

SCIENCE, TECHNOLOGY AND INNOVATION FOR SUSTAINABLE DEVELOPMENT IN ASIA AND THE PACIFIC

Policy Approaches for Least Developed Countries



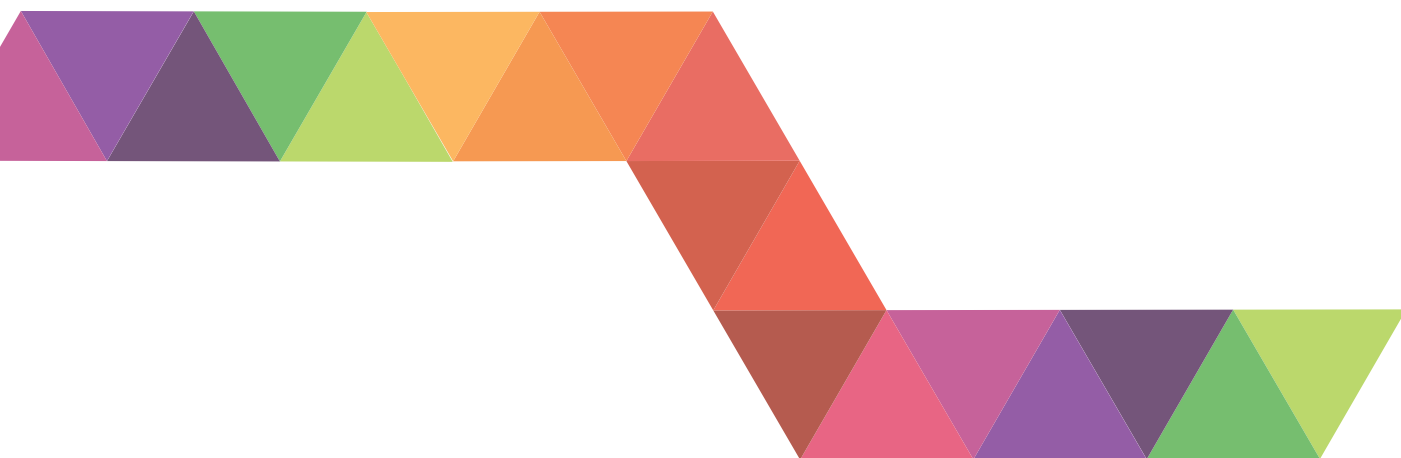


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FOREWORD



Investment in science, technology and innovation (STI) needs to be the backbone of productivity-led economic recovery and sustainable development. Despite significant increases in productivity over the past few decades, economic growth in developing economies of Asia and the Pacific has been primarily driven by factor accumulation. However, the average rate of productivity growth slowed between the periods 2000-2007 and 2008-2014 by 65 per cent, which has contributed to the current economic slowdown, potentially undermining efforts to effectively pursue the 2030 Agenda for Sustainable Development. We must revive growth in productivity and one of the keys to this is a highly-skilled labour force.

The good news is that the Asia-Pacific region is already home to some of the most dynamic and innovative economies in the world, leading the world in innovative business environments, socially inclusive government initiatives and complex scientific research. A number of Asia-Pacific economies also rank among the best in terms of research spending as a share of GDP, with the region accounting for almost 43 per cent of global research and development (R&D) expenditure. In 2013 alone, Asian developing economies spent more than \$650 billion on R&D.

However, these impressive gains have been confined to a relatively small number of economies. For example, 95 per cent of the region's researchers are located in just five countries. To meet the ambitions of the 2030 Agenda, the Asia-Pacific region will need to harness all of its potential resources, with a particular focus on widening the STI net. This is particularly important to least developed countries (LDCs).

Business as usual is not an option for the region if STI is to be used as an effective means of implementing the Sustainable Development Goals. The scale and depth of the Goals require a radically different and disruptive approach—the essence of innovation—along with significant scientific breakthroughs and technological advancements. The limited reach of STI achievements in the region so far will not, however, be sufficient to ensure that the Goals are met in the next 15 years. There are four elements that must be urgently addressed, especially with respect to LDCs:

First, we must develop a common and effective conceptual framework to enable STI to be more economically and socially inclusive, while promoting climate resilience and the reduction of carbon emissions. Effective institutions and digital infrastructure, appropriate legal and regulatory frameworks, commitment to and incentives for investment, and a workforce for the future are all critical components of such a framework.

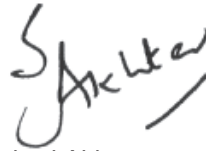
Second, to implement the Goals, governments will need to develop integrated and visionary STI policies, while incentivizing businesses and investors to support the three dimensions of sustainable development—economic, social and environmental. This will require explicit consideration of all three outcomes in any reporting standards.

Third, to be supportive of sustainable development, STI policies and strategies need to be inclusive, open and collaborative. Being inclusive in how we innovate, engaging vulnerable communities in the process of innovation and developing innovations that are accessible and affordable to people living in poverty, will be critical to ensure that no one is left behind.

Finally, there is ample scope for regional STI collaboration in Asia and the Pacific. The challenge is to develop concrete and sustainable innovation and technology sharing opportunities to help bridge the gaps that remain,

to enable countries at all levels of development to take advantage of available technologies and to develop a robust regional culture of innovation.

Regional collaboration will be crucial to share knowledge on what works, and to keep pace with the challenges and opportunities that this fast-moving and ever-changing agenda presents. The benefits of a wider STI net are inextricably intertwined with successful achievement of the 2030 Agenda.

A handwritten signature in black ink, appearing to read 'Shamshad Akhtar', with a stylized flourish at the end.

Shamshad Akhtar
Under-Secretary-General of the United Nations and
Executive Secretary, United Nations Economic and
Social Commission for Asia and the Pacific



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Analyses presented in the publication *Science, Technology and Innovation for Sustainable Development in Asia and the Pacific: Policy Approaches for Least Development Countries* are based on data and information available up to the end of March 2016.

Groupings of countries and territories/areas referred to in the publication are defined as follows:

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- Developing ESCAP region: ESCAP region excluding Australia; Japan; and New Zealand
- Developed ESCAP region: Australia; Japan; and New Zealand
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- Landlocked developing countries (LLDC): Afghanistan; Armenia; Azerbaijan; Bhutan; Kazakhstan; Kyrgyzstan; Lao People's Democratic Republic; Mongolia; Nepal; Tajikistan; Turkmenistan; and Uzbekistan
- Small island developing States (SIDS): Cook Islands; Fiji; Kiribati; Maldives; Marshall Islands; Micronesia (Federated States of); Nauru; Niue; Palau; Papua New Guinea; Samoa; Solomon Islands; Timor-Leste; Tonga; Tuvalu; and Vanuatu
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- North and Central Asia: Armenia; Azerbaijan; Georgia; Kazakhstan; Kyrgyzstan; Russian Federation; Tajikistan; Turkmenistan; and Uzbekistan
- Pacific: American Samoa; Australia; Cook Islands; Fiji; French Polynesia; Guam; Kiribati; Marshall Islands; Micronesia (Federated States of); Nauru; New Caledonia; New Zealand; Niue; Northern Marina Islands; Palau; Papua New Guinea; Samoa; Solomon Islands; Tonga; Tuvalu; and Vanuatu
- Pacific island developing economies: All those listed above under "Pacific" except for Australia and New Zealand
- South and South-West Asia: Afghanistan; Bangladesh; Bhutan; India; Iran (Islamic Republic of); Maldives; Nepal; Pakistan; Sri Lanka; and Turkey
- South-East Asia: Brunei Darussalam; Cambodia; Indonesia; Lao People's Democratic Republic; Malaysia; Myanmar; Philippines; Singapore; Thailand; Timor-Leste; and Viet Nam

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ABBREVIATIONS

2030 Agenda	2030 Agenda for Sustainable Development
ADB	Asian Development Bank
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
CSR	corporate social responsibility
DFID	Department for International Development (UK)
ECG	electrocardiograph machine
ESCAP	Economic and Social Commission for Asia and the Pacific
FDI	foreign direct investment
GDP	gross domestic product
GIF	Global Innovation Fund
ICDL	International Computer Driving Licence
ICT	information and communications technology
IP	intellectual property
ITT	international technology transfer
LDCs	least developed countries
MIT	Massachusetts Institute of Technology
NIF	National Innovation Foundation (India)
NIS	national innovation system
NKRA	national key results areas
OECD	Organisation for Economic Co-operation and Development
PEMANDU	Performance Management & Delivery Unit (Malaysia)
PPP	public-private partnership
R&D	research and development
SAARC	South Asian Association for Regional Cooperation
SDGs	Sustainable Development Goals
SIDA	Swedish International Development Cooperation Agency
STI	science, technology and innovation
TRIPS	Trade-Related Aspects of Intellectual Property Rights
TRQN	Temporary Return of Qualified Nationals
UK	United Kingdom of Great Britain and Northern Ireland
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
US	United States of America
USAID	United States Agency for International Development
USP	University of the South Pacific
VC	venture capital
WEF	World Economic Forum
WHO	World Health Organization
WIPO	World Intellectual Property Organization



INTRODUCTION

Science, technology and innovation (STI) have the potential to increase the efficiency, effectiveness and impact of our efforts to meet the ambitions of the 2030 Agenda and create benefits for society, the economy and the environment. Numerous innovations, such as pneumococcal vaccines, microfinance and green technologies, have been developed and have spread around the world at an unrelenting pace over the last few decades, improving health, providing economic opportunities and addressing climate change. Digital technologies such as mobile phones and the Internet have created an era where ideas, knowledge and data flow more freely than ever before, offering new avenues for collaborative and open approaches to innovation and providing real opportunities for this innovation to be truly inclusive.

Despite consensus on the transformative potential of STI, there remains a lack of clarity on how Least Developed Countries (LDCs) can effectively implement it for inclusive and sustainable development. With limited financial resources it is not feasible for LDCs to simply invest significantly in research and development (R&D) activity and develop world-class universities and infrastructure.

This publication highlights four key innovation policy options which have the potential to enable LDCs to reap the benefits of innovation in a cost-effective manner.

First, LDCs must mobilize all available talent towards sustainable development if the ambitions of the 2030 Agenda are to be met. Second, the rule of law and STI are inextricably linked. An enabling-environment that encourages and protects risk-taking, and a secure investment climate are vital components of an innovation system. Third, it will be critical to incentivize investment from sources such as foreign direct investment (FDI) and impact investment¹ and align all available sources of STI finance towards sustainable development. Fourth, creating open and inclusive innovative knowledge economies will be critical. Enabling international mobility, international technology transfer and participating in the regional and global innovation agendas will support national innovation capacity development.

Regional collaboration will be a must as many countries do not have the resources to develop meaningful innovation programmes. There is ample scope for regional collaboration in Asia and the Pacific. It is home to some of the most dynamic, pioneering and innovative countries in the world, but, at the same time, to some of the most technologically deprived. The challenge is to develop concrete and sustainable innovation and technology sharing opportunities to help bridge this gap, and enable countries at all levels of development to take advantage of available technologies and develop a robust culture of innovation.

By explicitly including STI in both the Sustainable Development Goals and the Addis Ababa Action Agenda, the United Nations has made a commitment to support countries in their efforts to harness STI for inclusive and sustainable development. The role of

ESCAP, as the regional arm of the United Nations, is to cross-fertilize the vast regional experience and expertise and to facilitate knowledge sharing of sustainable innovation and technology solutions for collaborative action.



CHAPTER

1



MOBILIZING TALENT

To sustain momentum in STI development, governments need to nurture and support their most important resource in this regard—their citizens. The best government structures, institutions and funding mechanisms in the world will amount to nothing without talented and educated people to run them. While scientists, technologists, innovators and entrepreneurs are considered the traditional sources of innovative activity, there is potentially an untapped resource of talent residing in what are often termed “vulnerable” communities or under-recognized community sources.²

The importance of recognizing the need to view talent in its broadest sense cannot be understated. This chapter discusses the four broad areas from which innovation can arise in a society and how each can be nurtured by government policy. The first is the academic sector who can contribute crucial inputs to innovative societies. The second is the private sector, specifically dealt with here through a discussion of entrepreneurial activity. The third is people working in government. Finally, the chapter discusses the need to recognize innovation at the grass-roots level—through indigenous efforts to improve everyday life by developing real solutions to practical problems.

1.1 Women in STI

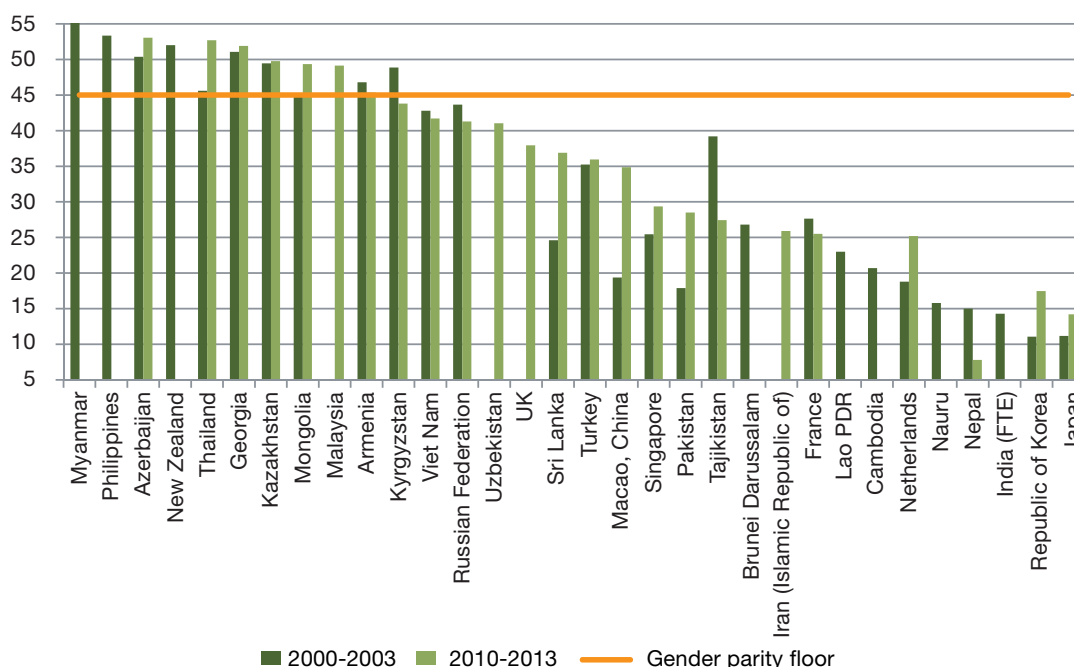
As noted, advances in STI come from all corners of society. To realize its potential, society must be able to access these various segments. As such, any departures from gender parity affect half of the population and any lack of progress towards parity can be a significant blockage in the STI system. Figure 1.1 shows the share of women researchers in selected ESCAP economies.

While there has been some progress towards gender parity around the world, globally, women’s participation in the knowledge economy still leaves much to be desired, especially within the upper, decision-making echelons. UNESCO’s most recent Science Report highlights a “leaky pipeline” in this respect, where women’s representation at lower levels of education and research fail to translate to improved shares at more advanced levels.³

While women now represent a small majority of university graduates worldwide (53 per cent), their share drops significantly when it comes to PhDs earned (43 per cent), and falls even further, to 28 per cent, when measuring women’s participation in the

**Figure
1.1**

Share of women researchers in ESCAP countries, averages of 2000-2003 and 2010-2013 (%)



Source: UNESCO, UIS.Stat. A available from <http://data.uis.unesco.org> (accessed February 2016).

world's research corps. Widespread evidence testifies to insignificant female presence within the upper echelons of STI establishments (e.g. as tenured professors, managers of research organizations, editors of influential journals etc.).⁴ More in-depth study of gender issues needs to be undertaken as an integral part of future reviews of ESCAP countries to identify the constraints such issues put on the advancement of STI systems.

1.2 Mobilizing academic talent for development challenges

University education has traditionally been centred on the study of current knowledge delivered through lectures and tested through examination. However, to develop problem-solving and innovation skills for real world problems, there is potential to generate new knowledge through "challenge-driven"⁵ university models that complement traditional approaches. These models challenge students by focusing their minds on problems with tangible economic, social and environmental applications and, as a result, greatly deepen the level of intellectual engagement.⁶

This model has three core components that differentiate it from traditional models. Firstly, the work is organized in teams, secondly, the work is organized through projects and thirdly, the projects are primarily aimed at addressing unsolved problems through the creation of new knowledge as opposed to the learning of existing knowledge⁷ (see Box 1.1).

A regional challenge-driven university model has the potential to mobilize and focus the minds of students to meet the ambitious targets of the SDGs. Providing students with an avenue to work towards the achievement of these goals, whilst at the same time earning credits for their studies, could generate new knowledge to help solve the world's problems. It could also produce graduates that are better prepared for the workplace and to be future citizens of the world.⁸

A regional online campus could link up challenge driven university programmes and be organized around each of the 17 SDGs.⁹ Such an initiative, combined with other challenge-driven models targeting the SDGs, could potentially develop

Box
1.1
Mobilizing academic talent for development challenges in Kiribati

An enterprising group of students has swapped the classroom for Kiribati to help find solutions to climate change challenges facing island communities.

The UNSW “Island Innovation Lab” brought together students from a diverse range of disciplines including architecture, fine arts, commerce, engineering, international studies, law and medicine with support from the New Colombo Plan, a federal government initiative to strengthen ties with the Indo-Pacific by supporting study in the region.

The aim is to enable students to experience first-hand the challenges facing the people of Kiribati and to consider innovative and multidisciplinary responses to these issues.

Source: <http://newsroom.unsw.edu.au/news/students/unsw-island-innovation-lab-supporting-kiribati>

innovative and problem-solving mindsets as well as focus a critical mass of the brightest minds on stubborn development challenges.¹⁰

1.3 Private sector talent

Entrepreneurship

Economic growth remains highly dependent on entrepreneurial activity. Entrepreneurs are an important source of income and employment for themselves, create employment opportunities for others, produce new and innovative products or services and drive greater upstream and downstream value-chain activities.¹¹

To understand how the entrepreneurial process works, it is important to get a picture of the entrepreneurial culture of a society. Figure 1.2 provides a snapshot for several Asia-Pacific economies. What is immediately apparent is the dynamic culture present in Singapore—a consistently top-ranked economy across a variety of metrics. The graphs show the availability of human capital along with the opportunity for start-ups are strong. Openness (measured as internationalization) and innovation also support a strong entrepreneurial culture as evidenced by both growth and job creation in Singapore. Malaysia also scores well across a number of these measures. Nevertheless, compared to Singapore, Malaysia still lags behind in areas such as risk capital, internationalization and high growth. In both these economies, the government has supported—and is continually supporting—entrepreneurship development. Indeed, numerous

agencies are involved in providing support for entrepreneurs.

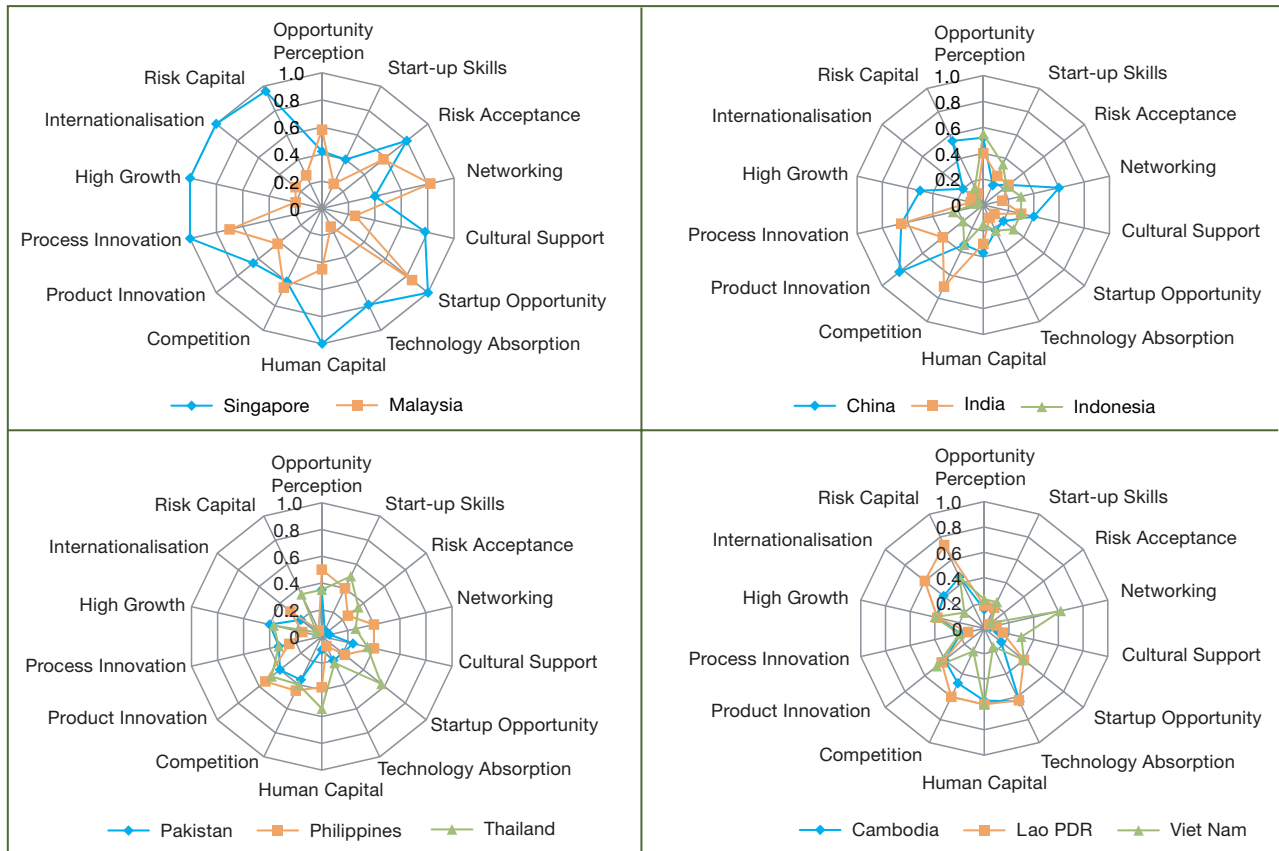
On the other side, despite having available human capital, the Lao People’s Democratic Republic, Viet Nam and Cambodia face major deficiencies in many of the crucial components of entrepreneurship. Among the lower-middle-income economies, many of the crucial components of entrepreneurship are still missing, namely adequate start-up skills, ability in identifying new business opportunities, low risk acceptance, lack of networking and cultural support and lack of opportunity for start-ups. Interestingly, the weaknesses of India, China and Indonesia lie in similar areas to those of the low-income economies. These economies share common challenges that may require cooperation to further improve their situations. In other words, there are no strong differences between these economies except in a few areas. That Singapore and Malaysia are in a better position compared to all the other economies is partly due to deliberate government policies to promote entrepreneurship.

Policies to develop an entrepreneurial ecosystem

Access to finance is critical in supporting entrepreneurial activity. However, to develop an entrepreneurial ecosystem, access to expertise, mentorship, infrastructure, business-friendly regulation and skills are also essential. India’s entrepreneurship policy framework¹² provides an example of the core elements of this type of ecosystem and details how the Government of India is aiming to address these dimensions. The framework proposes nine areas of focus for an entrepreneurship strategy:

**Figure
1.2**

Measure of entrepreneurial culture for selected Asia-Pacific economies, 2014



Source: Global Entrepreneurship and Development Institute, 2015.

- Educate and equip potential and early stage entrepreneurs across India
- Connect entrepreneurs to peers, mentors and incubators
- Support entrepreneurs through Entrepreneurship Hubs
- Catalyse a culture shift to encourage entrepreneurship
- Encourage entrepreneurship among underrepresented groups
- Promote entrepreneurship among women
- Improve the ease of doing business
- Improve access to finance
- Foster social entrepreneurship and grass-roots innovations

From a skills development perspective, what is notable about this framework is the intent to develop entrepreneurial skills as a core part of the national curriculum with an ambition to mainstream

entrepreneurship education in 3,000 colleges across India. Universities will be encouraged to award credits for entrepreneurship courses. The framework also places emphasis on the role of mentorship, with plans to develop a national network of high quality, screened mentors to guide the next generation of entrepreneurs.

What is innovative about this framework is a focus on fostering social entrepreneurs. The framework recognizes the emergence of social enterprise as a model for addressing social and environmental challenges through economic business models. With this in mind, the framework encourages universities and academic institutions to provide courses on social entrepreneurship.

Nurturing entrepreneurship skills and, in particular, social entrepreneurship skills, has the potential to spur the next generation of entrepreneurs to focus

their efforts on social and environmental challenges. This will be an important part of the innovation system for sustainable development and could potentially provide a pipeline of investments for impact investors and public sector procurers.

Building relationships for development: the government's role in stimulating sustainable development in business

Government can provide incentives for businesses to reward staff who generate social and environmental as well as economic value. The talent and know-how within existing businesses can be a key part of the next wave of sustainable innovations. By empowering staff, who are often at the forefront of change, to apply their commercial skills to development challenges, businesses could become a powerful driver in achieving the SDGs.

Corporations are equipped to deliver innovation at scale. However, in order to create social and environmental value to complement their economic imperative, corporations need to move beyond the concept of corporate social responsibility (CSR) and its focus on “public relations” or “community service” to redefine their objective as creating “shared value”.¹³ Creating shared value is the practice of creating economic value whilst explicitly incorporating social and environmental outcomes in the decision-making process. Shared value is not CSR, rather it is defining value across the three dimensions of sustainable development as part of the core business strategy.

Specific policies aiming to unlock shared value are rare, however India has experimented with policy applications on this agenda. In 2011, India released the National Voluntary Guidelines to encourage the adoption of responsible business practices and to mainstream disclosure and reporting on environmental, social and governance metrics in India.¹⁴ The National Voluntary Guidelines were launched by the Ministry of Corporate Affairs and provide businesses with a framework to enable them to move towards responsible operational decision making and adopt a “triple-bottom-line” approach (economic, social and environmental).

In a move to incentivize shared-value creation, India is the first country to enshrine corporate giving into law in 2014. The law mandates companies with a certain turnover and profitability to spend 2 per cent of their net profit on activities across several categories, which include hunger and poverty,

education, health, gender equality and women's empowerment, skills training, environment and social enterprise.¹⁵ In addition, companies that have to comply with this law are required to report on their activities. While this initiative could be seen as an extension of CSR, the policy intent is to raise much needed finance for social and environmental challenges and to move conversations about CSR from the fringes to the boardroom as companies are made to think seriously about their legal obligation.¹⁶ While it is too early to say whether this innovative policy has been successful, the lessons from this experiment will be valuable in developing best practice policies to generate shared value. Shared value could reshape capitalism by making the relationship between firms, society and the environment more explicit,¹⁷ and government has a key role to play in incentivizing this reshaping.

A true understanding of shared value and how best to incentivize it has still not been achieved. Governments need to underpin the momentum of this movement by finding creative, consistent ways to reward businesses that address the SDGs. This can be done through a mix of, for example, trade policy, public procurement, company reporting and the tax system. These policy mixes can be complex and politically sensitive and thus difficult to implement. Serious and substantive multi-stakeholder dialogue to develop concrete action plans will therefore be required to unlock the potential of shared value. The most direct route to innovation, technological advances and productive capacity is through a healthy, engaged industrial sector.¹⁸ An inclusive discussion format that involves business in national and regional development plans will be key. It will also be critical to build on and strengthen collaborative efforts between government and business. However, governments must take the lead on this engagement and ensure a transparent process.

1.4 Nurturing innovation skills within government

It will be critical for government and public sector workers to develop innovation skills if countries are to meet the diverse range of goals set out in the SDGs. Governments will need to support an agile, forward-thinking and digitally skilled civil service to respond to a rapidly changing world and the opportunities STI presents. While caricatures of public servants that depict them as hostile to innovation are out of date, public organizations continue to need

skills and better processes if they are to resist the tendency to inertia.¹⁹

Digital skills today have become as important as reading skills.²⁰ Digital training is an essential part of any job training, and one internationally recognized qualification is the International Computer Driving Licence (ICDL). In 2013, a memorandum of understanding was signed between the European Computer Driving Licence Foundation, the Thailand Ministry of ICT, the Telephone Organization of Thailand Academy and Plan-it Consultants (the ICDL Asia accreditation partner in Thailand). As part of the “Smart Thailand” initiative, 5,000 civil servants will undergo ICDL digital literacy certification.²¹

The Government of Bangladesh has also implemented an innovative policy to harness ICT for more effective public service delivery. As an example, the Government’s Access to Information (A2I) project plays a key role in revolutionizing public service delivery. A2I’s Horizon Scan Report (2007) indicated insufficient understanding and low confidence among government officials with regards to ICT skills and managing ICT projects as well as a lack of innovation capacity and partnership with the private sector in the delivery of effective public services to citizens. To address these issues, in 2008, A2I supported all Secretaries of the Government to identify 53 “Quick Wins” ICT-enabled initiatives to improve service delivery. Some of the successes have already been scaled up. Examples include Union Information and Service Centres (scaled up from 2 pilot Union Parishads to all 4,545), District e-Service Centres (scaled up from 1 district to all 64), e-Purjee System for sugarcane farmers (scaled up from 20,000 farmers in 2 sugar mills to 200,000 farmers in 15 sugar mills) and Multimedia Classrooms (scaled up from a handful of schools to 23,000 by 2013). Equally importantly, the “Quick Wins” that have not succeeded have taught the government officers who designed and implemented them valuable lessons about process re-design and organizational change management. The “Quick Wins” have enabled the government to explore greater possibilities in improving service delivery through cost-effective innovation. The “Quick Wins” also encouraged risk-taking.²²

Governments are often at the forefront of innovative and pioneering ideas,²³ but they can also struggle to find the space and time to invest in the future when they are responsible for delivering the services that people rely on today. Too often, hard-pressed civil servants focus on the performance of the current

system, mainstream budgets sustain incumbent approaches, and bureaucracies reject experimentation and change. Smart political leadership recognizes this tendency and creates the structures, capabilities and space needed to allow innovation to happen. In the Asia-Pacific region, governments have experimented with different models to equip public sector workers with the skills and space to explore innovative ways to transform governments.

As an example, The Performance Management and Delivery Unit (PEMANDU) was set up in 2009 to support the implementation of Malaysia’s National Transformation Programme. The aim of PEMANDU is to catalyse innovation within the Malaysian Government. It supports civil servants with the design and implementation of innovative solutions. PEMANDU targeted its efforts by conducting a series of extensive consultations, including public surveys, as well as analysing the media to identify the most pressing needs in the delivery of public services. This led to the development of seven national key results areas (NKRA) for Malaysia’s “Government Transformation Programme”²⁴ and to defining how success and impact could be achieved within each one. Over 250 civil servants from the Malaysian Government, including police officers, teachers, transport staff and senior managers, worked across each target area to develop innovative solutions that could achieve NKRA results.

One such solution relates to crime reduction in Kuala Lumpur. The number of crime incidents that occurred in Kuala Lumpur over a period of two years was mapped and it was established that most of the crimes were committed in 11 hot spots. The proposed solution involved redeploying 2,892 police officers to focus on those hot spots. This initial pilot proved a success and resulted, in just 12 months, in the redeployment of 20,000 police officers to primarily focus on 55 hot spots—the most significant redeployment of police officers in Malaysia’s history. The result was a 35 per cent drop in reported street crime within one year.²⁵

Providing public sector workers with the skills, time and space to innovate has the potential to transform public service delivery.

1.5 Innovation at the grass-roots level

Inclusive innovation is often defined as the inclusion in some aspect of the innovation process of groups that are currently marginalized.²⁶ The term “grass-roots” innovation tends to focus specifically on low

income groups, while broader notions refer to products that have been developed for the poor and middle class.²⁷ The notion of inclusive innovation as discussed in this section refers to making both the process and the outcomes of innovation available to all parts of society.

Examples of inclusive innovation include technologies and services that are simplified or modified for low and middle-income groups, providing access to the essential services and features of the product. Frugal innovation is a form of inclusive innovation.

Frugal innovation is innovation that generates considerably more business and social value while significantly reducing the consumption of scarce resources (for examples see Table 1.1). It is about solving—and even transcending—the paradox of “doing more with less”.²⁸ Jugaad and jhakaas innovation are two forms of frugal innovation at opposite ends of the spectrum. Jugaad is a colloquial Hindi word that roughly translates as “an innovative fix; an improvised solution born from ingenuity and cleverness”.²⁹ Jhakaas innovation is more sophisticated but still frugal thinking that has the potential to develop innovations that could disrupt even developed-world markets.³⁰ As an example, a portable electrocardiograph (ECG) machine developed for rural India, when redesigned in India, cost \$1,000 instead of \$10,000.³¹ By nurturing grass-roots frugal innovation skills, governments could surface a whole range of cost-effective innovations that solve everyday problems and ensure that innovation benefits the masses and not just the wealthy.

Innovation can only be truly inclusive if the necessary infrastructure is in place to reach those parts of the population most vulnerable to being “left out” of the process. This includes providing access to information and telecommunication, to financing and to training. A key concept underpinning inclusive innovation is that it is not necessarily based on extensive R&D or on radical change, but rather that it tends to be needs-driven, comes from users and can happen anywhere. Thus, it is inherently inclusive and only needs a supportive environment to become sustainable.

Building STI capacities at the grass-roots level is in no way an easy task.³² On the contrary, numerous idiosyncratic issues complicate targeting vulnerable populations with government policies. Key among these issues is that these constituents are not captured fully by national registries, making them invisible to the policy framework. As a result, targeting STI capacities and open innovation requires dedicated and innovative measures be taken up by the government (see Box 1.2).

Inclusion also has to do with the ability to benefit from knowledge products developed. High-value ideas can often capture markets and lead to a concentration among a few players. Given the large share of vulnerable populations in informal employment, it is important that innovations stemming from these activities are properly supported and valued. Evidence shows that traditional craft and other creative sectors can be important parts of the informal sector—as can artistic and cultural activities, including those practiced by indigenous

Box 1.2

Grass-roots innovation in India

Grass-roots innovations are driven by groups typically excluded from the innovation process, through projects designed by local communities and/or inventions designed to meet specific local needs.³³ As an example, the Government of India established the National Innovation Foundation (NIF) in 2000. The aim of NIF is to strengthen grass-roots technological innovation and harvest outstanding traditional knowledge. Through collaborations with R&D and academic institutions, NIF has supported the validation of thousands of grass-roots technologies. NIF has developed a database of technologies, innovations and traditional knowledge practices from over 575 districts in the country. It has also set up a Fabrication Laboratory (the Fab Lab) with the help of MIT to support product development. A pro bono arrangement with patent firms has helped NIF to file over 743 patents on behalf of innovators, of which 37 were granted in India and 5 in the US. It has also filed applications for 29 plant varieties developed by farmers at the Protection of Plant Varieties and Farmers' Rights Authority, India.³⁴

Table
1.1

Inclusive and grass-roots innovations

	Nature of innovation	
	Service innovation	Product innovation
Pro-inclusive Innovation	<p>Empresas Públicas de Medellín</p> <p>A utility company providing energy and water services. Low-income users can use prepaid cards to pay for the service according to their cash flow. Households do not pay fixed installation costs.</p> <p>Innovation: pay-per-use method.</p> <p>Operator: public utility company.</p> <p>Sector: energy and water.</p> <p>Country: Colombia.</p> <p>Scale: 43,000 low-income users have been connected since implementation in 2007.</p>	<p>Narayana Health</p> <p>One of India's largest healthcare services providers, Narayana Health offers low-cost cardiac surgeries and other healthcare services to the poor. It also caters to isolated communities via telemedicine.</p> <p>Innovation: business process innovations aimed at decreasing surgery costs. Use of ICTs to establish healthcare centres in remote locations for poor rural communities.</p> <p>Operator: private corporation.</p> <p>Sector: healthcare.</p> <p>Country: India.</p> <p>Scale: 6,200 beds are spread across 23 hospitals in 14 cities (up from an initial 300 beds in 2001).</p>
		<p>MoneyMaker irrigation pump</p> <p>Low-cost manpowered irrigation pumps.</p> <p>Innovation: no electricity or fuel is required for functioning and operating cost is lower.</p> <p>Operator: US-based NGO (KickStart).</p> <p>Sector: agriculture.</p> <p>Country: Kenya, Mali, Tanzania.</p> <p>Scale: the pumps are distributed in local shops and sold to other NGOs for wider diffusion in the three countries.</p>
Grassroots Innovation	<p>Honey Bee Network</p> <p>The Honey Bee Network links grassroots innovators from low-income groups.</p> <p>Sector: all sectors relevant to low-income groups' livelihood.</p> <p>Innovation: the Network has developed an extensive database documenting innovations by the poorest, including in agricultural practices (e.g. natural pesticides), machinery and other sectors. The aim is to foster the diffusion of knowledge to a wider group of potential users. The Honey Bee Network also supports the protection of inventors' intellectual property and the commercialisation of marketable innovations by connecting informal innovators with formal institutions, including universities and public research institutions.</p> <p>Country: India; similar networks in China and other countries.</p> <p>Scale: the Honey Bee Network led to the creation of India's National Innovation Foundation, an autonomous body aimed at providing institutional support to grassroots innovation. The Network's newsletter is printed in seven Indian languages.</p> <p>Grass-roots involvement: the poor are the innovators and are recognised as such. They determine the conditions of use of their creation, as well as its eventual commercialisation and scale-up.</p>	<p>Sanitary napkin-making machine</p> <p>A low-cost sanitary napkin-making machine that produces affordable sanitary pads for very poor women.</p> <p>Sector: health and manufacturing.</p> <p>Innovation: improves women's health and provides them with economic activity.</p> <p>Country: India.</p> <p>Scale: present in 1,300 villages in 23 states across India and developing abroad.</p> <p>Grass-roots involvement: the product was developed by an uneducated worker. India's National Innovation Foundation helped him apply for intellectual property rights and provided the means for the innovation to reach scale.</p>

Source: OECD, 2015.

communities.³⁵ Existing sectoral data provided on the informal economy does not make explicit these types of activities, which are based on innovative activities by indigenous peoples and local communities.³⁶ While international organizations, such as WIPO, provide support to indigenous and other vulnerable communities to ensure that such knowledge is protected, country governments must support this process by ensuring policy agendas include these groups.³⁷

Grass-roots innovators are often direct users of their innovations and thus have a better knowledge of their needs than outsiders.³⁸ What they need, however, is assistance in developing and protecting their ideas and opportunities to diffuse their ideas more broadly. Partnerships with the private sector or research institutions can help provide the necessary scale and expertise to achieve broader-based success. An example is the MIT D-Lab, which channels researchers towards pro-inclusive innovation and collaborates with low-income groups in developing economies to adapt innovations to local needs.³⁹

A growing area of inclusive innovation is in financing. ICT-enabled business approaches are providing capital to local communities to operationalize many

innovative activities. For example, Kiva is a non-profit organization that uses the Internet to provide loans to entrepreneurs in developing economies. For as little as \$25, individuals can lend money to projects that have been screened by Kiva's partners, international microfinance institutions and social businesses. To date, Kiva has lent out over \$835 million through more than 2.4 million users with a 98 per cent repayment rate.⁴⁰

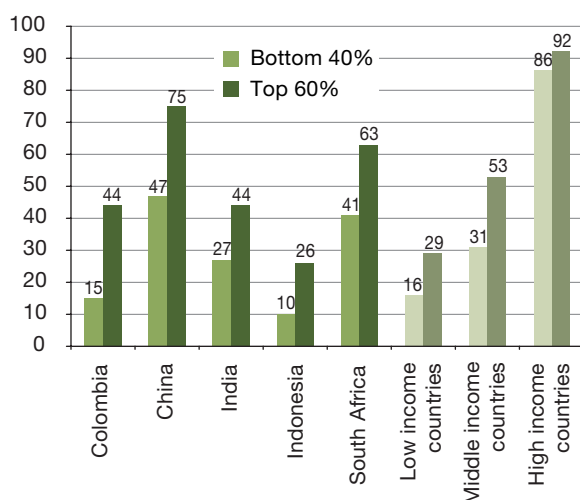
While access to formal financial institutions for vulnerable populations remains limited, other novel sources of banking, such as mobile phones (see Box 1.3), have yet to reach their potential (Figure 1.3). Governments can support increased access to novel financing tools by improving regulations surrounding such transactions and allowing innovative providers market access.

Inclusive innovation has great potential to motivate and involve a portion of the population not often included in the STI process. In this sense, it has the greatest potential to realize the sustainable development goal of truly leaving no one behind. The private sector's interest in developing new markets and future customers provides a ready source of support, along with non-profit and more traditional

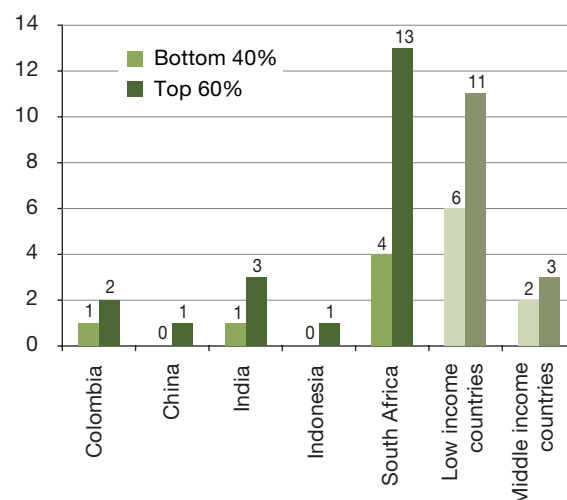
**Figure
1.3**

Financial inclusion

Share of the population with an account at a formal financial institution by income segment, 2011
(% age 15+)



Share of the population having used a mobile phone to receive money by income segment income
(% age 15+)



Source: OECD, 2015.

In Afghanistan, the M-Paisa initiative enables national remittances, salary disbursements, airtime purchases, bill payments and merchant services. The World Bank⁴¹ argues that the programme has particular potential to impact Afghanistan's economy, as less than 3 per cent of the population is banked and the financial sector is virtually non-existent, in large part due to the past 20 years of instability. In the Philippines, a flexible approach by the Bangko Sentral ng Pilipinas has contributed to growing adoption of mobile banking services in the country and, as of mid-2011, Globe and Smart—the two biggest telecommunication companies—had opened nearly 10 million e-money wallets. 2011 saw users conduct a total of 158 million e-money transactions with a total value of 535 billion Philippine pesos (approximately \$13 billion). In addition to providing services for overseas workers, mobile banking has also been used very effectively in the Philippines to transfer funding to those affected by disasters as well as as a cash transfer tool. One example is Panalo SIKAP, a mobile-based savings, credit, livelihood and insurance programme launched by Smart e-Money that is closely tied to the Philippine Government's conditional cash transfer programme.⁴²

research institutions. Collaboration will be a key part of successfully realizing this potential and governments are in an optimal position to enable such collaboration and ensure it takes place by

supporting private sector outreach efforts, underwriting non-profit and research institution programmes and providing information and capacity-building tools to local communities.



CHAPTER

2

RULE OF LAW

2.1 STI and good governance

Good governance is increasingly recognized as a key ingredient of sustainable development. Available evidence suggests that strong societal deference to the rule of law may have tangible effects on STI outcomes through a variety of mechanisms.⁴³ For example, the development of an IP protection system is dependent on the existence of an effective court system. Conversely, widespread corruption in the higher education system (e.g. the “buying” of diplomas) is incompatible with high-quality education. Figure 2.1 suggests that good governance may also affect STI outcomes through, and in combination with, the (perceived) quality of scientific research institutions. In this regard:

- No country with very high-quality scientific research institutions is found among countries with low rule of law standards (green ellipse).
- Although it is possible to find jurisdictions with moderately high-quality scientific research institutions at any level of rule of law compliance (purple ellipse), higher scientific productivity (bubble size) is broadly associated with better governance of the country as a whole.

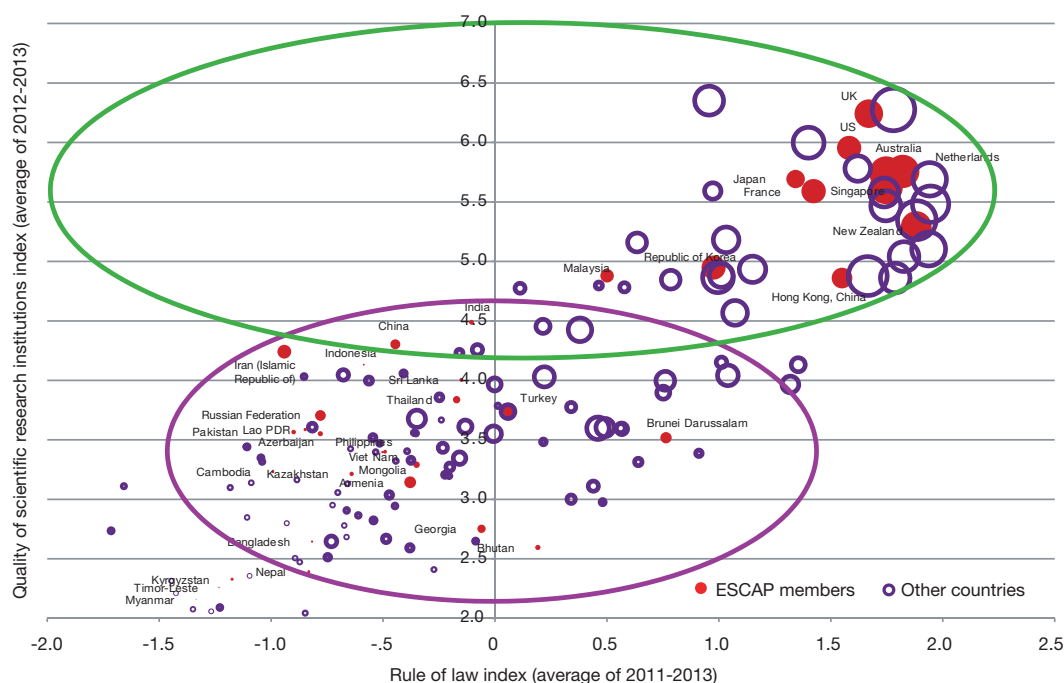
The benefits of deference to the rule of law and good governance go beyond R&D and the market for STI products and services. Indeed, their essential function is to provide legal certainty, facilitate contractual arrangements between formerly unknown parties and, as a consequence, enable risk-taking in STI creation.

As exemplified by Figure 2.1, good governance and strong regulatory frameworks also improve the quality of scientific research organizations, affecting upstream STI development. Indeed, the quintessential property of the rule of law is that it facilitates all societally beneficial transactions that are dependent on legal concepts such as property rights and enforcement.

The relevance and appropriateness of different legal and regulatory frameworks depends on both the stage of development and policy objectives of each country. For instance, a knowledge-driven economy will have a pre-existing set of institutions and regulatory frameworks that can be further improved with appropriate mechanisms that streamline or reduce undue regulatory burden. In the case of catch-up economies, each institution and legal framework element is likely to be new. Consequently, the sequencing, scope of mandates and first-order

Figure
2.1

Good governance and the quality of scientific research organizations



Sources: World Bank, Worldwide governance indicators, Rule of law index. Available from <http://data.worldbank.org/data-catalog/worldwide-governance-indicators>; Quality of scientific institutions data from WEF (2012); Publications per million population data computed by Science-Metrix based on Thomson Reuters, Web of Science. Available from http://ipsscience.thomsonreuters.com/product/web-of-science/?utm_source=Adwords&utm_medium=paid&utm_campaign=WoS&gclid=CM6b_oLrrswCFdKGaAodfGcLxw&gclid=aw.ds.

Notes: Presentation inspired by UNESCO (2014); Bubble size is proportionate to scientific productivity (i.e. scientific publications per million inhabitants, average of 2013-2014); Rule of law index range: -2.5 (weak) to 2.5 (strong); Quality of scientific institutions range: 1 (weak) to 7 (strong).

priorities carry much more weight, in particular in resource-scarce settings. Implementing basic, transparent regulatory processes that protect consumers and businesses is therefore a first order of business for catch-up economies.

STI development can be accommodated by existing regulatory frameworks in several ways. First, because applied R&D is an inherently risky endeavour, the legal setting can be strengthened to enable contractual arrangements for the sharing of risks and financial resources. Second, the outputs of STI are often either non-rivalrous, in the sense of intangible ideas and knowledge, or easily appropriable products that are prone to reverse engineering. Thus, the efforts of entrepreneurs, scientists and other innovators require some form of protection in order to both recoup their costs of development and to provide profit opportunities that will further incentivize innovative behaviour. IP rights, such as patents and trade secret protection, can be utilized to fulfil such

aims. It is important to tailor existing IP rights regimes in light of the current demand for protection and existing capacities to innovate.

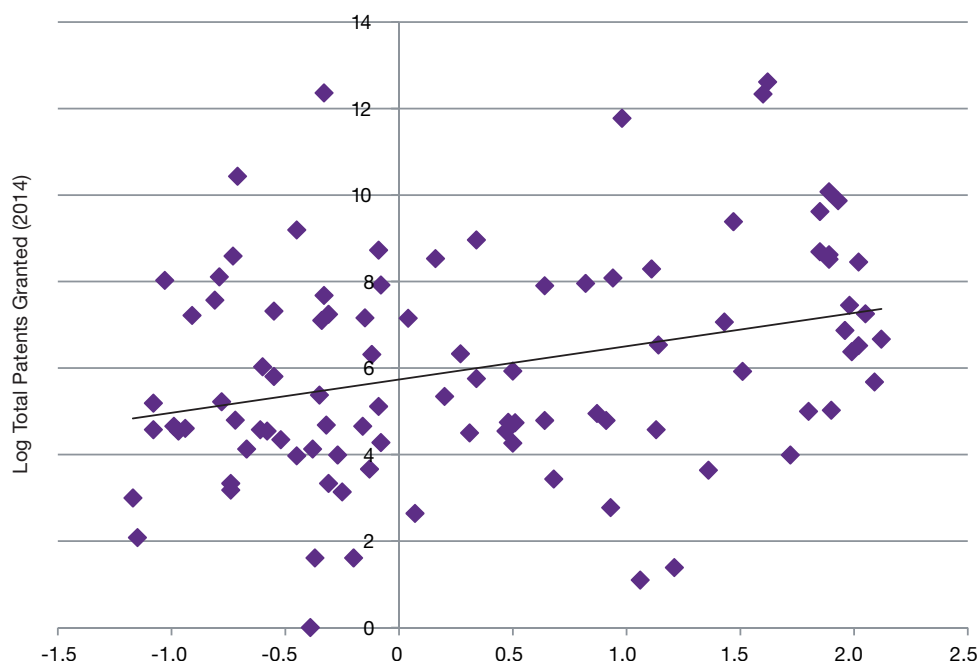
The intensity of patenting activity depends on a plethora of parameters, many of which are determined by the private sector. However, some of the most significant determinants, such as rule of law and governance, are driven by governments. Indeed, as Figure 2.2 shows, good governance is positively correlated with patenting activity—specifically successful patents, which require effective bureaucracy in addition to an empowered private sector.

2.2 Creating an enabling environment for risk-taking

Private sector institutions—including individual firms—develop directly in response to the regulatory and legal structures in which they operate. Thus, all

Figure
2.2

Patents granted and the Worldwide Governance Indicators



Source: WIPO, 2016. World Bank, Worldwide governance indicators, Rule of law index. Available from <http://data.worldbank.org/data-catalog/worldwide-governance-indicators> (accessed 2014).

forms of regulation—from labour laws, to professional standards, to tax structures to IP rights—affect how dynamic and competitive businesses can be. With regard to STI in particular, one of the key characteristics of a successful innovation system is its ability to provide private sector agents with sufficient flexibility to pursue uncertain ventures. Indeed, the ability of a business to reinvent itself—to start and end a business venture—can be an important determinant of its willingness to undertake R&D and to follow through with innovative transformations. At the same time, the regulatory environment must protect investors and creditors, and provide a stable atmosphere where investors' rights are protected and contracts enforced so that investors and innovators taking on risks do so in an informed, transparent way. The efficiency of the regulatory system depends on whether businesses can comply without suffering an undue administrative or financial burden that might act as a barrier to innovation.

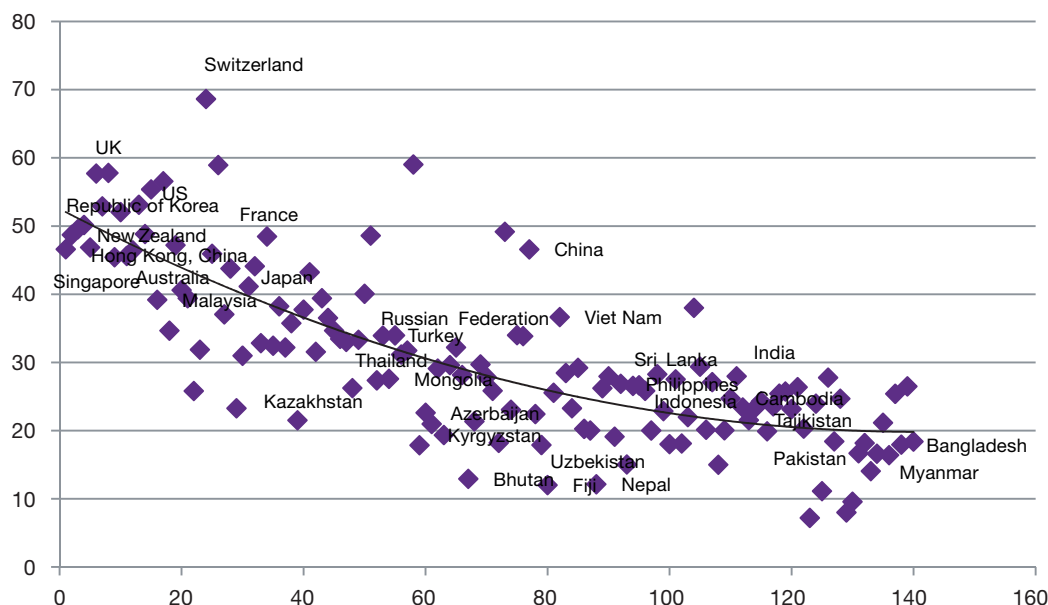
Figure 2.3 highlights the strong correlation that exists between the ease of doing business in a country and its innovation outputs, as captured by the World

Bank's Doing Business Rankings and the Innovation Output Sub-Index of the Global Innovation Index. The rankings for “ease of doing business” capture many of the characteristics that create a business environment conducive to STI, including: the ease of starting a business and resolving insolvency, the strength of protection for minority investors and contract enforcement, the ease of dealing with construction permits, paying taxes and accessing energy.

An interesting aspect of this relationship is its nonlinearity. Countries that rank lower (i.e. less effective) on the “doing business” scale show no strong relationship between institutional/regulatory quality and innovative output. This implies that until countries have reached a certain level of quality of business environment there is little correlation with STI outcomes. Once a critical mass of quality regulation is in place, innovative output begins to increase substantially. Hence, an integrated effort from governments to streamline the regulatory system across its various components will be one of the key starting points of establishing a functioning and efficient innovation system.

**Figure
2.3**

Innovation and the business environment, 2015



Source: ESCAP based on Global Innovation Index 2015. Available from: <https://www.globalinnovationindex.org/content/page/data-analysis/>; and World Bank, Doing Business Rankings 2015. Available from <http://www.doingbusiness.org/rankings> (accessed 28 January 2016).

2.3 Creating an environment for a social economy

Beyond the drive for innovation, individual businesses within many economies are beginning to incorporate all three dimensions of sustainability in their business practices. The outcome of this change in institutional dynamics is often referred to as social enterprise.⁴⁴ A social enterprise can be defined as an organization committed to explicitly including social and/or environmental returns as part of its core business while seeking profit or return on investment.⁴⁵ The concept of social enterprise has been gathering momentum with the growing recognition that the three dimensions of sustainable development will be key in achieving the SDGs.

The social enterprise movement is spreading throughout the region, with several governments putting in place institutional support and laws to incentivize the growth of social enterprise. In 2014, the Government of Viet Nam made revisions to its Enterprise Law, providing a legal definition of social enterprise and granting such organizations specific rights. The amended law stipulates, among other requirements, that a social enterprise must reinvest

a minimum of 51 per cent of its annual profits towards social and environmental goals.⁴⁶

In 2015, the Government of Malaysia launched the Malaysian Social Enterprise Blueprint 2015-2018, a three-year roadmap for developing a social enterprise ecosystem. A key aim of the Blueprint is to create more impact-driven entrepreneurs, that is, entrepreneurs who strive to create social and environmental, as well as economic impact. A key institutional component of the ecosystem the Blueprint is aiming to develop is the Malaysian Global Innovation and Creativity Centre. The Centre's mandate is to grow the nation's social enterprise sector through a mix of financial and non-financial support to social entrepreneurs.⁴⁷

Creating an environment for risk-taking whilst simultaneously putting in place policy and regulations to incentivize more social forms of enterprise could catalyse a more integrated approach to innovation development for the SDGs. It will be interesting to track the progress of these policies so that other countries can learn from these early stage experiments.



CHAPTER

3

STI INVESTMENT

A country may have at its disposal multiple sources of finance for innovation (e.g. domestic finance, foreign direct investment (FDI), donor capital). To effectively and efficiently deploy this capital, alignment of financial flows to STI strategies for sustainable development will be key. In LDCs, direct government funding for STI for sustainable development may be limited. As such, it will be important to create a conducive environment for investment to ensure benefits for the economy, society and the environment. This chapter focuses on how governments can create a conducive environment to attract FDI, the benefits of exploring public-private partnerships and the role of impact investing and donor capital. It also provides examples of how LDCs could collaborate to create substantive STI funding mechanisms.

3.1 Foreign direct investment

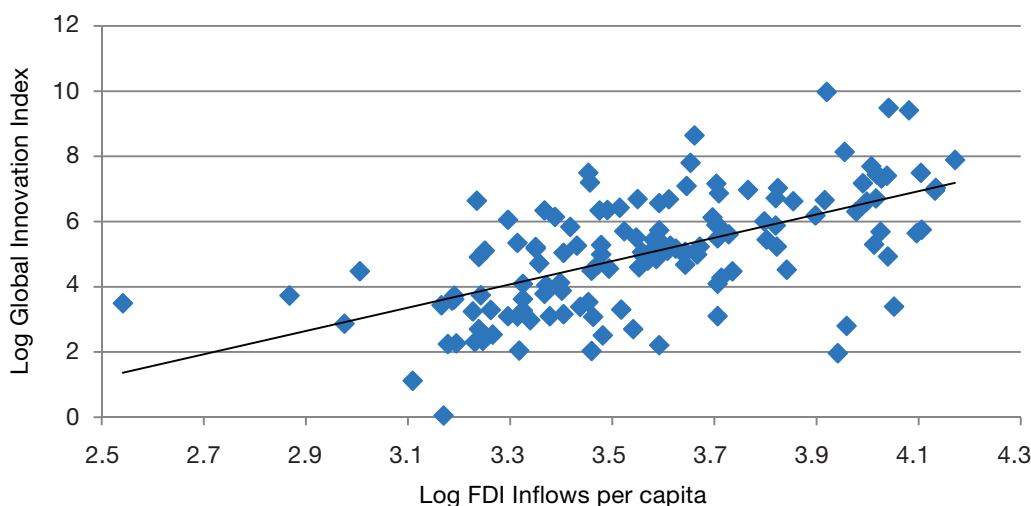
FDI is a potential source of financing and a direct facilitator of the attainment of STI policy objectives, such as the transfer of technology (Figure 3.1). There are a number of factors that drive FDI, a key among them being the expansion of their production chains

and seeking new markets in which to establish market presence. While the process is driven by the private sector, government has an essential role in both incentivizing FDI inflows and sustaining existing FDI stocks. To begin with, government is responsible for setting up the enabling environment for investment that allows FDI to enter the country. Sustaining FDI stocks—and, more importantly, reaping the long-term gains of FDI—requires well-functioning institutions and policies in areas such as human capital development and enforcement of property rights.

One of the primary benefits host countries expect from FDI is the transfer of technology. There are many mechanisms—direct and indirect—through which FDI can generate transfers of technology. The most obvious mechanisms include transfers that are directly connected to the FDI project itself, through the establishment of production facilities. Modalities for such FDI-spurred transfers comprise licensing and patent transfers, among others. Technology transfers may also happen as part of a “demonstration effect”, whereby domestic firms imitate the products or productive processes of foreign firms. Another way in

**Figure
3.1**

Correlation between the Global Innovation Index and FDI inflows per capita, 2014



Source: ESCAP based on Global Innovation Index 2014. Available from: <https://www.globalinnovationindex.org/content/page/data-analysis/>; and UNCTAD, Statistics Data Centre. Available from <http://unctadstat.unctad.org/EN/> (accessed 2016).

which FDI can facilitate technology transfers is through competition from the presence of foreign firms, which may also generate a market restructuring effect. Finally, there may also be limited labour turnover effects, whereby workers who acquire new skills in foreign firms leave those firms to create their own companies or join existing domestic companies—effectively transferring newly acquired human capital.

Empirical evidence in favour of indirect spillovers from FDI in developing countries has, however, proven to be scarce. In contrast, the notion of direct technology transfer through value-chain learning has received much attention and its positive effects are supported by a large body of empirical work. Certain types of FDI and trade flows provide far more opportunities for technology transfer than others, dependent upon the context in which they exist. The policies that facilitate technology transfer will therefore require careful deliberation. The absorptive capacity of the host country is critical and, consequently, so its institutional and business environments. This last point is important because a country's absorptive capacity and institutional context will determine the incentives that foreign firms may have to transfer technology as well as the types of FDI inflows that a country can attract.

3.2 Public-private partnerships

Partnering with the private sector is an mechanism by which governments can leverage private sector finance and spur innovation in public service delivery. Through a public-private partnership (PPP) contract, a private consortium typically finances a public infrastructure project and provides public services over an extended period of time—typically 20 years. In exchange, the private partners can be granted rights to collect fees from users, such as collecting tolls on highways for road projects. They can also be remunerated directly by the public authorities provided that the performance criteria defined in the PPP contract are met.

Over the last 15 years, private companies have invested around \$600 billion in Asian developing countries towards energy (55 per cent), transport (30 per cent), telecommunication (12 per cent) and water (3 per cent) infrastructure.⁴⁸ With PPP projects, public contracting agencies define projects in terms of outputs (“what we want to achieve”) rather than inputs (“how to achieve what we want”), which is a key distinction from traditional public procurement. In so doing, public authorities allow private companies to devise innovative solutions for delivering public services. Likewise, by encouraging a consortium of

international and local companies, governments can facilitate transfers of knowledge and technologies.

Private operators can also introduce new technologies for realizing the commercial potential of infrastructure. For example, a PPP was used to develop an automated fare-collection system for the three rail transit lines in Manila based on contactless smartcard technology. The system was developed at no extra cost to passengers or to the government because the private consortium expects to make profits in areas other than transport (for example, the smartcard technology will be used for payments in shopping malls and customer loyalty schemes). By involving the private sector in public service delivery, governments can capitalize on the private sector's capacity to capture additional sources of revenue from infrastructure assets. PPPs can be an excellent way to inspire innovation, especially in more mature areas of the economy, and inject new ideas, generating new revenue streams in public infrastructure services.

3.3 Donor and philanthropic funding

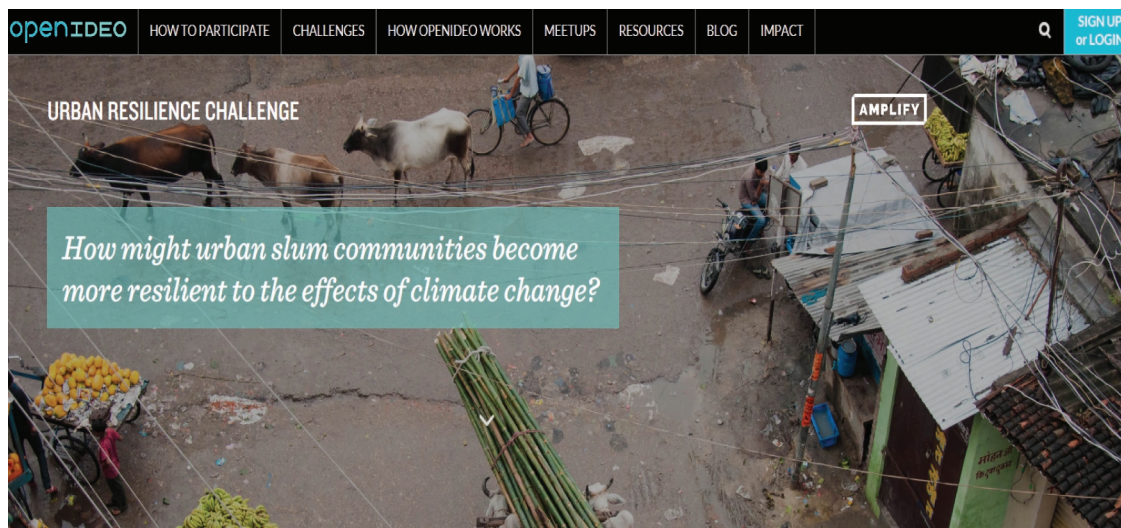
There has been a recent surge in interest in innovation initiatives within international development donor agencies. Donors are increasingly seeing innovation as a tool to increase the pace and impact of their poverty alleviation efforts and have experimented with different models to manage the inherent risk of innovation, scale the very best ideas and “crowd-in” a diverse range of funders and actors in order to deliver more cost-effective and high-impact aid. Whilst early innovation efforts were siloed experiments, there has been a movement towards multilateral donor innovation initiatives.

The GAVI Alliance⁴⁹ has been one of the most successful multilateral initiatives. The mission of the GAVI Alliance is to save children's lives and protect people's health by increasing access to immunization in the world's poorest countries. By “crowding-in” the specialist skills of all the main players in immunization—the World Health Organization (WHO), the United Nations Children's Fund (UNICEF), the World Bank, the Bill & Melinda Gates Foundation, donor governments, developing country governments, international development and finance organizations and the pharmaceutical industry—into one decision-making body, the GAVI Alliance has brought focus to the urgent task of closing critical gaps in the provision of vaccines.

In 2014, the Global Innovation Fund (GIF) was launched. A partnership between the British, American, Swedish and Australian governments and the Omidyar Network, GIF invests in social innovations that aim to improve the lives of and opportunities for millions of people living in poverty in the developing world. Borrowing from the experience of VC, GIF offers three stages of financing using a range of financial instruments, including grants, equity and debt, to pilot, test and scale innovations. GIF supports innovators who are committed to using and generating rigorous evidence for what works, and invests the largest funding amounts in innovations that can demonstrate evidence of success and that have potential to spread across multiple developing countries. GIF seeks innovative solutions that can scale up commercially, through the public or philanthropic sectors, or through a combination of both in order to achieve widespread adoption. In order to unlock social and commercial investment and facilitate commercial scaling up, GIF will also support innovations through the funding valley of death. It will do this by providing funding to get innovations “market ready” and to an investable state, and by brokering more systematic links with social impact and commercial investors. GIF has global reach, ambition and scope. Grounded in the belief that good ideas can come from anywhere and anyone, GIF is open to innovations in almost any developing country, across any sector, from any organization and from the early-seed-testing stage through to later-stage scale.

What can be drawn from this multilateral collaboration trend is the intent to scale innovation beyond the initial concept phase, spread risk and create mechanisms for collaboration by pooling resources and expertise. These innovative models are also aiming to catalyse a more integrated approach to innovation development by incentivizing the private sector to address social and environmental challenges and providing early stage risk capital to “market-ready” innovations. While these efforts have predominantly focused on addressing stubborn development challenges in Africa, there is huge potential for multilateral innovation mechanisms to address some of the critical development challenges in the Asia-Pacific region. What is also notable from these efforts is the role that philanthropic capital plays in developing STI for sustainable development.

Many countries in the Asia-Pacific region do not have the resources or economies of scale to develop



Open IDEO is an open innovation platform. Join our global community to solve big challenges for social good.
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Working in partnership with the design firm IDEO.org and OpenIDEO, the DFID Amplify programme sets development challenges for an online community of over 50,000 participants. The participants then work through a four-stage design process, tackling the challenges in phases—from research, through to an open call for ideas, to shortlisting and refinement and, finally, to evaluation and funding. The programme also uses radio projects, workshops and networks of volunteers to draw on the insights and ideas of communities without online access. Amplify's current challenge is crowdsourcing ideas on how urban slum communities could become more resilient to the effects of climate change. Other ideas on how these communities can adapt, transform and thrive as they meet climate challenges are being explored together with the Global Resilience Partnership (the Rockefeller Foundation, the US Agency for International Development [USAID] and the Swedish International Development Cooperation Agency [SIDA]).

Not only is an open challenge model a tool to gain diverse perspectives on stubborn development challenges, but it is also a mechanism that allows governments, donors, philanthropists and other investors to pool financial and human resources to collaborate on issues of aligned importance.

meaningful R&D and early-stage investment initiatives. In this regard, subregional collaboration (see Box 3.1) may be the only way for such countries to develop meaningful STI funding mechanisms.

3.4 Impact investment

The goal of impact investing is to generate social and environmental value, as well as financial return.⁵⁰ It

includes investments that serve or employ people living in poverty (defined as living on less than \$2 a day).

In tandem with the increased focus of the SDGs on the three dimensions of sustainable development (i.e. economic, social and environmental), this form of investment has been generating momentum in both the developed and developing world. It has been

estimated that the impact investment market has the potential to absorb between \$400 billion and \$1 trillion by 2021 from analysis covering just five sectors (housing, rural water delivery, maternal health, primary education and financial services).⁵¹

India is the largest impact investment market in the region. Pakistan and Bangladesh are also active in impact investing, with Sri Lanka and Nepal emerging (Figure 3.2).

To date, the level of impact investing remains small. This is due to the fact that the majority of impact funds come from development finance institutions, which are predominantly funded by overseas development assistance contributions, but these financial flows represent the smallest proportion of resource flows to developing countries globally (Figure 3.3).

There are several issues hindering the growth of impact investing. There is a lack of information about the availability of impact investment deals in the region and a high due diligence cost in assessing

deals. The perceived risk is also high, especially in emerging markets. A lack of standardized impact measurement and reporting, as well as a mismatch, in many instances, between investors' and investees' expectations for financial returns on impact investments are also critical issues.⁵² Thus, the potential of impact investment has not been realized.

The untapped potential of impact investing

To truly unlock this potential, its principles need to be ingrained in mainstream investment. Governments have an important role to play to ensure that impact investment thrives through regulatory incentives and the creation of an enabling environment capable of increasing the pipeline of social enterprises for impact investment. Governments can also catalyse impact investment approaches by implementing reporting requirements on the social and environmental impacts of investments. In short, to address the people, planet and prosperity elements of the SDGs, designing and implementing effective three-dimensional investment policies is a must.

Figure 3.2

Impact investment in selected Asia-Pacific economies

Figure 3.2a: Known capital deployed by DFIs

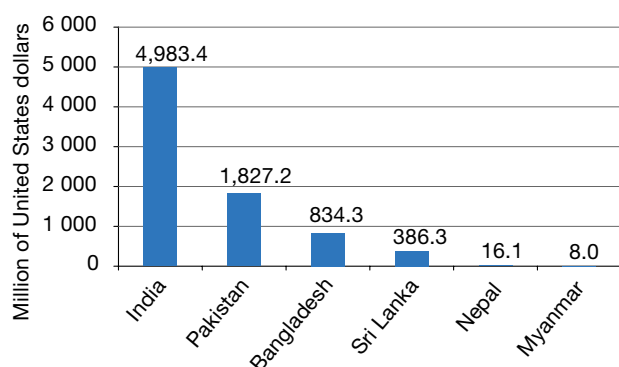
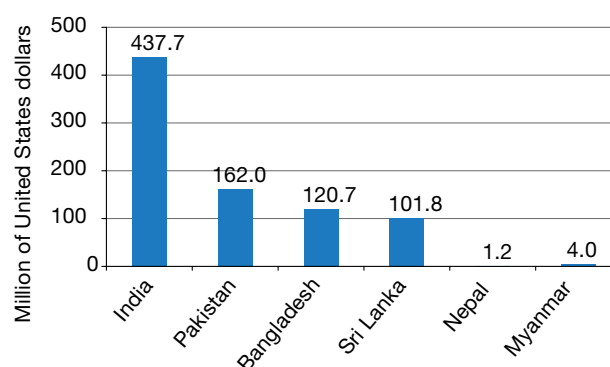


Figure 3.2b: Known capital deployed by non-DFI impact investors

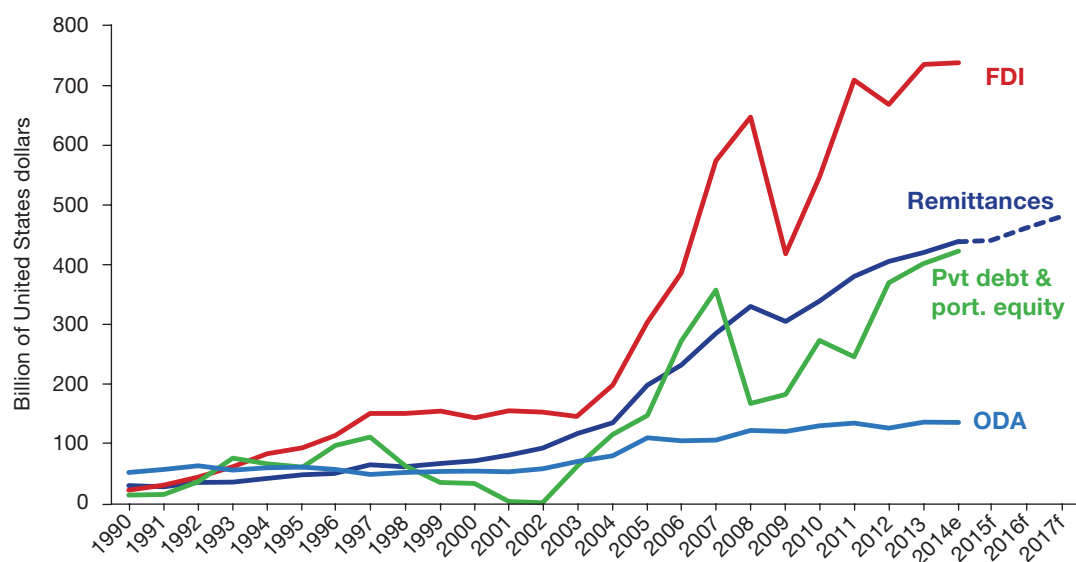


Source: Dalberg analysis.

Notes: Figures represent aggregate capital deployed from 2004-2014. The majority of the capital represented here was deployed between 2009 and 2014. This is due in part to the limited availability of data for 2004-2009.

**Figure
3.3**

Resource flows to developing countries



Source: World Bank calculations; World Bank, World Databank, World Development Indicators. Available from <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators>.

Note: Private debt includes portfolio investment bonds, commercial banks and other lending.



CHAPTER

4

OPEN AND INCLUSIVE INNOVATIVE KNOWLEDGE ECONOMIES

The Asia-Pacific region is home to some of the most technologically advanced economies in the world, as well as to some of the most technologically deprived. This diversity is best exemplified by the fact that the number of countries ranked in the top quartile of the Global Innovation Index is the same as the number ranked in the bottom quartile. This concentration of expertise means that the region relies on a handful of countries to push forward the STI agenda and, thus, there is large scope for diffusion of STI activity.

Collaboration at the regional and global levels can be a critical force for increasing broad innovation capacity across the continent and strengthening global knowledge creation. This is crucial in light of the global challenges that mark the modern development agenda. This chapter will first focus on two specific mechanisms that are catalytic for

knowledge spreading across borders: international mobility, in particular that of tertiary students, and technology transfer through economic flows. It will then explore some of the global and regional platforms that have been set up to support region-wide collaboration across STI relevant areas.

4.1 International mobility

Migration affects a country's ability to develop a knowledge economy in two ways: through the integration of foreign talent migrating into the country and through the loss of skilled workers of domestic origin. This loss of domestic talent, commonly referred to as “brain drain”, is particularly relevant for developing countries that may struggle to build up human capital in the first place. However, recent research has shown that an outward flow of skilled

To maximize the potential of “brain gain”, an increasing focus is being placed on the “scientific diaspora”: a self-organized community of immigrant scientists and engineers who live in developed countries and who organize to have an impact on the development of their homelands, especially in the fields of science, technology and education.

The Temporary Return of Qualified Nationals (TRQN) project of the International Organization for Migration in the Netherlands, funded by the Dutch Ministry of Foreign Affairs, aims to contribute to capacity building and knowledge transfer to countries of origin. The programme has been implemented in Afghanistan. The objective was to contribute to capacity building and knowledge transfer in Afghanistan.

Source: <http://unu.edu/publications/articles/highly-skilled-afghan-diaspora-contributes-to-innovation-and-change.html#info>

workers is not necessarily a loss for developing economies.⁵³

It is possible for developing countries to benefit from high-skilled migration if partnerships between sending and receiving countries encourage a repatriation of skills and knowledge, i.e. “brain circulation”. Furthermore, the prospect of migration can actually act as an incentive to acquire skills and build up human capital, which can mean that brain drain actually results in a net increase in the domestic level of human capital, i.e. “brain gain”⁵⁴ (see Box 4.1). Diaspora networks can also play a crucial role in the development of knowledge economies, as the large number of start-up companies created by returned Indian migrants demonstrates.⁵⁵

In light of the potential of migration to contribute to the development of knowledge economies, one particularly relevant aspect is the international mobility of tertiary students, which can serve as an important source of high-quality human capital for poor countries with weak educational systems. Although “brain drain” is a real issue in many countries—chiefly those that are smaller and poorer⁵⁶—for others the potential benefits from “brain gain” and “brain circulation” generated specifically by the mobility of tertiary students, represents a significant element of human capital development.

It is difficult to accurately estimate the impact of tertiary student mobility and of the return migration of students educated abroad, largely because there exists no internationally harmonized database on the incidence of return migration of tertiary students or on the proportion of the population with degrees earned

abroad. Information in this area exists only in terms of ad hoc studies, which makes extrapolation to the global sphere complicated.

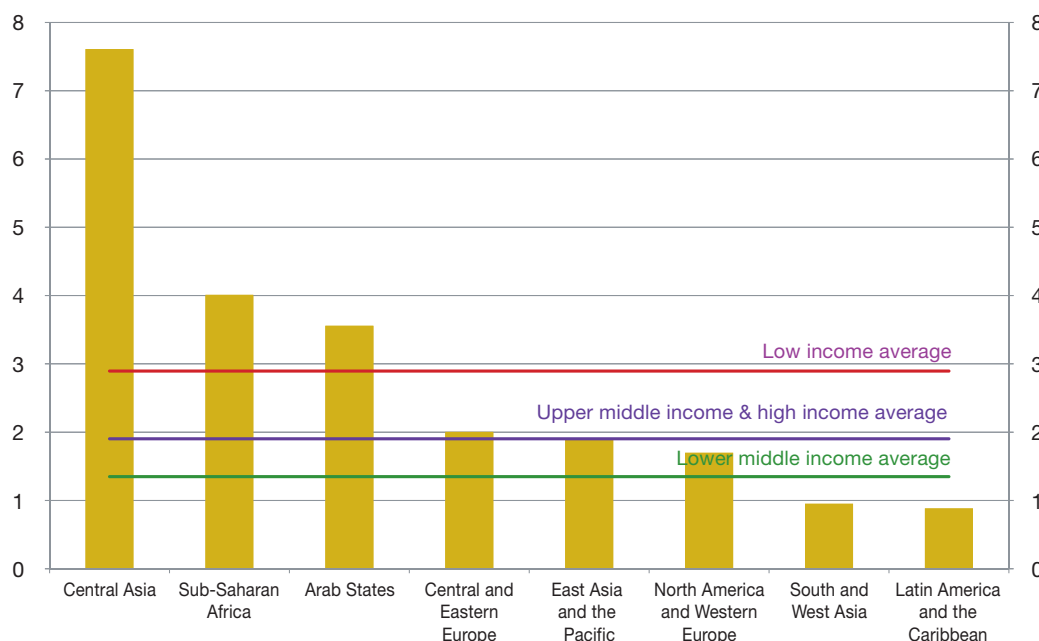
The data that is available on the mobility ratio of tertiary students seems to suggest that different countries have vastly different experiences with the outbound migration of tertiary students. There is no clear trend relating its incidence to development levels (Figure 4.1). The average outbound mobility ratio for 2013, at 2.9 per cent, tends to be highest in low-income countries, falls to 1.3 per cent in lower-middle-income countries and then rises to 1.9 per cent for upper-middle-income and high-income countries. Nevertheless, smaller countries, and fragile states in particular, have very high outbound mobility ratios, a phenomenon which underlines the weakness of their higher education systems, as well as issues related to broader social, economic and political conditions.

4.2 International technology transfer, development and collaboration

The idea that technologies can be transferred on a large scale from industrialized to developing countries through economic activity has, for many decades, sparked interest in both policy and research circles. The focus on FDI and trade—especially through imports of capital goods and intermediate goods—as the main channels of international technology transfer (ITT) has shaped the economic and policy discourse, and has been an important part of arguments in support of FDI incentive structures and the removal of trade barriers. It has become a long-established

Figure
4.1

Tertiary outbound mobility ratio by region or income category (%)



Source: UNESCO, UIS.Stat. Available from <http://data.uis.unesco.org> (accessed January 2016).

trope in economics that by opening their economies, developing countries provide attractive new markets and a ready supply of labour in exchange for productive technologies that are expected to trigger broader technological upgrading, productivity gains and economic growth.

The underlying argument rests on foreign firms from more advanced economies having access to cutting-edge technologies—which can be embodied in the capital or intermediate goods employed in production or in organizational and managerial know-how—and on domestic firms being able to learn from interacting with, or from observing the activities of, these firms. This notion is supported by the fact that firms operating internationally have been found to be more productive compared to domestic-only firms, by several orders of magnitude, and to spend more on R&D.⁵⁷ The channels through which these technologies are transferred can be direct or indirect. Direct transfers involve explicit transactions from one party to another, such as trade in goods embodying technology or the licensing of technologies themselves. For example, domestic firms buying foreign technology to put to use in their productive processes will enhance their capacity and

productivity, which will increase the range of products and processes available to them.⁵⁸ Similarly, the activity of more productive foreign firms in downstream sectors can improve domestic firms' performance by making higher quality inputs or services available.⁵⁹ Direct transfers also capture the concept of value chain learning, which occurs when domestic firms supplying upstream foreign firms benefit from their contact with those firms. The rationale being that upstream firms have an incentive to improve the productive processes and the quality of the goods supplied by downstream local firms.⁶⁰

Indirect transfers consist of spillovers and externalities from direct transfers as well as the mere presence of, or exposure to, foreign technology. This has the important implication that the introduction of foreign technology in a country can be considered a form of transfer, and that it may subsequently spread throughout the rest of the economy. For example, FDI can lead to a labour turnover effect, whereby workers trained in foreign firms bring their knowledge to domestic firms through subsequent employment.⁶¹ In addition, it can result in a demonstration effect, whereby domestic firms imitate or reverse engineer the products supplied by foreign subsidiaries, and

undertake a form of incremental innovation by adapting them to local market conditions.⁶²

Empirically, while there is ample evidence supporting the existence and benefits of direct spillovers from FDI,⁶³ the evidence on indirect spillovers remains inconclusive.⁶⁴ Several explanations for the lack of evidence of indirect-spillover gains have been put forth. One possibility is that if well trained labour and managers are maintained within the company directly receiving the technology transfer, there is little opportunity for benefits to make their way further into the host economy.⁶⁵ Another explanation is that the rest of the economy may have little ability to use the knowledge or technology transferred to a domestic company, due to lack of appropriate skills or industrial base (i.e. limited absorptive capacity).

It has also been argued that indirect-spillover benefits exist, but that they are much more diffuse and thus difficult to measure. Intuitively, the degree to which indigenous ideas and methods have developed as a result of being exposed to foreign technology or know-how is impossible to measure directly. Thus, arguments in favour of the existence of these broader gains rely on more-general evidence, including ex-post productivity gains, or the fact that no economy has managed to develop or realize substantial growth without being open to both trade and FDI, and that those companies that engage in international markets (e.g. as exporters, global value chain suppliers or multinational affiliates) have higher levels of productivity and pay higher wages than their domestic-only counterparts.⁶⁶

However, broader gains that do exist are likely counteracted to some extent by what is often referred to as the competition effect. Some domestic firms, especially in developing countries, may struggle to compete with the more productive foreign firms, and hence find it difficult to invest in upgrading their STI capacities. Therefore, the net benefit of openness has been found to be context dependent and reliant upon the degree to which efficiency and productivity gains outweigh the competition effect.

The degree to which a country experiences net gains from openness depends on a number of policy-related elements, including the absorptive capacity of the economy. Broadly, absorptive capacity is defined as an economy's ability to avail itself of the technologies present in the marketplace given the capacity of the country to utilize the technology for its benefit. Countries are therefore more likely to benefit from technology transfer if they have sufficient

absorptive capacity in place. Absorptive capacity can encompass many factors, including the quality of institutions, the skill level of workers and the available infrastructure. Complicating the issue is the fact that the kind of absorptive capacity needed may change by technology and through time, as technology changes. Given the vast interpretation of this concept, and the difficulty surrounding the measurement of the characteristics just mentioned, developing specific actionable policies can be a challenge.⁶⁷ However, there are certain basics—functioning transport, Internet and training facilities, for example—that can be implemented that will enhance a country's overall absorptive capacity regardless of the specific technology.

The question of what happens once the FDI inflows reach the host country, in terms of technological learning, opportunity for innovation and technological upgrading, is as important to policymakers as how the technology is transferred in the first place. This area of research is comparatively less explored within the classic technology transfer literature, while it has become a core issue within the more recent literature on innovation and development.⁶⁸

Towards a better understanding of ITT: What happens after the transfer of technology?

The stream of literature on innovation and development generally concentrates on whether and how processes of technological learning, capabilities building and technology upgrading happen once new technology inflows have reached host countries and are incorporated. In general, FDI and trade should only be treated as potential sources of external technology. The bulk of innovation processes that should follow once a technology has been introduced happen within domestic firms embedded in the host country's innovation systems.⁶⁹

The key lies in the distinction between technical change and technological learning. The former indicates changes in production processes that follow the incorporation of new technologies. These can be acquired, at times, through a “turnkey” approach, which limits the generation of incremental changes to the accumulation of production capabilities. In contrast, technological learning occurs when the incorporation of new technology is accompanied by processes that strengthen firms' capabilities to generate and manage further technical change.⁷⁰ The main idea, common to most of the conceptual and empirical contributions on innovation and development, involves assigning a “central role to

indigenous technological effort to master new technologies, adapting them to local conditions, improving upon them, diffusing them within the economy and exploiting them overseas by manufactured export growth and diversification, and by exporting technology themselves”.⁷¹

In this sense, innovations do not necessarily have to be radical, nor do they necessarily need to have a significant productivity increasing effect. Rather, incremental innovations are considered to be the first, necessary step—besides being the most common one—towards technological learning. The traditional, linear distinction between innovation development and innovation diffusion must be done away with. Similarly, the idea of radical innovations developed in industrialized countries and simply adopted in developing countries does not do justice to the complexity of mechanisms that accompany the process of diffusion.⁷² It is the process of diffusion, often accompanied by incremental innovations carried out by domestic firms, that is likely to be more effective in meeting local production needs and spur broader technological upgrading. Domestic, autonomous capability building is therefore the result of purposefully developed ability to manage further innovation.⁷³

The development of production and innovation capabilities is certainly linked to the time frame within which transfer, adoption, diffusion and learning occur, but also to the qualitative difference between the two. Production capabilities might well lead to a one-off improvement of the production process, whereas innovation capabilities can have a dynamic, self-sustained effect on the capacity of firms to be less dependent on ITT in the long run. Trade and FDI, though necessary, do not represent sufficient conditions for ITT, and tell us only part of the story.

Pillars of a next generation framework to promote ITT

To fully exploit available opportunities for accessing technology created abroad, a country will need to have sufficient levels of innovation capacity relevant to the area of technology in question. Indeed, it has been recognized that, in order for technological learning to happen after diffusion, there need to be at least two factors in place: (i) a parallel indigenous innovation effort and (ii) an institutional system conducive to innovation.⁷⁴

A “next generation” framework for ITT would therefore be built upon three pillars:

1. The understanding that production and innovation capabilities are often quite different. The presence of foreign capital or subsidiaries is found to have a (largely) positive effect on production capacity and capabilities but does not necessarily entail the development of innovation capabilities.⁷⁵ Instead, the occurrence of spillovers from ITT should be carefully steered, as in some contexts and for some sectors, spillovers cannot be expected to follow automatically from ITT. A new generation approach should therefore emphasize the role of indigenous effort and support both that effort and the development of domestic capabilities to fully exploit technology transfer. This implies parting from the idea of a hierarchy with frontier technology transferred from developed countries at the top and, at the bottom, the processes of imitation and incremental innovation that might follow the transfer. These are only part of the learning process that leads eventually to upgrading and diversification, and should be supported.
2. The understanding that technological learning goes beyond an educated workforce and includes a flexible business environment where firms (and individuals) can experiment and try new things. Technological learning also should be targeted at the host country’s needs, and not only be productivity enhancing but also be inclusive, so that opportunities to innovate are not limited to a subset of economic actors. It must lead to broader indigenous innovation, which is not necessarily radical, but can also be incremental. As such, it can be led by local firms and ensure employment-friendly growth and developmental outcomes. This is particularly relevant in countries that have large productivity gaps across different sectors. In these contexts, structural change stemming from liberalization and ITT might well benefit the relatively more productive sectors, but this may be at the cost of job-displacing effects in the short-run.⁷⁶ Ensuring a flexible business environment improves the ability of the economy to re-absorb these displaced workers.
3. The third, most challenging pillar is the need to design complementary, carefully timed, policies. These involve traditional trade and FDI policies, followed and complemented by domestic industrial and innovation policies. The construction of a national innovation system can be the basis of such policy integration and

coherence. A well-functioning NIS strengthens governance, improves networks among different sectors and institutions, and maximizes the synergies between public and private actors within the system.

Technology collaboration and sharing

To effectively implement the dynamics outlined above, the “next generation” framework for technology transfer needs to be based on principles of openness and opportunity. This is especially true in light of the large disparities across the Asia-Pacific region, and the global scale of the challenges facing the region. Technology transfer must be approached as a process of collaboration and sharing—not as a one-way transfer—if it is to catalyse innovation for sustainable development. It is not simply the access to new technologies that will be critical in making progress on the SDGs. Rather, these advancements need to reach and benefit broader local communities, be it through improved access to goods and services (including social and environmental goods and services) or through more effective forms of communication. Numerous breakthrough technologies, from mobile phones and the Internet to the pneumococcal vaccine, have been developed and spread around the world at an unrelenting pace over the last few decades. However, as the millions who still have no access to basic medicines, clean water or sufficient food can attest, more needs to be done. In order to generate and spread the next wave of breakthrough technologies, the international innovation system needs to evolve. In many circumstances this will not necessarily require more technology transfer, but it will require more technology collaboration and sharing.

Many countries in the region have neither the resources nor the economies of scale to develop meaningful R&D and technology investment initiatives. Collaboration, therefore, becomes the most effective way for such countries to develop functioning technology funding mechanisms, to ensure broader access to knowledge and to ultimately benefit from greater learning opportunities. In addition, some of the key challenges countries are faced with, such as climate change, are inherently shared challenges, and their solutions have significant international spillovers. Hence, there are significant incentives for technology sharing, since those who have solutions will also benefit from their widespread adoption. While there has long been recognition of the need for coordinated action on many of the

challenges the SDGs seek to address, there has never been such opportunity to collaborate on and share the innovative solutions to these challenges. Indeed, this shift in focus could, by itself, generate new technologies, build developing country innovation capability and improve the scope for scaling technology at pace.

Getting the balance between openness and competitiveness right will be critical. Competition drives innovation and governments need to carefully assess how a more collaborative approach could dampen the private sector’s incentives. One way to increase incentives is through a well-functioning IP rights regime that protects (without stifling) innovation. Another is through a flexible technology “pricing” regime, which would adjust to different levels according to the market and level of development. This would allow profit-maximizing companies with an IP-monopoly to charge lower prices where consumers are significantly poorer.⁷⁷ Although this concept is not new, the way it has been applied to date has left little incentive to develop new technologies. Rethinking technology transfer as technology collaboration and sharing could be one of the most important components of the 2030 Agenda.⁷⁸

4.3 Participating in global innovation

Technology development, dissemination and transfer, and the strengthening of scientific and technological capabilities of all countries, represent key means of implementation of the 2030 Agenda. Two global United Nations mechanisms in particular are in the early stages of development to advance the STI agenda.

The United Nations Technology Facilitation Mechanism

The Technology Facilitation Mechanism was established by the Addis Ababa Action Agenda in order to support the SDGs. The mechanism comprises:

- A multi-stakeholder forum on STI for the SDGs.
- An online platform as a gateway for information on existing STI initiatives, mechanisms and programmes.
- A United Nations inter-agency task team on STI for the SDGs, which will promote coordination, coherence and cooperation within the United Nations system on STI

related matters, and enhance synergy and efficiency, in particular to support capacity building initiatives.

The Mechanism will also engage stakeholders from civil society, the private sector and the scientific community. The work of the inter-agency task team is structured around four work streams where the team identified opportunities to collectively achieve greater impact within the scope of existing mandates:

- Mapping of existing technology facilitation initiatives, including support for policy formulation and strengthening of technological capabilities and innovation systems.
- Identification of areas of synergy and areas of possible cooperation within the United Nations system on technology-related work.
- Development of options for a possible online knowledge hub and information-sharing platform.
- Cooperation with relevant stakeholders on STI capacity building.

The United Nations technology bank for LDCs

The United Nations Secretary-General established a High-level Panel in November 2014 to study the scope and functions of a proposed “technology bank” dedicated to helping the world’s LDCs to lift themselves out of poverty. The High-level Panel proposed that the technology bank be composed of two interrelated organizational units: an STI supporting mechanism and an IP bank.

The overarching objective of the supporting mechanism would be to help the LDCs to strengthen their national STI capacities, which are essential for the development, acquisition, adaptation and absorption of technologies for sustainable development. According to the High-level Panel, the mechanism would foster knowledge networks and worldwide partnerships between researchers, innovators and entrepreneurs in the LDCs and their global peers.

The IP bank would serve to help build the national IP capacity of the LDCs and to facilitate technology transfers according to voluntary and mutually agreed terms and conditions. In the process, it would accelerate the beneficial integration of the LDCs into the global IP system. To that end, among other functions, it would assist in the realization of the

promise of technology transfer under the 1994 Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).

4.4 An open and inclusive regional platform for innovation knowledge

There is a dynamic, vibrant and pioneering STI ecosystem in the region, and there are many regional STI cooperation mechanisms that have been put in place to share knowledge and experience in creating an enabling environment for STI, as well as to collaborate on pressing global challenges.

There is now an opportunity to create a truly inclusive regional platform to stimulate South-South STI collaboration. Although subregional platforms for STI cooperation do exist, as do North-South STI platforms, they are disparate and unconnected and, thus, do not fully harness the region’s vast knowledge and potential. They also do not include many countries in the region—19 Asia-Pacific economies (including many Pacific Island nations) do not belong to any networks. Therefore, much work can be done in further integrating the disparate network of platforms, so as to promote deeper collaboration within the entire Asia-Pacific region and promote inclusive and sustainable innovation.

There are many opportunities in the Asia-Pacific region to promote the development of STI through further integration. This can be achieved by harnessing the potential impact of tertiary student mobility, by steering technology transfer through economic flows and by empowering the local innovation process through improved access to technology. Achieving improved STI outcomes requires an actively managed policy mix that promotes integration while maintaining a focus on developing indigenous capacity. Given the potential complexity of such a policy development process and the inherent regional spillovers of domestic policy approaches, regional cooperation is a necessary condition if the SDGs are to be reached.

In the context of STI, the 2030 Agenda’s goal to “leave no one behind” will be unmet if countries do not act to collaborate further to create open and inclusive knowledge economies. This issue is particularly acute in the Asia-Pacific region, which is home to some of the most technologically advanced economies in the world, as well as to some of the most technologically deprived.

Likewise, the fact that many countries in the region are not parties to existing STI cooperation platforms or mechanisms is a distinct challenge for fulfilling the SDGs. To fully harness the underlying potential of the region it is necessary to establish a platform that spans the whole of Asia and the Pacific, promotes inclusive STI cooperation and provides a forum for

South-South and North-South cooperation alike. ESCAP's ICT/STI Committee, which will meet for the first time in 2016, presents a unique opportunity to create a truly integrated and inclusive approach to knowledge sharing, capturing the diversity and dynamism of STI across the region and facilitating collaboration.



CHAPTER

5

ROLE OF ESCAP

Current intergovernmental STI cooperation in the region is disjointed and ad hoc. ESCAP, as the region's primary intergovernmental forum, provides a unique platform to link these disparate efforts, creating a whole that is greater than the sum of its parts. The most immediate avenue is the inaugural ICT/STI Committee meeting, which will take place in 2016. This Committee presents a unique opportunity to create a truly regional and integrated STI platform to share knowledge across the subregions and capture the diversity and dynamism of STI across Asia and the Pacific.

While the ICT/STI Committee will provide an important venue to ensure the region remains “on track”, the biannual meeting schedule may hamper countries' ability to keep pace with the fast-changing landscape of STI. Thus, an additional avenue of cooperation would be the establishment of an Innovation Forum, which could be convened more regularly. This Forum would complement the Global Forum on Science and Technology organized by the United Nations Conference on Trade and Development (UNCTAD) and the various science fora organized by the United Nations Educational, Scientific and Cultural

Organization (UNESCO), and provide a unique opportunity for countries to exchange experiences in identifying opportunities and challenges. The forum could include baselining activities, developing blueprints for STI implementation for the SDGs, outcome monitoring, developing regional standards and cooperation agreements, implementing skills-based exchange programmes and determining the contours of an open innovation framework for the region. To take advantage of the region's vibrant STI ecosystem and to support member States in meeting their ambitions and commitments, ESCAP could support collaboration between member States by:

1. Acting as a bridge between the numerous subregional STI platforms (e.g. the Association of Southeast Asian Nations (ASEAN), the Asia-Pacific Economic Cooperation (APEC) and the South Asian Association for Regional Cooperation [SAARC]) to ensure that the region as a whole is fully informed on STI developments, challenges and opportunities.
2. Coordinating a regional cross-government network on STI in support of knowledge sharing of SDG achievements.

3. Hosting an online platform as a gateway for information on regional STI needs, solutions, initiatives and policy developments.
4. Holding an annual multi-stakeholder Innovation Forum for the SDGs.
5. Ensuring regional needs and knowledge are integrated into the global STI agenda (e.g. for the Technology Facilitation Mechanism and Technology Bank).

The ICT/STI Committee provides a platform that could support more-specific areas of work, such as providing analysis and best practice assessment of STI policy; advocating for and facilitating commitments to key STI policy initiatives in the region (e.g. technology transfer, social enterprise and impact investment), with a focus on least developed countries and countries with special needs.

Endnotes

- ¹ Defined as investing to generate social and environmental value, as well as financial return, Monitor Institute, 2009.
- ² A Vulnerable group can be defined as a population that has some characteristic that make it at higher risk of falling into poverty (See <http://web.worldbank.org/website/external/topics/extpoverty/EXTPA> Accessed 15 April 2016).
- ³ See https://en.unesco.org/sites/default/files/usr15_is_the_gender_gap_narrowing_in_science_and_engineering.pdf.
- ⁴ Beede, 2011.
- ⁵ Mulgan and Townsley, 2016. See https://www.nesta.org.uk/sites/default/files/the_challenge-driven_university.pdf.
- ⁶ Koh, Hegde and Das, 2016.
- ⁷ Mulgan and Townsley, 2016.
- ⁸ Mulgan and Townsley, 2016.
- ⁹ Mulgan and Townsley, 2016.
- ¹⁰ Mulgan and Townsley, 2016.
- ¹¹ Ernst & Young, 2015.
- ¹² See <http://www.skilldevelopment.gov.in/assets/images/Skill%20India/policy%20booklet-%20Final.pdf>.
- ¹³ Porter and Kramer, 2011.
- ¹⁴ See http://www.mca.gov.in/Ministry/latestnews/National_Voluntary_Guidelines_2011_12jul2011.pdf.
- ¹⁵ See <http://www.eco-business.com/opinion/one-year-into-indias-csr-law-the-jurys-still-deliberating/>.
- ¹⁶ See <http://www.theguardian.com/sustainable-business/2016/apr/05/india-csr-law-requires-companies-profits-to-charity-is-itworking>.
- ¹⁷ Porter and Kramer, 2011.
- ¹⁸ UNIDO, 2014.
- ¹⁹ Mulgan, 2014.
- ²⁰ See <http://www.bangkokpost.com/tech/local-news/789137/digitally-savvy>.
- ²¹ See <http://www.bangkokpost.com/tech/local-news/789137/digitally-savvy> and <http://www.ecdl.org/index.jsp?n=2887&p=932&a=4622>.
- ²² <http://www.a2i.pmo.gov.bd/content/innovation-fund-a2i>
- ²³ Examples abound of innovative products that started life as government projects—microwave ovens, sonar, carbon fibre and the Internet are a few.
- ²⁴ Government of Malaysia, 2016. See <http://gtp.pemandu.gov.my/gtp/>.
- ²⁵ Nesta, 2014.
- ²⁶ Foster and Heeks, 2013.
- ²⁷ Heeks and others, 2013.
- ²⁸ See <http://knowledge.insead.edu/innovation/frugal-innovation-a-new-business-paradigm-2375>.
- ²⁹ Radjou, Prabhu and Ahuja, 2012.
- ³⁰ The Economist Intelligence Unit, 2014.
- ³¹ The Economist Intelligence Unit, 2014.
- ³² Karnani, 2009.
- ³³ OECD, 2015.
- ³⁴ See <http://nif.org.in>.
- ³⁵ <http://www.wipo.int/tk/en/resources/faqs.html>
- ³⁶ For a definition of traditional knowledge, see <http://www.wipo.int/tk/en/resources/faqs.html> and <http://www.wipo.int/tk/en/resources/glossary.html>.
- ³⁷ See <http://www.wipo.int/ip-development/en/agenda/>.
- ³⁸ OECD, 2015.
- ³⁹ OECD, 2015.
- ⁴⁰ See <https://www.kiva.org/about/stats>.
- ⁴¹ Kelly and Rossotto, 2012.
- ⁴² Groupe Speciale Mobile (GSMA), 2015.
- ⁴³ UNESCO, 2014; Luc Soete and others, 2015.

- ⁴⁴ This change in business attitudes has been supported by the United Nation's Global Compact, which works as a country-led initiative to support businesses in effectively integrating the three dimensions. See <https://www.unglobalcompact.org/what-is-gc/our-work/sustainable-development/background>.
- ⁴⁵ Whitley, Darko and Howells, 2013.
- ⁴⁶ See <http://www.theguardian.com/british-council-partner-zone/2014/dec/16/approved-social-enterprisereceives-legal-statusin-vietnam>.
- ⁴⁷ See <https://www.digitalnewsasia.com/digital-economy/malaysia-unveils-social-enterprise-blueprint>.
- ⁴⁸ World Bank, Private Participation in Infrastructure Database.
- ⁴⁹ Formerly the Global Alliance for Vaccines and Immunisation
- ⁵⁰ Monitor Institute, 2009.
- ⁵¹ J.P. Morgan, 2010.
- ⁵² ADB, 2011.
- ⁵³ Hunger, 2002.
- ⁵⁴ Beine, Docquier and Rapoport, 2010.
- ⁵⁵ Hunger, 2002.
- ⁵⁶ Beine, Docquier and Rapoport, 2008.
- ⁵⁷ See, for example, Helpman, Melitz and Yeaple, 2004.
- ⁵⁸ Parisotto and Heal, 2016.
- ⁵⁹ Amiti and Konings, 2007; Arnold, Javorcik and Mattoo, 2011.
- ⁶⁰ Javorcik, 2004; Blalock and Gertler, 2008; Havranek and Irsova, 2011.
- ⁶¹ Gorg and Strobl, 2005.
- ⁶² Navaretti and Venables, 2004.
- ⁶³ Irsova and Havranek, 2011.
- ⁶⁴ Irsova and Havranek, 2013.
- ⁶⁵ Aitken and Harrison, 1999.
- ⁶⁶ See, for example, Hidalgo and Hausmann, 2009; Poncet and Starosta de Waldemar, 2013. Of course the direction of causality is difficult to definitively substantiate.
- ⁶⁷ Frenz and Ietto-Gillies, 2015.
- ⁶⁸ See, for example, Bell and Pavitt, 1993; Bell, 2012; Lall, 1992; Lundvall, 1992; Marcotte and Niosi, 2000.
- ⁶⁹ Lundvall, 1992.
- ⁷⁰ Bell, 2012.
- ⁷¹ Lall, 1992.
- ⁷² Bell and Pavitt, 1993.
- ⁷³ Bell, 2012.
- ⁷⁴ Fu and others, 2011.
- ⁷⁵ Bell, 2012.
- ⁷⁶ Mcmillan, Rodrik and Verduzco-Gallo, 2014.
- ⁷⁷ Kenny and Barder, 2015.
- ⁷⁸ Kenny and Barder, 2015.



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