

## Executive Summary

The Global Innovation Index (GII) 2015 covers 141 economies around the world and uses 79 indicators across a range of themes. Thus GII 2015 presents us with a rich dataset to identify and analyse global innovation trends. The theme for this year's GII is 'Effective Innovation Policies for Development'. Taking advantage of the wealth of information produced by the GII analysis in its past editions, the outcome of various innovation policies can be reviewed to support their claims to effectiveness and to determine the impact that an economy's degree of development has on their efficacy.

This report presents chapters that discuss different aspects of the index and the theme, followed by appendices that provide a profile for each of the countries/economies covered this year, the data from individual data tables for each indicator, detailed information about the sources and definitions of each indicator, and technical notes about the composition of the index.

Below we provide a summary of the chapters.

**Chapter 1**, 'The Global Innovation Index 2015: Effective Innovation Policies for Development', written by Soumitra Dutta, Rafael Escalona Reynoso, and Alexandra L. Bernard from Cornell University; Bruno Lanvin from INSEAD; and Sacha Wunsch-Vincent from WIPO, introduces the idea that innovation-driven growth is no longer the prerogative of high-income countries alone, while providing tangible examples of effective innovation policies undertaken by developing countries with corresponding positive results in the GII rankings. Furthermore, this chapter discusses the results of this year's rankings. The key findings from the chapter are summarized below:

- Switzerland, the United Kingdom (UK), Sweden, the Netherlands, and the United States of America (USA) are the world's five most-innovative nations; at the same time, China, Malaysia, Viet Nam, India, Jordan, Kenya, Uganda, and a group of other countries are outpacing their economic peers in 2015.
- The GII leaders have created well-linked innovation ecosystems where investments in human capital, combined with strong innovation infrastructures, contribute to high levels of creativity. In particular, the top 25 countries in the GII consistently score well in most indicators and have strengths in areas such as information and communication technologies and business sophistication, which includes knowledge workers, innovation linkages, and knowledge absorption; they also create high levels of measurable outputs including creative goods and services.
- But innovation is not only about volume: Quality counts, too. In terms of innovation quality—as measured by university performance, the reach of scholarly articles, and the international dimension of patent applications—the USA holds the top place within the high-income group, followed by the UK, Japan, Germany, and Switzerland. Top-scoring middle-income economies are narrowing the gap on innovation quality: China leads this group, followed by Brazil and India, fuelled by an improvement in the quality of higher-education institutions.
- The GII 2015 confirms the persistence of global innovation divides. Among the top 10 and top 25, rankings have changed but the set of economies remains unaltered (the only exceptions being the Czech Republic, which has made its way into the top 25, and Malta, which has dropped from this list).
- For the purposes of this report, economies that perform at least 10 percent better than their peers for their level of gross domestic product (GDP) are called 'innovation achievers'.
- The 14 middle-income countries outperforming others in their income group—in order of performance—are the Republic of Moldova,

- China, Viet Nam, Armenia, Senegal, Mongolia, Malaysia, Montenegro, Ukraine, India, Bulgaria, Thailand, Morocco, and Jordan. The eight low-income countries outperforming others in their income group are Malawi, Mozambique, Rwanda, Kenya, Mali, Burkina Faso, Cambodia, and Uganda. These innovation achievers demonstrate rising levels of innovation input and output results because of improvements made to institutional frameworks, a skilled labour force with expanded tertiary education, better innovation infrastructures, a deeper integration with global credit investment and trade markets, and a sophisticated business community—even if progress on these dimensions is not uniform across their economies.
- On average, the technology gap between developing and developed countries is narrowing. One explanation for this phenomenon is that more and more developing countries outperform in innovation inputs and outputs relative to their level of development. The GII 2015 studies these ‘outperformers’—namely Armenia, China, Georgia, India, Jordan, Kenya, Malaysia, the Republic of Moldova, Mongolia, Uganda, and Viet Nam—analysing them in more detail and establishing links between performance and good business practices or innovation policies. They and other countries have realized that technology adoption alone is no longer sufficient to maintain a high-growth scenario; rather, investment in innovation is now crucial to spur further catch-up. As a result, national innovation policy programmes and the corresponding institutional arrangements have flourished in low- and middle-income countries.
  - The top three economies in the GII rankings for each region are as follows: in Sub-Saharan Africa, the top three are Mauritius, South Africa, and Senegal; in Central and Southern Asia, these are India, Kazakhstan, and Sri Lanka; in Latin America and the Caribbean, these are Chile, Costa Rica, and Mexico; in Northern Africa and Western Asia, these are Israel, Cyprus, and Saudi Arabia; in Southeast Asia and Oceania, these are Singapore, Hong Kong (China), and the Republic of Korea; in Europe, these are Switzerland, the UK, and Sweden; in Northern America, there are only two—the USA and Canada.
  - Encouraging signs continue to emerge in Sub-Saharan Africa. Following the trend identified in the GII last year, driven by selected countries, the Sub-Saharan Africa region has caught up significantly. In addition to South Africa, some African countries—in particular, Burkina Faso, Kenya, Malawi, Rwanda, and Senegal—stand out for having made important progress.
  - Although Latin America and the Caribbean region’s GII rankings have been slow to improve, Brazil, Argentina, and Mexico stand out as economies performing above the region’s average GII score. The consistent overperformance of Chile, Costa Rica, and Colombia—in both regional terms and as compared to their peers of similar economic development—is also noteworthy, as is the emergent role of Peru and Uruguay.
- Chapter 2, ‘Benchmarking Innovation Outperformance at the Global and Country Levels’,** written by Rafael Escalona Reynoso and Alexandra L. Bernard from Cornell University; Michaela Saisana from the Joint Research Centre at the European Commission; Martin Schaaper from UNESCO Institute for Statistics; and Sacha Wunsch-Vincent and Francesca Guadagno from WIPO, assesses the list of innovation achievers and pillar outperformers over the period 2011–14 and identifies a select group of 11 innovation outperformer economies. The chapter stresses that, at the country level—especially in developing countries—the emphasis on fostering innovation has increased and national innovation policies and programmes are flourishing.
- Although tracking absolute levels of innovation over time is difficult, measuring such progress has become a priority for policy makers who are seeking ways to assess the effectiveness of their innovation policies and innovation systems. This interest has also been permeated by high-level international development-related discussions.
  - By tracking global progress in innovation and focusing on those developing countries that outperform in innovation compared to countries at similar levels of development, the GII can be used to monitor progress in innovation and identify areas of strengths and weaknesses in innovation efforts.
  - The analysis within the chapter finds a growing percentage of countries with above-par performance (those that outperform their peers with a similar

level of economic development). The number of these innovation achievers continues to increase through the period under study here, namely 2011–14.

- Eight economies (China, India, Jordan, Kenya, the Republic of Moldova, Mongolia, Malaysia, and Viet Nam) can be signalled as innovation achievers, outperforming their peers on the overall GII score during 2011–14.
- Fifteen economies (China, Costa Rica, Georgia, Ghana, Hungary, India, Kenya, the Republic of Moldova, Mongolia, Malaysia, Rwanda, Serbia, Thailand, Ukraine, and Viet Nam) outperformed their peers in at least four innovation input or output pillars during 2011–14.
- Eleven developing countries (Armenia, China, Georgia, India, Jordan, Kenya, Malaysia, the Republic of Moldova, Mongolia, Uganda, and Viet Nam) are labelled ‘innovation outperformers’ because they conform to the following two more stringent rules: (1) their GII score relative to their GDP is significantly higher than it is for other economies (they attain ‘innovation achiever’ status) for two or more recent years (including at least 2013 and 2014); and (2) they outperform their income-group peers in a minimum of four innovation input or output pillars (they are designated ‘pillar outperformers’) for two or more years (including at least 2013 and 2014).
- Innovation achievers seem to perform the strongest in Market sophistication and Knowledge and technology outputs. At low income levels, countries that outperform their peers focus on removing structural obstacles to innovation, such as poor access to finance and poor linkages within the innovation systems. At higher income levels, efforts concentrate on increasing investments, spurring growth in innovation outputs, and improving human capital.
- Although the innovation system literature puts great emphasis on the role of human capital and institutions for innovation and development, these innovation input factors seem to be the most difficult of all inputs in which to achieve good scores, both in general and for low-income countries in particular. These results do not necessarily imply a lack of policy interest in these areas, but they might suggest that it is easier to outperform peers in certain inputs, either because

efforts to improve these inputs bring more immediate benefits or because peer countries perform particularly poorly in these areas.

- Research and development (R&D) is one of the key policy areas that can secure technological potential and, therefore, innovation and economic growth. In order to reach the income levels of high-income countries, low- and middle-income countries need to expand their access to technology and their capacity to use it.
- Countries at higher income levels, instead, can benefit from more developed innovation systems, where education and research can effectively provide the knowledge and skills to boost innovation. This allows them to more effectively translate innovation efforts into knowledge and technology outputs.

**Chapter 3, ‘Innovation Policies for Development,’** written by Micheline Goedhuys, Hugo Hollanders, and Pierre Mohnen from UNU-MERIT (United Nations University and Maastricht University), emphasizes that the competitiveness of both companies and countries depends on their ability to innovate and move in the direction of frontier technology and knowledge. 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, but the focus of innovation policies in these countries differs from that of policies in more advanced economies.

- There is a wide heterogeneity among enterprises in emerging economies. Besides top-performing companies, emerging economies also host 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.
- 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.

- 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.
- 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.
- 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.
- Since innovation processes are also more oriented towards knowledge diffusion and absorption, instead of investing in R&D, to a large extent firms in emerging economies try to reap the benefits of catching up through adoption and international technology transfer, and favour tax incentives over direct R&D support grants.
- Emphasis in emerging countries should be placed on gaining knowledge 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.
- 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.
- It is also essential to monitor the impact of innovation policies in order to determine whether policies have worked and which policies might be most effective.
- 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.

**Chapter 4, 'Principles for National Innovation Success,'** written by Robert D. Atkinson and Stephen Ezell from the Information Technology and Innovation Foundation, discusses the growing recognition that innovation is something in which all nations, including developed and developing, can, and indeed should, be engaged. The chapter presents six key principles all nations need to consider in order to design and implement the most effective innovation policies:

- **Principle 1:** Innovation policy should focus on maximizing innovation in all industries. Although manufacturing generally, and high-tech manufacturing specifically, is an important component of innovation, maximizing innovation requires maximizing innovation across all industries.
- **Principle 2:** Innovation policy should support all types and phases of innovation. One of the biggest mistakes countries make with their innovation strategies is to define innovation too narrowly, focusing mainly on developing and manufacturing high-tech products. Countries should focus more on across-the-board productivity growth strategies than on trying to grow primarily by shifting the compositional mix of their economy from lower- to higher-value-added sectors.
- **Principle 3:** Enable churn and creative destruction. To succeed in innovation, nations need to do more than merely enable some value-added innovation to supplement what is already going on in other, leading economies. They need to enable disruptive innovation, which is often generated by new market entrants, especially those emerging in their own economies.

- Principle 4: Keep the price of capital goods imports, especially information and communications technology (ICT) imports, low. Without new capital investment refreshing a nation's capital stock, innovation loses its power, productivity growth stagnates, and business competitiveness declines. The easiest and most important way countries can keep the cost of capital goods low is to limit tariffs and other trade barriers.
    - » ICTs represent a general purpose technology that are a foundational driver of modern economic growth, accounting themselves for as much as one-quarter of economic growth in many developing nations today.
    - » Although many nations impose high taxes and tariffs on ICT products in an attempt to either boost government revenue or to create a competitive domestic ICT industry or both, many nations—including China, Georgia, Malaysia, and Viet Nam—do a reasonably good job of limiting government-imposed costs on ICT products.
  - Principle 5: Support the creation of key innovation inputs. Firms not only need access to best-in-class, affordable ICT inputs, they also need access to other key innovation inputs, including digital infrastructure, a skilled workforce, and knowledge—both its production and its transfer. Examples of such support include:
    - » Kenya's National ICT Master Plan 2013/14–2017/18, introduced in April 2014, has played a vital role in developing a strategy to comprehensively deploy digital infrastructure, notably wireless and broadband Internet, throughout Kenya and to complement that availability of infrastructure with demand for it generated by popular applications such as mobile money and mobile government services.
    - » Countries increasingly recognize talent as a vital source of competitive advantage and thus have made education and training a core component of their innovation strategies.
    - » Because entrepreneurship is so risky and often involves first-time entrepreneurs, initiatives to help entrepreneurs learn from each other can be critical.
  - Principle 6: Develop a national innovation and productivity strategy and organizations to support it. In addition to national strategies, many successful nations have also established national innovation agencies specifically dedicated to spurring domestic innovation.
    - » For example, Kenya, India, Malaysia, Thailand, and Viet Nam have each established a National Innovation Agency.
    - » National innovation foundations also create national innovation strategies that constitute a game plan for how their countries can compete and win in a modern, innovation-based global economy. For instance, Kenya's National Science, Technology and Innovation Policy underscores the importance of mainstreaming science, technology, and innovation across all sectors of the economy.
- The chapter concludes:
- Countries attempting to achieve national innovation success need to envision a four-level pyramid as the path to prosperity that is based on key framework conditions; these support an effective tax, trade, and investment environment; these in turn support key factor inputs; and finally, at the top of the pyramid, is a group of innovation and productivity policies.
  - Countries must think holistically about how a wide variety of public policies impact the ability of their enterprises and industries to compete in the increasingly innovation-based global economy.
- Chapter 5, 'Innovation and Policy: A Business Perspective,'** written by Kai Engel and Justin Shepherd from A.T. Kearney and Martin Ruppert from the IMP<sup>3</sup>rove – European Innovation Management Academy, presents the findings of a survey of over 400 business leaders across several different countries to provide a business perspective on innovation policies. The results are as follows:
- Managers were generally positive and confident when evaluating their own innovation capabilities. Over half of those surveyed rated their performance as 'excellent' or 'very good' across all areas.



- Delivering radical innovation and collaborating with external partners were the two areas where companies saw the greatest need for improvement.
- Eighty percent of respondents answered that conditions in their countries permit them to pursue strategic objectives for innovation. This outcome suggests that policy environments are currently broadly supportive of innovation.
- The responses also reflected the need for policy makers to maintain a forward-looking orientation and to create policy frameworks that will support innovation in the future, not only in the present.
- More than 60% of survey respondents consider policy measures to be ‘important’ or ‘highly important’ to support different models of internal or collaborative innovation.
- Sixty-nine percent of survey respondents see policy measures to support internal innovation models as having either ‘high’ or ‘very high’ importance. By generating an increasingly complex innovation environment, current mega trends—such as digitization and connectivity—will make policy supports even more vital.
- When asked about future policy needs to support innovation, respondents suggested adopting forward-thinking legislation to ensure sustainability in the innovation environment; providing market participants with the tools to anticipate regulation; and improving regulatory harmonization to ensure smooth implementation into the international marketplace.
- Survey participants were further asked to name up to three specific actions that would develop enhanced conditions for innovation in their country: (1) to enhance innovation and entrepreneurship-related skills, (2) to provide large R&D infrastructure support (e.g., lab space and equipment), and (3) to provide direct financial R&D support. These priorities reflect the findings of the GII 2014, which indicated room for improvement in Human capital and Market sophistication-related factors such as access to finance, innovation linkages, and infrastructure.
- Encouraging policy that supports the development of an environment in which innovation can thrive should be a focus of efforts from the business community.

**Chapter 6, ‘The Impact of Science and Technology Policies on Rapid Economic Development in China,’** written by Dongmin Chen, Shilin Zheng, and Lei Guo from Peking University, details how science and technology (S&T) policy reform and innovation have been the important drivers for China’s remarkable GDP achievement and have accelerated progress in higher education and research and development (R&D):

- A Medium- and Long-Term National S&T Development Plan for 2006–2020 (the 2006 National Plan) was issued in 2006. The plan emphasizes achieving sustainable economic growth, seeking innovation-driven growth strategies, and further enhancing independent innovation capacity. Objectives of national policies shifted from promoting R&D to building an innovation ecosystem.
- Following the 2006 National Plan, Chinese R&D investment clearly stepped up and the rate of local government investment in R&D surpassed that of the central government. Moreover, the positive market response encouraged the industrial sector to steadily increase R&D investment.
- To further push talent mobility, particularly in critical S&T fields, a very effective Thousand Talents Recruitment Program was launched by the central government. This has so far drawn more than 2,000 overseas Chinese scholars and leading industrial innovators back to China.
- The wide range of S&T policies implemented and adjusted over the past three decades has effectively advanced the development of an innovation ecosystem, as well as significantly increasing the size of the educated workforce, laying out a solid foundation for China’s future development.
- The strategy of ‘rejuvenating the nation’s economy with science and education’ has accelerated the development of China’s top education system, increased the quantity of undergraduates and Master’s graduates, and increased investment in talented researchers, leading to an increase of both the quality and quantity of researchers.
- Over the last two years, the Chinese government issued the 2014–2020 Action Plan on the Implementation of National Intellectual Property Strategy to ease the market processes for transactions pertaining to intellectual properties. It has

also overhauled the entire S&T funding processes to improve efficiency, launched a special stock market to allow technology start-up companies to have more avenues through which to raise development capital, and published *A Guideline for the Development of Public Incubation Space* to promote grassroots entrepreneurship to encourage the participation of multi-level capital markets, including crowdfunding.

- China has set a national target of becoming a leading innovative country by 2020. Reaching this target depends on continuing policy reform to further improve a balanced relationship between the government and market forces; to establish a more comprehensive innovation ecosystem; to nurture a legal and regulatory system that encourages investment in innovation and entrepreneurship by all sectors; and to foster open and fair competition among private, state-owned, and foreign enterprises.

**Chapter 7, 'Radical Institutional Change: Enabling the Transformation of Georgia's Innovation System'**, written by Cristina Chaminade and Maria Moskovko from CIRCLE, Lund University, discusses the key institutional changes that are enabling Georgia to drive a rapid and positive change in its innovation performance.

- Since the collapse of the Soviet Union, Georgia has undertaken a process of deep transformation of its institutional framework enabled by the Association Agreement with the European Union. These reforms have improved tax administration and reduced corruption, progress that explains its exceptional performance in the GII rankings in Institutions and the significant increase of foreign direct investment inflows. The institutional change has led to a sizeable improvement in its innovation system. Further institutional change is necessary, however, to strengthen its education and research systems and improve firms' capabilities.
- Soft institutions, represented by societal practices, are harder to change. Intellectual property rights (IPR) protection is one of the areas in which soft institutions are making it difficult to implement new formal institutions.
- Despite the overall good performance in Human capital and research, Georgia is still facing the challenge of a fragmented research system and the loss of researchers who left the country after

the collapse of the Soviet Union. To solve these issues, the Georgian government has increased salaries for researchers, offered incentives to high-skilled Georgians who return to the country, and reformed the education system to bring it closer to the European standard.

- The Georgian business sector suffers from low capitalization, lack of training, low levels of patenting activity, and low levels of knowledge-intensive industries, which are reflected in its low levels of intangible assets and a poor use of ICTs, which severely hampers innovation capacity. The business sector is also poorly linked to university and research organizations. Investments in firms' innovation capabilities are needed—a major challenge for countries with very limited resources.
- The Association Agreement with the European Union (signed in 2014) could become a way to address some of the weaknesses outlined above. The agreement covers a large number of sectors and policy areas, including education, research and technological development, and ICT development. Moreover, access to the European market is expected to increase firms' incentives to be competitive.
- Links to multinational corporations are very important, but they need time and absorptive capacity to develop. Intermediate organizations such as non-governmental organizations and measuring and testing centres can play a crucial role in translating the knowledge of multinational corporations to the local actors.
- Especially given the current unstable situation in Eastern Europe and other external factors, it is essential for its continued development that Georgia stay on course on the innovation policy front.

**Chapter 8, 'Policies to Drive Innovation in India,'** written by Senapathy 'Kris' Gopalakrishnan and Jibak Dasgupta from the Confederation of Indian Industry, discusses the innovation performance of India, highlighting the strengths and weaknesses of its innovation system and the government interventions associated with them. Despite its achievements, especially in its scientific base and information technology (IT) and telecommunications industries, India still needs to implement substantial reforms in its innovation policy in order to further improve its innovation performance.

- India has consistently performed poorly during the last four years in political stability, ease of starting a business, tertiary inbound mobility, and environmental performance.
- Over the years, India has developed a stable foundation for scientific, technological, and business education by setting up centres of excellence. This contributed to its 66% average growth rate in scientific publications over the period 2006–10.
- The National Telecom Policy of 1994 and subsequent policy on broadband in 2004 lay the foundation for the rise of the Indian IT and telecommunications (mobile) industry. The National Telecom policy and IT Policy of 2012 is expected to further accelerate the growth of this industry by encouraging innovation and R&D in cutting-edge technologies, provide benefits to small- and medium-sized enterprises (SMEs) and start-ups, create a pool of 10 million skilled workers, and make at least one individual in every household e-literate.
- The SME sector has a high growth potential. This potential, however, has not yet materialized because of low credit availability. Government intervention in this area has focused on cluster development through various schemes and programmes of the Ministry of Micro, Small & Medium Enterprises and the National Innovation Council. Despite these efforts, SME cluster development in India is still not satisfactory.
- The Indian IPR regime has been crafted to strike a balance between protecting IPRs to support the commercialization of innovation and catering to social needs. This resulted in a relatively weaker IPR regime and a lower propensity to filing patents in India.
- With a population of more than 1.2 billion, and with 50% of that population under the age of 25, India faces a huge demand for higher education. This problem is exacerbated by low teacher quality, constraints in research capacity, and huge socioeconomic disparities.
- Despite their success, the Indian IT and telecommunications industries could contribute even more to economic growth and development in the country. For this to happen, higher education, IPR, institutional reforms, regulatory environment, infrastructure, and incentives

for entrepreneurship and R&D (especially for SMEs) should receive increased support of the government.

- As a partial response to these challenges, the newly elected government established a Ministry for Skill Development and Entrepreneurship, created financial schemes for SMEs and incubation programmes for start-ups, launched Intellectual Property Facilitation Centres to spread an intellectual property culture within SMEs, and announced increased expenditures on infrastructure.

**Chapter 9**, ‘Effective Innovation Policies for Development: The Case of Kenya’, written by Bitange Ndemo from the University of Nairobi, discusses how Kenya improved its innovation performance thanks to local innovators and a long R&D history in some key sectors, such as agriculture and health care. However, this rapid increase in new innovations is not strictly associated with the innovation policies in place in the country. These, therefore, need to improve to stimulate further innovation by guaranteeing stability and adequacy of funds for innovation, strengthening linkages between all the actors of the innovation system, and better communicating government plans to firms and innovation actors. The chapter explains:

- Pressure from a rapidly growing population, scarcity of resources, and soaring unemployment are driving the Kenyan government to push innovation as a new source of jobs. Successful commercialization of locally developed innovations has led to increased understanding of its potential to create employment and deal with local problems. Multinational corporations are also setting up research facilities in Kenya to get closer to this new potential market.
- Relative to other African countries, some of Kenya’s strengths lie in its governance system and political stability as well as its levels of expenditures on education and R&D, access to credit, microfinance gross loans, royalty and fees receipts, and intensity of local competition.
- Innovations in the financial sector (e.g., the diffusion of mobile banking) facilitate access to credit and explain the improvements in market and business sophistication.
- Since 2006 the government has created a number of ministries and organizations to stimulate human capital development, R&D



expenditures, and improve science and technology infrastructures.

- An emphasis was also placed on pursuing more and better collaborations and partnerships and encouraging entrepreneurship through start-up and accelerator programmes, incubation, and the creation of a technology park.
- Despite the existence of a policy framework, challenges hindering the adoption of innovation as a key driver of economic growth still exist. As a consequence, resource allocation to R&D is often not guaranteed and the little that is allocated to research organizations is spent on recurrent expenditures.
- Actors within the innovation system are still weakly linked, leading to capacity underutilization, disconnection between industry and research organizations, and obstacles to innovate for SMEs.
- In terms of future challenges, the education system needs to place more emphasis on science, technology, engineering, and mathematics (STEM); create more technical, industrial and vocational education training institutions; and move to business-friendly educational programmes. These issues are currently being tackled by creating a number of institutions. This proliferation of institutions, however, is not expected to solve these issues.
- The chapter also views lessons for Kenya from other countries. The USA has much to offer in its new approach to building a community of innovators—the TechShop concept—which is being explored through a collaboration between the University of Nairobi and MIT. The chapter then takes a look at an approach to encouraging start-up creation and SME growth from the Republic of Korea, which begins in reforms to the education system, coupled with military service. Together these may foster a culture of risk-taking and innovation, and may be a useful model for Kenya to consider.

**Chapter 10**, ‘Innovation Performance of the Malaysian Economy’, written by Rajah Rasiah and Xiao-Shan Yap from the University of Malaya, details how Malaysia offers an excellent example of a middle-income country that has done well in areas such as business financing of innovation and commercialization as

well as in Market sophistication and Business sophistication, but at the same time still has considerable progress yet to make in areas such as knowledge-based activities and technological dependence. The chapter details:

- Despite strong commercialization in business R&D, including in business financing, the country’s relatively poor performance in innovation efficiency shows a need to review government policies on the execution of government-sponsored R&D funds.
- Government support of innovation in Malaysia is primarily through science, technology, and innovation policies (STI) that began in the 1980s. The Ministry of Science, Technology and Innovation (MOSTI) supports the creation, research, development, and commercialization of innovative activities in Malaysia.
- After 2006, following efforts by the government to stimulate R&D in the country, the number of projects approved and the amounts involved rose. Stimulating R&D is viewed as key to making Malaysia a developed country by 2020.
- The Intensification of Research in Priority Areas grant was launched in 1988 under MOSTI, which was targeted at government organizations such as universities and public research institutes to stimulate research. At the same time, the government introduced the double deduction tax incentive for firms undertaking approved R&D. The Industrial R&D Grant Scheme to support R&D in the private sector was introduced in 1997.
- The increasing focus by the government on research funding has helped stimulate expansion in innovation input and output, as can be seen from the rise in R&D expenditure as a share of GDP, R&D researchers and scientists per million persons, and the output of doctoral graduates and scientific publications. Both the leadership at MOSTI and the National Science Research Council have systematically tried to address the fundamental aspects of targeting expenditure to the priority areas that can best generate innovation.
- Since the promotion of export-oriented industrialization from 1971, high-tech production has become a major pillar of manufacturing in Malaysia. Strong basic infrastructure

and consistent promotion incentives that are well coordinated by the Malaysian Industrial Development Authority have ensured that foreign capital continues to remain in Malaysia to assemble and test electronics products for the export market.

- Recognizing that private R&D cannot be a substitute for government funding—especially where the benefits share strong public goods characteristics—in 2010 the government increased R&D expenditure with a focus on increasing R&D scientists and engineers, commercialization, the filing of intellectual property, scientific publications, and postgraduates, and began to emphasize innovation through substantially improved products and processes.
- The Malaysian government has managed to expand scientific input and output through the coordination of MOSTI with the meso-organizations of the Malaysia Industry-Government Group for High Technology, the Multimedia Development Corporation, the Malaysian Technology Development Corporation, the National Science Research Council and the five research universities: Universiti Malaya, Universiti Kebangsaan Malaysia, Universiti Sains Malaysia, University Putra Malaysia, and Universiti Teknologi Malaysia.
- The chronic deficit in royalty and licensing fee receipts and payments demonstrates that Malaysia still relies heavily on foreign technology and services. Policies are needed to transform Malaysia from a technology-importing to a technology-exporting country.
- In 2012 the Collaborative Research in Engineering, Science & Technology (CREST) was established to drive growth in the electrical-electronics industry, focusing on bringing together the three key stakeholders (industry, academia, and the government) in collaborative R&D, talent development, and commercialization. Because each research project granted by CREST conditions the participation of both universities and industrial firms, it is directly targeted at building university-industry linkages in the country.
- The main shortcomings that have restricted Malaysia's GII ranking from rising above 33rd place relate to the efficiency of the innovation inputs and outputs. As a consequence Malaysia

has remained a net technology and services importer with net receipts and licensing fees remaining negative for many years. There should be greater effort made to improve institutional support and knowledge-based activities and turn Malaysia into a net exporter of technology and services.

**Chapter 11, 'Effective Innovation Policies for Development: Uganda'**, written by Julius Ecuru from the Uganda National Council for Science and Technology and Dick Kawooya from the University of South Carolina, School of Library and Information Science, discusses the case of Uganda and how it has changed dramatically in both economic terms and in other areas as a result of its relative political and economic stability. Uganda's rapidly growing population requires simultaneously expanding the economy to accommodate the people's needs and adopting more sustainable practices in natural resource management. For this reason, Uganda should turn to innovation and the creative use of resources across all sectors of the economy in order to build a sustainable future. The chapter explains:

- The Uganda government is deepening private-sector investment by improving its business environment and competitiveness through innovation.
- Uganda's GII strength in areas such as strong foreign direct investment net inflows is a direct result of the relative stability of the economy.
- Innovations in agro-processing and value addition may be essential for creating new sources of growth and agribusiness.
- The new Ministry of Education, Science, Technology, and Sports is a consequence of policy discussions over the last decade that identified a need for a standalone ministry for science and technology.
- Universities and other research organizations need to have internal policies that address and encourage research and intellectual property management.
- Uganda has a solid institutional foundation for developing the private sector. However, the private sector must be competitive domestically and internationally.
- Implementing the Uganda Registration Services Bureau's Strategic Investment Plan for 2012–17

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may remove institutional bottlenecks involved in business registration, which in turn would improve Uganda's current low score on the ease of starting and cost of running a business.

- One important dimension of innovation in Uganda is its learning-by-doing aspect, especially in the informal sector, which constitutes about two-thirds of the country's businesses.
- To foster productivity in the informal sector, efforts have been made to improve the skills of youth and women so they can either start or improve their businesses.
- The rapid growth of universities in the country is an opportunity to harness young talent by supporting creative work, research, and innovation.
- Streamlining the financing policy for research and innovation is a vital next step.
- Creating new businesses through active business incubation should be pursued.
- Government's sustained support and commitment to research and innovation activities in universities, research institutes, and other centres is needed through direct as well as annual competitive grants.
- Uganda's experiences provide lessons that can be valuable for other low-income countries that need to improve their ranking in the GII. The most important lesson is that policy formulation and institutional capacity development around STI must be addressed concurrently. Strong leadership can also provide an essential component of successful progress in bridging the gap between research and innovation centres and industry.