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### **Innovation Strategies in Developing Countries**

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# Innovation Strategies in Developing Countries

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August 2009

## **Abstract:**

This paper is a contribution to the discussion on Innovation for Development. It is argued that innovation strategies in developing countries are the result of competing policy and contextual factors. In exploring this theme, it suggests that innovation strategies which are shaped by domestic market and policy realities are more robust and contribute towards improving the country-level performance of enterprises. The paper has seven sections which include a brief review of the literature related to innovation strategies in developing countries; a small discussion of success factors and policies of countries that offer good experiences and lessons in applying innovation strategies; a part on what policy implications to draw from the literature and the success stories for less developed countries; and a final section on the role of the donor countries in facilitating the implementation of the innovation strategies. The paper puts forward some tentative conclusions that summarise what has been learnt from the paper and affirms that the innovation-systems based strategies are indeed internationally replicable. The resulting policy and developmental frameworks will invariably exhibit high levels of variation. These differences emerge primarily from the systemic approach encouraged by the use of innovation policy. Secondly, the innovation-systems approaches ensure adaptability whilst maintaining methodological rigour. It also enables comparability and thereby also promotes appropriate and relevant benchmarking. Finally, the innovation-systems paradigm has a normative capacity to dynamically absorb and respond to the needs and demands of locally-specified domestic contexts.

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## 1. Introduction

The 21<sup>st</sup> Century is a period in the history of humanity which is simultaneously exciting and frightening. Our collective accumulation of scientific knowledge, technological capabilities and competencies for innovation has advanced the well-being of billions of people scattered across 192 sovereign political entities<sup>2</sup>. 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 knowledge concentrations and the demands of equitable development. The 6.8 billion people<sup>3</sup> of the planet are further challenged by concerns over an increasing quality-of-life gap between and within all countries, the rapidity of global climate change, the extensive spread of an international financial crisis and its widening into a more generalised economic recession.

The changes of the past century are largely attributable to a particular form of economic development. This historical period of accelerated transformation 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. Globalisation has moved beyond the financial sector and is today more widespread in its embrace of investment, production and distribution systems on a global scale<sup>4</sup>. The mobility of highly skilled people has also increased<sup>5</sup>. Within capitalist systems, the key tools utilised in 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 strategies and international science and technology cooperation. Society's capacity has largely been framed through scientific and technological institutions meeting the needs of productive enterprises. As these enterprises have grown in scale and complexity, they have also transcended geo-political and sectoral boundaries. The literature concerning systems of innovation<sup>6</sup> has kept pace with these phenomenal transformations through an expanding network<sup>7</sup> of scholars, policy-makers and administrators.

Knowledge contributes to innovation insofar as the latter is the successful application of the former. The process whereby knowledge is generated and acquired through to its transformation into usefulness and implementation is nonlinear and also dynamic. The traditional relationship between knowledge-suppliers and users has been transformed.

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<sup>2</sup> United Nations Protocol's Blue Book "Permanent Missions to the United Nations No. 295", April 2006.

<sup>3</sup> United Nations, Department of Economic and Social Affairs, Population Division. Accessed through <http://www.un.org/esa/population/unpop.htm>.

<sup>4</sup> Maharajh, R. 2008, Global Economic Policy Reform, Chapter 9, in Pressend, M. and M. Ruiters (editors) Dilemmas of Poverty and Development, Institute for Global Dialogue, Midrand, pp. 166 – 201.

<sup>5</sup> See Pogue, T.E. 2008 and also earlier work in [Flight of the Flamingos](#) (2004).

<sup>6</sup> Fagerberg, J. 2005, Innovation: A Guide to the Literature, Chapter 1 in Fagerberg, Mowery & Nelson (editors) [The Oxford Handbook of Innovation](#), Oxford.

<sup>7</sup> Globelics, the global network for learning, innovation and competence-building systems is one such initiative. More details can be accessed at [www.globelics.net](http://www.globelics.net).

This has blurred the boundaries between public and private sectors with respect to innovation. It is also the case that the boundaries between discrete social, economic, political and environmental reform cannot be assumed. The interconnectedness of the different policy domains, the search for contextually-determined local relevance and the enormity of present global challenges has increased the complexity for innovation strategy development. It is also important to recognise that policies and politics are co-dependent. As such, public policy choices may be seen as determinations representing power relations in the society, the country and globally.

This paper is concerned with the ways in which knowledge contributes to innovation<sup>8</sup>. It recognises this relationship as dynamic and complex. Specifically, the paper reviews examples of policies and practices that have resulted in the transfer of knowledge to developing countries and examines the factors that influenced the successful transfer of the knowledge and the outcome of the transfer. It also discusses whether the approaches reviewed could be replicated beyond the borders of countries from which they originate. The paper therefore provides a starting point from which an assessment about how innovation policies could potentially generate improved and enhanced strategic responses in developing countries. It does so by flagging some of the key issues that have arisen in the literature concerning the developing regions of Africa, Asia and Latin America.

Government policies which seek to increase the rate of innovation have become more widespread and have deepened with feedback from the learning-through-implementation. Innovation policy is therefore increasing its significance in generating initiatives for the promotion of improving the country-level performance of enterprises. This rapid expansion of policies and associated instruments is even impacting on large sections of the least developed countries<sup>9</sup> (LDCs). Continuities in the development discourse remain however as developing regions still benchmark their policy and strategy choices to perspectives generated by policy research in more advanced and mature economies. However, and almost in a synchronous time-scale to the evolution of thinking about policy management and priorities in the more industrialised economies, innovation strategies in developing countries have begun to expand 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 between each other and then with the developing regions. This issue, whilst not pursued further in this paper, increases in significance when considered against the new dynamics of a truly globalised world facing the prospects of crises. It is however supportive of the need to acknowledge that innovation policies need to be informed and guided by the historical, socioeconomic and political contexts of individual countries and the global challenges of sustainable development.

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<sup>8</sup> 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.

<sup>9</sup> The subtitle of the 2007 Least Developed Countries Report by UNCTAD was “knowledge, technological learning and innovation for development”

Emerging from contemporary innovation systems studies is the notion that innovation in developing countries needs to be understood broadly. Given the persistence of dualisms<sup>10</sup> in national economies that characterise most developing countries, innovation should include aspects such as innovation in the informal sector and in traditional sectors (such as agriculture, energy and mining). Secondly, since the level of innovation in most LDCs generally takes place below the global technology frontier, considerations about innovation policies should be closely aligned with the 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 paper intends to provide directions for the design of innovation policies which are domestically contextualised, whilst simultaneously responding to the current milieu of increased global integration.

## **2. The recent history of innovation strategies in developing countries**

Early innovation theories developed in more advanced industrialised economies emphasising the role of technological advance and radical innovations (Schumpeter, 1947; Kline and Rosenberg, 1986; Freeman, 1987; Freeman and Soete, 1997). This perception of innovation has derived in a stream of policy recommendations directed to the promotion of scientific and technological outputs – scientific research and development (R&D), technical manpower, patents and scientific publications (see for example Tasseey, 1997; Patel, 1995; Furman et al, 2002). As a consequence, government initiatives in developed and developing countries have been mainly focused on supporting formal R&D, and improving the mechanisms for transferring the results of public and foreign R&D to the domestic private sector.

However, theoretical advances based on evolutionary economics, suggest that innovations are not originated in a linear manner, but are rather the result of complex and multiple interactions with a variety of actors and their environment, known as the “innovation system” (Freeman, 1987; Lundvall, 1988 & 1992; Nelson, 1993; Teubal, 1998; Lall and Teubal, 1998; Lall, 2003)<sup>11</sup>. These developments in the literature follow the more industrially-embedded earlier conceptualisation by Richard Nelson (1982). Over time, our understanding of innovation has been enhanced through the incorporation of the experience of developing countries and also through the increased availability of data that highlights the effects of networking, learning and collaboration among the multiple actors of the innovation system (Lundvall and Borrás, 1997).

The economic success of some *East Asian* countries in the 1980s and 1990s triggered a wide interest in understanding the nexus between technological performance and innovation policies in the context of developing regions. A wave of development theorists started

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<sup>10</sup> See especially the eloquent description by former South African President, Thabo Mbeki on the “two economies in one country” and a more empirical study: UNDP/ HSRC/ DBSA. 2005 Development Report: Overcoming Underdevelopment in South Africa's second economy, Midrand.

<sup>11</sup> These interactions take place at the national, regional, local and even sectoral level.

studying the fast-growing New Industrialised Economies (NIEs), and the role of the government in promoting their industrial dynamics (Pack & Westphal, 1986; Wade, 1988; Lall 1992; Hobday, 1995; Amsden, 1989; Kim and Nelson, 2000). The strong technological content (and the role of technological learning and imitation) put the emphasis on policies for technology transfer, assimilation and acquisition of foreign technologies. At the same time, research attention was also focused on the role of indigenous efforts to successfully assimilate foreign knowledge and technologies as well as acquire domestic innovative capabilities.

In *Latin America* initial views of innovation strategies were influenced by a general debate about industrial policy strongly marked by the structural adjustment programmes and subsequent economic reforms (see for example 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, examining local industrial clusters and the benefits of collaboration (Nadvi, 1995). More detail about the linkages between innovation and the local production systems have been collected by the Research Network on Local Productive and Innovative Systems<sup>12</sup> (RedeSist) in Brazil.

In *Sub-Saharan Africa*, early debates on innovation strategies were also influenced by the contention between the revisionist approach in favour of policies of state intervention (Stein, 1992; Mkandawire and Soludo, 1999; Lall and Wangwe, 1998, Griffin, 1996) versus the neoliberal agenda advocating for minimising the role of government while focusing on “getting the fundamentals right” (World Bank, 1994, 2000)<sup>13</sup>. Despite the significant advances that have taken place in certain African countries in the last three decades (such as South Africa, Mauritius, Mozambique, etc) and at pan-African level, entities, organisations and institutions which explicitly seek to enable innovation are still developing. The challenges of implementation, monitoring, evaluation and learning however still constitute major hurdles for Africa’s various innovation policies, strategies and programmes.

General consensus exists, albeit not uniform, that innovation and technology are strategic variables in any development process. Researchers and policy-makers however differ about which aspects and stages of innovation can and should be promoted, as well as how innovation “success” can and should be measured in developing regions. Some maintain that international market mechanisms appropriately assign innovation resources to the actors that most are able to exploit them productively. A second school of thought is critical of the dependence of developing countries on foreign technologies and rather seeks an enhanced role for indigenous innovative capabilities. A third school of thought maintains that what is important for developing countries is the achievement of the right combination of imported technologies and locally developed innovative capabilities. From the 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.

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<sup>12</sup> <http://www.redesist.ie.ufrj.br/Ev/home.php>

<sup>13</sup> which later developed into “getting the institutions right” (Rodrik, 2006)

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 those policies that rely purely on narrowly-framed technology transfers 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 supporting 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 Frascati and Oslo Manuals augurs well for current-debates to be premised on evidence and thereby to move beyond mere rhetorical posturing between stakeholders, role-players and policy-makers.

### **3. 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 are increasingly participating in this progress although access remains uneven. Changes brought by rapid global innovation have materialised into new opportunities for developing regions. This has especially been an outcome where domestic policy reform has sought to increase their capacity to absorb global technological advances.

Technological change has deeply affected the dynamics in global production chains, with large implications for both fast emerging and least developed amongst the developing countries. While the rapid pace of innovation has raised entry barriers in certain activities and industries (such as pharmaceuticals and biotechnology), the emergence of global outsourcing has provided increasing opportunities for lower cost sites in developing countries in other sectors (such as Information and Communications Technologies). Companies in developing countries are now competing 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 new-arising opportunities has become a deciding factor in the success and survival of firms in developing regions as well as advanced economies.

Despite sharing innovation as a common drive for competition, recent studies continue to confirm that innovation although generically described is not universal. This partially explains the significant differences in innovation activities, performance and results within and between countries. The 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:

- (i) pervasive technological isolation of firms,
- (ii) existence of market failures,
- (iii) different nature of innovation (based on incremental innovations and learning),
- (iv) larger presence of traditional sectors of production and the scale of the informal sector; and
- (v) tacit knowledge base of technologies

Notwithstanding falling costs of communication and 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' dislocation of latecomer firms from major international sources of technology, R&D, universities, and mainstream international markets. This disadvantage already places latecomer firms in a different starting point in innovation processes compared to that occupied by those located in more advanced economies.

Whilst acknowledging diversity in the developing world, scholars still identify common market failures that can significantly limit the success of innovative efforts. The ability of firms to access finance, human resources and other technical inputs, can not always be satisfied by market mechanisms (Lall and Teubal, 1998; Lall and Pietrobelli, 2002).

These limitations, though not unique to developing countries, may affect also the ability of these firms to market their goods and services and fulfil the continuous need to improve their technical capabilities to face competition. Particularly in least developed countries, existing problems with appropriability of innovations, failures in financial markets, poor technology infrastructure, and other factors have suggested that "strict reliance on a market system is likely to result in underinvestment in innovation relative to the socially desirable level" (Martin and Scott, 2000, p. 438; and also supported by Lall and Teubal, 1998; Romijn, 2002; Mani, 2000). Responding to these constraints are a large number of studies that recommend the need for tailored and strongly-supported innovation strategies to address many of the pervasive market and institutional constraints in developing countries, especially LDCs.

Innovation in developing countries is largely related to 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 innovations take place, since conditions of scarcity – as opposed to abundance – are often at the basis of innovations in developing countries. Additionally, most generic technologies are imported or generated abroad; therefore, innovation in developing countries is also likely to be based on adopting, adapting, imitating and improving foreign technologies. Examples of successful innovators in developing countries have generally concluded that radical innovations are not the main output of the innovative performance in developing countries, but incremental innovations (this is supported by many of the Innovation Survey results, including those of South Africa).

The currently hegemonic conception of innovation is as *something* that occurs in firms as formal organisations of enterprise. Ironically, even the broadening of the concept of national systems of innovation is yet to fully incorporate and address innovation that takes place in the larger economic sector of most developing economies: the informal sector. As stressed by Srinivas and Sutz (2008), scarcity is the key driver of the generation of new ideas and thus, innovation. The informal sector especially those in developing countries comprise millions of enterprises that operate under extreme conditions of primary survival, scarcity and constraints. The dynamics of innovation in the informal sector, whilst predominantly present in developing countries, are largely ignored in the literature for both developing and more developed economies. From this brief overview, it is clear that disregarding the particularities of innovation in developing countries produces misleading, asymmetrical or ineffective innovation strategies.

#### **4. Frequent issues in the literature of innovation strategies in developing countries**

This section detects five dimensions – (1) generation, (2) assimilation and (3) diffusion of innovation, (4) enabling environment and (5) policy management – drawing from the most frequent issues addressed in the literature. Not all these dimensions need to have equal weight in all countries, but the adequate alignment of innovation policies will depend on the particular needs of an economy. The rise of evidence-based policy formation offers much to redress the specific needs of individual economies.

##### **4.1 Generation of innovation**

The generation of innovation in developing countries starts from a rather different level to that of more advanced economies. Whilst in common this represents the ability of an economy to generate ‘new’ technologies and innovate, vast differences can be observed. There has existed a historical tradition whereby 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 Research and Development). Output measures have included counting patents and scientific publications (OECD, 2002 and 2007; Industrial Development Report, etc). This situation has significantly advanced beyond the simplifications of Input-Output Tables.

One notorious criticism for the heavy reliance on these indicators for policy making is the observed tendency to conceive innovation strategies on the basis of “research-in, technology-out” (UN, 2003). This view implicitly considers innovation outputs and other technological advancements as the results of a linear process driven by the supply of R&D resources and other inputs. Innovation strategies designed on this basis assume that promoting the supply of inputs countries will be mechanically reflected in a higher level of innovative capabilities (UNU-INTECH, 2004).

In contrast, the widely accepted framework of innovation systems, 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,

1997; Kim and Nelson, 2000). As argued by Gabriela Dutrenit (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”. Output indicators are thus insufficient to describe the complex and multidimensional aspects of innovation processes, which depend not only on formal investments on R&D but also in gradual knowledge sharing and interactivity with other actors of the innovation system (UN, 2003). This 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.

The generation of innovations in developing countries, particularly in LDCs takes place largely outside of formal firms and institutions, in the informal economy. The informal economy constitutes the livelihood of an average of half to three quarters of the urban active population in LDCs from 1990 to 2004 (UNDP, 2007)<sup>14</sup>. Moreover, current trends in urbanisation, unemployment and population growth suggest that the informal economy in LDCs can be expected to grow. Admittedly, the upgrading of technologies in small-scale informal urban businesses has not received the necessary attention it deserves in the context of LDCs. Even formal firms (especially Small and Medium Enterprises) often make expenditures in informal innovation activities (Bougrain & Haudeville, 2002). By adopting and adapting technologies, firms, as users of these technologies, are able to deploy a range of skill 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). This lacuna ensures that the impact of these informal activities are usually absent in policy deliberations.

#### **4.2. Acquisition and assimilation of foreign innovations**

The acquisition and effective assimilation of innovations generated abroad are crucial for developing countries. Many authors have highlighted that developing countries largely depend on technologies generated abroad. However, mere acquisition of foreign technologies is not sufficient. Once innovations have been acquired (or technology imported), local efforts are critical to master its tacit elements (Lall, 2000, p.7), adapt them to local conditions and improve them over time. This insight is complimentary to the perspectives of user-initiated innovation (Gault and von Hippel, 2009).

The successful acquisition of foreign innovations has very much to do with the outwards orientation of a firm, sector or country, and 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 FDI sees the MNC subsidiary 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,

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<sup>14</sup> For the 44 countries, where information exists.

2007). External sources of innovation and technology are not seen as a substitute for strengthening domestic innovative capabilities, but rather as a significant complementary measure.

Effective absorption depends on many interacting factors, but it 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, based on the establishment of centres of excellence to enhance the scientific capacity of developing countries and initiatives promoting technical training. However, assimilation does not simply require the existence of sufficient technical skills but implies deliberate and explicit investments and efforts in the context of domestic firms – such as on-the-job learning, and knowledge-sharing. The process and efforts leading to the development of “absorptive competencies” within firms in developing countries is crucial although widely ignored in research studies and surveys.

An important advance is best articulated by Lundvall and Borras (1997) who stressed the concept of “learning economy”, arguing that what really matters for economic development is the ability to learn rather than the existing stock of knowledge. These authors highlight the link between learning and change<sup>15</sup>, as the source of economic dynamism regardless of its initial technological endowments. They recognise that globalisation of technology offers new opportunities for developing countries, but 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 should respond to this learning effect and its implications for the formation of capabilities.

#### **4.3. 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 of assimilate or internalise the disseminated knowledge, which as mentioned above, does not come without cost or effort.

The literature on diffusion of innovation is ample and has been identified as a crucial element of the innovation strategy in developing countries. However, our understanding of the necessary local capabilities that are required for the effective diffusion of innovation in a particular context is very limited.

The international diffusion of innovation through formal mechanisms has been extensively studied – such as foreign direct investment and foreign licensing. However, it has also been recognized that a larger amount of technological knowledge is transferred through various informal mechanisms (Westphal et al., 1985; Kim, 1991; Ernst and Kim, 2000). Research on

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<sup>15</sup> “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 Borras, 1997, p.36).

informal mechanisms of knowledge transfer is scarce. The importance of local capabilities in assimilating, adapting, and improving imported technology has long been recognized, but few studies exist on the complex process of formation and development of local competencies in developing countries, not only to maximise the benefits from knowledge transfer but also to effectively engage into joint-learning and knowledge-sharing with foreign providers of technology.

The growing literature on clusters and experiences of industrial clustering in developing countries has provided useful contributions on networking and collaboration among actors (local and foreign). In the main they suggest that networks have acted as a catalyst for international knowledge diffusion and provided new opportunities for local capability formation in lower-cost locations.

#### **4.4. Enabling environment**

For many developing countries the fundamental problem is simply the lack of an explicit innovation strategy itself. 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 improvements in competitiveness and economic performance. For those countries where innovation strategies exist, the efficiency with which these strategies are implemented also matter. The continuance of structural problems including corruption, institutional barriers and overall anti-competitive behaviours also conspire to hinder the successful implementation of strategies in developing countries and LDCs.

The increased opportunities for domestically-inspired policy choices has only now begun to emerge as larger numbers of countries free themselves of massive debt-obligations. With an improvement in macroeconomic conditions, policy space has been created for efforts at microeconomic interventions. The current financial contagion, decreased international demand and government interventions to rescue failing enterprises may however undo the positive gains achieved in recent times. Indebtedness of governments of the more advanced countries is increasing together with unemployment and a reduction in the availability of finances. The spill-over across into developing countries is still emerging amidst global forecasts of deep depressions following the current recession (World Bank, 2008).

It would appear that the post-structural-adjustment-period (after 1999) has improved conditions for experimenting with incentives and regulations which could spur innovation. These opportunities can now ensure that innovation policies in developing countries could be framed by more comprehensive development strategies. To increase the probability of success, innovation strategies must take into account and promote broader socio-economic targets and inform policy formulation at the micro, meso and macroeconomic levels.

#### **4.5. Coordination of innovation policies**

Whilst devising policy at a conceptual level is often not too difficult, the capacity and capabilities to coordinate complex systems and steer them through a coherent innovation

strategy is much more problematic. With short time-horizons often stemming from electoral cycles, managing and administrating the implementation of these strategies becomes more difficult. A successful innovation strategy implies that governments in developing countries need to establish explicitly clear visions of the improvements sought, transparent regulatory and incentive structure and possible technological trajectories. It is only through such an explication that the transformation of the economy would be aligned to the objectives of an innovation policy. This vision needs to be evidence-based and respond to the reality of the dynamics observed in the private, education, and public sectors, as well as their conjuncture with global integration.

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

The effective promotion of innovation activities in firms has been related to balanced interventions in multiple dimensions (Wade 1989; Lall and Teubal, 1998; Lundvall and Borrás, 1997; Freitas and Tunzelmann, 2008). In the context of developing countries, all these dimensions need to be adjusted and coordinated in such a way that they effectively promote innovation, as well as other core development goals such as poverty alleviation.

This paper highlights one major contribution that pioneered concerns about these issues in the literature. Reviewing the role that technology policies played in East Asian economic growth, Lall and Teubal (1998) identified three types of policies: (a) *functional interventions*, intended to improve markets operations without favouring particular activities; (b) *horizontal policies*, signed to promote specific activities across sectors – such as incentives to promote greater innovation, R&D and training, and (c) *vertical policies*, designed to promote the advance of particular sectors<sup>16</sup>.

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

This three-dimensional framework providing a design space of government support of innovation, define priorities and levels of intervention for the effective promotion of innovative activities. However, its specific use is largely left to the context in which it is applied, since the authors recognise that ‘the exact mix vary with country context and the capabilities of its policy makers.’ (Lall and Teubal, 1998, p.1370). Max Rolfstam has drawn particular attention to the critical role played by public procurement of innovation (2008).

## **5. Policy implications for developing countries**

The comparison and replication of innovation strategies across countries has been a matter of heated debate. While success and performance has been largely determined through international benchmarking exercises others have argued that success and performance need to be evaluated at the local level. For instance, Archibugi and Coco (2005) argue that international comparisons are meaningful, regardless their differences in social, cultural and geographical contexts. On this basis, they aggregated various statistics on technological capabilities assuming that each individual indicator is a complimentary rather than a substitute to each other (Archibugi and Coco, 2005).

Other views put greater emphasis on the need for policy experimentation in developing countries (for instance Lundvall et al, 2006; Sutz and Arocena, 2006; Srinivas and Sutz, 2008, Juma et al, 2005). These views highlight the need to open up new development trajectories with greater emphasis on generating knowledge and learning and argue that the use of a global basis to measure and assess innovation strategies, incentives and regulations do not reflect the innovative activities that are in fact taking place in developing regions.

In this paper we stress the importance of policy experimentation based on solid evidence-based formulation. However, it is also critical that policy makers learn from other experiences in order to design and implement effective domestic innovation strategies. In this line, key policy dimensions need to be identified and benchmarked internationally with the purpose of extracting 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. Whilst maintaining international comparability, seeking generic one-size-fits-all solutions are bound to fail. It should be noted that the price of policy and strategy failures usually extorts significant costs to developing countries and especially those less developed.

## **6. Role of the donor countries in facilitating the implementation of the innovation strategies**

Increased levels of globalisation necessitate serious consideration of the international dimensions of domestic policy formulation. Whilst seeking harmonisation, many multilateral institutions such as the WTO<sup>17</sup>, WIPO<sup>18</sup>, WB<sup>19</sup> and IMF<sup>20</sup> continue to exert a strong influence over local policy research activities. In the face of evidence of inherited legacies derived from past performance, many such interventions seem not to be internally consistent with the overall institutional frameworks which drive these organisations. Whilst the diffusion of ‘innovation’ thinking is generally beneficial, the idea that a single formula of innovation policy could be easily parachuted into local conditionality’s (sic) requires caution.

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<sup>17</sup> World Trade Organisation

<sup>18</sup> World Industrial Property Organisation

<sup>19</sup> World Bank Group

<sup>20</sup> International Monetary Fund

The processes around the World Summit on Sustainable Development (WSSD), Multilateral Environmental Agreements & Climate Change provide a uniquely global set of challenges which require international and multilateral efforts. At a regional (supra-national) level, various voluntary associations including the New Partnership for Africa's Development (NePAD) have encouraged an increased participation by many countries in the domain of science, technology and innovation. These efforts, because of their broader-based access to organisations beyond just state actors, also hold much by way of opportunity space. Even the difficult tasks of conducting studies based on internationally comparable methodologies need more support as do efforts in encouraging regionally-integrated cooperation especially where learning from policy is shared.

All of these features demand innovative approaches with respect to donor coordination, resource mobilisation and alignment with the domestic development agenda. The value of systems of innovation approaches are maximised through engineering coherence between different actors and competing agendas.

## **7. Tentative Conclusions**

Knowledge is increasingly recognised as a critical determinant of economic growth, good governance and improvements in the quality of life even though there are contestations and contradictions within the paradigm of development and the field of economics more generally. We assert that development thinking derived from evolutionary economics and systems of innovation confirm that knowledge is transformed into goods and services through a country's enterprises, higher education institutions and public research institutes. It is in fact the relationships between the latter and the policy environment which largely shapes a national system of innovation.

The literature confirms that skilled people are the most effective knowledge transfer and adaptation mechanism. The centrality of human capacity, capability and competence formation in innovation policy can therefore not be underemphasised. Ensuring coherent and effective administrative routines and suitable governance regimes is necessary to ensure the coordination of complex systems. The latter challenge may even be asymmetrical with the greatest need not necessarily attracting the commensurate supply. Whilst these conditions may equally serve more advanced economies, they are especially relevant for developing countries. In times of significant economic and financial flux, safeguarding policy gains which offer much more in the long-run than to an immediate planning horizon is also important.

It is within this context that the following tentative conclusions should be considered:

1. Build domestic STI Policy Competencies through evidence-based research.
  - a. Building intermediary facilities which institutionalise and build the overall capacity for policy research and learning is critical. Most of the fast emerging developing countries are investing in these capabilities both within government and in the public higher education sector. These initiatives require cooperation and support to ensure that domestic situations gain

advantages from global networks and more mature institutions located in the North.

2. Improve policies and institutions within a framework of autonomy and accountability whilst ensuring that the learning from implementation is acknowledged and progressively feeds back towards improving strategies.
  - a. To ensure that policies remain relevant, flexible and agile requires that monitoring, evaluating and learning are built into strategic frameworks. These strategic frameworks will benefit from clearly defined and articulated goal-setting processes which bring together a wider participation of enterprises, universities, public research institutes and civil society organisations. Democratically defined terms of autonomy would improve the competencies of performing and funding agencies. Not only would this ensure accountability, it would redress concerns in small economies over matters of trust, cooperation and competition.
3. Recognise and support human resource development and management capability formation.
  - a. Whilst the broad thrust around generally maximising human resource development must be maintained, paying specific attention to the need for expanding the cadre of management practitioners would contribute significantly to improving coherence and alignment of policy and strategies. This demand is especially high in project and programme management. The complexity of developing country contexts, and the non-linearity of STI policies and strategies, also increases the demand for skilled managerial professionals. Ensuring that STI policy managers have access to continuous upgrading of learning is another challenge as the domain demands may generate a substitution of research activities for management to improve incomes through career mobility. Increasing the stock of capable and competent STI managers is therefore essential to ensuring congruent implementation, monitoring, evaluating and improving system-level performance.

4. Achieve funding sustainability through public-private interaction and cost-recovery.
  - a. The scarcity of finances in the face of competing demands on the public purse necessitates the exploration of innovative funding regimes. Much has been learnt from other domains such as infrastructural development which could contribute to exploring both recovering costs of public support and also encouraging greater cooperation between public and private enterprises.
  
5. Aim at merit and scientific rigor through competitive funding, peer review, etc.
  - a. 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. Using such mechanisms will also improve the validity and veracity of the evidence-base for policy and strategy reform. This could generate continuous improvements in Institutions and Agencies as they seek to ensure greater alignment and coherence with local realities and policies.
  
6. Enhance existing & establish new linkages between the productive and the knowledge sectors, whilst ensuring improved access to basic research and the growing international knowledge base.
  - a. The main recommendation of this section is to improve the relationship between users and producers of knowledge. The literature supports the growing recognition of the importance of user-perspectives<sup>21</sup>. The spread of increasingly open and global research practices poses significant challenges for improving the endogenous innovative capacities of developing countries. As an opportunity space, much can be gained from seeking alignment between international support and local needs. Carefully constructing international research collaboration in a manner which is supportive of redressing local constraints offers possibilities for equitable development.

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<sup>21</sup> For example, see Eric von Hippel, 2005.

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