus narrowly on science-based innovation in high-tech sectors may result in an underestimation of innovation capabilities and potentials, since these often occur as incremental improvements and adaptations in medium and low-tech sectors as well as in the informal sector.

Furthermore, tacit knowledge such as competencies and skills that cannot be made explicit and easily communicated among individuals or transmitted through telecommunication networks, but which is tied to persons or groups, plays an important role in the broad approach to innovation systems. Tacit knowledge is crucial for economic dynamics. Engineers use tacit knowledge when they solve technical problems; managers base complex business decisions on tacit knowledge; scientists use tacit knowledge when doing research, etc. To share tacit knowledge among

persons, groups, and organizations is costly and time consuming, but it is an integrated part of economic change and development, and it underlines the relevance of a broad systems of innovation approach.

3. Innovation Systems in the Countries in the South

The innovation system approach was developed in the North and has concentrated on the dynamics of these countries. Now the interest in innovation systems is growing in Latin America, Asia, and Africa. This may not be surprising since many of the primary elements of this approach are imported from development literature. The focus on interactions among different sectors and economic activities was crucial for Hirschman (1958). The idea of cumulative causation, especially in the form of vicious and virtuous circles, started with Veblen and was further developed by Myrdal (1968), who also emphasized the importance of institutions.

A reason for the increasing interest in the innovation system approach applied to the South is that it concentrates on factors and relationships that many scholars believe to be significant in development (Johnson and Segura 2001). It is «capability based». It is based on learning capabilities and focuses on innovation processes and their role in development. It has a broad explanation of innovation that is seen both in research and in everyday, routine economic activities, in both high-tech and low-tech sectors, and in both the formal and the informal part of the economy. Its drivers are interacting and feeding upon each other. Institutions and production structures matter. Interaction among firms, organizations, and the public sector is essential. Furthermore, it is a flexible approach that can put emphasis on either local, national, or regional systems and their mutual interdependence. It includes an actor-centered

approach to development that takes the roles of both state and market actors into account. At the same time, it goes beyond the normal dichotomy between state and market by focusing on the interactions and complementarities between them and by drawing attention to civil society and its role in the innovation process. Finally, it is an inherently comparative approach; it does not try to define illusive optimal states of equilibrium but compares the anatomy and change of different innovation system.

However, when applying an innovation system approach to countries in the South, it is also important to be aware of some weaknesses. It has been used mainly as an ex-post rather than as an ex-ante concept (Arocena and Sutz 2002). It has been used to describe and compare relatively strong systems of innovation with well-developed institutional and infra-structural support of innovation activities. It has not, to the same extent, been applied to system building. Since the innovation systems in the South often can be described as fragmented and weak, the focus tends to shift in the direction of system construction and system promotion.²

Even if the approach covers both territorial and sectoral systems of innovation, and even if territorially defined systems in principle include local, national, regional, and global systems, the focus in the research on territorial systems has so far mainly been on regional (within countries) and national systems. In the context of a developing country, one should devote much more interest to local systems and their interaction with regional and national ones.³

² To some extent this has already been done; see, for example, studies of innovation systems in Brazil (Cassiolato, Lastres and Maciel 2003).

³ For a discussion of local systems of innovation in El Salvador, see Cummings (2007).

An important weakness of the system of innovation approach when applied to developing countries is that it lacks an adequate treatment of the political issues and power aspects of development. Introducing new technology and altering the control of knowledge is often an instrument for changing the power structure. The focus on interactive learning—often described as a process in which agents communicate and cooperate in the creation and utilization of new economically useful knowledge—has led to an underestimation of the conflicts over income and power that are also connected to the innovation process. Interactive learning and innovation may seem like a positive sum game in which everybody wins. However, there is little learning without forgetting. Skills and competencies are destroyed and incomes and power are redistributed. Some people make gains and some suffer losses. Increasing rates of learning and innovation often lead to increasing polarization.

Of course, it does not have to be that way. Different policies might counteract the polarization tendency, but it is inherent in the innovation process and counteracting policies may not be implemented as often in the South as in the North. Furthermore, an amount of stability in the macroeconomic and financial environment, including well behaved and not overly conflict provoking fiscal and monetary policies, is important for interactive learning and innovation. Again, such stability is typically lacking in developing countries. Corruption and lack of trust may also aggravate the situation. It is clear that the system of innovation approach has to be significantly modified when applied to countries in the South.

The main thrust of the innovation system argument is quite evident, however. Policies in the South need to reinforce and improve the existing local, national, and regional systems of innovation. In so doing, they also need to counteract tendencies in the present process of

globalization to dismantle and break-up linkages in the previously existing innovation systems.

4. Policy Implications of the System of Innovation Approach

Gradually, some policy implications of the innovation system approach have taken form. Some of them are on a general level and are rather obvious. In spite of the existence of an important and broadly accepted literature showing that innovation may be both science-based (the STI-mode) and experience-based (the DUI-mode), there is still a bias among statisticians, scholars, and policy makers to regard it largely as connected to formal R&D, especially in science-based firms (Jensen et al. 2007), but innovation policy should not focus exclusively on science and technology or on high-tech firms. It should acknowledge the existence of both STI and DUI modes of innovation, and it should, more broadly, consider the needs of many sectors and different kinds of firms and organizations and include both the creation and the diffusion and utilization of knowledge.

Innovation policy should concentrate on the systemic character of innovation, on framework conditions and network relations—avoiding lock-in to outmoding technologies and sectors and keeping options open. Factors at the enterprise level that affect innovation capabilities like management, organization, training, and education are important and policy relevant. At the same time, since many types of knowledge are combined in innovation and since the sources of this knowledge often lie outside the individual firm, its external organization and surrounding institutions matter as well. Sector targeting is common in development policy, but it usually makes more sense to concentrate on sectors with infrastructural characteristics like education, health, and environment than on more narrowly defined presumed future winners.

In mainstream economic theory, the term “system” seems to evoke the idea of equilibrium. The existence, uniqueness, and stability of equilibrium situations attract much interest. Innovation systems, however, are systems in which equilibrium situations are analytically dubious. Innovations are processes changing over time in which new knowledge is created and utilized. This is in contradiction to the notion of equilibrium, which is normally understood as a situation in which economic agents have no reason to change decisions which were presumably made, at the time, on the basis of all available relevant knowledge.

Equilibrium analysis cannot be a guideline for innovation policy. Like institutional analysis, innovation system analysis and innovation policy rely heavily on comparative methods. Comparing regions, countries, and sectors with focus on how different organizations and institutions affect innovation processes, bearing in mind that the same type of performance may result from different organizations and institutions, have to play an important role in innovation policy.

A final general observation is that a policy that works by changing and «improving» organizations, institutions, and knowledge has to have a historical perspective. To contribute to the learning capability of people, firms, and organizations in order to improve the performance of innovation systems is a long-term project that has to operate with quite another time perspective than, for example, that of a macroeconomic stabilization policy.

These general implications constitute a new policy perspective with a focus on long-term learning and competence building in firms and organizations and in society as a whole. This perspective is useful but not very specific, and it is not always obvious which types of concrete policy measures it implies. Furthermore, more often than not the relevant policies are not clearly defined and

understood. They need to be developed. The learning and competence building perspective discussed above needs to include the policy making process itself. “Policy learning” is an important part of economic development.

5. The Need for Policy Learning

5.1. Increasing Transformation Pressure

When the innovation system approach is applied to developing countries, the perspective needs to be shifted towards system building and system improvement, including structural, institutional, and policy change. The importance of innovation system promotion becomes even more obvious in the case of small open economies trying to encourage sustainable development, such as the countries of Central America. These countries are facing the combined challenges of political, social, and economic development and environmental protection in a period of increasing international competition.

An important aspect of globalization has been institutional change related to the process of economic liberalization, such as the dismantling of financial regulations and deregulation and privatization of public utilities. Part of this liberalization is connected to the development of information technologies, but there are also political forces related to changing power relations involved.

One result of the globalization process with its technical, economic, demographic, institutional, and cultural aspects is that the typical small, relatively poor, environmentally vulnerable Central American country is put under strong pressure to undergo transformation. It includes pressure for new and improved government policies—not only monetary and fiscal policies but especially policies to improve the learning and innovation

capabilities and the performance of the national systems of innovation.

5.2. *Policy Learning*

This situation calls for “policy learning”. In textbooks, economic policy is traditionally described as a branch of rational decision-making. Politicians decide which goals to pursue and economists, given a reasonably accurate model of the economy and access to relevant and sufficient data, calculate the best use of the available instruments in order to achieve the goals. This rational choice perspective has tended to exclude another important aspect of policymaking; that is, that it is a process of learning. It can make a fundamental difference if the process of policy learning is handled badly or well, and if it is slow or fast.

To clarify what policy learning is about, one can refer to the case of the macroeconomic stabilization policy. It may be argued that Keynesian fiscal policy was born in Sweden in the 1930s several years before the publication of «The General Theory» in 1936.⁴ It took a considerable number of years, however, before a capability to conduct a reasonable effective counter-cyclical stabilization policy was developed. The first employment policies, such as governmentally financed construction investments, increased public consumption, and unemployment benefits leading to budget deficits were forced onto the political agenda and implemented against strong political opposition and against the advice of most economists, who were arguing for balanced budgets based on what in those days seemed to be sound theoretical grounds.

Later, and over a long period of time, experiences and practices, administrative competence, statistical data,

⁴ A similar argument may be made about the New Deal in the US starting in 1933 under President Roosevelt.

national accounts, policy-making organizations in the government, organizations for economic counselling and advice, macroeconomic theory and visions, and ideas about what was politically and economically possible and valuable co-evolved in a self-reinforcing way. Considerable development of values, institutions, and organizations were required before macroeconomic stabilization policy was established on the policy scene.

5.3. *Innovation Policy Learning*

Innovation policy may be regarded as a new area of policy learning. It includes many aspects. In terms of theory, simple linear models of innovation have been replaced first by more complex, “chain-linked” models, and then by innovation system approaches. Parallel to this, the statistical descriptions of innovation activities and innovation performance have become better. Infrastructures like universities, libraries, and databases as well as institutions like intellectual property rights, technological service systems, tax rules, and government subsidy systems have been improved, too. Gradually, and in interaction, the theories, practices, and institutions of innovation policy have become a normal part of economic policy.

The innovation policy learning process has so far mainly taken place in a rather limited number of sub-areas. Even so, it is now possible to identify at least the following six innovation policy types, excluding policies that affect innovation as unintended side effects of policies with other targets:

(1) *Policies to strengthen the knowledge infrastructure*, consisting of universities, schools, training systems, research labs, telecommunication networks, libraries, databases, etc. (Smith 1997). This includes measures to connect universities to firms and government

support of human resource development. The changing environment of both firms and universities and other research organizations affects their collaboration. Research networks, science parks, research joint ventures, private/public partnerships, and incubator arrangements are a few examples of new forms of network-based collaboration. Most European countries have set up specific programs like these to stimulate further collaboration among firms, universities, and research organizations. They are much needed in developing countries as well.

Despite a broad and growing consensus about the importance of human resource development, there is still a big gap between public and private investments in this area, on the one hand, and the actual need for upgrading, on the other. Ruiz (2007) has, for example, shown that even if many firms in Costa Rica carry out training programs for their employees, there are still many barriers to competence building. Firms complain about the training costs, and the supply of external courses from the government and the labor market organizations is both too small and short of funding.

(2) *Policies to develop institutions and new forms of organization affecting interactive learning.* The growing importance of networking with inter-firm cooperation and other forms of interactive learning is one of the most crucial aspects of a learning economy. It reflects both the increase in the rate of change and the growing complexity of the innovation process.

Along with implementing new information technologies, new forms of organization emphasizing more interaction between departments, more intense communication inside and outside the firm, and delegation of responsibility to workers especially in the form of practices such as project teams, problem-solving groups, and job and task rotation are key elements in the stimulation of learning and innovation. The study by Ruiz (2007)

referred to above shows the existence of aspects of learning organizations in all the investigated firms.

Government and public policies can play a much more active role in this process, for instance, by initiating fora for exchange of organizational learning experiences, knowledge management issues, and benchmarking efforts.

Intellectual property rights, tax incentives, law regulation—for instance, of start-ups and shutdowns of firms—and other formal institutions which the government affects influence interactive learning and innovation capabilities. However, also trust, willingness, and ability to co-operate and other relevant informal institutions are indirectly formed by government policies.

(3) *Policies to create specific organizations to support innovation activities.* Patent offices, standard setting agencies, and technical service organizations are examples of organizations that are set up by governments and play important roles in innovation processes. One important policy task is to promote access to knowledge-intensive business services for SMEs and marginal regions. In Denmark, this includes, for example, providing a well-functioning public or semi-public knowledge infrastructure with regional Technological Information Centers (TICs) and specialized approved Technological Service Institutes. Such knowledge centers can play an important role as mediators between universities and firms. They could play key roles in developing countries as well.

(4) *Policies to improve the financing of innovation.* This includes policies related to high levels of risk, large genuine uncertainty, long gestation periods, etc. in connection with innovation.

Policy types 1-4 may be termed framework condition policies. However, there are also more targeted policies, especially those used when governments want to intervene in support of new entrants and innovators:

(5) *Policies support the development of science and technology to selectively and directly.* Public investment in R&D, targeted at specific sectors or technologies, is a significant component of overall R&D and knowledge creation in, for instance, most European countries.

(6) *Technology procurement policy.* This is a demand-side policy occurring when a public agency places an order for a product or system that does not yet exist in a developed form in an effort to trigger innovation. Qualitatively advanced public demand in the form of public procurement and regulation can play a crucial role for building and maintaining innovative networks.

Such a positive role of public procurement is, though, not self evident or automatic. It presupposes that the government actors are both competent and unbiased in relation to the interests of specific groups. Even in the absence of outright corruption close relations between government agencies and specific power-groups may disqualify procurement policies as a vehicle for general development and turn it into just another part of the ongoing struggle over the distribution of income and power. In fact, due to historical experiences, this may be how most people in large parts of Latin America regard the topic.

There are many different instruments and procedures within each of these six types of innovation policy, and it is also possible to identify or develop other types of innovation policy instruments. A seventh type might consist of policies that stimulate innovation by monetary carrots and sticks connected to targeted areas. Pollution taxes could be used to support the development of “greener” technologies. This is a combination of environmental policy and technology policy and requires cooperation between the relevant ministries.

It should be clear from the discussion above of different forms of policy measures that they include things that are not normally thought of as “innovation policy.”

Measures for human resource development, will often reside within “education policy.” In fact, it is characteristic of the learning and innovation capability of an economy that it is influenced by a vast range of policies primarily aiming at things other than innovation, such as education, employment, income distribution, and social security. Policies that primarily aim at supporting, retraining, and re-educating unemployed people may, at the same time, make it easier for firms to introduce new technology and organization and, thus, indirectly support innovation. Such “indirect innovation policies” may be more important than the often quite modest direct innovation policy most countries employ today.

The different kinds of innovation policies discussed above may be looked upon as areas of policy learning, but they are not yet supported by well-defined and efficient practices and routines. They all need to be sustained by new institutions and monitored and evaluated in dialogues between different actors to become more effective.

Policy learning is not only a question of improving the competences of the economic experts that advise politicians, or even of having wiser and more mature politicians. It also includes improving data, including innovation statistics and new and enhanced economic theories and models. There is still no developed theory that combines the insights of innovation theory, growth theory, and development theory. There is still a lack of good ways of measuring innovation inputs and outputs. Furthermore, the values, visions, and targets of innovation policy remain rather vague, and the necessary supporting organizations and institutions are, as yet, rather underdeveloped.

5.4. Low Trust Traps for Policy Learning

Almost all learning is interactive, and accordingly, policy learning requires communication, interaction, and

cooperation between private and government sectors, but this is not easy. It presupposes trust that in its own time develops through interaction and cooperation. It is to be expected, then, that policy learning is ineffective and slow in conflict-riddled, low-trust societies. It takes a long time to break out of such low trust traps. Trust is not scarce in the traditional sense, but since trust, like knowledge, tends to grow when used and erode when not used, one can get trapped in a condition of a low level of trust.

This seems to be the case in many developing countries. Here we often find a very uneven distribution of income, wealth, and power. Access to information, education, and training is limited for large parts of the population. Universities are relatively isolated from the business sector. There is generally little cooperation between the government sector and private interests, and the relations that do exist are often contaminated by corruption. This is not a good environment for policy learning and may be the underlying reason why so many problems in the public-private interface remain unsolved even when there is no lack of resources in a traditional sense. There is often a lack of capability for conflict management, negotiating, and consensus building. Such capabilities are basic ingredients in policy learning, and without new institutions to foster them, policy learning will remain slow and developing countries unable to handle the requirements and challenges of the globalizing learning economy.

Certain types of “policy forgetting”, such as getting rid of harmful practices in the relations between private and public agents, seem to be especially important but at the same time lacking in the South, for example, in relation to corruption. Different types of costs are connected to corruption; an important but neglected one is its ability to prevent open interaction and cooperation both between and within the private and public sectors. Corruption thus conceals

information and hampers conflict resolution; therefore, it may also retard and block policy learning, which is highly interactive and depends on trust and long-term cooperation.

The importance of trust, cooperation, and uncorrupted relationships for policy learning is especially significant in innovation policy. Procurement policy, for instance, builds on long-term processes of intense interaction between competent government customers and private firms in which the parties learn to cooperate. It seems to have been successful in a number of cases, like that of telecommunication procurement in France, Finland, and Sweden, in which a positive atmosphere of trust and cooperation in the pursuit of mutual interests was present. In other countries and in a number of different cases, it has been blocked by lack of competence, trust, and conflict resolution (Edquist et al. 2000). In Latin America, it is common to argue against procurement policy pointing at the many examples of corruption. It is essential, but difficult to break out of low-trust traps, and it seems necessary to embark on new roads of institution building to create communication, interaction, and consensus building among firms, universities, NGOs, and state agencies.

6. *Innovation Policies and Innovation Policy Learning in Central America*

The purpose of this section is to indicate that innovation policy learning is taking place in Central America. The discussion is mainly organized according to the groups of policies for innovation presented in section 5 above. It builds on work done within the SUDESCA project reported in Orozco et al. (2005).

The examination of the many reports of the SUDESCA projects leads to broad policy conclusions: quite generally, innovation policy in Central America is often

segmented and irrational. Innovations are usually perceived as isolated events and not as parts of an integrated process. It is, therefore, meaningful to encourage policy makers to use the system of innovation approach as a tool for forming policies aimed at ensuring sustainable development. Applying innovation system perspectives in the SUDESCA sub-projects has led to the singling out of at least three policy areas as especially important: the knowledge infrastructure, institutions, and organizations. The policy conclusions from these areas will be discussed briefly below. In addition, conclusions regarding environmental issues will also be included.

6.1. Knowledge infrastructures

In Central America there is a general need for a stronger knowledge infrastructure. In the long run, the educational system is a main issue. It needs to be improved on all levels, including the university level. Vocational training is also insufficient. This is a general problem, but it may be particularly serious in some sectors, as is the case of agriculture. In a few other sectors the situation seems to be quite good, however. The infrastructural resources connected to the development of the environment as a source of income in Costa Rica is a well-known example.

In relation to the pressure of competition stemming from internationalization and globalization, the R&D systems certainly also need more resources, but the problems of the knowledge infrastructure are not only problems of resource scarcity, what with the problem of relative isolation from the rest of society. There is a poor coordination between different actors. A closer and more dynamic relation between higher education and public R&D organizations on one hand, and the production sector on the other, is much needed in the creation and dissemination of knowledge throughout societies.

In spite of the generally weak knowledge infrastructure, signs of policy learning also are visible. In connection with the labor market in Costa Rica, the development of a big technical training institute providing many different kinds of training, *Instituto Nacional de Aprendizaje* (National Institute for Learning, INA, in Spanish), is an example of this.

Also in connection with environmental policy, there are examples of development of new knowledge infrastructures. The educational program of biodiversity implemented in the primary school system in Costa Rica is an encouraging example. Bio-alphabetization is a learning process that allows individuals to value biodiversity, develop ethics concerning the living environment, and assume management and conservation responsibilities towards all kinds of living species and ecosystems. This aims at promoting changes in human behavior favoring harmonious relations between nature and social development (Segura and Gregersen 2003). This initiative is developed by the Ministry of Education and coordinated with the National Biodiversity Institute (INBio), an NGO created in October 1989, devoted to promoting knowledge and sustainable use of biodiversity, in collaboration with other organizations and initiatives, and in close interaction with the Ministry of Environment and Energy.

This type of bio-alphabetization is handled several ways: one at primary schools and another with the creation of “INBioparque”, a thematic park that includes recreational and educational areas with guided trails through groups of representative plants from different tropical ecosystems. Another instrument is the Bio-literacy Program, which INBio is coordinating with the Ministry of Education. It uses information, teaching, field trips, and even multimedia to educate children about conservation and the sustainable use of biodiversity.

6.2. *Institutions*

There is a clear need for “better institutions”, especially institutions supporting learning and innovation capabilities. The focus should be on institutions improving communication, interaction, and cooperation. Promotion of networking and joint activities in different sectors is mentioned in several of the reports. Supporting national level initiatives with local ones in agro-industry is also recommended. The “quality of interactions” within as well as between firms and organizations is in focus in the reports about the palm oil sector, but are probably useful in other sectors, too. The crucial contribution of new institutions as part of the development of environmental resources in Costa Rica has been underlined, and, again, there is no reason to believe that institutional innovation is not important for new activities more generally.

Trust and partnerships are vital elements of well-performing systems of innovation and may be strengthened by more lively interaction among the different sectors and actors. However, the relation between interaction and trust is not necessarily a positive one; interaction may destroy as well as strengthen trust between the interacting parties. It is, therefore, necessary for policy makers to consider how “meeting-places” for “positive” communication and interaction can be created.

Collective reflections in order to define development problems and opportunities are vital and should be supported by new institutions. The performance of a national system of innovation depends much on trust and the degree of consensus in any given society. To build consensus around the goals and instruments of development including the value and character of knowledge and of nature may be an exercise of both instrumental and substantial value. The government, research agencies, universities, NGOs and

private firms, cooperation agencies, and local producer organizations may all join new fora for consensus-building and cooperate to stimulate interactive learning. Clearly, in countries where, for “historical” reasons, deep mistrust exists between different social strata, this is a task that has to be addressed with great care and with a long-term perspective.

Even if the reports mostly document a need for many kinds of institutional learning, there are also, as in relation to knowledge infrastructures, several examples of actual policy learning, especially in environmental policies in Costa Rica. For example, the primary school system, NGOs, and some private firms have developed institutions of denouncing misuse of the environment and the forest. This has contributed to the development of a new rationale for the forest sector. In coordination with other actors, the government has also promoted similar policies. Eco-labeling and forest certification are examples of new kinds of institutions developed within this policy framework.

In the case of Costa Rica, the 1996 Forestry Law (No. 7575) created a totally new kind of incentive by giving forest owners the possibility to request Environmental Service Payments (ESP) for their forests. The law established four key forest commodity services: a) mitigation of greenhouse gases (fixation, reduction, sequestration, and storage); b) watershed protection; c) protection and development of the biodiversity; and d) the protection of natural forest ecosystems with particularly beautiful scenery or of particular interest (Art. 3, K). The law empowers forest authorities to make contracts with landowners and pay them for providing society and the world in general with these services, as long as they can present a forest management plan signed by a licensed forester (Segura and Gregersen 2003: 11).

Also in Nicaragua there are clear signs of policy learning in relation to the forest sector. Increasingly, more

sustainable practices are institutionalized in order to reduce deforestation and safeguard forest resources (López 1998 and López and Amaya 2000)

6.3. New Organizations

In some cases it seems necessary to create new organizations in order to stimulate innovation. For example, to support certification and labeling for international markets new organizations are needed. High transaction costs often accompany the promotion of new products and services, and even more so in developing countries with limited market experiences. New organizations may be required to cope with this problem. The INBio organization in Costa Rica is one case in point.

6.4. Finance

Finance is often crucially scarce in connection with innovation. In general, the more radical the innovation is, the higher the degree of uncertainty. Stock markets and the companies' stock negotiations are still very limited in the Central American countries. Furthermore, the system of credit financing through bank loans is weak, and with very few exceptions not flexible enough to handle long-term innovative investments. This means that environmental innovations, for example, are often difficult to finance.

Thus institutional and organizational innovation is needed. It may be possible to create alternative financial mechanisms by the direct participation of the state through, for instance, a bank of development. The state could also act as a guarantor for projects that could be financed or co-financed by international investors or through international cooperation. Special funds or special programs for innovative behavior should also be considered, such as

“green funds”, special CO₂ taxes, or minimum electricity prices as instruments for securing long-term investments in environmentally friendly technologies (renewable energy systems and low energy transportation, among others).

6.5. *Environmental Issues*

Systems of innovation clearly affect the environment, and environmental performance can be improved by innovation policies. As shown by Porter and van der Linde (1995), high environmental standards create new incentives for the industry and may improve its competitiveness in relation to countries with lower environmental standards. This approach, in which the focus shifts from regulation to innovation, entails that the environment is not only the responsibility of the government but also of industry. It also implies that other stakeholders must be engaged and put pressure on industry to honor this responsibility. The systems of innovation approach can illustrate the need to promote better practices in many parts of society, including an increased use of the market and self-regulation by the industry as driving forces for environmental innovations.

Some interesting trends in innovation policies can be identified in the different Central American countries. One clear example is the effort to improve the environmental performance by using new instruments that are common in some European countries. The challenge is to combine normative instruments (environmental approvals, integrated pollution prevention control, differentiated enforcement), economic instruments (financial support programs for cleaner technology, EMAS, cleaner products, green taxes on resource consumption and emissions, green public procurement), information instruments (eco-labels and other product declarations, green accounts/environmental reporting), and institutional instruments (self-regulation,

ISO, 14001, LCM, eco-design, voluntary agreements, stakeholder participation). The movement towards innovation approaches instead of regulation approaches emphasizes the importance of collaboration networks and is, thus, in accordance with the innovation systems approach to sustainable development.

7. Final remarks

7.1. Emerging Traits of a Learning Economy in Costa Rica

It has been suggested (Arocena and Sutz 2002) that underdeveloped countries are the ones that have not become learning economies. A learning economy is in this context an economy in which learning and innovation have become the main drivers of change. In light of this, it is noteworthy that some of the projects within the SUDESCA framework documented the development of important elements of learning economies. Even if it would be an exaggeration to describe the Central American countries as learning economies, they do show signs of moving in this direction. This is especially true in the case of Costa Rica.

Ruiz (2007, and Chapter 7 in this publication) discusses how firms in Costa Rica engage in competence building and how this is connected to labor market relations and institutions. He concludes that the labor market institutions are much more geared to traditional questions like wages and working conditions and workers' rights than to competence building and innovation. At the same time, his studies of firms of different sizes and from different sectors of the economy identify clear signs of development in the direction of, in some cases, rather sophisticated learning organizations. Courses and on-the-job-training are increasing and the internal and external organization of firms

has changed in order to stimulate communication, interaction, and the sharing of information and knowledge. In part, this is connected to the application of management ideas, such as continuous improvement, total quality control, just-in-time and functional integration, but in all cases it seems to have had effects on competence and learning capability building. The general impression is that there is an increasing focus on learning and innovation in Costa Rican firms reflected by changes in the ways firms are managed and organized, and in the ways they interact with other firms and organizations.

However, the development of learning organizations is mainly a response to changing business environments, including increasing competition. It is not matched by improved policies for learning and innovation, either in the labor market or for the country as a whole. Ruiz argues that a reorientation towards a learning economy as part of development does not happen by itself; it requires coordinated and deliberate policies. Turning the labor market in this direction, supporting employment and workers' rights as well as competence building should be a part of this. This is far from the case in Costa Rica today, and the clear signs of emerging elements of a learning economy that have been spotted in the firms are not matched by adequate policies on a macro level.

As in the example of learning organizations in Costa Rica, local learning and innovation capabilities emerge in spite of, rather than as a result of, policy initiatives at higher levels. Visions of building learning economies based on well functioning innovation systems do not seem to be very strong amongst national policy makers.

7.2. *Local learning in El Salvador*

Cummings (2007, and Chapter 9 in this publication) discusses the emergence of learning and innovation

capabilities in connection with economic initiatives taken by a number of local and regional actors in the municipality of Tecoluca in El Salvador. Several local innovative initiatives and the interactive learning going on within as well as between them are described.

Key elements of Tecoluca's emerging regional innovation system are also analysed. This system is described as a diversity of public and private firms and organizations involved directly or indirectly in the creation, diffusion, and utilization of technical innovations, the relationships between them and the elements of the local institutional fabric which enable and constrain them.

Cummings concludes that some innovative capabilities have in fact been built, even if the main initiatives also have run into many problems. He also concludes that the main obstacle for improved livelihoods is not a general lack of understanding of the development problem at the local level. It is rather a problem of lacking capabilities for collective action of the kind necessary for fruitful innovative efforts. He describes how a lack of commitment and trust, a lack of collective reflection on common problems, fragmented action and different kinds of conflicts within and between the task-networks sometimes destroy development efforts and prevent the building of innovative capabilities.

7.3. *A Double Focus*

The often weak regional and national innovation systems and the rather fragmented developments towards a learning economy in Central America do not contradict the conclusion that it is both possible and meaningful to apply the concept of a national innovation system to the analysis of sustainable development in this part of the world.

Even if in some of the countries many people suffer from problems of poverty, insecurity, and poor health, it is

not irrelevant to use the innovation system approach. Innovation is not a luxury that should be postponed until the more basic problems are solved. It seems clear that competence building and innovation are crucial for development, also in situations in which fundamental problems remain. Mobilizing and improving existing technology and knowledge when building new production capacity is necessary for an open economy in a globalizing world. To innovate and constantly upgrade capabilities is required in order to remain competitive. This implies a need for mobilizing people in processes of education and life-long interactive learning.

What may seem like a contradiction may be eased by a double focus on basic living conditions and innovation. Fighting poverty and building institutions to create order and stable living conditions are necessities if people are to be given the opportunity and incentive to learn new competences, but such institutions cannot be built if people are not engaged in competence building and learning. Learning and innovation are necessary and can be considered as basic processes that should interact with the fight against poverty. This is not unrealistic. Innovativeness and learning capabilities are essential conditions for daily survival in large parts of the South. The fact that many people survive and live in these environments testifies to the existence of such abilities. However, to get learning and innovation to contribute to the fight against poverty and for this to become a goal and incentive for learning and innovation are really the main problems. Policies need not only to support learning and innovation but also to channel substantial parts of it towards the alleviation of poverty. This is certainly not easy, but the system of innovation approach may help to overcome some of the problems and conflicts in this endeavor.

References

- Arocena, R. and J. Sutz, (2002), 'Innovations System and Developing Countries', *DRUID Working Paper* 02-05.
- Cassiolato, J., H Lastresand, M. Maciel (eds.) (2003), *Systems of Innovation and Development*, Edward Elgar.
- Cummings, A. (2007), 'Against All Odds. Building Innovative Capabilities in Rural Economic Initiatives in El Salvador', Ph.D. dissertation, Aalborg University. *SUDESCA Research Papers* No. 40.
- Edquist, C., L. Hommen, and L. Tsipouri (eds.) (2000). *Public Technology Procurement and Innovation*, Boston/Dordrecht/London: Kluwer Academic Publishers.
- Hirschman, A. (1958), *The Strategy of Economic Development*, New Haven: Yale University Press..
- Jensen, M. B., B., Johnson, E. Lorentz and B. Å. Lundvall, (2007), 'Forms of knowledge and modes of innovation', *Research Policy*, Vol. 36, No. 5.
- Johnson, B. and O. Segura, (2001), 'Innovation Systems and Developing Countries: Experiences from the SUDESCA project', *DRUID Working Papers* 01-12.
- López, Mario (1998), 'State of the Art of the Forestry Sector in Nicaragua', *SUDESCA Research Paper* No. 13.
- López, M. R. and Lisette Amaya (2000), 'Análisis de políticas desde la perspectiva de innovación: El Caso de Nicaragua', *SUDESCA Research Paper* No. 27.
- Metcalfe, Stanley (2007), 'Policy for Innovation' in H. Hanusch and A. Pyka, (eds), *Elgar Companion to Neo-Schumpeterian Economics*, Edward Elgar.
- Myrdal, G. (1968), *Asian Drama, An Inquiry into the Poverty of Nations*, Penguin Books.
- Orozco, J., Segura, O., Gregersen, B., Johnson, B., and Remmen, A. (2005), 'Policies for Innovation and Sustainable Development in Central America', *SUDESCA Research Paper*, No. 33.
- Porter, M. and van der Linde (1995), 'Green and Competitive. Ending the Stalemate', *Harvard Business Review*.

- Ruiz, K. M. (2007), 'Costa Rica as a Learning Economy: An Exploratory Study of Competence-Building and the Significance of Labour Relations and Labour Market Institutions', Ph.D.dissertation, Aalborg University.
- Segura, O. And B. Gregersen, (2003). 'A Learning and Innovation Capability Approach to Social and Ecological Sustainability', The first GLOBELICS conference: Innovation Systems and Development Strategies for the Third Millennium, Rio de Janeiro, Brazil.
- Smith, K. (1997), 'Economic Infrastructures and Innovation Systems', in C. Edquist, (ed), *Systems of Innovation, Technologies, Institutions and Organizations*, London and Washington. Pinter.