

Innovation Policies for Development

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Innovation is a key driver of economic success. Companies in developed economies innovate to reduce production costs, to develop new products, and to create new markets. Innovative enterprises are shown to be economically more successful than firms that rely on tried and true processes and approaches.¹ Innovation also generates unintended spillover benefits for other companies and consumers—for example, by lowering the prices or increasing the quality of intermediate or final demand products. Similar to investment in research and development (R&D) activities, investment in innovations by enterprises is at a level below what would be optimal for society because of market and system failures (Box 1). Governments in developed economies have therefore been supporting business innovation by offering various kinds of direct and indirect support programmes, including loans, grants, tax incentives, and tax reductions.

Globalization and innovation

With globalization, firms in emerging and developing economies find themselves under more and more pressure to engage in continuous innovation. R&D, software, design, engineering, training, marketing, and management all play an increasingly important role in the production of goods and services, even in more traditional industries, such as

textiles and food. In addition, rising international standards dominate in international trade and global value chains. The competitiveness of both companies and countries therefore depends on their ability to innovate and move in the direction of frontier technology and knowledge.

However, there is a wide heterogeneity among enterprises in emerging economies: some companies operate close to the technological frontier and rely more on their own research and innovation efforts, either alone or in collaboration with others, to develop new products and improve production processes. Emerging countries such as India, China, and the Republic of Korea host companies that are technological leaders in their respective industries. But besides those top-performing

companies, emerging economies are also hosting large groups of micro and small businesses, operating far below the frontier of innovation, with basic technologies and low levels of human capital. Raising the productivity of these smaller producers through innovation and the adoption of better technologies will have a substantial aggregate impact on a country's economic growth, employment, poverty alleviation, and sustainable development.

With such heterogeneity in the productive sector, innovation in emerging and developing countries is also diverse in nature; it is determined not only by the level of technological complexity, industry of activity, and firm size, but also by the institutions and infrastructure where the company operates. Innovation

Box 1: Market and system failures

Market failures are the result of (1) excessive uncertainty, (2) absence of markets for risks, (3) insufficient appropriability (leading to failure to appropriate returns from innovation and new knowledge), (4) financing problems in the presence of information asymmetries, (5) failure of markets to assign values to externalities (impacting knowledge diffusion), and (6) undervaluation of public good technologies in firms' strategies. The first two types of market failures involve risk aversion hampering innovation activity; this affects small and medium-sized enterprises in particular because these firms have

limited sources of funds.

Not only can markets fail to deliver optimal results but so can the lack of a favourable business environment for innovation, which is referred to as 'system failure'. The concept of system failure aims at ensuring that the innovation system works effectively as a whole by removing blockages that hinder the effective networking of its components.¹

Note

¹ European Commission, 2009.

Box 2: M-PESA: An example of inclusive innovation

M-PESA ('M' for mobile; 'pesa' is Swahili for money) is a mobile phone-based money transfer and micro-financing service, launched in 2007 by Vodafone for Safaricom and Vodacom. M-PESA allows users to deposit, withdraw, and transfer money easily with a mobile device. Users are charged a small fee for sending and withdrawing money using the service. M-PESA is a branchless banking service; its customers can deposit and withdraw money from a network of agents that includes airtime resellers and retail outlets

acting as banking agents. M-PESA has spread quickly, and by 2010 had become the most successful mobile phone-based financial service in the developing world. By 2015, a stock of about 20 million M-PESA accounts had been registered in Kenya. It has since expanded to South Africa and India, among others, and in 2014 to Romania.

Sources

The Economist, 2013; Mas and Radcliffe, 2010; Safaricom, no date.

surveys from developing countries have provided data on the characteristics of the innovation process in developing-country firms. At the aggregate level and in comparison with data from developed economies, innovation in developing countries is more incremental than radical and takes place in an informal setting more often than it does in formal R&D laboratories. Innovations are primarily driven by investments in and mastery of new machinery and equipment that embody more advanced technologies; innovations less often arise from new products or technologies developed through R&D. Furthermore, marketing and organizational innovations also play an important role, especially in countries that liberalized and privatized their economies, thus forcing their companies to restructure.²

In this context, governments are increasingly challenged to develop policies that stimulate innovation and facilitate large-scale diffusion of existing knowledge and improved technologies. This is a complex process that, depending on target groups and on the government's objectives—for example, employment

growth or reduced environmental impacts—combines interventions to stimulate embodied technology acquisition with policies to develop research capacity and raise the human resources needed to absorb, adapt, and master technologies developed elsewhere. For emerging countries that are catching up, experience shows that technology adoption alone is no longer sufficient to maintain a high-growth scenario. These countries too must invest in innovation, and governmental support is crucial for promoting it.

Social challenges and innovation policies in developing and emerging economies

In developing and emerging economies, the importance of innovation is widely recognized and innovation policies occupy a central role in their development plans and strategies. Emerging countries, by definition, are growing rapidly and expanding production at impressive rates. However, they also face particular challenges, two of which stand out. First, all emerging countries with the exception of China have very young and growing populations.

The rapidly expanding young labour force is often facing high levels of unemployment, resulting in fragile groups, widespread poverty, and unequal growth. Another problem that lines up with rapid development and demographic change is the increased pressure on natural resources and pollution—a pressure that is felt both locally and in international markets. As countries develop, their energy needs increase and a limited availability of energy can quickly become a binding constraint. In the same way, the availability of land for housing and food production is a critical factor. This is especially critical in countries where the agriculture sector and agro-processing comprise the driving force of growth, and where land tenure systems could encourage further land fragmentation.

In emerging countries, innovation is seen as key to addressing pressing societal problems such as pollution, health issues, poverty, and unemployment. The role and significance of innovation goes beyond the objective of economic success. Rather it should be seen through the lens of inclusive development because it can address poverty and health issues, and through the lens of environmental sustainable development because it can address problems of pollution and energy provision.

Illustrating this point, in many low-income developing countries local demand comes from individuals whose preferences, aspirations, and budgets are of a different nature than those in high-income countries. So-called inclusive innovations directed at this stretch of the population may be low-priced but have a high social value because they allow large segments of society to benefit from them. Low-cost manpowered irrigation pumps or folded-paper microscopes for US\$0.50 that

offer the same quality as desktop microscopes are examples. Another example from Kenya is M-PESA (see Box 2), as are the many useful mobile phone applications that have been developed to provide quick and accurate market information and production technologies to farmers in rural areas (such as M-Farm and iCow),³ to give health-related information (such as Mimba Bora),⁴ or to provide entertainment (such as Matatu and Afrinolly).⁵

Emerging economies have a high demand for agricultural and biotechnological research, as well as a need for more research on neglected tropical diseases such as dengue, river blindness, tropical parasites, and malaria, as well as acute respiratory infections, diarrhoea, tuberculosis, and HIV/AIDS. Influencing the direction of the international research agenda into these research domains has important consequences for multiple areas, such as agricultural production, nutrition, and health.

With innovation occupying a central place in a sustainable and inclusive development agenda, it is not surprising that innovation policies can be found in different policy domains, strategies, and pieces of legislation. For instance, in Uganda—one of the more successful countries in terms of innovation, and discussed more in detail in Chapter 11—numerous policies that support research and innovation are identified. These include the country's National Industrialization Policy; its National Science, Technology and Innovation Policy 2009; its National Development Plan 2010; and its Agricultural Sector Development Strategy and Plan. The same holds for Kenya, where the political institutions supporting innovation are so numerous that coordination and harmonization

Table 1: Science, technology, and innovation (STI) policies: Kenya and Uganda, 2014

Policy characteristic	Kenya	Uganda
Title	<ul style="list-style-type: none"> Science, Technology and Innovation Act (2013) Draft National Science, Technology and Innovation Policy (2012) 	<ul style="list-style-type: none"> National Science Technology and Innovation Policy (2009)
Objectives and priorities (percent of goals reached as formulated in national policy)		
Research capacity	75%	75%
Human resources	75%	50%
Network of researchers	50%	75%
ICTs	50%	75%
Institutional capacity	25%	50%
Links with the private sector	25%	25%
STI policy authority	<ul style="list-style-type: none"> Presidential Advisory Parliamentary Committee on Education, Research and Technology National Commission on Science, Technology and Innovation Ministry of Education, Science and Technology 	<ul style="list-style-type: none"> Uganda National Council for Science and Technology (UNCST) operates under Ministry of Finance, Planning and Economic Development)*

Source: Iizuka et al., 2015. For more details on the entries in the table see <http://www.merit.unu.edu/deipafrika>.

* The UNCST is expected to become part of the new Ministry of Education, Sports, Science and Technology.

issues arise (Chapter 9). As Table 1 shows, experts assessed that by 2014 both countries had made considerable progress in meeting their science, technology, and innovation (STI) policy objectives and priorities.

Innovation policies have been recently introduced in most emerging economies. Even in developing and least-developed countries, innovation is at the core of the political debate. The Republic of Moldova, for example, introduced its innovation strategy 'Innovations for Competitiveness' for the period 2013–2020. This strategy aims to stimulate innovation in firms and society in general.⁶ In another example, recent policy initiatives in Viet Nam are setting the stage for developing a mature national innovation system.⁷

Broad tendencies of innovation policy frameworks

Governments in developed countries have a whole range of instruments at

their disposal to stimulate firms to invest more in research and innovation. These tools include direct and indirect support measures for R&D and innovation, institutional and competitive funding instruments, and supply-side and demand-side measures.⁸ In Europe the range of policy instruments is most diverse: not only are European Union (EU) Member States adapting measures to their own needs but also the European Commission is supporting research and innovation with instruments open to firms in all Member States and other European countries. A recent study, drawing lessons from 10 years of European innovation policies, shows that Europe is a thriving environment for such policies.⁹

By contrast, because of their reduced fiscal space, governments in developing and emerging countries have less room to manoeuvre. Given their limited tax income, in part the result of the large size of

their informal economy, these countries have less leeway to correct for market failures. Since innovation processes are also more oriented towards knowledge diffusion and absorption, as described above, the focus of innovation policies in these countries differs from policies in more advanced economies.

Because developing and emerging country governments do not have the same latitude as those in developed countries to hand out R&D tax credits, subsidies, or government procurement contracts, firms in these countries largely rely on themselves to build up a stock of technological knowledge. Instead of investing in R&D, to a large extent these firms try to reap the benefits of catching up through adoption and international technology transfer. Among the various possible channels for transfer are imports of capital goods, subcontracting agreements, technical assistance programmes, technology licensing contracts, international standards certification, and inward foreign direct investment.

In the context of such innovation processes, and considering that most of the firms in developing countries are small, without patents, and with little experience in intellectual property protection, these firms should favour tax incentives over direct R&D support in the form of grants or R&D subsidies. It gives them immediate funds to innovate and invest without having to write grant applications that would partially leak their innovative ideas. Moreover, given the small size of these firms' R&D budgets, the R&D tax incentives policy does not suffer from the presence of deadweight loss (financing R&D that would have taken place anyway).

In part for the reasons just mentioned, firms in developing countries

often do not have the technological expertise or the financial means to run R&D laboratories. This does not prevent them, however, from being creative and finding solutions to day-to-day problems by way of incremental innovations—on-the-shop-floor kinds of small improvements in engineering, management, or marketing and training their workforce. The success of these efforts depends on their technological capabilities. These capabilities are necessary to select and acquire the adequate technologies, to adapt those technologies to local circumstances, and to operate and develop them further, and they include skills, experiences, attitudes, and schooling. In cases of successful development of technological capabilities in an economy, local firms gradually move from adapting imported technology to indigenously developing technology, as in the cases of the Republic of Korea and Taiwan, Province of China.

The fact that companies rely less on formal R&D puts into perspective the policies of some emerging countries that aim to achieve target levels of R&D/GDP ratios (e.g., a 2% target is presently set for India) comparable to those of industrialized countries. Emphasis in emerging countries should be placed on reaching R&D levels as much as on providing the right framework conditions that stimulate a process of innovation and knowledge diffusion: political stability and supportive institutions; good and widespread technical and tertiary education to enhance absorptive capacity; reliable and widespread basic infrastructure; excellent provision of information and communication technology (ICT) property rights; and stronger links and interaction between publicly funded research institutes and private companies.

Each of these components is represented in the GII framework. In the context of emerging economies, some of the pillars cannot be overemphasized. Institutions are important because they create the proper framework conditions for doing business.¹⁰ All countries are currently developing legislation and innovation support plans. The success of this approach is seen in Uganda, which embarked on a period of political stability since 1986 accompanied by strong innovation and growth performance (see Chapter 11).

Human capital and research supply the necessary skills, but equally serve other social targets. There is usually a gap between the demand for education and the availability of resources. Improvements in primary education and in primary and secondary technical education are vital for basic technological capabilities. But the development of more specialized capabilities is also imperative in key areas where technologies—such as ICTs and biotechnology—are changing rapidly. This may require higher education in technical, scientific, and agricultural disciplines. In Uganda, for instance, scholarship schemes prioritize students in STEM (science, technology, engineering, and math) fields and attract diaspora in these fields. In Kenya, by contrast, tertiary education has been neglected, and various institutions are now created to coordinate technical education and vocational training.

Infrastructure, in particular ICTs, has a leveraging effect on the exchange of knowledge and new technologies. Low-cost ICTs facilitate inclusive innovations such that all people in society will benefit from the advantages of new products and processes. Access to ICTs will foster the diffusion of information

and knowledge that may have a more profound societal impact than the creation of new knowledge (such as the M-PESA example in Kenya).

There exists a broad consensus that stronger export orientation triggers innovation and the development of capabilities. Competing in international markets requires meeting international technology and quality standards. The body of standards that firms have to implement is rising and relates not only to product standards but increasingly also to process standards, labour standards, and standards for environmental conduct. For firms in developing countries, even more than for firms in advanced economies, the adherence to these standards and the acquisition of certifications are important to reduce transaction costs.¹¹ But the standards certification process also triggers innovation through improved managerial practices and company-wide operational improvements and training. Policy can play a crucial role in raising awareness of these standards and assisting local firms as they go through the difficult certification procedure.

An innovation policy for developing and emerging economies is thus necessarily multifaceted and complex, involving aspects of education policy, industrial policy, international trade policy, and various other institutional reforms. With limited budgets, most countries will have to make hard choices on where to invest to make the most of their available human and natural resources and their competitive advantage. Choices of smart specialization may also be done in collaboration with other countries.

The ultimate policy mix will depend on a country's broader development objectives, and will have to be made in collaboration with all

the stakeholders to maximize the chances of success. Good coordination between ministries and between the private and the government sectors is therefore essential. In other words, the systemic nature of innovation policy needs to be reinforced.

Padilla-Pérez and Gaudin identify the following eight barriers of innovation policy in Central America, but the same barriers are likely to apply to many developing and emerging economies: the absence of high-level political support for STI policies; frequent institutional changes and the absence of long-term planning; modest government support for STI; insufficient enforcement of institutions to promote innovations, such as intellectual property rights and competition; lack of coordination among government agencies and policies; a lack of absorptive capacity and weak educational system; difficulties in financing STI; and a lack of policy evaluations.¹²

The need for progress in metrics

It is essential to monitor the impact of innovation policies in order to determine whether policies have worked and which policies might be most effective. For this, governments need access to relevant, timely, and reliable statistical information. A wide range of statistics is available in developed countries, including, among others, data on educational skills, R&D expenditure, patent applications, trademarks and designs, and firms' innovation activities (these latter are collected using innovation surveys). High-quality indicators are essential for good STI policy making because decision making will otherwise be based on partial knowledge of the STI systems already in place.¹³

The first innovation surveys asking firms about their innovation

activities date back to the 1980s. Following the recommendations on measuring innovation in the *Oslo Manual*,¹⁴ the European Commission took the initiative in the early 1990s to develop a harmonized questionnaire—the Community Innovation Survey—which is currently used by most European countries and has inspired setting up innovation surveys in countries around the globe.¹⁵ A recent study by the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (UIS) has identified fewer than 30 non-European or non-OECD countries that have introduced at least one innovation survey since the early 2000s.¹⁶ Many emerging economies have not yet introduced an innovation survey to measure firms' innovation activities. Not all of the indicators developed for more-advanced economies are equally relevant to less-developed economies. The international standards and protocols developed for collecting data in advanced economies are sometimes incompatible with the STI systems found in many developing countries. For emerging economies this might be less problematic because they are evolving into advanced economies, so the international standards and protocols are more applicable and thus achievable.

A great deal of GDP—as much as 40%—in developing economies is generated in the informal sector. In terms of total employment, the part played by the informal sector is even greater.¹⁷ Currently the innovation surveys conducted in developing countries, however, do not cover firms from the informal sector. As a report on innovation in Ghana shows,¹⁸ the proportion of innovating firms may be lower in the informal than in the formal sector, but nevertheless be quite sizeable. For instance, in Ghana, 72%

of the firms in the informal sector declared themselves to be innovative compared with 90% in the formal sector. Actual innovation surveys do not cover firms in the informal sector because these are not formally registered. It would be interesting to assess innovation in the informal sector and to understand what motivates these firms to be innovative. It is encouraging that new work aimed at better understanding innovation in the informal sector has been ongoing for the last three years.¹⁹ To better capture innovation, our measurement frameworks and tools will have to be adapted in this regard.²⁰

The 2015 GII is based on data available for all 141 countries included this year on the various pillars of innovation. This need for pervasive statistics for comparability purposes stands in conflict with the local nature of some innovation characteristics. M-PESA, for instance, is available in several countries but not yet in many others. The use of M-PESA would be a good indicator of creative output pillars, but given its local usage it cannot yet be used as a component of the GII.

Conclusions

Emerging economies are very conscious that innovation plays a key role in an environmentally sustainable and socially balanced growth agenda. Innovation policy has therefore moved to the centre of the policy debate. Because innovation is not only a process of knowledge diffusion, as countries develop, simply adopting existing technologies is no longer sufficient to maintain a high growth rate. Rather countries need to invest in research and innovation to develop products that address their particular needs. Governments are therefore developing innovation-support policies that

take into account the specificities of their domestic industries. A few emerging countries have successfully introduced such policies and provide interesting cases from which lessons can be learned on a diverse range of innovation policies.

Notes

- 1 Mohnen and Hall, 2013.
- 2 Bogliacino et al., 2012.
- 3 M-Farm provides Kenyan farmers price information for their products and inputs via SMS text. iCow provides small-scale dairy farmers in Kenya information, via SMS text, on different aspects of their cows' lifecycle, thus raising family incomes by improving milk production. More details are available at <http://www.mfarm.co.ke/> and <http://icow.co.ke/>.
- 4 Mimba Bora is a mobile application that helps expectant women to monitor their pregnancies. More details are available at <http://www.mimbabora.com/>.
- 5 Matatu is a two-player card game originating from Uganda available for smartphones. Afrinolly is an application that allows users in Africa to watch movie trailers, music videos, and concert videos on their smartphones. More details are available at <http://www.afrinolly.com/>.
- 6 European Commission, 2013.
- 7 OECD, 2014.
- 8 OECD, 2010.
- 9 Izsak and Markianidou, 2013.
- 10 Goedhuys and Srholec, 2014.
- 11 Goedhuys and Sleuwaegen, 2013.
- 12 Padilla-Pérez and Gaudin, 2014.
- 13 Tijssen and Hollanders, 2006.
- 14 OECD, 2005.
- 15 Arundel and Smith, 2013.
- 16 Information about the first UIS innovation data collection is available at <http://www.uis.unesco.org/ScienceTechnology/Pages/innovation-data-release.aspx>.
- 17 Iizuka et al., 2015.
- 18 Fu et al., 2014.
- 19 The full details of this project can be found at http://www.wipo.int/econ_stat/en/economics/studies/. See also de Beer et al., 2013.
- 20 Charnes et al., 2015.

References

- Arundel, A. and K. Smith. 2013. 'History of the Community Innovation Survey'. In *Handbook of Innovation Indicators and Measurement*, ed. F. Gault. Cheltenham: Edward Elgar. 60–87.
- Bogliacino, F., G. Perani, M. Pianta, and S. Supino. 2012. 'Innovation and Development: The Evidence from Innovation Surveys'. *Latin American Business Review* 13 (3): 219–61.
- Charnes, J., F. Gault, and S. Wunsch-Vincent. 2015, forthcoming. 'Formulating an Agenda for the Measurement of Innovation in the Informal Economy'. In *The Informal Economy in Developing Nations: Hidden Engine of Innovation?* ed. E. Kraemer-Mbula and S. Wunsch-Vincent. New Economic Insights and Policies. Cambridge: Cambridge University Press. Chapter 9.
- de Beer, J., K. Fu, and S. Wunsch-Vincent. 2013. 'The Informal Economy, Innovation and Intellectual Property: Concepts, Metrics and Policy Considerations'. *WIPO Economics Working Paper* No. 10. Geneva: World Intellectual Property Organization.
- The Economist. 2013. 'Why Does Kenya Lead the World in Mobile Money?' *The Economist explains*, 27 May. Available at <http://www.economist.com/blogs/economist-explains/2013/05/economist-explains-18>.
- European Commission. 2009. *Making Public Support for Innovation in the EU More Effective: Lessons Learned from a Public Consultation for Action at Community Level*. Commission Staff Working Document SEC(2009)1197. Available at http://ec.europa.eu/enterprise/policies/innovation/files/swd_effectiveness_en.pdf.
- . 2013. *The Innovation Strategy of the Republic of Moldova for the Period 2013–2020: 'Innovations for Competitiveness'*. ERAWATCH Policy Documents. Available at http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/md/policydocument/policydoc_0003.
- Fu, X., G. Zanello, G.U. Essegbey, J. Hou, and P. Mohnen. 2014. *Innovation in Low Income Countries: A Survey Report*. Technology and Management Center for Development, Oxford University.
- Goedhuys, M. and L. Sleuwaegen. 2013. 'The Impact of International Standards Certification on the Performance of Firms in Less Developed Countries'. *World Development* 47: 87–101.
- Goedhuys, M. and M. Srholec. 2014. 'Technological Capabilities, Institutions and Firm Productivity: A Multilevel Study'. *European Journal of Development Research* 27: 122–39.
- Iizuka, M., P. Mawoko, and F. Gault. 2015. 'Innovation for Development in Southern & Eastern Africa: Challenges for Promoting ST&I Policy'. *UNU-MERIT Policy Brief* No. 1-2015.
- Izsak, K. and P. Markianidou. 2013. *Lessons from Ten Years of Innovation Policy: What Can Be Learnt from INNO Policy TrendChart and the Innovation Union Scoreboard*. Brussels: European Commission.

- Mas, I. and D. Radcliffe. 2010. 'Mobil Payments Go Viral: M-PESA in Kenya'. *Yes Africa Can: Stories from a Dynamic Continent*. Washington, DC: World Bank. Available at http://siteresources.worldbank.org/AFRICAEXT/Resources/258643-1271798012256/M-PESA_Kenya.pdf.
- OECD (Organisation for Economic Co-operation and Development). 2005. *Oslo Manual: Guidelines for Collecting and Interpreting Technological Innovation Data*. Paris: OECD Publishing.
- . 2010. *Science, Technology and Industry Outlook 2010*. Paris: OECD Publishing.
- . 2014. *Science, Technology and Innovation in Viet Nam*. Paris: OECD Publishing.
- . 2015. *Innovation Policies for Inclusive Development, Scaling up Inclusive Innovations*. Paris: OECD Publishing.
- Padilla-Pérez, R. and Y. Gaudin. 2014. 'Science, Technology and Innovation Policies in Small and Developing Economies: The Case of Central America'. *Research Policy* 43: 749–59.
- Safaricom. No date. M-PESA. Available at <http://www.safaricom.co.ke/personal/m-pesa/>.
- Tijssen, R. and H. Hollanders. 2006. 'Using Science and Technology Indicators to Support Knowledge-Based Economies'. *UNU-MERIT Policy Brief* No. 11-2006.