

KNOWLEDGE, TECHNOLOGICAL LEARNING AND INNOVATION FOR DEVELOPMENT: THE FINDINGS, ARGUMENTS AND RECOMMENDATIONS OF UNCTAD'S LEAST DEVELOPED COUNTRIES REPORT 2007

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Abstract

This paper summarizes the main findings, arguments and policy recommendations of UNCTAD's *Least Developed Countries Report 2007: Knowledge, Technological Learning and Innovation of Development*. It shows that although most of the least developed countries (LDCs) are closely integrated into the global economy through trade and foreign direct investment, their level of technological development is very low and the capabilities of their domestic firms and farms to acquire and effectively use technology is very weak. The current situation is one in which there is liberalization without technological learning and global integration without innovation.

In a situation where international markets are not working to support the international diffusion of technology, there is a strong case for ODA to support technological development. But in practice aid for science, technology and innovation (STI) in LDCs is very weak both in quantitative and qualitative terms. In addition, many LDCs are being adversely affected by emigration of skilled personnel, and some asymmetries within the international IPR regime can discourage technological catch-up in LDCs. Nevertheless there are constructive and pragmatic policies which can be adopted to support the promotion of STI for development in the LDCs. The paper summarizes the current situation and makes some key practical policy proposals.

Introduction

Since 2000, UNCTAD has published a series of flagship Least Developed Countries Reports which are devoted to examining how development can be started and sustained in the poorest countries in the world (UNCTAD 2000; 2002; 2004; 2006; and 2007). The Reports are based on the view that much development thinking is derived from, and oriented to, the conditions of more advanced developing countries and that there is a need for deeper analysis of the challenge of development in

very poor countries. Together, these reports have undertaken a critical assessment of current national and international policies to promote development and poverty reduction in the least developed countries, and also proposed constructive and pragmatic policy alternatives.

The Reports have elaborated a production- and employment-centered approach to development and poverty reduction which is distinct from both the World Bank and IMF approach to economic reform and also UNDP's human development approach. This approach is set out most fully in *The Least Developed Countries Report 2006: Developing Productive Capacities*, and it is deepened in *The Least Developed Countries Report 2007: Knowledge, Learning and Innovation for Development*. The present paper provides a summary of the main findings, arguments and policy recommendations of the latter Report, which was published in July 2007.

The overall argument of the Report is that to escape the current trap of poverty, underdevelopment and marginalization, the governments of the least developed countries (LDCs) and their development partners need to adopt new policies designed to narrow the technology

Moving up the technological ladder?



gap between themselves and the rest of the world and to increase the knowledge-intensity of their economies. This argument is based on three propositions: 1. Science, technology and innovation (STI) matter even in the poorest countries, 2. Current policies to promote STI in LDCs are unsatisfactory and 3. There are constructive and pragmatic alternative policies to promote STI available to LDC governments and their development partners.

This paper summarizes the main findings, arguments and recommendations of the Report in relation to each of these propositions. Attention is paid to both national policies and international policies, with specific attention to the weaknesses of the current policy configuration and possible alternatives in the areas of: (i) aid for STI, (ii) the intellectual property rights (IPR) regime, and (iii) the brain drain.

STI Matters Even in the Poorest Countries

The Report is founded on the view that sustained economic growth and poverty reduction in the LDCs requires the expansion of their productive capacities in a way in which the population of working age becomes more and more fully and productively employed. The development of productive capacities of a country occurs through two major processes – capital accumulation and technological change – which in turn lead to structural change. Capital accumulation and technological change are closely interrelated processes but each requires the mobilization and application of different key elements. On the one hand, capital accumulation requires the mobilization and investment of financial resources. On the other hand, technological change requires the mobilization and application of knowledge. Finance and knowledge are the key ingredients for the development of productive capacities.

Finance and knowledge are inseparable twins in successful processes of development. But in national and international policy debates the spotlight has usually been on finance rather than knowledge. Knowledge is the neglected sibling in national and international development policy. Around the notion of financing development, there is a common vocabulary and accepted terminology. But in policy terms, what does it mean to mobilize and invest in knowledge for development?

One focus of attention might be investment in education. Another focus of attention may be investment in information and telecommunications infrastructure and bridging the digital divide. Both of these issues are certainly impor-

tant. But in the LDC Report 2007, the focus is on how technological change can happen in LDCs, and more particularly how knowledge is commercially applied in production by firms and farms.

For poor developing countries, innovation occurs through technological learning. LDCs cannot be expected to be at the global frontiers of technology. But innovation occurs when enterprises introduce products which are new to them or to the country. Such a form of innovation – which differs from the commercial application of inventions which are new to the world – depends on enterprises learning to master, adapt and improve technologies that already exist in more technologically advanced countries.

This is not a passive process but an active process of learning, assimilation and creative imitation in which physical technologies and skills concerning their use, as well as associated organizational routines, are applied and adapted in new contexts. Such adaptation often requires a blending of foreign and local knowledge in new ways. This is a process in which the absorptive capabilities of firms and farms, and also of the domestic knowledge systems within which they are embedded, are critical. Such absorptive capabilities encompass not simply the ability to access knowledge, but also the ability to assimilate and use it in local conditions.

This type of innovation is not a matter of hi-tech production. It involves rather the incremental introduction of new ways of doing things by firms and farms, as well as their introduction of new products and their targeting new markets. It is this myriad of small and large innovative acts which underlie improved productivity, increase local value-added, increased competitiveness, better quality products and the introduction of new activities into an economy.

It is through these innovative acts by firms and farms that LDC economies can move away from strong dependence on primary commodities and low-skill manufactures.

It is through these innovative acts that substantial poverty reduction will occur – though the relationship between technological change and poverty reduction is complex depending on the labour-intensity of technology and also on the economy-wide processes of crea-

tive destruction in which employment opportunities decline in some sectors whilst they expand in others through technological change.

It is through these innovative acts that LDCs will reverse their marginalization in the global economy and start to achieve catch-up growth. The marginalization of the LDCs ultimately reflects the fact they are falling behind other countries technologically. Unless LDC governments and their development partners adopt policies which help stimulate technological catch-up they will continue to fall behind.

Weaknesses of Current National and International Policies

When one looks at where LDCs currently stand in terms of their level of technological development and the capabilities of their domestic firms and farms to acquire and effectively use technology, the situation is depressing. Their domestic knowledge systems which enable the creation, accumulation, use and sharing of knowledge are also ineffective and divorced from production needs. Like the domestic financial systems of which they are a key counterpart, they are dualistic – separated into a traditional and modern knowledge system. Moreover, they are weakly integrated with the rest of the world. The state of technological underdevelopment of the LDCs is an expected pattern as weak technological development and economic underdevelopment go hand in hand. But what is perhaps remarkable in the current situation – and also perpetuating the current situation – is the failure of both domestic and international policy to address the problem.

This is particularly paradoxical as a key insight in the understanding of processes of economic growth in the last 25 years – perhaps the key insight – is that technological change is central. But neither LDC governments nor their development partners are seriously drawing policy implications from this.

For the LDCs this is a long-standing neglect. It is worth noting in this regard that the year 2007 is the 25th anniversary of the global introduction of structural adjustment programmes. Some LDCs began implementing these programmes right back in 1982, but since the late 1980s they have been particularly intensely implemented by the majority of the LDCs. Active promotion of technological change has not been part of these policies. Indeed SAPs often sought to dismantle the institu-

tions and incentives of active agricultural and industrial development policies which – though certainly often flawed in design – were at the heart of developmentalism of the 1960s and 1970s and which usually involved the promotion of technological change as a central element.

Since 2000, SAPs have been replaced by PRSPs. But the new poverty reduction strategies continue to have the classic SAP recipe of stabilization, liberalization and privatization at their heart, with the addition of social elements. Technological change has not been conceptualized as critical to processes of poverty reduction. Thus, for example, there is no chapter of the World Bank PRSP Sourcebook on this issue. Moreover, only 4 out of a sample of 11 recent PRSPs undertaken in LDCs include science and technology as a priority policy for poverty reduction. The latest poverty reduction strategies are all committed to economic growth as a basis for poverty reduction. But essentially they ignore one of the key sources of economic growth – technological change – and the role of national policy in promoting such change in a way that enables both economic growth and poverty reduction to occur.

The present national policy configuration is based on a flawed understanding of how technological progress occurs in follower countries. The basic assumption is that openness to trade and investment, coupled with investment in basic formal education and more lately also investment in ICT infrastructure (“closing the digital divide”), will automatically lead to transfer of technology. But in practice, this has not worked. The Report provides evidence to show that this underlying assumption is false. Access to technology is not equivalent to its effective acquisition and use. International transfers of technology to LDCs are not occurring through international market linkages.

The current situation is one in which there is liberalization without technological learning and global integration without innovation. LDCs are already highly integrated to the world economy in terms of trade and investment flows. Exports and imports constitute 50 per cent of GDP, and FDI is equivalent to almost one fifth of gross fixed capital formation. But strong market integration through trade and FDI is associated with weak technology acquisition in LDCs and also weak development of the capabilities required to facilitate the effective use of technology diffusion.

Some facts and figures from the Report can show this.

⇒ First, LDC investment in imported machinery and equipment – which is a major channel for the arrival of new

technology – is very low. In 2000-2005, LDC capital goods imports corresponded to 6 per cent of GDP, only half the level for ODCs.

- ⇒ Second, participation in international value chains – in which products go through numerous steps from raw materials to finished forms – are doing do little to infuse technology into LDCs. Processes of export upgrading have various dimensions. But an analysis of 24 value chains in which LDC exports play a role shows that export upgrading in the sense of increased processing of raw material before export has only occurred in 9 of them since the 1990s, involving just 18% of total merchandise exports from LDCs.
- ⇒ Technological "spillovers" to domestic firms are expected from foreign direct investment (FDI) in LDCs. But in African LDCs, most FDI is focused on mineral extraction, and spillover into domestic firms is limited. In Asian LDCs, case study evidence shows that the rapid growth in FDI in garment manufacturing has not led to a corresponding development of domestic firms' technological capabilities.
- ⇒ Technology licensing – payments for the right to undertake activities protected by patents – in LDCs is very weak and has been stagnant since the 1990s. On a per capita basis, it is 80 times higher in other developing countries than in LDCs.

In the present situation where international markets are not working to support the international diffusion and assimilation of technology, there is a strong case for official development (ODA) to be used to ensure through public action that technological transfers occur and domestic capabilities are developed so that technology can be acquired and effectively used. It is likely that there needs to be a minimum threshold level of domestic technological competences and capabilities in place before market forces start facilitating international technology flows. But in practice aid for STI is very weak both in quantitative and qualitative terms.

The quantitative situation is difficult to portray because an aspect of donors' failure to recognize the relevance of STI is that they do not monitor aid for STI. But focusing on just two categories – aid for research and aid for advanced skills – one finds that these activities receive only 3.6 per cent of total aid to LDCs. Moreover, most of it goes to higher education. There is a particular stark failure to support technological development within firms and farms, which are the places where technological change occurs. Aid commitments for agri-

cultural research, extension and education within LDCs are actually falling. Aid for industrial technological development in LDCs – a category which includes industrial standards, quality management, metrology, testing, accreditation and certification – is even more insignificant than for agricultural development. Technological upgrading is also generally overlooked within the Aid for Trade initiative which is presently being developed and also within the Integrated Framework for LDCs, with the issue of building supply-side capacities being conceptualized more in terms of the provision of physical infrastructure.

The quality of the aid for STI which is actually provided to LDCs is also unsatisfactory. Aid projects to deepen domestic STI capacity are disjointed rather than systemic, and STI policy capacity-building in LDCs ignored. Global linkage initiatives, such as international scientific cooperation and business-to-business matchmaking schemes, tend to exclude LDCs. The provision of global and regional public goods in terms of scientific research is not sufficiently responsive to LDC needs.

Technical cooperation could be an important avenue for building domestic technological capabilities. Free-standing technical cooperation is actually defined as "the provision of resources aimed at the transfer of technical and managerial skills or of technology for the purpose of building up general national capacity". But in practice this transfer of skills and technology is going mainly to support social sectors and particularly governance, rather than productive sectors and the capabilities of private firms and farms. In fact, in 2003-2005 aid commitments to LDCs for technical cooperation in relation to governance were equivalent to \$1.3 billion per year, whilst the total annual aid commitments to agricultural extension were \$12 million.

On top of the omission of technological change as a central objective of the national policies of LDC governments and of the aid policies of their development partners, another weakness of the current policy configuration is that there are some disturbing asymmetries within the international IPR regime that can discourage technological catch-up in LDCs. This is important as innovation and technological learning in developing countries depend increasingly on the intellectual property rights (IPR) regime.

In this regard, LDCs theoretically have a window of opportunity. They are subject to the same rules as other

countries but they have a breathing space in the sense that until 2013 they do not have to apply global IPR norms as mandated by the TRIPS Agreement of the World Trade Organization (WTO). However, in practice, this breathing-space has become more hypothetical than real. TRIPS-plus obligations are being written into free trade agreements, bilateral investment treaties, regional organizations and also into the terms of accession of some LDCs to the World Trade Organization (as happened for example with Cambodia). This is of particular concern because it is evident that creative imitation is at the heart of technological learning and innovation in circumstances of catch-up. This was how successful developing countries assimilated technology in the past and it is also critical for follower countries to catch-up now.

A case study of the impact of IPRs in Bangladesh was undertaken especially for the Report and it shows that the IPR regime is mainly benefiting TNCs and that domestic companies are not benefiting from it as innovation is not occurring through invention. Indeed many domestic firms are worried about the negative impact of IPRs as many patents are being taken out by non-residents as a defensive monopolistic strategy and the cost of key inputs, such as seeds, is rising.

The final weakness of the current policy configuration is that there are no effective national or international initiatives to deal with brain drain from LDCs. This has become a significant problem for many LDCs. The loss of skilled people is adversely affecting the quality for governance and also endangering the development of private sector technological capabilities. The available statistics show that brain drain is high and intensifying in many LDCs. In fact, 1 million out of 6.6 million people from LDCs with tertiary level education qualifications are working in developed countries. Moreover 12 LDCs have lost more than one third of their qualified professionals to emigration in recent years.

Constructive and Pragmatic Proposals

3.1 National Policies

What can be done? The Report argues that there are constructive and pragmatic possibilities for new national and international policies. Indeed, focusing on innovation and technological learning can potentially offer a new departure after 25 years of structural adjustment programmes, either in their initial form or

adapted with social elements in the transformed medium of PRSPs.

In terms of national policies, the Report argues that LDC governments should integrate STI policies into their development strategies and poverty reduction strategies. Successful developing countries adopted technological catch-up with more advanced countries as a strategic goal and there is no reason why LDCs should not do likewise. However, it will be necessary to adapt policies to the challenges of the earliest phases of catch-up.

The precise nature of the policies will depend on each country. But the Report argues that given the employment transition they are experiencing, with an increasing number of persons seeking employment in cities, they should promote technological change in both agriculture and non-agricultural activities.

For agriculture, what is critical is the promotion of science-based agricultural productivity growth, particularly through a Green Revolution in basic staples. This will require increased investment in adaptive research and extension as part of a broad effort to promote agricultural development. This includes infrastructure investment and improved marketing.

For non-agricultural activities, the key is to promote business formation and upgrade the core competences and technological capabilities of domestic firms. This will involve training and skills development in design and engineering as much as the encouragement of R&D. What matters in particular is to increase the absorptive capabilities of firms, i.e. their ability to search for and use technologies and information which are available elsewhere, and to blend them with their existing knowledge to improve their practices. For this, the improvement of the domestic knowledge systems - the networks connecting the users of knowledge (private enterprises) and the providers of knowledge, notably research institutes and technology centres - is also important, as well as the leverage of more learning from international linkages through FDI and global value-chains.

There are difficult implementation issues and the promotion of learning does not mean going back to old style industrial policy. But there will be need for providing incentives to promote learning and innovation as these are risky activities. Moreover there is a need for a mix of horizontal measures to encourage innovative activities by

domestic firms as well as targeted measures which foster innovation through dynamic linkage effects, such as the development of rural non-farm productive activities and also value-added production clusters associated with exploitation of natural resources.

3.2 International Policies

A critical aspect of technology issues is that they cannot be solely dealt with in a national context. They have national and international dimensions and thus action by the development partners of LDCs is necessary, as is the creation of international arrangements which can enable rather than constrain innovation and technological learning. In this regard, the Report points to action that is required in three main areas: the IPR regime; brain drain; and knowledge aid.

3.2.1 The IPR Regime

The major recommendation of the Report in terms of the TRIPS Agreement of the WTO is that realistic deadlines be established for compliance with global IPR norms. The Preamble to the TRIPS Agreement gives the LDCs a grace period on the grounds that this will allow them to establish a "sound and viable technological base". But is it realistic to expect that this will occur by 2013. The Report argues that this deadline is arbitrary and thus the transitional period should last until the LDCs have achieved "a sound and viable technological base".

On top of this the Report recommends that Article 66.2 of the TRIPS Agreement should be clarified and effectively operationalized. The Article foresees that developed countries will grant incentives for the transfer of technology to LDCs. But as yet nothing has been done to make this a reality.

The Report also argues that technical assistance for LDCs with regard to IPRs should be unbiased and development focused. In addition TRIPS-plus provisions should be excluded from bilateral and regional agreements and should stop being a requirement for other LDCs acceding to the WTO.

Finally, it is recommended that LDCs should not focus exclusively on IPRs as an incentive mechanism for innovation but rather explore alternative ways to incentivize innovation. In this regard, such mechanism as open source software, publicly-funded research, patent buy-outs and development prizes may be particularly promising.

3.2.2 Brain Drain

With regard to the emigration of skilled persons, the critical policy issue is to transform brain drain into brain circulation. This requires actions by the LDC themselves, in particular to encourage return –especially short-term stays which can be used to transfer skills – and also mobilize the knowledge resources of the diaspora. But action by development partners which are destinations for emigrants is also vital. In this regard, possible measures include:

- ⇒ Hiring on a temporary rather than permanent basis
- ⇒ Establishing development assistance programmes which help LDCs to retain their professionals
- ⇒ Creating programmes to help skilled emigrants return to their home country
- ⇒ Avoid hiring some professionals most urgently needed in LDCs (which is a complex issue)

Ultimately the brain drain problem will only be solved through the development of economic opportunities in the LDCs. Continued economic marginalization will not be conducive to converting brain drain to brain circulation.

3.2.3 Knowledge Aid

The case for ODA is usually made on the basis of the lack of domestic financial resources. But knowledge is equally important, as we pointed at the beginning of this presentation. Donors are not insensitive to the importance of boosting the role of knowledge in development. But they have tended to focus on using knowledge to improve aid delivery rather than to support knowledge accumulation in partner countries. Such aid – knowledge aid – can be a key to aid effectiveness, and aid for STI is an essential part of this. Such aid is a type of aid which is not a hand-out but a hand-up.

Conclusion: In terms of aid for STI, the Report makes a series of recommendations.

Firstly, it is important to boost aid for agricultural research, extension and education in LDCs. Agricultural research intensity (agricultural R&D as percentage of agricultural GDP) in LDCs is at the lowest level since 1971 and has been falling in recent years. It will be difficult for LDC governments to increase it without foreign aid. Donors must reinforce their support to the network

of international agricultural research centres under the umbrella of the Consultative Group on International Agricultural Research (CGIAR) and ensure that its work is oriented towards increasing agricultural productivity of smallholders.

Secondly, it is suggested – as in the UN Millennium Project Report *Innovation: Applying Knowledge in Development* led by Professor Calestous Juma – that aid-funded physical infrastructure projects should all be designed in such a way that they support the development of domestic design and engineering capabilities. In other words, a component of knowledge transfer and domestic skill accumulation by national professionals should be included in all such projects.

Thirdly, innovative uses of aid should be designed to leverage more learning from international linkages, particularly from FDI and global value chains. Most attention has been directed thus far to promoting FDI through ODA. But the thrust of this suggestion is more focused on increasing the technological effects of FDI by using ODA to build the capability of domestic firms that are engaged in international trade or that have business links with transnational corporations. The aim is to strengthen the transfer of skills through market transactions.

Fourthly, the Report recommends that technological upgrading is explicitly elaborated as an aspect of development in the Aid for Trade initiative currently being developed and in the Enhanced Integrated Framework for LDCs.

Finally, it is proposed that the economic effects of trade preferences for LDCs (such as the Everything But Arms Initiative) could be enhanced by deepening such preferences through National Innovation Funds which finance technological learning and innovation by domestic firms whose activities are stimulated through trade preferences. Such Funds would seek in particular to spread the benefits of trade preferences to more firms, to encourage technological upgrading by exporters and to catalyze dynamic linkage effects. Technological upgrading is particularly important at the present moment for garment firms faced by competition following the end of the transitional arrangements at the end of the Agreement on Clothing and Textiles.

Conclusion

The Report focuses on making practical suggestions. But more broadly, the Report argues that knowledge-based development can be the foundation for a reinvigorated and forward-looking partnership for development in LDCs. There is a wide sense of restlessness with the ineffectiveness of current policies and a desire to find a new policy model, the report notes. Focusing on science, technology and innovation can provide a platform for innovative solutions and fresh thinking. It is in this area that more effective policies to promote sustained growth and poverty reduction can be found.

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