

Chapter 7

Innovation Strategies in Developing Countries

by

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This chapter explores issues relating to innovation strategies in developing countries. By flagging some key issues in the literature, it identifies the many dimensions of innovation strategies in developing countries and examines the implications for different developing regions. It suggests that innovation strategies that are shaped by domestic market and policy realities are more robust and help to improve the performance of enterprises at country level. As countries differ in their challenges, resources and needs, their policy and development frameworks necessarily vary considerably. This chapter draws some tentative conclusions from the literature, which suggests that strategies based on innovation systems are, to some extent, replicable.

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Introduction

The world's collective accumulation of scientific knowledge, technological capabilities and competences for innovation has advanced the well-being of billions of people across 192 sovereign political entities (United Nations, 2006). This progress is however not evenly distributed nor has it been achieved without anthropogenic impacts on the planetary ecosystem. Inequality, insecurity, environmental degradation and an uneven spread of infrastructure and technical know-how conspire to produce an asymmetry between the concentration of knowledge and the demands of equitable development. The planet's 6.8 billion people¹ are further challenged by concerns over the increasing gap in the quality of life between and within all countries, the rapidity of global climate change, the extensive international financial crisis and the subsequent more generalised economic recession.

The changes of the past century are largely attributable to a particular form of economic development. This period of accelerated change has mainly been characterised as the growth of productive capacities through industrialisation, mass production and distribution. The current era is a time of increased international integration, and globalisation today embraces not only the financial sector, but also investment, production and distribution systems (Maharajh, 2008). The mobility of highly skilled people has also increased (Pogue, 2007; see also Kahn *et al.*, 2004). Within capitalist systems, the key tools for facilitating economic expansion have been the mobilisation and organisation of society's capacity to generate new goods and services from accumulated traditional knowledge, endogenous research and development (R&D) strategies, and international science and technology (S&T) co-operation. This has been achieved through a process of generating the necessary capacity, largely by S&T institutions. As these enterprises have grown in scale and complexity, they have transcended geo-political and sectoral boundaries. The literature on systems of innovation (Fagerberg, 2005) has kept pace with these developments through an expanding network of scholars, policy makers and administrators.²

Knowledge contributes to innovation insofar as the latter is the successful application of the former. The process whereby knowledge is generated and acquired through its transformation into a useful form and its implementation is non-linear and dynamic. The traditional relationship between knowledge suppliers and users has changed and has blurred the boundaries between the public and private sectors with respect to innovation. In addition, the interconnectedness of different policy domains, the search for contextually determined local relevance and the enormity of present global challenges have made the development of an innovation strategy increasingly complex. Furthermore, it is important to recognise that policies and politics are co-dependent and that public policy choices represent power relations in the society, the country and globally.

This chapter is concerned with the ways in which knowledge contributes to innovation.³ It views the relationship as dynamic and complex. It provides a starting point for assessing how innovation policies can potentially generate more effective strategic responses in developing countries. It does so by looking at some of the key issues that have arisen in the literature concerning the developing regions of Africa, Asia and Latin America.

Government policies that seek to increase the rate of innovation have become more widespread and have benefited from feedback from learning through implementation. The role of innovation policy in generating initiatives to promote the better country-level

performance of enterprises is increasing. The rapid expansion of policies and associated instruments is even affecting large sections of least developed countries (LDCs).⁴ Continuities in the development discourse remain, however, as developing regions still benchmark their policy and strategy choices on policy research in more advanced and mature economies. At the same time, and almost simultaneously with the evolution of thinking about policy management and priorities in the more industrialised economies, innovation strategies in developing countries have begun to move beyond supply-side strategies towards more demand-led options. Countries with more advanced and mature economies are engaging in debates on the relevance of “national” innovation strategies in the context of their relations with each other and with developing regions. Although this issue is not addressed in this chapter, it increases in significance in light of the dynamics of a truly globalised world facing the prospects of crises. It indicates the need to acknowledge that innovation policies should be informed and guided by the historical, socioeconomic and political context of individual countries and the global challenges of sustainable development.

Emerging from contemporary studies on innovation systems is the notion that innovation in developing countries needs to be understood broadly. Given the persistence of economic dualisms in most developing countries,⁵ innovation should cover innovation in the informal sector and in traditional sectors (such as agriculture, energy and mining). Also, since the level of innovation in most LDCs is generally below the global technology frontier, considerations regarding innovation policies should be closely aligned with existing processes of technological learning.

Finally, given the particular constraints and challenges that characterise the various actors in developing economies, innovation needs to be considered as a systemic process, strongly linked to specific domestic conditions. This chapter aims to provide directions for the design of contextualised innovation policies that also take account of current trends in global integration.

The recent history of innovation strategies in developing countries

Early innovation theories developed in more advanced industrialised economies emphasised the role of technological progress and radical innovations (Schumpeter, 1947; Kline and Rosenberg, 1986; Freeman, 1987; Freeman and Soete, 1997). This perception of innovation led to a stream of policy recommendations aimed at the promotion of S&T outputs – R&D, technical manpower, patents and scientific publications (see Chapter 3 in this volume). As a consequence, government initiatives in developed and developing countries have mainly focused on supporting formal R&D and on improving the mechanisms for transferring the results of public and foreign R&D to the domestic private sector.

However, theoretical advances in evolutionary economics suggest that innovation is not linear but takes place in an “innovation system” that is the result of complex and multiple interactions at the national, regional, local and even sectoral level among a variety of actors and their environment (*e.g.* Freeman, 1987; Lundvall, 1988, 1992; Nelson, 1993). These developments in the literature follow the earlier more industrially oriented conceptualisation of Richard Nelson (1982). Over time, our understanding of innovation has been enhanced through incorporation of the experience of developing countries and through the increased availability of data that highlight the effects of networking, learning and collaboration by the many actors of the innovation system.

The economic success of some East Asian countries in the 1980s and 1990s triggered interest in understanding the nexus of technological performance and innovation policy in developing regions. Development theorists started studying the fast-growing newly industrialised economies (NIEs) and the role of government in promoting their dynamism (e.g. Pack and Westphal, 1986; Amsden, 1989; Wade, 1990; Lall, 1992; Hobday, 1995; Kim and Nelson, 2000). Strong technological content (and the role of technological learning and imitation) led to an emphasis on policies for technology transfer, assimilation and acquisition of foreign technologies. At the same time, research attention also focused on the role of indigenous efforts to assimilate foreign knowledge and technologies as well as to acquire domestic innovative capabilities.

In Latin America initial views of innovation strategies were influenced by a general debate about industrial policy and were strongly marked by structural adjustment programmes and subsequent economic reforms (e.g. Katz, 1984, 1987; Teitel, 1984). However, with the emergence of new patterns of production, specialisation and trade, innovation strategies paid particular attention to the diffusion of innovation and knowledge, local industrial clusters and the benefits of collaboration.⁶ Details on the linkages between innovation and local production systems have been collected by the Research Network on Local Productive and Innovative Systems (RedeSist)⁷ in Brazil.

In Sub-Saharan Africa, early debates on innovation strategies were influenced by the tensions between the revisionist approach, which favoured policies of state intervention (Stein, 1992; Griffin, 1996; Lall and Wangwe, 1998; Mkandawire and Soludo, 1999), and the neoliberal agenda, which advocated minimising the role of government while focusing on “getting the fundamentals right” (World Bank, 1994, 2000).⁸ In spite of the significant advances in certain African countries in the last three decades (such as South Africa, Mauritius and Mozambique) and at pan-African level,⁹ entities, organisations and institutions that explicitly seek to enable innovation are still developing. The challenges of implementation, monitoring, evaluation and learning still constitute major hurdles for Africa’s various innovation policies, strategies and programmes. The African Science, Technology and Innovation Indicators (ASTII) project of the NEPAD will help the continent as a whole as more countries begin to use OECD methodologies to collect information.

It is more or less generally agreed that innovation and technology are strategic variables in any development process. Researchers and policy makers differ about which aspects and stages of innovation can and should be promoted, as well as about how “success” can and should be measured in developing regions. Some maintain that international market mechanisms appropriately assign innovation resources to the actors best able to exploit them productively. A second school of thought is critical of the dependence of developing countries on foreign technologies and seeks an enhanced role for indigenous innovative capabilities. A third position maintains that what is important for developing countries is the achievement of the right combination of imported technologies and locally developed innovative capabilities. From this last perspective, the focus on acquiring technologies abroad would not be incompatible with the aim of promoting indigenous innovations. This tends to increase the complexity of the technology transfer process.

As a result of the multiplicity of views on this issue, the current debate on innovation strategies in developing regions remains polemical and controversial. It reflects the past history of differences in the understanding of innovation processes in both developed and developing countries, as well as the recognition that policies that rely solely on technology

transfer, narrowly framed, have failed. Different views on innovation and effective technology transfer ultimately affect the allocation and use of scarce resources in developing countries, as well as the development of the institutional system that supports innovative activities. Fortunately, the utilisation of common measurement devices is improving the availability of comparable data. The fact that most regions of the world are beginning to utilise the OECD's *Frascati Manual* (2002) and the OECD/Eurostat *Oslo Manual* (2005) augurs well for basing debate on evidence and moving beyond mere rhetorical posturing by stakeholders, role players and policy makers.

Is innovation different in developing countries?

One of the most fundamental global trends over the last decades has been the accelerating rate of innovation and change. Developing countries increasingly participate in this evolution, as changes wrought by rapid innovation at the global level have led to new opportunities for developing regions. This has especially been the case when domestic policy has sought to increase capacity to absorb global technological advances through appropriate support for capability formation functions.

Technological change has profoundly affected the dynamics of global production chains, with important implications for both the rapidly emerging developing countries and the LDCs. While the rapid pace of innovation has raised entry barriers in certain activities and industries (such as pharmaceuticals and biotechnology), global outsourcing has provided increasing opportunities for lower-cost sites in developing countries in sectors such as information and communications technologies (ICTs) (Kraemer-Mbula, 2009a). Companies in developing countries now compete not only with suppliers in higher-cost locations in advanced economies, but also among themselves. The ability to innovate and respond to fast-changing and newly arising opportunities has become a deciding factor in the success and survival of firms in developing regions as well as in advanced economies.

Yet, in spite of the falling costs of communication and the growing integration of economic activities around the globe, enterprises in developing countries still remain relatively isolated from global innovation dynamics. This is in marked contrast to the experience of enterprises located in more advanced economies. Hobday (1995, 2003) highlighted the physical and “virtual” distance of latecomer firms from major international sources of technology, R&D, universities and mainstream international markets. This disadvantage already places latecomer firms at a different starting point in terms of innovation processes from that of firms in more advanced economies.

This partially explains the significant differences in innovation activities, performance and results within and between countries. The burgeoning literature on latecomer enterprises has taken into account the different economic, social and technological environment in which firms in developing countries operate. Some of these particularities are related to the pervasive technological isolation of firms, the existence of market failures, differences in types of innovation (*e.g.* incremental innovations, learning), the greater presence of traditional sectors of production, the scale of the informal sector, and the tacit knowledge base of technologies.

Although scholars recognise the diversity of the developing world, they also identify common market failures that can significantly limit the success of innovative efforts. Weak financial and labour markets, dysfunctional education and training systems, inadequate intellectual property rights (IPR) regimes and regulatory systems, and poor

support for investment in innovation characterise many developing countries across the globe. Efficient markets allow latecomer firms not only to obtain the necessary resources to innovate, but also to appropriate the returns from their innovative activities. This constitutes an incentive to invest in further innovations. However, it has been argued that the ability of firms to access finance, human resources and other technical inputs cannot always be ensured by market mechanisms (Lall and Teubal, 1998; Lall and Pietrobelli, 2002). Correcting such limitations often requires direct interventions.

These limitations, which are not unique to developing countries, may also affect the ability of innovative firms to market their goods and services and to continuously improve their technical capabilities in order to face competition. Particularly in least developed countries, problems of appropriability of innovations, failures in financial markets and poor technology infrastructure, among others, have suggested that “strict reliance on a market system will result in underinvestment in innovation relative to the socially desirable level” (Martin and Scott, 2000, p. 438; also supported by authors such as Lall and Teubal, 1998; Romijn, 2001). Given these constraints, many have indicated the need for tailored and strongly supported innovation strategies to address the pervasive market and institutional weaknesses in developing countries, especially LDCs.

Innovation in developing countries is affected by the ability of firms to solve problems and overcome existing structural, infrastructural, institutional and financial constraints. Recent research from Srinivas and Sutz (2008) highlights the importance of considering the context in which technological innovation takes place, since conditions of scarcity – as opposed to abundance – are often the source of innovations in developing countries. This is particularly the case in emerging technology-intensive activities that rely on modern infrastructure, such as ICTs, which tends to be scarce in developing countries (Kraemer-Mbula, 2009a). Additionally, as most generic technologies are imported or generated abroad, innovation in developing countries is likely to be based on adopting, adapting, imitating and improving foreign technologies. Examples of successful innovators in developing countries indicate that incremental innovations, rather than radical innovations, are the main source of their innovative performance (this is supported by the findings of many innovation surveys, such as those of South Africa¹⁰).

As currently understood, innovation is something that occurs in firms as formal organisations. Ironically, even the more comprehensive concept of national systems of innovation has yet to fully incorporate and address innovation that takes place in the informal sector (see Chapter 4 for further discussion of the informal sector, particularly in Africa). The informal sector, especially in developing countries, comprises millions of enterprises that operate under extreme conditions of survival, scarcity and constraints. The dynamics of innovation in the informal sector, which is most extensive in developing countries, are largely ignored in the literature on both developing and more developed economies. Yet disregarding the role of such innovation in developing countries produces misleading, asymmetrical or ineffective innovation strategies.

Frequent issues in the literature on innovation strategies in developing countries

Drawing on the issues most frequently addressed in the literature, this section detects five important dimensions: generation of innovation, assimilation of innovation, diffusion of innovation, the enabling environment and policy management. Not all of these dimensions need to have equal emphasis in all countries, as an adequate innovation strategy will depend on the particular needs of an economy. The rise of evidence-based policy formulation can help to reveal the specific needs of individual economies.

Generation of innovation

Historically, the generation of innovation has been measured using input and output indicators. Inputs have mainly been identified with R&D expenditures, both public and private (government, business and higher education expenditures on R&D). Output measures have included counting patents and scientific publications (OECD, 2002, 2007; UNIDO, 2002, 2004, 2005). However, the situation has now moved well beyond the simplifications of input-output tables.

One well-known criticism of the heavy reliance on these indicators for policy making is the observed tendency to identify innovation strategies with R&D strategies, on the basis of “research in, technology out” (UN, 2003; Bell, 2006). This view implicitly considers innovation outputs and other technological advances the result of a linear process driven by the supply of R&D resources and other inputs (such as technical personnel). Innovation strategies designed on this basis assume that promoting the supply of inputs will result mechanically in a higher level of innovative capabilities (UNU-INTECH, 2004).

In contrast, the now widely accepted innovation systems framework describes innovation as the result of complex interactions among actors, both national and international. This branch of the literature caricatures firms in developing countries as technologically immature (Kim and Nelson, 2000). As argued by Gabriela Dutrénit (2004, p. 210) “[firms in LDCs] do not engage in radical innovation but tend to learn over time, they accumulate knowledge, and, on these bases, they are able to progressively carry out new activities and innovate”. The gradual, incremental and interactive generation of innovations based on learning – which in LDCs often develops as response to lack of, weak or inadequate inputs (Srinivas and Sutz, 2008) – evidently calls for different measures. Output indicators are clearly insufficient for describing the complex, multidimensional aspects of innovation processes that depend not only on formal investments in R&D but also on gradual knowledge sharing and interactivity with other actors of the innovation system (UN, 2003).

The generation of innovation in developing countries therefore has a somewhat different starting point from that of more advanced economies. Particularly in LDCs, it also takes place largely outside of formal firms and institutions, in the informal economy, which constituted the livelihood of an average of half to three-quarters of the active urban population in 44 LDCs from 1990 to 2004 (UNDP, 2007). Moreover, current trends in urbanisation, unemployment and population growth suggest that the informal economy in LDCs will grow (see Chapter 4 for further discussion). Admittedly, the upgrading of technologies in small-scale informal urban businesses in LDCs has not received the attention it deserves. Yet even formal firms (especially small and medium-sized enterprises) often spend on informal innovation activities (Bougrain and Haudeville, 2002). By adopting and adapting technologies, firms, as technology users, are able to develop a range of skills and resources. These are usually hard to estimate but can be very relevant, especially in developing countries. Unfortunately, a large part of these activities may not be captured in R&D or innovation surveys (Gault and von Hippel, 2009). As a result, the impact of these informal activities is usually absent from policy deliberations.

Acquisition and assimilation of foreign innovations

Developing countries have traditionally depended on technologies generated abroad. Therefore, their ability to acquire and assimilate innovations generated abroad has been regarded as critical. Yet, mere acquisition of foreign technologies is not sufficient. Once

innovations have been acquired (or technology imported), local efforts are essential for mastering its tacit elements (Lall, 2000, p. 7), adapting them to local conditions and improving them over time. This complements the notion of user-initiated innovation (Gault and von Hippel, 2009).

The successful acquisition of foreign innovations has very much to do with the outward orientation of a firm, sector or country and with participation in global production networks (Ernst and Kim, 2002). Therefore, innovation strategies that pursue the acquisition of technological knowledge have traditionally focused on reinforcing the reliance on foreign investment, joint ventures and imports of capital goods. The usual perspective on technology spillovers from foreign direct investment (FDI) sees the subsidiary of the multinational company (MNC) as a passive actor. However, recent research suggests that technology and knowledge spillovers are more effective when domestic companies incorporate domestic innovation (Marin and Bell, 2003; Marin and Sasidharan, 2007). From this perspective, external sources of innovation and technology are not a substitute for strengthening domestic innovative capabilities but rather as a significant complement.

While acquiring technology might be a matter of access to foreign markets and finance, effective assimilation of technology generally requires a broad base of skills and a critical mass of technical expertise. This focus on human resources as pivotal for the assimilation of foreign innovations has driven innovation strategies in developing countries, with the establishment of centres of excellence to enhance their scientific capacity and initiatives to promote technical training. However, assimilation requires more than the existence of sufficient technical skills. It demands deliberate and explicit investments and efforts by domestic firms, such as on-the-job learning and knowledge sharing (Bell, 2007). Developing and improving the set of absorptive competences in developing country firms is crucial but widely ignored in research studies and surveys.

An important advance is best articulated by Lundvall and Borrás (1997) who stressed the concept of the “learning economy”, arguing that what really matters for economic development is the ability to learn rather than the existing stock of knowledge (Lundvall and Borrás, 1997, p. 35). They highlight the link between learning and change¹¹ as the source of economic dynamism, regardless of the initial technological endowments. They recognise that globalisation of technology offers new opportunities for developing countries, but argue that these opportunities are not available without deliberate efforts to absorb innovation through endogenous learning. In summary, global competition generates the need for developing countries to ensure that their domestic innovation strategies respond intelligently to this learning effect and its implications for the formation of capabilities that are in demand.

Diffusion of innovation

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers, 1995). The diffusion of innovation is not automatic. It requires a significant level of absorptive capacity and the ability to assimilate or internalise the disseminated knowledge, which, as mentioned above, does not occur without cost or effort.

The literature on the diffusion of innovation is ample, and diffusion has been identified as a crucial ingredient of innovation strategies in developing countries. However, current understanding of the local capabilities necessary for the effective diffusion of innovation in a particular context is very limited.

The international diffusion of innovation through formal mechanisms such as foreign direct investment and foreign licensing has been extensively studied (see Chapter 4 for further discussion of FDI in innovation studies). However, it has also been recognised that a large amount of technological knowledge is transferred through various informal mechanisms (Ernst and Kim, 2000; Figueiredo, 2001). Despite the recognition of the importance of informal interaction and tacit knowledge flows within and across organisations (*e.g.* Breschi and Lissoni, 2001; Jensen *et al.*, 2007), empirical research on these aspects remains scarce. The composition of local capabilities to assimilate, adapt and improve foreign technology requires further consideration, not simply in order to maximise the benefits from knowledge transfer but also to effectively engage in joint learning and knowledge sharing with foreign providers of technology.

The growing literature on clusters and experience with industrial clustering in developing countries have made useful contributions concerning networking and collaboration among actors (local and foreign) (Bell and Albu, 1999; Mytelka and Farinelli, 2000; Giuliani *et al.*, 2005; Pietrobelli and Rabellotti, 2007). In the main, these studies suggest that networks have acted as a catalyst for international knowledge diffusion and provided new opportunities for local capability formation in lower-cost locations. Recent research illustrates the transition of some of these clusters from competition based on low costs to innovation-based competition (Chaminade and Vang, 2008).

Enabling environment

For many developing countries the fundamental problem is simply the lack of an explicit innovation strategy. Nevertheless, the mere existence of an innovation strategy does not ensure that firms' technological and non-technological efforts are translated into increased rates of innovation, and subsequently into greater competitiveness and better economic performance. For countries in which innovation strategies exist, the efficiency with which they are implemented also matters. Structural problems, including corruption, institutional barriers and overall anti-competitive behaviour, also help to hinder the successful implementation of innovation strategies in developing countries and LDCs.

Increased opportunities for domestically inspired policy choices have only now begun to emerge, as more countries free themselves of massive debt obligations. With improved macroeconomic conditions, there is room for policy efforts and interventions at the microeconomic level. The current financial contagion has generally dampened international demand and government interventions to rescue failing enterprises may undo the positive gains achieved in recent times. Government indebtedness is increasing in the more advanced countries, together with unemployment and a reduction in the availability of finance. The effects on developing countries are still emerging in a context of global forecasts of deep depressions following the current recession (World Bank, 2008).

The period following structural adjustment (after 1999) appears to have improved conditions for experimenting with incentives and regulations that can spur innovation. There are opportunities for framing innovation policies in developing countries in line with more comprehensive development strategies. To increase the probability of success, innovation strategies must take into account and promote broader socioeconomic goals and inform policy at the micro, meso and macro levels.

Co-ordination of innovation policies

The implementation of an innovation policy requires the capacity and capabilities to steer a coherent innovation strategy through the co-ordination of complex systems. The difficulty of managing and administering the strategy is often compounded by the short-term horizons of electoral cycles. To ensure a successful innovation strategy, governments in developing countries need to establish a clear vision of the improvements sought, ensure a transparent regulatory and incentive structure, and define possible technological trajectories in line with the objectives of their innovation policy. The vision should be founded on the dynamics observed in the private and public sectors and on their consistency with goals of global integration.

The role of developing country governments in shaping innovation strategies in order to address technological trajectories, lock-ins and social demands for near-term amelioration is crucial. However, little has been done to analyse processes of policy making in developing countries and to identify the ways in which policy makers in these regions can better define priorities and avenues for implementation.

Many scholars have acknowledged that an effective innovation strategy requires co-ordination of multiple layers of support policies (Lall and Teubal, 1998; Lundvall and Borrás, 1997; Rodrik, 2007; Freitas and von Tunzelmann, 2008). In developing countries, these layers of intervention need to be adjusted and co-ordinated so as to effectively promote innovation as well as other core development goals such as alleviation of poverty. Max Rolfstam has recently drawn particular attention to the critical role played by public procurement of innovation (2008).

A major contribution by Lall and Teubal (1998) pioneered concerns about these issues in the literature. Reviewing the role that technology policies played in East Asian economic growth, they identified three types of policies: *i*) functional interventions, intended to improve markets operations without favouring particular activities; *ii*) horizontal policies, designed to promote specific activities across sectors, such as incentives to promote greater innovation, R&D and training; and *iii*) vertical policies, designed to promote the advance of particular sectors.¹²

Other authors have adopted variations of this three-dimensional taxonomy. For instance, Lundvall and Borrás (1997) described the three elements of a broadly oriented innovation policy as: *i*) policies affecting the pressure for change (competition policy, trade policy and the stance of general economic policy); *ii*) policies affecting the ability to innovate and absorb change (human resource development and innovation policy); and *iii*) policies designed to take care of losers in the game of change (social and regional policies with redistribution objectives).

This three-dimensional framework provides a format for designing government support of innovation and for defining priorities and levels of intervention for the effective promotion of innovative activities. However, its specific use is largely defined by the context in which it is applied, since the authors recognise that “the exact mix var[ies] with country context and the capabilities of its policy makers” (Lall and Teubal, 1998, p. 1370).

Policy implications for developing countries

The comparison of innovation strategies and their replication across countries has been a matter of heated debate. Success and performance have largely been assessed through international benchmarking exercises. For instance, Archibugi and Coco (2005) argue that international comparisons are meaningful, regardless of differences in social, cultural and geographical contexts. They aggregate various statistics on technological capabilities, assuming that individual indicators are complementary rather than substitutes.

Others have argued that success and performance need to be evaluated at the local level and put greater emphasis on the need for policy experimentation in developing countries (e.g. Lundvall *et al.*, 2006; Sutz and Arocena, 2006; Srinivas and Sutz, 2008; Juma and Yee-Cheong, 2005). They highlight the need to open up new development trajectories with greater emphasis on generating knowledge and learning, and they argue that a global basis for measuring and assessing innovation strategies, incentives and regulations does not reflect the innovative activities that are in fact taking place in developing regions.

This chapter stresses the importance of evidence-based policy experimentation. However, it is also essential for policy makers to learn from the experiences of others in order to design and implement an effective domestic innovation strategy (Kraemer-Mbula, 2009b, p. 11). Key policy dimensions therefore need to be identified and benchmarked internationally to draw useful lessons from the experience of other developing regions. This latter point is particularly relevant, considering the urgent need to accelerate innovation and socioeconomic development in developing countries. Although international comparisons are useful, generic one-size-fits-all solutions are bound to fail. It should be noted that the price of policy and strategy failures usually means significant costs for developing countries and especially for LDCs.

Role of donor countries in facilitating the implementation of innovation strategies

The international implications of domestic policy take on greater importance in the context of an increasingly globalised economy. While they seek harmonisation, multilateral institutions such as the World Trade Organization, the World Intellectual Property Organization, the World Bank and the International Monetary Fund continue to exert a strong influence over local policy on research activities. Indeed, many of their interventions do not seem consistent with the overall institutional frameworks of developing countries. Although the diffusion of “innovation” thinking is generally beneficial, the application of a single form of innovation strategy to various local conditions requires caution.

The World Summit on Sustainable Development, multilateral environmental agreements and climate change offer a set of global challenges which require multilateral international efforts. At the regional (supra-national) level, various voluntary associations such as the New Partnership for Africa’s Development (NEPAD) have encouraged many countries to increase their participation in science, technology and innovation. Because their efforts offer broader-based access to organisations beyond state actors, they make available a wide variety of opportunities. Countries need more support for conducting studies based on internationally comparable methodologies and for encouraging regional co-operation on sharing of experience and policy learning.

This situation requires innovative approaches with respect to donor co-ordination, mobilisation of resources and alignment with the domestic development agenda. The value of an innovation systems approach is maximised by achieving coherence between different actors and competing agendas.

Conclusion

Knowledge is increasingly recognised as a critical determinant of economic growth, good governance and improvements in the quality of life, in spite of disagreements within the development paradigm and economics more generally. Nonetheless, development thinking based on evolutionary economics and innovation systems confirms that knowledge is transformed into goods and services through a country's enterprises, higher education institutions and public research institutes. It is in fact these entities' relationships with the policy environment that largely shapes a national system of innovation.

The literature confirms that skilled people are the most effective means of knowledge transfer and adaptation. The central role of human capacity, capability and competence formation for innovation should not be underemphasised. Coherent and effective administration and suitable governance regimes are necessary to ensure the co-ordination of complex systems. However, there is the risk that the areas of greatest need in this respect may not attract a sufficient supply of human resources. The problem may also exist in more advanced economies, but it is especially present in developing countries. In times of significant economic and financial flux, safeguarding policy gains that offer much more in the long run than in the immediate future is also important.

With this in mind, it is tentatively suggested that innovation policies and strategies should undertake the following efforts:

- *Build domestic STI policy competences through evidence-based research.* It is crucial to build intermediary facilities that institutionalise and build the overall capacity for policy research and learning. Most fast-emerging developing countries are investing in these capabilities in government and in the public higher education sector. These initiatives require co-operation and support to ensure that domestic situations gain advantages from global networks and more mature institutions in the North.
- *Improve policies and institutions within a framework of autonomy and accountability while ensuring that learning from implementation is acknowledged and progressively feeds back into improving strategies.* To ensure that policies remain relevant, flexible and agile requires building monitoring, evaluating and learning into strategic frameworks. These strategic frameworks will benefit from clearly defined and articulated goal-setting processes involving wide participation of enterprises, universities, public research institutes and civil society organisations. Democratically defined terms of autonomy would improve the competences of performing and funding agencies. Not only would this ensure accountability, it would address concerns about trust, co-operation and competition in small economies.
- *Recognise and support human resource development and management capability formation.* It is important to maintain the broad goal of maximising human resource development, but specific attention should be paid to the need to expand the cadre of management practitioners who can contribute significantly to improving

the coherence and alignment of policy and strategies. This need is especially great in project and programme management. The complexity of developing country contexts and the non-linearity of STI policies and strategies also increase the demand for skilled managerial professionals. Ensuring that STI policy managers have access to continuous upgrading of their learning is another challenge. Increasing the stock of capable and competent STI managers is therefore essential to ensure appropriate implementation, monitoring, evaluation and improved system-level performance.

- *Achieve funding sustainability through public-private interaction and cost recovery.* The scarcity of finances in the face of competing demands on the public purse necessitates the exploration of innovative funding regimes. Much has been learned from domains such as infrastructure development for exploring means of recovering the costs of public support and of encouraging greater co-operation between public and private enterprises.
- *Aim at merit and scientific rigour through competitive funding, peer review, etc.* Utilising a principle embedded in the very definition of scientific research and knowledge for broader application in selecting projects and programmes would improve quality and encourage wider experimentation. This would also improve the validity and veracity of the evidence base for policy and strategy reform and could lead to improvements in institutions and agencies as they seek to ensure greater alignment and coherence with local realities and policies.
- *Enhance existing linkages and establish new ones between the productive and the knowledge sectors, while ensuring improved access to basic research and the growing international knowledge base.* It is essential to improve the relationship between users and producers of knowledge. The literature shows the growing recognition of the importance of user perspectives (e.g. von Hippel, 2005). The spread of increasingly open and global research practices poses significant challenges for improving the endogenous innovative capacities of developing countries. Much can be gained from seeking alignment of international support and local needs. Carefully constructing international research collaboration in a manner that helps to address local constraints offers possibilities for equitable development.

Notes

1. United Nations, Department of Economic and Social Affairs, Population Division, www.un.org/esa/population/unpop.htm.
2. Globelics, the global network for learning, innovation and competence-building systems is one such initiative, www.globelics.net.
3. Following OECD/Eurostat (2005), innovation is defined as the realisation of the value created through the introduction of a new product (a good or a service) to the market, the introduction of a new process that produces products for the market, or delivers them, the use of new organisational structures or business practices, or the development of new markets or the capturing of a greater share of existing markets.
4. The subtitle of UNCTAD's 2007 Least Developed Countries Report was "Knowledge, Technological Learning and Innovation for Development".
5. See the eloquent statement of former South African President Thabo Mbeki on the "two nations' divide" (Mbeki, 2003) and the more empirical UNDP/HSRC/DBSA (2005).
6. Reviews of relevant empirical cluster studies in Latin America can be found in Albaladejo (2001) and Pietrobelli and Rabellotti (2007).
7. www.redesist.ie.ufrj.br/Ev/home.php.
8. This later became "getting the institutions right" (as noted by Rodrik, 2006).
9. For instance, the establishment of the African Ministerial Council on Science and Technology (AMCOST) in 2003 under the auspices of the New Partnership for Africa's Development (NEPAD) and the African Union (AU). AMCOST is a high-level platform for developing policies and setting science, technology and innovation priorities for African development; see www.nepadst.org. Also, the Consolidated Plan of Action of NEPAD, which was endorsed by the AU Summit in January 2007, proposes specific regional programmes to promote the role of science and technology to support social and economic development in Africa – the full document can be accessed at www.nepadst.org.
10. Available on the Human Sciences Research Council (HSRC) website, www.hsrc.ac.za.
11. "Rapid change implies a need for rapid learning, and those involved in rapid learning impose change on the environment and on other people." (Lundvall and Borrás, 1997, p. 36)
12. The impact of each of these layers of intervention has been tested for the ICT sector in South Africa by Kraemer-Mbula (2009a).

References

- Albaladejo, M. (2001), “The Determinants of Competitiveness in SME Clusters: Evidence and Policies for Latin America”, in *Small-Scale Enterprises in Developing and Transitional Economies*, H. Katrack and R. Strange (eds.), Macmillan, London.
- Amsden, A. (1989), *Asia's Next: South Korea and Late Industrialization*, Oxford University Press, New York.
- Archibugi, D. and A. Coco (2005), “Measuring Technological Capabilities at the Country Level: A Survey and a Menu for Choice”, *Research Policy*, Vol. 34 (2), pp. 175-194.
- Bell, M. (2006), “Background Discussion Paper for the L20 Workshop”, *Furthering Science & Technology*, Maastricht.
- Bell, M. (2007), “Technological Learning and the Development of Production and Innovative Capacities in the Industry and Infrastructure Sectors of Least Developed Countries: What Roles for ODA?”, SPRU-Science and Technology Policy Research, University of Sussex, Paper prepared for UNCTAD Division for Africa, Least Developed Countries and Special Programmes.
- Bell, M. and M. Albu (1999), “Knowledge Systems and Technological Dynamism in Industrial Clusters in Developing Countries”, *World Development*, Vol. 27(9), pp. 1715–1734.
- Bougrain, F. and B. Haudeville (2002), “Innovation, Collaboration and SMEs Internal Research Capacities”, *Research Policy*, Vol. 31(5), pp. 735-747.
- Breschi, S. and F. Lissoni (2001), “Knowledge Spillovers and Local Innovation Systems: A Critical Survey”, *Industrial and Corporate Change*, Vol. 10(4), pp. 975-1005.
- Chaminade, C. and J. Vang (2008), “Globalisation of Knowledge Production and Regional Innovation Policy: Supporting Specialized Hubs in Developing Countries”, *Research Policy*, Vol. 37(10), pp. 1684-1697.
- Dutrénit, G. (2004), “Building Technological Capabilities in Latecomer Firms: A Review Essay”, *Science, Technology and Society*, Vol. 9 (2), pp. 209–241.
- Ernst, D. and L. Kim (2002), “Global Production Networks, Knowledge Diffusion, and Local Capability Formation”, *Research Policy*, Vol. 31(8-9), pp. 1417-1429.
- Fagerberg, J. (2005), “Innovation: A Guide to the Literature”, Chapter 1 in J. Fagerberg, D. Mowery and R. Nelson (eds.), *The Oxford Handbook of Innovation*, Oxford, pp. 1-26.
- Figueiredo, P.N. (2001), *Technological Learning and Competitive Performance*, Edward Elgar Publishing, Cheltenham and Northampton, MA.
- Freeman, C. (1987), *Technology and Economic Performance: Lessons from Japan*, Pinter, London.

- Freeman, C. and L. Soete (1997), *The Economics of Industrial Innovation*, Pinter, London.
- Freitas, I.M.B. and N. von Tunzelmann (2008), “Mapping Public Support for innovation: A Comparison of Policy Alignment in the UK and France”, *Research Policy*, Vol. 37(9), pp. 1446-1464.
- Furman, J., M.E. Porter and S. Stern (2002), “The Determinants of National Innovative Capacity”, *Research Policy*, Vol. (31), pp. 899-933.
- Gault, F. and E. von Hippel (2009), “The Prevalence of User Innovation and Free Innovation Transfers: Implications for Statistical Indicators and Innovation Policy”, *MIT Sloan School of Management Working Paper #4722-09*, MIT Sloan School of Management, Cambridge, MA.
- Giuliani, E., R. Rabellotti and M.P. van Dijk (2005), *Clusters Facing Competition: The Importance of External Linkages*, Aldershot, Ashgate.
- Griffin, K. (1996), *Macroeconomic Reform and Employment: An Investment-Led Strategy of Structural Adjustment in Sub-Saharan Africa*, International Labour Office, Geneva.
- Hippel, E. von (2005), *Democratizing Innovation*, MIT Press, Cambridge, MA.
- Hobday, M. (2003), “Innovation in Asian Industrialization: A Gerschenkronian Perspective”, *Oxford Development Studies*, Vol. 31, No. 3, pp. 294-314.
- Jensen, M.B., B. Johnson, E. Lorenz, and B-Å. Lundvall (2007), “Forms of Knowledge and Modes of Innovation”, *Research Policy*, Vol. 36, pp. 680-693.
- Juma, C. and L. Yee-Cheong (2005), *Innovation: Applying Knowledge in Development*, Report of UN Millennium Project Task Force on Science, Technology, and Innovation.
- Kahn, M., W. Blankley, R. Maharajh, T.E. Pogue, V. Reddy, G. Cele and M. du Toit (2004), *Flight of the Flamingos: A Study on the Mobility of R&D Workers*, HSRC Publishers, Capetown, South Africa.
- Katz, J.M. (1984), “Domestic Technological Innovations and Dynamic Comparative Advantage: Further Reflections on a Comparative Case Study Program”, *Journal of Development Economics*, No. 16, pp. 13-38.
- Katz, J.M. (1987), *Technology Creation in Latin American Manufacturing Industries*, St. Martin’s Press, New York.
- Kim, L. and R.R. Nelson (2000), *Technology, Learning, and Innovation: Experiences of Newly Industrializing Economies*, Cambridge University Press, Cambridge.
- Kline, S. and N. Rosenberg (1986), “An Overview of Innovation”, in R. Landau and N. Rosenberg (eds.), *The Positive Sum Strategy: Harnessing Technology for Economic Growth*, National Academy Press, Washington, DC, pp. 275-305.
- Kraemer-Mbula, E. (2009a), “Building Technological Capability in Developing Countries: A Study of ICT Firms in South Africa”, Doctoral Thesis, University of Oxford, Oxford.
- Kraemer-Mbula, Erika (2009b), “Report of the Rapporteur General”, in *Innovation for Development: Converting Knowledge to Value, Summary Report*, UNESCO, Paris, pp. 7-17.

- Lall, S. (1992), “Technological Capabilities and Industrialization”, in *World Development*, Vol. 20(1), pp. 65-86.
- Lall, S. (2000), “Skills, Competitiveness and Policy in Developing Countries”, Working Paper, Queen Elizabeth House, University of Oxford.
- Lall, S. and C. Pietrobelli (2002), *Failing to Compete: Technology Development and Technology Systems in Africa*, Edward Elgar, Cheltenham.
- Lall, S. and M. Teubal (1998), “Market Stimulating Technology Policies in Developing Countries: A Framework with Examples from East Asia”, *World Development*, Vol. 26(8), pp. 1369-1385.
- Lall, S. and S. Wangwe (1998), “Industrial Policy, and Industrialization in Sub-Saharan Africa”, *Journal of African Economies*, Vol. 7, pp.70–107.
- Lundvall, B-Å. (1988), “Innovation as an Interactive Process: From User-Producer Interaction to the National System of Innovation” in G. Dosi, C., Freeman, R.R. Nelson, G. Silverberg and L. Soete (eds.), *Technical Change and Economic Theory*, Pinter, London, pp. 349-369.
- Lundvall, B-Å. (ed.) (1992), *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, Pinter, London.
- Lundvall, B-Å. and S. Borrás (1997), “The Globalising Learning Economy: Implications for Technology Policy”, Final Report under the TSER Programme, EU Commission.
- Lundvall, B-Å., P. Interakummerd and J. Vang (eds.) (2006), *Asia’s Innovation Systems in Transition*, Edward Elgar, London.
- Maharajh, R. (2008), “Global Economic Policy Reform”, in M. Pressend and M. Ruiters (eds.), *Dilemmas of Poverty and Development*, Institute for Global Dialogue, Midrand, pp. 166-201.
- Marin, A. and M. Bell (2003), “Technology Spillovers from Foreign Direct Investment (FDI): An Exploration of the Active Role of MNC Subsidiaries in the Case of Argentina in the 1990s”, Paper presented at the DRUID Summer Conference 2003 on Creating, Sharing and Transferring Knowledge: The Role of Geography, Institutions and Organizations, Copenhagen, 12-14 June.
- Marin, A. and S. Sasidharan (2007), “Active MNE Subsidiaries and Technology Spillovers in Late Industrialising Countries: The Case of Argentina and India”, Paper presented at Globelics 2007.
- Martin, S. and J. Scott (2000), “The Nature of Innovation Market Failure and the Design of Public Support for Private Innovation”, *Research Policy*, Vol. 29, pp. 437-448.
- Mbeki, T. (2003), “Letter from the President: Bold Steps to End the Two Nations Divide”, *ANC Today*, Vol. 3, No. 33, August, pp. 22-28.
- Mkandawire, T. and C. Soludo (1999), *Our Continent, Our Future: African Perspectives on Structural Adjustment*, Africa World Press, Trenton, NJ.
- Mytelka, L. and F. Farinelli (2000), “Local Clusters, Innovation Systems and Sustained Competitiveness”, *UNU/INTECH Discussion Paper Series*.
- Nelson, R.R. (ed.) (1982), *Government and Technical Progress: A Cross-Industry Analysis*, Pergamon, New York.

- Nelson, R.R. (ed.) (1993), *National Innovation Systems: A Comparative Analysis*, Oxford University Press, Oxford.
- OECD (2002), *The Measurement of Scientific and Technical Activities: Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development*, OECD, Paris.
- OECD (2007), *Reviews of Innovation Policy: South Africa*, OECD, Paris.
- OECD/Eurostat (2005), *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, 3rd Edition, OECD, Paris.
- Pack, H. and L.E. Westphal (1986), “Industrial Strategy and Technological Change: Theory versus Reality”, *Journal of Development Economics*, Vol. 22, No. 1, pp. 87-128.
- Pietrobelli, C. and R. Rabellotti (2007), *Upgrading to Compete. Global Value Chains, Clusters and SMEs in Latin America*, Harvard University Press, Cambridge, MA.
- Pogue, T.E. (2007), *Human Resource Mobility and the National System of Innovation: A Review of Literature*, HSRC Publishers, Capetown.
- Rodrik, D. (2006), “Goodbye Washington Consensus, Hello Washington Confusion? A Review of the World Bank’s ‘Economic Growth in the 1990s: Learning from a Decade of Reform’”, *Journal of Economic Literature*, Vol. 44, No. 4, pp. 973-987.
- Rodrik, D. (2007), *One Economics, Many Recipes. Globalization, Institutions, and Economic Growth*, Princeton University Press, Princeton and Oxford.
- Rogers, E.M. (1995), *Diffusion of Innovations*, 4th edition, Free Press, New York.
- Rolfstam, M. (2008), “Public Procurement of Innovation”, Doctoral Thesis, Lund University, Lund.
- Romijn, H. (2001), “Technology Support for Small Industry in Developing Countries: A Review of Concepts and Project Practices”, *Oxford Development Studies*, Vol. 29 (1), pp. 57-76.
- Schumpeter, J.A. (1947), “The Creative Response in Economic History”, *Journal of Economic History* 7(2), pp. 149-159.
- Srinivas, S. and J. Sutz (2008), “Developing Countries and Innovation: Searching for a New Approach”, *Technology in Society*, Vol. 30, Issue 2, pp. 129-140.
- Stein, H. (1992), “Deindustrialization, Adjustment, the World Bank and the IMF in Africa”, *World Development*, Vol. 20, No. 1, pp. 83-95.
- Sutz, J. and R. Arocena (2006), “Integrating Innovation Policies with Social Policies: A Strategy to Embed Science and Technology into Development Processes”, IDRC Innovation, Policy and Science Program Area, Strategic Commissioned Paper, April.
- Teitel, S. (1984), “Technology Creation in Semi-Industrial Economies”, *Journal of Development Economics*, Vol. 6, pp. 39-61.
- United Nations (UN) (2003), *New Indicators for Science, Technology, and Innovation in the Knowledge-Based Society*, Economic and Social Commission for Western Asia (ESCWA), United Nations, New York.

- UN (2006), United Nations Protocol's Blue Book "Permanent Missions to the United Nations No. 295", April.
- United Nations Conference on Trade and Development (UNCTAD) (2007), *Least Developed Countries Report: Knowledge, Technological Learning and Innovation for Development*, United Nations Conference on Trade and Development, Geneva.
- United Nations Development Programme (UNDP) (2007), *Human Development Report*, United Nations Development Programme, Geneva.
- UNDP, Human Sciences Research Council (HSRC) and Development Bank of Southern Africa (DBSA) (2005), *Development Report: Overcoming Underdevelopment in South Africa's Second Economy*, Development Bank of Southern Africa, Midrand.
- United Nations Industrial Development Organization (UNIDO) (2002), *Industrial Development Report: Competing through Innovation and Learning*, United Nations Industrial Development Organisation, Geneva.
- UNIDO (2004), *Industrial Development Report: Industrialization, Environment and the Millennium Development Goals in Sub-Saharan Africa*, United Nations Industrial Development Organisation, Geneva.
- UNIDO (2005), *Industrial Development Report: Capability Building for Catching-up: Historical, Empirical and Policy Dimensions*, United Nations Industrial Development Organisation, Geneva.
- United Nations University-Institute for New Technologies (UNU-INTECH) (2004), *Designing a Policy-Relevant Innovation Survey for NePAD*, UNU-INTECH, Maastricht.
- Wade, R. (1990), *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialisation*, Princeton University Press, Princeton, NJ.
- World Bank (1994), *Adjustment in Africa: Reform, Results, and the Road Ahead*, Oxford University Press, New York.
- World Bank (2000), *Can Africa Claim the 21st century?*, The World Bank, Washington, DC.
- World Bank (2008), *Global Economic Prospects: Technology Diffusion in the Developing World*, World Bank, Washington, DC.



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