

# Introduction

---

Bengt-Åke Lundvall, Mammo Muchie, and Peter Gammeltoft

## Introduction

When Muchie and Lundvall initiated the international conference ‘African Systems of Innovation and Competence Building’ March 2001 in Aalborg the intention was to re-examine the problems of African development by mobilising the scholarship on innovation systems. The major objective was to respond to academic and analytical questions: what lessons could be drawn from applying the innovation system concept on Africa? The indirect objective was to address more political and controversial questions: could the introduction of the innovation system concept help to break the ideological stalemate where Africa appears as the hopeless victim doomed to permanent poverty and could it also help to bolster the idea of a Pan African renaissance that Mandela and other African leaders have tried to build recently? Could it open up a new vision ‘where the last becomes the first’?

We managed to bring together leading experts from various parts of the world and later on a number of further contributions have been added. The chapters in this volume relate to different aspects of African innovation systems and they contribute to a revitalised agenda for African development. The contributions span a wide set of issues relevant for African innovation systems. Among them are general contributions to the understanding of innovation and economic development (Johnson and Lundvall; Jamison; Mytelka; Wangwe; Oyelaran-Oyeinka and Barclay) as well as sector studies (Sørensen; Tomlinson; Marcelle; Lall and Pietrobelli). The geographical level of analysis goes from the mobilisation of local knowledge (Dahms; Kuada) and regional innovation systems (Djeflat; Scerri) to national (Mani; Latif) and Africa-wide (Muchie; Baskaran and Muchie; Shulin Gu; Gammeltoft) studies. Some chapters have their focus on science-based activities (Amsden) while others focus on activities rooted in informal and tacit knowledge (Müller and Bertelsen).

The concept ‘national system of innovation’ can be traced to the work of Friedrich List. In his book *The National System of Political Economy*, List criticised what he called ‘the cosmopolitan’ approach of Adam Smith for being too focused on competition and resource allocation to the neglect of productive forces (List 1841). His analysis took into account a wide set of national institutions including those engaged in education and training as well as tangible infrastructures such as railroads (Freeman 1995). In relation to the current challenges for Africa and the Pan African response to them, it is interesting to note that List married his analysis of national production systems to a political agenda for nation-building in what was to become

Germany. In this introduction we will relate the basic elements in the national innovation system concept to the African reality.

### **Why Innovation?**

In this volume innovation refers to the creation, diffusion and use of new ideas applied in the economy. The applications can take the form of new production processes, new products, new forms of organisation and new markets.

If a less developed economy has the ambition to grow and create more and better paid jobs for its citizens, continuous innovation, in this broad sense, must be part of the solution. Hard work, investment and more efficient use of resources are important elements in any development strategy. But in order to keep the momentum of economic development, technical and organisational innovations are important.

First, it might help to move into rapidly growing sectors characterised by the production and use of advanced technology. The entrance into the production and exports of information technology in Taiwan, South Korea and Singapore has been one reason for the rapid economic growth in these countries. This is an option that is not easy to exploit in most of the African states. One prerequisite is access to a highly trained labour force another is a reliable infrastructure. It should also be taken into account that this route to wealth may be less attractive than originally assumed in the height of the New Economy era. The experience from South East Asian economies is that there is instability built into high tech specialisation.

Second, the capability to use the new technologies in old sectors is highly important. This capability can be built through experimentation and learning. Without adaptation of organisational forms and human competence, the introduction of complex technologies in production processes may actually do more harm than leaving it aside? A major challenge is to develop technical training in the interface between schools and industry in such a way that the formation of theoretical and practical skills supports each other.

Third, product innovation is not something that takes place only in science-based sectors such as electronics and biotechnology. Developing gradually higher quality and more attractive agricultural products, textiles and machinery is one of the most important ways to establish economic growth and employment growth. Sector specific and technical institutes with a close connection to producers may be crucial for developing the new qualities.

It should be noted that in an open economy 'not to innovate' means that domestic producers will bear the negative impact of innovations made by others. Most African countries are quite open in terms of trade and have export and import shares of GNP over 20 per cent. Domestic producers are constantly confronted with competition from innovating producers abroad. This is true also for those countries producing agricultural products for the world markets – there is a permanent drive toward more attractive and cheap products also in this field. Therefore, in most markets, not to innovate means continuously to lose market share and income.

It is also helpful to note that in the African context, the most important innovation and competence building activities are not a specialty reserved for engineers and scientists. Diffusing good practices in tilling the land, transporting the products to the market and training farmers to use new crops and technologies are the elements of innovation processes that may have the most important effects on economic growth and well being.

### **Why Systems?**

At the end of the Second World War, technology policy was based on a linear model of innovation. It was assumed that if a firm or a country invested in scientific research, this would create the basis for new technologies, and when these were transformed into new products, the result would be a strong international competitiveness and economic growth.

Especially in the sixties and on-wards, empirical research on technical change and innovation demonstrated that this was not what actually takes place in innovation processes. Innovating firms may draw upon science but then it is usually quite old research results. Crucial for innovation is the *interaction* with many other organisations and firms. Firms do not innovate alone – they innovate in an interaction with customers, suppliers and even, sometimes, with competitors.

The research also demonstrated that the quality of linkages and relationships between firms and knowledge institutions, not only universities but also technical institutes and schools, was important for innovation. The single firm operates in a local and national environment and this environment forms an innovation system that may be more or less supportive to its innovative activities.

The system approach helps to keep an eye on the needs of users in the system and on the importance of having good feedback links from users to producers. In the context of Africa users may refer to households utilising new infrastructure and technologies, including the Internet (Dahms). It may also refer to private firms interacting with knowledge institutions such as schools, technological institutes and universities.

In most African economies, the most important linkages are those between agriculture on the one hand and the rest of the production system. They are crucial when it comes to develop better methods and products. This involves building and establishing links to 'land universities' with research and training addressing the needs of agriculture. It also implies establishing links to the manufacturing industries that produce the crucial means of production for agriculture. To diffuse good practice within agriculture is of course also important, but again, this might take place through consultants and producers addressing many users in primary agriculture.

## **Why National?**

It might appear paradoxical that the concept 'national' system of innovation has become increasingly popular among policy makers and in the business community in a period when the focus is upon globalisation. It reflects that while competition becomes more global, some of the factors that lie behind competitiveness remain local and national. The most important localised factor is specialised competence and learning. Competing exclusively on low wages and hard work has become increasingly difficult and strong positions based on such advantages will be gradually undermined if not supported by competence building.

The focus on the national level makes explicit what has been implicit in strategies aiming at strengthening 'the international competitiveness of the national economy' and it broadens the understanding of what such strategies need to include. Especially for less developed economies it offers a concept that might be used to mobilise agents around an agenda of action that is forward looking and optimistic rather than backward looking and defensive. Its historical roots demonstrate that it is a concept strongly connected to 'catching-up' with world leaders.

But not least in the context of Africa, analysis and action at the national level cannot stand alone. Weak and split nation states and weak political institutions at the national level call for combining alternative perspectives. Building capabilities in local communities, combining the forces of economies located close to each other in economic integration and not least drawing upon Pan African resources and idealism are as important as building institutions at the level of nation states.

## **Why 'Innovation and Competence Building Systems'?**

Our attempt to relate the concept National System of Innovation (NSI) to a largely agrarian Africa may at first sight appear as an impossible exercise. Africa South of the Sahara has about 70 per cent of the population in rural areas. Agriculture employs 45 per cent of the 600 hundred million people. Industry in Africa is still largely waiting to be organised. According to the World Bank Sector Analysis (2002), the size and structure of firms in the African manufacturing sector have continued to show a lack of development toward a dynamic industrial economy (World Bank, RPED 2002). The studies of the Bank's Regional Programme on Enterprise Development claim that the growth rate of exports of African countries continues to be either negative or well below those of other developing countries.

It is thus far from obvious that it is meaningful to apply the NSI-concept developed mainly as a tool to analyse industrial and post-industrial economies (Freeman 1987; Lundvall 1992; Nelson 1993) to the circumstances in Africa. When we are dealing with Africa we are speaking of a continent regarded by the international financial institutions as 'the last in the world'. It is from such an unpromising condition that African systems of innovation have to emerge.

The modern revival of the NSI-concept some 12-15 years ago gave rise to different more or less broad definitions of innovation systems. The US-approach (Nelson 1988)

linked the concept mainly to high-tech industries and put the interaction between R&D-departments in firms, the university system and national technology policy at the centre of the analysis. Freeman (1987) introduced a broader perspective that took into account national specificities in the organisation of firms – he emphasized for instance how Japanese firms increasingly used ‘the factory as a laboratory’. The Aalborg approach (Lundvall 1985; Andersen and Lundvall 1988) also saw national systems of innovation as rooted in national production systems.

In order to justify our endeavour we need to broaden and enrich the NSI-concept so that it becomes a useful tool for promoting structural transformation in Africa. The title of the international conference in Aalborg in 2002 ‘African Systems of Innovation and Competence Building’ was chosen to signal such a need to broaden the innovation system-approach (Lundvall 2002). In Africa science-based activities still play a miniscule role in economic and social development. The most advanced economy in Africa is South Africa which has a population of 40.5 million people. [South Africa] produced only a total of 1088 doctoral and master’s graduates in science and technology in 1993. In the same year, South Africa produced a meagre total of 4264 master’s and doctoral graduates overall in the fields of natural sciences and engineering, health sciences, and social sciences and humanities...[In the same year] the total enrolment of natural science and engineering master’s and doctoral students in South African universities was only 5602’ (FRD 1996). In reality, this will be the case for the near future as well. One of the indicators at our disposal shows that so-called high technology products form between 0 per cent and 10 per cent of exports with most countries close to zero and only South Africa close to the upper limit. Building effective universities of good quality is certainly becoming increasingly important (Mytelka) but what will be at least as important for economic development is to enhance the competence among the majority of those working in agriculture, manufacturing and services.

Some of the chapters in this volume analyse R&D-systems, others link innovation and technological capabilities to the production system while some introduce broader perspectives that include competence building in the informal economy and in service sectors. Combining these insights in a holistic systemic framework that includes all kinds of innovation and competence building helps us to understand what are the major problems and opportunities for African innovation systems.

## **Knowledge and Learning**

In order to understand the concept of innovation system and why competence building needs to be integrated with innovation, it is necessary to understand the role of knowledge and learning in the economy. In Lundvall (1992: 1) it was proposed that ‘the most fundamental resource in the modern economy is knowledge and, accordingly, the most important process is learning’. Over the last decade the attempt to get a better understanding of the knowledge-based economy and the learning

economy has created a more satisfactory theoretical foundation for innovation systems.

It has been argued that what is new in the present phase of development is not the use of knowledge in production, but rather the speed of learning and forgetting. We have coined the concept ‘the learning economy’ to capture these characteristics and argued that the success of individuals, organisations, regions and countries today will reflect, not what specific knowledge they have at a specific moment, but rather the capability to learn (Lundvall and Johnson 1994).

The understanding has been developed using the basic distinctions between information and knowledge, between ‘knowing about the world’ and ‘knowing how to change the world’ and between knowledge that is explicit and codified versus knowledge that remains implicit and tacit. In this context, it was proposed to make a distinction between four different kinds of knowledge. *Know-what* refers to access to information, *know-why* to understanding causal relationships, *know-how* to capability to do things and *know-who* to the access to knowledge and capabilities of others. While it is easier to make the kind of knowledge belonging to the first two categories explicit, the crucial elements of know-how and know-who to a much higher degree remain tacit knowledge.

What makes a difference in economic terms between success and failure for a firm or a region is knowledge that is not easily appropriated by others. This will typically be knowledge with tacit elements or explicit knowledge protected by intellectual property right instruments. The last category has certainly been growing in importance over the last decade, not least in pharmaceuticals and biotechnology. In more and more areas the richest countries initiate restrictive intellectual property regimes and more strict sanctions are imposed on those who try to break the rules.

It is legitimate to ask if Africa can get away from the bottom of the ladder respecting fully the existing rules set by the established players of the world economy. Historically every country that has succeeded to industrialise has broken one rule or another. The USA has done it. As report from the Office of Technology Assessment (OTA) puts it: when ‘the United States was still a relatively young and developing country [...] it refused to respect international intellectual property rights on the grounds that it was freely entitled to foreign works to further its social and economic development’ (OTA 1986: 228). In the context of the establishment of the German state, the rules set by the British Empire were broken. It might be argued that the African countries – ‘being the last in the world economy’ – would have good moral grounds to break some of the rules when these get in the way for development. Even better would it be if Africa, acting as one player on the world economic scene, could negotiate a change in the rules so they did not hinder learning from abroad.

## **Innovation and Allocation**

The advice to African governments coming from international organisations such as the World Bank and IMF is strongly focused on macroeconomic stability and on

‘structural reform’ aiming at establishing well-defined private property rights and well functioning markets. This type of advice is based on a neo-classical perspective where the most important issue is assumed to be the efficient allocation of resources. A shift of focus to innovation and learning changes the policy agenda as well as the agenda for ‘structural reform’ changes.

The distinction between knowledge about the world and know-how are especially helpful when it comes to contrast the theoretical micro-foundations of innovation systems with those of standard economics. If agents are allowed to learn, at all, in a neo-classical model, learning is either understood as getting access to more or more precise information about the world or it is a black-box phenomenon as in growth models assuming ‘learning by doing’. The very fundamental fact that agents – individuals as well as firms – *are more or less competent* in what they are doing and that they may learn how to become more competent is abstracted from in order to keep the analysis simple so that it can be based upon ‘representative firms’ and agents. This abstraction is absolutely fatal in an economy where the capability to learn tends to become the most important factor behind the economic success of people, organisations and regions (Lundvall and Johnson 1994).

Table 1 illustrates how the analytical framework connected to innovation systems relates to mainstream economic theory. The theoretical core of standard economic theory is about rational agents making choices between well-defined (but possibly risky) alternatives and the focus of the analysis is on the allocation of scarce resources. What is proposed here is a double shift in focus that can be illustrated by the following table.

*Table 1* Four Different Perspectives in Economic Analysis

	Allocation	Innovation
Choice making	Standard neoclassical	Management of innovation
Learning	Austrian economics	Innovation systems

The table illustrates that learning as well as innovation, in principle, can be analysed in analytical frameworks closer to the mainstream neoclassical economics. It is possible (but not logically satisfactory) to apply the principles of rational choice to the analysis of innovation. It may, for instance, be assumed that ‘management of innovation’ is aiming at funds getting allocated to alternative R&D-projects according to the private rate of return, taking into account the risk that the projects do not succeed.<sup>1</sup>

Austrian economics (Hayek and Kirzner) has the focus on allocation of scarce resources in common with neoclassical economics. But Hayek presents the market as a dynamic learning process where the allocation of scarce commodities is brought closer to the ideal of general equilibrium without ever reaching this state.

The analysis of innovation systems moves the focus toward the combination of innovation and learning. Innovation processes may be seen as a process of joint production where one output is innovation and the other a change in the competence

of the involved agents. Applying the perspective of 'national innovation system' in a country is basically a way to re-assess its structure, institutions and organisations – including the public sector. While the focus of traditional economics is to evaluate their capacity to utilise existing resources the innovation system perspective helps to evaluate their capacity to create new resources and to build new competence in the economy.

In an economy where innovation and learning are of fundamental importance for economic growth the institutional recommendations and the program for structural reform derived from neoclassical thought are misleading. A key issue is to establish institutions that support learning (and forgetting) in relation to all markets, including financial markets and labour markets. From the perspective of innovation systems the very idea of 'pure markets' as the ideal form tends to evaporate as an illusion. From a neo-classical perspective, 'market failure' appears as exceptions. A combination of 'market failure' and 'system failure' offers a rich agenda for intelligent public policy making when we see the economy as an innovation system.

### **Building and Integrating Innovation Systems as an Element in African Renaissance?**

This book is particularly timely since the African Union and the New Partnership for Africa's Development (NEPAD) have been formed at the turn of the century in Africa. There is some optimism in the air and agreement that Africa must undergo a transformation of its social, political and economic structure. For the first time African leaders have accepted 'sovereignty with responsibility' permitting peer reviews of their conduct and possible intervention and sanction if they carry out activities that put large classes of their citizens to danger or use unlawful seizure of power. A new post cold war desire to respect citizens and tame arbitrary authority seems now to have a chance to become a reality. The strong focus upon Africa's many disasters should not hide that there are also signs of a positive development (Muchie 2003).

One of the key expressions of the new positive trend is the New Partnership for Africa's Development (Gammeltoft). NEPAD aims at establishing a new type of interaction between Africa on the one hand and the Northern industrialised regions and multilateral financial institutions on the other. One goal is to stimulate African GDP growth so that it reaches to 7 per cent per annum. While this objective is laudable, this ambition to create a new framework of interaction to alter radically Africa's current rate of growth is strongly linked to building and integrating African systems of innovation.

This volume, amongst other things, asks the difficult question of whether the national system of innovation concept can be appropriated from its earlier applications in industrial economy contexts and usefully applied to Africa. The contributors have divergent views. But they have in common an intellectual willingness to put the innovation system as an issue on the African agenda. It is a first step and there is a need to go further in the analysis of how to build systems of



innovation and competence building in Africa. The intellectual and political endeavour is to find paths for transforming Africa much like Friedrich List broke the orthodoxy of Smithian and Ricardian comparative advantage in order to create a German national system of political economy. The African system of political economy is waiting to be written.

One of the most useful aspects of the concept of national system of innovation is that even with globalisation, nations and states matter. The concept may be seen as a framework for policy learning when it comes to policies aiming at promoting innovation and competence building. Such learning processes may take place at the national level but they would certainly benefit from being organised also at the African level. This could become an integrated element in the current trend by Africans to accelerate the African Union and NEPAD initiatives. African leaders have recognised that ‘Development is a process of empowerment and self-reliance. Africans must not be wards of benevolent guardians; rather they must be architects of their own sustained upliftment’ (OAU-NEPAD 2001). Even more radical would be the implementation of a long-term vision of a Pan African innovation system that could complement and strengthen AU/NEPAD.

### Notes

<sup>1</sup> Arrow has pointed out the obvious that innovation is a phenomenon not ideal for that kind of analysis because innovation has as its most fundamental characteristic that it gives rise to something that is not known in advance – and it is not possible to apply the principles of rational choice if the choice set is not defined in advance. But it is still the case that, for instance, new growth theory operates with models that combine on-going innovation with assumptions of rational choice.

## References

- Andersen, Esben S. and Bengt-Åke Lundvall (1988), 'Small National Innovation Systems Facing Technological Revolutions: An Analytical Framework', in Christopher Freeman and Bengt-Åke Lundvall, *Small Countries Facing the Technological Revolution*, London: Pinter Publishers.
- Freeman, Christopher (1987), *Technology Policy and Economic Performance: Lessons from Japan*, London: Pinter Publishers.
- Freeman, Christopher (1995), 'The National Innovation Systems in Historical Perspective', *Cambridge Journal of Economics*, Vol. 19, No. 1.
- Foundation for Research and Development (FRD) (1996), *South Africa Science and Technology Indicators*, South Africa: Pretoria.
- List, Friedrich (1841), *Das Nationale System der Politischen Ökonomie*, Basel: Kyklos, (translated and published under the title: *The National System of Political Economy by Longmans*, London: Green and Co.).
- Lundvall, Bengt-Åke (1985), *Product Innovation and User-Producer Interaction*, Aalborg: Aalborg University Press.
- Lundvall, Bengt-Åke (2002), *Innovation, Growth and Social Cohesion: The Danish Model*, London: Edward Elgar Publishers.
- Lundvall, Bengt-Åke (ed.) (1992), *National Innovation Systems: Towards a Theory of Innovation and Interactive Learning*, London: Pinter Publishers.
- Lundvall, Bengt-Åke and Björn Johnson (1994), 'The Learning Economy', *Journal of Industry Studies*, Vol. 1, No. 2: 23-42.
- Muchie, Mammo (2003), *The Making of Africa-Nation: Pan-Africanism and the African Renaissance*, London: Adonis-Abbey Publishers.
- Nelson, Richard R. (1988), 'Institutions Supporting Technical Change in the United States', in Giovanni Dosi, Christopher Freeman, Richard R. Nelson, Gerald Silverberg, and Luc Soete (eds.), *Technology and Economic Theory*, London: Pinter Publishers.
- Nelson, Richard R. (ed.) (1993), *National Innovation Systems: A Comparative Analysis*, Oxford, Oxford University Press.
- OAU (2001), *OAU-NEPAD Document*, Addis Abeba.
- Office of Technology Assessment (OTA) (1986), *Intellectual Property Rights in an Age of Electronic Information*, Washington, D.C.: US Government Printing Office.
- World Bank, Regional Programme on Enterprise Development (RPED) (2002), *Nigeria Firm Survey*, Paper No. 118, April, World Bank.