Bridging the Digital Divide

Innovation Systems for ICT in Brazil, China, India, Thailand, and Southern Africa
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Edited By:

Angathevar Baskaran and Mammo Muchie

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CHAPTER 1: INTRODUCTION

The Problem of Integrating ICT within National Systems of Innovation: Concepts, Taxonomies and Strategies

Mammo Muchie and Angathevar Baskaran

Technology is not an object to be aimed at, but a tool to be used for the benefit of the common man.

-- Vikram A. Sarabhai, Founder of India’s Space Programme (Abdul Kalam, 1992: 67)

The origin of the project

The idea to write a book on a group of economies that share broadly similar constraints, challenges, and pressures from the world economy with respect to creating, acquiring, absorbing and implementing the information and communication technologies (ICT) came to us when we were trying to create an innovation research group in Middlesex University, London, UK. We developed a proposal for innovation research that brought together initial survey of emerging economies such as Brazil, Russia, India, China and South Africa and a few developed countries such as Denmark and the UK. We tried to develop a funding proposal that helped us to write on the shared characteristics of the economics of

1 Throughout this book (except few places) we use ‘ICT’ to mean information and communications technologies instead of ‘ICTs’ for convenience.
technology in these countries. It is indeed the effort we undertook then that truly made us think about the pertinent issues we need to identify and work through in relation to the group of countries that eventually acquired the unflattering acronym of BRICS, where each letter stands for Brazil, Russia, India, China and South Africa. As we were working to develop a research area constituting the core BRICS group of economies, we found out that the Global Network for the Economics of Learning, Innovation, and Competence Building Systems (GLOBELICS) was also keen to develop a similar research programme. We entered into an interesting e-mail debate on how research on the BRICS might be developed with the leading scholars that have been working over decades on innovation system theory in particular and the evolutionary economics and sociology of technical change in general.

Eventually, at the Second Globelics Conference-2004 (Beijing), we proposed to prepare an edited book of readings related to the problem of identifying the peculiarities of the systems of innovation on ICT by focusing specifically on government policies, institutions, programmes and impacts in this specific group of economies in order to draw lessons for the less developing economies. GLOBELICS facilitated identifying the scholars working in this area from BRICS and soon the idea of this book took a concrete shape. We all agreed to complete this work to assist the organisation of the Third Globelics Conference-2005, to be held in Tshawane, South Africa.

As one can easily see, of the countries from the original BRICS group, Russia is missing. Unfortunately, we could not include Russia due to constraints imposed by our publisher’s schedule. Nevertheless, we still believe that it is critically important that the states that emerged from the former Soviet Union are not excluded in the type of studies. All these economies have copied the free market economy model in the same way they previously imposed the central planning model and they are still undergoing the painful transition into what has been described as emerging markets. In particular Russia adopted the free market model with a high velocity policy of shock therapy that left it still reeling with exhausting shocks. Indeed, it would have been very interesting to carry out research and report on the trajectories, evolutions, complexities, difficulties and distortions of the Russian national innovation system in general and the development of
innovation system for ICT in particular. We leave this task to the community of innovation system scholars for future research.

Apart from BRICS economies, at first, we have selected to add Thailand as we thought that it would be interesting to compare the large emerging BRICS economies and a smaller second tier East Asian tiger economy. Next, as our aim was to draw lessons from these economies that may be applicable for less developing economies, we decided to include a group of countries from a particular region that can help us to highlight the gap between BRICS and these countries in terms of institutional infrastructure to support national system of innovation and technological capabilities. Thus, countries of Southern African region, (excluding South Africa that is a large emerging economy included as one of the country cases in BRICS), were chosen as an exemplar for drawing the implications of innovation systems for ICT for developing economies.

The major insight that we are looking for is how much ICT form an integral part of the national system of innovation of the selected economies. This will require that a given country’s, say, India’s or China’s innovation system is clearly delineated at the level of policy, programmes and impact, and how this country-specific particular innovation system works to facilitate or hinder ICT development, and conversely, how ICT also influences and shapes the country’s innovation system.

That is, the study will draw principally comparative insight by focusing on each country’s approach separately to analyse how far the national system of innovation framework is effective in managing ICT revolution – in a specific location and social economic, institutional and territorial environment. For this, it will investigate and analyse ICT policies aimed at building social and technological capabilities to achieve development goals and also policies to avoid negative impacts of the ICT revolution on the society. We will look at the national efforts to deal with the so-called ‘digital divide’, and to empower all sections of a given population in a specified and well-defined state by creating the engaged society, the participating citizen with access to ICT. Essentially, the study will require detailed country specific information such as government ICT policies, ICT education, skills creation, the role of key government departments and research institutions involved, mechanisms for inter-institutional linkages, the role and involvement
CHAPTER 4

Innovation System for ICT: The Case of India

Angathevar Baskaran and Mammo Muchie

Introduction

The greatest challenge facing [India] is to make high technology work for the poor.

-- Manmohan Singh, the Prime Minister of India (2004).

Since its independence in 1947, India, like other major developing countries such as Brazil and China, has been determined to employ science and technology to modernize the economy and address widespread poverty and underdevelopment in the country. Jawaharalal Nehru, India’s first Prime Minister, declared: “science alone...could solve these problems of hunger and poverty” (Nayar, 1983: 252). No wonder, the successive governments have shown a keen interest in exploiting the Information and Communication Technology (ICT) revolution not only to build a strong ICT industry to achieve economic growth, but also to address the age old problems in the field of education, health, rural development, poverty alleviation, employment, etc. Furthermore, the government believes that ICT can be a major facilitator of information transparency, good governance, and empowerment of grass-root democracy. In other words, India has decided to use ICT as a major vehicle for all round socio-economic development in the country.

With a view to facilitate faster growth of ICT industry in the country, in 1998, the government had set up a National Task Force on
Information Technology and Software Development. The government has already implemented a number of recommendations of the Task Force to enable the growth of IT industry and widespread diffusion of ICT in the country. While taking steps to actively promote the growth of ICT Industry, the government is equally concerned about creating a ‘digital divide’ in society – a divide between those who have access to ICT based services and those who do not. Therefore, it is determined to see that the benefits of ICT reach all sections of the society. The government believes that if any technology can create new opportunities to bridge the gap between poor and rich in society, it is ICT. Therefore, to establish India as ‘knowledge super power’ and to bridge the digital divide, India has been making strong effort to foster an efficient innovation system for ICT.

Over the years, a ‘duality’ or ‘lopsided’ phenomenon emerged in the Indian national innovation system (see Figure 4.1), as India put greater emphasis on ‘big-science’ programmes such as nuclear and space programmes that affected the allocation of resources towards other areas, mainly civil. While strong linkages between various actors such as the government agencies, R&D performing institutions, user agencies, and the industry were forged in the dual-use areas, such linkages have been weak in the civil areas. This affected technology accumulation in civil areas, while India has accumulated a high level of technological capabilities in complex dual-use areas such as nuclear and space systems (Baskaran, 2000, 2001; Chengappa, 2000). Despite its significant achievements in areas such as building strong industrial and R&D base, establishing a large number of science and technology institutions, and creating large pool of scientists and engineers, the Indian national innovation system has been criticised for its inefficiency in terms of low rate of growth, poor export performance, low quality of manufactured goods, relatively low level of competitiveness, and its inability to eradicate poverty (Baskaran and Muchie, 2003).

Therefore, in this context, it will be interesting to examine the effort of India to develop an efficient innovation system for ICT that aims to achieve a number of socio-economic development goals. For this, in this chapter, we analyse the national ICT policies towards the industry and diffusion of applications, their impacts, and various developments in India. We will focus particularly on one issue whether the
innovation system for ICT has been able to overcome the ‘lopsided’ phenomenon that persists in India’s national innovation system.

**Figure 4.1: Three Major Features of Indian National Innovation System**

<table>
<thead>
<tr>
<th>Inward-looking Phase (1950s - mid 1980s)</th>
<th>Outward-looking Phase (Since late 1980s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main emphasis:</strong></td>
<td><strong>Main emphasis:</strong></td>
</tr>
<tr>
<td>- To create indigenous capability to meet as much domestic demands as possible</td>
<td>- To accelerate the growth rate</td>
</tr>
<tr>
<td>- To reduce and avoid foreign dependence wherever possible</td>
<td>- To increase competitiveness and export performance</td>
</tr>
<tr>
<td>Uneven technological capabilities in Civil and Dual-Use areas</td>
<td>'Duality' Phenomenon</td>
</tr>
</tbody>
</table>

*Source: Baskaran and Muchie (2003)*

**ICT Policy Framework**

Indian leaders and policy makers have had a ‘blind faith’ in science and technology to solve all kinds of socio-economic problems that never diminished. On the contrary, with the onset of ICT revolution, this appears to have reached a new height almost as a ‘religious belief’ that ICT would provide a cure for the country’s socio-economic problems such as illiteracy, unemployment, poverty, regional imbalances and so on.

Initially, the ICT policy focus was on developing the industry and its export capacity. By the late 1990s, the policy makers in India recognised the capacity of ICT to transform the socio-economic conditions of the people both in urban and rural areas and decided to exploit it to achieve broader development goals, while continuing to pursue its industrial objectives. For example, the IT Task Force, (1998) perceived ICT “as an agent of transformation of every facet of human
CHAPTER 6

Innovation System for ICT: The Case of South Africa

Angathevar Baskaran, Mammo Muchie, and Rasigan Maharajh

Introduction

We must continue the fight for liberation against poverty, against underdevelopment, against marginalisation...information and communication technology...is a critically important tool in that struggle.

-- Thabo Mbeki, President of South Africa (Department of Education, 2003)

Since the end of the apartheid, South Africa has been attempting to reengineer its political and socio-economic structures to level racial inequalities, to eradicate poverty, to bridge the gap between the rich and the poor, to reduce regional imbalances, and to provide universal access to health care and education. For this, the government has been introducing significant changes to policies, institutions, and resource allocation. It has also been making effort to develop a strong and competitive national innovation system with the twin objectives of addressing the socio-economic problems internally and raising the competitiveness of its industry to face the challenges of globalisation. However, as the legacy of apartheid lingers on, the country is facing many obstacles and the exclusion and division within the South African society continue to be major problems. For example, "the production of science is still dominated by historically white universities and technikons, and
majority of scientists in the public sector are still white and male” (Mouton, 2003: 254). The national innovation system in South Africa appears to be still in transition.

Before the dawn of democracy in 1994 South Africa, under the apartheid regime, used science and technology mainly to build defence and nuclear capabilities. The national innovation system was geared towards strengthening the capability to export military hardware. This resulted in a lopsided or uneven technology accumulation - a high level of capability in the defence and selected areas of civil industries, and a low or no capability in many civil sectors. The racial inequality perpetuated under apartheid was also reflected by the national innovation system in South Africa. The scientists were predominantly white, and R&D organisations and educational institutions were highly imbalanced between the white and black communities. The lopsided national innovation system coupled with apartheid policies exasperated the inequality, exclusion, division, disparity in income and social benefits. This division or lopsided development of South African economy is captured by Figure 6.1. In South Africa this division is known as the first and the second economy.

The first economy is well developed (though mineral and financial based) and comparable to that of the EU or the US and has many similar characteristics of developed economies. The financial, technological and production systems and inter-linkages between these systems of the first economy are largely similar to that of developed countries. The first economy is outward looking and tends to link up with developed economies such as the US and Europe. On the other hand, the second economy is informal and rural/ agricultural based. It involves urban and semi-urban trading systems. And the education system is afflicted by severe disparities and imbalances. Therefore, the problem of lopsided national innovation system and the divide between the first and second economies have been posing serious challenge to the policy makers.

Since mid 1990s, the democratic government has been taking efforts to correct the imbalances and to facilitate opportunities for the historically disadvantaged communities. This is clearly stated by the White Paper on S&T in 1996: “The vision is one where, on the one hand, South Africa uses S&T to become economically competitive on a global scale and, on the other hand, to provide essential services,
Particularly, ICT is perceived as an important tool to achieve this. At all levels of government - local, provincial, and national - ICT policies and initiatives have been implemented to achieve socio-economic objectives such as reducing poverty, empowering black businesses, removing imbalances in the education system and creating opportunities and employment in the rural areas. However, the situation in the ICT sector appears to be no different from other areas of the economy. Some imbalances in ICT infrastructure and access that existed in the country during the pre-democratic era appear to persist (Davie, 2005). In this context, it will be interesting to examine whether the innovation system for ICT will be able to bridge ‘digital divide’ and bridge the gap between the first and second economies in South Africa.

**ICT Policy Framework and Initiatives**

As a response to the concern that Africa may be left behind in the information revolution the African countries meeting at the UN Economic Council for Africa (ECA) adopted a resolution in 1995 for
CHAPTER 8

General Conclusions: Innovation Systems for ICT - Implications for the Less Developing Economies

Mammo Muchie and Angathevar Baskaran

The study concentrated on a group of emerging economies (Brazil, China, India, South Africa, and Thailand) that have a national system of innovation however lopsided and uneven it may be, and also an ICT specific industrial sector. Many developing economies in the poorer part of the world, as shown in the case of Southern Africa in this study, neither have fully functioning national systems of innovation systems nor ICT industrial sectors. The question then becomes what lessons can be drawn from the BRICS economies to the lesser developing economies whose primary task is to build an effective systems of innovation that can facilitate and support the uptake, creation and diffusion of knowledge, innovation, learning and technological capabilities.

We start with the current phase of globalization with which the world economy is often described. Developing economies face a double constraint. On the one hand, they cannot avoid globalization; on the other hand they cannot afford to allow globalization wholly to dominate their development dynamics. They have to learn to engage whilst at the same time learning to insulate themselves from the adverse and deleterious effects of their insertion in the world economy.

They need to conceptualize their development as a function of both engagement with the world economy as well as protection from the world economy by learning to be far when they are very near and even inside the global economic dynamics. Still more they must be capable of learning to undertake multi-faceted engagement, whilst also undertaking and learning varied strategies to protect themselves...
without falling into autarchy. The key good that can facilitate engagement whilst permitting some protection can be technology, provided developing countries build institutions and learning to make innovative appropriation of new technologies. One of the enabling technologies that have a pervasive influence as a techno-economic technological paradigm is information and communication technologies. These technologies now have reached every corner of the world crossing all barriers such as the north and south division, rich and poor economies and various social, cultural, linguistic and spatial divisions. The important concern is how these technologies are enabling globalization to reach the remotest corner of the most remote rural backwater. Who drives them? What benefits and costs do they bring? Who are actually the beneficiaries and the losers? These questions cannot be answered in the abstract.

The contributions in this volume show clearly that the context of the national system of innovation, whether it exists in a weak, strong, bifurcated, lopsided and uneven way or whether it is in a state of birth, emergence, consolidation, maturity or decline, has serious consequences in the manner in which information and communication technologies are created, appropriated, diffused and used in many of the economies. For the economies in the developed world, ICT develops as industrial sectors and promote economic growth and is essential for daily life and society. It has become central to the existence and reproduction of society, economy and various institutions. Also in the BRICS type economies ICT has emerged as industrial sectors to varying extent promoting more or less economic growth and with varying degree of success confronting the so-called digital divide, access and use. The country case studies revealed that innovation systems for ICT could perform more efficiently in achieving industrial and social economic goals when they are strongly linked to and supported by the institutions and infrastructure of national innovation systems. However, they also have shown how ICT specific system could be influenced by the lopsided or uneven phenomenon of national innovation system. Particularly, in achieving socio-economic objectives, the case studies have shown that strong linkages between various actors such as government agencies, industry, R&D institutions, private and non-profit organizations, and multinational organizations; the involvement of local people in and their awareness about the benefits of ICT projects; easy and cheap access to ICT; and well defined
and useful ICT application for local people are the major factors that determined the rate of success or failure of ICT projects.

For many of the poorer developing economies in Africa, Latin America and Asia the introduction of ICT as harbinger of globalization comes with a mixed blessing. This is illustrated by the case of Southern African countries in this study. If ICT is used mainly by external corporations, governments and other bodies engaged in facilitating speed and movement of primary commodity exports that these economies largely specialize in on the basis of static comparative advantage, then ICT mainly will help in recording and storing data and accelerating the rate of circulation and transaction of already produced commodities. This largely consigns its function to add cost whilst defraying some other leaving on balance unchanging the basis of the export economy of many developing countries. This role for ICT would not be as productive as one would hope for, as there is no value addition in knowledge and learning that accrues from the kind of ICT linkages with these economies. Unfortunately it seems to us, intuitively in many poor countries ICT will be used mainly to accelerate speed of transaction and circulation of the primary export economy and not to transform it.

Where the value added from the ICT would come would be when it is integrated with what List called mental capital building as a means of augmenting wealth. In that case it means that the national system of innovation of these poor economies would need to evolve to integrate ICT to foster the building of mental capital as a means of wealth accumulation. Given that many of the poorer economies may not have the rudiments of a national system of innovation (as illustrated by the case of Southern African countries in this study), there would be a double challenge. First the very making of a national system of innovation must be on the policy agenda of national and international policy actors, and second the integration of ICT as the facilitator of globalization writ large across the globe need to be regulated from undermining the very making of innovation systems in these very poor economies. Such a regulated introduction of ICT would involve in fostering the creation of an incipient ICT sector, the building of mental capital and the beginning of diversification of the economy by adding a value added manufacture and service sectors along with the primary commodity economy. This expected synergy between the making of
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