OECD Reviews of Innovation Policy

Science, Technology and Innovation in Viet Nam

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Foreword

The OECD-World Bank Review of Science, Technology and Innovation in Viet Nam was carried out through a partnership between the Organisation of Economic Co-operation and Development (OECD) and the World Bank (WB). It forms part of a series of OECD country reviews of innovation policy and of the ongoing policy dialogue on science, technology and innovation (STI) policies between the World Bank and the OECD with the Government of Viet Nam. The review was requested by the Viet Nam Ministry of Science and Technology (MoST) with financial support from the Viet Nam-Finland Innovation Partnership Programme (IPP).

This review follows the methodology of the OECD country reviews of innovation policy which, over the past years, have covered both advanced countries recognised as global leaders in innovation as well as emerging economies with fast-evolving capabilities in S&T and innovation.[*]

The purpose of this review is to obtain a comprehensive understanding of the key elements, relationships and dynamics that drive the Vietnamese innovation system and the opportunities to enhance it through government policy. More specifically, the review:

- provides an independent and comparative assessment of the overall performance of the National Innovation System (NIS) of Viet Nam;
- recommends where improvements can be made within the system;
- formulates recommendations on how government policies can contribute to such improvements, drawing on the experience of OECD and other countries and evidence on innovation processes, systems and policies.

The review is intended to be relevant to a wide range of stakeholders in Viet Nam, including government officials, entrepreneurs and researchers as well as the general public. It also aims to provide an accessible and comprehensive analysis of the Viet Nam innovation system and policy to a global audience through the OECD and World Bank communication channels.

The Vietnamese counterpart team was led by Tran Quoc Thang (Director, IPP), Tran Ngoc Ca (Secretary General, National Council for Science and Technology Policy, NCSTP), Luong Van Thang (Deputy Director-General, ICD, MoST), Bui Quy Long (MoST, Director of Centre for Viet Nam Science and Technology Internationalization Promotion, VISTIP), Tran Thu Huong (Deputy Chief of MOST Office), Le Xuan Dinh (Director General of the National Agency for Science and Technology Information, NASATI), and Hannu Kokko (former IPP's CTA).

The review draws on information gathered through a series of interviews with major stakeholders of Viet Nam's innovation system during a joint OECD – World Bank fact-finding mission to Viet Nam at the end of 2011, and from a background report commissioned by the IPP, prepared under the responsibility of Tran Ngoc Ca. The collection of innovation statistics and data in general, as well as the administration of innovation survey was possible thanks to the collaboration and support from NASATI and Central Institute for Economic Management (CIEM).

[*] www.oecd.org/sti/innovation/reviews

On the OECD side, the review was led by Gernot Hutschenreiter (Country Studies and Outlook Division [CSO], DSTI, OECD). Gang Zhang (CSO, DSTI, OECD) played an instrumental role in its initiation and in project co-ordination, in particular for external relations. Valuable contributions in various forms and at different stages were received from Koen de Backer with support from Laurent Moussiegt (both Structural Policy Division [SPD], DSTI, OECD) on trade and global value chains. Research assistance and other valuable input at various stages of the preparation of the review were provided by Richard Scott (formerly STP, DSTI, OECD), and Natalie Cooke (working at the OECD at the time of her contribution).

On the World Bank side, review work was led by Suhas D. Parandekar (Senior Education Economist, EASHE) and Emanuela di Gropello (Sector Leader, AFTHD) under the overall guidance and supervision of Victoria Kwakwa (Country Director, Viet Nam), Xiaoqing Yu (Sector Director, EASHD), and Luis Benveniste (Sector Manager, EASHE). Atsuko Muroga (ET Consultant, EASHE), Eleanor Wang (Junior Professional Associate, EASHE), Ronald Kim (Senior Operations Officer, EASHE), Saori Imaizumi (Consultant, EASHE) and Shahid Yusuf (Consultant, EASHE) conducted background research and provided inputs. Valuable comments and support were provided by the Viet Nam Education team including An Thi My Tran (Education Specialist), Binh Than Vu (Senior Education Specialist, EASHE), Christian Bodewig (Country Sector Coordinator, EASHS), Lan Anh Vu (Human Development Specialist, EASHE) and Thanh Thi Mai (Senior Education Specialist, AFTEE). Anna Coronado (Program Assistant, EASHE), Nga Thi Anh Hoang (Team Assistant, EACVF) and Nguyet Minh Nguyen (Program Assistant, EACVF) provided logistical and administrative support.

Éric Archambault, President and CEO of Science-Metrix Inc, and Grégoire Côté (Montreal, Canada) supported the review by providing key bibliometric statistics. The Asian Productivity Organisation, located in Tokyo, Japan, provided support by generously allowing the OECD to use its rich database.

The review report was prepared for publication by Dimitrios Pontikakis (CSO, DSTI, OECD) under the overall responsibility of and contribution from Gernot Hutschenreiter. Chapter 2 was drafted by Gernot Hutschenreiter and Shahid Yusuf (consultant to the World Bank and to the OECD and formerly World Bank), Chapter 3 by Dimitrios Pontikakis and Jean Guinet (consultant to the OECD, and formerly OECD), Chapter 4 by Emanuela di Gropello (World Bank), and Chapter 5 by Jean Guinet, with support by Anna Zaitseva (Consultant to the OECD, Higher School of Economics, Russia).

The review process benefited from the World Bank internal quality assurance exercise: Peer reviewers at the concept stage included Al Watkins (Public Sector Specialist, PRMPS) and Kurt Larsen (Senior Education Specialist, SASED); Peer reviewers at the finalisation stage are Anny Wong (Research Fellow, John G. Tower Center for Political Studies at Southern Methodist University), Diego Ambasz (Senior Operations Officer, LCSHE) and Gabriel Demombynes (Senior Economist, EASPV).

Finally, the draft report has benefited from detailed comments from the IPP.

Joseph Loux and Julia Gregory of the OECD Secretariat provided general editorial support for the publication.

All support and contributions, financial, in-kind and intellectual, are gratefully acknowledged.

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Abbreviations and acronyms

APO	Asian Productivity Organization
ASEAN	Association of Southeast Asian Nations
BPO	Business Process Outsourcing
CIDA	Canadian International Development Agency
CIEM	Central Institute for Economic Management
CIT	Corporate Income Tax
CLRRI	Cuu Long Rice Research Institute
DoST	Departments of Science and Technology
DRV	Democratic Republic of Viet Nam
EDB	Economic Development Board
EPB	Economic Planning Board
FASIE	Russian Foundation for Assistance to Small Innovative Enterprises
FDI	Foreign Direct Investment
FIE	Foreign-Invested Enterprise
GRI	Government Research Institute
GERD	Gross Domestic Expenditure on R&D
GSO	General Statistics Office
GVC	Global Value Chains
HCM	Ho Chi Minh
HRST	Human Resources in Science and Technology
IAS	Institute of Agriculture for South Viet Nam
ICOR	Incremental Capital-Output Ratio
ICT	Information and Communication Technology
IP	Industrial Park
IPP	Innovation Partnership Program
IPR	Intellectual Property Rights
ISCED	International Standard Classification of Education
ISO	International Organization for Standardization
IT	Information Technology
JICA	Japan International Cooperation Agency

KOIKA	Korea's International Co-operation Agency
MARD	Ministry of Agriculture and Rural Development
METI	Ministry of Economy, Trade and Industry
MITI	Ministry of International Trade and Industry (Japan)
MNE	Multinational Enterprise
MoET	Ministry of Education and Training
MoF	Ministry of Finance
MoIT	Ministry of Industry and Trade
MoPI	Ministry of Planning and Investment
MoST	Ministry of Science and Technology
NAFOSTED	National Foundation for Science and Technology Development
NASATI	National Agency for Science and Technology Information
NATEC	National Agency for Technology Entrepreneurship and Commercialisation Development
NATIF	National Technology Innovation Fund
NCNST	Natural Science and Technology
NCSR	Centre for Scientific Research
NIS	National Innovation System
NISTPASS	National Institute for Science and Technology Policy and Strategy Studies
NOIP	National Office of Intellectual Property
NTBF	New Technology-Based Firms
OEM	Original Equipment Manufacturing
PCI	Provincial Competitiveness Index
PCT	Patent Cooperation Treaty
PISA	Program for International Student Assessment
PPP	Purchasing Power Parity
PPP	Public-Private Partnership
PRO	Public Research Organization
QF	Qualification Framework
R&D	Research and Development
RCA	Revealed Comparative Advantage
S&E	Science and Engineering
S&T	Science and Technology
SATI	State Agency for Technology Innovation

SEDS	Socioeconomic Development Strategies
SHTP	Saigon High-Tech Park
SME	Small and medium-sized enterprises
SOE	State-Owned Enterprise
STAMEQ	(Directorate for) Standards, Metrology and Quality
STEM	Science, Technology, Engineering and Mathematics
STI	Science, Technology and Innovation
SWOT	Strengths, Weakness, Opportunities and Threats
TEC	Technical Efficiency Change
TFP	Total Factor Productivity
TP	Technological Progress
TVET	Technical and Vocational Education and Training
UNDP	United Nations Development Program
UNIDO	United Nations Industrial Development Organization
VAAS	Viet Nam Academy of Agriculture Sciences
VARANS	Viet Nam Agency for Radiation and Nuclear Safety
VASS	Viet Nam Academy of Social Sciences
VAST	Viet Nam Academy of Science and Technology
VAT	Value Added Tax
VC	Venture Capital
VCCI	Vietnamese Chamber of Commerce and Industry
VND	Vietnamese Dong
VNPT	Viet Nam Post and Telecommunications Corporation
VUSTA	Viet Nam Union of Science and Technology Associations
WfD	Workforce Development
WHO	World Health Organization
WIPO	The World Intellectual Property Organization
WTO	World Trade Organization

Executive summary

Viet Nam's achievements and new challenges

- Viet Nam's economic and social development has been impressive. High economic performance has translated into a rise in per-capita income and reduction of poverty. This has meant better lives for many.
- Viet Nam is approaching a crossroads, nevertheless. GDP growth has been slowing in a less buoyant international environment. Previous sources of growth are diminishing in power, raising the threat of a "middle-income trap". Viet Nam will have to rely more on productivity gains driven by innovation. This will require considerable improvements in domestic innovation capabilities.
- Viet Nam has expanded and diversified its exports but structural change towards "high technology", and eventually more sophisticated goods and tradable services of high knowledge content has been rather slow. Lock-in in low value-added activities limits the scope for technological learning and improving innovation capabilities.

Viet Nam's innovation imperative: Time for effective action

- Current science, technology and innovation (STI) capabilities are weak and the national innovation system is in a nascent, fragmented state. Research and development (R&D) is still a peripheral activity, both in the business and the public sector.
- Increased competition in globalising markets mean that it is more important than ever to invest early in advanced technological capabilities, including R&D. Stronger innovation capabilities are essential for enterprises to position themselves better in global value chains.
- To prepare for the future, a significant increase in investment on STI is required to strengthen and at the same time streamline and rebalance the innovation system by putting enterprises at the centre.

Improve public governance of the innovation system

- Governments play a key role in providing long-term orientation on social and economic priorities, ensuring that resources for innovation are adequate, public actors perform well, and the various components of the innovation system link up and form a coherent whole. Innovation system governance in Viet Nam has been beset by a number of shortcomings which can be related to a lack of effective commitment, co-ordination and implementation of government policies.

- Visionary leadership and political commitment to STI can contribute to raise the profile of STI within government, among stakeholders and the wider public. Effective innovation policy should aim at ambitious but realistic and operational targets.
- It also needs improved co-ordination between ministries and agencies, and involvement of representatives of enterprises in the formulation of strategies and policies. Formal high level co-ordination mechanisms should be complemented by informal networking and include collaboration of agencies involved in the policy implementation.
- Viet Nam has advanced the legal basis for STI and established several new institutions engaged in steering and funding R&D. But progress in building a modern institutional framework has to continue in a timely manner. Professionalised government agencies with a sufficient degree of operational autonomy and larger portfolios can help enhance policy implementation. The example of East Asian countries highlights that implementation capacity is a major factor of success.
- There is an urgent need to strengthen the information base for STI policy, indicators and evaluation practices. R&D statistics and other relevant information are often fragmentary, out of date or not internationally comparable.
- Evaluation needs to be pragmatic, timely, transparent and actionable. Results of evaluations should help improve policymaking, showcase the tangible economic and social benefits of STI, while high-profile awards may help mobilise the general public's interest in STI.

Strengthen the human resource base for innovation

- Human resources are the key to innovation. A nation's innovation capacity depends crucially on the quality of education and training for scientists, technologists and a wide range of professionals and on the inclusiveness of the education system. Viet Nam has made a substantial effort on education and skills. The results of the 2012 OECD PISA assessment of the performance of secondary students bode well.
- However, there is still scope for increasing the quantity and improving the quality of human resources, particularly at the tertiary and secondary vocational levels. Funding of tertiary education has been insufficient to cope with the increase in technical and research students.
- The skills supplied through formal education and training are often out of date or too theoretical and do not meet the demands of the labour market. In addition to financing constraints, the governance of higher education suffers from weaknesses in terms of information about skills needs and incentives for alignment.
- The accumulation of innovation capabilities within businesses depends on the availability of specialised professionals. Broadening options for professional specialisation in upper secondary education and enhancing the standing of vocational training seem necessary.

- It is also important to provide more opportunities for upgrading the skills of those already in the workforce and to improve the effectiveness of short-term training. An expansion of part-time tertiary education and other lifelong learning opportunities could help address gaps in "soft" skills.
- Public-private partnerships (PPPs) could be used to encourage businesses to take greater part in the national effort on human resource development. Firms, especially SOEs and MNEs, should be encouraged to increase their training investments, to fund demand-tailored aspects of formal education and to partake in decisions over curricula and programme design.
- Skills constraints in the public sector are a major constraint to the effective delivery of public functions. Meeting the government's ambitious targets to remove skills constraints in the public sector by 2020 should be a priority.

Strengthen innovation in the enterprise sector: Put business enterprises at the heart of the innovation system

- Business enterprises that thrive on innovation – and leverage R&D done in universities and PROs – are at the centre of all national innovation systems that drive growth and development.
- Viet Nam's business sector still accounts for a very small share of R&D expenditure. Few firms perform R&D, the level of innovation activity is overall low and links to public research are weak. Improving in-house innovation capabilities – which require skills to engage in design, engineering, marketing, information technology and R&D – in a broad range of enterprises should be an overarching priority.
- Innovation requires conducive and stable framework conditions. Viet Nam has made progress but there remains much scope for improvement, including through continuing regulatory and SOE reforms, stimulating competition, facilitating access to finance etc. Frequent regulatory changes lead to a proliferation of red tape.
- In addition, Viet Nam could benefit from increased funding of promising support schemes for business R&D and innovation, provided that their design and delivery is brought up to good practice standards. A comprehensive inventory (covering direct support instruments and tax incentives) and successive evaluations should inform the streamlining and re-orientation of support.
- Additional measures should be taken to attract knowledge-intensive foreign direct investment and facilitate spillovers from foreign-invested to domestic firms. A suitably adapted public-private partnership (PPP) pilot programme for R&D and innovation could help focus and leverage resources, and improve co-operation between public research and business actors, including foreign firms.

Strengthen the contribution of universities and public research institutes

- Viet Nam's public research sector has undergone profound changes since *doi moi*, but problems persist. These include a large number of often overlapping labs and R&D units, many of which are of sub-optimal scale, a lack of resources (funding, qualified personnel, research infrastructure) and distance from potential end-users.

Tackling these issues effectively requires a clear, strategic view on the desired division of labour between universities and PROs and the balance between the main functions of PROs.

- A profound restructuring of the governance of PROs and research universities should be a precondition for the necessary increase in their funding. The process of corporatisation of PROs and towards institutional autonomy should continue, while the remaining non-corporatised PROs be restructured into fewer, better performing organisations. They should be aligned with socioeconomic priorities by clear missions and funding criteria, including performance-based ones set at the appropriate level.
- The co-ordinating role of MoST at the strategic level should be enhanced while, at the operational level, a limited number of agencies – such as NAFOSTED – could play a constructive role in streamlining the portfolio of PROs.

Chapter 1

Overall assessment and recommendations

This chapter brings together key parts of the assessment derived from the review. It discusses some of their policy implications and develops specific policy recommendations.

1.1. Achievements and challenges

Viet Nam's development over the last a quarter of a century has been impressive. Following the Doi Moi reforms, which started in the 1980s, Viet Nam began the transition from a centrally planned economy to a socialist-oriented market economy. Over time, significant progress in building and remoulding its institutions and in opening the economy have provided new opportunities for development, and increasing integration in the global economy leading to the country's accession to the World Trade Organization (WTO) in 2007. As a result of its reforms, Viet Nam has grown faster than most other countries in the East Asian region except China. In the 1990s and the 2000s, growth of gross domestic product (GDP) exceeded 7% a year on average. This has helped to reduce poverty and has meant better lives for many. Viet Nam has also been remarkably resilient to external shocks and weathered the crisis of 2007-08 well. However, GDP growth has slowed from 8.5% in 2007 to around 5%, a figure that may suggest the rate of growth to expect during the next few years.

The country's development, the economic health of the East Asian region despite the recent slowdown, and Viet Nam's medium-term prospects taken together suggest a good basis for achieving its broad economic and social objectives if the international economic environment remains supportive overall. Nonetheless, it will need to continue to reform its institutions to meet current and emerging challenges and boost the efficiency of state-owned enterprises (SOEs) and investment more generally, including in a modern infrastructure. Its young population will buoy the economy, and continuing capital investment should help to absorb agricultural workers into more productive employment in urban activities.

Yet Viet Nam is approaching a crossroads. To boost GDP growth to the 7-8% a year called for in the Socio-Economic Development Plan for 2011-15, Viet Nam will have to rely more on gains in productivity. This will require further technological catch-up, which may happen at first largely through technology embodied in imported capital goods and associated organisational and managerial innovation, but increasingly through process and product innovations arising from the domestic innovation capabilities of business enterprises. In the longer term, total factor productivity (TFP), the overall efficiency with which the factors of production are used in an economy, will have to rely more on innovation as a source of growth than on transfers of resources from agriculture to higher-productivity industrial and services activities. In contrast to other countries in the region, notably China, where TFP growth has been high and picked up further in the second half of the 2000s, TFP growth in Viet Nam has stagnated.

To address this issue, Vietnamese enterprises will have to improve their human capital and innovation capabilities as other countries in the region have done. Innovative firms in Japan and later in Korea have largely been responsible for their entry into the ranks of high-income nations. For its part, China first used institutional reforms in agriculture and SOEs and the opening of the economy to promote economic performance. It then started to invest heavily in knowledge and domestic innovation capabilities in the 1990s. It is now becoming an important global actor in research and development (R&D) and innovation and is reshaping the international division of labour, including in knowledge production. Nurturing and achieving Viet Nam's potential for innovation as a source of economic growth and development will require a sustained, forward-looking policy effort and, in addition to an open and competitive environment, progressive diversification and upgrading into manufacturing and service activities that increase domestic value added and generate technological spillovers.

Viet Nam participates in global value chains (GVCs) in a number of areas, such as textiles and garments, food, furniture, and more recently mobile phones. Although its exports are varied, structural change towards more sophisticated, "high-technology" exports has been rather slow.[1] There are some recent signs of significant changes, such as the steep increase in exports of mobile phones, largely due to the operations in Viet Nam of Korean multinational enterprises (MNEs). These are positive developments, but Viet Nam should further move into GVCs that provide opportunities to create a virtuous circle of innovation, learning and productivity growth and new value-added activities. As their innovation capabilities increase, enterprises in industry and services will be able to upgrade technologically by assimilating new knowledge, engage in more advanced innovation activities, strengthen their backward and forward linkages and enter sophisticated new production activities.

The experience of many countries indicates that the industrial composition of output and investment has a large bearing on the near-term and longer-run development of business innovation capabilities and productivity gains. Potential returns to certain activities, through cycles of learning and innovation, are greater than others. During their catch-up process, some Asian countries were quick to upgrade and to achieve advanced manufacturing capabilities. In time, they started to engage in innovation that fed into productivity. Other countries have been unable to diversify out of the production of textiles and garments or other sectors in which profits and productivity gains are constrained by ease of entry, saturated markets and limited scope for technological advances. Such a lock-in situation limits learning opportunities and the acquisition of innovation capabilities. Growth without sufficient structural change towards higher value-added activities raises the prospect of a "low-/middle-income trap". While Viet Nam has started to diversify and upgrade, it needs to set in motion a virtuous circle of learning and innovation of the kind that has driven other countries' growth.

Recent research has shown that countries that have acquired sufficient human capital and climbed up the technology ladder are less likely to suffer a slowdown of growth. Such countries also have enterprises able to compete in vigorously competitive environments, such as that created by the on-going regional economic integration of Southeast and East Asia. Stronger innovation capabilities allow enterprises to position themselves better in the reshaping of value chains in the region and worldwide. Increased global competition as a result of more interconnected global markets, the rise of economic powerhouses such as China and an expanding group of competing middle-income countries also mean that it is more important than ever to invest early in advanced technological capabilities, including high-quality R&D.

Currently, Viet Nam's science, technology and innovation (STI) capabilities are weak and much needs to be done to improve them. The business sector accounts for a very small share of both the funding and performance of R&D. All indications are that research, which is a part of wider innovation activity, is still a peripheral activity in Viet Nam, both in the business and in the public sector. However, an up-to-date examination of Viet Nam's research system is made difficult by the fact that R&D statistics and other relevant information are often fragmentary, out of date or not internationally comparable. International experience shows that government has an important role in fostering innovation in the business sector and in nurturing the gradual building of an effective and efficient national innovation system that links the business sector with public research in universities and public research organisations (PROs).

1.2. Evolution of science, technology and innovation policy

Viet Nam looks back at three decades of reform and the gradual move towards a socialist-oriented market economy. Unlike, e.g. the Russian Federation, it did not engage in large-scale privatisation. Rather it was characterised by MNEs operating in joint ventures with SOEs and the parallel emergence of small-scale private enterprises. Viet Nam shares certain aspects of this process with China, which took a gradualist approach to modifying the overall politico-economic framework. At the same time China has swiftly adopted and persistently implemented reforms of the microeconomic structure, notably as regards the corporate and public S&T and R&D sectors. Viet Nam's specific combination of transformation and resilience of certain institutional arrangements and attitudes has resulted in a very different trajectory. Overall, it seems that currently Viet Nam lags China in most aspects of the development of its innovation system.

A snapshot on the evolution of Viet Nam's STI system and policy is provided in Figure 1.1.

Incubation during "pha rao" *(1979-86)*

The S&T field was characterised by a strict top-down system of control and allocation of resources and a separation of R&D, production and educational activities. Decision 175 in 1981 which allowed the signing R&D contracts, can be seen as the precursor of the series of reforms that would follow in the next decades.

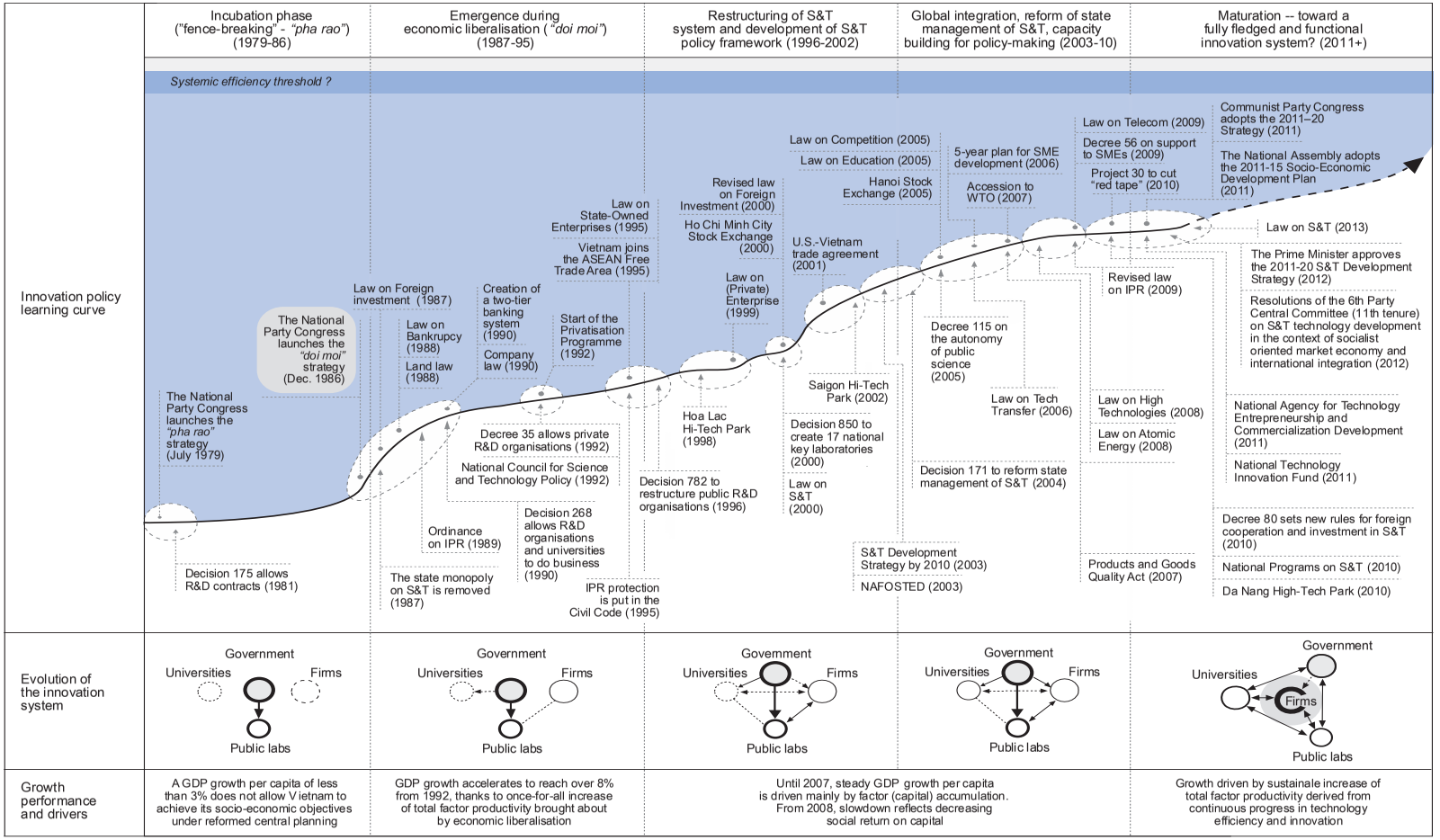
Emergence during economic liberalisation ("doi moi") *(1987-95)*

This period saw the emergence of first elements of a new legal framework for S&T-based development. The first initiatives removed the state monopoly on S&T activities; R&D organisations were allowed to enter into contractual relationships with individuals and non-state organisations, rules for technology transfer were introduced, and a legal basis for intellectual property rights (IPR) established. It was decided almost to double the budgetary effort in favour of S&T, although this decision was slow to take effect. In 1993, the National Centre for Natural Science and Technology (NCNST) was given the broader mission to conduct both fundamental and applied research. However, public funding of S&T continued to go exclusively to governmental S&T organisations, and S&T prioritisation and evaluation mechanisms remained unchanged. New technology transfer arrangements did not alter the situation markedly, owing to weak systemic linkages between R&D institutions and the state and a nascent private business sector.

Restructuring of the S&T system and expansion of the S&T policy framework (1996-2002)

Restructuring gained momentum in the mid-1990s with a reform of subsidies to a number of governmental research organisations. Several institutes under line ministries were transferred to newly created corporations and state-owned enterprises. Research centres were established under corporations (in accordance with Decision 782) in order to strengthen links between S&T and production. Relations between PROs and industry began to take shape and new innovation infrastructures were initiated (e.g. the Hoa Lac and later the Saigon high-technology park). Seventeen Key National Laboratories were created; to bring about breakthrough research in some priority sectors of national socio-economic development. The first Law on Science and Technology was passed.

Figure 1.1. Viet Nam's innovation policy: Institutional reforms and the learning curve



Source: OECD.

Global integration, reform of state management of S&T, and capacity building for policy making (2003-10)

The Law on Science and Technology opened a new phase in the relatively slow but constant transformation of Viet Nam's S&T system and policy. The S&T Development Strategy (2003), too, played a significant role, but it mainly focused on identifying priority technology routes and infrastructure, rather than on guiding institutions and policy. In the following years, the government provided new legislation and regulations, new financing instruments, and new institutional arrangements and infrastructures, with three overriding objectives.

- First, it sought to integrate the country's emerging innovation system into the global system. It improved the Law on IPR in 2005 and again in 2009, and in 2006 passed the Law on Technology Transfer, which defines the areas in which transfers are allowed and even encouraged. In 2007, the Law on Standards and Technical Regulation aligned relevant national norms with international standards. In the same year a Plan to Foster International Integration in S&T was adopted. Decree 80/2010/ND-CP aimed to facilitate foreign investors', firms' and research institutes' investment in setting up of R&D units and subsidiaries in Viet Nam.
- Second, the improvement of public management and financing of S&T was made a priority. The 2004 Decision of the Prime Minister laid down very ambitious and commendable objectives, which were challenging given current levels of implementation capability. Important measures profoundly changed the funding mechanisms of public R&D organisations, especially Decree 115 of 2005. In parallel, new legal frameworks and new public support mechanisms were introduced, notably the National Foundation for Science and Technology Development (NAFOSTED) which began operation in 2008, the National Technology Innovation Fund (NATIF), founded in 2011 but yet to become operational, and the Law on High Technologies in 2008.
- Third, the institutional capability of the government, particularly the Ministry of Science and Technology (MoST), to formulate, co-ordinate and implement S&T and innovation policy was reinforced by the creation of a series of relevant bodies: in addition to the National Council for Science and Technology Policy (directly advising the Prime Minister on national S&T development policy) the State Agency for Technology Innovation (SATI) (2007), the Viet Nam Science and Technology Evaluation Centre (2006), and the National Agency for Technology Entrepreneurship and Commercialisation (NATEC) (2011).

Maturation: Towards a fully-fledged and functional innovation system (2011+)?

Viet Nam has recently entered a new phase which may well turn out to be decisive for the development of a mature national innovation system. The current phase has already seen a number of achievements as regards the legal basis (the Law on Science and Technology; Decree 80 setting new rules for foreign cooperation and investment in S&T), strategy documents (such as the 2011-15 Socio-Economic Plan, the 2011-20 Development Strategy and the resolution of the Party Central Committee on S&T development). Important developments took place at the institutional side (National Agency for Technology Entrepreneurship and Commercialisation, and National Technology Innovation Fund, 2011), and the National Programs on S&T or the Da Nang High-tech Park (2010). Viet Nam's has made progress and acquired some of the building

blocks of a fully-fledged innovation system and has moved up the learning curve. However, to develop a mature, well-performing innovation system which can take on fully its role as a driver of sustainable social and economic development, much needs to be done to put ambitions into practice.

1.3. Main strengths and weaknesses of Viet Nam's innovation system

Viet Nam has an energetic and resilient population with a strong sense of identity. Despite its historical record of scientific research, Viet Nam's innovation system in the modern sense is only emerging. At present it has a number of strengths and weaknesses, which are described below.

Main strengths

- *Strong economic growth performance, increases in income and diminishing poverty levels*. Viet Nam's dynamism over more than two decades appears very favourable in international comparisons.
- *A privileged geographical location in one of the world's most dynamic regions*, with access and proximity to large and increasingly integrated regional markets and increasing knowledge flows.
- *A sizeable labour force and favourable demographics*. Although the working population has begun to age, Viet Nam will continue to benefit from a demographic bonus for some time.
- *A substantial national effort on education*. This is bearing fruit, as the country performs better than countries with similar income in terms of primary/secondary enrolments, secondary student performance and adult literacy rates.
- *Attractiveness for investment by multinational enterprises*, which transfer more advanced and modern production and management methods.
- *Export strengths in a range of sectors*. Viet Nam has built new export strengths in a number of sectors and integrated in key global value chains. Science and technology (S&T) have played an important part in Viet Nam becoming an important exporter of agricultural goods (including rice and coffee).
- *Reputation in S&T fields such as mathematics and specialisation in agricultural research and biology*. In some areas including Earth and environmental sciences and biomedical research, Viet Nam has an above-average scientific impact.
- *Progress in putting in place and sustaining a set of organisations and institutions to support innovation*. These concern standardisation, quality, intellectual property rights (IPR), the information base and funding of R&D.
- *Regional initiatives of national benefit*. Regional governments in Viet Nam play an important role in experimenting with new forms of fostering innovation.

Main weaknesses

- *Low levels of productivity and income.* Despite rapid economic growth, Viet Nam's levels of productivity and GDP per capita are still low in international comparisons.
- *Inadequate framework conditions and disincentives for innovation.* There is much scope for improving the institutional framework, the business environment, competition and enforcement of IPR.
- *Limited access to finance, especially for domestic* private *enterprises*, including for innovation, puts a brake on the dynamism and restructuring of the economy.
- *Inefficiencies in the state-owned* corporate *sector* are a burden on the economy and an obstacle to innovation.
- *Infrastructure deficiencies*. Weaknesses in the communications, transport and energy distribution infrastructure constrain the expansion of enterprises, their integration in GVCs, and eventually their ability to innovate.
- *Weak performance of the teaching and learning system*. This is mainly evident in lack of quality, particularly in vocational and tertiary education. Skills shortages already begin to constrain innovation, including in the business sector.
- *Low level of sophistication in production and exports.* Exports still are largely concentrated in low-technology and low value-added industries. Competitiveness is currently based on cost rather than on quality. Links between foreign and domestic firms are very weak.
- *Little innovation and even less R&D capacity in the business sector*. Viet Nam lags other countries in the region, and the gap with China is widening. Innovation capability will be a decisive factor in Viet Nam's future position in GVCs. To date, very little FDI goes to knowledge-intensive or R&D-based activities.
- *Weak* performance *of public-sector research.* Public-sector research is poorly funded and, overall, does not satisfy criteria of excellence or relevance. With some exceptions, it contributes little to social and economic development.
- *Weaknesses in the organisation and governance of universities and public research organisations.* The division of labour within PROs and between PROs and universities is inadequately defined. Allocation of funding is not performance-based.
- *Weaknesses in the S&T infrastructure as regards key laboratories, specialised labs and research equipment*.
- *Seriously underdeveloped information base for innovation policy making*. R&D and innovation statistics and other relevant information are not systematic, lack international comparability and are out of date. "Strategic intelligence" for STI policy making, including evaluation and specialised analysis, does not meet the necessary standards.
- *Inadequate STI governance arrangements and policy implementation.* The STI governance system has tended to produce multiple and partly competing strategies, as well as overlapping and weak, overly top-down implementation. A division of labour between the government and the agency level is at an early stage.

Opportunities and threats

The **opportunities** include:

- *Developing the human capital and the skills base*. Universities and PROs need strong human capital and skills to produce excellent and relevant research. Business enterprises need a wide range of specialised capabilities to thrive through innovation.
- *Developing a dynamic businesses sector and its innovation capabilities*. Innovation capabilities are essential to a business sector that is internationally competitive in terms of productivity, quality and ability to respond to shifts in demand. They crucially depend on skills in design, engineering, marketing and information technology.
- *A more welcoming attitude towards healthy entrepreneurial risk-taking* would help the development of an innovative economy.
- *Diversifying and upgrading the economy*. Diversifying and upgrading to higher value-added activities in production and exports can set in motion a virtuous circle of learning and innovation, resulting in gains in productivity, income and standards of living.
- *Building an effective innovation system*. Gradually building a more mature and effective national system of innovation, with innovative enterprises at the core, will help reap high returns from investments in innovation.
- *Strengthening inclusive growth*. Innovation can provide new solutions and reduce the cost of existing responses to the challenges of economic development. It can help tackle challenges linked to industrialisation, urbanisation and environmental degradation.

At the same time, Viet Nam's innovation system faces a number of **threats**:

- *An unfavourable macroeconomic environment and a slowdown in growth*. External conditions may make it difficult for Viet Nam to achieve its aspirations, although East Asia has remained more resilient than other regions.
- *Failure to improve the institutional and business environment*, e.g. by tackling banking system reform and corruption.
- *Failure to prepare for increased international competition.* Viet Nam has benefited greatly from integration in the world economy and is likely to do so in the future. At the same time, competition is likely to be fiercer in a more integrated regional economy.
- *Increasing brain drain*. Viet Nam may lose out in the intensifying global competition for talent and not be able to benefit from brain circulation.
- *A looming middle-income trap*. As a result of inadequate upgrading of its human capital and economic activity, Viet Nam may find it more difficult to avoid the "middle-income trap".

Table 1.1 provides a summary SWOT analysis of Viet Nam's innovation system.

Table 1.1. SWOT analysis of Viet Nam's innovation system

Strengths	Weaknesses
• Strong economic performance and diminishing poverty levels. • Geographical location in one of the world's most dynamic regions. • Sizeable labour force and favourable demographics. • Substantial national education effort and good secondary education performance. • Attractiveness for investment by multinational enterprises. • Export strengths in a range of sectors. • Reputation in S&T fields such as mathematics and specialisation in agricultural research and biology. • Efforts to create and sustain a set of organisations and institutions to support innovation. • Regional initiatives of national benefit.	• Low levels of productivity and income. • Inadequate framework conditions and disincentives for innovation. • Limited access to finance for enterprises. • Inefficiencies in SOEs. • Infrastructure deficiencies. • Weak performance of the teaching and learning system. • Low level of sophistication of production and exports. • Little innovation and even less R&D capacity in the business sector. • Weak performance of public-sector research. • Weaknesses in the S&T infrastructure as regards laboratories and research equipment. • Seriously underdeveloped information base for innovation policy making. • Inadequate STI governance arrangements and policy implementation.
Opportunities	**Threats**
• Further developing the human capital and skills base involving the sizeable Vietnamese diaspora. • Nurturing a dynamic business sector and its innovation capabilities. • Diversifying and upgrading the economy. • Developing a healthy attitude to risk-taking. • Improving effectiveness of the innovation system in terms of economic and social impact. • Strengthening inclusive growth.	• Unfavourable macroeconomic developments and a slowdown in growth. • Failure to improve the institutional and business environment by tackling banking system reform and corruption. • Increasing brain drain. • Failure to prepare for increased international competition. • A looming middle-income trap.

1.4. Strategic tasks and guiding principles

Viet Nam's development dynamics, including the continuing integration into the regional (ASEAN and ASEAN+) and global economy provide many opportunities. Gradually building an efficient and mature innovation system is a major challenge for STI policy.

The overriding task of Viet Nam's STI policy is to strengthen national innovation capabilities, nurture the emergence of an efficient and effective national innovation system and raise the contribution of innovation to sustainable growth. Specifically, this will involve:

- *Helping to boost productivity throughout the economy* by fostering a range of capabilities for R&D but also for innovation in organisation, marketing, business models, etc., and for upgrading to higher value-added activities.
- *Gradually developing a national innovation system in which business enterprises take a central role* by acquiring the in-house capabilities they need to engage in R&D and innovation, yielding wider economic and social benefits.

To this end, Viet Nam's innovation policy must address various challenges related to productivity performance, to rationalisation of public support and funding for R&D and innovation more broadly, and to the reform of universities and PROs. Allocating investment to priority areas in line with broader development targets, and an appropriate policy framework for the development and attraction of high-quality human resources will be central in this effort.

1.5. Guiding principles for policy

Viet Nam requires a more balanced innovation policy that addresses a range of issues:

- *Framework conditions for innovation*. In Viet Nam, as in other countries that have recently adopted a market-oriented framework, perhaps the most significant policy contribution to boosting innovation would still be to improve the framework conditions for innovation. Government can also use SOEs to drive technological upgrading, whilst ensuring that they remain responsive to market and societal demands. This is not a substitute for good overall framework conditions, however.
- *Producers: the heart of the innovation system*. It is producers – mostly companies, but also farmers and parts of the state that produce goods and services – that translate innovation into the economic benefits that underpin social development. The system should be re-balanced to respond better to the needs of producers, with appropriate changes in the strategic orientation of public research, and to the accumulation of broad innovation capabilities in a greater number and variety of firms.
- *International knowledge and production networks*. Examples of successful catch-up demonstrate the importance of accessing foreign sources of knowledge through purchase of equipment, foreign direct investment (FDI), original equipment manufacturing (OEM), student mobility, international R&D collaboration, etc. Participation in GVCs provides an important path for upgrading.
- *A broad approach to innovation.* This means to overcome the tendency to define innovation as synonymous with "high technology" and frontier science and look to types of innovation that are more likely to have pervasive economic impact in the shorter term. These include non-R&D-based forms of innovation that draw on all types of creativity, such as organisational and marketing innovation, new business models, innovation in services and social innovation.
- *Effective governance and feedback.* Relationships between the government, its agencies and public research performers can be facilitated by simplifying the relevant institutional framework and professionalising policy design and implementation. The development of evaluation and feedback mechanisms to inform successive rounds of decision making is important.

- *Effective co-ordination*. Co-ordination requires good communication across organisations and institutional sectors as well as effective monitoring and evaluation of the various actors' contributions. Greater interaction within the policy-making community needs to be accompanied by engagement with all relevant stakeholders, including producers, in policy formulation, implementation and assessment.
- *Evidence-based policy design*. A sound basis for the design of policy requires systematic evidence on the performance of the innovation system and its constituent parts in the form of statistics, qualitative analysis and feedback from evaluations on the effectiveness of policy interventions.
- *Visionary leadership and political commitment to S&T* are reflected in the attention given to innovation at the highest levels of government, higher priority and additional resources devoted to the development of domestic innovation capabilities.

1.6. Recommendations

In the light of these strategic tasks and guiding principles, and taking due account of Viet Nam's innovation-related strengths, weaknesses, opportunities and threats, a number of policy recommendations can be made.

Improving framework conditions for innovation

Good framework conditions and a healthy business environment are essential for strong innovation performance. The macroeconomic framework, the general business environment, product market regulations, the intensity of competition, openness to trade and to FDI, business finance, the tax system, the level and quality of entrepreneurship, and the infrastructure all influence a country's innovation performance. It is these framework conditions that allow innovators to take calculated risks because they are in a position to reap the gains of their innovation effort and also to benefit society at large.

Flaws in framework conditions not only discourage innovative activities, but also constrain policy makers' room to manoeuvre and prevent the use of policy tools that have proven effective in favourable circumstances. For instance, pervasive corruption can make governments reluctant to provide direct subsidies to business enterprises. Even when policy makers use these instruments, their impact may be diminished.

Over some two decades, Viet Nam has made significant progress in a number of dimensions. Most importantly, it has been moving from a centrally planned economy towards a socialist-oriented market economy a process that was accompanied by sustained economic growth. In this process it has successfully built new and remodelled old institutions. However, certain adverse conditions continue to hold back value-creating entrepreneurial activity, including innovation. These shortcomings must be addressed to give innovation a greater role and to embark on a more productivity-driven growth trajectory.

- *Macroeconomic stability.* Viet Nam's longer-term development requires a macroeconomic framework that is supportive of entrepreneurial risk taking and innovation. In recent years imbalances have developed in the macroeconomy. The situation has improved recently in a number of areas. However, without further structural reforms the slowdown in the economy's growth may persist.

- *Institutional environment*. A strong institutional environment helps maintain stability and reduces the risks and transaction costs associated notably with investment and innovation. Despite changes for the better, there remains considerable scope for reducing the incidence of corruption, improving government transparency and developing a more efficient and effective legal process.
- *Entrepreneurship and administrative burden*. Whether or not high growth proves feasible will depend in part on the quality of the business environment. While Viet Nam has made progress since the early 2000s, bureaucratic hurdles for setting up new businesses are steep and there is scope for improvements in, among other areas, investor protection, taxation and resolving insolvency.
- *Financing innovation in the business sector.* A well-developed financial system that reduces the cost of external financing and contributes effectively to managing risk is critical for business innovation. Funds for innovation and risk financing are scarce in Viet Nam. Banks tend to channel much of their lending to state-owned enterprises, which reduces access to finance for small and medium-sized enterprises (SMEs). This acts as a brake on the development of a dynamic and innovative non-state business sector.
- *Competition*. There is clear evidence of a positive correlation between innovation and competition. SOEs continue to dominate many markets, although they are often less efficient and innovative than their non-state counterparts. Changes made in recent years have reduced their influence but have not gone far enough. IPR legislation and enforcement stimulate research by enabling successful innovators to reap rewards and by preventing free riding. While Viet Nam possesses a comprehensive and consistent IPR framework, enforcement mechanisms are considered weak.
- *Infrastructure.* Despite large investments in recent years, deficiencies in the infrastructure for communications, transport, logistics platforms and energy distribution are major constraints on firms' ability and potential to engage in innovative activities.

In sum, in spite of the progress made, there is urgent need for further improvements in the framework conditions for innovation. The potential gains from such improvements are greater than in most OECD countries. To prepare a solid and more fertile ground for innovation, the government should review the current situation with the following main objectives:

- *Establish and maintain sound macroeconomic conditions*, including the sustainability of public finance and low inflation.
- *Consider performing an in-depth assessment of the impact on innovation of the current regulatory framework.* The aim would be to produce evidence on major regulatory obstacles and detailed recommendations on the most suitable way of removing them.
- *Reinforce efforts to improve the institutional setting* as regards administrative burden, irregular payments and bribes, lack of transparency, weak auditing and reporting standards, and the complexity of the legal system.
- *Reduce burdens on doing business* by addressing bureaucratic hurdles for starting a business, increasing the protection of investors, raising the quality of the

workforce, and emphasising a user-centred approach in public service delivery agencies.

- Address aspects of the financial system and related regulation that constrain the financing of innovative projects in the business sector. This includes a reform of the banking sector to fulfil its basic functions of lending to enterprises, notably SMEs.
- In order to facilitate bank lending, consider the development of independent institutions for providing evaluations of and guarantees for technology projects, following, e.g., the example of KOTEC (Kibo) of Korea.
- *Further reduce the dominance of SOEs and the resulting distortion of incentives for innovative entrepreneurial activity* through more transparency in SOE governance, separation of the role of government as owner from its role as regulator, and exposure of SOEs to the same market rules and incentives as competitors.
- *Strengthen market incentives that reward innovation* by continuing to improve enforcement of IPR, creating stronger deterrents to infringement, and increasing the clarity of the relationship between administrative and enforcement agencies.
- *Extend and increase the quality of infrastructure* and link spending to national strategic priorities, in particular for innovation.

Improving public governance of the innovation system

The government performs an essential role in innovation systems at different stages of development. No other actor has an explicit mission to ensure that the innovation system prospers and addresses the challenges and concerns of society at large. Among other actions, the government may provide long-term orientation on priorities, make sure that resources for innovation are adequate in scale and scope, strive for efficient performance by public actors, and ensure that the various components of the system link up and form a coherent whole. While business is the principal source of knowledge generation and use in advanced systems, the business sector's long-term success and contribution to sustainable economic development is dependent on the quality of innovation system governance.

In Viet Nam, the Communist Party plays a central role and guides every aspect of national development policies and orientations. Development programmes for the transitional period and reform, and mid-term (5 years) and long-term (10 years) strategies and plans for national socio-economic development are all subject to approval at the behest of the National Congress of the Communist Party, which forms the basis for providing guidance for legislature and executive branches at the highest level of the state management bodies. The national assembly and the government are both supported by consultative councils and committees. While a number of ministries play a role in the implementation of S&T policy (notably through their institutional control of various academies of science and attached PROs), the leading ministries are those of Planning and Investment (MoPI), Finance (MoF) and, especially, Science and Technology (MoST). MoST is the central actor in the public management of S&T activities. Its functions include the programming of S&T policies, the design of incentive programmes, and monitoring the implementation of the national S&T strategy and plans. In spite of MoST's central position in the planning and management apparatus, co-ordination with

the sectoral ministries tends to be weak. At the regional level, provincial departments of Science and Technology (DoSTs) are in charge of adaptation and implementation of S&T policies, under the supervision of MoST.

MoST delegates some of its functions. Some of the MoST-affiliated departments fulfil state management functions and participate in policy making – the State Agency for Technology Innovation (SATI), the National Agency for Science and Technology Information (NASATI), the National Office of Intellectual Property (NOIP); others have administrative, and policy implementation functions and support policy making – the National Foundation for Science and Technology Development (NAFOSTED), the National Institute for Science and Technology Policy and Strategy Studies (NISTPASS). Other important agencies include the National Agency for Technology Entrepreneurship and Commercialisation Development (NATEC), National Technology Innovation Fund (NATIF), the Directorate for Standards, Metrology and Quality (STAMEQ), the Viet Nam Agency for Radiation and Nuclear Safety (VARANS), etc. International organisations and foreign aid agencies provide both material support and policy advice.

STI policy does not yet appear to be sufficiently recognised as an important, if not central, component of Viet Nam's economic development. One reflection of this is the low level of public resources devoted to R&D, as well as S&T more generally, which must be raised considerably if Viet Nam is to fulfil its ambitious social and economic goals. Another reflection is the seriously underdeveloped STI policy information base. Concerted efforts will be needed to raise the profile of STI within government and economic development policy communities and legitimise increased resources.

Policy orientation is sometimes overly ambitious but targets are not sufficiently specific. Insufficient co-ordination of both the conception and implementation of innovation policies, while not unique to Viet Nam, is another serious constraint. Perhaps most important, however, is a widespread failure to implement decisions in a comprehensive and timely manner which severely limits the effectiveness of policy. High implementation capability is a major ingredient of international experiences of success.

Efficiency and effectiveness are also hampered by the continuous flow of regulatory changes. The way in which these changes have been specified and managed has facilitated the proliferation of red tape and often hindered the needed reforms.

An important constraint on the drafting of appropriate policy and its effective implementation is the insufficient knowledge-base for policy making, including STI statistics and evaluation practices. Strengthening the capacity to produce and distribute relevant and timely information and to draft policy based on informed analysis of robust evidence would be an important pillar of long-term development.

In light of the above, the following means of bringing about improvements in STI governance seem worthwhile:

Commitment to and budgetary clout of STI policy

- *Consider placing strategic decisions on STI policy matters at the highest level of government*. Many countries use high-level committees (e.g. chaired by the prime minister) as a sign of their political commitment to STI policy.
- *Use e.g. the results of evaluations to showcase the tangible economic and social benefits of upgrading STI capacities*. High-profile awards may also help to attract attention to and mobilise interest in STI matters.

Policy co-ordination

- *Improve co-ordination between ministries and agencies,* foster consistency and coherence in strategic visions and sectoral priorities, and increase the involvement of representatives of business enterprises in the formulation of strategies.
- *Complement formal co-ordination mechanisms with "soft" communication and networking* among lower-level policy makers, including representatives of implementation agencies. This could help to design policy that is more likely to be implemented successfully and to minimise possible inter-ministerial friction.

Policy design and implementation

- *Increase innovation policy implementation capacity and foster the accumulation of experience in specialised government departments and agencies*, in order to improve the ability of S&T managers to translate high-level policy orientations into achievable objectives.
- *Facilitate implementation by easing bureaucratic requirements for implementing decisions of administrative bodies*. Strive for openness and transparency in all policy decisions.

Evaluation and evidence base

- *Increase the resources for evaluation in relevant government agencies and departments* and facilitate the development of a community of professional evaluators. Evaluation needs to be pragmatic, timely, transparent and actionable. Move towards evaluations that use policy-relevant, systematic and comparable performance metrics. The system could form the basis for linking the funding of PROs to performance and enhancing public accountability.
- *Improve the analytical base for policymaking, STI statistics and evaluation practices.* Encourage the generation, distribution and analysis of information in a greater number and variety of public organisations. Setting realistic and well-defined goals is important, as the attraction of increased resources will be a reflection of improved credibility to deliver on promises made.

Strengthening the human resource base for innovation

A nation's capacity to innovate depends crucially on the quality of education and training for scientists, technologists and a wide range of creative professionals and on the extent to which the education system is inclusive and ensures a wide pool of available talent.

Viet Nam has made a substantial national effort on education and skills. It has higher primary and secondary enrolments and adult literacy rates than countries of similar income per capita. Adjusted for purchasing power, Viet Nam spends an amount per secondary and tertiary student comparable to wealthier countries such as China. The expansion and institutional differentiation of higher education has been impressive: over the past two decades, student numbers have risen 13-fold and the number of universities has more than tripled. Viet Nam's effort on education has borne fruit. The performance of secondary students from Viet Nam in the 2012 PISA assessment is better than the OECD average, lagging only that of wealthier countries in the region. However, the impact of the effort on education on other areas has been mixed so far.

- There is still scope for improving the quality of education and of skills, particularly at the tertiary and secondary vocational levels. Raising quality takes time and substantial investment of human and financial resources, from pre-school through to vocational and tertiary-level education. International evidence suggests that for innovation, improvements in the quality, rather than simply in the quantity, of education are especially important.
- The country's human resource potential is far from fully used. Average years of schooling are among the lowest in Southeast Asia; there are relatively few vocational offerings in upper secondary education, although the situation is considerably better at the tertiary level. This has a significant impact on both businesses and the public sector. A lack of interest in science and technology appears to limit the take-up of related studies. Moreover, graduates in technical disciplines are much more likely to be men. Funding of tertiary education has been insufficient to cope with the increase in technical and research students and many students choose to study abroad. Brain drain is a significant challenge, owing in part to low salaries and limited opportunities at home. Evidence suggests that brain drain among S&T researchers is a greater problem for Viet Nam than for Malaysia, Thailand, China or Indonesia.
- The skills supplied through the formal education and training system do not meet the demands of the labour market; they are often insufficiently aligned, out of date or too theoretical. Issues of governance, financing and lack of information about the skills in demand constrain the capacity and relevance of higher education. There are few efforts to co-ordinate curriculum development with industry. While firms appear willing to offer internships and collaborate with education providers in other ways, they have difficulty finding partners for collaboration. Insufficient funding for science, technology, engineering and mathematics (STEM) appears to be an important issue.

Businesses are more likely to report skills as an obstacle than firms in Korea, Thailand and China. The magnitude of the problem increases in line with the required degree of skill sophistication. A recent World Bank survey found that employers consistently rated workforce quality and quantity as a greater obstacle than framework conditions such as legislation, related taxes and wage controls, an obstacle that is more pronounced for manufacturing and innovative companies than for services and non-innovative companies. Skill constraints are also evident in the STI policy-making and in the S&T management communities. For their part, universities and PROs find it hard to attract and retain highly qualified staff, given competition from a growing business sector, resource constraints, unattractive working conditions and few opportunities for younger staff. Researchers in the public sector tend to be older and to have poor qualifications.

Lack of suitably skilled human resources is currently the central bottleneck to the development of the national innovation system. The slow pace at which skills are accumulating suggests that removing this bottleneck will take quite some time. International experience and a few success stories in Viet Nam demonstrate that significant gains can be achieved in the short term by attracting expatriates back home.

Tackling these issues requires a richer evidence base, a concerted effort to set priorities, and the resources and policy attention required to deal with each issue. The government therefore should:

- *Increase the quality of education at all levels and in particular address deficiencies in STEM skills provision*. Exposure to mathematics and science of high quality should start early in the education cycle so as to shape future choices. It would be useful to evaluate the performance of STEM and business- and management-related in-service programmes offered by colleges and universities against the standards of regular programmes.
- *Provide more options for professional specialisation in upper secondary education and explore ways to enhance the standing of vocational training and improve facilities at vocational colleges.* The accumulation of innovation capabilities by businesses crucially depends on the availability of qualified professionals.
- *Provide more opportunities for upgrading the skills of those already in the workforce* and improve the effectiveness of short-term training. An expansion of part-time tertiary education and other lifelong learning offerings would help address some of the gaps in "soft" skills and provide a further boost to labour productivity. Overall, policy should pay attention to the effective and efficient use of available human resources in state agencies, research institutes, universities and enterprises.
- *Use public-private partnerships (PPPs) to encourage the business sector to take a greater part in the national effort on education and skills development.* Firms, especially SOEs and MNEs, should be encouraged to increase their investments in training, to fund demand-tailored specialisation or programmes, and to engage in curricula development. This will not only concern STEM but also "soft skills".
- *Ensure that the government's ambitious targets to remove skills constraints in the public sector by 2020 are met*. In addition, explore fellowship programmes for civil servants (including for training and retraining S&T policy makers at central and local levels), academics and outstanding practitioners, as well as needs-tailored support programmes for selected institutions to bring them up to date in terms of S&T management practices and developments in selected fields of science and engineering.
- *Place more emphasis on entrepreneurship and soft skills* such as problem solving, creativity, leadership, communication and teamwork. Consider fostering a move towards multidisciplinary and trans-disciplinary courses, at least in tertiary education. The upcoming 2015 curriculum reform offers a good opportunity to bring about such changes.
- *Consider scholarships for advanced study abroad as a strategic tool for national capability accumulation*. These should ideally form part of broader strategies for science, technology and industrial development and include education and training components that involve or take place in the productive sector.
- *Turn a brain drain into a brain gain*. To address some of the skills constraints, the government could make a significant effort to scout potential returnees and give them powerful incentives (in the form of special remuneration packages and/or key management positions) to return. This should be complemented by the provision of a sound working environment and reduced bureaucratic administrative procedures. If sustained long enough, this process could catalyse other developments, such as attraction of knowledge-intensive investments, improved access to global knowledge production networks, and better training and education of human resources.

Fostering innovation in the business sector

A business sector that thrives on innovation is at the center of all successful national innovation systems. For S&T activities to contribute effectively to high and sustainable economic growth through innovation, they must be undertaken to a significant extent in or in close liaison with businesses. Fostering innovation capabilities and activities in the business sector is a major policy challenge for Viet Nam. It will require essential improvements in framework conditions as well as targeted innovation policy measures, and effective means of attracting and embedding foreign-invested firms.

There are indications that the business sector has a relatively low capacity to absorb highly skilled workers. Nevertheless, for firms which are building innovation capabilities, the supply of skills, rather than business-sector demand, is likely to be the main constraint for some time. Compared to OECD economies, Viet Nam's business sector has low levels of technology adoption and use, as indicated, e.g., by data on ISO (International Organization for Standardization) certification and various forms of information technology. However, its levels of adoption and use are in keeping with, or better than, those suggested by its income per capita.

Up to now, few firms perform R&D and the level of innovation activity is low overall. The results of the 2009 survey by NASATI indicate that total business expenditure on R&D and innovation (RDI) is very low, both in absolute terms and relative to GDP. About two-thirds of this expenditure is used for adaptation and related activities. The state funds about 3% of business RDI directly. SOEs account for nearly one third of total business RDI expenditure. There are now mandatory provisions for state-owned enterprises (SOEs) to deduct a minimum portion of their annual pre-tax profit for setting up scientific and technological development funds. RDI is concentrated in a few sectors and foreign invested firms account for nearly half of both RDI and R&D expenditures. Domestic patent and, especially, trademark applications suggest a modest improvement in innovation capacities over the past decade. However, estimates of firm-level total factor productivity suggest low levels of innovation relative to firms in comparable countries, though there are indications of improvement over time, particularly in sectors with high FDI and SOE involvement. As could be expected, data on international patent applications suggest that "new-to-the-world" innovation remains exceptional.

The overarching innovation policy objective for Viet Nam is to facilitate accumulation of in-house innovation capabilities in a wide range of enterprises. These capabilities typically relate to the skills and experience needed to engage in sophisticated business activities in design, engineering, marketing, information technology and, in more advanced contexts, R&D. The policy effort required is multifaceted. It involves increases in innovation capabilities in a much greater number and variety of firms and the attraction and integration of knowledge-intensive FDI projects which hinges on the upgrading of national innovation capacities in local enterprises and the quality of universities and PROs.

Public resources in support of business R&D and innovation are low in absolute terms and in relation to GDP. Moreover, their leverage is limited by a number of factors such as a bias towards SOEs, a narrow focus on technological innovation, and shortcomings in the design and delivery of programmes. Tax incentives have proliferated in recent years but little information is available on their effectiveness; for R&D and innovation, they may have replaced rather than complemented direct funding instruments. The development of innovation capabilities in SMEs is particularly challenging, given their diversity and differing needs.

There has been a proliferation of sectoral programmes with no mechanism in place to ensure effective co-ordination and a balance between such selective approaches and more horizontal/thematic, including the business environment or economy-wide support for R&D and innovation together with a lack of effective co-ordination have made it difficult to set priorities effectively. In OECD economies, sectoral targeting has largely been supplanted by more horizontal policies and new approaches to selectivity, such as cluster-based policies and "smart specialisation" in areas of revealed comparative advantage. These approaches rely largely on STI policies as a means to spearhead industrial development. Some of the successful emerging economies have developed their own "clever" or adaptive approaches of prioritisation – experiences from which Viet Nam could benefit.

Develop firms' innovation capabilities

- *Consider expanding public support for business R&D and innovation conditional on consolidating and improving the design and delivery of support schemes and fostering accountability through evaluation*.
- *Focus efforts on the goal of supporting the accumulation of in-house capabilities* (in design, engineering, marketing, information technology and R&D) in enterprises.

Attract and integrate knowledge-intensive FDI

- *Take additional measures to attract more knowledge-intensive FDI*. Better policy co-ordination (including investment incentives) in the design of sectoral policies and the management of industrial parks will help.
- *Provide more opportunities for knowledge spillovers between domestic and foreign-invested firms.* This would include encouraging labour mobility between sectors as well as capacity-building measures to help bridge the large productivity and quality gaps between foreign-invested and domestic private-sector firms that currently impede forward and backward linkages.

Maximise the impact of limited public resources

- *Increase the budgetary resources for funding proven/promising public support schemes, alongside measures to improve their design and implementation*. In this context, consider an (external) evaluation of current programmes that support business innovation, starting with a comprehensive inventory. This could be led by MoST-VISTEC, in co-operation with MoPI and in consultation with the S&T departments of key sectoral ministries.
- *Consider the use of matching-fund mechanisms, e.g. to enhance the effectiveness and efficiency of the National Technology Innovation Fund (NATIF)* in supporting firms' investment in technological innovation.
- *Consider streamlining existing tax incentives and simplifying the tax treatment of R&D in line with international good practices.* MoST-VISTEC, in co-operation with MoF and MoPI, appear best suited to lead an evaluation of the tax treatment of R&D and innovation-related investment.
- *When deciding on priorities for building innovation capacities, seek to relate national strengths to emerging global opportunities.* Consider a suitably adapted public-private partnership (PPP) pilot programme for R&D and innovation that

would help focus attention and resources, leverage additional resources, and improve co-operation between public research and domestic and foreign-invested business actors.

Increasing the contribution of public research

In advanced innovation systems around the world, universities and PROs – in varying combinations – fulfil important functions in terms of skills generation, formalisation/ standardisation of knowledge and provision of services that are insufficiently provided by markets, including some types of basic research, dissemination services and social innovation. At the same time, these advanced systems have the business sector at their core, which typically performs and finances the larger part of R&D. In Viet Nam as in other emerging innovation systems, it is public research that dominates in terms of R&D expenditure and R&D workforce. Moreover, most public research in Viet Nam and other emerging countries takes place in PROs rather than in universities and is currently spread across many rather small PROs in a few geographic locations.

Historically, Viet Nam's small public research sector focused largely on various types of mission-oriented research and technology absorption. In this sense it acted as somewhat of a substitute for the in-house S&T capabilities of production enterprises. The public research sector has undergone some profound changes, with the number of public R&D-performing bodies almost doubling from 1990 to 2000. As a result of reforms, they are also beginning to fulfil more varied functions. Yet, the public research sector still retains some features of the Soviet-style system, with its separation from production and universities' limited engagement in research. The path of reform has not been consistent but has oscillated between centralisation and autonomy, expansion and contraction, owing, among others, to the difficulties of reconciling the public research system with the needs of a rapidly changing Vietnamese society and economy. Notwithstanding progress made after the adoption of the 2000 Law on Science and Technology, procedures can be further improved and extended to make the allocation of funding more performance-based.

Given its trajectory, a lack of evaluations and comparative information, the current state of Viet Nam's public research system is difficult to compare to that of other countries. However it seems clearly less well connected to the business sector than that of China and is much less strong scientifically than that of the Russian Federation. Low public R&D capacities have been matched by equally low demand for related services from the business sector. Viet Nam's public research sector is large relative to other actors of the national innovation system, but is quite small by international standards. Some success stories notwithstanding, many factors limit the contribution that Viet Nam's PROs and universities can currently make to innovation.

Major problems requiring urgent attention and corrective action are:

- *Overly complex organisational features* and a very large number of often overlapping laboratories and R&D units in ministries or under VAST and various government agencies, many of which are of sub-optimal scale.
- *Lack of resources.* Whereas many research bodies suffer from insufficient funding, almost all, including universities, suffer from a lack of sufficiently qualified personnel. Research activity of universities and PROs is also hampered by poor research infrastructures.

- *Distance from national end-users and from global knowledge networks. S*ome organisations or teams have been able to seize new opportunities across the R&D spectrum, ranging from basic research to near-market technological development. However, there are many more whose research fails to reach the level necessary to gain international recognition and/or fails to deliver sufficient value to others actors of the economy and society.

Relating Viet Nam's national setting to international experience suggests that future policy development for PROs and universities could focus on addressing resource constraints while enhancing their economic relevance while bringing about more wide-ranging and effective institutional reform of steering and funding public research.

Address resource constraints

- *Strengthen funding of universities' and PROs research but make more funds conditional on institutional reform and increasingly link them to their performance.*
- *Strengthen the capacity of universities and PROs to attract and retain high-quality staff*. This will require more funding and better working conditions. Changes in recruitment, retention and promotion procedures may also be necessary to address the underrepresentation of younger staff and to attract diaspora and other international talent.
- *Devise a national policy to address the lack of research equipment and associated infrastructures.* Policy design will have to start with a comprehensive identification of needs, specific investment planning for infrastructures, and an exploration of possible changes in rules and regulations to allow for the sharing of infrastructures. Another dimension of this effort would be to explore international options for access to very expensive research infrastructures and the possibility of cost sharing with enterprises.

Enhance economic relevance

- *Define a clear division of labour between universities and PROs, and clarify the desired balance between the main functions of PROs.* Clarity of purpose should facilitate long-term specialisation and ensure that the public research sector increasingly contributes to the national effort to develop a market-oriented production sector that thrives on innovation.
- *Strengthen the role of PROs in the education and training of highly qualified personnel for the business sector*. Changes in rules that facilitate intersectoral staff mobility and active participation in corporate training activities can help diffuse experience with the performance and management of R&D acquired in a PRO.

Profoundly restructure the governance of PROs and research universities

- *Consolidate the public research sector based on national research priorities*.
- *Continue the process of corporatisation towards granting institutional autonomy and self-responsibility of the corporatised PROs.*

- *Merge the remaining, non-corporatised PROs into fewer, better performing organisations with the objective to enhance their viability and foster the alignment of their research with socioeconomic priorities through clarifying their missions and funding.*
- *Accompany the move towards greater organisational autonomy of research organisations by the gradual strengthening of performance-based funding.*
- To *carry out this restructuring, enhance the co-ordinating role of MoST at the strategic, policy supervision level. At the same time consider embracing a new model in which a limited number of (funding) agencies could play a constructive role in streamlining the portfolio of remaining PROs.* (For example, consider adopting – with the necessary adaptation to national conditions – the Korean model of management at agency level of a diversified portfolio of PROs.) This should be done without complicating an already over-populated institutional landscape by building around existing organisations such as NAFOSTED.

Fostering innovation linkages

Available evidence suggests that there is little collaboration on innovation, either between firms or between firms and public research actors. Among firms that innovate, few work with other firms and even fewer with universities. The foreign investment sector does not appear to be connected to the local research system; there seem to be difficulties for establishing not only innovation linkages to domestic private firms but even more routine supply relations, owing to differences in the quality required and the quality available.

The establishment of industrial parks has been a major policy instrument to attract FDI projects and strengthen linkages. While there have been positive experiences their results have not always lived up to expectations. Concrete evidence on their impact on innovation linkages is currently lacking.

Of course, the low level of innovation capabilities in the vast majority of enterprises and the few resources devoted to innovation throughout the system affects the potential for collaboration. However, there is probably considerable room for enhancing linkages even under current conditions. The absence of incentives both in universities and in public research and the lack of dedicated intermediary organisations such as technology transfer offices point to an area that deserves policy attention in this respect. As the public research system and the national innovation system develop further, ancillary services with an explicit knowledge transfer and commercialisation mission will arguably become more important in terms of offering advice on intellectual property, the local technology market as well as active outreach to firms, particularly SMEs. While alignment with the needs of industry is an immediate concern, care should also be exercised to develop a critical mass of core scientific capabilities. The provision of high quality skills is a key function of universities, but has to become a major function of public research organisations.

The following policy recommendations seem especially relevant in this respect:

- *Closely examine organisational and individual performance incentives in universities and PROs* with a view to encouraging more collaboration with industry and integration with national and international S&T networks.

- *Examine all other institutional arrangements applying to universities and PROs that may hinder such collaboration.*
- *Encourage the establishment of training partnerships between vocational education providers, universities, foreign-invested enterprises and domestic firms* to bridge the large productivity and quality gaps between foreign-invested and domestic private enterprises. SOEs could act as intermediaries in such partnerships, given their extensive involvement with the foreign-invested sector and their knowledge of the local business environment.
- *Consider an assessment of the impact of industrial parks* on the international integration of domestic private industry and the generation of knowledge spillovers, including by way of formal collaboration on innovation.

Note

1. In this context it should be noted that in contemporary GVCs, industries classified as "high technology" on the basis of widely used international classifications may actually perform low value-added assembly using high-value imported intermediates in certain locations; this may overstate the sophistication of the activity performed.

Chapter 2

Economic performance and framework conditions for innovation in Viet Nam

This chapter discusses the robust economic growth Viet Nam achieved based on openness to international trade, foreign direct investment and integration in global value chains, but which has slowed down somewhat recently. It highlights the composition of exports which until recently has been dominated by low value-added, low-technology goods. The chapter then looks at the current state of framework conditions for innovation which, in a number of ways, constrain innovative activities. It concludes with a discussion of the role of science, technology and innovation as a driver of Viet Nam's future economic development.

During both decades since 1990, Viet Nam's GDP grew at an annual average rate exceeding 7%, well above that of most other East Asian economies except China. Moreover, Viet Nam weathered the global financial crisis of 2007-08 easily, with only a modest deceleration in the rate of growth. GDP rose by 6.2% in 2011 but has since slowed and is projected to grow in the low 5%-range in the years to 2015 (World Bank, 2013). Viet Nam's aim is to develop more rapidly as its population climbs from an estimated 89 million in 2013 to over 100 million by 2025 (Ministry of Planning and Investment, 2011).[1]

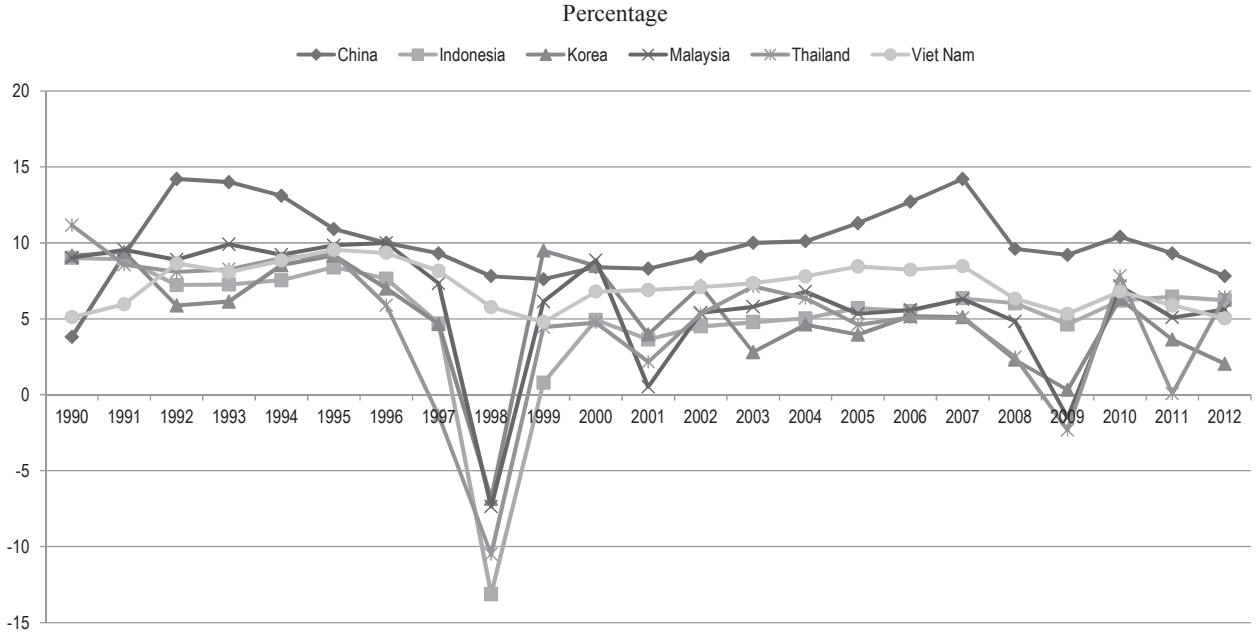
Viet Nam is located in a region that has demonstrated remarkable economic prowess. Its northern neighbour, China, is now the world's second largest economy and one of the fastest growing. East Asia now accounts for over a quarter of global GDP and represents a market of more than 2 billion consumers (World Development Indicators). Owing to its size and increasing prosperity, it seems partially insulated from economic swings elsewhere in the world. Viet Nam has benefited from its gradual integration into the Asian regional production network, which includes China, Thailand, Malaysia, the Philippines, Chinese Taipei and others. In short, recent trends in Viet Nam, the economic health of the East Asian region and its medium-term prospects all suggest that with suitable policies and progress in structural reforms, Viet Nam should achieve its broad economic objectives. However, international experience indicates that accelerated growth does not necessarily continue and that it tends to revert to a mean (Easterly et al., 1993; Durlauf et al., 2005). Countries that have maintained their momentum have done so through a supportive environment and appropriate policy initiatives. Recent empirical research, for example, finds that countries which have acquired sufficient human capital and succeeded to climb up the technology ladder are less likely to experience a growth slowdown (Eichengreen et al., 2013).

In the medium term growth will continue to derive considerable impetus from capital investment. This will help to absorb the transfer of workers from agriculture into more productive employment in urban activities. However, Viet Nam's growth in the longer run will be increasingly tied to gains in productivity stemming from continuing technological catch-up, initially driven by technology embedded in capital goods, increasingly from process and product innovations based on growing domestic innovation capabilities, and from innovations that make institutions and organisations more effective and efficient. China has demonstrated how institutional reforms in agriculture and state-owned enterprises (SOEs) can promote economic performance. In the 1990s, it started to invest in building its domestic innovation capabilities and is now in the process of reshaping the international division of labour, including in knowledge production. Innovative Korean firms have been largely responsible for the country's ascent into the ranks of high-income nations. Nurturing and realising Viet Nam's potential for innovation as a source of economic growth and development will require proactive policy efforts, an open and competitive environment, and progressive diversification into manufacturing and service activities that increase domestic value added and generate technological spillovers. Greater integration in value chains that link key industries in the Asian region and in value chains that straddle the globe and provide avenues for moving into more sophisticated activities will also help.

2.1. Macroeconomic performance and productivity growth

Following the Doi Moi, political and economic reforms aimed at opening the economy in the 1980s, Viet Nam has grown faster than most other countries in the East Asian region except China.[2] Growth averaged 7.4% a year between 1990 and 2000 and 7.2% a year between 2000 and 2010. Viet Nam has been resilient to past external shocks. During the Asian crisis of 1997, in particular, and to a lesser extent during the recent global financial and economic crisis, other Southeast Asian countries experienced severe recessions, with persistent effects in some countries, while Viet Nam consistently maintained growth at an annual rate close to 5%. Viet Nam has also weathered the global crisis of 2007-08 well but has finally recorded a slowing of growth from 8.5% in 2007 to 6.8% in 2010 and to 5.2% in 2012 (Figure 2.1). Recent projections indicate that GDP growth may remain in the range of 5% (World Bank, 2013).

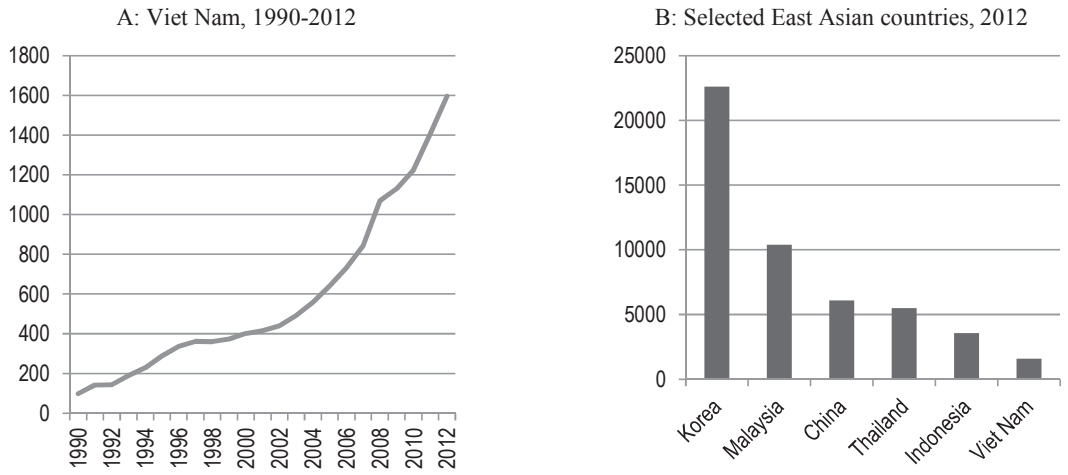
Figure 2.1. Annual growth of GDP, selected Southeast Asian countries 2000-12



Source: World Bank.

Viet Nam's consistent growth has raised GDP per head from USD 98 in 1990 to almost USD 1 600 in 2012. Viet Nam now ranks among the lower-middle-income countries on the World Bank's classification. However, compared to other Southeast Asian countries, its GDP per capita is still relatively small, less than half that of Indonesia and less than one-third that of China (Figure 2.2).

Figure 2.2. GDP per capita



Source: World Bank, World Development Indicators.

Over the longer term, Viet Nam, like several of its East Asian neighbours, has been successful at mobilising domestic savings and achieving high levels of investment. Foreign direct investment (FDI) as a percentage of GDP exceeded rates in other Asian countries (Table 2.1). Domestic savings increased from 18% of GDP in 1995 to over 29% in 2011, and combined domestic and foreign investment rose from 27% to 30% from 1995 to 2011. Growth was also pulled by rising exports: the ratio of exports to GDP more than doubled between 1995 and 2011 from 33% to 87%, a much higher ratio than in Thailand but slightly lower than in Malaysia (Table 2.2). Domestic investment, supplemented by FDI, has been more than adequate to meet growth targets in the past, but investment rates have declined in recent years.[3] FDI remains high but has been declining as a share of GDP (World Bank, 2013, p. 19). Future growth will require, in addition to maintaining national investment at close to 30% a year for the next two decades, efficient capital investment and use of capital, the creation of needed transport and ICT infrastructures, and an increase in innovation capacities in the business sector. The role of innovation in this respect is discussed later in this chapter.

Table 2.1. Gross domestic savings and foreign direct investment as a percentage of GDP, 1995-2011

	Gross domestic savings (% of GDP)		FDI, net inflows (% of GDP)	
Country	**1995**	**2011**	**1995**	**2011**
China	43.54	52.49	4.92	3.83
Indonesia	30.59	34.20	2.15	2.27
Korea	36.57	31.52	0.34	0.43
Malaysia	39.71	39.48	4.70	4.17
Thailand	35.35	31.16	1.23	2.25
Viet Nam	18.05	30.77	8.59	6.01

Source: World Bank, World Development Indicators.

Table 2.2. Exports of goods and services as a percentage of GDP, 1995-2011

Country	1995	2011
China	20.23	31.36
Indonesia	26.31	26.34
Korea	28.83	56.25
Malaysia	94.09	91.56
Thailand	41.84	76.94
Viet Nam	32.81	86.96

Source: World Bank, World Development Indicators.

In sum, the broad economic indicators present a reasonably favourable picture of Viet Nam's performance and prospects. These, and projections for the global and East Asian economies, suggest that growth in the range of 4.5-6.0% a year is easily within reach (Breu et al., 2012, p. 19). However, sustaining a rate between 7% and 8% a year will require extracting more mileage from capital investment and augmenting productivity growth through efficiency gains and innovation which requires additional effort.[4]

An increase in GDP per capita can be achieved either by raising the employment rate (labour utilisation) (e.g. by reducing unemployment) or by increasing labour productivity (see Box 2.1), or through a combination of the two. Once an economy achieves high levels of labour utilisation, the only way to increase GDP per capita is to boost labour productivity.[5] Increases in labour productivity may result from capital deepening (an increase in capital intensity, measured by capital input per hour worked) or total factor productivity (TFP), the overall efficiency of the use of production factor inputs (see Box 2.1).[6] Labour quality also plays a role. In the short term changes in labour productivity are influenced by fluctuations in the level of economic activity. Rapid capital deepening tends to be characteristic of the earlier phases of industrial development. In the East Asian region, Japan and Singapore recorded rapid capital deepening in the 1970s and 1980s. Viet Nam and other emerging economies have followed the same pattern. Over 1970-2010, capital deepening contributed some 50% or more to labour productivity growth, with considerable variation across countries and over time (APO, 2012).

Box 2.1. Labour productivity and total factor productivity

Labour productivity shows how productively labour is used to generate gross output. Changes in labour productivity reflect the joint influence of changes in capital and intermediate inputs, as well as technical and organisational changes and changes in efficiency within and between firms, the influence of economies of scale, varying degrees of capacity utilisation, and measurement errors. Labour productivity reflects how efficiently labour is combined with other factors of production, how many of these other inputs are available per worker and how rapidly embodied and disembodied technical change proceeds. Depending on the definitions of output and labour input, labour productivity can be measured in terms of GDP per working hour or per worker.

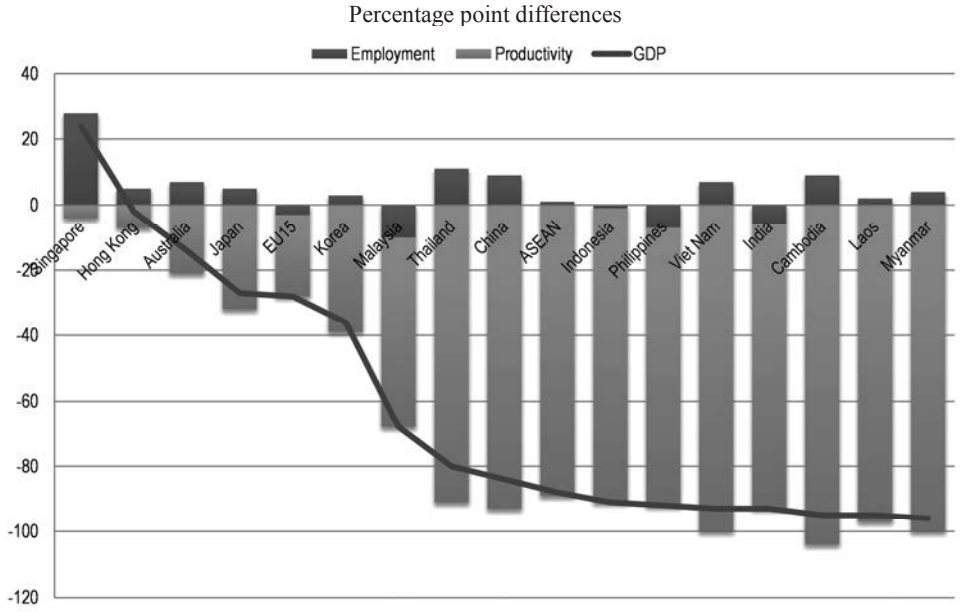
From a growth accounting perspective, the growth of output can be broken down into changes in the amount of capital and labour and changes in TFP. In more recent growth accounting studies, capital is separated into information technology (IT) capital and non-IT capital to reflect the increasing impact of IT, a "general purpose technology" in modern economies, on productivity in a wide range of sectors, including services. Labour input is another key factor of production (important for estimates of TFP); it can be measured by actual hours worked or numbers of workers. …/…

Box 2.1. Labour productivity and total factor productivity *(continued)*

Total factor productivity shows how productively combined inputs are used to generate gross output and measures the efficiency of inputs used in production. It is a broader measure of productivity efficiency than labour productivity since it takes all input categories into consideration. It is the part of growth that cannot be explained by the accumulation of the traditional inputs of physical capital and labour. TFP growth is measured by deducting from output growth the growth of labour and capital inputs. The growth rate of both inputs is weighted with their share in total costs. TFP growth reflects the impact of technological progress and innovation more generally. It consists of two components, technological progress (TP) and technical efficiency change (TEC). TP is due to technological innovation, technology diffusion and technology introduction. TEC derives from improvements in the management of production processes and resource allocation, organisational change and scale efficiency. For example, better management enables a firm to be more productive with the same level of inputs and technology, and more flexible labour markets result in a more efficient allocation of labour across firms and industries.

Source: OECD (2001), *Measuring Productivity: OECD Manual*, *Measurement of Aggregate and Industry-level Productivity Growth,* OECD Publishing, http://dx.doi.org/10.1787/9789264194519-en; Hanel (2008), *Productivity and Innovation: An Overview of Issues,* Note de Recherche for the Centre Interuniversitaire de Recherche sur la Science et la Technologie, University of Quebec Press, Quebec.

Figure 2.3. Labour productivity and employment gap relative to the United States, 2010



Note: Breakdown of per capita GDP gap at constant market prices, using 2005 PPPs.

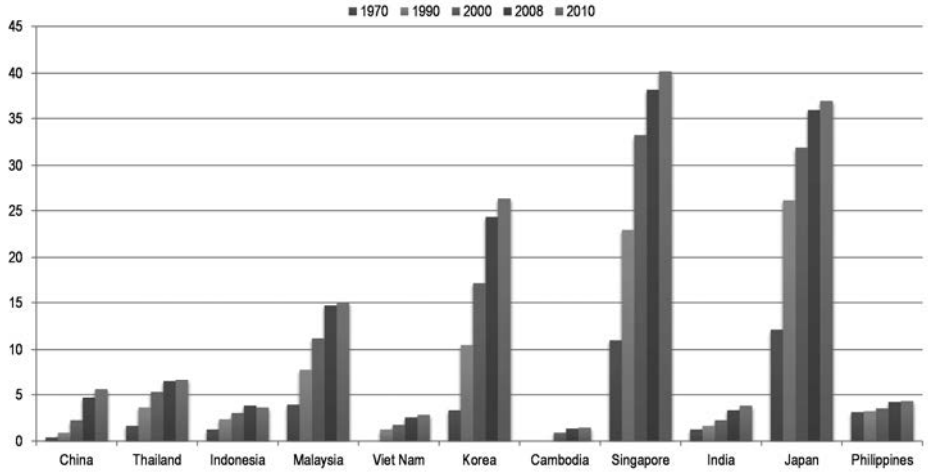
Source: APO (2012), *APO Productivity Databook 2012*, Keio University Press, Tokyo, based on official national accounts, including adjustments.

A closer look at the income gap that separates Viet Nam and most Southeast Asian countries from advanced economies can help identify the scope for raising productivity. By breaking down the difference in GDP per capita between two economies into the gap in labour productivity and the gap in employment (or labour utilisation), it becomes apparent that, compared to the United States, the gap in GDP per capita of Viet Nam and most other Southeast Asian economies can be attributed (almost) entirely to lagging labour productivity (Figure 2.3). The same holds true in comparison to Japan or the

European Union, although the gaps are smaller. The labour productivity gap is also the main factor behind lagging GDP per capita in China and India and the much smaller gap that still separates Korea from the United States. Labour productivity in Malaysia, and to a lesser extent Thailand, compares favourably to the other Southeast Asian economies; Singapore is the great exception.

As the above breakdown suggests, levels of labour productivity are still modest in most Southeast Asian economies. In particular, levels in Viet Nam are low in comparison to other countries in the region, except Cambodia (Figure 2.4). Viet Nam has progressed rather slowly and has failed to achieve the large increases in labour productivity realised in earlier phases by Singapore, Korea and Japan. A powerful – and in the long term the most powerful – driver of labour productivity growth is innovation, including process or product innovations and technological or non-technological innovations (which often occur in combination).

Figure 2.4. Levels of labour productivity per hour worked, 1970-2010



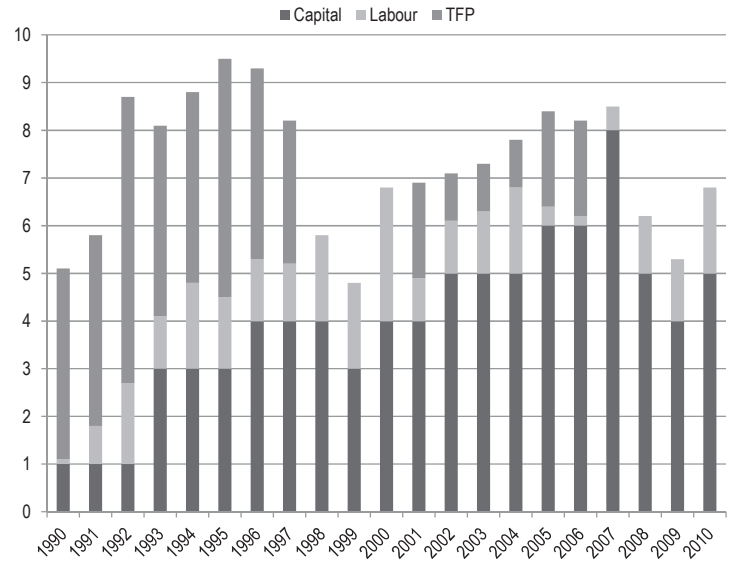
Note: GDP at constant basic prices per hour, using 2005 PPPs, reference year 2010, USD.

Source: APO (2012), *APO Productivity Databook 2012*, Keio University Press, Tokyo.

Labour productivity is driven by capital deepening and TFP. According to a 2011 World Bank Update for East Asia, "While initially not very high, total factor productivity (TFP) improvements have strongly contributed to growth in the years after the Asian crisis. When capital accumulation fell after the crisis, countries that were able to increase total factor productivity grew faster. If the middle-income countries were accumulating capital at the average historical rate, they would need to facilitate even faster improvements in total factor productivity to achieve growth rates of around seven per cent. In some countries, these improvements would need to make up for the declining labour force and for the naturally slowing growth in capital stocks" (World Bank, 2011b, p. 37).

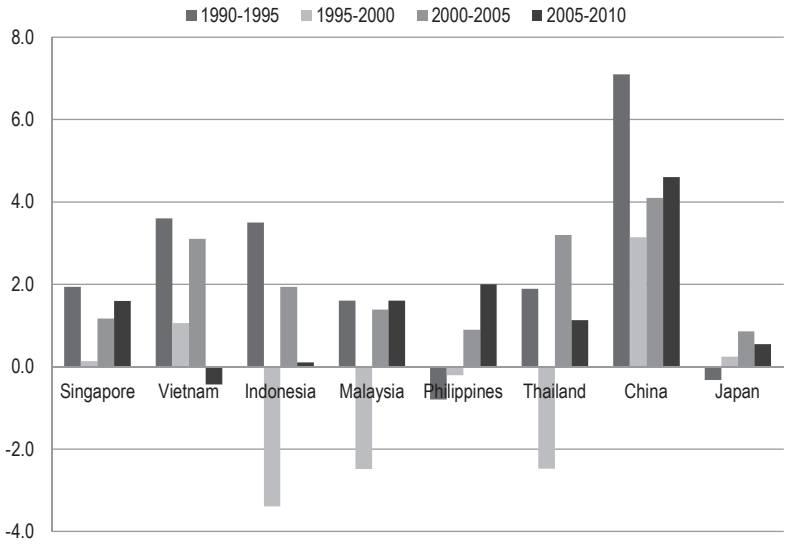
In Viet Nam TFP growth was highest during the 1990s before the Asian crisis – it is not uncommon to reap high gains in early stages of reform – and again in the 2000s before the global financial and economic crisis when technological catch-up was brisk (Figure 2.5). TFP growth has since come to a standstill, however, a situation that needs to be reversed. Since the early 2000s capital has clearly been the strongest driver of growth, particularly in 2007 in the lead-up to the crisis, when it reached 8%.

Figure 2.5. Growth has increasingly been driven by factor accumulation rather than productivity



Source: CIEM (2010), from Asian Development Bank et al. (2012), *Vietnam Development Report 2012: Market Economy for a Middle-Income Vietnam*, Joint Donor Report, Vietnam Development Information Center, Hanoi.

Figure 2.6. Total factor productivity growth, selected countries, 1990-2010



Source: APO (2012), *APO Productivity Databook 2012*, Keio University Press, Tokyo.

Results of a growth accounting exercise carried out by the Asian Productivity Organisation for a set of Asian countries over three decades (APO, 2012) also point to Viet Nam's weak TFP performance in the second half of the 2000s relative to countries such as Malaysia and, in particular, China, which has maintained and even accelerated its already high rate of TFP growth.[7] Box 2.2 summarises major developments in the contribution of (physical and IT) capital, labour and TFP to growth in Southeast Asian economies.

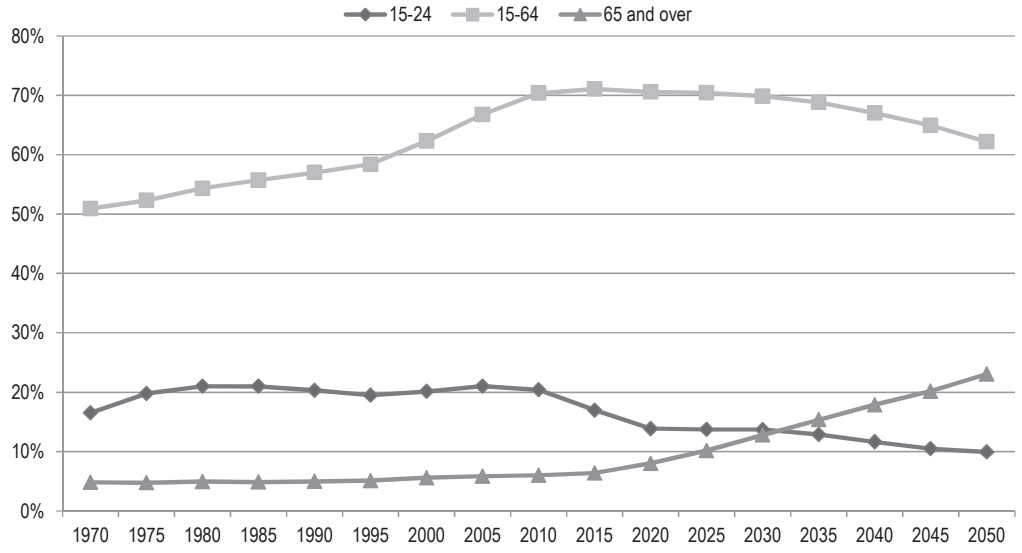
Box 2.2. Shifting contributions to growth in Southeast Asia

According to the Asian Productivity Organisation, the accumulation of (physical) capital accounted for two-thirds to three-quarters of growth in Southeast Asia during the period 1970–85. This suggests that it was a necessary part of embarking on catch-up. In "subsequent periods, the contribution of capital input became progressively smaller, falling to a share of below 50% on average, while the contribution of TFP became progressively more significant, rising to a share of above 40 per cent on average in the 2000s" (APO, 2012, p. 79). Another important trend is the rise in the contribution of information technology capital (in the physical capital category). During 1970-85, IT capital accounted for less than 5% of economic growth in Southeast Asian countries. By the 2000s, its share exceeded 5% in most countries, with the notable exception of Indonesia (2%), the region's largest economy. Between 1985–2000 and 2000–10, the contribution of IT capital more than doubled in Viet Nam and Malaysia, increasing from 3% to 7% and from 5% to 14%, respectively. This is consistent with the region's transition from a low-income, capital-deficient region to an increasingly middle-income, capital-abundant region, and the advent of diminishing marginal returns to capital (Park and Park, 2010). Technological change and more sophisticated and therefore more demanding forms of innovation are likely to become more prominent in the future.

Over four decades (1970–2010), TFP grew in almost all Southeast Asian economies, except the Philippines. In Thailand and Viet Nam (data available from 1986) it grew by 1.8%, twice as much as in Indonesia (and the United States for comparison), but much less than in China (3.2%). TFP grew by a meagre 0.5% in Singapore and Malaysia and even declined by 0.2% in the Philippines. In the wake of the Asian crisis (1995-2000), TFP growth in all Southeast Asian countries, except the Philippines, fell sharply, but Viet Nam and especially China maintained growth. During 2000-05, Southeast Asian countries' TFP growth picked up again.

Source: Adapted from OECD (2013a), *PISA 2012 Results: What Students Know and Can Do – Student Performance in Mathematics, Reading and Science (Volume I),* PISA, OECD Publishing, http://dx.doi.org/10.1787/9789264201118-en, based on APO (2012), *APO Productivity Databook 2012*, Keio University Press, Tokyo.

Figure 2.7. Viet Nam's working age population is soon declining



Source: UN Population Prospects Database, medium variant.

The growth of the labour force is an additional, albeit diminishing, source of growth. The scale of its contribution depends on the vintage of capital that the labour force works with as it transfers to the urban economy. Figure 2.7 indicates that the share of the workforce in the prime age groups starts declining after 2010.[8]

Earlier stages of development require much more capital because a country must first build a production base (i.e. provide its workforce with modern tools, equipment and facilities) and infrastructure. Once that has been done and much of the workforce has been absorbed (with capital-to-labour ratios approaching those of middle-income countries), the need for physical capital diminishes. While Viet Nam is still in the phase in which capital acts as a principal driver, this process already entails a host of local innovations. Moreover, its longer-term growth prospects are likely to be linked to factors that determine the course of TFP. Even as it builds its economic foundations, maintaining performance requires attention to crafting an innovation system that will lead to steady improvements in factor productivity. As noted by Breu et al. (2012), growth of 7-8% a year in GDP would require a near doubling of growth in labour productivity to 6.4% a year. This would require innovations that increase productivity in existing lines of production and, more importantly, accelerate the transition from light manufacturing and processing activities to higher value-added medium-technology industries. As Bangladesh is discovering, a continuing focus on textiles, garments and similar industries does not advance a country's development.

2.2. Globalisation and structural change

Viet Nam's economic renaissance was initiated by the Doi Moi reforms that began in 1986 (Trung et al., 2006). It accelerated after 1989 following the breakup of the USSR, which had been Viet Nam's principal trading partner and economic bulwark. A Foreign Investment Law introduced in 1987 began opening the country up to overseas investment (Freeman, 2002) and subsequent emendations to laws and other regulations[9] enhanced its attractiveness to foreign investors. Sound macroeconomic policies served to maintain stability, and trade reforms, culminating in Viet Nam's accession to the World Trade Organization (WTO) in January 2007, led to a progressive lowering of barriers to trade. By 2008, Viet Nam's weighted mean tariff on all products was down to 5.2% and was 5.7% on manufactured products (World Bank World Development Indicators, 2011). FDI and trade reforms helped boost flows of investment and exports (Bank of Tokyo-Mitsubishi UFJ, 2010; Thanh and Duong, 2011).

FDI contributed nearly 12% to Viet Nam's annual fixed capital investment in 2006 and 24% in 2008, while the stock of FDI as a share of total investment rose from 25% in 1990 to 46% in 2005 and 56% in 2008 (Ketels et al., 2010). In the 1990s, FDI favoured the protected heavy industry, communications, construction and transport sectors. By 2005, 70% of FDI stock was in manufacturing and 6% in real estate. By 2010 the share of manufacturing was down to 30%, although the absolute amount rose, while real estate absorbed 34% with power, transport and construction together accounting for 28% of the total. However, investment in manufacturing has been slow to rise and most FDI has been in low-technology manufacturing, with some change on the way recently. Even in the Hoa Lac High Tech Zone (see Chapter 5), there has been limited technology-intensive production (Ketels et al., 2010, p. 45). Foreign-owned firms (foreign-invested enterprises – FIEs) produce 43% of industrial output and are responsible for 53% of Viet Nam's exports by value. Recent data indicate that the foreign sector contributes 63.1% of merchandise exports in 2012 (Table 2.4), and recorded a percentage change of export

value of 4.8% and 31.1% in 2011, and 2012, respectively. As in other Southeast Asian countries, the technological spillovers from FDI seem to have been meagre; this partly accounts for the low domestic value added in most manufactured exports. For example, Japanese electronics manufacturers such as Canon continue to rely on Japanese subcontractors to supply parts for laser printers. Horizontal spillovers are hampered in particular by Viet Nam's lack of the technological capabilities needed to meet the demands of Japanese assemblers for high-quality components, tight delivery schedules and continuous improvements in productivity to achieve a steady lowering of prices.

Structural changes supported growth.[10] The share of the urban population increased from 20% in 1990 to 30% in 2010 (the almost 26 million urban residents in 2010 were twice the number two decades earlier). This is likely to continue at a trend rate of more than 3% a year. As the economy's centre of gravity shifted, the share of agriculture in GDP fell to 21% in 2010 from 27% in 1995. The share of manufacturing climbed to 26% and of industry to 41% in 2010[11] on the back of growth averaging over 10% a year. Almost 38% of GDP was sourced from services in 2010. In 1992, Viet Nam's exports were mainly food, fuel and agricultural products.[12] Per capita manufactured exports rose from USD 87 in 2000 to 417 in 2009 (UNIDO, 2011). The period also saw the emergence of two large urban-industrial agglomerations centred on Hanoi and Ho Chi Minh City.[13] Together they generated over 40% of Viet Nam's GDP and 30% of its industrial output in 2010.

The composition of Viet Nam's industry is evolving, although much of the country's modern productive capacity remains in low value-added and low-technology processing and assembly manufacturing activities and low-end tradable services. This may be changing with the entry of a number of high-technology MNEs such as Canon, Intel, Fujitsu, Tokyo Micro, Renesas, Huawei, Samsung, LG Electronics, Foxconn and others, and this seems to be evidenced by the recent rise of "high-technology" assembled exports (see below). Value added in textiles is in the 40% range, but under 10% in electronics and transport equipment (Breu et al., 2012, p. 91). Business process outsourcing (BPO) and web-based services[14] are taking root slowly because of a shortage of skills and a business ecosystem that is unevenly supportive. By investing in innovation capacity, the government can begin easing some of the constraints on technology absorption and productivity growth. However, demand for innovation must play a leading role. The pattern of investment – local as well as foreign – will pace and structure the deepening of innovation capabilities across industries.

The economy-wide distribution of investment (Table 2.3) and new entries adds vital detail by pointing to favoured sectors and in particular to the emergence of subsectors with greater productivity potential, R&D intensity and scope for innovation. These may be in manufacturing or services. Net new entry brings out the vigour of entrepreneurship and the intensity of Schumpeterian creative destruction and can be a leading indicator of growth as well as of technological advance. The increase in investment is greatest in energy production and telecommunications; this helps to ease developmental constraints and promote investment and new entry in higher-technology activities, such as the production of office and telecommunication equipment and computers.

Table 2.3. Viet Nam's state and foreign direct investment, by industry 2005-10

	Total investment USD millions		State investment USD millions		FDI USD millions	
	2005	2010	2005	2010	2005	2010
All industries	14 611	35 092	7 771	15 206	6 840	19 886
Manufacturing	5 468	7 275	650	1 296	4 818	5 979
Real estate activities	538	7 158	78	330	461	6 828
Electricity, gas, steam and air conditioning supply	1 155	5 498	1 135	2 546	20	2 953
Transportation and storage	2 291	3 631	1 607	2 750	684	881
Construction	498	2 522	327	706	171	1 816
Activities of Communist Party, socio-political organisations; public administration and defence; compulsory security	518	1 208	518	1 208		
Mining and quarrying	711	1 025	655	1 020	56	6
Information and communication	433	958	433	852		107
Agriculture, forestry and fishing	606	927	555	890	51	36
Wholesale and retail trade; repair of motor vehicles and motorcycles	198	779	99	317	99	462
Education and training	448	629	423	555	26	75
Human health and social work activities	465	617	262	411	203	206
Water supply, sewerage, waste management and remediation activities	321	598	321	588		10
Accommodation and food service activities	95	501	33	185	62	316
Other activities	250	439	250	423		16
Arts, entertainment and recreation	206	430	164	368	42	62
Professional, scientific and technical activities	102	361	102	289		72
Financial, banking and insurance activities	180	268	35	209	146	59
Administrative and support service activities	127	268	127	263		5

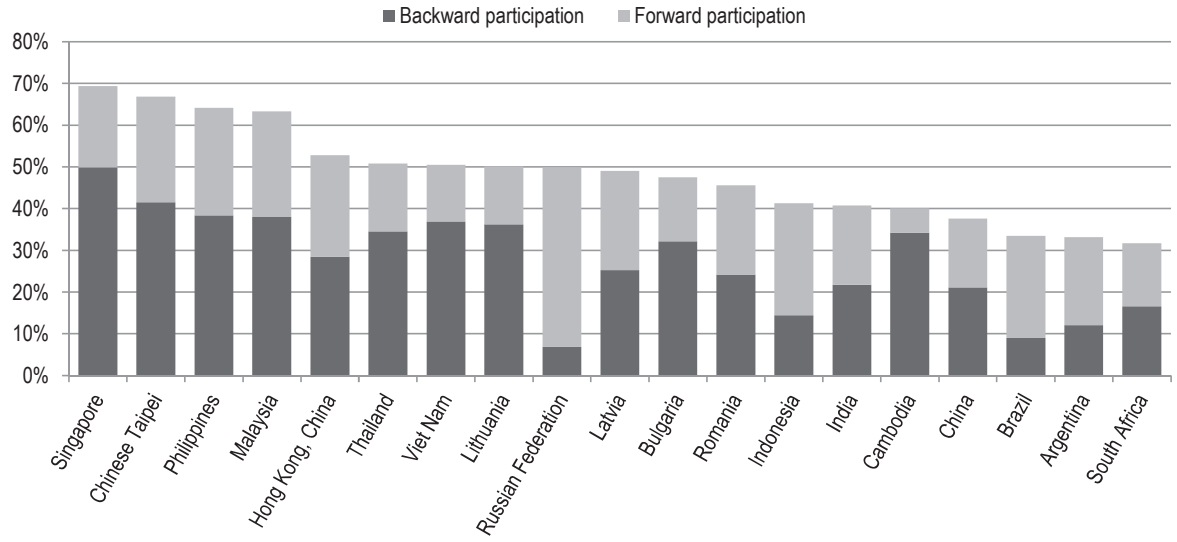
Source: General Statistics Office of Viet Nam, 2005-10.

During the past decade, trade increased from USD 15.0 billion in 2001 to USD 96.9 billion in 2011. This is largely due to two related factors: productive capacity in export-oriented activities has increased as a result of FDI, and, while wages have risen, Viet Nam has maintained its relative competitiveness. Investment by East Asian and western firms has enabled Vietnamese producers to link into to buyer-driven GVCs, which now account for a large share of trade in many standardised commodities. The chains are an outgrowth of a fragmenting of production processes (Baldwin, 2011) into specialised activities that can be located where production costs are lowest. In most cases, high-value activities such as R&D, design, marketing and advertising remain in western countries, as does the management of dispersed production that has been facilitated by advances in IT and supply chain logistics. Low-value component manufacture, processing and assembly are divided among producers in East Asia according to their expertise and production costs. Items such as clothing, footwear, auto parts, consumer electronics, toys, computers and furniture are now the preserve of value chains. Entry into the export market by late-starting economies such as Viet Nam involves becoming a part of the value chain for such products or others. When producers integrate a value chain for a manufactured commodity, they undertake a specific task in conjunction with other producers in the same or other countries. Frequently, value added is only a few percentage points, especially when the task involves labour-intensive assembly of computers, mobile devices or clothing. One of the most frequently cited cases is the Apple iPhone, which is assembled in China from components, most of which are

produced elsewhere. Chinese workers in Foxconn's giant factory in Guangdong add less than 2% to the value of the final product (Kraemer et al., 2011). Becoming a part of a value chain involves not only efficient specialisation but also effective trade facilitation, as intermediate goods may cross borders several times before a product reaches the final buyer (OECD, 2013b; Cattaneo et al., 2013).

In a little more than a decade, Viet Nam has entered several important GVCs, in clothing, furniture and electronics. Figure 2.8 shows Viet Nam's types of participation. The participation index is composed of the share of foreign inputs in economies' exports (looking backward along the value chain) and of domestically produced inputs used in third economies' exports (looking forward along the value chain). Although Viet Nam is a latecomer, its participation in GVCs (50%) is similar to Thailand's (51%), but less than that of Singapore, Chinese Taipei, the Philippines and Malaysia. Viet Nam's participation is predominately backward (37%), involving a large share of imported intermediates. Its forward participation is 14%, compared to 25% for Malaysia, 24% for China and 16% for Thailand. Viet Nam is more reliant on imported inputs than its local competitors and makes a smaller domestic contribution to GVCs.

Figure 2.8. Viet Nam's position in the GVC participation index, 2009



Note: The participation index is calculated as the sum of the Hummels et al. (2001) so-called VS (i.e. the share of imported inputs in the overall exports of a country) and VS1 (i.e. the share of exported goods and services used as imported inputs to produce other economies' exports) measures.

Source: OECD (2013b), *Interconnected Economies. Benefiting from Global Value Chains*. OECD Publishing, Doi: 10.1787/9789264189560-en.

The economic reforms that opened the economy and enlarged the role of the private sector (Kim, 2008) have resulted in increased exports between 2000 and 2010, but changes in the mix of the top exports have been limited for some time. Petroleum, rice, coffee and seafood have remained among these, together with garments and footwear (Table 2A.1 in Annex 2A.1 for top exports in 2001 and 2011). The situation is similar in Malaysia and Thailand, which export many more manufactured products but have also experienced minimal changes in the mix largely because the export sector is dominated by multinational enterprises (MNEs). Because domestic firms lack the technological capabilities to upgrade or diversify their manufacturing activities, they move into real

estate or services or invest abroad in their current lines of activity (Tables 2A.2 and 2A.3 in Annex 2A.1). Top manufactured exports in Viet Nam are footwear, apparel, and furniture. These still accounted for 39% of manufactured exports in 2009 (UNIDO, 2011). The textile industry employs 1.1 million workers and is dominated by state-owned enterprises with VINATEX, a conglomerate that also publishes fashion magazines and runs design institutes, vocational schools and a university, accounting for 40% of apparel and 60% of the textiles produced. Viet Nam contributes little domestic content to services. Indeed, domestic services content is the lowest among the comparator countries included in Figure 2.9. Previous studies indicated that Viet Nam's export structure was slow to shift towards high-technology exports. According to UNIDO (2011) the share of high-technology exports in Viet Nam's total merchandise exports rose by 1 percentage point between 2000 and 2009, and that of medium-technology products by 3 percentage points. Among comparators, the share of high-technology products rose substantially in China and India but declined elsewhere, reflecting slower growth in high-technology exports relative to others in the world market.

Table 2.4. Viet Nam merchandise exports, 2012

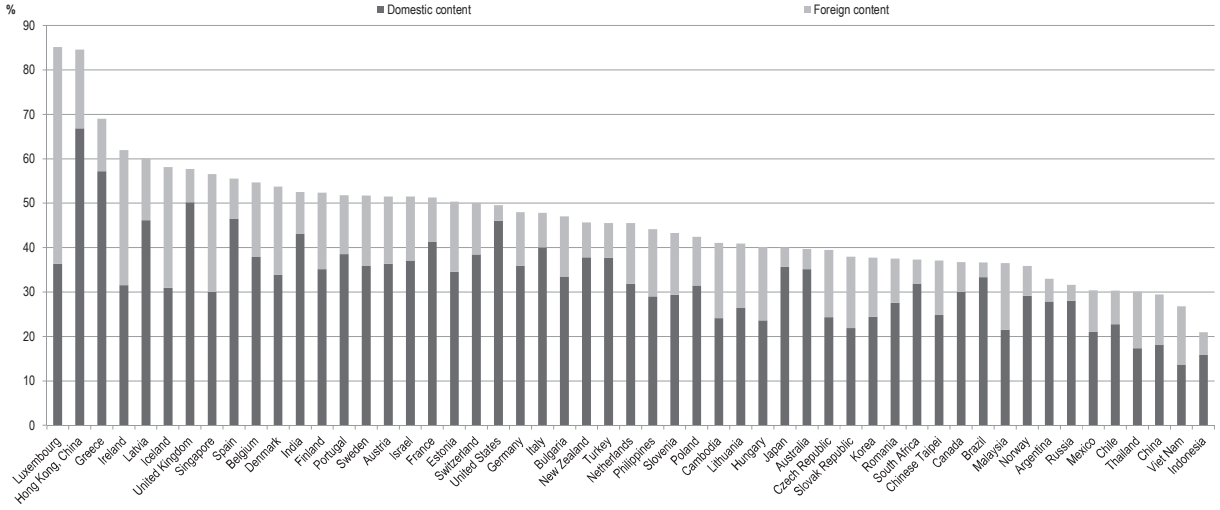
	Export turnover 2012		Value change in %	
	USD billion	Share (%)	2011	2012
Total export value (f.o.b. price)	114.6	100.0	34.2	18.2
Crude oil	8.2	7.2	44.2	13.6
Non-oil	106.3	92.8	33.4	18.6
Agriculture				
Rice	3.7	3.2	12.6	0.4
Other agricultural commodities	9.9	8.6	39.9	9.2
Seafood	6.1	5.3	21.9	-0.3
Low cost manufacturing				
Garment	15.1	13.2	25.3	7.5
Footwear	7.3	6.3	27.9	10.9
Wood products	4.7	4.1	13.7	17.9
Hi-tech				
Electronics and computers	7.8	6.8	30.1	68.1
Cell phones and accessories	12.7	11.1	98.4	98.8
Transport vehicles and parts	4.6	4.0	49.2	32.2
Others	34.6	30.2	34.0	8.7
Domestic sector	42.3	36.9	26.5	1.2
Foreign sector	72.3	63.1	40.8	31.1

Source: World Bank (2013), "Statistical Country Profiles: Viet Nam", www.wipo.int/ipstats/en/statistics/country_profile/countries/vn.html, accessed July 2013.

More recent export data indicate that the structural composition of exports is currently undergoing some change. In an environment of brisk manufacturing export growth in 2011, and – in the foreign sector – also in 2012, exports of high-technology products expanded very rapidly; exports of cell phones and accessories doubled in both 2011 and 2012 (Table 2.4). Exports of electronics and computers, and Transport vehicles and parts also achieved high growth. Phones and parts (11.1%) and electronics and computers (6.8%) have become an important component of Viet Nam's export basket by 2012, and further expansion is imminent. According to the World Bank (2013, p. 21), Viet Nam

exported cell phones and accessories worth USD 12.7 billion in 2012, and is expected to export USD 18 billion in 2013, overtaking garments as Viet Nam's largest export item.[15] In parallel to exports, imports of "hi-tech intermediates" have also increased steeply (and account for 16% of merchandise imports in 2012, up from 3% in 2002), indicating that Viet Nam is providing a platform for assembling. The expansion of production is a positive development and offers new opportunities for entering new activities and acquiring related manufacturing capabilities.

Figure 2.9. Services value added, % of total exports, 2009

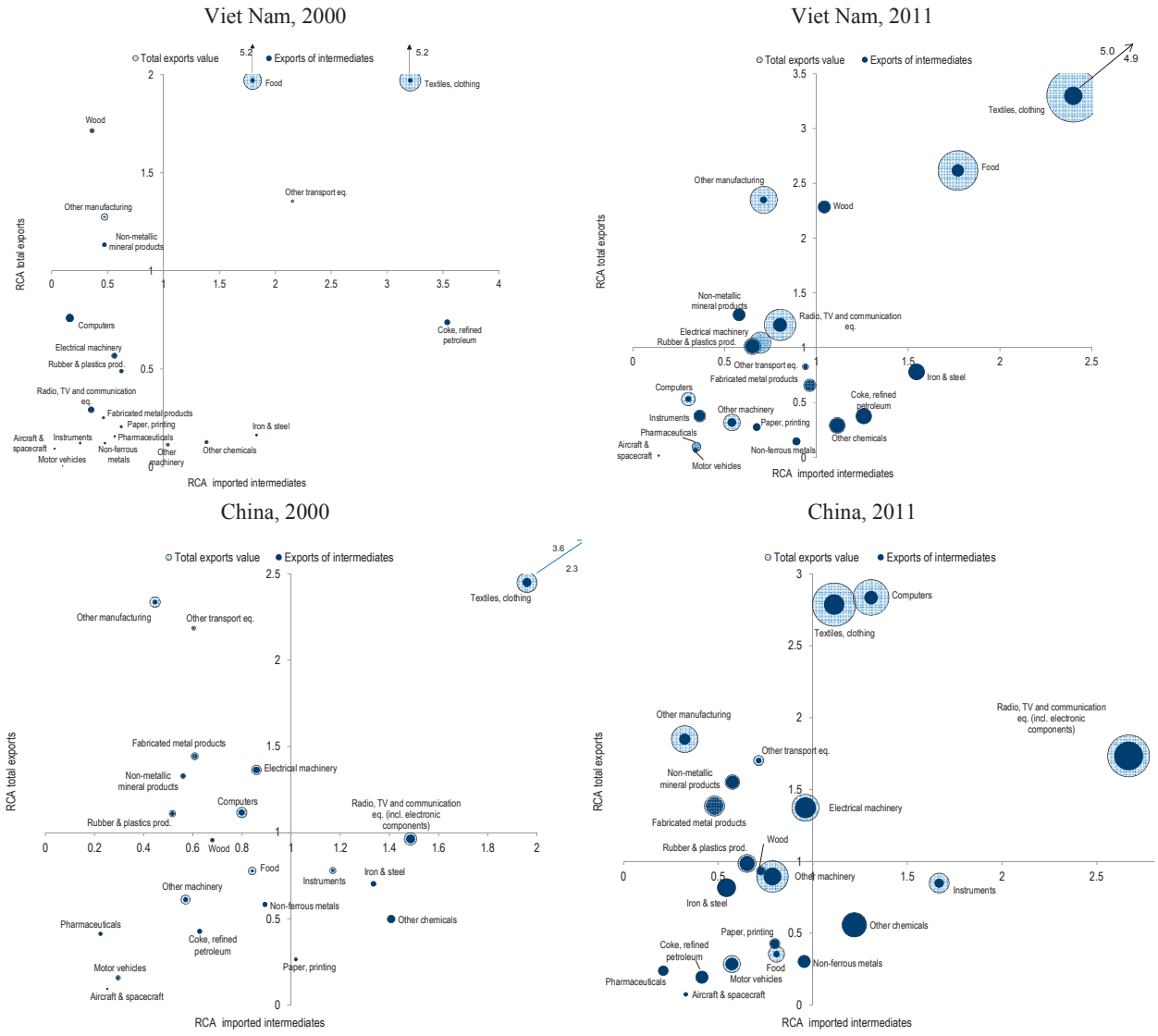


Note: Part of the explanation for the difference between OECD countries and emerging economies is the relatively higher degree of (largely domestic) outsourcing of services by manufacturers in OECD countries in recent decades. A similar process might lead to improvements in the competitiveness of emerging economy manufacturers.

Source: OECD (2013b), *Interconnected Economies: Benefiting from Global Value Chains*. OECD Publishing, doi: 10.1787/9789264189560-en.

Figure 2.10 shows Viet Nam's evolving specialisation patterns in foreign trade, both as regards exports and imported intermediates. As mentioned Viet Nam's export volumes increased in all industries between 2000 and 2011 (as reflected in the expansion of the circles between the two years), exports of intermediates (reflected in the size of the dark circle within) have also increased. As the dark circles represent the portion of exports used as intermediate goods in other countries, their expansion indicates that Viet Nam is extending its forward participation in GVCs. In other industries, particularly radio, TV and communication equipment, other machinery and computers, the share of intermediates in Viet Nam's total exports has declined, the sign of a move towards finished products. Viet Nam's revealed comparative advantage (RCA) is still predominantly in low-technology items, although some changes are occurring. The RCA index for exports is highest in textiles and clothing, food and wood products (although it has decreased over the past decade), followed by other manufacturing. The RCA in imported intermediates – which can be interpreted as indicating a revealed "advantage in assembling" (Ng and Yeats, 1999; OECD, 2013b) – has increased, particularly for textiles and clothing, indicating its backward integration in value chains. "Other manufacturing", which has high and increasing export competitiveness and lower specialisation in imported intermediates.

Figure 2.10. Revealed comparative advantage, Viet Nam and China, 2000 and 2011



Note: 1. The vertical axis represents the index of revealed comparative advantage (RCA(X)) of total exports; calculated as $RCA(X)_{i,c} = (X_{i,c}/X_{i,world})/(X_{economy,c}/X_{economy,world})$ where $X_{i,c}$ and $X_{i,world}$ are respectively exports in industry i by country c and the world, while $X_{economy,c}$ and $X_{economy,world}$ are economy-wide exports by country and the world; the horizontal axis represents the index of RCA of imports of intermediates and is calculated as $RCA(M)_{int\text{-}i,c} = (M_{int\text{-}i,c}/M_{int\text{-}i,\ world})/(M_{int\text{-}economy,c}/M_{int\text{-}economy,world})$ where $M_{int\text{-}i,c}$ and $M_{int\text{-}i,world}$ are respectively the imported intermediates of industry i by country c and the world, while $M_{int\text{-}economy,\ c.}$ and $M_{int\text{-}economy,world}$ refer to total intermediates imported by country c and the world.

2. The size of the bubbles is proportional to countries' total exports and should only be compared within and not across countries.

Source: Calculations based on OECD Bilateral Trade Database.

The rapid increase in China's exports between 2000 and 2011 was accompanied by a massive change in specialisation patterns. Figure 2.10 also captures an important aspect of change in the international division of labour in the Southeast Asian region. China has lost its comparative advantage in assembly of textiles and clothing, while that of Viet Nam has increased with its increasing integration in GVCs. For a decade or more, China has been increasing its domestic backward and forward linkages and raising its domestic content. In contrast to China, Viet Nam has not made significant progress towards specialisation and competitiveness in high-technology industries until recently. As the upper panel of Figure 2.10 shows, Viet Nam's radio, TV and communication, and electric machinery exports have moved in the right direction, however. They both expanded and are now items in which Viet Nam's exports are specialised.

Viet Nam's near-term objectives should be to consolidate its position in GVCs by raising manufacturing productivity and innovation capabilities, to increase the share of domestic services that support participation in value chains, e.g. logistics, financing, insurance, and to further facilitate the movement of goods in and out of the country. The challenge is to move up the value chain during the coming decade, as Thailand and Malaysia has done with varying success earlier, to increase domestic value added and to diversify further into exports that deliver larger productivity gains and provide opportunities for innovation.

2.3. Framework conditions for innovation and entrepreneurship

The role of framework conditions

A country's innovation performance is affected by a number of factors, including the macroeconomic framework, the overall business environment, product and labour market regulations, the intensity of competition, openness to trade and to FDI, business finance, the tax system, the level and quality of entrepreneurship, and infrastructure. Good framework conditions and a healthy business environment are essential for strong performance in innovation. There are several reasons for this:

- Weaknesses in framework conditions result in distorted incentives.
- Innovation activity requires a medium- or long-term horizon and a sufficiently stable environment in which to carry it out. This is particularly important for R&D and more fundamental types of innovation activity.
- The regulatory framework is of crucial importance for generating new technologies and for their rapid diffusion. Developments in the telecommunications sector in recent decades have demonstrated this.
- When institutions and framework conditions are of insufficient quality, they are likely to reduce the effectiveness of policies designed to foster innovation.

Cross-country empirical work suggests that sound framework conditions for business are necessary to boost business innovation. A large body of research highlights the importance of framework conditions for R&D activity throughout the economy (e.g. Jaumotte and Pain, 2005a). In fact, most innovation policy initiatives are likely to be ineffective if appropriate framework conditions are lacking. At a minimum, innovative activity requires sound macroeconomic conditions. Analysing cross-country differences, Jaumotte and Pain (2005b) find that robust output growth, low inflation and low real interest rates have a positive influence on the rate of growth of R&D. The micro-level

characteristics of the investment environment are also critical: secure property rights, effective enforcement of contracts, low barriers to market entry and a stable institutional environment all play a role in fostering innovation.

Favourable framework conditions are necessary for achieving strong innovation performance, but specific policy measures are also needed to address specific market or systemic failures that impede R&D and innovation activities. Targeted innovation policies are an essential complement to sound institutions and healthy framework conditions for entrepreneurship. However, the impact of specific interventions is likely to depend in no small measure on the capacities of the public bodies charged with implementing them and on the quality of the overall institutional environment.

The general state of framework conditions varies widely across countries. In some of the more advanced countries, they are by and large favourable to innovation, as in Sweden (OECD, 2013c). However they are a major bottleneck, and even a binding constraint, in many less developed or transitional countries. If this general constraint is not removed, no system-wide improvement in innovation performance can be expected.

Viet Nam has undergone important changes in the past two decades, moving from a centrally planned economy to a socialist-oriented market economy. To do so, it has had to build new, and remodel old, institutions. It has made much progress; among its achievements has been membership in the WTO. The following section assesses the current state of Viet Nam's framework conditions for innovation. Each of the areas discussed affects the ability of individuals and firms to plan, take entrepreneurial risks and innovate.

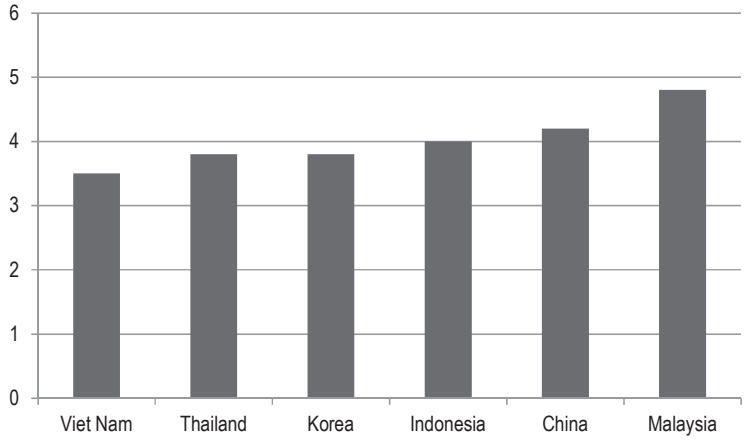
Although Viet Nam's framework conditions have evolved significantly in the past two decades, a number of deficiencies need to be addressed to build a more conducive environment for innovation. The World Economic Forum ranked Viet Nam 70th in 2013-14 out of 148 countries and 7th among eight ASEAN countries, ahead of Cambodia. The improvement in rankings from 75th place in the previous year is due to slightly better macroeconomic conditions, in particular a reduction in inflation, and an improvement in the quality of transport and energy infrastructures. An area of concern is technological readiness for which Viet Nam is now ranked 102nd, attributed to the slow speed at which Vietnamese businesses adopt the latest technologies for business use (Schwab, 2013). The institutional setup is still relatively weak, the macroeconomic framework shows some imbalance and instability, and the competition framework still results in inefficient SOEs with an undue advantage over non-state firms, although attempts have been made to create a more level playing field. The Law on Enterprise Income Tax 2013, e.g., requires SOEs to deduct a minimum portion of their annual taxable income to set up S&T development funds; while other types of enterprises may deduct up to 10% of their annual taxable income to establish these funds at their discretion. Institutions need to improve accountability, and businesses and individuals need a greater voice in policy planning, while some progress has been made in this area.[16] Businesses face a number of additional barriers, in particular weak investor protection, and weaknesses in the enforcement of intellectual property rights (IPR) and administrative burdens. As regards the latter, during 2007-10, the government reviewed an overall of 5 700 administrative procedures at four state levels (Project 30), resulting in a simplification of over 30% of unnecessary procedures, and time and cost saving for residents and enterprises. Finally, shortfalls in infrastructure are detrimental to business investment and innovation and therefore to the country's future development prospects.

The institutional environment and political stability

A strong institutional environment helps maintain stability and reduces the risks and transaction costs associated with economic activity, notably for investment. Political stability is necessary for longer-term growth.[17] The best-performing economies tend to pursue clearly defined development objectives with the help of institutions that induce the active participation of key stakeholders and co-ordinate their activities. They have also emphasised implementing policies flexibly and with a minimum of delay (see below).

The significant shift in Viet Nam's economy over the past two decades has been underpinned by considerable changes in the country's institutions. While Viet Nam has successfully formulated policy as a pragmatic response to national circumstances, complex issues involving market-based institutions and a better balance between the state and the market – the "unfinished agenda" of transition – remain to be addressed (World Bank, 2012, p. 10). While Viet Nam is considered politically stable, there is considerable scope for improving the country's institutions; it ranks 98th out of 148 countries in the Global Competitiveness Report (Schwab, 2013). Figure 2.11 shows the comparatively poor quality of Viet Nam's institutions; it has the lowest score (3.5 out of 7) among comparator countries in the East Asian region. Thailand just leads Viet Nam with a score of 3.8, while Malaysia outstrips Viet Nam by more than one point. The 2012-13 report noted as problem areas for Viet Nam poor protection of property rights, irregular payments and bribes, wastefulness of government spending, lack of transparency in government policy making, and weak auditing and reporting standards.

Figure 2.11. Quality of institutions across selected countries in Asia, 2012-13



Note: Values are on a 1 to 7 scale, with 7 the highest.

Source: Schwab (2013), *The Global Competitiveness Report 2013-14*, World Economic Forum, Geneva.

Institutions are burdened by corruption and inefficiencies of various kinds. Table 2.5 presents the World Bank's worldwide governance indicators for Viet Nam; they reflect the views of Viet Nam's institutions among businesses, citizens and experts. Countries are graded between -2.5 (lowest) and 2.5 (highest) on a number of indicators. Percentile ranks are provided to allow for comparing countries, with the highest rank 100 and the lowest 0. Many of Viet Nam's indicators deteriorated between 1996 and 2011. Voice and accountability suffered the largest decrease, from -1.08 to -1.48, with a percentile rank of just 8.45 in 2011. Control of corruption and regulatory quality also reached very low levels in 2011 at -0.59 and -0.61, respectively. These features of Viet Nam's institutional environment are almost certainly detrimental to innovation.

Table 2.5. Viet Nam's scores in worldwide governance indicators

Indicator	1996	2000	2004	2008	2011
Control of corruption					
Estimate	-0.43	-0.60	-0.75	-0.68	-0.59
Percentile rank	39.51	31.71	24.39	28.16	33.65
Government effectiveness					
Estimate	-0.47	-0.44	-0.44	-0.17	-0.28
Percentile rank	34.63	38.54	40.98	48.06	45.02
Political stability					
Estimate	0.41	0.30	0.13	0.16	0.17
Percentile rank	58.65	58.65	50.48	49.76	52.83
Regulatory quality					
Estimate	-0.53	-0.72	-0.54	-0.58	-0.61
Percentile rank	28.43	22.06	30.39	31.55	29.38
Rule of law					
Estimate	-0.40	-0.34	-0.48	-0.42	-0.46
Percentile rank	37.32	41.63	37.80	40.38	39.91
Voice and accountability					
Estimate	-1.08	-1.25	-1.37	-1.49	-1.48
Percentile rank	16.35	12.02	8.65	8.17	8.45

Note: The six aggregate indicators are reported in two ways: Estimate: in their standard normal units, ranging from approximately -2.5 to 2.5; and percentile rank terms: from 0 to 100, with higher values corresponding to better outcomes.

Source: World Bank, Worldwide Governance Indicators.

Further issues involve aspects of governance. The issuance of a new law or ordinance or the amendment of a current one involves a protracted and inflexible process that takes up to two years. This slows down the law's ability to adapt to the current social and business environment. In addition, the private sector and other affected groups are insufficiently involved in designing and executing policies (Ketels et al., 2010, p. 67).

Macroeconomic conditions

Viet Nam's longer-term development requires a macroeconomic framework that is supportive of entrepreneurial risk taking and innovation. While economic growth has been robust over an extended period of time Viet Nam has passed through episodes of macroeconomic instability beginning in 2007 when some developments, including inflation, created some concern. In 2008, inflation (the consumer price index) reached a peak of 23% before declining to 10.8% in 2012, slowing further to 6.7% by June 2013. Now, "with moderate inflation, a stable exchange rate, increased reserves and reduced country risks" Viet Nam is trying to put an end to these episodes. However, progress in structural reform has been insufficient "to lift the economy of its long spell of slow growth" (World Bank, 2013, p. 15). Viet Nam has made progress in narrowing the current account deficit from nearly 12% of GDP in 2008 to 0.8% in 2012 because of the rise in domestic savings and the decline in the level of investment. The adjustment has been supported by continuing flows of FDI and remittances. This improvement parallels a decline in fiscal imbalances from a peak of 7.2% of GDP in 2009 to 3.4% in 2012, largely because of cuts in expenditures and the recent easing of inflationary pressures (IMF, 2012). Yet further improvements are required to create a favourable framework for innovation.

International openness

FDI has an effect on the volume of investment in productive assets, the composition of industry, technological spillovers and export volume. In addition to Viet Nam, it decisively influenced the growth of Singapore, Malaysia, Thailand and China by raising domestic supplies of capital, transferring embodied technology and tacit knowledge, providing technological spillovers that benefit local suppliers once these have taken root, and by drawing East Asian producers into the orbit of global value chains that channel exports to markets in advanced countries. With MNEs responsible for 27% of global value added, and the thousand largest MNEs accounting for over 50% of global R&D (Dahlman, 2012, p. 13) as well as the bulk of incremental innovation, they can be a reliable source of technology transfer, although this depends on a country's policies and the competitiveness of its domestic firms. China, because of the bargaining power conferred by its large and growing market and its expanding stock of human capital, has been particularly successful in this respect, but others, such as Chinese Taipei, have also been able to derive substantial technological benefits from dealings with MNEs.

Openness to trade and a competitive domestic market reinforce innovation and other contributors to productivity gains in important respects. With openness to trade, countries can stimulate domestic firms to export and take advantage of scale economies. Exporting firms are important actors in national innovation systems as they tend to be more productive (Bernard, 2006) and more quality-conscious, while participation in global markets can induce further gains in efficiency and technology transfer.[18] Openness to imports also affects local innovation, as it facilitates access to imported capital goods and to material and services embodying the latest technologies. It breaks down institutional and other barriers to technology adoption (Parente and Prescott, 2000) and forces domestic firms to raise their productivity or risk being driven out of business. Openness also helps to attract FDI, as in the case of Malaysia, Singapore and China.

With greater openness, a country is more likely to develop a competitive domestic market environment, with important implications for productivity, growth and innovation. The road to competitiveness requires dismantling many regulations and relaxing rules that adversely affect the investment climate and the ease of entry and exit. In every country investors must meet many requirements, all of which affect to varying degrees the incentive to invest. Some of these requirements may promote rent seeking. Well-designed and properly implemented rules are desirable, but investors too often face steep hurdles, uneven application of rules and corruption, all of which raises transaction costs and risks. Pruning and rationalising laws and regulations governing competition can also boost productivity. In addition, the forging of a competitive economy offers government an opportunity to come to grips with public-sector reform (see below).

Entrepreneurship, administrative burden and financing innovation

Whether Viet Nam's goal of maintaining high growth proves feasible will depend in part on the shaping of its business environment relative to that of its competitors. The investment climate is not the only factor influencing business decisions, but it is one of the leading determinants. "Doing business", "competitiveness", "entrepreneurship" and other indicators are closely watched by investors, especially foreign ones, as they decide where to invest in a globalised world that offers many possibilities. Viet Nam has made great progress since the early 2000s, but needs to do more to prune administrative rules and lessen red tape (see OECD, 2011b). Bureaucratic hurdles for setting up new businesses are steep. For Viet Nam to become a mature, internationally competitive

economy, the government needs to bring the business environment more in line with international benchmarks. This requires changing the administrative culture of regulators and public service delivery agencies through an emphasis on a user-centred approach (OECD, 2011b).

In the World Bank's *Doing Business*, Viet Nam has fallen from 87th place in 2007 to 90th in 2011 to 99th in 2014 (Table 2.6). The regional average for East Asia and Pacific was 88. While Viet Nam compares favourably with Indonesia (120th), it is far behind Thailand (18th) and Malaysia (6th) (World Bank and IFC, 2012). Viet Nam ranked 109th in 2014 for starting a business. It takes 34 days to establish a business, with 10 procedures to complete. Key problem areas for Viet Nam, in addition to the number of days required to start a business, are obtaining electricity, protection of investors, time required to pay taxes and resolving insolvency. Reducing these times and protecting investors are issues that Viet Nam needs to address if it wishes to encourage investment, especially in innovation.

Table 2.6. *Doing Business* rankings, 2014

Indicator	Viet Nam	Thailand	Malaysia	Korea	Indonesia	China
Ease of doing business	99	18	6	7	120	96
Starting a business	109	91	16	34	175	158
Construction permits	29	14	43	18	88	185
Getting electricity	156	12	21	2	121	119
Registering property	51	29	35	75	101	48
Getting credit	42	73	1	13	86	73
Protecting investors	157	12	4	52	52	98
Paying taxes	149	70	36	25	137	120
Trading across borders	65	24	5	3	54	74
Enforcing contracts	46	22	30	2	147	19
Resolving insolvency	149	58	42	15	144	78

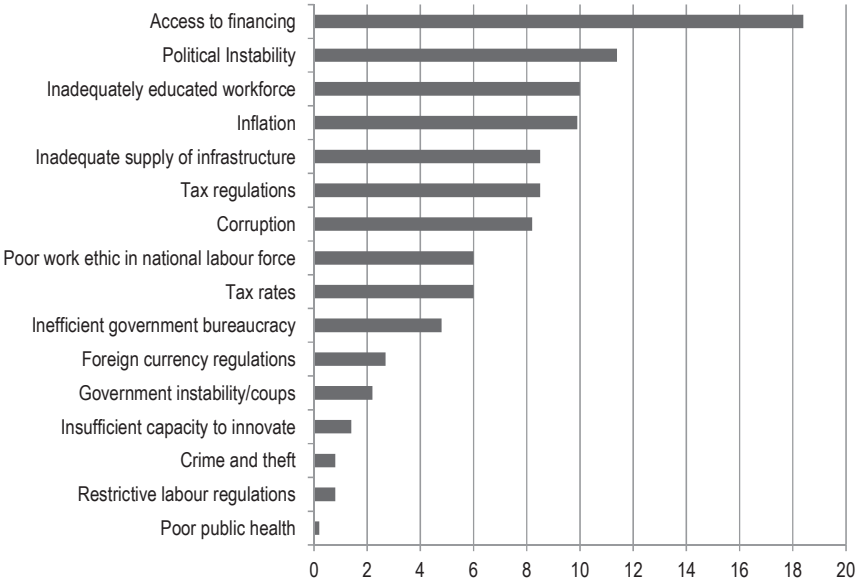
Note: Rankings are out of a total of 189 economies.

Source: World Bank and IFC (2013), *Doing Business 2014*, The World Bank/International Finance Corporation, Washington, DC.

Vietnamese respondents to a survey conducted by the World Economic Forum's Global Competitiveness Index considered that access to finance was the greatest problem for doing business in Viet Nam (Figure 2.12).

The Vietnamese government has made a number of changes to lessen bureaucratic hurdles. Administrative procedures were tackled under Project 30 (USAID, 2011) and MOST is one of the ministries that play an active role in implementing this project. The total number of administrative procedures under inventory and review in Project 30 during 2007-10 were 5 700, of which 258 were identified as hindrances to residents and enterprises that should be given priority over others for review (pursuant to Resolution 25/ND-CP of 2010 of the government). In addition, the government created the Administrative Procedure Control Agency, a permanent unit that reviews the flow of new regulations and manages a new national database of administrative procedures. Policies implemented to complement Project 30 include the use of regular impact assessments to strengthen the regulatory system, building capacity for developing and financing infrastructure, and developing the Provincial Competitiveness Index (PCI).

Figure 2.12. The most problematic factors for doing business, 2012-13



Note: From the factors listed above, respondents were asked to select the five most problematic for doing business in their country and to rank them between 1 (most problematic) and 5. The bars in the figure show the responses weighted according to their ranking.

Source: Global Competitiveness Index.

Financing innovation

A thriving innovation system requires ease of access to finance for established firms and start-ups and an administrative burden that does not deter entry of new firms. A well-developed financial system that reduces the cost of external financing is an important catalyst of innovation activities (Jaumotte and Pain, 2005b; OECD, 2011a).

Access to financing is the single most important problem for doing business in Viet Nam, followed by inflation (Figure 2.12). Banks tend to orient much of their lending to SOEs, and smaller, private firms are crowded out. In particular, firms that lack the management capabilities needed to obtain bank loans have difficulty accessing and mobilising finance. Reduced access to bank lending and the high cost of capital, exacerbated by decreased domestic demand, seems to have played a role in the liquidation or temporary suspension of operations of SMEs in 2012 (World Bank, 2012, p. 13). Credit activity remains subdued in 2013 despite interest rate cuts. However, a dynamic SME sector is a critical part of a thriving, innovative economy. Specialised providers of capital to start-ups and to SMEs can stimulate the growth of knowledge-based and technologically advanced activities, which often carry higher entrepreneurial risk, and increase the probability of SMEs' survival and chances of growth. Restoring the function of the credit market will require a restructuring of the banking sector, and associated restructuring of SOEs (World Bank, 2013, p. 28).

Viet Nam lacks venture capital companies. In 2007, the US-based International Data Group (IDG) launched a venture capital fund to invest in information technology businesses in Viet Nam. IDG Ventures Viet Nam plans to invest USD 120 million in Vietnamese IT outsourcing firms, telecommunications and software producers and in

publishing of IT-focused magazines. Viet Nam Innovation Day is an annual programme co-organised by the World Bank and the Vietnamese government to provide seed funding for innovative, early-stage ideas at the grassroots level. The theme in 2011 was "Innovation for Social Equity and Sustainable Growth". The objective was the development of products and services for poor and under-served communities in the areas of energy efficiency and agriculture-based products and services (OECD, 2013a).

Taxation

Tax policy affects returns to innovation and the incentive to innovate. The innovative activity of firms is influenced by the types and levels of taxation, including indirect taxes, such as value-added tax (VAT) on innovative products; direct taxes, such as income tax paid by researchers and scientists; social security contributions; and taxes on intellectual property. Corporate income (CIT) and capital gains taxes are the most significant for business investments (OECD, 2013c).

Viet Nam has below-average total tax rates compared to other countries in the Asia-Pacific region, but there are a number of associated inefficiencies: 32 payments a year take a total of 872 hours to complete. To address these inefficiencies and reduce the burden on SMEs, changes were made to the tax system in 2012. SMEs are now allowed to delay VAT payments. The Tax Administration Law was also adopted to simplify tax administration and reduce the burden of compliance, particularly for SMEs; to adopt modern practices of risk-based audits and advance pricing mechanisms to deal with transfer pricing issues; and to improve the efficiency and effectiveness of tax administration (World Bank, 2012, p. 24).

Competition

It is widely agreed that competition is a key driver of innovation, even if debate continues regarding the precise circumstances under which it has the greatest effect. Research shows that competitive product markets force companies to "innovate their way out" to increase labour productivity and TFP.[19] The most direct effect of competition policy is on organisational change in firms; it has a large impact on the commercialisation of new science and technology and on efforts to diffuse innovations throughout the economy (Shapiro, 2002). The forging of a competitive economy is an important prerequisite for spurring a thriving enterprise-based innovation system.[20] Competition-enhancing policies, including divestiture, privatisation and corporatisation of SOEs, to reduce the drag on economic performance exerted by a large and inefficient public sector, are part of a long-term growth strategy centred on spurring innovation and productivity.

In addition to these policies, the Enterprise Law of 1999, followed by the Enterprise Law of 2005, induced a boom in private-sector activity and rapid growth in the share of private firms by simplifying the procedures to start a business. The Competition Law was introduced in 2004 (Box 2.3). These laws and the Investment Law of 2005 unified rules relating to investment in Viet Nam by local and foreign investors. They also brought Viet Nam's investment regime in line with WTO commitments, increased decentralisation, drew a clearer boundary between the role of the state and business, and paid greater attention to investors' legitimate interests. This process culminated in Viet Nam's joining the World Trade Organisation in 2007 (OECD, 2009a). By 2012, there were 663 800 established enterprises nationwide, of which 468 000 were operating, with SMEs comprising approximately 97% (MPI, 2012). Their numbers grew on average by 28% a year between 2000 and 2009 (see Anh and Duc 2010; GSO, 2010).[21]

Box 2.3. The Competition Law 2004

Viet Nam introduced a Competition Law in 2004. It is applicable to all economic sectors without discrimination on the basis of ownership or scale. The Law created the Competition Administration Department (VCAD), which has responsibility for restraint of competition, anti-dumping, unfair competition, management of competition, consumer protection and international co-operation.

The Competition Law set rules that apply to all enterprises: SOEs, domestic private and FIEs. Exemptions are allowed, for instance, when agreements among enterprises enhance efficiency or set standards that may enhance competition. Exemptions may also be possible in order to protect SMEs or to form export cartels.

State-owned monopolies are allowed under the law, with VCAD only permitted to take action if the state monopoly acts outside of its monopoly grant.

Agreements that restrain competition are prohibited only when the participating parties' have a combined market share of 30% or more of the relevant market. Below that threshold, agreements among firms are not prohibited even if they restrain competition.

Source: Ketels et al. (2010), *Vietnam Competitiveness Report 2010,* Central Institute for Economic Management (CIEM) and Asia Competitiveness Institute.

These policies have to a sharp decline in the number of SOEs. In 1989 there were 12 084 SOEs in operation. Through closures, mergers, ending of direct subsidies, increased autonomy, revised incentive structures for workers, privatisation, divestment and liquidation, the number of SOEs dropped to 3 287 in 2008. In 2009 their number increased by 175, a trend that is likely to have persisted during 2010 and 2011 (World Bank, 2011a, p. 27).

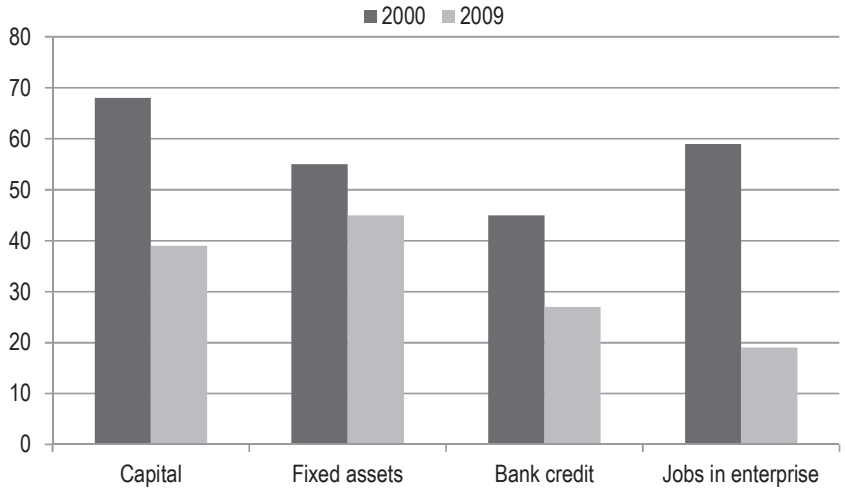
The number of SOEs is small relative to non-state and foreign firms (Table 2.7). They were only 6.7% of firms in 2009.[22] However, their share in other indicators – capital, fixed assets, bank credit – shows a still strong, although declining, position in the economy (Figure 2.13). In certain sectors they have a dominant position in terms of output and revenue (Figure 2.14). In both telecommunications and insurance, they accounted for over 85% of revenue. For fertiliser, coal, electricity and gas, and water supply, SOEs produced over 90% of total output. SOEs have maintained a strong position in the production of commercial products such as beer and sugar (41% and 37%, respectively), i.e. in industries where market failure arguments for state intervention are less likely to hold.

Table 2.7. Number of enterprises at the industry level, 2009

	Unit (enterprise)			Share of total (%)		
	SOEs	Non-state	Foreign	SOEs	Non-state	Foreign
Wearing apparel	32	2 697	547	1	82.3	16.7
Chemicals	31	1 216	268	0.9	80.3	17.7
Rubber and plastics	22	2 080	447	1.5	81.6	17.5
Electricity	80	1 919	5	3.1	95.8	0.2
Construction	388	24 022	129	19.4	97.9	0.5
Water transport	35	869	3	3.9	95.8	0.3
Telecommunication	30	776	10	3.7	95.1	1.2
Insurance	16	43	20	20.3	54.4	25.3
Total	634	33 622	1 429	6.7	85.4	9.9

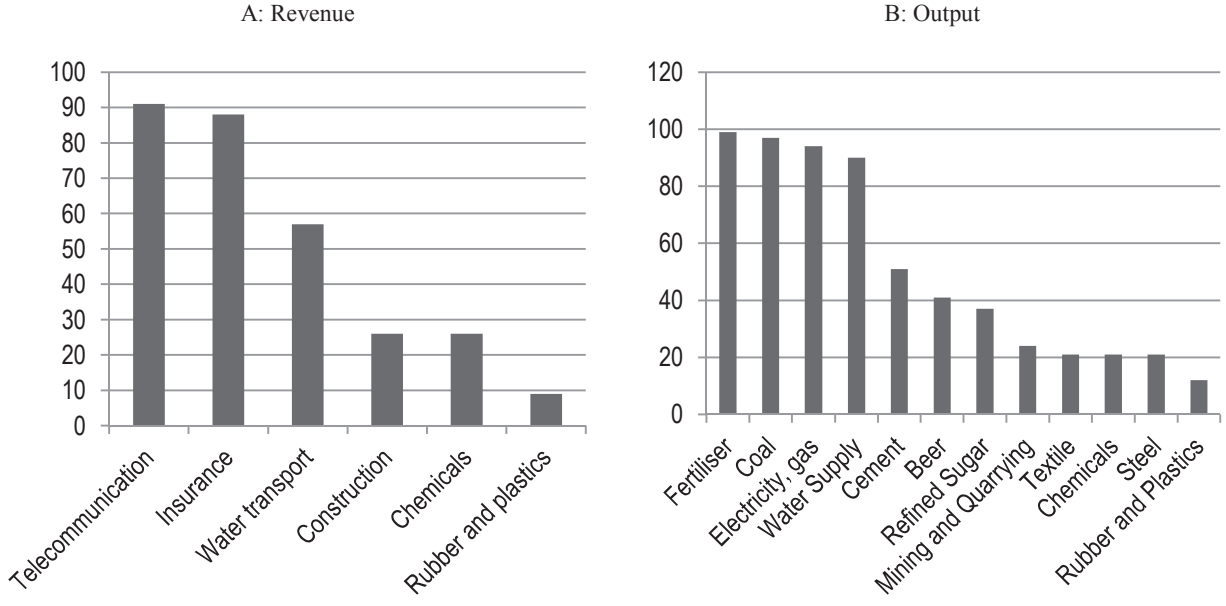
Source: GSO Enterprise Survey, World Bank (2011a), "Market Economy for a Middle-Income Vietnam, Vietnam Development Report 2012", *World Bank Report* No. 65980.

Figure 2.13. Share of state-owned enterprises in, capital, fixed assets, bank credit and jobs, 2000 and 2009



Source: World Bank (2011a), "Market Economy for a Middle-Income Vietnam, Vietnam Development Report 2012", *World Bank Report* No. 65980.

Figure 2.14. Share of SOEs in revenue/output of the enterprise sector, 2010 or latest available year



Source: World Bank (2011a), "Market Economy for a Middle-Income Vietnam, Vietnam Development Report 2012", *World Bank Report* No. 65980.

SOEs are typically sheltered from competition. They have privileged access to credit from state-owned[23] and other banks and weak managerial performance.[24] Because of these characteristics, among others, which they share with SOEs in other transition economies, Vietnamese SOEs have tended to be among the country's less dynamic firms. This is apparent from their incremental capital-output ratio (ICOR), which is 1.5 times that of the rest of the economy and appreciably higher than that of private firms (Ketels et al., 2010, p. 40).[25]

Although a change for the better in the Vietnamese legal environment, the laws described above still allow firms to restrain competition under a variety of circumstances (Box 2.3). Even where competition is legally restrained, penalties and enforcement measures are very weak (Ketels et al., 2010). In addition, specific enforcement regulations as regards anti-competitive practices originating outside of Viet Nam are lacking, even though they may have adverse effects on competition in the domestic market (OECD, 2009a). Although they affect SOEs' market power, the laws have not reduced their dominance. Governance of SOEs is still not transparent, the ownership role of government is not clearly separated from its regulatory role, and SOEs are still not exposed to the same market rules and incentives as their foreign and local rivals (Ketels et al., 2010).

There are signs however that the government is moving towards a more open and competitive market. In mid-2012 two Prime Ministerial Decisions announced plans to restructure SOEs to increase competitiveness. Decision 704 targets the strengthening of corporate governance of SOEs, while Decision 929 provides a framework for restructuring state economic groups and state general corporations. This Decision mainly aims to classify SOEs on the basis of the nature of their activities and their role in the economy. These classifications and a decision regarding the role that the state is expected to play in the economy will determine the desired level of state ownership. In October 2012, at the 6th Plenum of the Central Committee of the Communist Party of Viet Nam, it was further stated that in the future the leading role of SOEs will be confined to four areas: defence, natural monopolies, essential public utilities and some strategic high-technology industries with large spillover effects (World Bank, 2012, p. 31). Changes have been rather slow in the past but further initiatives are under way.[26]

The industrial policy of Viet Nam was heavily based on the role of the SOEs in the different sectors (UNIDO, 2011). The consolidation of SOEs into State Economic Groups (SEGs), loose alliances of SOEs with similar business interests, was based on an industrial policy modelled on that of Korea's *chaebols* and Japan's *keiretsu*.[27] The goals established for SEGs include the introduction of new and advanced technologies into the country (Decree 101/2009/ND-CP). Even though the position of SOEs in the economy is not as predominant as it was before, the SOEs still have a disproportionate influence on the economy, with implications for efficiency and innovativeness.[28] While large and complex private sector corporations can be fairly efficient in incremental innovation if they have the right capabilities, they often fail when it comes to disruptive innovation. Public sector bureaucracy further constrains even the incremental innovation that might lead to improved productivity. The dominance of the government sector in R&D in Viet Nam stands in marked contrast to the predominant role of the private sector in R&D expenditures in successful innovative economies.

Intellectual property

Protection of intellectual property rights through patents, trademarks, copyrights, etc., stimulates research by enabling successful innovators to reap rewards and by preventing free riding. Also, when IPRs are well enforced, entrepreneurs may be more ready to assume the risks of innovation. OECD research shows that, for a given level of IPR protection, regulatory barriers to entry in product and labour markets undermine long-run productivity and that the burden of regulation rises with a country's distance from the technology frontier. Reducing anti-competitive regulation induces businesses to increase spending on R&D (Jaumotte and Pain, 2005d). The importance of intellectual property is highlighted in Box 2.4.

Box 2.4. The importance of intellectual property

Patents offer incentives that encourage inventors to invent and to develop innovations that otherwise might never exist. With ownership of their inventions, innovators can signal the value of their inventions to financial markets without the risk of allowing other to appropriate their inventions. Patents also help encourage inventions that address social challenges, such as those aimed at environmental issues or healthcare problems. The economic rationale for patents is that they foster innovation by encouraging inventors to engage in upfront R&D and other relevant investments in hopes of *ex post* rewards for their future inventions. They can in this way contribute substantially to economic growth.

The disclosure of information about inventions in patent applications is an additional contribution to innovation systems. Given the non-rival nature of knowledge and the fact that the marginal cost of reproducing knowledge is close to zero, access to this knowledge benefits a much larger group. It also avoids needless duplication of research efforts, which is wasteful from the perspective of social benefits. Emerging countries can benefit by tapping into the knowledge developed abroad in order to become competitive internationally. This requires IP offices make information widely available to potential inventors. Training may be needed to help make information provided in patents useful in different contexts and for different users.

However, IP protection fosters dynamic efficiency to the detriment of static efficiency. This leads to reduced competition and higher prices and thus excludes some consumers. The appropriate balance is to reward inventors for the investments they would not be able to recoup if pricing is forced to marginal cost, without imposing excessive social costs and without removing competitive incentives for innovation. A lack of incentives for innovation and of exclusive rights to an invention can impose particularly high social costs.

The gains from IP will only be achieved if owners have the opportunity to appropriate some of the rewards that the market provides for their inventions. This has to do with the operations of the IP system, including legal provisions, operations and procedures for processing IP applications and, critically, enforcement. Suitable framework conditions, including competitive markets and technology markets can strengthen the contributions of IP to development.

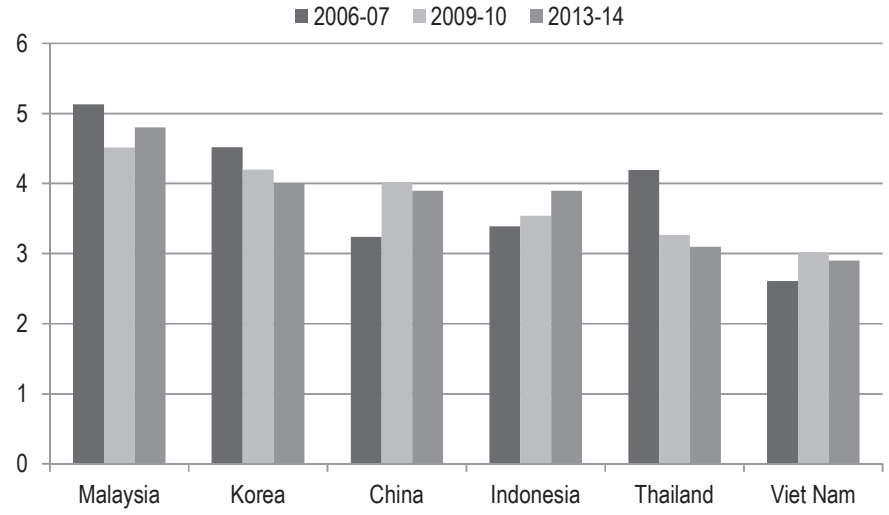
Source: Adapted from OECD (2014), *National Intellectual Property Systems, Innovation and Economic Development: With perspectives on Colombia and Indonesia*, OECD Publishing, doi: 10.1787/9789264204485-en.

Viet Nam possesses a comprehensive and consistent IPR framework (OECD, 2009a). At the heart of this framework are the 2005 Civil Code, and the Intellectual Property Act. They are complemented by Decree No. 89/2006/ND-CP on trademarks and branding. The framework was developed to be compatible with international standards and help Viet Nam to join the WTO, among other things. Although the current law on intellectual property is adequate, Viet Nam lacks an intellectual property court and technical officials. The enforcement of IPR is therefore considered weak, with low deterrent effects. It lacks the necessary power, in conjunction with inconsistent and ineffective co-ordination among enforcement agencies.

Viet Nam has separate metrology, standards and patent institutions. The system is dominated by the public sector and coverage, quality and use of services by private firms is low. Most facilities, including laboratories, equipment and skilled staff, are inadequate, and Vietnamese industry makes limited use of quality standards (such as those of the International Organization for Standardization, or ISO). The World Intellectual Property Organization (WIPO) is now helping Viet Nam improve the capacity of government agencies and personnel to register and protect intellectual property (OECD, 2013a).

Viet Nam ranked 116th out of 148 in the Global Competitiveness Report for Intellectual Property Protection, with a score of 2.9 out of 7 in 2013-14 (Figure 2.15). This is low compared to other countries in the region. Malaysia received the highest score in 2013-14 with 4.8. Viet Nam's ranking improved in 2009-10 but has since decreased slightly.

Figure 2.15. Strength of intellectual property rights, 2006-07, 2009-10 and 2013-14



Note: Grade from 1 to 7 (best).

Source: World Economic Forum Global Competitiveness Index; Schwab (2013), *The Global Competitiveness Report 2013-14*, World Economic Forum, Geneva.

To deal with such issues, the government is trying to make domestic firms more aware of how to use the IPR system (OECD, 2009a). A national training programme on IPR has been established for SMEs. The government has also created special market watchdogs, promoted the development of private services, and supported the development of detection and protection of property rights. The National Office of Intellectual Property has also been active, setting up an IPR information database covering world and Vietnamese IPRs. The information in the database is collected through the exchange of information with international counterparts and organisations.

Infrastructure

Infrastructure deficiencies in communications, transport, logistics platforms and energy distribution are major constraints on firms' engagement in innovative activities. These constraints may affect firms' ability to use available technology efficiently or the ability of potentially innovative firms to reap the benefits of expanding domestic and foreign markets and of integration into global value chains.

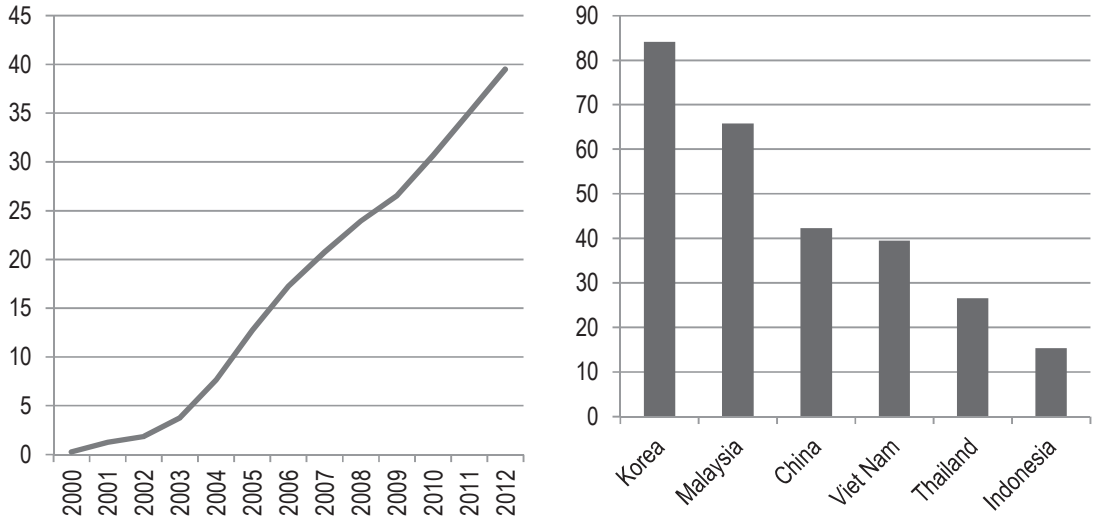
Viet Nam has, in various respects, made important progress in infrastructure in recent years. The ratio of rural households connected to electricity grids increased from 14% in 1993 to almost universal access by 2010, while electricity production grew by an annual average of 13% between 1990 and 2009. The length of paved roads increased four-fold, connecting farms and firms with the market and lowering transaction costs (World Bank, 2011a, p. 54).

The World Bank's *Doing Business 2012-13* identified weak infrastructure as one of the leading impediments to doing business (World Bank and IFC, 2012). Viet Nam's investment strategy has focused on increasing the extent of the infrastructure but has often failed to improve efficiency. If all of the approved projects were built, Viet Nam would have one of the largest numbers of deep-sea ports, international airports and industrial parks relative to the size of its economy (World Bank, 2011a, p. 57). A further issue is the absence of links between infrastructure investment and national strategic priorities and the failure to use the market as a means of allocating resources. Decentralised infrastructure planning has caused localities to compete to attract business. While competition may provide incentives for improvement and the dissemination of good practices, holistic development has not occurred, and in certain cases efficiency has not been achieved despite the large amounts of funding invested (World Bank, 2011a, p. 57). The result is fragmented, suboptimal infrastructure projects with low utilisation rates scattered around the country (World Bank, 2011a, p. 60).

As a consequence, Viet Nam's physical infrastructure, including roads, seaports and power generation, is generally considered poor and strained by the country's fast growth and rapid urbanisation. It constitutes one of the greatest obstacles to investment in the country. The state-controlled railroad infrastructure is obsolete and cannot meet rising demand (Ketels et al., 2010, p. 75). Seaports are similarly constrained by capacity barriers and are unable to meet the requirements of shippers, particularly because of high service costs and lengthy customs clearing times. Furthermore, the infrastructure is not well connected, as railways and roads do not sufficiently connect to the seaport system (Ketels et al., 2010, p. 76). This affects businesses; in the Provincial Competitiveness Index 2009, 71% of manufacturing firms reported that their products are damaged owing to poor road quality, causing an average annual loss of VND 43 million per firm. These responses have since improved, with 40% of respondents now stating that road quality is good, however further efforts need to be made (Malesky, 2011). In addition, in spite of improvements in electricity, utilities are inadequate. Some locations have limited access to safe drinking water and power outages are frequent (Ketels et al., 2010, p. 77). Viet Nam ranks 156th in the World Bank's *Doing Business 2014* with regard to obtaining electricity (Table 2.6). It requires six procedures and takes on average 115 days (World Bank and IFC, 2013).

Network industries such as telecommunications are of great importance for innovation and productivity both in the industry itself and in other industries (OECD, 2009b). A World Bank study (2009a) emphasised the importance of broadband penetration and concluded that every 10% increase in broadband penetration provides a 1.38% increase in GDP.[29] The government has supported the development of the ICT sector and has made major investments in network modernisation and capacity upgrading. Beginning in 1995, the government started to license non-state companies in addition to the Viet Nam Post and Telecommunications Corporation (VNPT). The pricing of telecommunication services has also been liberalised, resulting in a more competitive ICT sector (OECD, 2013a). Internet penetration in terms of users per 100 inhabitants has risen substantially since 2003 to 39.5 in 2011 (Figure 2.16). These levels are much lower than in Korea (84.1) and Malaysia (65.8), but much higher than in Thailand (26.5) and Indonesia (15.4).

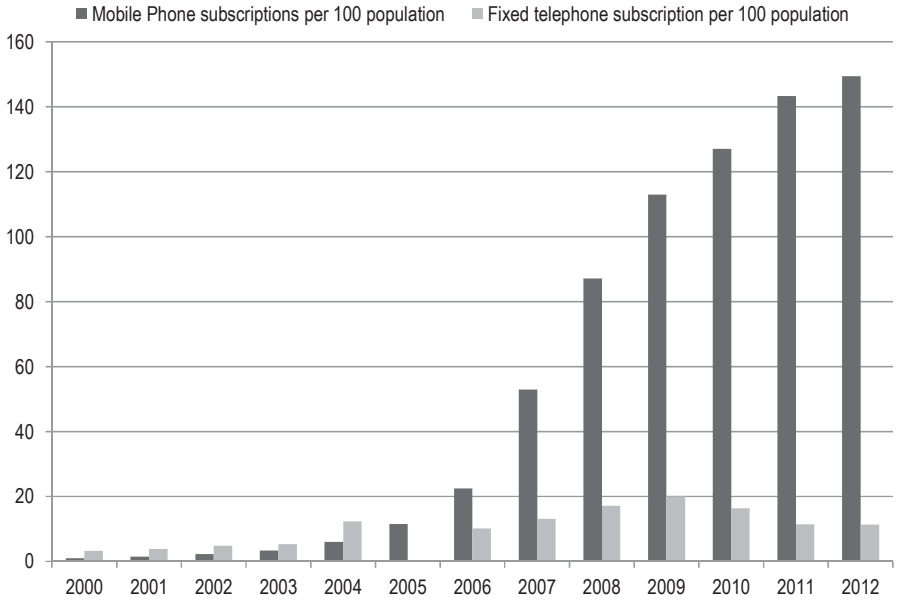
Figure 2.16. Internet users per 100 inhabitants, 2012



Source: ITU.

Telecommunications have also grown substantially in Viet Nam, particularly since 2006. There were 149 mobile phone subscriptions per 100 population in 2012, i.e. on average, every person has 1.4 mobile phone subscriptions (Figure 2.17), higher than all other comparator countries. Fixed phone subscriptions are much lower at 11.4 per 100 population and have been decreasing since 2009. This suggests that, owing to the expense of fixed lines and the advantages and utility of mobile phones, the Vietnamese prefer mobile phones.

Figure 2.17. Mobile and fixed phone subscriptions per 100 population



Source: ITU (International Telecommunications Union) (2012), World Telecommunications and ICT Database, International Telecommunications Union, www.itu.int/ITU-D/ict/statistics/.

In terms of overall ICT development, the International Telecommunications Union (ITU, 2012) ranked Viet Nam 81st out of 155 in the ICT Development Index, ahead of Thailand (92) and Indonesia (95), but behind Malaysia (58) and China (78) and, of course, world leader Korea (1).

2.4. The role of innovation in Viet Nam's future economic development

Viet Nam faces important choices as it looks to its future development. It has achieved much in the past two decades and its economy has changed and grown rapidly. This has translated into a better life for many. Viet Nam is exposed to a competitive, but currently sluggishly growing global and regional environment, and the strength of some of the sources of its past growth is diminishing. The labour productivity gains of about 4% a year achieved over the past decade will be difficult to sustain through intersectoral transfer of resources to higher-productivity activities alone; in fact, they need to rise to over 6% in order to realise GDP growth rates of 7% (Breu et al., 2012, p. 19). To achieve the desired level of GDP growth in the longer term will require raising productivity growth by gradually developing Viet Nam's national innovation system. If this system is to deliver the desired results it will have to centre increasingly on business sector innovation.

In the early stages of industrial development, it is structural change – the evolution of the sectoral composition of the economy – that provides most of the initial gains in total factor productivity. The transfer of labour and resources from low-productivity employment in subsistence farming and small-scale rural industry to urban industry and services results in a leap in factor productivity. This continues until much of the excess rural workforce is depleted or, to use different terminology, until the economy has reached the Lewis turning point as agricultural labour becomes scarcer and agricultural productivity and wages rise (Lewis, 1954).[30] This process can last for two decades or more depending on growth in demand for labour in the urban sector. Viet Nam is still some distance from that turning point (45% of the population was still engaged in primary activities in 2010, down from 59% in 2002). China may be approaching the turning point, and India may still be a long way from completing the transition. The urbanisation of the economy can confer productivity gains through agglomeration economies (Glaeser and Gottlieb, 2009) and a greening of urban development with an eye to the implications of global warming, rising energy prices and emerging technological opportunities.[31] As intersectoral resource transfers stabilise and a country begins approaching the technology frontier, home-grown innovation acquires a more important role. Sustaining rapid growth depends more on promoting innovative activity and on the commercial success of innovations. There are already indications that Viet Nam will have to rely more on within-industry productivity growth to maintain growth of around 7% a year.

Fixed investment, especially in machinery and equipment imported from more advanced countries[32] and embodying more advanced technologies, contributes to productivity (via process or combined process/product innovation in latecomers). Its contribution increases with learning and as labour force skills improve. A high level of investment in productive capacity and complementary infrastructure can, up to a point, reinforce the push imparted by structural change. There comes a point, however, when further capital accumulation – unless offset by accompanying innovations – leads to diminishing returns and is reflected in rising incremental capital-output ratios. This has occurred in China where investment spending rose steeply over the past decade and now amounts to almost 50% of GDP. However, the efficiency of this investment appears to have declined, as China's ICOR (World Bank, 2008) has risen from 3.8 in the 1990s to 4.9 in

2008-09.[33] Viet Nam's ICOR averaged 4.8 during 2000-08, already close to that of China, but soared to 5.4 in 2006-08 (Ketels et al., 2010).

Viet Nam can still be expected to continue to derive a productivity bonus from the intersectoral transfer of labour. While the growth of the workforce will slow from the average 2.8% of 2000-10 to 0.6% a year by 2020, the youth dividend[34] will buoy the economy for two to three decades (Ketels et al., 2010, p. 33). Urbanisation will also be a source of productivity gains, although this will depend on the effective harnessing of urban design and greening technologies so as to create compact and low-carbon, yet liveable and innovative cities. As mentioned, the rate of labour productivity growth achieved over the past decade will be difficult to sustain through structural changes alone; in fact, it will need to rise further to realise growth rates of 7%.

In the past two decades, growth economics has paid more explicit attention to the role of innovation (see Box. 2.5). This shift in thinking has accompanied the decline in global rates of savings and investment, a trend that is likely to continue as populations age (and draw down savings) in western countries, and propensities to consume rise in China, India and the Middle East, countries that currently generate much of the world's surplus.

Viet Nam is approaching an important crossroads and has to mobilise new drivers of productivity growth in order to sustain future growth. While there is no single way to promote innovation and build a national innovation system from a comparatively low base, the case of Viet Nam today, the experience of countries that have succeeded in doing so provides guidelines. Sketched below are some of the factors and developments that help to boost innovation and build an efficient innovation system. They reflect the experience of a wide range of countries, and in particular that of emerging economies during the past two decades.

- Innovation capabilities depend first and foremost on the volume and *quality of human capital*. It is the key to allocative efficiency, to the absorption of technology and to its adaptation to local circumstances, to the scale and productivity of R&D, and to successful innovation across the entire spectrum of activities. Mastering modern technologies and developing manufacturing capabilities requires a literate workforce; with every step up the ladder of technological sophistication, the demands made of the workforce increase. East Asian economies were quick to develop export-oriented manufacturing industries because their labour force had the needed technical skills (through vocational training provided by the state and on-the-job training by firms) and was well adapted to the discipline of modern factory production lines. The transitioning economies with a strong human capital base and the capacity to renew that stock quickly exploited the advantages of a market system faster.[35.] A better-educated and skilled workforce is more likely to take technological change in its stride and to contribute to incremental process innovations and to product innovations, many of an inclusive nature. As technological change becomes more capital- and skill-intensive and requires ever greater computer literacy, future gains in productivity are likely to be paced more and more by the quality of the workforce, with technical, learning, vocational and soft skills taking on equal importance.[36] Many enterprises in countries at a per capita income level similar to that of Viet Nam are, for the time being, less constrained by quality at every level of the workforce because they focus on assembly and processing activities and low-technology services. However, quality-related constraints are already kicking in and hold back the more advanced enterprises and projects that play a role in upgrading the

economy.[37] Workforce quality is becoming critical for moving up the middle-income range. Since the lead time is long, an early start at achieving quality, starting with schooling and extending to universities, is a matter of some urgency. Enhancing quality requires substantial and persistent investment in human and financial resources from the pre-school level through to the vocational and tertiary levels. The quality of management is also vital.[38] Furthermore, the efficient utilisation of human resources requires the creation of a competitive and merit-based environment. For example, a competitive market for managers is necessary to improve firm management. Governments need to give special attention to the management of public enterprises that may be shielded from market forces and may be led by public servants or political appointees with limited managerial skills.[39.] Selecting managers of public enterprises (and members of Boards of Directors where these exist) on the basis of merit is of utmost importance.

- The experience of successful countries indicates that *the industrial composition of output and investment* has a large bearing on the near-term and longer-run development of business innovation capabilities and productivity gains. Potential returns to certain activities, through cycles of learning and innovation, are greater than to others; much depends on how investment is allocated over time. At an early stage, a country might invest in light manufactures, reap (modest) productivity gains and begin shifting to more complex industries (as manufacturing capabilities strengthen and supporting services become firmly established). Productivity gains reinforced by innovation can accrue, over a long period of time, directly or be realised indirectly through spillovers to linked activities. Korea and Chinese Taipei upgraded quickly from light manufactures to heavy industry, were quick to master manufacturing capabilities in more advanced sectors, and, in time, began introducing incremental innovations that fed into productivity. Both economies have moved, to use terminology popularised by Hidalgo et al. (2007), from the fringes of the product space to core areas, and then graduated to densely interconnected activities with better long-term technological and market prospects both of which potentially impinge on productivity gains (Hidalgo et al., 2007; and Felipe et al., 2010). China is following a similar path. In contrast, Pakistan, Bangladesh and Mauritius have been unable to diversify out of the production of textiles and garments, sectors in which profits and productivity gains are constrained by ease of entry, saturated markets and limited scope for technological advances. A lock-in into such industries limits learning opportunities and the acquisition of innovation capabilities. Many African countries, among them South Africa, Tanzania, Kenya and Zambia, also languish on the fringes of the product space and incur growth penalties over the short and long term. The experience of Singapore and Chinese Taipei suggests that FDI, combined with greater openness to trade (as indicated above), can stimulate upgrading and movement up the technology ladder in value chains and spur innovation. Viet Nam has started to diversify but needs to advance further to set in motion a virtuous circle of learning and innovation through a well-designed industrialisation strategy as other countries in East Asia have done before.

- *The importance of acquiring R&D and sophisticated non-R&D-based innovation capabilities increases as an economy matures*. While absorption and adaptation of technology allow low- and middle-income countries to achieve productivity gains, even at a fairly early stage the acquisition of technology calls for investment in R&D and the building of research capabilities in firms, universities and think

tanks just to monitor and assess advances realised elsewhere. As countries catch up, R&D (with increasing emphasis on more basic and complex types of research) becomes one of the principal means, not just of pushing the knowledge frontier but of innovation by firms striving to become globally competitive and to enlarge their market share. R&D of a certain scale is becoming a necessity for all countries – even relatively low-income ones – because in its absence, technological search, borrowing and adaptation become increasingly difficult, as does the reverse engineering of products to take advantage of market opportunities as they emerge. There are other reasons as well. R&D that leads to innovation gives firms a head start because it enables them to capture rents before competitors can develop comparable products. While not all innovative firms conduct research, the most successful are those that sustain a steady pipeline of product, process and design innovations as well as organisational and marketing innovations. Furthermore, research and innovation have become a global effort, and firms and academic research bodies need to collaborate more and more with international partners to create new ideas, products and services. In the absence of own research, demonstrated research expertise, and the generation of ideas or patents that lend themselves to commercialisation, it is hard to tap into and benefit from global innovation networks. Especially in countries such as Viet Nam, with a limited pool of researchers and scientists and a modest research infrastructure, specialisation, with an eye to longer-run comparative advantage, and global networking to harness the specialisations of others, offer the only viable means of building science and technology capacity.

- The *OECD Innovation Strategy* (OECD, 2010) made it clear that innovation is a multi-faceted activity, encompassing R&D-based as well as non-technological innovation. Development trends point towards the increasing importance of the latter in business models, organisation, etc., as manifested by the growing share of financial and business services even in low- and middle-income economies. This is a shift from the development pattern of three to four decades ago when industry was the dominant sector (for India's experience see Ghani and Kharas, 2010). Aside from increasing their share of GDP and their contribution to manufacturing value added (approximately 30%), services can be an important source of innovation[40] They are also a direct source of sizeable productivity gains and can facilitate the development of other segments of the economy. Research on the role of finance in development shows that financial depth spurs growth by enhancing allocative efficiency and promoting productive activities.[41] Furthermore, specialised providers of capital to start-ups and to SMEs can stimulate the growth of riskier and technologically more advanced activities and increase SMEs' chances of survival and growth. Providers of other services – retail, marketing, medical, logistics, engineering, education, legal, information and consulting – also have the potential to innovate, with potentially large impacts. Relatively late starters such as Viet Nam may thus derive much more of their productivity gains and growth impetus from innovation in services, particularly those at the heart of the ICT revolution, than the tiger economies did during the 1980s and 1990s.
- The fruitful commingling of the critical determinants of innovation is a function of sound framework conditions and of the macroeconomic, sectoral and innovation policies that together shape expectations and define incentives. Macroeconomic and political stability are necessary for longer-term investment (including R&D) and growth.[42] The best-performing economies have tended to

pursue clearly defined development objectives with the help of institutions that encourage the active participation of key stakeholders and co-ordinate their activities. The leading performers have achieved results by empowering nodal agencies, e.g. the Ministry of International Trade and Industry (MITI)[43] in Japan, the Economic Planning Board (EPB) in Korea, and the Economic Development Board (EDB) in Singapore, with authority for planning and co-ordination. They have emphasised implementing policies flexibly and with a minimum of delay. Their success in crafting and implementing policies has derived in part from the institutional architecture and the political backing of the principal economic agencies, but equally if not more importantly from the quality and motivation of staff drawn from the cream of university graduates and endowed with high prestige. The calibre of the staff made flexibility in the design of policies and the incorporation of innovative features possible; their expertise and the high prestige they enjoyed made for smoother and more rapid implementation.

- To strengthen innovation and build a mature national innovation system requires the *top leadership's commitment to a growth strategy that fuses knowledge and capital*. Boosting innovation is a central pillar of such a strategy, as stronger innovation capabilities and more advanced knowledge augment the effects and quality of traditional drivers of growth. Such a strategy involves changes in attitudes and in the composition of the economy that are cumulatively far-reaching. These changes tend to take place slowly and therefore efforts can be made to accelerate the process, as Doi Moi intended. The latter course requires sustained executive guidance to ensure the building of institutions, the adoption of a results-oriented approach through trial and error, and the assembly of incentives spur actors in the innovation system to start to deliver the desired results. Korea, Chinese Taipei and Singapore, like Finland (Yusuf and Nabeshima, 2012), have successfully developed high-performing innovation systems. They have had the staunch backing of the highest levels of government, which have engaged with and won over key stakeholders. China began moving in this direction as early as the mid-1980s. Since the 1990s, the Chinese leadership has invested policy attention and resources to strengthen the country's innovation system (OECD, 2008; The Economist, 2012) in order to lessen China's reliance on capital (increasingly invested in infrastructure and housing) as the main driver of growth.[44] As a result of this sustained effort, China has steadily improved its domestic innovation capabilities and is beginning to approach the technological frontier in a number of industries. As innovation systems take years to mature and begin to produce the desired economic and social benefits, Viet Nam must begin take forceful steps to implement a strategy now to reap the desired results early in the next decade.

Notes

1. For a chronological overview of Viet Nam's development, see US Department of State (2012).
2. During 2009–11, developing East Asia, excluding China, recorded an average growth rate of 4.3% a year compared to 6% a year for Viet Nam.
3. The comparatively strong investment performance of Viet Nam is reflected in the World Bank Update (2011b, p. 38) for East Asia: "The shares of investment in GDP in the middle income countries in the region are not sufficient to escape the middle-income trap, and some are not even at their pre-Asian crisis levels. Korea and Japan invested as much as 31% of GDP to escape the middle income trap, and investment rates of 25% of GDP or more are usually needed for robust and high growth. At present, only China, Mongolia, and Viet Nam are investing at such high rates, which may or may not be sustainable. Increased spending alone, however, is not likely to be an effective solution. A new index of public investment management practices suggests that the quality of planning, appraisal, selection, implementation, and evaluation for projects within government investment portfolios could be improved in most countries within the region." Total investment in the first quarter of 2013 was estimated to at 29.6%. nearly 13 percentage points below the peak in 2007 (World Bank, 2013, p. 19).
4. Ketels et al. (2010, p. 36) estimate that Viet Nam's productivity was 9% of that of the United States, 15% of Singapore's, 40% of Thailand's and 52.6 % of China's in 2009.
5. In the short term there may be a trade-off between levels of labour productivity and labour utilisation, as less productive workers may enter employment.
6. During 2000-10 TFP growth was the main driver of labour productivity growth in Singapore and Malaysia (APO, 2012, p. 91).
7. A recent decomposition of the sources of growth by Woo (2012, Table 2, p. 19) indicates that during 1970-2000, the OECD countries grew at an average rate of 2.92 % with total factor productivity (TFP) contributing 0.60% and capital 1.18%. During 2000-07, the average growth rate was 2.51% with the shares of TFP and capital being 0.37 and 1.17% respectively. However, according to these estimates, China derived 55% of its 9.52% annual rate of growth from TFP and only 35% from capital. For a total of 104 countries sampled by the paper, average growth was 3.97% per annum during 2000-07, with TFP contributing 26% and capital 31%.
8. A declining workforce can be offset by a better-quality workforce through better education and training. Workforce quality, measured by test scores of 4th and 8th grade students, correlates closely with GDP growth.
9. The Enterprise Law and the Common Investment Law were enacted in 2005 (coming into force on 1 July 2006) and the corporate tax rules were modified.
10. Breu et al. (2012) estimate that two-thirds of growth during the early period derived from the structural shift away from agriculture.

11. UNIDO (2011) pegs manufacturing value added (MVA) at 26.1% in 2009. MVA per capita rose from USD 73 in 2000 to USD 171 in 2009.

12. Viet Nam is a major exporter of rice, coffee, rubber, peanuts, cashews and pepper among other agricultural products.

13. Many of the new starts are concentrated in and around these two cities.

14. Vinagame (an online gaming and other services provider) with revenues of over USD 100 million is one of the success stories. Socbay, which provides a search engine tailored for local users, is another.

15. "According to the South Korean Embassy, with Samsung's rapid expansion in Viet Nam, exports of cell phones are expected to exceed USD 30 billion by 2015. Following Samsung's success, LG Electronics is establishing a cell phone factory in Viet Nam as well. With their entry, a number of ancillary units have started to relocate to Viet Nam, giving rise to the prospect that Viet Nam could emerge as one of the largest exporters of cell phones in the world" (World Bank, 2013, p. 21).

16. Enterprises and individuals have been encouraged to gradually participate in policy making. The 2008 Law on issuance of legal documents and the guiding Decree stipulate that legal documents shall be published in the web for public commentary within 60 days prior to submission to the government; and the feedback and comments of the stakeholders to whom the documents target shall be collected.

17. See Sirimaneetham and Temple (2009) for evidence on the positive relationship between macroeconomic stability and conditional convergence and returns on investment.

18. Almeida and Fernandez (2007) analyse a sample of firms to show that trade promotes technology diffusion and new-to-the-country innovation. Majority-owned foreign subsidiaries are less likely to engage in such transfers than minority-owned firms. The relationship between trade and productivity-based growth is also reviewed by Lopez (2005) and Greenaway et al. (1999).

19. The effect of competition in product markets on innovation activity that is predicted by economic theory is somewhat ambiguous: competition among incumbents can stimulate innovation, but the possibility of gaining a certain degree of market power may also provide a strong incentive to innovate (the so-called Schumpeterian effect). Aghion et al. (2005) found that the degree of product market competition bears an inverted U-shaped relationship to innovation, with the Schumpeterian effect dominating at higher levels of competition.

20. In some cases this involves the breaking up and privatisation of public entities that are not natural monopolies; in others it may involve reining in the powers of specific agencies, public utilities and producers and a reform of pricing policies that burden private producers; in yet other cases, a reform of the governance and management of public bodies to raise their efficiency might be called for. Transitioning economies in particular, but not only, must face issues raised by the sheer scope of public-sector activities, by the political and economic power wielded by individual entities, and by the inefficiency of many public corporations that are the result of distorted incentives, poor accountability and inept management.

21. The formal private sector now employs 2.9 times the workers employed by SOEs and 2.4 the number working for FIEs.

22. There were more SOEs in construction and insurance, with 19.4% and 20.3% of firms, respectively. In all other industries listed in Table 1.8, SOEs were less than 4% of the total number of firms.

23. State-owned banks accounted for 59% of total deposits in 2007. They provided 62% of all credit, 31% of which went to SOEs. SOEs are also able to obtain resources from local funds and from the Viet Nam Development Bank. See Perkins and Anh (2009, p. 29).

24. This was most starkly revealed by the financial problems of Vinashin, the state-owned shipbuilding group.

25. Anh and Duc (2010) estimate the ICOR of SOEs in 2007 as 8.28, of FIEs as 4.99 and of private firms engaged in labour-intensive activities as 3.74.

26. MPI submitted a project named "Continuing re-organisation, reform and improvement of SOEs" to the regular meeting of the government in August 2013. As guided by the government, MPI is currently working on concretising the two most important aspects: i) an organisational model for executing the function of representing state ownership on the basis of segregation of state management functions and state ownership representative functions; and ii) Proposal for relevant legal regulations regarding firm-specific issues. In addition, on 15 November 2012, the government issued Decree No.99/2012/ND-CP on assignment and decentralisation of the implementation of the rights, responsibilities and obligations of the state owner for the state-owned enterprises and state capital invested in the enterprises.

27. So far the state has established 11 major conglomerates.

28. 46% of the top 500 firms in Viet Nam in 2010 were state-owned and 31% were private. The rest were foreign-owned.

29. A doubling of broadband speed can increase GDP by 0.3% (Ericsson, 2011). However, these findings may reflect reverse causation (Kenny, 2013).

30. Herrendorf et al. (2013) provide a detailed review of the literature analysing the process of structural change and its relationship to growth. Effectively, the turning point arrives when the mobile population in the 18-45 age group has migrated to urban areas. China is rapidly approaching this point.

31. Rapid growth of GDP is correlated with increasing energy consumption and emissions. Rapidly industrialising countries tend to be more emissions-intensive. Bowen and Fankhauser (2011) argue for a low carbon approach from an early stage of development to avoid locking in high carbon technologies and to facilitate the borrowing of low carbon technologies and learning by doing, making it easier to reach eventually a global deal on climate change.

32. Coe and Helpman (1995), Bayoumi et al. (1999) and Coe et al. (2008) have shown how countries benefit from technological spillovers when they import from countries with high levels of R&D and large stocks of knowledge capital.

33. This is well above the range of Japan in the 1960s and 1970s and Korea and Chinese Taipei from 1961 to 1980. (The ICORs of these economies ranged between 2.7 and 3.0.) Singapore's situation is somewhat akin to that of China. Its investment spending has risen during the 2000s but growth has not responded (Felipe and Usui, 2008).

34. The contribution of the demographic dividend to growth was initially identified by Bloom and Williamson (1998) and was examined more recently by Bloom et al. (2003). The average age of Viet Nam's labour force is 27 years and China's is 35 years (Breu et al., 2012, p. 20).

35. Shleifer (2012) observes that the "economic theory of socialism has put too much weight on incentives and too little on human capital".

36. Hanushek and Woessman (2007, 2009) and Pritchett and Viarengo (2008) present some findings that show the causative links between education quality and growth.

37. Intel's efforts to find suitable engineering personnel for its new facility highlight the problem. Of the 2 000 applicants who took the standardised tests only 90 passed and of these just 40 had adequate English language skills (Ketels et al., 2010, p. 83; Breu et al., 2012, p. 24).

38. A large body of research looks at the training and experience of management with reference to the productivity of plant operations and the innovativeness of firms. Based on a study of Indian firms, Bloom et al. (2011a) found that better management raised productivity by 11%, led to more decentralisation of decision making and encouraged the use of computers to collect and analyse data. Worker skills, market competition, MNE ownership and dispersed shareholding all contributed to better management and to productivity.

39. In a study of cross-country management skills, Bloom et al. (2012) conclude that management is weakest in public enterprises and in family- and founder-owned companies. In transition economies, Bloom et al. (2011b) found that management was weakest in Uzbekistan and Kazakhstan relative to countries such as Poland and China and that this was reflected in firm performance. They maintain that better management is linked with a greater presence of MNEs, private ownership and human capital.

40. Chesbrough (2011) discusses the scope for open innovation in services. See Jensen (2012) and Francois and Hoekman (2010) on the growth of services exports.

41. Levine (2004, 2011) argues the case persuasively with a marshalling of illuminating research. Certain financial innovations have also contributed to rising productivity in the financial sector itself although the worth of some of the more sophisticated hedging and risk-mitigating instruments has been called into question by recent crises. See Posen and Hinterschweiger (2007).

42. Sirimaneetham and Temple (2009) present evidence of the positive relationship between macroeconomic stability and conditional convergence and returns on investment.

43. From 2001 Ministry of Economy, Trade and Industry (METI) following restructuring.

44. In March 2012, Premier Wen Jiabao announced a 12.4% increase in the government's spending on R&D, which included a 10.1% increase in outlay on basic research (Qui, 2012).

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Annex 2A.1

Top ten export commodities: Viet Nam, Malaysia and Thailand, 2001 and 2011

Table 2A.1. Viet Nam's top 10 export commodities, value (USD millions), 2001 and 2011

2001		2011	
Commodity	**Value**	**Commodity**	**Value**
All commodities	15 029.2	All commodities	96 905.7
3330 Petroleum oils and oils obtained from bituminous minerals, crude	3 125.6	2709 Petroleum oils, crude	7 241.5
8512 Sports footwear	1 144.5	8517 Electrical apparatus for line telephony or line telegraphy	6 676.5
0361 Crustaceans, frozen	941.4	1006 Rice	3 659.2
0423 Rice, semi or wholly milled (including broken rice)	623.5	4001 Natural rubber, balata, gutta-percha, guayule, chicle	2 989.2
7599 Parts and accessories for machines of 7511-2, 7519 and 752	444.3	6403 Footwear with outer soles of rubber, plastics, leather	2 917.9
0711 Coffee, not roasted; coffee husks and skins	388.0	0901 Coffee, whether or not roasted or decaffeinated	2 761.1
0363 Molluscs and aquatic invertebrates, fresh, frozen, dried, etc.	360.1	7113 Articles of jewellery and parts thereof, of precious metal	2 501.6
8414 Trousers, bib and brace overalls, breeches and shorts	332.0	0304 Fish fillets and other fish meat (whether or not minced)	2 348.7
8515 Other footwear, with uppers of textile materials	300.4	9403 Other furniture and parts thereof	2 258.1
8458 Other garments, not knitted or crocheted	273.4	8443 Printing machinery used for printing by means of the printing type, blocks	1 912.2

Source: UN Comtrade Database.

Table 2A.2. Malaysia's top 10 export commodities, value (USD millions), 2001 and 2011

2001		2011	
Commodity	**Value**	**Commodity**	**Value**
All commodities	88 004.5	All commodities	226 992.7
7764 Electronic microcircuits	12 319.9	8542 Electronic integrated circuits	27 239.5
7599 Parts, n.e.cof, and accessories for machines of headings 7512 and752	8 753.2	2711 Petroleum gases and other gaseous hydrocarbons	18 210.2
3413 Petroleum gases and other gaseous hydrocarbons, n.e.c., liquefied	3 339.7	1511 Palm oil and its fractions	17 446.9
7524 Digital central storage units, separately consigned		2710 Petroleum oils, other than crude	10 797.4
3330 Crude petroleum and oils obtained from bituminous materials	2 999.1	2709 Petroleum oils and oils obtained from bituminous minerals, crude	10 760.3
7643 Television, radio-broadcasting; transmitters, etc.	2 458.1	8471 Automatic data processing machines and units thereof	9 691.2
4242 Palm oil	2 334.9	8473 Parts and accessories for use with machines of heading 84.69 to 84.72	6 318.7
7638 Other sound recording and reproducer, n.e.c.; video recorders	2 254.1	8541 Diodes, transistors and similar semiconductor devices	7 480.6
7522 Complete digital data processing machines	1 968.5	8528 Reception apparatus for television	4 832.9
7763 Diodes, transistors, photocells, etc.	1 860.7	4001 Natural rubber, balata, gutta-percha, guayule, chicle	4 339.7

Source: UN Comtrade Database.

Table 2A.3. Thailand's top 10 export commodities, value (USD millions), 2001 and 2010

2001		2011	
Commodity	**Value**	**Commodity**	**Value**
All commodities	65 113.3	All commodities	228 824
7599 Parts, n.e.c. of, and accessories for machines of headings 7512 and 752	5 944.2	4001 Natural rubber, balata, gutta-percha, guayule, chicle	13 176.4
7764 Electronic microcircuits	3 208.4	8471 Automatic data processing machines and units thereof	11 189.6
9310 Special transactions, commodity not classified according to class	2 249.7	2710 Petroleum oils, other than crude	10 093.2
0360 Crustaceans and molluscs, fresh, chilled, frozen, salted, etc.	1 603.9	8542 Electronic integrated circuits	7 910.4
0422 Rice, semi-milled or wholly milled	1 548.7	1006 Rice	6 507.5
7525 Peripheral units, including control and adapting units	1,543.8	8703 Motor cars and other motor vehicles principally designed for the transport	6 264.7
2320 Natural rubber latex; natural rubber and gums	1 321.2	7108 Gold (including gold plated with platinum)	5 897.3
7821 Motor vehicles for the transport of goods or materials	1 234.9	8704 Motor vehicles for the transport of goods	5 360.8
0372 Crustaceans and molluscs, prepared or prepared, n.e.c.	1 152.4	8708 Parts and accessories of the motor vehicles of headings 87.01 to 87.05	4 581.9
7415 Air conditioning machines and parts thereof, n.e.c.	1 151.2	8415 Air conditioning machines, comprising a motor-driven fan	3 881.2

Source: UN Comtrade Database.

Chapter 3

Innovation performance and actors in Viet Nam

This chapter reviews Viet Nam's overall innovation performance and examines the innovation capabilities of the business and public research sectors. It begins with a review of a range of indicators of science, technology and innovation from the perspectives of capacity building and innovation output. It then examines the characteristics and recent evolution of the business sector and assesses the sector's capacity to absorb knowledge and engage in research and innovation. The chapter concludes with an examination of the main features of the public research sector, including universities and public research organisations.

3.1. Innovation performance

Science and technology capacities

The imperatives of development are many and pressing. In spite of scarce resources and competing demands, building capacities in science and technology (S&T) is central to sustainable economic development for a number of reasons:

- Scientists and engineers play an important role in every contemporary economy, not least for the delivery of essential, if only routine, services in education, health and construction. In a development setting they help improve the efficiency of investments in human capital and in physical infrastructure.
- S&T can provide solutions to the social challenges of development; solutions from abroad require some amount of local adaptation (OECD, 2012a).
- S&T capacities take time to build. They include not only the associated human and material resources but also the accumulation of context-specific knowledge and the gradual development of an institutional framework for the governance of innovation and of linkages suited to the local environment.
- Innovation is essential for long-term structural change (Guinet et al., 2009). An important aspect of R&D and innovation policy is its potential to influence long-term industrial structure. This is particularly relevant in a development setting where, with strong growth dynamics, even minor shifts can make a significant difference over time.
- The overall quality of the economic development process may hinge on setting evidence-based policy priorities, not only for industry but also to meet health, environmental and social challenges.
- A large and well-trained body of scientists and engineers can facilitate public awareness of science and technology and the collection and dissemination of policy-relevant information and thus improve the capacity for sound decision making.

Human resource capacities

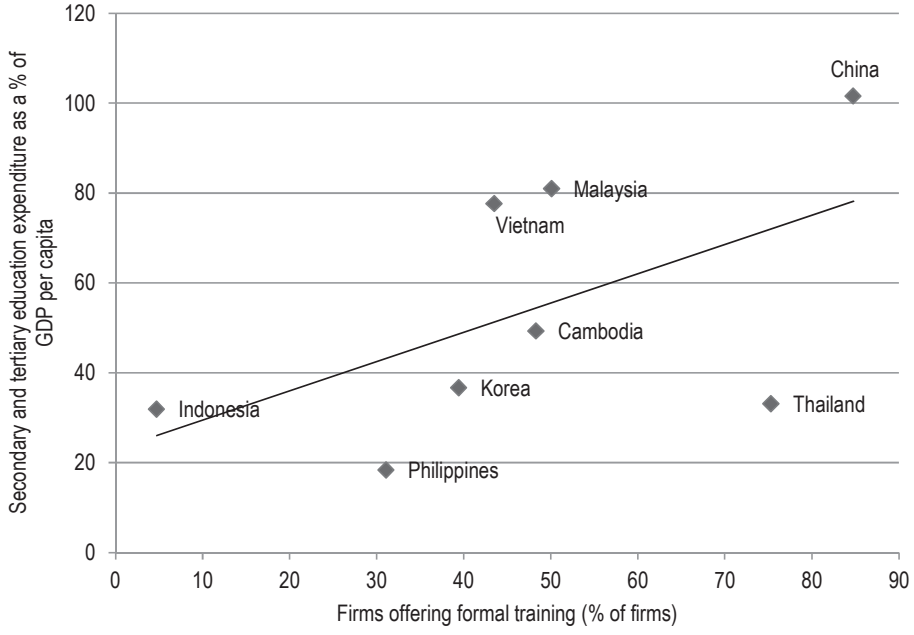
The development of suitably skilled and productive human resources is the basic building block of a country's innovation system. Investments in human capital in the form of better health care and education (including formal schooling, on-the-job training and lifelong learning) are among the concrete actions that can upgrade the human resource base. Knowledge-related investments play an especially important role in the acquisition of skills and other economically useful knowledge that translate into productivity improvements. Such investments also have a role in "learning to learn" and prepare the workforce to deal with a continuously changing economic environment. Most importantly, as individuals are the instigators of innovation, national innovative capacity hinges on the quality of specialised training for scientists, technologists and other creative professionals and on the extent to which the education system is inclusive and ensures that the pool of available talent is as wide and as diverse as possible.

Measuring performance in terms of human resource capacities is not straightforward, as the available indicators only capture isolated dimensions of what are complex and interdependent social processes. Cross-country comparisons also need to take account of important qualitative differences among countries.

Expenditure on secondary and tertiary education as a percentage of GDP per capita can be used as a broad measure of a country's efforts to develop its human capital relative to its means (Figure 3.1). This measure aims to capture efforts beyond basic education. To give a sense of perspective, Viet Nam is compared to some Southeast Asian developing counterparts (Cambodia, People's Republic of China, Indonesia, Malaysia, Philippines and Thailand) and to more developed regional neighbours (Japan, Korea, Singapore). Efforts to develop human capital are especially prominent in China and Malaysia. Viet Nam ranks third in the regional group with an impressive (equivalent of) 77.6% of its average income devoted to secondary and tertiary education. In this respect Viet Nam is ahead of the Philippines and Indonesia, countries with similar income levels. In a development setting, such high shares are understandable, but China's 101% cannot be sustained indefinitely. Developed economies such as Japan, Korea and Singapore have larger national incomes and proportionately smaller cohorts of young people in the secondary and tertiary education age groups and thus devote smaller shares.

Relating the indicator on public commitments to education to an indicator of on-the-job training in companies (the percentage of firms offering formal training) can show the relative contribution of the public and private sectors to the national effort to upgrade human resource capacities (Figure 3.1). Compared to other countries in the region, the overall burden of the national effort to upgrade skills falls more on the state and households than it does on businesses. Formal training in firms is more frequent in Viet Nam than in Korea, the Philippines or Indonesia. Viet Nam's middling performance in the group across both indicators is probably a testament to its concerted policy efforts on human capital (OECD, 2012b) but also signals considerable room for progress.

Figure 3.1. Education and on-the-job training

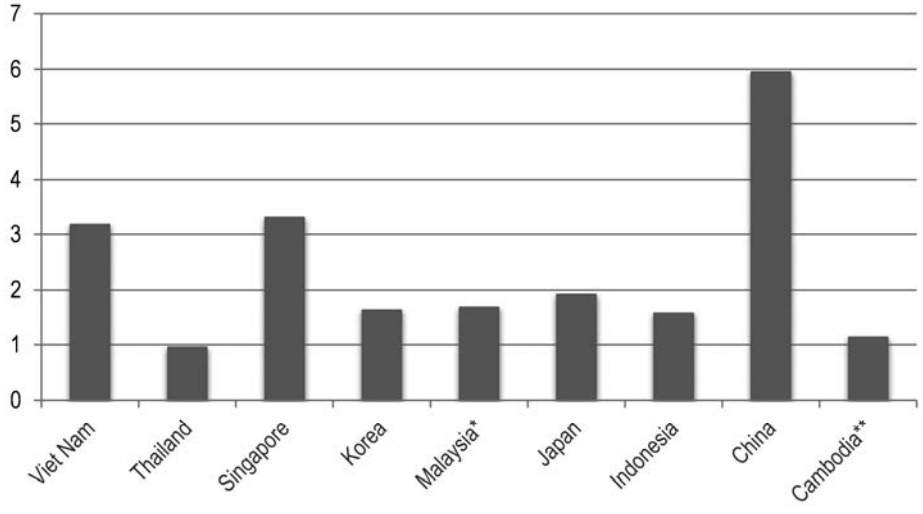


Note: On the vertical axis, the latest figures are from 2010 for Cambodia (2001 for tertiary), Indonesia and Japan (2009 for tertiary), 2009 for Korea and Malaysia, 2008 for Viet Nam and the Philippines (2007 for tertiary) and 1999 for China. On the horizontal axis, the latest figures are from 2009 for Viet Nam, the Philippines and Indonesia, 2007 for Cambodia and Malaysia, 2006 for Thailand, 2005 for Korea and 2003 for China.

Source: OECD, based on World Bank.

The development of globally relevant S&T capacities requires more than this. The capacity to provide specialised training for research is necessary to develop human resources able to access the global pool of economically useful knowledge and transfer it to the local environment. UNESCO's International Standard Classification of Education (ISCED) can be used to gauge such capacities across countries; level 6 (the second stage of tertiary education) corresponds to research-oriented degrees. However, such an indicator only suggests broad patterns, as important qualitative differences among countries (e.g. drop-out rates, skills content, the extent of specialisation and international orientation) prevent strict comparisons. Figure 3.2 compares the percentage of all students enrolled in a research-oriented degree in Viet Nam with that of comparator countries. China leads with almost 6% of all students working towards a research-oriented degree. It is followed by Singapore and Viet Nam at just over 3%, still a high share by regional standards. The remaining countries, including Japan and Korea, have shares below 2%.

Figure 3.2. Percentage of students at ISCED level 6, 2010 or latest available year

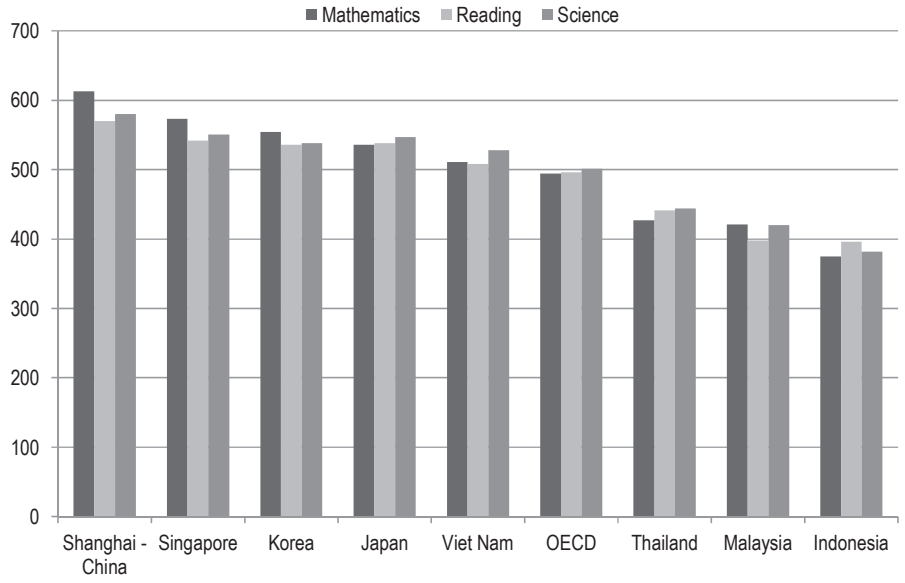


Note: *2009. **2005.

Source: UNESCO.

The indicators examined so far shed light on the quantity of education and skills. However, as international student assessment exercises, such as the OECD's PISA initiative, demonstrate, there are pronounced qualitative differences among countries. Differences in the quality of education matter, especially for producing new-to-the-world innovation (Varsakelis, 2006). In Viet Nam, numerous policy initiatives have aimed to improve the quality of education (UNESCO, 2011; OECD, 2012b). Viet Nam has participated in the 2012 PISA assessment, and related international benchmarks have become available recently. The PISA assessment measures 15-year-old students' proficiency in mathematics, reading and science (Figure 3.3). Viet Nam performs very well, with scores above the OECD average for mathematics, reading and science. Indeed, among countries in the region participating to PISA, Viet Nam is only lagging in comparison to countries of much higher income per capita.

Figure 3.3. Performance in PISA international student assessment, 2012



Source: OECD (2013a), *PISA 2012 Results: What Students Know and Can Do – Student Performance in Mathematics, Reading and Science (Volume I),* OECD Publishing. http://dx.doi.org/10.1787/9789264201118-en, p. 19.

Bottlenecks in the supply of human resources were identified as a key issue for Viet Nam in the *OECD Southeast Asia Economic Outlook* (OECD, 2012b, p. 130-132). They include low and unequal participation, and mismatches between education and the labour market. Viet Nam's recently launched Strategy on the Development of Vietnamese Human Resources 2011-12 and the Human Resource Development Plan 2011-20 aim to address such weaknesses. Notable policy objectives include an increase in the share of trained and skilled personnel from 40% in 2010 to 70% by 2020 and the expansion of vocational training and its appeal, especially to rural labourers (Ngoc Vinh, 2012).

In spite of these efforts, only a small share of the population possesses either a professional or a tertiary education qualification (Table 3.1). Across all types of qualification, the urban-rural divide is considerably more pronounced than the gender divide. Overall, 4.7% of the population possess a vocational degree but 7.6% in urban settings, and 4.2% possess a university degree but 10.2% in urban settings. Vocational skills can be important, e.g. in Ireland, strengthening post-secondary vocational skills arguably improved its attractiveness for foreign direct investment (FDI). Postgraduate degrees are industrially relevant, as they are specialised and sometimes occupation-specific. They also tend to be closer to the state of the art in the scientific or technical discipline than a corresponding undergraduate degree and can be the means of acquiring research training and skills. In 2009 less than 1% of the population of Viet Nam possessed a postgraduate degree. Such degrees may be increasingly important as Viet Nam seeks to develop its innovation system.

Viet Nam's national education effort is also reflected in the presence of Vietnamese students abroad. They are the fifth largest group of foreign students studying in OECD countries (after China, India, Malaysia and Morocco) (OECD, 2011, p. 327). A potentially interesting avenue of investigation would look at their career paths, including their propensity to remain abroad and to interact with peers in Viet Nam.

Table 3.1. Highest professional and technical qualification in 2009, percentage of population

Characteristic	Short-term training certificate	Vocational degree	Junior college degree	University degree	Post-graduate degree
Urban	4.4	7.6	2.5	10.2	0.6
Rural	1.8	3.5	1.2	1.5	0.0
Male	3.7	5.5	1.4	4.8	0.3
Female	1.5	4.0	1.8	3.5	0.1
Total	2.6	4.7	1.6	4.2	0.2

Source: General Statistics Office (2011), "Education in Viet Nam: An Analysis of Key Indicators", Ministry of Planning and Investment, Hanoi.

Specific S&T capacities are typically assessed by reference to stocks and flows of human resources in science and technology (HRST), ascertained on the basis of training or education (OECD, 1995). Viet Nam does not have statistics that conform to the OECD definition of HRST. According to estimates by MoST, by 2011 there were about 4.2 million people with junior college and university degree and higher, of which more than 24 000 held a doctoral degree and 101 000 masters. The percentage of graduates in engineering, manufacturing and construction can be suggestive of the inflows of skills relevant to technology (Table 3.3). A corresponding indicator for skills in science would be valuable but the relevant data are not currently available. Korea and Malaysia lead the regional group, with about a quarter of graduates in technical subjects. In Viet Nam an encouraging 17% of graduates are in technical subjects, the same share as in Japan and more than in the Philippines and Cambodia.

Table 3.2 Tertiary graduates in engineering, manufacturing and construction as a percentage of total graduates, latest available figures

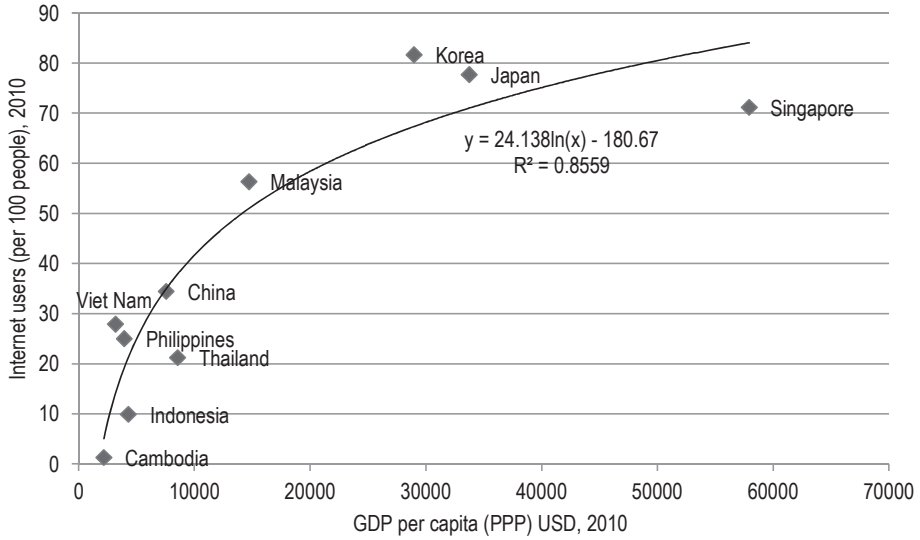
	Viet Nam, 2010	Korea, 2009	Philippines, 2004	Malaysia, 2009	Japan, 2010	Cambodia, 2008
Female	9%	11%	6%	13%	4%	1%
Total	17%	24%	14%	24%	17%	3%
Male to female ratio	3.3	3.2	2.8	2	7.1	20

Source: OECD based on UNESCO.

Technological upgrading of capital

Qualitative elements of capital accumulation can be assessed by reference to the diffusion of key general-purpose technologies. In particular, Internet usage (an enabling technology of wide appeal) can reflect an economy's general receptiveness to new technologies. A comparison that relates Internet usage in Viet Nam and comparator countries to income per capita can help distinguish lack of receptiveness from lack of means (Figure 3.4). Internet usage is slightly higher than would be expected on the basis of Viet Nam's income per capita, with a level that is slightly above that of the Philippines and Thailand and close to that of China.

Figure 3.4. Internet usage and income levels in Viet Nam and Southeast Asia

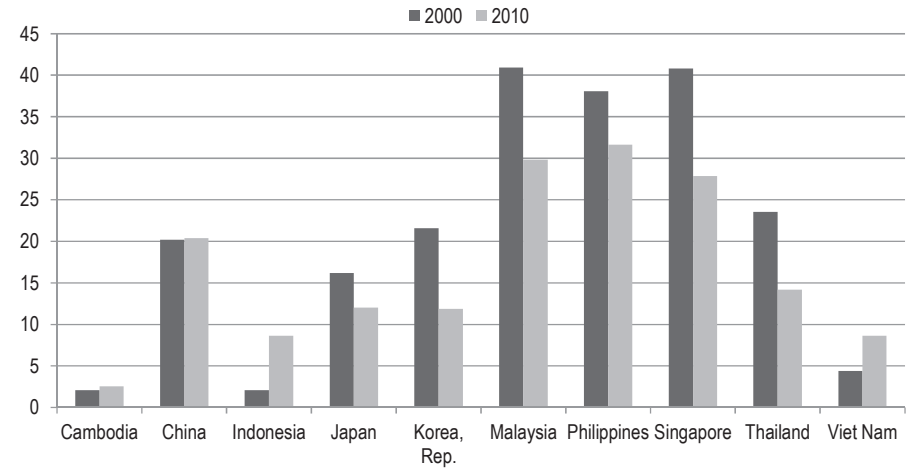


Source: OECD based on UNESCO and World Bank, World Development Indicators.

The share of information and communication technologies (ICT) goods imports in total goods imports can be considered a proxy of embodied technology transfer over a broader range of technologies (Figure 3.5). Compared to other countries in the region, Viet Nam has a share similar to that of Indonesia and less than half that of Thailand. From 2000 to 2010 the share of ICT imports in Viet Nam doubled to 8.3%. Among the countries considered, the share increased in Viet Nam and Indonesia, and to a lesser extent in Cambodia and China, but it decreased in the others. However, the interpretation of this indicator is not straightforward, as such imports have uses other than investment, including household consumption (which should also translate into overall welfare improvements). They may also be used as intermediate inputs in production. In countries in which ICT imports decreased over time, the decline may be due to the diminishing importance of ICT compared to other forms of investment, consumption and intermediate inputs or the substitution of imports by domestic ICT products. Another possibility may be an overall economic slowdown during the financial crisis.

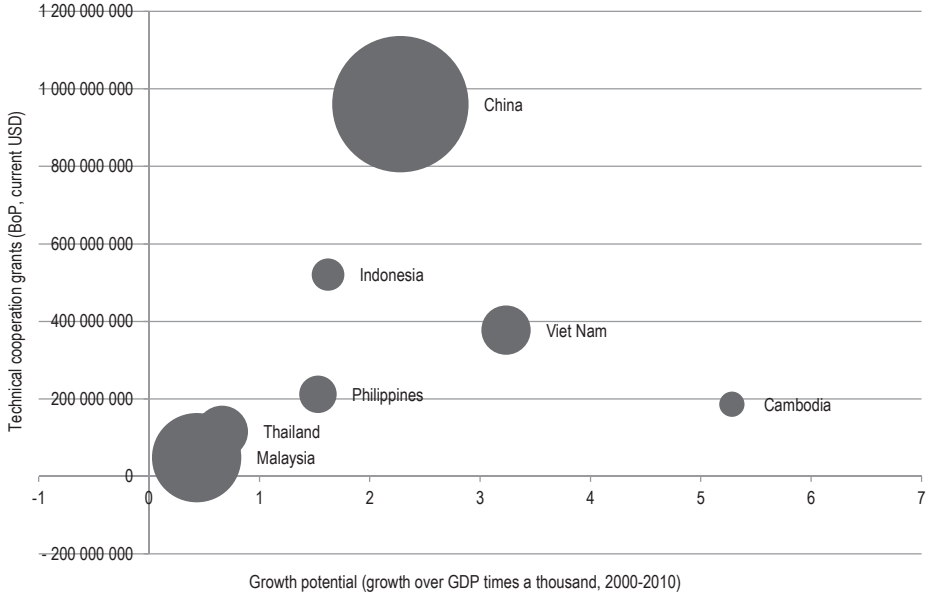
In a development setting, the technical co-operation grants that correspond to international aid for developing skills and technical know-how can be used as a rough indicator of technology transferred through non-commercial sources. Figure 3.6 plots technical co-operation grants against an indicator of catch-up potential.[1] The amount of technical co-operation grants corresponds better to a country's catch-up potential than it does to its R&D intensity; the country's size (in terms of population) also appears to play a role. Viet Nam received USD 387 million, more than other countries in the group, except China and Indonesia.

Figure 3.5. ICT goods as a share of total goods imports



Source: World Bank, World Development Indicators.

Figure 3.6. Technical co-operation grants and catch up potential



Notes: The size of the circle denotes the country's R&D intensity.

Source: OECD, based on World Bank and UNESCO data.

The Asian Productivity Organisation (APO, 2012) has compiled data on the share of investment accounted for by six types of assets (dwellings, non-residential buildings, other structures, transport equipment, information technology capital and non-IT capital) in 1970 and 2010. Data for Viet Nam are only available for 2010, and investment in construction (dwellings, residential buildings and other structures) accounts for the lion's share of investment. Construction dominates in most countries; however the share of IT capital has expanded considerably over time (APO, 2012, p. 50). As a rule, developed economies, in Southeast Asia and elsewhere, devote considerably larger shares to IT capital. The share of IT capital in Viet Nam is notably smaller than in Thailand and Malaysia but greater than in the Philippines and Indonesia.

Research capacities

R&D expenditures and number of researchers are commonly used indicators of a country's research capacity. The latest internationally comparable figures for indicators relating to R&D expenditures in Viet Nam are from 2002 (UNESCO Institute for Statistics). The lack of publicly available, internationally comparable, current information is itself an indication of the incomplete development of statistical infrastructure for innovation policy making, a feature Viet Nam shares with countries with lower income per capita such as Cambodia, Myanmar and Laos. The policy relevance of interpretations based on out-of-date figures is bound to be limited, especially in a rapidly growing economy. MoST continues to collect national statistics in comparison with international data for relevant assessments and more attention and investment is devoted to the S&T statistical and information infrastructure. However, there is considerable scope for upgrading and improvement.

Gross domestic expenditure on R&D (GERD) as a percentage of gross domestic product (GDP), an indicator often referred to as R&D intensity, is commonly used to understand the prominence of R&D as an economic activity (Figure 3.7). In 2002 Viet Nam devoted USD 273.5 million (constant 2005 USD in PPP) to R&D, a figure comparable in terms of orders of magnitude to those of OECD countries such as Estonia (USD 128 million), Iceland (USD 258 million) or the Slovak Republic (USD 615 million). With GERD the equivalent of 0.2% of GDP, Viet Nam is considerably less R&D-intensive than Malaysia and slightly less so than Thailand, but close to Myanmar, the Philippines and Indonesia. Only Cambodia, Brunei Darussalam and Laos had notably lower R&D intensity. During 2006-11 the state maintained annual funding for S&T (public S&T expenditure) of approximately 0.5-0.6% of GDP. The average growth rate of funding in 5 years is about 16.5%.[2] In 2012, the total state budget allocated for S&T was VND 13 186 billion (USD 627.9 million), and in 2013 VND 14 144 billion (USD 673.5 million). Total social investment for S&T in Viet Nam is currently below 1% of GDP. In terms of R&D staff, estimates by MoST suggest that there are over 62 000 R&D staff (about 7 per 10 000 population), distributed among the following specialisations: social science – 10.6%; natural science – 7.3%; agricultural science – 25.3%; pharmaceutical and medical science – 10.8%; technical science and technology – 45.9%.[3]

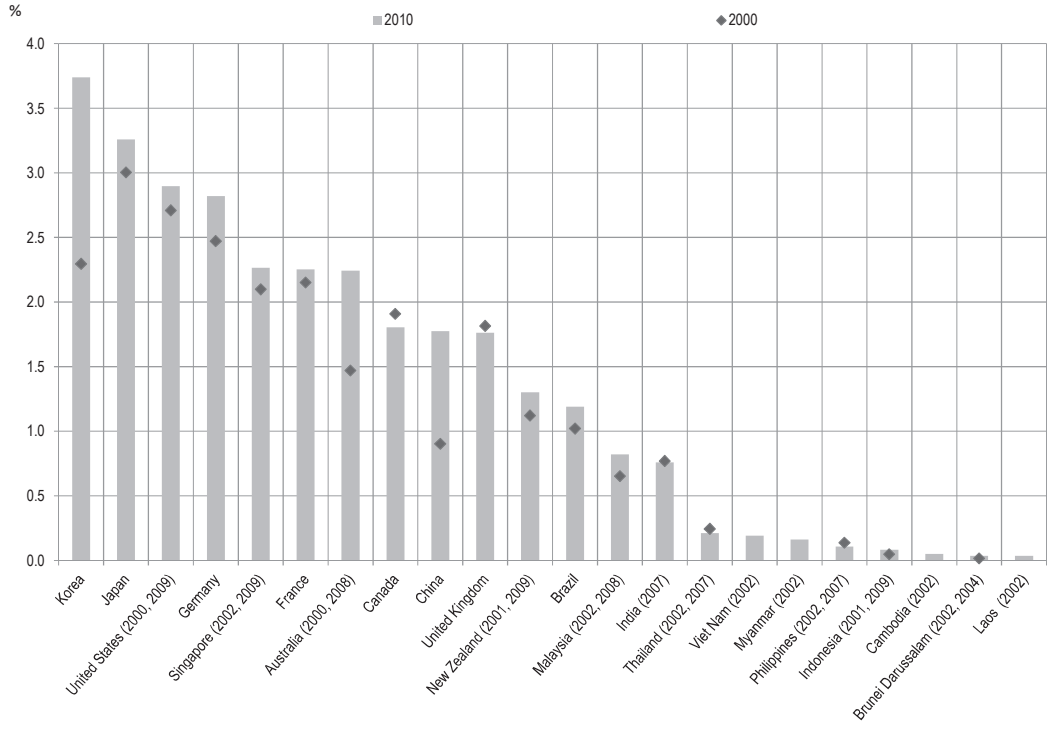
The recently launched Strategy for Science and Technology Development 2011-2020 (MoST, 2012), foresees large increases in the resources devoted to S&T and in the numbers of R&D staff. These include the targets of increasing S&T expenditure to 1.5% of GDP by 2015 and to 2% by 2020. The strategy also sets the target to raise the number of R&D staff to 9-10 per 10 000 population by 2015 and to 11-12 by 2020.

Viet Nam's low R&D capacity is not surprising. In spite of its impressive economic growth, Viet Nam remains a lower-middle-income country. In this context and given pressing needs in other areas, devoting resources to the search for new-to-the-world innovation can be hard to justify. It seems more profitable to make other investments in knowledge, in terms of human capital but also new-to-the-country innovation and the adaptation process needed for technological catch-up. However, extensive international technology transfer is associated with own, domestic R&D performance. For instance, Coe et al. (1997) found that while developing countries benefit significantly from the R&D efforts of their trading partners, the magnitude of the benefit depends on the extent to which they do R&D themselves. Lederman and Maloney (2003) also suggest that the returns to R&D in developing countries can be substantial. Indeed, there is evidence that China's impressive economic catch-up is due to a combination of investment and

productivity gains and that, at least over the past decade, it has been accompanied by strong expansion of R&D activity (OECD, 2008; The Economist, 2009). R&D is not however a universal solution to the challenges of development. Goñi-Pacchioni et al. (2012), in a comprehensive cross-country study of the relationship between R&D and economic growth, find that initial local conditions can be crucial for harnessing the benefits of R&D and that countries that lack complementary conditions such as high-quality human capital and technologically developed business sectors may find it hard to do so.

Figure 3.7. R&D intensity of Southeast Asia and selected countries, 2000-10 or latest available year

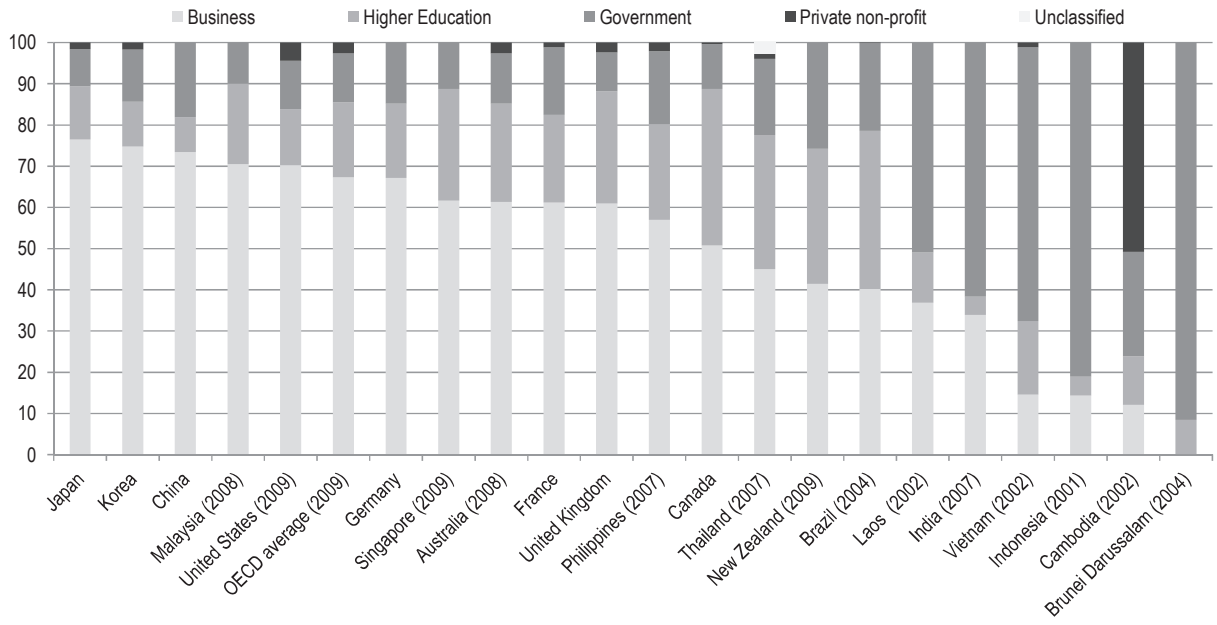
Gross domestic expenditure on R&D as a percentage of GDP



Source: UNESCO, OECD, MASTIC.

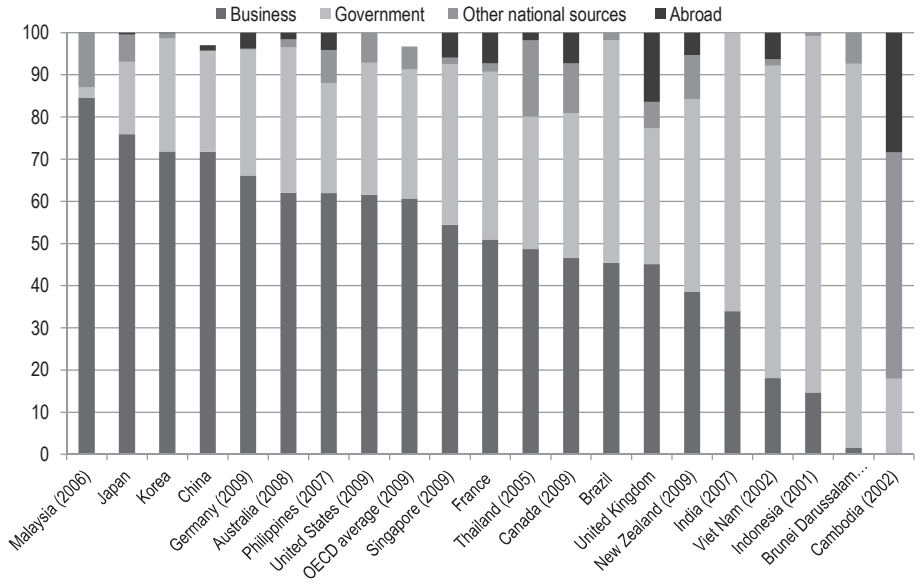
A regime in which a greater proportion of R&D is priced and eventually traded is crucial for the economic relevance of research. This effectively means moving from a regime in which public research institutes and universities are the central actors to one in which businesses perform the majority of R&D. The share of GERD performed by various institutional sectors, and by the business sector in particular, can indicate how far this is the case (Figure 3.8). As for other R&D-based indicators, the latest internationally comparable figures for Viet Nam are over a decade old and can only be suggestive of major patterns. The government accounts for the majority of R&D expenditures by sector of performance. This presents a sharp contrast to OECD countries and to most Southeast Asian neighbours, except Indonesia and Brunei Darussalam. Higher education R&D performance (17.9%) is almost on a par with that of business (14.5%). Business R&D expenditure (BERD) in 2002 was equivalent to 0.01% of GDP. A more recent pilot survey of business R&D suggests some improvement, at 0.02% of GDP, but for all practical purposes it is fair to say that BERD remains a very peripheral activity.

Figure 3.8. Gross expenditures on R&D by performing sector, Southeast Asia and selected countries, 2010 or latest available year



Source: UNESCO, OECD, MASTIC.

Figure 3.9. Gross expenditures on R&D by funding source, Southeast Asia and selected countries, 2010 or latest available year



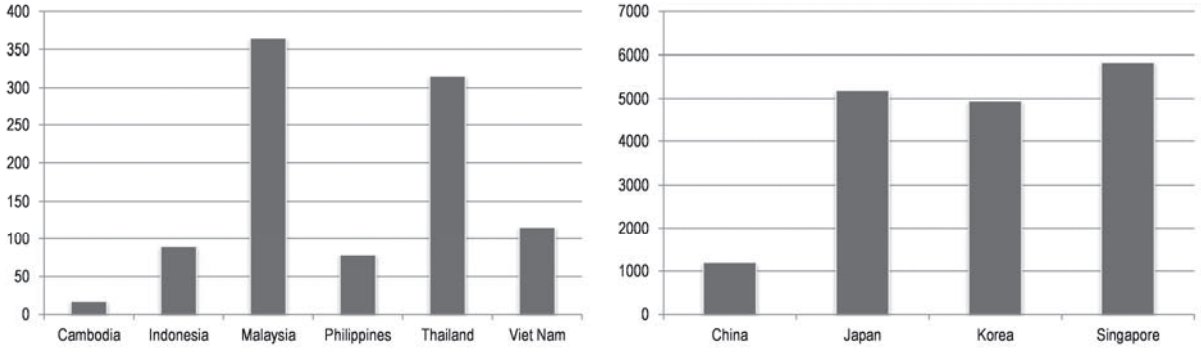
Source: UNESCO, OECD, MASTIC.

Another way to assess the situation is to examine GERD by source of funding (Figure 3.9). Countries in which business accounts for a greater share of GERD typically have favourable framework conditions and strong supporting systems that make R&D an attractive type of investment. In Viet Nam government has the dominant role, accounting for over 74% of GERD. The share of business funding is slightly higher than the share of business expenditure; this suggests that at least some funds flow between institutional sectors. The share of funding from abroad is a notable 6.3% and represents both multinational affiliate research activities and foreign aid.

The impact of the low level of R&D resources is apparent in the number of researchers (headcount) per million population (Figure 3.10). In comparison with its developing country neighbours, Viet Nam's performance is middling, behind China, Malaysia and Thailand but ahead of all of the low-income countries.

Another issue identified in OECD (2012b) is the inclusiveness of the education system and the labour market as regards rural residents and women. The participation of the rural population in education and the workforce is difficult to compare across countries. Some insights into the economy's ability to utilise its available human resources fully can be gained from indicators on gender balance. In addition to addressing equity concerns, greater participation of women in science and technology would be a relatively straightforward way to achieve a sizeable increase in the resources for innovation.

Figure 3.10. Researchers per million population



Note: Latest years for which statistics are available are: 2002 for Cambodia and Viet Nam, 2006 for Malaysia, 2007 for the Philippines and Thailand, 2008 for China, Japan, Korea and Singapore, and 2009 for Indonesia.

Source: World Bank, World Development Indicators.

While the overall share of female employment stands at 49% of total employment in Viet Nam and is larger than in the United States (47%) and Japan (42%) (APO, 2012, p. 34), there is room for improvement in science and technology. In particular, three times more men than women complete tertiary-level education in engineering, manufacturing and construction (Table 3.2). Viet Nam's male-to-female graduation ratio in these subjects is roughly the same as that of Korea and the Philippines; only Malaysia is noticeably closer to gender parity. Japan and Cambodia have the most unequal gender distribution in this respect. In terms of gender balance among researchers, Viet Nam fares relatively well: 42% of researchers (headcount) are female compared to only 14% for Japan, 17% for Korea and 24% for Singapore. Among the countries in the group, only Thailand and the Philippines fared better, with 51% and 52%, respectively.

New-to-the-country innovation

As a developing country, Viet Nam still has room to grow rapidly through the accumulation of capital and labour. New-to-the-country innovation is relevant to the quality of factor accumulation: not all infrastructure investment is equally profitable for society and it is important to train better as well as more human resources. The qualities of capital and labour can be reflected in the characteristics of tools, machines and infrastructure and in the skills of labour and how it is deployed.

New-to-the-country innovation is important for addressing some of the pressing social challenges of development, such as environmental degradation, urban congestion and social inequality. Importantly, because no two countries are alike, the transfer of knowledge from abroad requires context-specific adaptation. This can give rise to further innovation. Therefore, aside from its domestic productivity dividends, new-to-the-country innovation can be a stepping-stone for the development of niches that may appeal to countries with similar conditions (OECD, 2012a).

National patents and trademarks

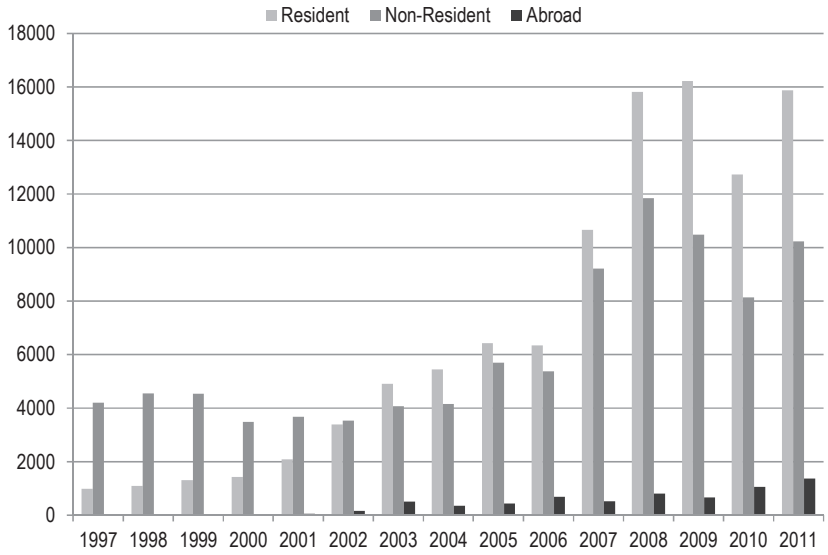
Patent applications filed in Viet Nam's national patent office can be distinguished as domestic or foreign patents on the basis of the applicant's residence. The two types reflect different economic processes. Domestic patents correspond for the most part to new-to-the-country technological innovations and reflect the efforts of Viet Nam-based applicants. Patents filed by foreign applicants seek to protect a foreign invention from imitation and production in and for the Vietnamese market. The latter can be understood as an indicator of international technology diffusion (in the sense that an international invention is disclosed to the community of Vietnamese inventors) as well as an indicator of barriers to prevent the appropriation of foreign knowledge by local actors.

Patent applications in Viet Nam's national office are overwhelmingly filed by foreign residents. According to the 2012 Annual Report of the National Office of Industrial Property of Vietnam (NOIP), over 2001-12, for every patent filed by a domestic applicant, 12 foreign applications were filed. Domestic applications grew rapidly over the period, with the annual flow increasing from 52 in 2001 to 382 in 2012. According to the 2012 Annual Report of NOIP, during period of 2001-10, 1 665 patent applications were filed by Vietnamese and 20 057 by foreigners; during 2001-13, the respective figures are 2 348 and 27 021). The number of industrial property right applications (particularly of trademarks) has also grown significantly in recent years (discussed below). This indicates that social and business awareness of the importance of IPR protection has gradually improved. Application processing times have been reduced, as have procedures and steps in accordance with the legislation. However, it appears that NOIP has faced difficulty in handling the increased number of applications due to its limited administrative resources. The substantial increase in patent applications by foreign applicants from 2004 can be seen as an indication of high expectations for the development of Viet Nam's technology market.

A trademark is a legal instrument meant to protect intellectual property, such as a company's distinctive logo and other aspects of its brand. Like other intellectual property instruments, trademark applications may signify the generation of economically useful novelty and may therefore be used as a complementary indicator of innovation. Trademarks are especially relevant in the services sector and, compared to patents, are more representative of the activities of smaller firms and of non-technological innovation in general. Trademarks have been shown to correlate well with other innovation indicators (Millot, 2009) and are a proxy for activity that is closer to the commercialisation stage

(Mendoça et al., 2004). Viet Nam witnessed a steep rise in both resident and non-resident trademark registrations during 2001-11 (Figure 3.11). Viet Nam's international position has also improved over time, as the country ranks 15th (resident) and 19st (non-resident) on the World Intellectual Property Organizations' ranking of trademark registrations (WIPO, 2013).

Figure 3.11. Trademark registrations in Viet Nam



Source: WIPO (2013), "Statistical Country Profiles. Viet Nam", www.wipo.int/ipstats/en/statistics/country_profile/countries/vn.html, accessed July 2013.

New-to-the-world innovation

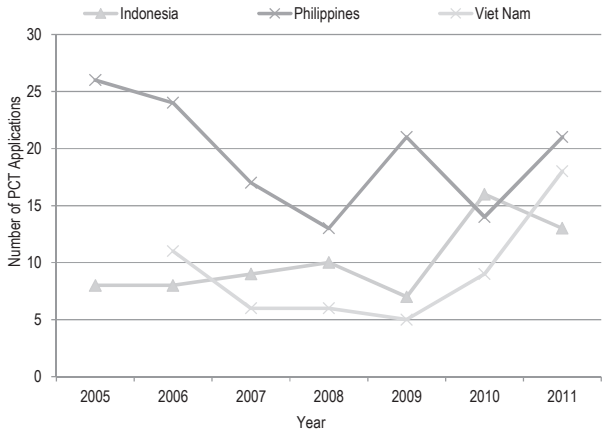
There are a number of reasons why engagement in frontier-shifting innovation can be important for development:

- The ability to perform frontier-shifting innovation is important for (and an important indicator of) a country's ability to absorb and productively redeploy foreign technology.
- Internationally appealing niches may emerge as the result of the combination of foreign and local varieties of knowledge, even at an early stage in the development of an innovation system.
- The value of such niches may not be appreciated unless local researchers are well integrated in global research, development and production networks. Shifting the frontier enables local research to participate in these networks.
- Ultimately, new-to-the-world innovation is not an end in itself, but a means to other national goals, such as greater competitiveness and sustainable growth beyond the catch-up process.

International patents

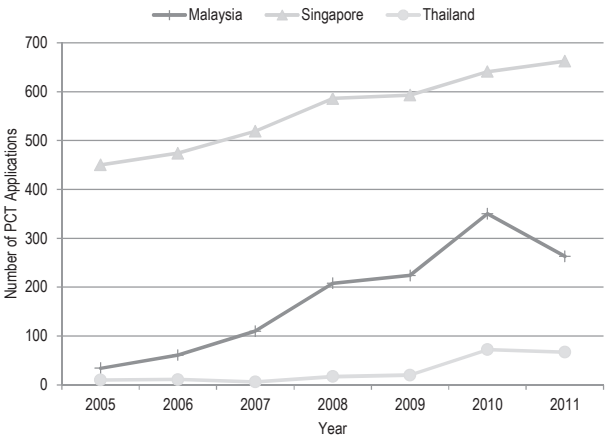
Patent Cooperation Treaty (PCT) patent applications in Viet Nam and other Southeast Asian countries represent economically significant new-to-the-world technological innovations (Figure 3.12 and Figure 3.13). Viet Nam has very low levels of international patenting, having filed on average just under ten PCT patent applications a year from 2005 to 2011. This is not surprising given the low levels of R&D expenditure in general and in the business sector in particular. By 2011 Viet Nam had levels of international patenting similar to those of Indonesia and the Philippines, while Malaysia and Thailand had levels several times higher. Nevertheless, the net positive trend could be indicating that capacities are gradually being built up.

Figure 3.12. PCT patent applications in Philippines, Viet Nam and Indonesia, 2005-11



Source: WIPO Statistics Database, September 2012.

Figure 3.13. PCT patent applications in Singapore, Malaysia and Thailand, 2005-11

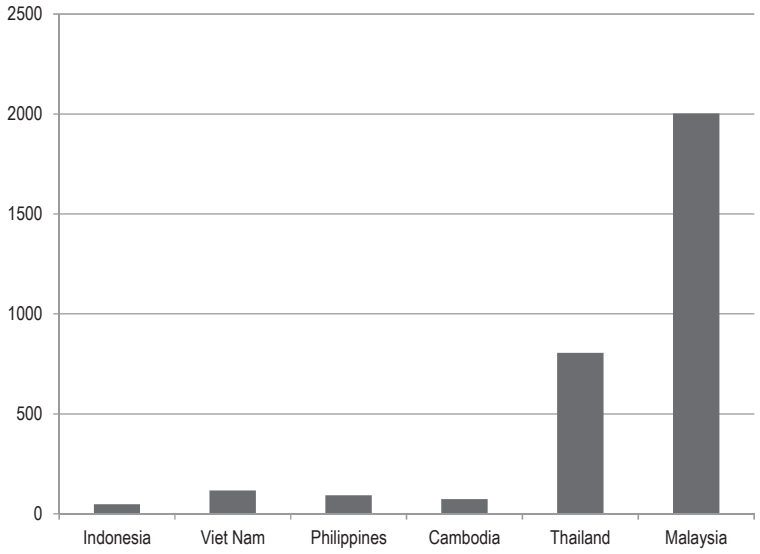


Source: WIPO Statistics Database, September 2012.

International scientific publications

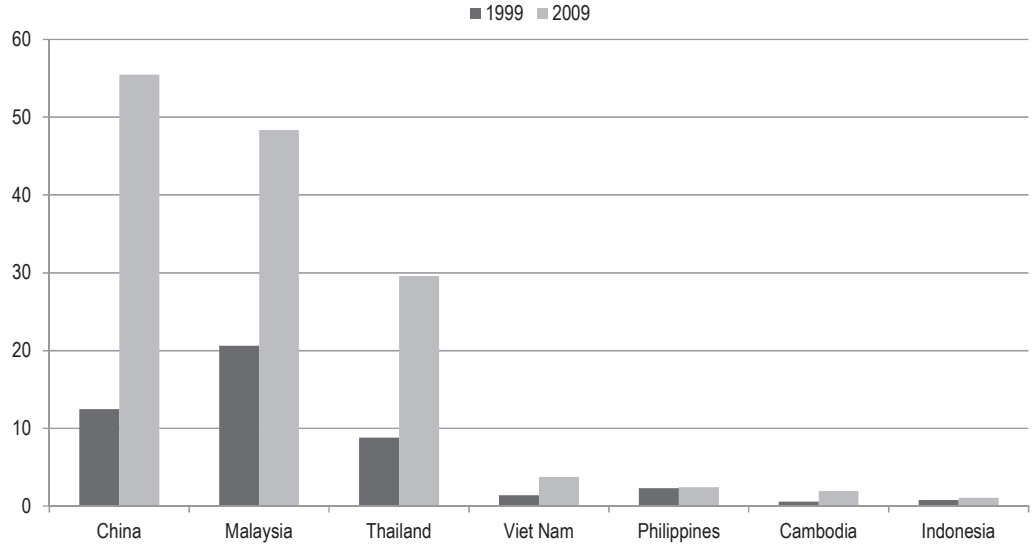
In terms of the total number of scientific papers per population published over 2000-10 (Figure 3.14). Viet Nam's performance is marginally better than that of the Philippines and Cambodia and Indonesia, but considerably weaker than that of Malaysia and Thailand. Publications per population in science and engineering (S&E) are also at a very low level (Figure 3.15); in 2010 Viet Nam had almost eight times fewer than Thailand. Nevertheless, Viet Nam has experienced a sizeable increase in S&E output, which more than doubled over the decade.

Figure 3.14. International scientific publications per million population, 2000-10



Source: Science Metrix for publication counts based on Scopus (Elsevier) and UNESCO (2012) for population data.

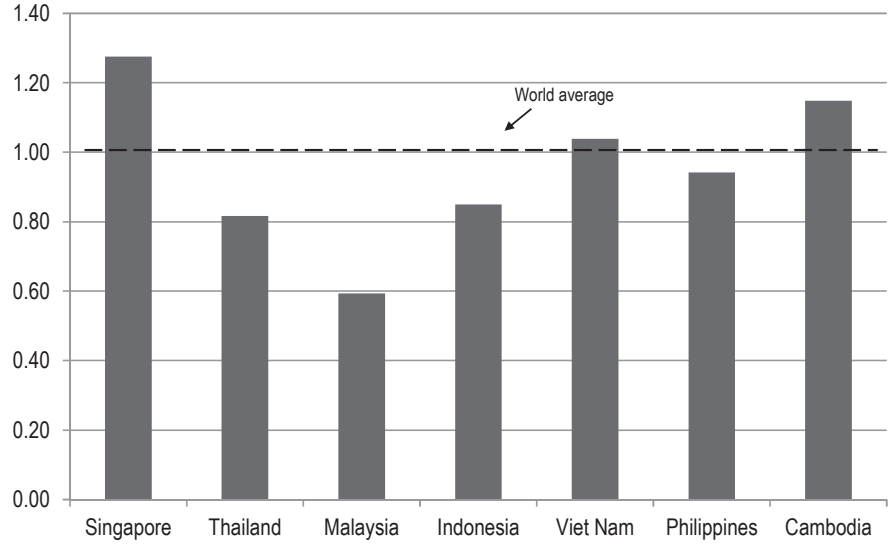
Figure 3.15. Science and engineering publications per million population, 1999 and 2009



Source: NSF (2012) for S&E article counts based on SCI and SSCI (Thomson Reuters) and UNESCO (2012) for population data.

Figure 3.16 shows the scientific impact of national publications [4] for Viet Nam and comparator countries. This indicator is based on the number of citations received per scientific publication and is considered a proxy for the visibility, impact and, indirectly, quality of national scientific output. The impact of Viet Nam's scientific output over 2000-10 was just over the world average. Among the countries considered, Viet Nam was second only to Singapore and led countries with much more developed research systems, such as Malaysia and Thailand. Such a positive showing may be related not only to internal capabilities but also to the impact dividend yielded by international scientific collaboration.

Figure 3.16. Impact of scientific publications of selected countries, 2000-10



Source: Science-Metrix using the Scopus (Elsevier) database.

There is a virtuous relationship between international scientific collaboration and national impact. International scientific collaboration increases the visibility of national scientific output and enhances its impact, and greater impact enhances attractiveness as a collaboration partner. Table 3.3 presents an index of international scientific collaboration in Southeast Asian countries for 2000-10. In Viet Nam 76% of all scientific publications over the period had at least one international co-author, a share exceeded in the comparator group only by Cambodia's 90%. As a rule, smaller countries tend to have higher shares of international collaboration (Schubert and Braun, 1990). For this reason, the index presented in the last column of Table 3.5 is adjusted to control for size. Following the size adjustment, Viet Nam leads the regional group, followed by Indonesia and Cambodia.

Table 3.3. Size-adjusted index of international scientific collaboration by Southeast Asian countries, 2000-10

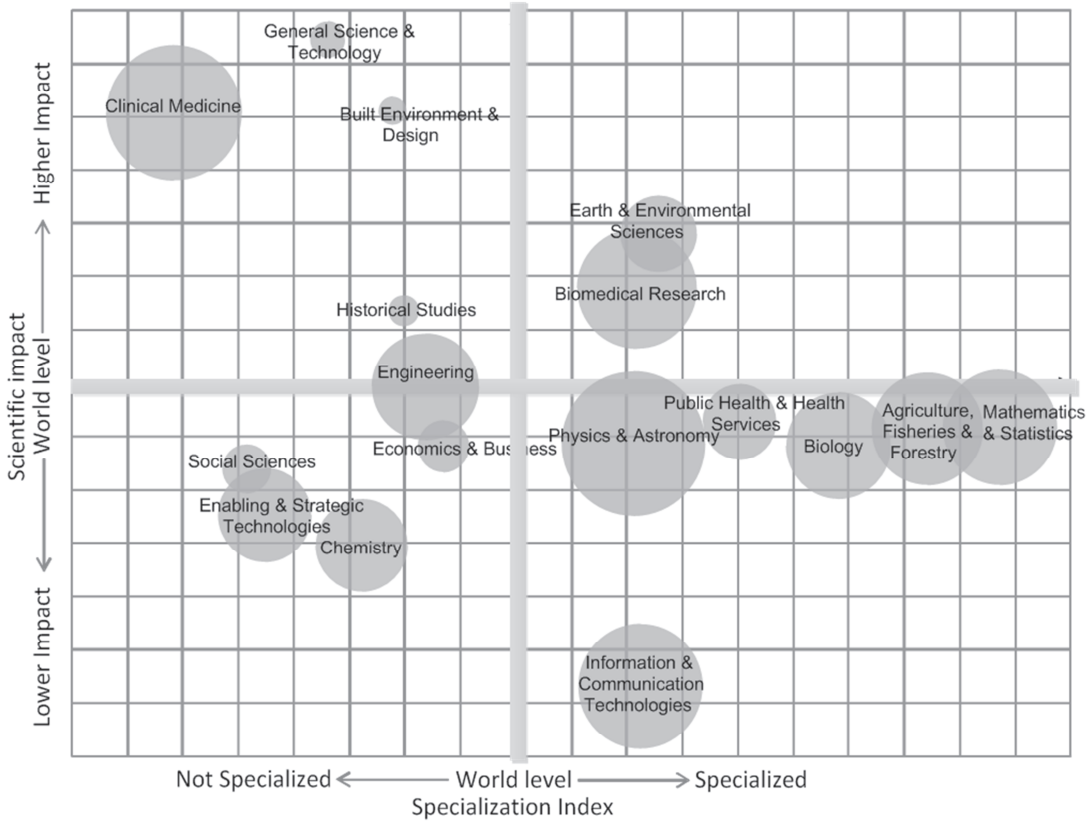
Country	Collaborations	All papers	Collaboration rate	Collaboration index
Viet Nam	7 367	9 724	76%	1.44
Indonesia	8 094	10 970	74%	1.42
Cambodia	896	992	90%	1.38
Philippines	5 050	7 906	64%	1.19
Singapore	42 667	99 840	43%	1.01
Thailand	23 223	53 717	43%	0.97
Malaysia	17 360	52 242	33%	0.74

Source: Science-Metrix using the Scopus (Elsevier) database.

Scientific impact is also closely related to a country's specialisation. Specialisation in specific knowledge areas is built up incrementally over time and can lead to the accumulation of knowledge and related capacities that permit shifting the scientific frontier. Figure 3.17 presents an overview of Viet Nam's specialisation profile, in terms of the relative size of various knowledge areas (the size of the circles corresponds to the number of papers). The horizontal and vertical axes correspond to Viet Nam's specialisation with respect to the world and its scientific impact with respect to the world, respectively.

Bibliometric data indicate that physics and astronomy, together with clinical medicine, are the leading knowledge areas in Viet Nam. Viet Nam has a specialisation above the world average in mathematics and statistics, agriculture, fisheries and forestry, and biology. However, these areas still have lower than world average impact. Only Earth and environmental sciences and biomedical research have both above world average specialisation and impact, and even in these cases, Viet Nam is only a few notches above the respective world averages. Clinical medicine, general science and technology, as well as built environment and design, have a scientific impact that is not only above world average but also not far from the maximum but a below-average specialisation. This last observation may provide an initial indication of shortcomings in the build-up of resources in those knowledge areas and may open a fruitful policy discussion about the merits of priority setting and concentration.

Figure 3.17. Viet Nam's scientific impact and specialisation index, 2000-10



Note: Area of circles represents the number of scientific publications

Source: Computed by Science-Metrix using the Scopus (Elsevier) database.

Table 3.4 presents Viet Nam's top collaboration partners, ranked according to their respective share of total international collaborations. The table indicates that interregional collaboration is much more common than intraregional collaboration. Viet Nam collaborates mostly with developed OECD economies, notably Japan, the United States, France and Korea. Among its Southeast Asia neighbours, the most prominent collaboration partner is Thailand, followed by Singapore, Indonesia, the Philippines, Malaysia and Cambodia, each accounting for between 2.2% and 1.1% of Viet Nam's international collaboration.

Table 3.4. Viet Nam's collaboration partners by share of total collaborations, 2000-10

Rank	Economy	Share	Rank	Economy	Share	Rank	Economy	Share
1	Japan	18.5	9	China	4.6	17	Malaysia	1.8
2	United States	15.1	10	Chinese Taipei	2.9	18	Cambodia	1.1
3	France	14.4	11	Russia	2.5	19	Brazil	1.1
4	Korea	11.0	12	Canada	2.5	20	South Africa	0.8
5	United Kingdom	9.4	13	Italy	2.4	21	Laos	0.8
6	Australia	9.3	14	Singapore	2.2	22	Myanmar	0.5
7	Germany	7.0	15	Indonesia	2.1	23	New Zealand	0.4
8	Thailand	6.0	16	Philippines	2.1	24	Brunei Darussalam	0.0

Source: Science-Metrix using the Scopus (Elsevier) database.

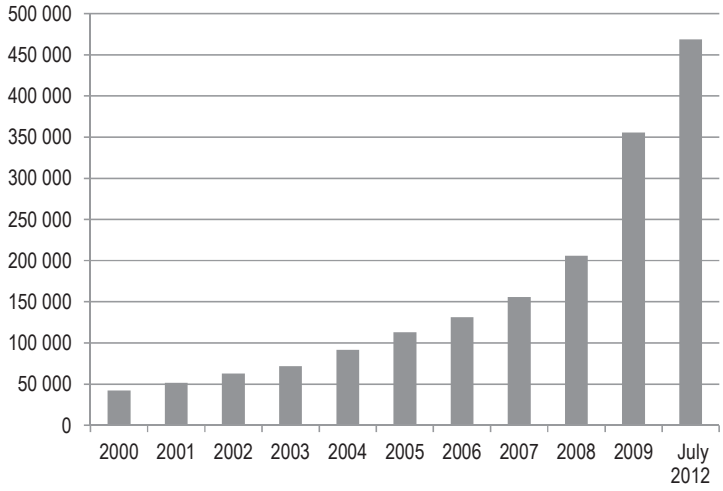
3.2. Innovation actors

Business sector

Characteristics

Lack of indicators and other sources of information preclude painting a comprehensive and internationally comparable picture of business-sector innovation. An accurate view of the scope and magnitude of business innovation is further complicated by the fact that the business sector is undergoing rapid change. According to Ketels et al. (2010), following the adoption of the Enterprise Law in 1999, the number of new businesses registered during 2000-02 exceeded the total of the previous decade. Further legislative changes in 2005 simplified the procedures for starting a business and induced a boom in private-sector activity and rapid growth in the share of private firms. In 1995, the state and non-state sectors had equal shares in the total value of industrial output, but by 2009, the share of the non-state sector was three times that of the state sector (Ketels et al., 2010). The number of companies has been growing at an average of 28% a year since 2000 (Figure 3.18). By 2009 about 356 000 private firms had been registered (GSO, 2010; Anh and Duc, 2010), and some 273 000 were paying taxes (Ketels et al., 2010). By 2012 the number of established enterprises had increased to approximately 663 800, of which 468 600 were operating (MPI, 2012).

Figure 3.18. Number of firms in Viet Nam, 2000-09



Source: 2000-08 data from GSO (2010); 2009 data from Anh and Duc (2010), *Efficiency and Competitiveness of the Private Sector in Vietnam*, CIEM/DFID, Hanoi.
http://vnep.org.vn/Upload/Competitiveness%20of%20Vietnamprivate%20sector%20DFID-first%20draft.pdf;
2012 data from MoPI (2012), "Report on socio-economic status for the first 7 months of 2012 and implementation of Resolution 01/ND-CP", submitted to regular government meeting in July 2012, Ministry of Planning and Investment.

In spite of these changes, state-owned enterprises (SOEs) remain an important part of the business sector. According to information provided by the Viet Nam National Agency for Scientific and Technological Information (NASATI), in 2009 they accounted for 27% of the business sector's total income and 37% of its assets. In developing countries, SOEs have sometimes played an important role in upgrading the technological capabilities of the domestic business sector through demand for innovation from suppliers, engaging in extensive training schemes, helping consolidate quality and other standards (OECD, 2007). However, available evidence about technological capabilities in SOEs in Viet Nam is mixed. SOEs account for the majority of domestic business R&D expenditure (Table 3.6). Businesses operating in sectors with a high concentration of state ownership have higher total factor productivity (TFP) (Newman et al., 2009); this may suggest that SOEs have some technological leveraging potential. However, SOEs, like other domestic businesses, have lower TFP than foreign-owned businesses. Moreover, by some estimates, SOEs are unable to allocate investments as productively as other domestic businesses.[5] Given their continuing weight in overall economic activity and their potential to act as catalysts for wider change, improving the productivity of SOEs seems an urgent task. Intensifying competition from domestic and multinational firms should help to raise the productivity of SOEs and other firms, a process that will be helped by the maturing of a financial sector that remains fairly shallow. SOEs are in some cases sheltered from competition and may be profitable without necessarily innovating (Tagscherer, 2010). Intensifying competition should also stimulate demand for innovation.

A sizeable foreign-owned sector has developed in the years since *doi moi.* According to information provided by NASATI, in 2009 the foreign-owned sector accounted for 26% of the business sector's total income and 23% of its assets. While some parts of the foreign-investment sector conduct R&D (see below), anecdotal evidence suggests that they do not always use the latest production methods. Interviews with relevant

stakeholders suggest few spillovers from multinational enterprises (MNEs) and joint ventures (Tagscherer, 2010).

Over the past decade the domestic private sector has grown substantially. NASATI reports that 96% of all businesses belong to the domestic private sector, which accounts for 51% of the business sector's total income and 37% of its assets. The sector has many SMEs, some of which are developing innovation capacities (Box 3.1).

Box 3.1. Examples of Vietnamese-owned innovative firms

Ba Huan. Specialised in the production of eggs (more than 1 million a day), it uses the latest technology (hardware, software and training imported from the Netherlands) and has acquired a reputation for high quality.

Vinamit. This food processing company focuses on jackfruit, bananas, sweet potato and increasingly on livestock. It has an average annual growth rate of 35% and exports 60% of its production. The technology and machinery for cleaning, processing and packaging of dried fruit come from the United States and Chinese Taipei. Vinamit has its own lab for developing new seeds and has launched a pilot programme for contract farming with a view to more consistent production, prices and quality.

THP. With non-carbonated beverages that are well known across the country, it has grown quickly and now employs 4 000 workers on a 50 hectare site. Equipment is imported from Germany, Japan, France and China and it has its own R&D department.

Humix. An organic fertiliser company, Humix's products are considered high quality. Its production undergoes a rigorous testing process and much of it is exported. It has just moved to a larger factory in which the machinery was built on the basis of designs from overseas.

All four firms have some common features: the owners are from the diaspora, educated overseas, or have connections abroad; all four have upgraded technology; and all are currently exporting or plan to export, meaning that they must meet higher quality standards.

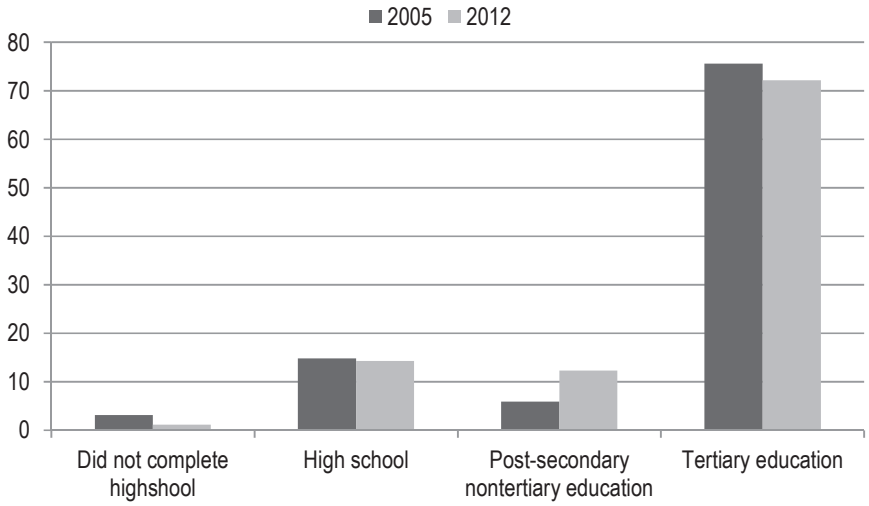
Source: World Bank and NISTPASS (2010), "Innovation Policy in Viet Nam", Policy Discussion Note, March, p. 10.

Absorptive capacity of firms

The capacity to absorb knowledge and technology and adapt them to the firm's needs is jointly determined by the ability and willingness of management to mobilise resources for investment and the characteristics of the firm's organisation and workforce. Absorption of existing knowledge is central to achieving productivity improvements and moving to more sophisticated economic activities with higher value added. Firms operating in more advanced settings may use part of their workforce to search for new ideas and thus further strengthen their ability to draw upon the ideas of others.

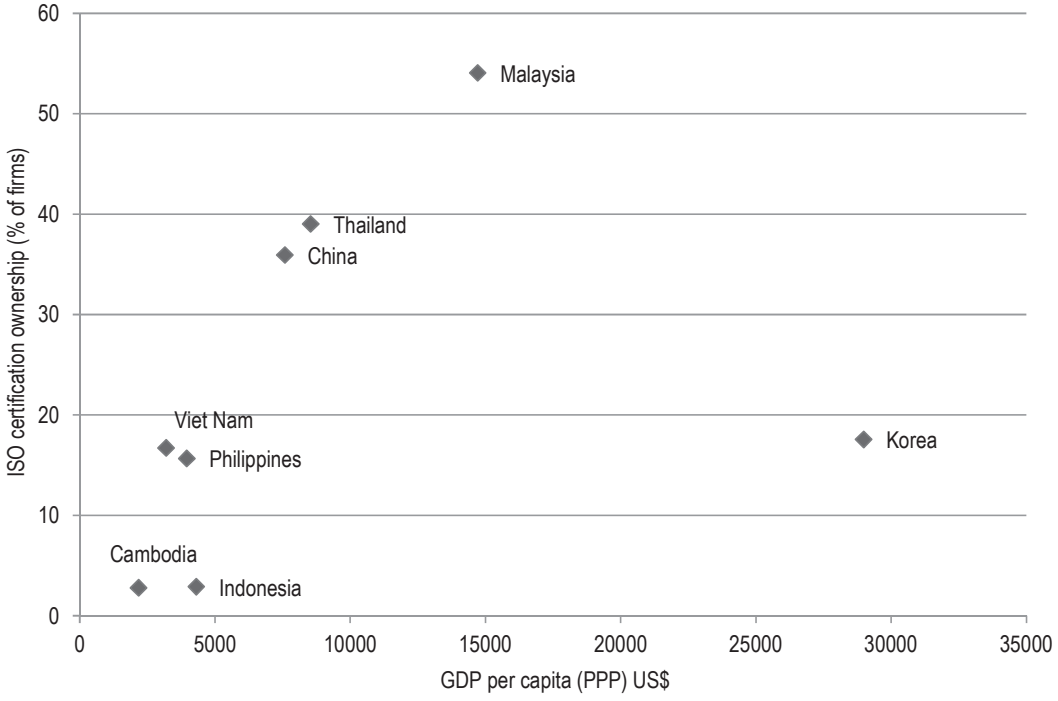
Capable managers can be pivotal for recognising opportunities arising from the search for and adaptation of knowledge and for devoting resources to this activity. There is some evidence that poor managerial skills are a drawback for all firms but most seriously for SMEs,[6] which are mostly family-run, but lack of experienced middle managers hampers other firms as well (Ketels et al., 2010). These firms also have few scientists, only 4 per 1 000 firms as against 94 and 31 per 1 000 for SOEs and foreign-invested enterprises (FIEs), respectively (Anh and Duc, 2010). While managers are much more likely to be university graduates (over 70%) than the average worker (around 10%, according to NASATI data for 2009), the educational profile of business managers in Viet Nam has changed little over time (Figure 3.19). In a survey by the Japan External Trade Organization, over half of surveyed firms reported difficulties in hiring skilled engineers and managers (McKinsey Global Institute, 2012, p. 32).

Figure 3.19. Highest level of education completed for managers in Viet Nam, 2005-12.



Source: Viet Nam 2005 Investment Climate Survey; Viet Nam 2012 STEP Skills Survey.

Figure 3.20 Firm ownership of ISO certification and GDP per capita



Source: OECD, based on World Bank and UNESCO.

The introduction of new organisational methods can affect the productivity of the labour force. The multitude of organisational methods relevant to various industrial sectors and product categories precludes any comprehensive assessment. However, a representative organisational method such as ISO certification can help to show the spread of new organisational methods. As an indicator of product and service quality, ISO certification carries a reasonable expectation of productivity benefits and therefore serves as a form of credential, signalling readiness to operate at the global level. Though more relevant to manufacturing, ISO certification also applies elsewhere. Moreover, the award of an ISO certification may hinge on the adoption of associated organisational methods.

Figure 3.20 plots the share of companies with ISO certification against national income per capita. There is a close correlation between the two measures, except in Korea. In Viet Nam, 17% of companies are ISO-certified, a share that is in line with its national income per capita. Viet Nam has a slightly higher share than the Philippines, despite the latter's higher income per capita. In Malaysia 54% of companies are ISO-certified, followed by Thailand with 39% and China with 36%.

Internationally comparable indicators on firm-level use of technology can reveal the receptiveness of Vietnamese companies to technical change (Table 3.5). Viet Nam is ahead of Indonesia and behind the Philippines in terms of the share of manufacturing firms using technology licensed from foreign companies. The share of firms with their own website in Viet Nam was larger than in Malaysia and Indonesia but lower than in the Philippines and Thailand. Viet Nam leads the comparator group (83%) with respect to email use by companies. Overall, the receptiveness of Viet Nam's business sector to the technologies covered by Figure 3.20 and Table 3.5 is low but encouraging, as it is in keeping with, or better than, its income per capita.

Table 3.5. Firm-level technology use in Viet Nam and other countries

	Year	Percentage of manufacturing firms using technology licensed from foreign companies*	Percentage of firms with their own website	Percentage of firms using email to interact with clients/suppliers
Indonesia	2009	4	5.7	13.2
Cambodia	2007	...	39.2	56
Korea	2005	...	...	77.4
Malaysia	2007	...	24.6	66.8
Philippines	2009	17.9	50.1	67.8
Thailand	2006	...	50	74.1
Viet Nam	2009	12.3	40	83.2

Source: World Bank, Enterprise Surveys.

Research and innovation capacity in firms

A pilot R&D survey of the business sector performed by NASATI suggests that companies devote few resources to R&D and innovation (RDI), in both absolute and relative terms. In 2009 total RDI commitments were VND 746 059 million (about USD 42 million) of which about a third were for R&D (Table 3.6). The foreign investment sector accounted for about 45% of business RDI and about 47% of business R&D. The state directly funds only about 3% of business RDI. However the RDI funding of SOEs accounts for a substantial 31% of total business funding.

Table 3.6. R&D and innovation expenditure and number of projects in Viet Nam, by economic sectors and industries, 2009

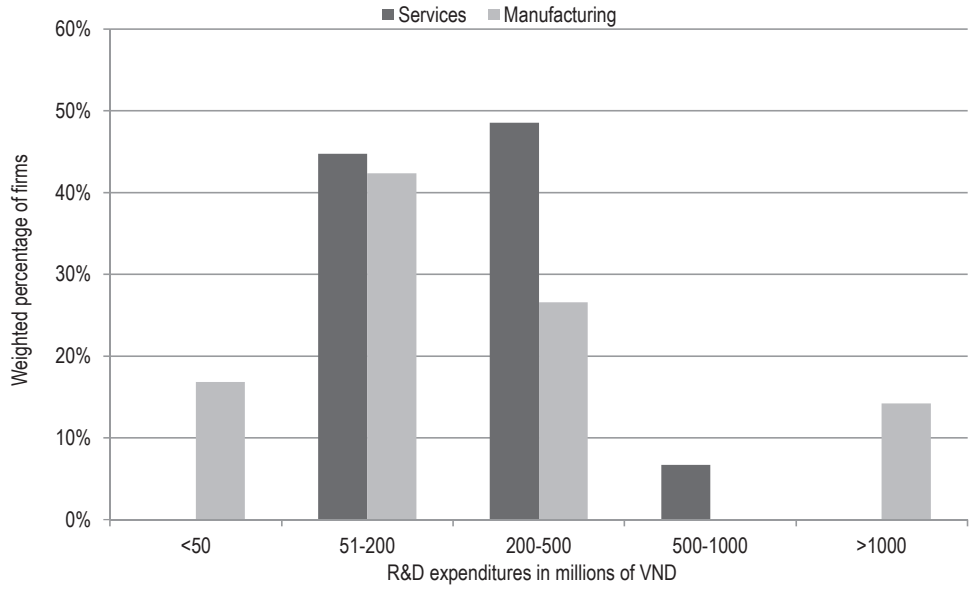
	R&D expenditure								R&D projects			
	Funding source (in million VND)					Purpose (in million VND)						
	Total	State	Enterprise	Foreign	Others	Total	R&D	Innovation	Total	State	Ministry	Local
Economic sector	746 059	25 034	705 823	92	15 110	653 374	253 210	400 164	773	22	69	682
State-owned	240 805	14 178	218 853	-	7 774	233 984	100 835	133 149	442	14	24	404
Non-state	166 123	10 536	148 209	42	7 336	94 677	32 858	61 819	312	8	43	261
Foreign investment sector	339 131	320	338 761	50	-	324 713	119 517	205 196	19	-	2	17
Industry												
Processing industry	437 495	12 665	419 455	-	5 375	387 304	134 795	252 509	474	9	31	434
Mining industry	210 970	-	208 819	-	2 151	210 880	83 824	127 056	16	-	-	16
Finance - credit	41 884	48	41 836	-	-	1 841	495	1 346	20	-	2	18
Construction	12 913	3 253	5 660	-	4 000	12 904	5 323	7 581	30	3	2	25
Agriculture and forestry	10 488	3 422	5 535	-	1 531	8 816	7 615	1 201	27	2	8	17
Trade; repair of motor vehicle motorbike consumer goods	7 825	1 165	6 560	-	100	7 825	5 718	2 107	25	-	7	18
Activities related to asset business and consultancy	6 500	3 272	3 166	42	20	5 993	4 528	1 465	39	2	17	20
Fishery	6 458	1 189	5 269	-	-	6 438	1 180	5 258	21	2	-	19
Individual and communities support activities	5 585	-	5 585	-	-	5 585	5 585	-	8	3	1	4
Transportation storage and communication	2 074	20	2 054	-	-	1 921	1 714	207	67	1	1	65
Electricity gas and water production and delivery	1 983	-	50	-	1 933	1 983	1 933	50	10	-	-	10
Hotel and restaurants	572	-	572	-	-	572	222	350	1	-	-	1
Culture and sport	54	-	54	-	-	54	-	54	-	-	-	-
Health care and social well-being	50	-	-	50	-	50	30	20	5	-	-	5
Education and training	-	-	-	-	-	-	-	-	25	-	-	25

Source: Viet Nam National Agency for Scientific and Technological Information (NASATI)

In terms of industries, the processing and mining industries account for the lion's share of RDI funding, with 87% of business RDI. The small amounts of RDI performed in other sectors mostly involves formal R&D (rather than other innovation expenditure) and probably corresponds to a very small number of advanced firms operating in relative isolation from the rest of the business sector.

Additional evidence on the propensity of Vietnamese firms to engage in innovation can be gleaned from a 2012 survey by the Central Institute for Economic Management - CIEM and the World Bank. This random survey of 352 employers mainly concerned the workforce skills profile. Only about 10% of respondents had a dedicated R&D unit; these employed on average 8-9 staff in the three years prior to the survey. The survey also asked about firms' R&D expenditures (Figure 3.21). Overall most companies spent modest amounts on R&D. In terms of the amount of expenditure, about 90% of service firms and about 70% of manufacturing firms spent between VND 51 million and VND 500 million (USD 2 400-USD 23 500). Manufacturing firms spent more on R&D than services firms and a greater share of their expenditure was concentrated in larger spenders, with 14% of manufacturing firms spending over VND 1 000 million (about USD 47 000).

Figure 3.21. R&D expenditures in services and manufacturing companies by size of expenditure



Note: Weighted percentage of surveyed firms.

Source: World Bank.

The share of tertiary-educated in the labour force can be indicative of the capacity of industry to employ highly skilled workers. Viet Nam has the second-lowest share among the countries in the comparator group for which data are available, ahead only of Indonesia (Table 3.7). In the other comparator countries tertiary graduates are between a fifth and a third of labour force total.

Table 3.7. Share of labour force with tertiary education as a percentage of total, 2008

Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Viet Nam
7.1	41.4	35	21.2	28	25.8	14.6

Note: Korea: 2007. Viet Nam: 2009.

Source: World Bank, World Development Indicators and NASATI.

Doctoral graduates and postgraduates are generally an insignificant share of the business workforce (Table 3.8). Only about 10% of business personnel are university graduates. Fewer than 5% have a college diploma, which is usually associated with vocational skills. The shares are nearly identical for men and women. The relative lack of human capital in the productive sector is a medium-term constraint on technological catch-up. Human resource constraints, together with the small financial resources devoted to R&D and innovation, are in keeping with the very small production of new-to-the-world knowledge (as captured by international patents) and suggest that the impact of most innovation activity does not extend much beyond the boundaries of the firm.

Table 3.8. Science and technology personnel in enterprises, 2009

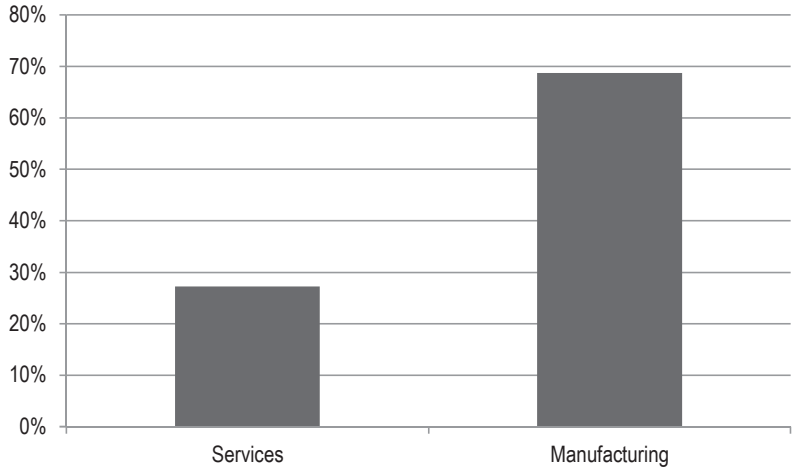
No.		Total		Women	
		Total	Percentage	Number	Percentage
1	Total labour	8 927 859		3 751 604	
2	PhD	2 668	0.03	650	0.02
3	Master	25 225	0.28	8 802	0.23
4	Undergraduate	856 062	9.59	339 882	9.06
5	College diploma	418 952	4.69	176 359	4.70

Source: Viet Nam National Agency for Scientific and Technological Information (NASATI), pilot survey.

The 2012 CIEM and World Bank survey also enquired about the prevalence of broader innovation activity. Given the focus of the survey on skills, innovation-related responses are not directly comparable with those of other international innovation surveys (such as the EU's Community Innovation Survey). Nevertheless, the survey provides some insight on innovation activity, challenges, collaboration activity and perceived policy needs across a broad cross-section of firms.

About half of employers reported that their firms had worked on at least some "new characteristics" over the previous three years. The definition of "new characteristics" is somewhat broader than in international innovation surveys as it includes new inventions, research results, new business ideas, products, services and production/management processes (CIEM and World Bank, 2012). Manufacturing firms were more likely than services firms to have engaged in some form of innovation (Figure 3.22). Over 70% of firms developed an idea within the firm before commercialising it, while a mere 1% sold the idea or patent to a business partner. Only about a tenth of surveyed firms applied for a patent. In terms of perceived needs connected to innovation, most firms reported "training for technology use", an indication that more vocational training would be needed. The survey also revealed that firms co-operated rarely with partners. Finally, with respect to assistance from research institutes and firms, "access to developed technologies for absorption and adaptation" was the area most often mentioned.

Figure 3.22. Share of firms that worked on "new characteristics", 2011

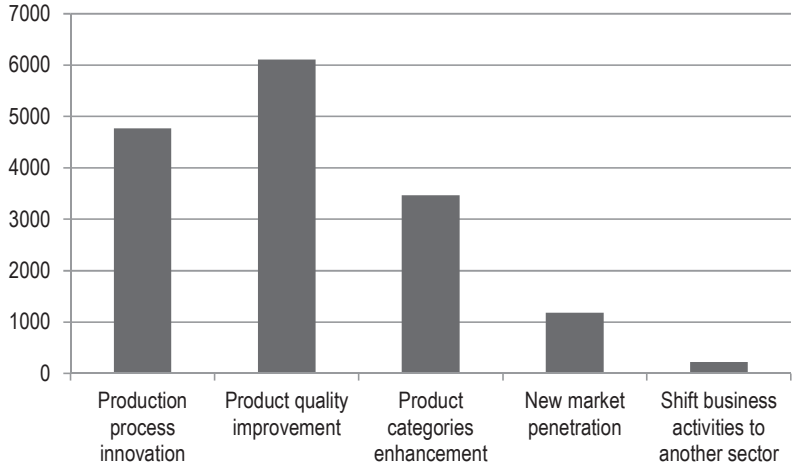


Note: Weighted percentage of surveyed firms. 36% of services and 20% of manufacturing firms did not respond to this question.

Source: World Bank.

Information from a 2010 enterprise survey on 8 000 innovative businesses suggests that companies' dominant innovation strategy involved improvements in product quality (Figure 3.23). The introduction of process innovations with potential productivity improvements was also important. However, few firms saw innovation as a way to diversify into new types of products or new markets. Only about 11% of surveyed firms engaged in R&D activities, and of those that did, 60% conducted only intramural R&D.

Figure 3.23. Number of firms pursuing various innovation strategies, 2010



Source: Viet Nam National Agency for Scientific and Technological Information (NASATI).

With regard to difficulties encountered in the innovation process, a majority of firms responding to the CIEM and World Bank survey cited product development, a stage that typically follows R&D but precedes commercialisation. Ketels et al. (2010) suggest that given the business environment, investment in innovation may be less profitable than speculation in land and real estate. Technological adoption and upgrading are also hampered by high investment costs, limited ability to obtain credit and to prepare the necessary applications, and difficulties in recruiting appropriate human resources (World Bank and NISTPASS, 2010, p. 5). According to Tran Ngoc Ca (2007), SMEs in particular face several obstacles, including lack of resources (financial, human and equipment), unavailability of technical services, lack of information (about available technologies, product requirements and distribution channels), and difficulty in obtaining credit (such as the bank or government loans typically available to SOEs).

The finance and human resource constraints and the provision of information and technical services call for dedicated policies. Improvements in other framework conditions would also be needed. For instance, increased competition from trade liberalisation and the presence of MNE activity have had a positive impact on the innovation activities of Vietnamese SMEs (Ngoc Anh et al., 2011). Viet Nam's greater openness therefore provides possibilities for more technology transfer and adaptation.

Innovation linkages

The available evidence, while partial and fragmented, points to very weak linkages between science and industry. Businesses account for only 2.8% of the funding of public research. The 2012 CIEM and World Bank survey found that only about 6% of firms had engaged in innovation-related co-operation with an outside partner and only about 1% collaborated with research institutes and universities. This is hardly surprising, given the small amount of business research, in absolute as well as relative terms, and the proclivity of the majority of businesses to engage in small-scale research (CIEM and World Bank, 2012). The public research system also suffers from pronounced resource constraints, which may limit opportunities for collaboration. There are other factors at work as well. Many institutes do not actively look for the market, and seem to be content with simply conducting research using their currently available resources without concern for the needs of enterprises. Furthermore, the lack of intermediary institutions, agencies, consultancy, evaluation, valuation and provision of technology-related information is also a constraint on interactions between the public research sector and businesses. Information technology and training are the services that firms commonly seek outside their boundaries (Tran Ngoc Ca, 2007). MNE affiliates are not connected to the local research system (Tagscherer, 2010) and find it difficult even to establish supplier relations owing to quality issues (Giroud, 2007).

There is probably considerable room to enhance linkages despite the currently low level of resources and capacities. One way would be to strengthen links between science and industry. The lack of suitable intermediaries between public research and business and the absence of incentives for universities and public research institutes (Tagscherer, 2010) point to areas for policy attention. The 2013 S&T Law established some mechanisms that can be considered "incentives" for public research sector (allowing for granting the ownership of S&T outputs financed by the state budget to the respective line agencies). However, there remains room for improvement towards transfer of ownership under a "flexible" mechanism, which does not require permission from the state representatives (MoST) in order to facilitate research institutes and universities in commercializing their research outputs. In case of generating revenues, only a small

portion should be contributed to the state budget, and more importantly, the whole society will benefit from commercialisation and application of such research. The pursuit of more extensive linkages with MNEs is another possibility. Policy instruments such as joint training schemes with local universities and incentives for collaborative innovation activities may be considered. With improved productivity, SOEs could also play a role in getting more domestic firms to innovate and progressively extend their innovative horizon.

Increasing internationalisation and integration of the domestic sector into global value chains may provide both the market demand conditions and the opportunity for the knowledge spillovers necessary for comprehensive and continuous technological upgrading. The establishment of industrial parks (IPs) has been extensively used for industrial development in Viet Nam and is a major policy initiative that is somewhat related to the strengthening of linkages. It is estimated that by the end of 2010, 261 IPs had been approved (173 operational) and housed 8 339 firms and employed 1.6 million workers (World Bank and Donor Working Group, 2012, p. 60). While IPs are recognised as having facilitated structural change to in some cases technologically intensive manufacturing, their low occupancy rate suggests that their rate of growth may not be commensurate with manifested demand for investment. The Que Vo Industrial Park and the Saigon High Tech Park offer examples of some of the more advanced activities that take place in such parks (Boxes 3.2 and 3.3). Because SOEs enjoy preferential treatment, MNEs develop joint activities with them, taking advantage, among other things, of their easier access to land (Perkins and Anh, 2010). Evidence on the impact of IPs in strengthening innovation linkages is lacking.

Box 3.2. Que Vo Industrial Park and technology transfer

The Kinhbac City Group (a family-owned company) owns and runs about 20 IPs, including the Que Vo IP, which has created 20 000 jobs in a wide range of industrial sectors. Firms located within Que Vo (all of which are foreign-owned) enjoy favourable tax, land and infrastructure conditions. A special arrangement with the local authorities allows companies to receive VND 500 000 for hiring one Vietnamese employee. Housing is available both inside and outside the IP, two technical universities are being constructed, and synergies are being sought through regular meeting between the firms in the IP, local authorities, and local universities and vocational education/training centres. There is however no dual vocational education system whereby students obtain theoretical training at school and practical training at a company. In general, companies prefer not to take on board the extra "burden" that a trainee would impose. Foreign firms prefer to train their workers in-house and in some cases "import" highly skilled workers, mainly from China, to handle specialised machinery. There are annual meetings among investors in the IP where salary issues are discussed in order to align salary levels and development between the firms operating in the IP.

The IP has an interest in attracting large MNEs since they attract suppliers to the IP, thus creating more jobs and revenues. According to government regulations on local content, for example, Samsung, which produces mobile phones, must ensure that all components used in assembling its phones are made by companies in Viet Nam. However, the suppliers of these components are foreign firms, many of which are Chinese companies that have already acquired extensive experience as suppliers to Samsung. Most Vietnamese companies do not have the capacity and skills to compete with these foreign suppliers. This seriously constrains knowledge and technology transfer through FDI.

Source: World Bank and NISTPASS (2010), "Innovation Policy in Viet Nam", Policy Discussion Note, March, p. 6.

Box 3.3. Technology parks in high-technology industries: Saigon High-Tech Park

The Saigon Hi-Tech Park (SHTP) was established in 2002 with the strong support of the Ho Chi Minh (HCM) City government and the Vietnamese government, SHTP boasts a number of foreign companies, including Intel, Nidec (Japanese producer of computer motor fans) and Sonion (Danish producer of micro-acoustic parts for cellular phones). As of 2012, SHTP hosted 61 licensed investment projects(of more than USD 2 billion in total) , had 25 enterprises operating, 12 of which have R&D activities (5 of which devoted 10-38% of their revenues to R&D), employed more than 17 000 people. Their production volume was more than USD 2.2 billion, and their export value above USD 2.1 million.

SHTP has been quite successful in integrating Viet Nam in knowledge-intensive GVCs. The transport infrastructure features harbours and airports within a half-hour drive, which lowers the cost of accessing export markets. In addition, it has an adequate skill endowment; the park is located near downtown Ho Chi Minh City and its universities. SHTP has targeted skill enhancement through the creation of an on-site training and research centre, where newly recruited employees of tenant companies receive job-preparation courses. SHTP has also established research laboratories with funding from the Ho Chi Minh City government to invest in technical infrastructure and equipment. The research laboratories are managed as business units that receive contracts from the government and tenant companies. Finally, institutional improvements have been instrumental in facilitating SHTP's integration into value chains: the government grants SHTP companies a "one-stop-shop" to ease business transactions and channel tax incentives.

The SHTP has been effective in attracting foreign companies, stimulating economic activity, including employment, and integrating Viet Nam in GVCs. There is some debate, however, about the extent to which SHTP has helped shift Viet Nam's industrial structure towards higher-value-added and skill-intensive sectors. This is one of the government's goals and an important reason why the SHTP was originally set up. Many tenant companies continue to concentrate on lower value activities (even in higher-technology industries). Technology parks that are isolated from the developmental challenges affecting the rest of the economy may be too limited a tool. For example, the SHTP's advanced training centre and research laboratories contrast sharply with the level of human resources and technological capabilities found elsewhere in the country.

Source: Adapted from OECD (2013b), *Interconnected Economies: Benefiting from Global Value Chains*, OECD Publishing. Doi: 10.1787/9789264189560-en.

Technological change and firm-level productivity

The efforts of firms in Viet Nam to upgrade their technological capacities and engage in innovation can also be usefully examined from the perspective of the impact on firm-level productivity. A study by Newman et al. (2009) examined the effects of investment, ownership structure (state, domestic private, foreign) and technology use (proxied by the number of personal computers used) on TFP at the firm level).[7] They found that levels of investment and technology use, foreign ownership and operating in sectors with a high concentration of state ownership were associated with higher productivity. They point to evidence suggesting that higher productivity levels in foreign-owned firms were the result of investment and technology use. They also found that while the distribution of productivity across firms is becoming more even in many sectors, smaller domestic firms appear to be at a disadvantage.

A cross-country study of firm-level TFP performance in 2009 examined, in addition to Viet Nam, Asian developing countries such as Indonesia, Mongolia, Nepal and the Philippines (Saliola and Seker, 2011). While all of these countries had low TFP performance relative to other countries, Vietnamese companies lagged the group which was led by Indonesia and the Philippines.

Public research

This section reviews the main features of the public research sector in Viet Nam, in order to provide a background for the evaluation of its steering, funding and performance in Chapter 5.

The public research sector has expanded from a very small base in the 1960s to become a more diversified S&T system with a growing portfolio of public missions (Table 3.9). For a long time, this gradual development took place in the context of a planned and less developed economy. This meant that it was separate from the activities of both the corporate and the education sector and emphasised technology absorption and transfer rather than more creative research and, especially in the social sciences, it focused on mission-oriented research geared to the needs of a non-market-friendly overall political governance. The public research sector still exhibits many of the features that were shaped during this period.

Table 3.9. Growth of R&D organisations in Viet Nam: A historical perspective

	1960	1965	1970	1975	1980	1985	1990	1995	2000
Number	11	16	39	53	107	170	264	340	517

Source: Ministry of Science and Technology, Viet Nam, "Fifty Years of Viet Nam S&T".

This is not to say that the public research sector has remained on the fringes of the uninterrupted stream of economic and institutional reforms that have been implemented since the launch of the *doi moi* strategy, at the end of 1986. However, the fact that it is still in transition, and lagging rather than leading the overall trend for reform, calls for some caution in international benchmarking. As in China, but with a far less dynamic pull from business sector development, and as in Russia, but with a much weaker core of high-level scientific activities, the Vietnamese public research sector has been both the object of reforms over the last two decades and used as a tool for reform.

From this perspective, the evolution of the number of public research organisations (PROs) since the start of *doi moi* must be seen as the result of two contradictory trends: contraction (corporatisation, closures and mergers for the sake of efficiency) and expansion (initially triggered by Decree 35 in 1992 which removed the state monopoly on research activities; see Chapter 5), the latter having dominated up to now. In the absence of developed market mechanisms on the demand side, it was not easy for the government to ensure that this would free rather than waste creative energy.

Table 3.10. Number of R&D organisations in Viet Nam, 2012

Type of parent	Number	%
Ministries and other state organisations	953	43.3
Higher education	88	4.0
State-owned enterprises	33	1.5
Collective sector[1]	893	40.5
Foreign	7	0.3
Individuals	182	8.3
Other	46	2.1
Total	2 202	100

1. Political, socio-political, socio-professional organisations.

Source: Ministry of Science and Technology, Viet Nam.

In fact, the reform of the governance of PROs has often been marked by hesitation between centralisation and decentralisation, reflecting the difficulty in the Vietnamese context of reconciling the search for efficiency through greater autonomy for PROs with the need to align their research activities with national priorities.

Today the public research sector presents the following, enduring main characteristics:

- An overwhelmingly dominant position in the innovation system in terms of number of research units, amount of R&D expenditures and size of the R&D workforce.
- The predominance of PROs, as opposed to R&D units in universities or SOEs.
- A dualistic governance structure (Viet Nam Academy of Science and Technology and ministries).
- The large number of sub-optimal sized PROs.[8]
- Geographically concentrated location patterns.[9]

Drawing a comprehensive and detailed picture of the public research landscape is hindered by a lack of information, statistics and indicators. The fragmented and often out-of-date information is not very useful for international comparisons. NASATI has just completed the first pilot R&D survey ever carried out in Viet Nam. It covers only agricultural research and the results are summarised in Figure 3.24.

Public R&D and engineering organisations

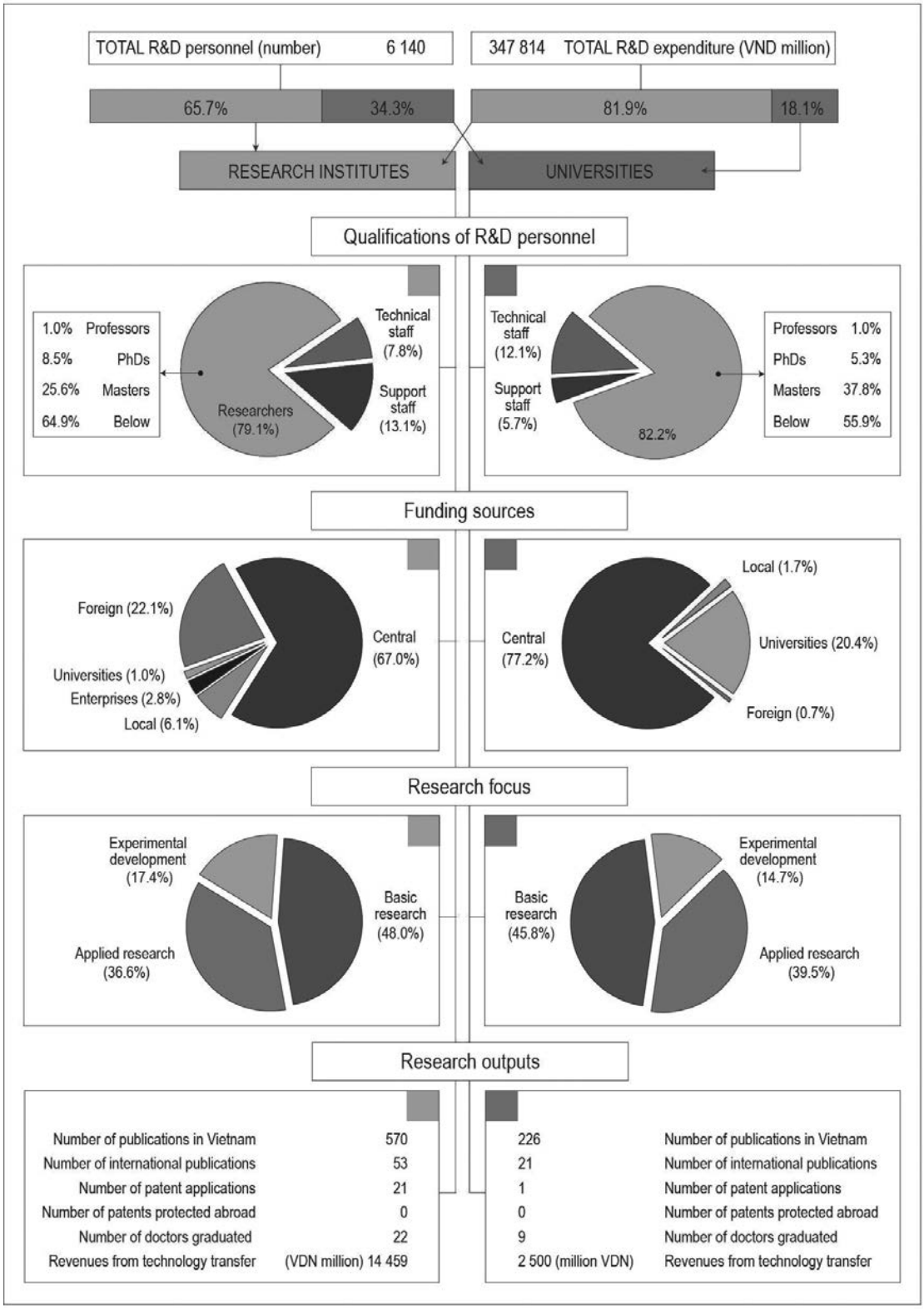
In 2012, 953 organisations fell into this category. The most important are research institutes under line ministries, and the two Academies – the Viet Nam Academy of Science and Technology (VAST) and the Viet Nam Academy of Social Sciences (VASS). VAST is by far the largest Vietnamese research agency (Box 3.4).

In terms of governance, Table 3.13 shows the number of organisations linked with various government bodies and their funding. It shows that, as a result of a series of reforms (discussed in Chapter 5), only a minority are now fully subsidised. Those that are not have to rely partly or wholly on a variety of consultancies with firms or other organisations.

University-based laboratories

The tertiary education system as a whole is under stress, as a massive expansion in student numbers since 1990 has been accompanied by only a modest growth in faculty numbers (Perkins and Anh, 2010). A research university is quite a new concept in Viet Nam and research is not a prominent activity for the majority of faculty staff. Only a small minority of university professors are involved in research projects (Tagscherer, 2010). However, recent initiatives held promise to improve the situation. Notably, the Ministry of Education and Training has been implementing a project for the "Establishment of 20 research universities". Some prominent universities are under development such as: Viet Nam - German University (founded in 2008 in Binh Duong High Tech Park), Hanoi S&T University (with the support of France, founded in 2009, located in Hoa Lac High Tech Park); others are under procedural preparation for establishment (Viet Nam - Russia University in Hanoi, Viet Nam - UK university in Da Nang) or seeking for partners (Viet Nam - Japan University and Viet Nam - US University).

Figure 3.24. Public R&D in Viet Nam's agricultural sector, 2010



Source: OECD, based on the provisional results of the first Pilot R&D Survey carried out by NASATI.

Box 3.4. VAST in brief: Key facts and figures

The Viet Nam Academy of Science and Technology (VAST) runs the largest part of scientific research in Viet Nam through a large number of national research institutes (Table 3.11) and some keys elements of the national S&T infrastructure (e.g. Viet Nam National Museum of Nature, Publishing House for Science and Technology, Institute for Scientific Information, Centre for Training, Consultancy and Technology Transfer, Centre for Information Infrastructure Development, Centre of Technology Development Assistance and Service, Centre for Food Technology and Technique Development). It also manages SOEs that are technology-oriented (e.g. the New Technology and Tourism Company, the Biotechnology Development Company, the Inspection and Technology Transfer Company). The majority of VAST facilities are located in Hanoi, but the Academy is also active in Ho Chi Minh City, Haiphong, Nhatrang, Dalat, and Hue.

In its institutes VAST also hosts the country's largest research facilities and infrastructures: i) four National Key Laboratories (Gene Technology, Multimedia and Networking Technology, Electronic Materials and Devices, Plant Cells Technology; ii) the Centre for High Performance Scientific Computing; and iii) advanced scientific equipment for measurement, analysis in physics, chemistry, mechanics, etc. During 2001-08, VAST invested around VND 50 billion in each key laboratory. At present, it invests around VND 60 billion a year for new infrastructures, VND 40 billion for scientific equipment and VND 10 billion for the maintenance of infrastructure.

As the main national employer of highly skilled scientists (doctors of sciences, PhDs and masters (Table 3.12), VAST is also involved in training, on its own or in co-operation with leading universities.

Table 3.11. Main VAST national research institutes

Name (Institute of)	Number of employees	Name (Institute of)	Number of employees
Mathematics	105	Materials Sciences	291
Physics	224	Information Technology	180
Chemistry	240	Biotechnology	322
Mechanics	102	Environmental Technology	174
Ecology and Biological Resources	116	Space Technology	47
Natural Products Chemistry	82	Tropical Technology	73
Geography	132	Applied Informatics and Mechanics	77
Geological Sciences	155	Tropical Biology	167
Geophysics	99	Chemical Technology	80
Oceanography	136	Applied Materials Sciences	65
Marine Environment and Resources	83	Technology Research and Application	58
Marine Geology and Geophysics	66	Viet Nam National Satellite Centre	31
Energy Science	91	Total	3196

Source: VAST.

Table 3.12. Qualification and age of VAST scientific staff

	Number		Age				
Qualification	Total	Female	≤ 30	31-40	41- 0	51-55	> 5
Professors	44	0	0	0			3
Assistant professors	158	30	0	4	20	38	98
Doctors of science	55	5	0	1	5	11	38
PhDs	603	135	14	99	178	146	170
Masters	5 0	200	108	318	107	24	11
Bachelors	848	322	198	206	234	141	95

S*ource*: VAST.

Table 3.13. Funding status of PROs linked with ministries and other public bodies, 2006

	Total	Funding status		
		Fully funded	Partly funded	Not funded
Ministries				
Ministry of Education and Training	155	3	21	131
Ministry of Agriculture and Rural Development	94	1	89	4
Ministry of Industry and Trade	38	3	27	8
Ministry of Science and Technology	33	1	25	7
Ministry of Transportation	23	3	19	1
Ministry of Health	20	8	10	2
Ministry of Defence	19	19	0	0
Ministry of Construction	15	1	12	2
Ministry of Public Security	10	9	1	0
Ministry of Natural Resources and Environment	9	1	8	0
Ministry of Culture, Sport and Tourism	5	4	1	0
Ministry of Labour, Invalids and Social Affairs	5	4	1	0
Ministry of Finance	5	3	1	1
Ministry of Planning and Investment	3	3	0	0
Ministry of Home Affairs	2	2	0	0
Ministry of Information and Communication	2	1	1	0
Population, Family and Children Committee	1	1	0	0
Academies				
Viet Nam Academy of Science and Technology	44	23	5	16
Viet Nam Academy of Social Sciences	28	26	1	1
Other public bodies and associations				
Labour Union	4	1	3	0
Youth Union	1	1	0	0
Committee for Ethnic and Highland	1	1	0	0
State Inspectorate	1	1	0	0
Viet Nam Television	1	1	0	0
The People's Supreme Court	1	1	0	0
Committee for Clean Water and Environmental Hygiene	1	0	0	1
Total	521	122	225	174

Source: Ministry of Science and Technology, Viet Nam.

In 2012 there were 88 laboratories managed by higher education institutions, but very few were world-class, and many did not perform high quality research. The most important and productive were and still are concentrated in a few places. Only a limited number of faculties and academic departments at Viet Nam's universities and colleges have sufficient personnel, equipment and other resources to perform serious R&D. Among them, the two national universities (in Hanoi and Ho Chi Minh City) and the two largest polytechnics (Hanoi University of Science and Technology and Ho Chi Minh City University of Technology) are the most research-intensive bodies in the Vietnamese academic system. They are currently intensifying efforts to become visible on the global map of internationally competitive research universities (see the example of the Hanoi University of Science and Technology in Box 3.5).

Box 3.5. Hanoi University of Science and Technology: Bridging engineering and scientific research

Hanoi University of Science and Technology (HUST) was established in 1956 as the first national university of technology in Viet Nam. Since then, it has functioned as an institution performing engineer training and, increasingly, scientific research for almost all industrial branches. Over the years, HUST has trained more than 80 000 engineers and 1 800 masters and doctors.

In addition to five key laboratories working on engineering, HUST hosts the following institutes and research centres:

- International Training Institute for Materials Science (40 employees)
- Automation Research Centre (10 employees)
- Bach Khoa Internetwork Security Centre
- Biomedical Electronics Centre (22 employees)
- Centre for Development and Application of Software (25 employees)
- Centre for Education and Development of Chromatography
- Centre for High Performance Computing
- Centre for Research and Development of High Technology
- Centre for Talents Training
- International Research Institute on Multimedia Information, Communication and Application (25 employees)
- BK Network Information Centre
- Materials Science Centre
- Polymer Centre (30 employees)
- Polytechnology Company (850 employees)
- Renewable Energy Research Centre (18 employees)

Source: Hanoi University of Science and Technology.

The National Key Laboratories

In 2000 the decision was made to create 17 National Key Laboratories, with three main goals: promoting creative scientific research whose results can be published in top international scientific journals; generating patented inventions which can be commercialised and contribute to improve the country's S&T level; enlarging the pool of qualified scientists who can perform national S&T missions according to international quality standards. These labs were to be designed to serve six fields of basic science: biotechnology, information technology, material technology, mechanics-automation, petro-chemistry and infrastructure. However, the implementation has been quite slow since only two labs had been built by 2004, 3 more in 2005, and 12 more by 2008. According to the Ministry of Science and Technology, the total investment for the 17 first labs has been more than VND 1.120 trillion (USD 66 million). If the return on such investment has been so far disappointing in some fields of research, it has been much more satisfactory in others, e.g. biotechnology, petro-chemistry and information security. As confirmed by a recent evaluation by the Ministry of Science and Technology major impediments to greater efficiency are the difficulty to attract or retain highly qualified staff, due to low salaries, as well as in some cases the lack of a sufficiently clear research mission.

Notes

1. A developing country's catch-up potential is calculated as the ratio of its long-run growth rate over its average income level (in both cases using averages for 2000-10), scaled by multiplying by 1 000. The ratio has the interesting quality of taking high values for high-growth/low-income countries and low values for low-growth/high-income countries.
2. Ministry of Finance, Report on implementation of policy and legislation on S&T investment and environmental protection, submitted to Committee for Science, Technology and Environment of the National Assembly (no. 4761/BTC-HCSN, dated 10 April 2012).
3. Project for submission to the 6th Plenum of the 11th Party Central Committee on S&T development in the context of socialist oriented market economy and international integration, October 2012.
4. Defined as the average number of citations received per national publication relative to the world over the citation window. The citation window consists of the year in which the article was published and the following two years.
5. According to McKinsey Global Institute (2012, p. 23), the capital efficiency ratio (defined as the amount of investment needed to generate an additional unit of revenue) of SOEs was USD 1.67, compared to USD 0.69 and 0.47 for multinational and private businesses as a whole.
6. A very small percentage has tertiary-level qualifications.
7. Based on survey data by the General Statistics Office of Viet Nam covering 29 425 manufacturing firms over the period 2001-07, the analysis was performed within a statistical framework that can ascertain the influence of each of the above determinants, controlling for factors such as firm size, firm age, whether a firm was a recent entrant or had exited the sample during the duration of the study, as well as sector fixed effects and time and province dummy variables.
8. Some PROs have been created with only limited staff. They were set up mainly for administrative reasons (e.g. to enjoy more freedom and autonomy than their parent organisations). They have different forms and names such as: research institutions, research centres, consulting centres, laboratories, experimental stations, observatory stations, etc. The government has taken measures to address this problem. For example, one of the prerequisite conditions for a S&T organization to be granted an operating license is to meet requirements regarding personnel, as stipulated by law, which requires the PRO to have at least 5 staff members holding university or higher degree (Circular 02/2010/TT-BKHCN on the establishment and registration of S&T activities, dated 18 March 2010).
9. Most of the country's R&D is concentrated in Hanoi and Ho Chi Minh City. One area of the capital city (Nghia Do-Cau Giay-Tu Liem) has about a third of all government R&D institutes.

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Chapter 4

Human resources for innovation in Viet Nam

This chapter examines the skills that are critical for innovation and discusses where Viet Nam stands in terms of its human resource capacity for innovation. It first looks at human resource capacity in universities, research institutes, firms, intermediary organisations and the government. It then analyses main constraints on producing human resources and skills for innovation, moving from those most directly related – faculty and the education and training curriculum and programmes – to broader constraints affecting the education and training systems and the labour market.

4.1. What are the human resources and skills that matter for innovation?

Increasing productivity will require smart investments in the right skills for growth and innovation. Viet Nam and its East Asian neighbours are recognising that their workforces must not only become flexible enough to acquire new skills for jobs, but also be able to adapt and/or develop new technologies. Human resources and skills need to meet the demands and needs of today's economies, while helping to build a foundation for the economy of tomorrow. The ability to match workforce skills with the skills employers require is crucial for developing a productive and efficient labour market. Workers acquire their skills through education and training. Employers demand the skills needed in their economic and business climate. A close match between supply of and demand for skills can contribute to faster growth by providing firms with productive workers, improving worker's employability, enabling firms and entrepreneurs to expand their technological capability and move up the value chain, and reducing poverty. In contrast, a poor match can slow growth by increasing joblessness and underemployment, producing skills shortages, fostering technological stagnation or laggardness, and encouraging brain drain (Tan *et al.*, 2010). Beyond addressing current employer demand for skills and innovation, Viet Nam needs skilled human resources to build the technological capability to expand the economic structure (address needs and priorities for development), while undertaking the research and investing in the skills needed to prepare for the needs of the future economy.

In terms of the human resources and skills needed to foster innovation, secondary and tertiary graduates play a critical role in assimilating, adapting and developing new technologies. In Viet Nam, private rates of return to secondary and tertiary education of 4% and 11%, respectively, are evidence of the link between education and growth (Moock *et al*., 1998). Colleges play a critical role in developing both a solid basis of core generic skills and applied professional and technical skills in many subjects. These serve community and local development and prepare for further studies. Holders of Master's, and particularly PhD degrees, help provide high-level technical skills for research and for specialised fields in manufacturing and services. Many types of professionals engage in innovation in many areas, and university researchers conduct innovative activities and train graduate students to become future researchers. Some of the world's most innovative companies have emerged as start-ups or spin-offs from the work of professors and graduate students working together with industry. In addition to universities, around the world, governments, businesses and research institutes are also producers of innovations. Researchers, engineers and managers can work together to initiate, develop and commercialise innovations.

While education, training and occupations are important inputs to innovation, discussions of human resources for innovation increasingly look at the quality of human resources in terms of "skills". Skills are seen as the outcome of the education and training process, and education and training are assessed in relation to their capacity to produce the needed skills.

Skills can be categorised into three main groups (World Bank, 2012). Academic skills are generally associated with subject areas such as maths and literacy. Generic skills are the broader set of skills that are transferable across jobs and from education to employment. They generally include thinking skills (critical and creative thinking, problem solving), behavioural skills (communication, organisation, teamwork, time management, ability to negotiate conflict and manage risks, leadership) and computing

skills. Technical skills are those associated with a profession and are generally considered to be a mix of specific knowledge and skills to perform specific jobs.

Employers expect workers, particularly those with tertiary education, to possess the academic, generic and technical skills needed to increase productivity and growth. They want workers with the ability to think, adapt and learn continuously. Table 4.1 shows the mix of technical, thinking and behavioural skills relevant to Viet Nam and a sample of comparator countries. All countries need a mix of these skills.

Table 4.1. Importance of technical, thinking, and behavioural skills for professionals

	Viet Nam[a]	Philippines	Thailand[b]	Malaysia[b]	Average
Technical	7	7	5	7	6.5
Communication	6	5	4	5	5.0
English	5	3	7	4	4.8
Problem solving	n.a.	6	4	4	4.7
Leadership	n.a.	6	4	4	4.7
Information technology	n.a.	3	6	6	5.0
Creativity	n.a.	4	4	5	4.3
Work attitude	7	4	3	4	4.5

Note: Ranking from 0 to 7, of the relative importance of each skill for employers.

a. Relates to college graduates; does not include results of 2011 Innovation and Skill Employer Survey, which is not directly comparable to other surveys.

b. Relates to professionals and other skilled workers.

Source: Investment Climate Surveys and Skill Surveys, various years.

As countries develop and their economic structures gain higher value added, employers' demand for skills evolves from basic to more sophisticated technical and higher-level generic skills. Countries with low technological capacity use less technical skills for light manufacturing and assembly activities. As they develop their technological capacity, the demand for skills evolves towards adapting and improving existing technologies and finally to solving problems and developing new high-technology products. Innovation requires not only job-specific technical skills, but also skills in problem-solving, thinking and communication, among others. Countries' technological capacity is closely linked to income: high-income countries have highly skilled workforces able to contribute to the development of products that are leaders in their field. Across sectors, not only is it important for countries to innovate to increase value added in their manufacturing sectors, they also need to pay close attention to their growing services sectors as a driver of skills.

A World Bank innovation survey asked employers in low- and middle-income economies about the skills needed to innovate. Responses indicate that a more innovation-driven economy will require industry experience, a "big picture" mindset, creativity and the ability to "think outside the box" (World Bank, 2012). Without at least some workers possessing these skills, many firms are reluctant to innovate. For example, the lack of knowledgeable and trained personnel was the second reason (after insufficient funding) identified by nearly half of the firms surveyed in Thailand for not engaging in innovative activities and a much greater obstacle than insufficient knowledge about

innovation activities. This suggests that firms are often aware of what is needed to engage in innovation but are constrained by their lack of skilled staff (Thailand PICS, 2007).

The role of creativity, entrepreneurship and the capacity to take risks in spurring innovation is often underscored. Innovation requires creativity to produce or apply new ideas, and innovative thinkers are curious and able to analyse problems from many angles (Csikszentmihalyi, 2003). Entrepreneurs identify good ideas, locate the necessary resources, develop the prototype, and follow the idea to fruition (Lucas, 1998). While innovation can entail risks, social safety nets and incentives can help individuals take the risks to innovate (World Bank, 2010a).

In addition, problem-solving and the ability to think outside the box make it possible to find new and better solutions to everyday problems. These skills are useful for examining current technology and assimilating and adapting it in the local context. Successful entrepreneurs have good leadership and business skills, and are persistent and motivated. These skills allow them to commercialise and apply new technology and ultimately achieve productivity improvements.

Developing technological capability also requires a significant capacity in science, technology engineering and mathematics (STEM) in the stock of workers and in the flow of students to the future workforce. The East Asian tigers have relied on at least one-third of graduates in STEM to drive their innovation and productivity agenda. Correlations between East Asia's secondary-level TIMSS (Trends in International Mathematics and Science Studies) scores, tertiary enrolments in STEM and journal articles show that countries that score higher on TIMSS assessments of science and maths have higher tertiary enrolments in STEM and more journal articles. This suggests that raising STEM capacity in the labour market can be fostered as early as secondary education (World Bank, 2012).

Finally, the capacity to apply knowledge through practical skills means that individuals can transfer their knowledge from the classroom to the workplace. Vocational education can play a critical role and is associated with a 5% private rate of return in Viet Nam (Moock *et al*., 1998). Successful technical and vocational education and training (TVET) programmes have close ties with industry and design their curriculum to teach valuable practical, job-specific technical skills. Singapore was able to adjust its TVET curriculum in the 1970s to meet the growing demand for skills during its rapid economic growth (Yusuf and Nabeshima, 2010). A survey of firms in innovation-intensive industries in Australia found that individuals in vocational occupations were "principal sources of ideas for technological innovation" and were crucial in terms of knowledge sharing and developing practical skills (Toner, 2004). Training is also regarded as an integral part of firms' growth, and innovative firms spend more time and money on training than non-innovative firms. In the United States on-the-job training can contribute up to half of human capital (World Bank, 2010a).

4.2. Where does Viet Nam stand? What are its human resource and skill gaps?

In order for Viet Nam to develop an innovation-driven economy, it will need to enhance significantly the human resource capacity of its national innovation system (NIS). The actors of the NIS include universities, research institutes, firms, intermediary organisations and the government. Their interactions contribute to global knowledge and they assimilate, adapt and develop new technology and products. Viet Nam ranks eleventh out of twelve East Asian countries in terms of human resource capacity (a score

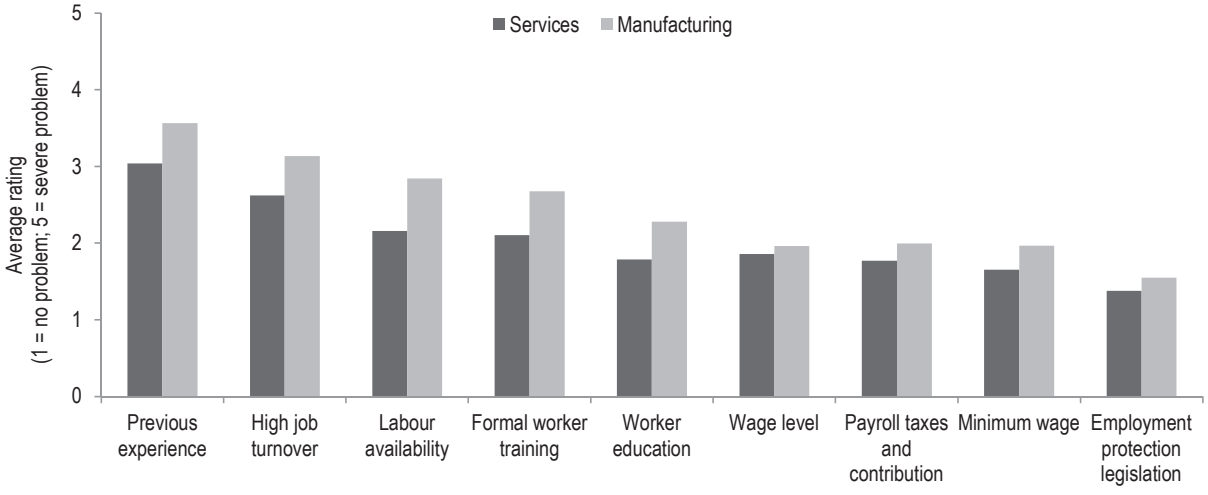
of 3.79 out of 10). Although Viet Nam does have firms and industries actively engaged in innovation, the overall innovation system is weak. Strengthening Viet Nam's NIS will require improvements in many areas.

In terms of human resources for the NIS, Viet Nam should work to upgrade its human resources and its productive sectors, focusing on key manufacturing and service sub-sectors and other key actors and institutions. It also needs to lay the foundation for developing human capital able to respond to future innovation needs at all levels of the NIS. At present, this is not the case. This section therefore reviews the situation of Viet Nam's NIS at the firm and government levels and in the R&D sector.

Human resource gaps in firms

A 2011 World Bank survey[1] of 352 firms in Viet Nam found that the quality of employees was the major labour constraint for the operation and growth of their businesses. As Figure 4.1 shows, services and manufacturing firms alike consistently rated the quality (and quantity) of their employees – measured by employee experience, job turnover, labour availability, formal training and education – as a greater obstacles than factors of employment (protection law, payroll tax, overall wage and minimum wage). Manufacturing firms consistently reported more problems than service firms across all labour factors.

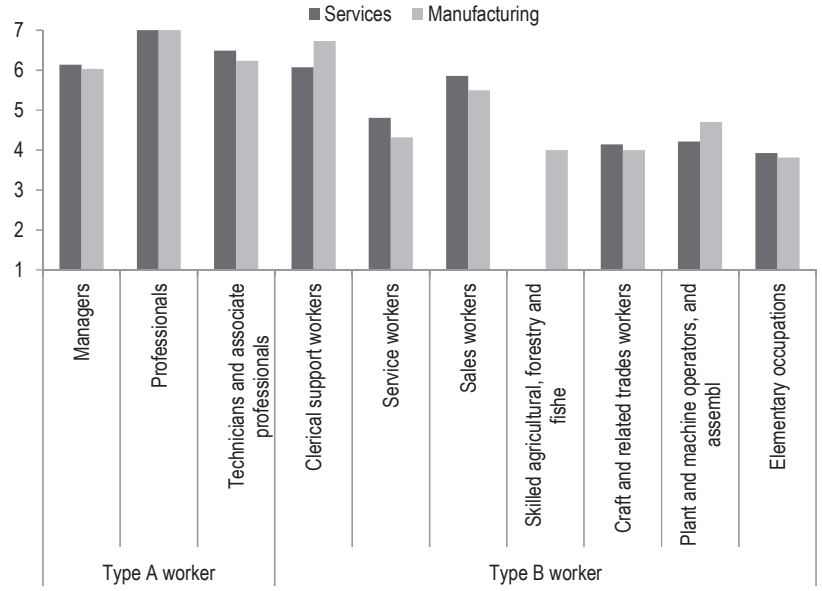
Figure 4.1. Average firm rating of problematic labour factors for the operation and growth of their business, by sector



Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

Figure 4.2 shows that education levels in service and manufacturing firms tend to be similar, with some differences across occupations. In all firms, Type A workers (*i.e.* managers, professionals, and technicians and associate professionals) have higher education levels, often tertiary education, than Type B workers (*i.e.* clerical support; service; sales; agricultural, forestry and fishery; craft and related trades; plant and machine operators, and assemblers; elementary occupations) who generally have up to post-secondary education.

Figure 4.2. Average level of education by occupation and sector in surveyed firms

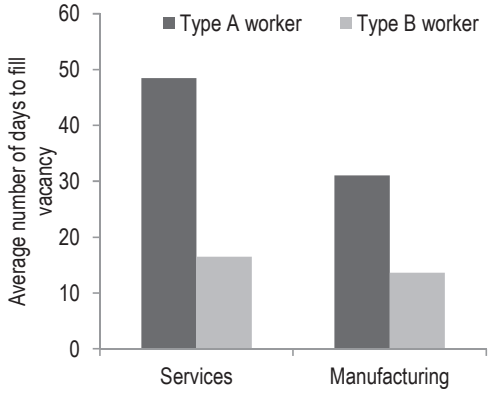


Note: 1 = pre-primary education; 2 = primary education; 3 = lower secondary education; 4 = upper secondary education; 5 = post-secondary non-tertiary education; 6 = first stage of tertiary education; 7 = second stage of tertiary education.

Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

The evidence of bottlenecks is confirmed by the fact that firms often spend up to two months recruiting for vacant positions. Figure 4.3 shows that manufacturing firms take more than twice as long to fill vacancies for Type A workers than for Type B workers. For service firms vacancies for Type A workers are more difficult to fill, but there is little difference in the amount of time needed to fill vacancies for Type B workers. Relative to other countries in East Asia, Viet Nam has one of the highest vacancy rates for Type A workers (Figure 4.4). Both service and manufacturing firms recruit about three times as many Type B workers as Type A workers; this suggests that the labour-related constraints shown in Figure X may be attributed to some extent to Type B workers.

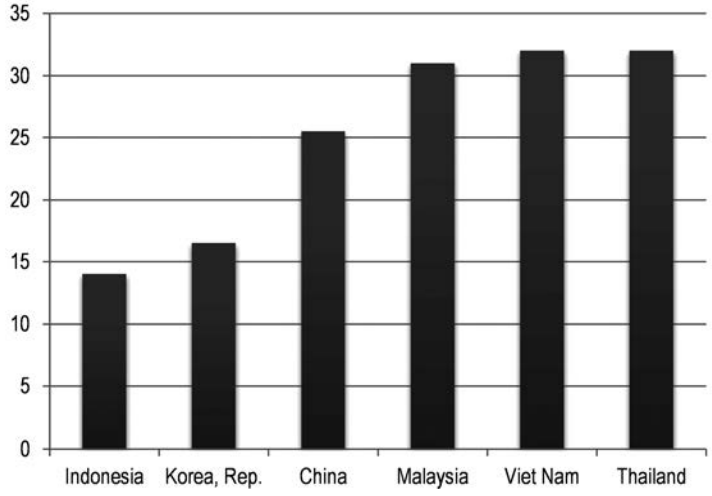
Figure 4.3. Average number of days to fill employee vacancies, by type of worker



Note: Type A workers include managers, professionals, and technicians and associate professionals. Type B workers include clerical support workers, service workers, sales workers, skilled agricultural, forestry and fishery, craft and related trades workers, plant and machine operators, and assemblers, elementary occupations, and other occupations.

Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

Figure 4.4. Average number of days to fill professional employee vacancies in East Asia

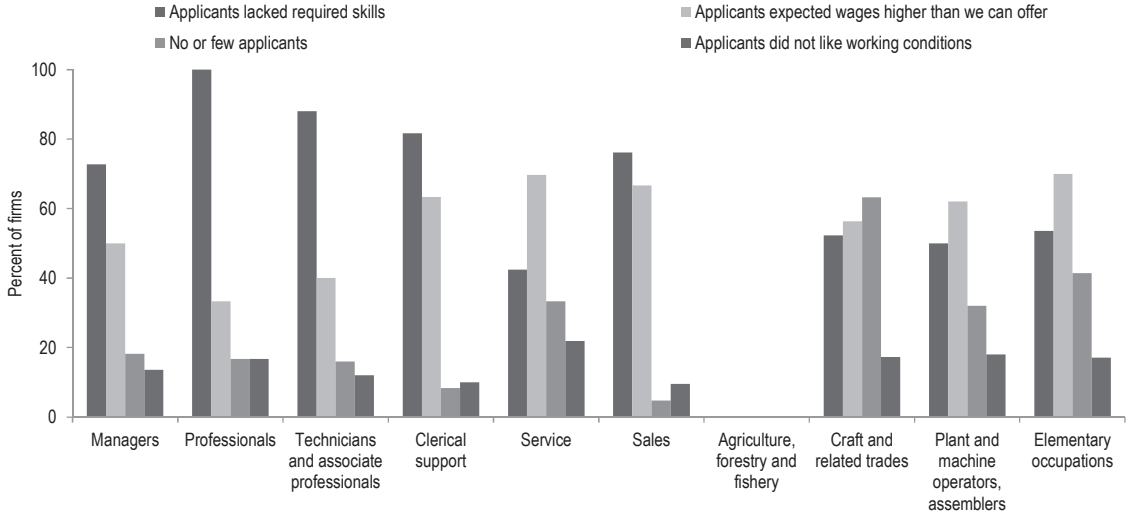


Source: Investment Climate Surveys (various years) and 2011 Viet Nam Employer Skill and Innovation Survey.

Figure 4.5 suggests that skills gaps are greatest for more sophisticated skills. Overall, firms report a lack of required skills to be their greatest recruitment problem. Firms seeking to hire managers, professionals, and associate professionals face the highest level of skills gaps. In contrast, very few firms reported a lack of applicants as a constraint, an indication that while firms receive many candidates for a position, few possess the necessary skills.

A glimpse at the skills employers consider important is indicative of the main gaps by type of occupations, beyond some likely constraints in terms of education levels.[2]

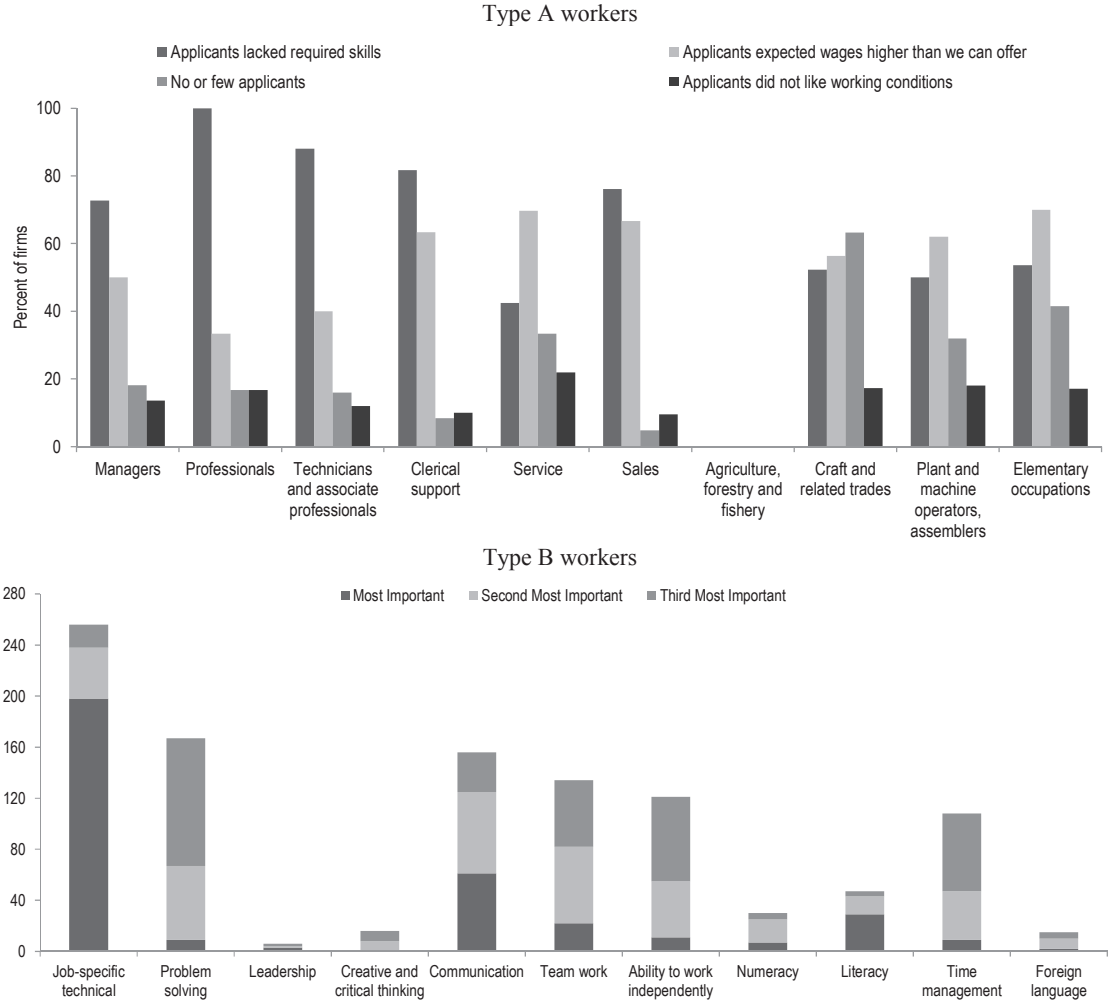
Figure 4.5. Proportion of firms encountering recruitment problems in the past 12 months, by occupation and type of problem



Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

The 2011 Viet Nam Employer Skills and Innovation Survey shows that nearly half of the 352 firms reported technical skills to be the most important job-related reason for retaining high-skilled (Type A) workers following a probationary period; and more than half reported technical skills to be the most important for retaining low-skilled (Type B) workers (Figure 4.6). These findings show that among the three broad categories of skills – academic, generic, and technical – Vietnamese employers consider technical skills the most important for retaining new employees. Relating this to Figure X, employers clearly have difficulties finding the high-level technical skills needed by Type A workers.

Figure 4.6. Most important skills for retaining new employees after a probation period, by worker type



Note: Type A workers include managers, professionals, and technicians and associate professionals. Type B workers include clerical support workers, service workers, sales workers, skilled agricultural, forestry and fishery, craft and related trades workers, plant and machine operators, and assemblers, elementary occupations, and other occupations.

Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

Among generic skills problem-solving, leadership, creative and critical thinking, and communication are among the most important for high-skilled workers (Type A). Nearly one-third of firms reported leadership as the most important skill and several reported problem-solving skills as the second or third most important skill. Creative and critical thinking and communication skills are also among the top three most important skills.

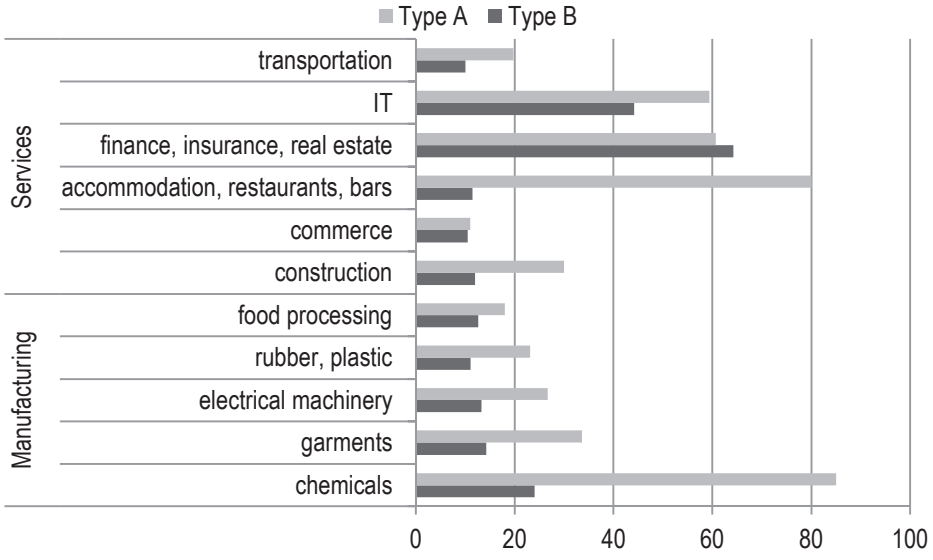
Among low-skilled workers (Type B), firms rate job-specific technical skills as overwhelmingly the most important, followed by problem-solving and communication skills. Skills considered important for Type B workers include teamwork, autonomy and time management.

Gaps in innovative firms

Beyond immediate demand, human resource gaps constrain firms' capacity to upgrade technology in key sub-sectors and make it difficult to innovate in the long run.

In most manufacturing and services sub-sectors, firms require more time to fill Type A than Type B vacancies. For example, service firms need an average of 80 days to fill Type A workers in the food and accommodation sub-sector, but only 11 days for Type B workers. Similarly, manufacturing firms need an average of 85 days to fill Type A worker vacancies in the chemical sub-sector, compared with 24 days for Type B workers (Figure 4.7). Vacancies in general also tend to be more difficult to fill in higher value-added or sophisticated sub-sectors (such as IT, chemicals, finance) than lower value-added ones, suggesting important constraints in these sub-sectors.

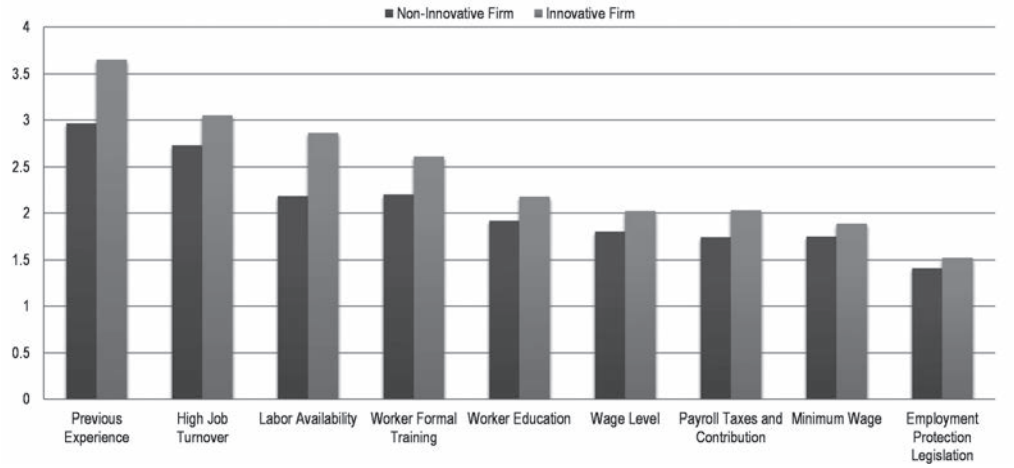
Figure 4.7. Average number of days to fill employee vacancy by type of worker and sub-sector



Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

Responding to innovation needs requires an understanding of the characteristics of innovative firms and, in particular, of the types of skills and qualifications needed to improve workforce quality. Across the board, innovative firms report more labour factor constraints on their operation and growth than non-innovative firms (Figure 4.8). Furthermore, they rate quality and quantity of employees as greater obstacles to their business overall than do non-innovative firms and as greater obstacles than factors of employment, which have lower overall ratings and greater similarity between innovative and non-innovative firms.

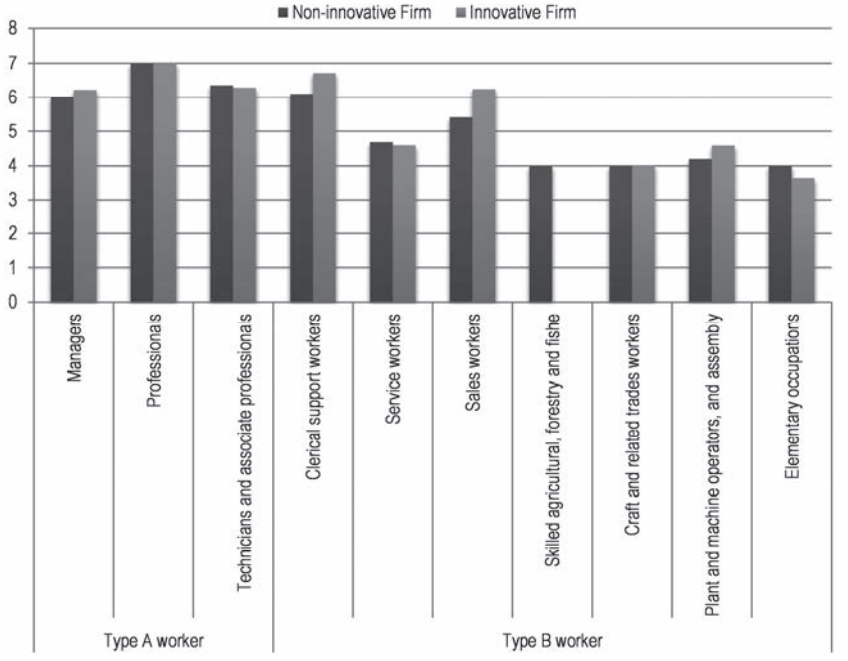
Figure 4.8. Average firm rating of labour factors that hinder the operation and growth of their business, innovative and non-innovative firms



Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

Although Figure 4.9 shows that innovative firms report higher education levels overall, Figure 4.8 also suggests that education is a greater constraint for innovative than for non-innovative firms. Engaging in innovation may require more managers and associate professionals with PhDs (*i.e.* second stage of tertiary education), and more workers with some level of post-secondary education.

Figure 4.9. Average education level by occupation and firm type

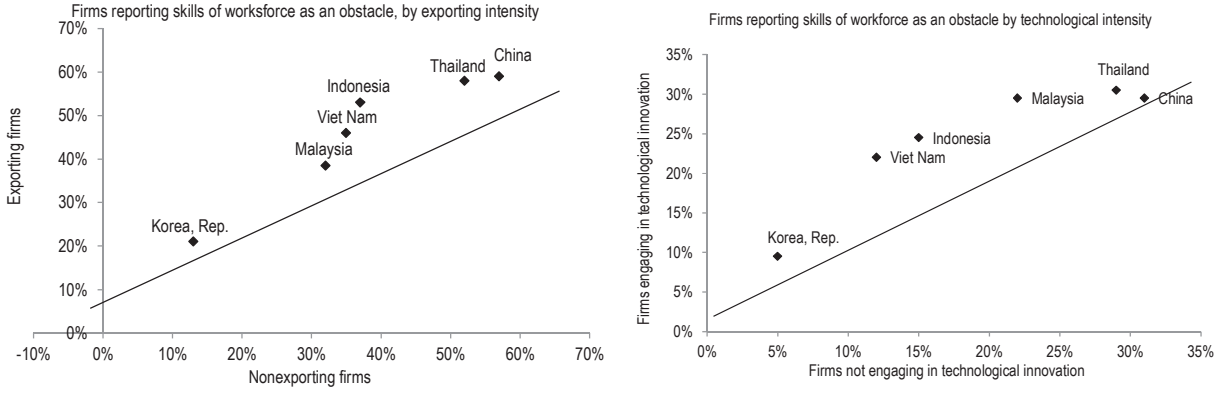


Note: 1 = pre-primary education; 2 = primary education; 3 = lower secondary education; 4 = upper secondary education; 5 = post-secondary non-tertiary education; 6 = first stage of tertiary education; 7 = second stage of tertiary education.
Type A workers include managers, professionals, and technicians and associate professionals. Type B workers include clerical support workers, service workers, sales workers, skilled agricultural, forestry and fishery, craft and related trades workers, plant and machine operators, and assemblers, elementary occupations, and other occupations.

Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

A closer look at skills gaps in innovative and non-innovative firms reveals that exporting firms and firms engaged in technological innovation are more likely to report workforce skills as an obstacle (Figure 4.10). Vietnamese firms tend to see skills as a greater obstacle than Korea, Thailand and the People's Republic of China. In Viet Nam, firms engaged in technological innovation find skills to be a greater obstacle than do exporting firms (Almeida, 2009a).

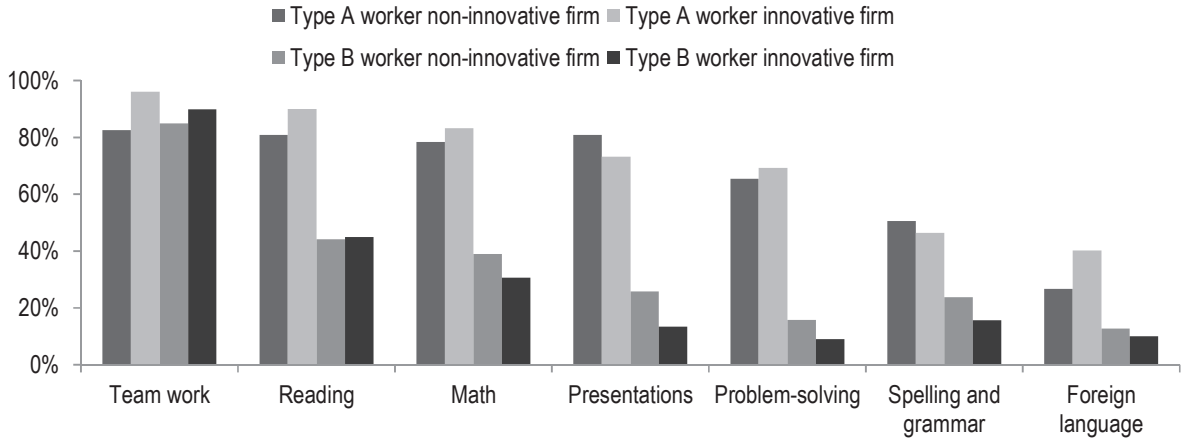
Figure 4.10. Exporting firms and firms engaged in technological innovation report skills as a an obstacle to their business



Source: Almeida (2009), "Does the Workforce in East Asia Have the Right Skills? Evidence from Firm-Level Surveys", background paper prepared for the World Bank, Washington, DC, based on Investment Climate Surveys, various years.

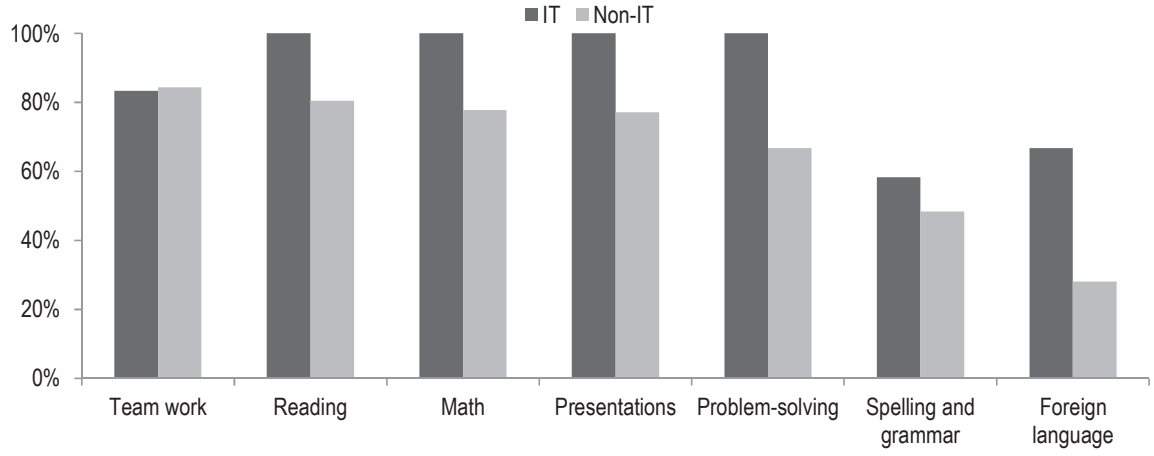
There is also some evidence that, beyond education levels, the types of skills used in innovative and non-innovative firms vary. Figure 4.11 shows that innovative firms report more use of teamwork, reading, maths, problem-solving and foreign language skills by high-skilled workers (Type A). For low-skilled workers (Type B), non-innovative firms appear have greater skill use (maybe because of a bias towards skilled Type A workers in innovative firms). Information technology (IT) firms report more skill use in nearly all areas than other service firms (Figure 4.12). Similarly, Figure 4.13 shows that service firms, innovative firms and Type A workers report more specialised computer use than manufacturing firms, non-innovative firms and Type B workers.

Figure 4.11. Percentage of firms reporting skills used by the current workforce, by worker and firm type



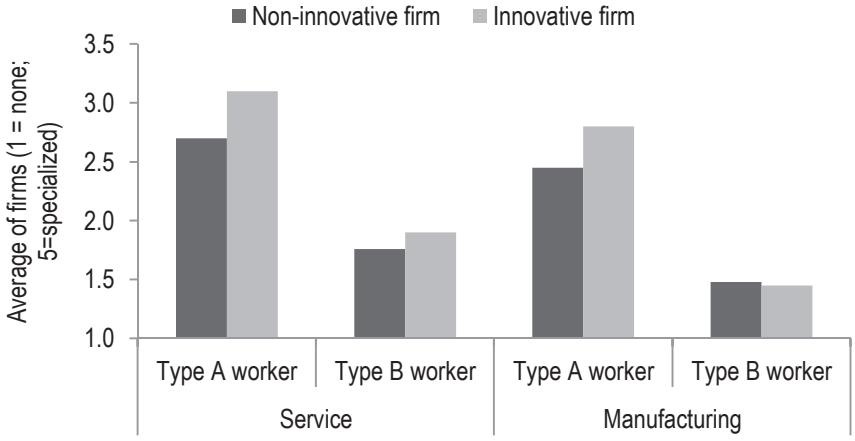
Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

Figure 4.12. Percentage of firms reporting skills used by the current workforce, IT and non-IT service firms



Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

Figure 4.13. Highest level of computer use by the current workforce, by worker, firm type and sector

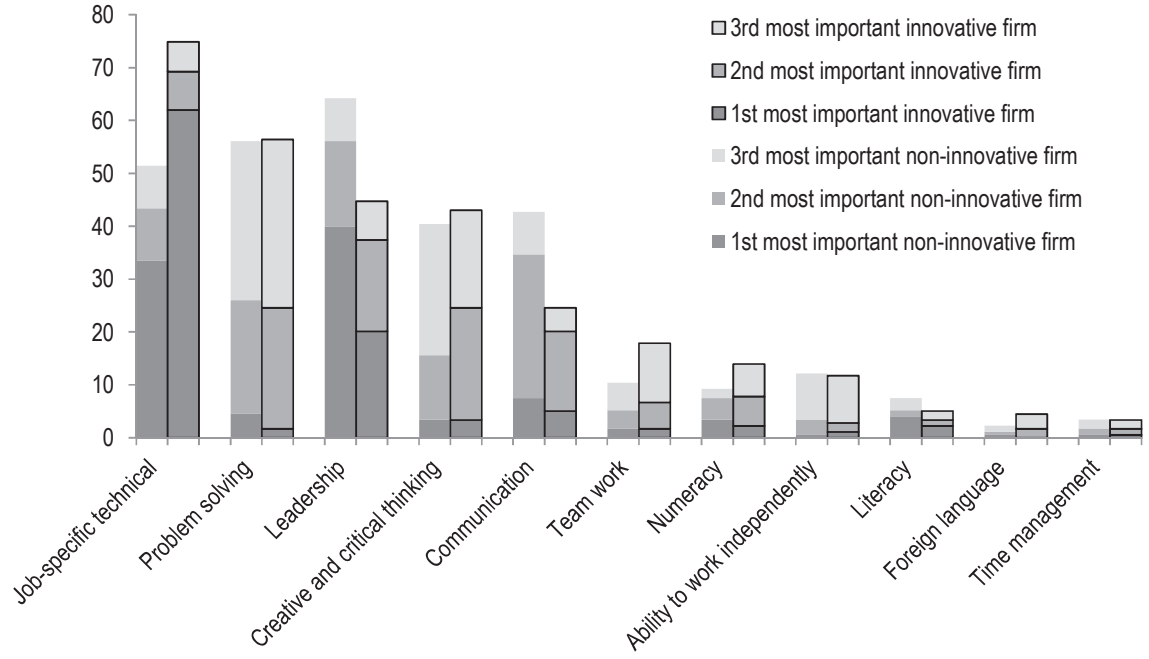


Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

The firm survey provides further evidence that firms engaged in innovation are more likely to report technical and generic skills as important reasons for retaining employees than firms not engaged in innovation. Figure 4.14 shows that for Type A workers, 62% of firms engaged in innovation reported job-specific technical skills as the most important factor, but only 34% of firms not engaged in innovation. Furthermore, nearly three-quarters of all innovative firms report job-specific technical skills as important; this suggests, together with the greater importance of maths, the possible importance of job-specific STEM skills for innovation. For both innovative and non-innovative firms, problem-solving, thinking and communication are important generic skills. Creative and critical thinking and teamwork are more important in innovative firms. In contrast, and perhaps surprisingly, non-innovative firms appear to require better leadership and communication skills in their high-skilled workers.

Figure 4.14. The three most important skills for retaining new Type A employees after a probation period, by type of firm

Percentage of firms



Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

Strengthening Viet Nam's national innovation system will require not only a more qualified workforce generally, and more qualified managers and professionals in particular, but also a strong push in numbers of qualified science and technology (S&T) personnel. A 2009 census of Viet Nam's 248 847 firms revealed the lack of highly trained S&T workers (NASATI, 2009). Table 4.2 shows nearly 9 million individuals working on S&T projects in surveyed firms; however, only 0.03% held a PhD degree and only 0.28% a Master's degree. The number and relevance of S&T projects needed for technology upgrading and long-term innovation will remain highly constrained by such numbers.

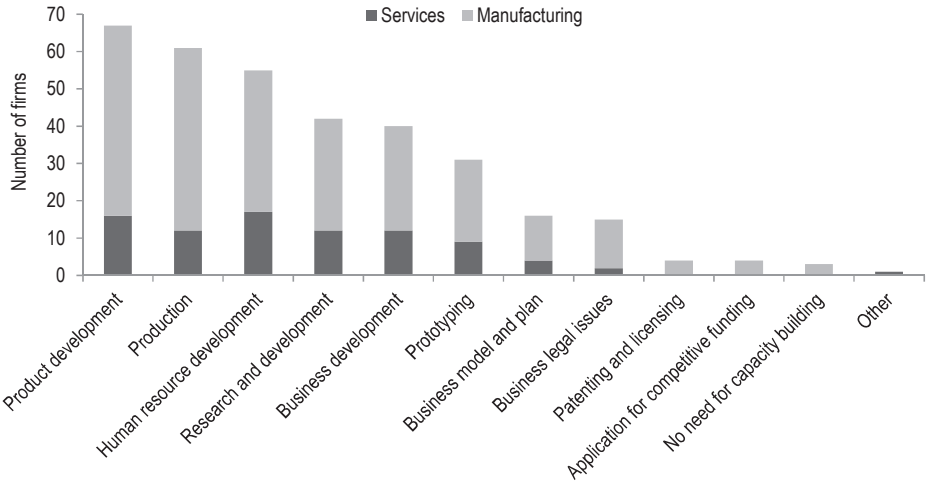
Table 4.2. S&T personnel in Vietnamese firms, 2009

	Labour force	
Education level	Total	%
All	8 927 859	100.00
PhD	2 668	0.03
Master	25 225	0.28
Undergraduate	856 062	9.59
College diploma	418 952	4.69
Less than college	7 624 952	85.41

Source: NASATI R&D Enterprise Survey, 2009.

The survey found that Vietnamese firms invested a total of USD 35.86 million in R&D and innovation. However, the findings also showed that promoting innovation in Viet Nam requires more investments in human resources and skills for innovation. Furthermore, the 2011 Employer Skill and Innovation Survey showed that only 90 out of the 352 firms (or 26%) conducted capacity-building activities for their employees during the past three years. Among those that did, 84 also engaged in innovation. In order to build capacity for innovation, firms ranked human resource development third out of eleven training needs, following product development and production. Human resource development ranks first for service firms and third for manufacturing firms (Figure 4.15).

Figure 4.15. Need for training to innovate, by sector



Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

Human resource gaps in S&T governing bodies (S&T managers)

Although the NIS has the institutions and conditions needed to facilitate innovation, it is fragmented and in need of improvement. The system remains weak, isolated, decentralised, bureaucratic, uncoordinated, *ad hoc* and lacking in clear responsibilities. It includes over 3 200 managers, each of whom takes part in formulating policies and procedures, implementing S&T programmes, and supervising staff. Viet Nam's Ministry of Science and Technology (MoST) is the main ministry for co-ordinating S&T, building capacity, guiding national research programmes and measuring the impact of S&T. Ministries which are also involved in S&T include the Ministry of Industry and Trade (MoIT), the Ministry of Agriculture and Rural Development (MARD), and the Ministry of Education and Training (MoET). There are provincial Departments of Science and Technology (DoST) offices in all 63 provinces and there are 1 100 GRIs reporting to various agencies at central, provincial and university levels. The MoST-affiliated State Agency for Technology and Innovation (SATI) and the Vietnamese Chamber of Commerce and Industry (VCCI) have S&T managers responsible for technology transfer and diffusion at national, regional and provincial levels. Other S&T agencies include the Viet Nam National Foundation for Science and Technology Development (NAFOSTED) with its own managers at the central level. In this decentralised and fragmented system, there is no single agency with overarching power; STI governance cuts across a broad and a diverse range of public- and private-sector actors. Each agency is relatively isolated, with little co-ordination or formal power.

In addition to the overall fragmentation of the NIS, its human resource capacity is weak in terms of managing science, technology and innovation (STI) policies, specific activities, and the many GRIs. At all levels, STI managers have limited knowledge and skills for managing the innovation system and promoting technology transfer and diffusion. The government has therefore sought to increase the quality and quantity of S&T managers at the central and local levels and within GRIs. Currently less than 10% of S&T managers have a Master's degree. Table 4.3 shows the government's goal to increase the number of managers from 3 934 to 4 400 in 2015 (a 12% increase) and to 5 290 in 2020 (a 20% increase). The largest expansion will take place within MoST, where the government aims to double the number of managers within ten years, and emphasises increasing the number of managers with a Master's degree from 165 in 2015 to 955 in 2020 (a 479% increase). By 2020, the government also aims to increase the number of managers by 50% in other ministries and by nearly 25% at the provincial and local levels.

Table 4.3. Projected demand for S&T managers in Viet Nam's governing bodies, 2015-20

	2010	2015				2020			
	Total	PhD	MSc	Graduate	Total	PhD	MSc	Graduate	Total
Ministry of Science and Technology									
Radiation safety	40	10	30	50	90	20	60	100	180
Atomic energy	20	10	20	30	60	20	30	50	100
Intellectual property	95	15	35	100	150	20	50	150	220
Quality/ measurement standards	129	10	20	120	150	15	30	150	195
Science & technology management	226	35	60	165	260	40	75	200	315
Subtotal	510	80	165	465	710	115	955	650	1 010
Ministries and ministerial agencies									
Departments of science & technology	286	90	180	100	370	100	200	120	420
Central provinces and cities									
Office of science & technology	3 138	50	270	3 000	3 320	60	300	3 500	3 860
Total	3 934	220	615	3 565	4 400	275	1 455	4 270	5 290

Source: MoST (Ministry of Science and Technology) (2011), *Demand for Capacity Building and Training for Science and Technology Management Agencies in National and Local Governments, Research Institutes and Universities*, Hanoi.

Human resource gaps in the public R&D sector

This section looks at human resource capacities in GRIs and universities. As part of its efforts to move towards a market-driven economy, the government issued Decree No. 115 in 2005 which mandated GRIs to move towards autonomous management and responsibility. The aim is to create more efficient GRIs and strengthen their links with firms. However, the government has provided little guidance on how to implement the decree, making it difficult for GRIs to switch from dependence on government funding and activities to self-reliance. As a result, the transition process has been slow, and by the end of 2010, fewer than half of the identified GRIs had been approved for conversion to autonomous status.

The reasons include fears of government budget cuts and lack of market information, but a main obstacle has been overall low capacity, particularly at the managerial level. The shift to full autonomy will require managers with more knowledge and better

managerial skills than were needed when they were under government supervision. Furthermore, as their managers are ageing, the GRIs risk not having the talent needed to lead them and facilitate the transition.

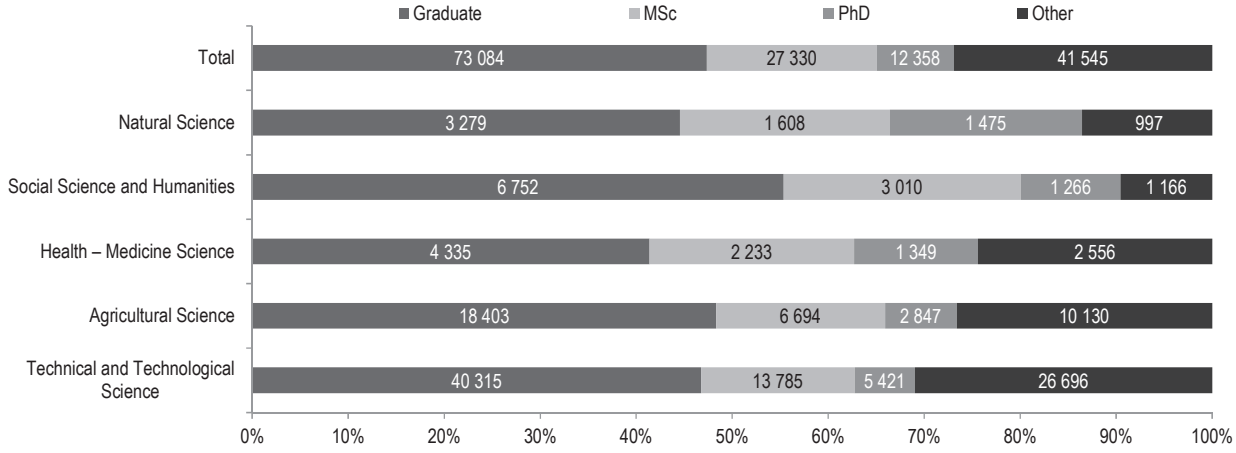
GRIs have had persistent staffing issues and, without proper support, autonomous GRIs may face even greater difficulties. In addition to ageing managers, GRIs and universities also face an ageing population of researchers with poor qualifications. As a result, the government has sought to increase the quantity and quality of S&T personnel in GRIs and universities. Viet Nam's goal is an increase of up to 21% in its technical and technological staff by 2020 (Table 4.4). However, it will also need more highly qualified staff. The share of qualified personnel is expected to remain stable at just under 10% of overall staff with a PhD degree and less than 20% with a Master's degree (Figure 4.16). Viet Nam currently has one of the lowest numbers of R&D researchers relative to the size of its population (Table 4.5). In China and Korea by contrast, the relative number of R&D researchers per million population more than doubled from 2000 to 2008 (WDI, 2012).

Table 4.4. Annual growth of human resources in science and technology, 1995-2020

Science and technology field	1995-2010 annual growth rate (%)	2010-20 projected annual growth rate (%)
Social science and humanities	7.80	9.00
Natural science	5.04	6.50
Agricultural science	12.00	15.00
Health – medicine science	4.20	6.00
Technical and technological science	18.30	21.00

Source: MoST (Ministry of Science and Technology) (2011), *Demand for Capacity Building and Training for Science and Technology Management Agencies in National and Local Governments, Research Institutes and Universities*, Hanoi.

Figure 4.16. Projected demand for S&T personnel in Viet Nam's S&T organisations, by qualification, 2020



Source: MoST (Ministry of Science and Technology) (2011), *Demand for Capacity Building and Training for Science and Technology Management Agencies in National and Local Governments, Research Institutes and Universities*, Hanoi.

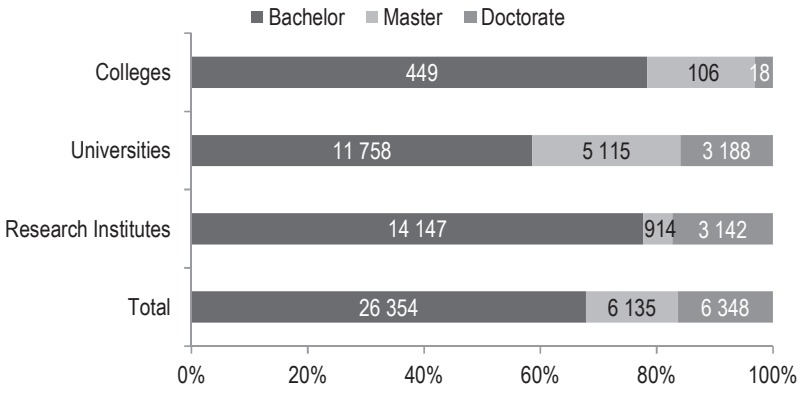
Table 4.5. R&D researchers (per million population) in East Asia

Country	R&D researchers (per million population)
Indonesia	90
Viet Nam	116
Thailand	316
Malaysia	365
China	1 199
Korea	4 947

Source: World Development Indicators, latest year 2002-09.

Researcher quality also needs to improve. The majority of researchers in tertiary education and GRIs, and particularly in colleges and GRIs, hold only a Bachelor's degree (Figure 4.17). Universities have a higher percentage of researchers with a Master's degree. Altogether, only 16% of researchers in these institutions hold a doctorate degree, and in colleges only 3% of researchers have doctorates. However, Viet Nam's ambitious goal is to triple its science and technology faculty by 2020, with as much as 75% of its university lecturers in informatics technology holding a PhD (MoST, 2011).[3]

Figure 4.17. Qualifications of researchers, by institution



Source: NASATI (2011). (tbc)

Finally, the culture of "seniorism" has contributed to the ageing of the population in research and universities. Some 60% of researchers with postgraduate degrees are over 45 years of age. The average age of senior S&T researchers is between 55 and 60 years, the average age of professors and associate professors in GRIs is 57, and the average age of directors of GRIs is 55 years (UNIDO, 2000). This can give rise to frustration among younger staff and lead to a brain drain and a strongly skewed age distribution among researchers (UNIDO, 2011). GRIs have in fact been seeing more qualified researchers, particularly those with PhDs, exit (UNIDO, 2000). Without more support, Viet Nam's innovation system will find it difficult to attract talented young researchers.

4.3. What are the main constraints?

Human resources are the heart of an innovation strategy. Without adequate human resources, Viet Nam will be unable to assimilate, adapt and/or develop the new technologies needed by its productive sectors. The preceding sections have shown that Viet Nam has many human resource and skill gaps which affect the government, firms and R&D institutions at many levels. This section looks at some of the main current constraints on producing human resources and skills for innovation, moving from those most directly related to human resources and skills for innovation – faculty and the education and training curriculum and programmes – to broader constraints affecting the education and training systems and the labour market. The following section proposes ways to start addressing them.

Faculty constraints in universities and the TVET system: insufficient quantity and quality

The first constraint is the quality and quantity of faculty in universities and technical and vocational education (at post-secondary level). University and TVET faculty play a critical role in developing human resources and skills for innovation. They train future primary, secondary and tertiary teachers who in turn shape the quality and relevance of the entire education system. They provide future high-level research, technical, managerial and administrative personnel with skills they will need to lead government, business and industry. They are incubators of the innovation and creativity that will enhance national productivity and competitiveness (Chapman, 2010). Today, Viet Nam suffers from a lack of staff with Master's and PhD degrees, high pupil-faculty ratios, ageing staff, and poor teaching, research and entrepreneurial skills.

As a result of the last decade's rapid expansion in East Asia's tertiary enrolments, these have grown far faster than faculty numbers. This growth has largely been due to increases in the tertiary age population, a higher rate of participation in that group, and a growing middle class. As a result, most low- and middle-income countries in East Asia have significantly higher student-faculty ratios than the OECD average of 15:1, and Viet Nam's 30:1 ratio is among the highest[4] (Table 4.6).

Given the high and increasing student-faculty ratios, many universities and other tertiary-level institutions in Viet Nam have hired insufficiently prepared instructors and have too few PhDs. For example, only about 52% of academic staff in 2010/11 had postgraduate qualifications, and very few had doctorates (Table 4.7). Moreover, attendant to the expansion in coverage, the share of faculty with doctorates has decreased, from about 15% in 1999/2000 to 11% in 2012.

Though Viet Nam's situation is similar to that of the Philippines, middle- and high-income countries such as Thailand and Korea have much higher concentrations of faculty with advanced degrees. In Korea close to 60% of faculty have PhDs (Figure 4.18). Coupled with a very high pupil-teacher ratio, this places Viet Nam in the unenviable position of facing the greatest quantity-quality challenge of the region (Table 4.8).

Table 4.6. Student-faculty ratios in tertiary education, Viet Nam and comparator countries, 2007

Country	Viet Nam	Philippines	China	Thailand	Malaysia	Korea
Student- faculty ratio	30:1	23:1	19:1	37:1	20:1	16:1

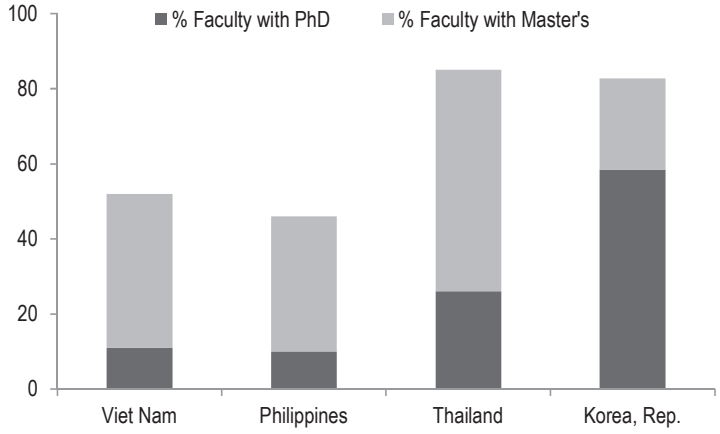
Source: UNESCO Global Education Digest (2009); Chapman (2009).

Table 4.7. Staff qualifications in Vietnamese higher education institutions (%)

	1999/2000	2001/02	2003/04	2005/06	2007/08	2008/09	2010/11	2011/12
Doctorate	14.8	13.8	13.4	12.4	10.5	10	10.9	11.0
Master's	22.4	26.6	29.3	32.3	36.1	37	41.3	44.0
Other university & college qualifications	59.1	56.6	54.6	53.4	51.7	—	45.8	44.0
Professional qualifications	1.9	1.7	1.4	0.9	0.8	—	—	
Others	1.8	1.3	1.3	1.1	0.9	—	—	1.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: MoET, various years.

Figure 4.18. Ratio of faculty with Master's and PhD degrees, Viet Nam and comparator countries, various years



Source: Viet Nam: MoET, Higher Education Institutions Survey 2012. Philippines: Commission on Higher Education, 2006. Thailand: Commission on Higher Education, 2008. Thailand: Social Monitor, 2009. Korea: OECD Review of Tertiary Education, 2008.

Table 4.8. Pupil-teacher ratios and ratios of faculty with PhDs in Viet Nam and East Asia

		% of PhDs		
		>30	20-30	<20
P-T Ratio	>28		Thailand, Mongolia	Viet Nam
	23-28			Cambodia, Philippines
	17-22		Malaysia*, China*	
	<17	Japan, Chinese Taipei, Korea		Indonesia

Notes: * Estimates used for PhD ratios. No shade = upper income; light shade = middle income; dark shade = lower income.

Source: Based on World Bank (2012), *Putting Higher Education to Work: Skills and Research for Growth in East Asia,* The World Bank, Washington, DC.

High student-faculty ratios, while not systematically correlated with education outcomes, imply higher teacher workloads. In combination with a lack of well-educated teachers and frontal pedagogical practices, they are likely to have led to poor teaching. Higher teaching loads also mean less time for research, while lower ratios of faculty with PhDs translate into lower ratios of qualified researchers. Insufficiently qualified faculty is also one of the major reasons why Viet Nam, like several East Asian countries, has a very small share of academic staff with the rank of full professor,[5] an indicator often used to measure research capacity (and teaching quality[6]).

Finally, "outdated" teacher-centred pedagogical practices exacerbate these qualification issues and may perversely increase the tendency to use them. A teacher-centred approach is generally pedagogically less effective in tertiary education than a "student-centred" approach. Lack of creativity in research and lack of management skills and scientific leadership are other faculty weaknesses that are relevant to higher education. Likewise, teaching in Vietnamese universities is heavily focused on theoretical concepts rather than on practical application and entrepreneurship, both of which are crucial for promoting creativity and innovation (UNIDO, 2010). These issues are further exacerbated by the fact that most professors and associate professors are over 55 years old with few replacements in the pipeline (Ca and Hung, 2011).

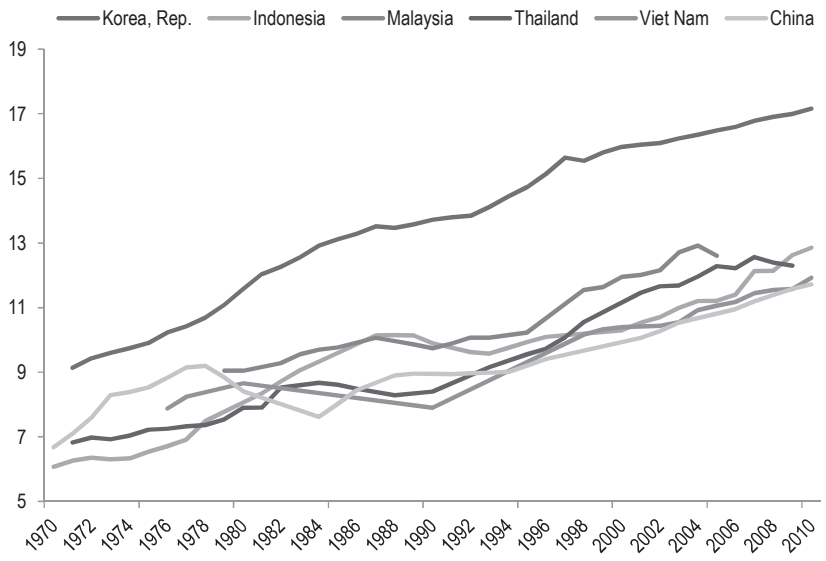
Teaching and learning institutions' constraints: Lack of relevant content

There is a lack of relation between what education and training offer and what the labour market and the economy need, owing both to staff constraints (as cause and effect) and to insufficient capacity to produce high-quality human resources for the economy. This is partly due to the quantity of education but even more to what is offered in tertiary (and earlier) education, particularly in terms of fields of study, types of programmes, curricula and pedagogical approaches.

Viet Nam's expected years of schooling centre on secondary education, on a par with other middle-income countries (Figure 4.19). To become an innovation-driven economy, Viet Nam will need to continue to expand its citizens' education to tertiary education. Tertiary gross enrolment rates show that Viet Nam lags behind its middle- and upper-income counterparts with only 22% (Figure 4.20). The rising rates of return to tertiary and secondary graduates suggest that, in spite of the increases, the quantity of graduates is still a binding constraint.

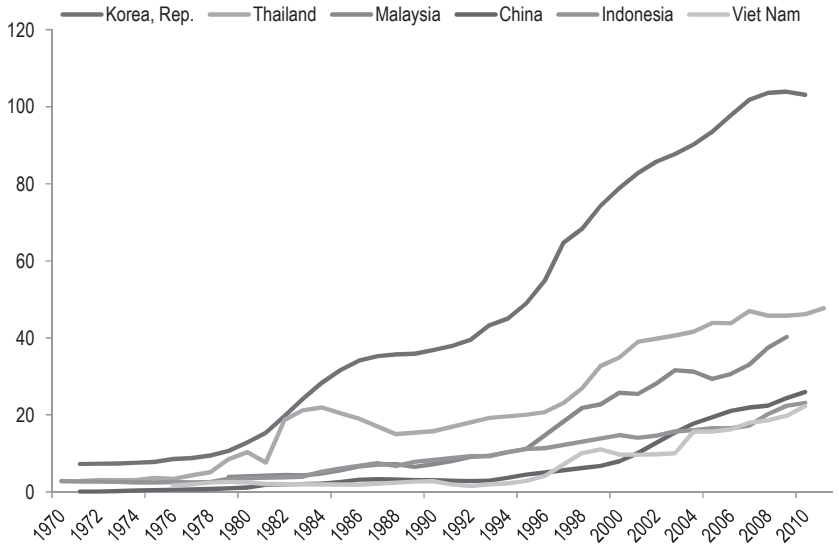
More generally, the development of the thinking and entrepreneurial skills necessary for innovation requires early intervention. The current primary and secondary education curriculum does not meet this need because of its emphasis on root knowledge and memorisation rather than on inquiry, problem solving, communication and leadership skills. The curriculum is scheduled for reform in 2015.

Figure 4.19. Expected years of schooling in East Asia, 1970-2010



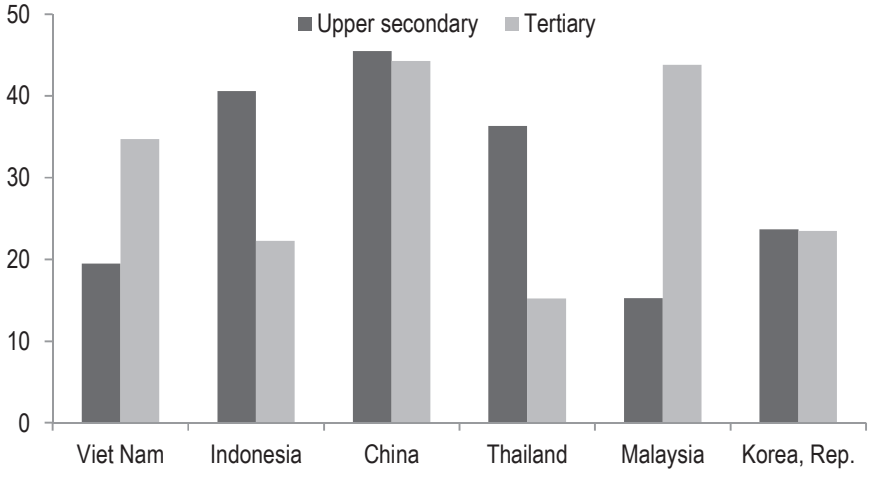
Source: UNESCO Institute for Statistics, 2012.

Figure 4.20. Tertiary gross enrolment ratio in East Asia, 1970-2011



Source: EdStats, 2010 and UNESCO Institute for Statistics, 2012.

Figure 4.21. Share of TVET in upper secondary and tertiary enrolment



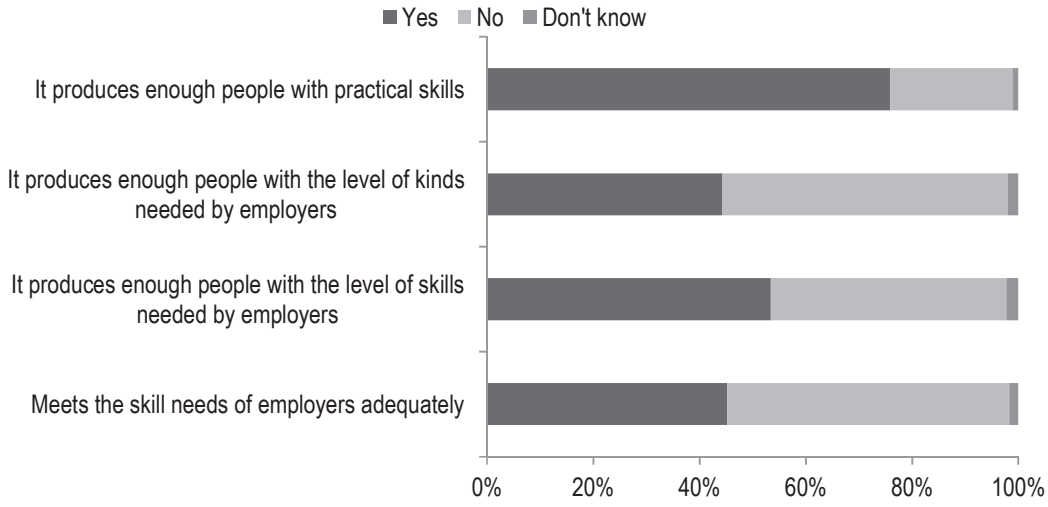
Note: Viet Nam: 2010. Indonesia 2010. China: 2010. Thailand: 2011. Malaysia: 2009. Korea: 2010.

Source: UNESCO Institute for Statistics, 2012.

Courses at the tertiary level do not meet the skill requirements of the workplace. This is made plain by the results of the 2011 Employer Skill and Innovation Survey (Figure 4.22) and broader findings indicating that teaching in both higher education and TVET colleges is not student-centred but aims at certification rather than at active learning, intellectual stimulation, critical thinking, problem solving and a desire for self-learning (MoET, 2011). Teaching and learning are too theoretical overall, as illustrated by the gaps reported in practical skills in both general and TVET education and training in the employer survey (Figure 4.23) and other evidence (Ca, 2012; World Bank, 2008).[7] Part of the problem is the mono-disciplinary approach that is still the norm in contrast to the more multidisciplinary approaches that have become a popular means of equipping graduates to learn, solve problems and think across a broad range of fields while developing in-depth academic and key generic skills.[8] Many firms feel that scientists produced by Vietnamese universities cannot contribute effectively to technology development because they lack the understanding of economics and business needed for applying technologies in real life (MoET, 2011).

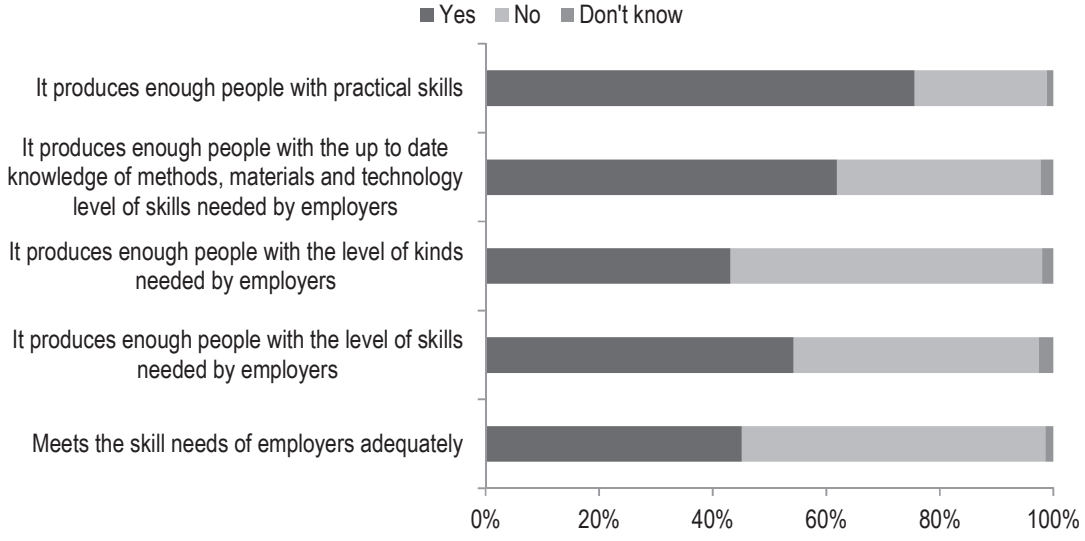
Finally, beyond supplying the future workforce for the labour market, tertiary education institutions can also play an important role by training the current workforce in order to complement their current skills set and keep their skills up to date. This is essential in a context of fast technological improvement where skills become outdated fairly quickly. Many Viet Nam universities (including polytechnics) have traditionally offered programmes to train and re-train employees (thus strengthening their finances). The 2011 Employer Skill and Innovation Survey found that 19% of firms interacted with education and training institutions for training Type A and 10% for training Type B employees. These programmes range from longer-term training to short-term courses in job-specific fields but vary substantially in quality.

Figure 4.22. Employers expressing satisfaction with the general education system (%)



Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

Figure 4.23. Employers expressing satisfaction with the TVET system (%)



Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

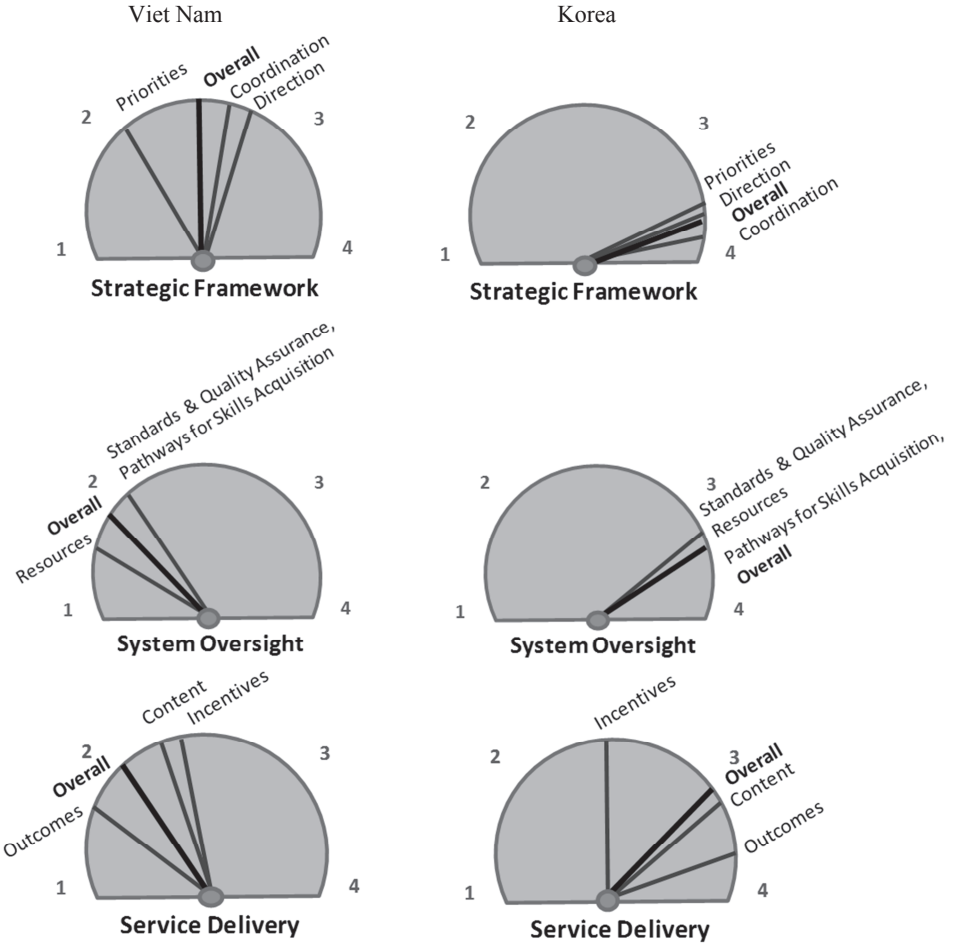
Broader systemic constraints on workforce development and higher education

These weaknesses are symptomatic of broader constraints related to the way the Vietnamese education and training system, and in particular the TVET and higher education system, is organised, managed and financed. These broader constraints are briefly reviewed below.

A recent workforce benchmarking exercise undertaken in several countries,[9] with Viet Nam as a pilot country, indicates serious shortfalls along several key dimensions of Viet Nam's workforce development system.[10] Figure 4.24 compares Viet Nam with Korea across the three main dimensions and six sub-dimensions of the benchmarking

exercise. As expected, Viet Nam lags behind in most sub-dimensions, and particularly in strategic priorities, funding strategy and outcome orientation for workforce development. At a more disaggregated level (various sub-dimensions of these three sub-dimensions) there are important weaknesses in: promotion of demand-driven workforce development; measures to strengthen firms' demand for skills to improve productivity and motivate public training institutions to respond to the demand for skills; allocation of public resources for workforce development to achieve results efficiently and promotion of partnerships between workforce development authorities and other stakeholders; and development of a monitoring and evaluation system for workforce development. All these weaknesses constrain the formation of human resources for innovation.

Figure 4.24. Benchmarking workforce development in Viet Nam and Korea



Source: Viet Nam WfD Benchmarking (CIEM and World Bank (2012), "Skills for Productivity. An Analysis of Employers Skills Survey 2011", Draft Report).

Overall, Viet Nam urgently needs to improve the quality of its TVET system. Vocational schools do not meet regional and international standards, and MoET's limited role in these schools has given it little prominence in the education sector (UNIDO, 2011). The low 5% rate of return for vocational education suggests high costs and overall poor investment (Moock *et al*., 1998).

At the same time, higher education has significant systemic weaknesses in terms of governance (information and incentives) and financing, which constrain its capacity to produce the human resources and skills needed for the labour market. Higher education institutions may be unable to provide the skills to meet labour market needs because they lack information on demand. Instruments to provide institutions (and students) with labour market information[11] and mechanisms to channel inputs from firms into curriculum and programme design and implementation are limited in Viet Nam. In terms of university-industry links in curriculum design, for example, all polytechnics in Korea have to undertake regular visits to companies to keep their curricula up to date, and companies are regularly invited to visit campuses to provide input (Mok, 2010). This is important to ensure that future (and current) workers have the skills needed to apply, assimilate and develop new technologies in different sectors. In Viet Nam, while there are some notable exceptions,[12] such relationships are much less widespread and more informal, with the result that curricula and training programmes for current workers are outdated and lack relevance. Only about 9% of firms responding to the 2011 Employer Skill and Innovation Survey were involved in curriculum design (Table 4.10). According to MoET (2011) "the employers interviewed felt that they were not welcome to contribute to the development and delivery of training programmes in universities, and none reported being engaged with university councils". On a more positive note, almost half of the firms included in the 2011 Employer Survey offered internships and apprenticeships to students. This is an indirect way of providing inputs to institutions' curricula and improves the practical skills of the future workforce. However, these opportunities are not formalised (MoET, 2011) which limits their usefulness.

Table 4.9. Purposes of employers' contact with educational or training institutions

Purposes of contact	Percentage of firms
Recruitment	83
Participation in testing of students	3
Curriculum development	9
Further training of your firm's existing employees	38
Provision of work experience for students (internships and apprenticeships)	45
Other	0

Source: World Bank (2011a), *2011 Vietnam Employer Skill and Innovation Survey*, The World Bank, Washington, DC.

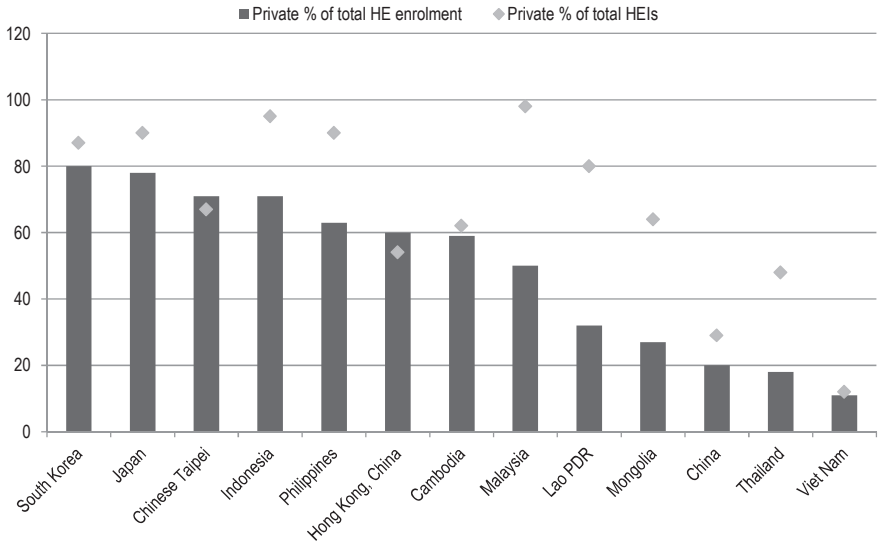
Even when sufficient information exists, the lack of incentives for public institutions to produce the skills needed by the labour market may ultimately hamper all attempts to improve the relevance of education. Incentives to attract high-performing faculty to universities are lacking. On the one hand, highly qualified faculty in public institutions often do not deliver because they are not held adequately accountable to parents and students. On the other hand, relatively low salaries at entry and, most importantly, limited opportunities for advancement make it hard to attract high-quality people to university careers. At least in the public sector, where faculty are civil servants, cumbersome promotion procedures do not sufficiently reward academic achievement on the basis of merit. Senior ranks are often filled with individuals who have been in place for many years, limiting younger colleagues' promotion opportunities. Appointments are subject to the recommendation of the rector of the institution to the relevant managing ministry, and promotions to higher ranks are decided with a recommendation of the rector. Party affiliation also plays an important role. Finally, research is very bureaucratic and requires

approval, so that researchers have limited flexibility to revise their research to accommodate new discoveries along the way. This has also made it difficult for universities to attract quality staff.

Viet Nam's public institutions are still "protected" by financing policies that shield them from having to show results or compete against other institutions. Limited autonomy in academic and administrative areas[13] also generates disincentives to tailor programmes to the needs of the local community and hire and reward the faculty required to deliver these programmes and/or undertake relevant research (which also contributes to low salary levels).[14] Viet Nam has been experimenting with autonomy in its two national universities with early positive results. While some of the legal framework for expanding autonomy is in place – such as the University Charter (*Decision No. 58/2010/QĐ-TTg*) requiring public universities to establish governing councils – implementation is still at the pilot stage.

Viet Nam is still very much a laggard in East Asia in terms of private higher education (Figure 4.25). This is largely due to insufficient incentives for private delivery,[15] which lessen the capacity to produce more higher education graduates and many relevant skills for the economy in fields of high demand, such as business, management and economics. It also hinders the country's ability to take the lead in innovative fields[16] and create links with businesses, nationally and internationally, and to play an important role in supporting innovative management and academic practices. It may also contribute to the lack of prioritisation of public spending on STEM fields.

Figure 4.25. Private higher education as a share of total institutions and enrolments in Viet Nam and selected East Asian economies, various years



Source: PROPHE International Databases and WDI.

Insufficient public spending for STEM fields and research is another important constraint that affects the capacity to achieve sufficient undergraduate and postgraduate degrees in STEM fields and increase the share of faculty with PhDs and numbers of researchers. Public subsidies are fairly equally distributed across public universities in Viet Nam, with little differentiation among fields of study. This results in lower than optimal supply and/or quality in several STEM fields which generally involve higher unit costs.[17] (Spending for research is further analysed in the next chapter of this review.)

Developing private delivery would help prioritise these fields. Private institutions could easily take over fields with high private rates of return and relatively low unit costs such as economics and business and recover their costs so that public funding (and institutions) would better be able to support STEM fields.

Economic and labour market constraints: the importance of "demand" and "matching"

Human resource constraints are due not only to education and training supply. A number of economic and labour market constraints also enter the picture.

"Brain drain" poses a real challenge for Viet Nam's human resource capacity. In 2000, 40% of Viet Nam's emigration concerned highly skilled individuals (*i.e.* post-secondary education) (Docquier *et al*., 2009). Given limited domestic resources and low salaries, Viet Nam's supply of talented workers and academics is quickly being depleted. This is most apparent in the GRIs and universities where ageing populations signal the government's inability to meet market salaries and attract young staff. Students are also part of the brain drain, and domestic firms are losing their talent to foreign companies and multinational enterprises (MNEs). Losing talent to MNEs may be less of an issue, to the extent that these human resources remain in the country, but because spill-overs from MNEs to the domestic sector are limited, this still affects the economy.

Table 4.10 shows the effect of brain drain in various countries from 1990 to 2000. China, Indonesia and Thailand benefited from brain drain, particularly China and Indonesia. In these countries, brain drain improved the size of their skilled labour force with post-secondary education. However, brain drain is detrimental to small and low-income countries such as Viet Nam where it decreased the size of the skilled labour force with postsecondary education by 0.70%; in 2003 81.8% of Viet Nam's S&T researchers emigrated to the United States (Docquier and Rapoport, 2009).

Table 4.10. Brain drain in selected East Asian countries

Country	Effect of brain drain on labour force, 1990-2000			Brain drain of S&T researchers to United States, 2003
	Effect on labour force[a]	Effect on skilled labour force[b]	Effect on proportion of skilled[c]	
Beneficial brain drain				
Thailand	-83 572	318 506	1.00%	29.7%
Indonesia	-99 302	451 452	0.40%	10.2%
China	-741 293	1 440 794	0.20%	14.9%
Malaysia	-92 619	-815	0.10%	43.3%
Detrimental brain drain				
Viet Nam	-458 807	-289 465	-0.70%	81.8%

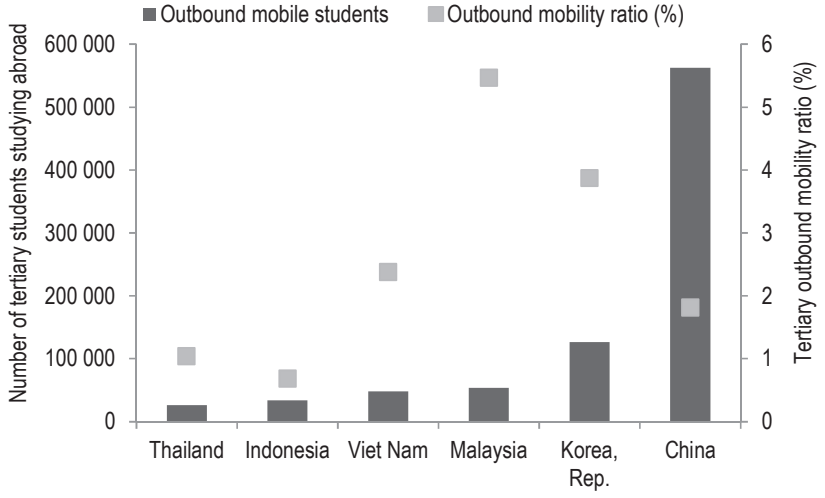
Notes: a) Effect on the labour force (population aged 25 and more): observed labour force minus counterfactual labour force. b) Effect on the skilled labour force (with postsecondary education): observed skilled labour force minus counterfactual skilled labour force. c) Effect on the proportion of skilled (BG): observed proportion minus counterfactual proportion (brain gain).

Source: Beine *et al*. (2008) "Brain Drain and Human Capital Formation in Developing Countries: Winners and Losers", *Economic Journal*, Vol. 118(528), pp. 631-65; Docquier and Rapoport (2009), "Documenting the Brain Drain of 'La Crème de la Crème': Three Case-Studies on International Migration at the Upper Tail of the Education Distribution", Discussion Papers (IRES – Institut de Recherches Economiques et Sociales) 2009031, Université Catholique de Louvain, Institut de Recherches Economiques et Sociales (IRES).

The brain drain from universities draws attention to the different employment conditions in universities and in other economic sectors. As Viet Nam produces few PhDs and Master's degrees, the private sector competes with universities to attract them. Teaching loads can be very heavy in some institutions, staff may be paid less per teaching hour than in other types of institutions, and greater difficulties for career development than in the private sector are further disincentives to a university career.

An increasingly saturated higher education system coupled with the poor quality of its faculty has prompted many students to study abroad. While China sends by far the most students abroad among East Asian nations, Viet Nam has experienced one of the largest increases. It has more than doubled the number of students studying abroad from 23 000 students in 2006 to nearly 48 000 in 2011 (UIS, 2012), a fairly high percentage of its tertiary students (Figure 4.27). By 2012, Viet Nam, the number has further doubled to 100,000 students studying abroad, of which 90% are self-financed. While many students studying abroad expect to return, some may find better employment and life options abroad and remain there.

Figure 4.26. Number and percentage of tertiary students studying abroad



Source: UNESCO Institute for Statistics, latest year 2009-2011.

The domestic private sector is also short of qualified human resources. The reasons for transfers from domestic firms to MNEs and emigration are well known. They include the better remuneration and professional opportunities that derive from different economic and financial conditions and the still limited demand for innovation in the domestic private sector. This constrains the overall, and otherwise growing, wage premium paid to qualified workers. Because a skilled workforce is mobile, expectations of higher salaries in MNEs or abroad are an important driver of brain drain.

Demand-side constraints in the labour market also explain the acute shortage of qualified human resources in SMEs. SMEs may be unable or unwilling to offer the necessary compensation (the employer survey indicates that salaries are a greater constraint in SMEs). On the supply side, there is the paucity of students enrolled in some hard sciences and some PhD programmes. In middle-income East Asian countries, wage premiums for education show that postgraduate degrees are well rewarded on the labour market,[18] so that an insufficient supply is clearly due to supply constraints. In lower-

income countries such as Viet Nam, however, the demand constraint may be greater, as illustrated by the fairly low labour market rewards for postgraduates. This requires, at least in an initial stage, public subsidies to support higher enrolment.

Beyond supply and demand issues, there appear to be problems in matching supply with demand on the labour market owing to poor recruitment processes and insufficient information on the demand for and supply of skills. Evidence from the 2011 Skill and Innovation Survey shows that the vast majority of employers use informal channels to recruit new workers, with a significantly lower share using media advertisements and the Internet, in line with results from previous investment climate surveys (World Bank, 2008). Public and private employment services are rarely used. The lack of diversified recruitment methods constrains the efficient allocation of labour and skills. The lack of systematic information on demand and supply available to all economic actors requires urgent action.

4.4. What are the key options?

Viet Nam needs a human resource strategy to develop human capital able to spur innovation. The strategy needs to: define human resources comprehensively to include qualifications, specialisations and skills for innovation; have broad coverage by supporting the main actors of the NIS – firms, GRIs, universities and government; be selective in developing the human resource base (in terms notably of priority sectors) to address shorter-term economic and labour market needs and priorities, but keeping a longer-term view of the human resources needed to respond to future innovation needs; and focus on the critical constraining factors and policy levers to improve human resource outcomes, balancing short- and longer-term components/actions with longer-term results. Some of the main actions, from relatively short-term to longer-term, are described below. The human resource strategy needs to be seen as complementary to other economic and labour market reforms, which will also play a very important role in spurring innovation and creating attractive jobs for skilled labour, thereby leading to even more skilled human resources.

Make short-term training more effective

Short-term training programmes can be a powerful complement to traditional education and training to build the capacity of leaders and practitioners in S&T. Specific programmes can help youth strengthen their life skills before employment, often in combination with employment placement programmes.[19] In-service capacity-building programmes can be used to increase S&T capacity in the workforce, with a focus on specific sectors if needed.

Viet Nam should look into a combination of four main actions: *i)* evaluate the performance of STEM and business- and management-related in-service programmes offered by colleges and universities against the standards that apply to regular programmes; *ii)* update outdated curriculum for in-service training of S&T managers and consider introducing a new high-level management programme for S&T managers; *iii)* explore fellowship programmes for civil servants, academics and outstanding practitioners, as well as needs-tailored support programmes for selected institutions to bring them up to date in terms of new management practices in S&T and new developments in selected fields of science and engineering; and *iv)* create further incentives for MNEs and other firms in priority sub-sectors to invest in the skills of local human resources. A few details on the three last options are provided below.

In Viet Nam the S&T curriculum has not been updated since 1998. It is therefore imperative to update it to include contemporary knowledge of technology development, commercialisation and management, with a focus on problem solving. Furthermore, the existing, although improved, in-service training options available at the tertiary level may not suffice to support the development of a stronger cohort of government and business leaders. This suggests the need for a new management programme, or even an institution specialised in S&T management, possibly along the lines of what upper-income East Asian countries such as Korea and Singapore did to help their industrialisation process take off. A past policy report saw the need for a Vietnamese techno-management programme loosely based on Korea's experience[20] to educate and train Viet Nam's industrial leaders in: technology management systems; performing technical assessments, systems analyses and syntheses; and planning and management of projects at all levels. The programme would consist of formal technology management programmes (such as Master's degrees) and non-degree special advanced programmes on modern technology management for both young college and university graduates and managers and decision makers already on the job.[21] It could have been developed in an existing university (such as the Viet Nam National University), but has never been introduced as such (only some elements based on an outdated curriculum). Its relevance to the needs of Viet Nam remains intact, judging from the role that GRIs, universities and firms are to perform in the S&T system. The country's recent move to increase the proportion of managers with Master's degrees (up to 28-30% by 2020) is therefore welcome.

The role that the main innovation actors are expected to play will also require specific areas of training for human resources in S&T, broadly defined, on technology transfer, use, upgrading and commercialisation, product development, and manufacturing practices and processes.[22] Ideally, this would accompany an increase in the share of S&T personnel with a Master's degree in firms and S&T scientific organisations. It will be important to enhance the impact of these capacity-building programmes by linking them with incentives for performance and with GRIs, universities and firms with international networks. They would be more effective if implemented in institutions in key priority sectors.

Finally, MNEs can play an important role in skilling human resources in specific sectors. INTEL Viet Nam, for example, is present in the HCM High Tech Park and has also been setting up courses in technology and engineering in communication-related fields in collaboration with some important Vietnamese universities. INTEL's incentives have been the fiscal and other incentives offered in the High Tech Park and the potential of Viet Nam's market. Local firms can also do more for skill development if offered the right incentives. The local government in Ho Chi Minh City, for example, has encouraged links with local businesses and established a university council to advise on how to promote training and innovation in universities linked to city development in co-operation with firms.

Emphasise "soft" skills for innovation and multidisciplinary approaches in curriculum design

Viet Nam's curricula and pedagogical approaches need to be drastically reformed in line with best practices to produce "soft" skills for innovation. They need to incorporate thinking skills, including problem solving and creativity, and behavioural skills such as leadership, entrepreneurship, risk-taking, communication and even teamwork skills, at all levels of the education and training system. The upcoming 2015 curriculum reform offers an excellent opportunity to do so. One effective way to support this reform, while

equipping graduates to think across a broad range of fields, would be to encourage, as a general pedagogical and curricular trend, a transition towards multidisciplinary and trans-disciplinary courses, at least in tertiary education.[23] Such courses shift from discipline-based learning to problem-based learning and allow students to make connections across various fields. Students are encouraged to work in problem-solving teams to understand complex systems that rely heavily on modelling and to simulate real-world situations, often using case studies (Kennedy and Lee, 2008). This offers the additional advantage of improving practical job understanding. This reorientation would help Viet Nam face many of its emerging challenges, such as climate change, while shaping a more comprehensive innovation and growth strategy by forming a generation of problem-solving risk takers who are keen to experiment and innovate.

Develop curricula that are more responsive to changing demand and economic needs

Along this line, there is room for more demand- and needs-driven curricula that make good use of industry's and other employers' inputs and skills-related information. Tertiary institutions and employers interact little in Viet Nam. This can be changed through mechanisms to incorporate employers' inputs into course design; Korea and Singapore provide models to study. For curriculum design, consultation mechanisms and professional practice groups should be set up, and there should be more "external" members on the governing councils of tertiary institutions.[24] As part of such programmes, student internships would encourage on-the-job learning and the development of core work and innovation-related skills across sectors, thereby sharing the "burden" of skill provision with firms more effectively.[25] At a broader level, the movement towards university autonomy should allow institutions to adapt their curricula to economic and labour market needs. The new Higher Education Act to be approved in June 2012 is a good step into this direction.

Finally, labour force and employer surveys with skill modules, regular graduate tracer studies,[26] and labour market and economic observatories could be used to provide valuable guidance to curriculum designers on skill needs for productivity, innovation and growth.

Invest in and support faculty and hold them accountable

It is urgent to address the quality-quantity issue as regards faculty. There are no obvious ways to do so, but a twofold approach may help fills gaps until longer-term improvements in supply are achieved (measures to build a stronger pipeline of graduates are discussed below). It would entail a combination of strategies to boost the current faculty stock for tertiary education through a mix of recruitment and benefit-related policies, and policies to maximise the use of the current stock through more efficient allocation of staff and better performance.

Faculty recruitment

Pro-active recruitment policies may involve hiring qualified expatriates and students who have studied abroad and who are still there or have moved to other sectors domestically or abroad. Because employing qualified expatriates is expensive, this may be less feasible for Viet Nam than for upper-income East Asia countries (especially for lower-tier institutions), so the second route may be more promising. Viet Nam could draw on a substantial pool of well-trained talent abroad and, to a lesser extent, domestically. In

all cases, such policies will require changes in benefit- and career-related policies in tertiary education institutions. To attract more talented people to the university sector, universities would benefit greatly from more financial autonomy and the liberty to set salaries. Such policies have been applied effectively in universities in Singapore, Hong Kong (China) and Japan.[27] Viet Nam should pursue such a policy, at least in a first stage, for selected institutions.[28] Other steps would include increasing non-monetary benefits for academic faculty, such as subsidised housing, and, even more important, opportunities for professional advancement which are currently limited, in particular for younger staff. Across East Asian countries, some top universities have made a special effort to strengthen academic leadership by giving more authority to department chairs, thereby lessening external influence (World Bank, 2012). China is an interesting case, as it made good progress in improving the balance among the four levels of academic staff – professors, associate professors, lecturers and instructors (*jiaoyuan*) and tutors (*zhujiao*) – by increasing the ratio of professors and associate professors relative to lecturers and instructors.[29] During the same period, according to the same source, the average age fell.

A more complete strategy also needs to include policies to maximise the use of the existing faculty stock. While there is scope to allocate current staff more efficiently across institutions,[30] most emphasis should be on improving faculty performance through curriculum reform (see below) and on professional support and evaluation of performance.

Professional support

Viet Nam trains its faculty on the job, often using old-fashioned methods. It should put much more emphasis on connecting faculty and institutions by developing professional networks and encouraging faculty to participate in them, and by developing research partnerships as a way to build research capacity. Professional organisations and networks can link teachers and improve pedagogy. Professional organisations create a venue for faculty in the same field to meet, interact and share ideas about their instruction and research, sometimes leading to new ideas and creative classroom practices. Furthermore, developing research collaboration with other academic institutions can be a way to support research and skills upgrading. International research collaboration is growing, as demonstrated by the rise in the number of internationally co-authored articles. Between 1988 and 2005, the number of such articles more than doubled, increasing from 8% to 18% of all scientific articles (World Bank, 2012).

Performance evaluation

Holding teachers accountable for their performance will conclude the virtuous cycle of increased productivity. While the nature and rigour of evaluation systems differ by country and by type of institution, many colleges and universities are feeling the pressure to introduce more quality-oriented criteria (largely related to the extent to which faculty are effective in their teaching and productive in their research and whether graduates are finding employment) into their promotion decisions. China has introduced over the years a number of faculty performance programmes with positive effects.[31] Viet Nam should look at some examples as a source of ideas for its institutions. Particularly important will be the need to ensure that faculty in at least top-tier institutions use their research hours appropriately.[32] This is an important objective in its own right and results in positive complementarities between teaching and research.[33] Achieving this objective should become easier with the increase in the pipeline of potential faculty.

Build a diversified education and training system in which TVET, colleges and private delivery have the place and relevance they deserve

To address effectively the needs and priorities of the agriculture, manufacturing and services sectors of today while positioning itself to address future needs, Viet Nam needs an education and training system in which institutions' mandates are well differentiated and address the research and skill needs of different levels. It should have a certain number of first- and second-tier institutions, including research and teaching institutions offering undergraduate and postgraduate degrees, but also high-quality colleges and TVET institutions at secondary and tertiary levels that provide a strong basis of practitioners able to apply and adapt existing technologies. In Viet Nam, as in other countries of the region, families and students often consider college and TVET as second- or even third-best options. Their quality is often low because of lack of vision and investment. There is a need, therefore, to make college-based and TVET training programmes more distinctive and more attractive, to improve the relevance of their programmes to employers' needs, and to improve quality-assurance mechanisms and service delivery.

Qualification frameworks (QF) can provide quality-assurance and support increased accountability, through skill certification and horizontal and vertical articulation of providers. There are many examples of qualification frameworks at different stages of development, including advanced QF in Malaysia and QF under development in Thailand, Indonesia and the Philippines (World Bank, 2012). In Viet Nam, a QF would greatly help clarify how secondary and tertiary vocational training programmes articulate with higher education programmes delivered by universities and colleges, facilitate student mobility and make TVET more attractive, while bringing firms more forcefully into the definition of competencies required for the labour market. As developing QFs takes time and patience, Viet Nam should make a start.

Finally, private delivery, in particular at tertiary level, needs to be further encouraged through clarification of their profit/non-profit status and by ensuring that student loans and research funds are equally available to public and private institutions.

Build a pipeline of graduates in science, engineering and technology

The current and expected need for technology upgrading in various sectors requires Viet Nam to put more emphasis on developing a pipeline of science, engineering and technology graduates. A package of interventions is needed to address the combination of demand and supply constraints. Scholarships to encourage secondary school and college graduates to earn advanced degrees in science in domestic or foreign universities are an option to be pursued because of the still low private rates of return to these fields/degrees. Such a scheme has been implemented successfully in Thailand for some time.[34] This option was also strongly supported by UNIDO in 2000 (UNIDO, 2010) when it proposed the launch of a selective postgraduate fellowship programme in selected S&E fields to send a significant number of outstanding young graduates to leading universities abroad for periods of 2-3 years. Unfortunately, the proposal has not been implemented.

These demand-side measures should be combined with additional public financing for STEM and research to help build capacity on the supply side by freeing up public resources from more labour-market-oriented fields and by more selectivity on the part of financing institutions. These two measures are part of the new tertiary education financing framework spearheaded by the Viet Nam Ministry of Finance and are still in their infancy. Scholarships for foreign universities should be made conditional on return

or other incentive measures should be implemented to make return to an academic career in Viet Nam attractive (and thus strengthen the capacity to offer courses in STEM). In any case, high-quality exposure to maths and science should start early in the education cycle, as Korea and Singapore have done for years.

Notes

1. In 2011, the World Bank surveyed a random sample of 352 Vietnamese manufacturing and services firms stratified on the basis of size, sector and geographic distribution. Among other aspects, the survey aimed to measure employers' demand for cognitive, non-cognitive and technical skills and innovation patterns (World Bank, 2011a).

2. The 2011 World Bank Employer Survey found that Type A workers systematically have higher education levels than Type B workers, and that, regardless of their profession (e.g. manager, technician, clerical), workers with higher levels of education tend to have higher income, an indication of a degree of scarcity.

3. By the end of 2012, total college and university lecturers in the country is 84 109 people, of which 2 687 are professors and associated professors (3.1%), 9,152 are doctors (11%), 36,347 are masters (44%), 37,243 are bachelors and engineers (44%), and 1% of other degrees (Report No.2662/BGDDT-KHCNMT; as cited). It is expected that by 2020, total number of university lecturers is to reach 127 000, of which 30% are doctors and 70% are masters; college lecturers are to reach 78 500 people, of which 8% are doctors and 60% are masters (Planning and development of human resources in education for 2011-2020, Decision 6639/QD-BGDDT dated 29 December 2011).

4. In order to achieve targets set by Resolution No. 14/2005/NQ-CP regarding the higher education enrolment rate and the lecturer-to-student rate, Viet Nam will need about 205 500 lecturers in higher education institutions by 2020. Currently, they number about 84,109.This implies a growth rate of almost 300% between 2011 and 2020 (MoET, 2011).

5. According to 2005 data, only 1% of academic staff in Viet Nam had the title of full professor, a remarkably low proportion by international standards (World Bank, 2008). This ratio for 2012 is 3.2% (MoST).

6. Prominent academics bring prestige to institutions and attract high-quality students and increased external resources. The lack of prominent academics can also affect universities' ability to retain younger academics and the quality of teaching.

7. MoET (2011) also highlights "concerns about the lack of attention to the practical application of knowledge, the extent to which graduates were weak in terms of the development of their communication skills, 'soft skills' and teamwork skills, and the extent to which their knowledge was considered to be out of date". The lack of practical skills was also highlighted as a key issue for technical colleges in the 2003 MOLISA-ADB survey showing that this is a persistent – and possibly rather unexpected – issue for TVET education.

8. This is in line with research showing that students need to acquire knowledge in more than one specialisation– for example, mathematics, statistics, economics and/or computer science – to become more flexible learners (Gibbons, 1998).

9. See the Workforce Development initiative led by the World Bank Human Development network in collaboration with the Viet Nam Human Development team and diagnostics of workforce development in several countries (Tan, 2011).

10. The workforce development (WfD) system includes technical and vocational education and training at secondary, postsecondary and tertiary levels. Results are still preliminary. The three key dimensions examined are: strategic framework for WfD; system oversight for WfD; and service delivery for WfD. Each dimension is composed of three sub-dimensions, which in turn have three sub-dimensions, for a total of 27 main characteristics.

11. Such as graduate tracer surveys and labour force and employer surveys complemented with skill modules to assess demand and supply of skills in the working population.

12. The Ho Chi Minh University of Technology, for instance, has been very active in training and skill development for local businesses (World Bank, 2008).

13. Broader governance issues related to the configuration and type of higher education institutions are discussed in Chapter 5 on the role of government.

14. The disincentive is particularly strong for conducting research. Salaries are very low, and the inability to increase salaries has led faculty members to teach extra hours or take on second jobs to supplement their base salaries, further compressing the time for research. This has made salaries an important bottleneck for the university, and project funding has often been used to supplement the salaries. For example, at the Hanoi University of Science and Technology, salaries for foreign professors are ten times those of Vietnamese professors.

15. Viet Nam has recently taken a more favourable stance towards private delivery. The Higher Education Agenda has set a goal of 40% of private higher education by 2020. Private firms are encouraged to establish their own universities, taking advantage of their autonomy to set salaries and design curriculum that is tailored to their needs. An earlier goal of 30% by 2010 was not reached, however, and regulations on private-sector participation remain ambiguous (World Bank, 2008). The share of private enrolment is struggling to pick up.

16. They can even make inroads into more expensive fields, such as engineering and information technology (as recently documented by the Philippines and even by China and Thailand) (World Bank, 2012).

17. Recent evidence based on secondary data and university surveys suggests that unit costs for economics and business are only about VND 3.8 million versus more than VND 10 million for medical sciences.

18. In Thailand, the Philippines and Indonesia those with postgraduate degrees make 30-50% more in salary than those with undergraduate degrees, according to 2006-09 surveys (World Bank, 2012).

19. The EYE programme in Indonesia, which combines skill development, certification and placement, is an interesting example for Viet Nam (World Bank, 2010b).

20. UNIDO (2000) citing the Korean experience with specialised research and graduate schools.

21. This programme would also have elements of pre-service training and more traditional postgraduate programmes.

22. According to the 2011 Innovation and Skills Employer Survey.

23. Financial incentives to merge mono-disciplinary universities and create more multidisciplinary universities, and requiring all new universities to be comprehensive and multidisciplinary would also help effect this shift.

24. The current Charter places a cap of 70% on the proportion of "internal" members (including the rector, Party secretary, lecturers, researchers, management staff). By international standards, this is extremely liberal. In many instances, "external" members are not paid for their services. They volunteer their time because of "civic-mindedness". It is accepted in Viet Nam that "external" members would need to be paid for their time and that this could impose a significant cost on the university. The cost must, however, be considered alongside the long-terms benefits of well-informed and valuable governance and curriculum decisions (MoET, 2011).

25. To make them more effective, these efforts could be framed as part of the development and implementation of competency-based curricula.

26. Institutions such as Can Tho University have undertaken graduate tracer studies and employer surveys as a basis for assessing the relevance of their curricula and instruction methods, with good results.

27. The level of administrative (including salary setting) and academic freedom enjoyed by the Hong Kong University of Technology helped make it an internationally ranked university within a decade of its establishment thanks to the recruitment of top talent (World Bank, 2012).

28. A pilot under way in five tertiary education institutions involves higher autonomy, including in financing and budgetary issues (such as liberalising fees and cost norms).

29. In 1991 the ratio was 4.0:21.4:38.5:36.0; a decade later it was 10.1:30.0:36.3:23.0 (Wei, 2005).

30. For instance through the use of part-time instructors and new delivery methods (World Bank, 2012). In Viet Nam, universities and GRIs and the public and private sectors already often share faculty and achieve some allocation efficiencies.

31. Including a teaching evaluation programme of all regular higher education institutes in 2000, and the use of graduate employment rate as a major indicator of programme quality on the national "Assessment on the teaching standard of undergraduate programmes in higher institutes", as described in World Bank (2012).

32. Resolution No. 64/2008/QĐ-BGDĐT require lecturers to complete 500 hours of research per year, associate professors 600 hours, and professors 700 hours. There are, however, few incentives to engage intensively in research and many universities do not enforce MoET's provisions strictly (MoET, 2011).

33. It is often argued that lecturers who do not do research tend to use outdated knowledge and materials, are unaware of the range of knowledge generated by others, and are limited in the scope and range of their teaching skills (World Bank, 2012).

34. The Anadamahidol Foundation, for instance, was established by King Rama IX to provide graduate study scholarships (Anandamahidol scholarships) for students willing to continue postgraduate studies in high-income countries. The scholarship's main goal is to support students pursuing degrees in one of the eight fields, including S&T, identified as crucial for national development (World Bank, 2010c).

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Chapter 5

The role of government

This chapter reviews the range of public activities the shape Viet Nam's innovation system. It begins with a description of the system of governance and of its evolution over time. It then examines the main government institutions and their role in the innovation system in some detail. A particular focus is placed on institutions and procedures dedicated to the allocation of public R&D funding. The chapter concludes with an examination of selected policy tasks which are critical the innovation system's further development. These include fostering policy learning, securing the availability of qualified human resources, enhancing the contribution of public research to innovation, promoting business R&D and innovation, providing supporting infrastructures to innovators and harnessing global opportunities.

5.1. Introduction

Creative individuals and market-oriented organisations are the principal sources of innovation, but OECD work has shown that governments in all countries play a key and enduring role in shaping and stimulating innovation processes (OECD, 2010). However, it is difficult to draw lessons from international experience to suggest what the government's role should be in Viet Nam. One obvious reason is that the country is still at an intermediate stage in its development and industrialisation process; this precludes simple comparisons with most OECD countries and the formerly planned economies of Eastern Europe and the Russian Federation. Second, the resilient socialist character of Viet Nam's economy complicates benchmarking against neighbouring emerging economies (*e.g.* Thailand, Malaysia) or others. Third, the Vietnamese version of a socialist-oriented market economy is different in many respects from the Chinese variant, not only in terms of its technological development (Lee *et al.,* 2005).

Assessing the Vietnamese government's current science, technology and innovation (STI) policy requires due consideration of some aspects of the country's unique history, geography, political culture and socioeconomic fabric. Among distinguishing features to be kept in mind when discussing how Viet Nam can best harness technical progress and innovation to achieve its development goals, the following seem particularly important:

- *Political culture*. A "centralist tropism" is not only a legacy of the planned economy, it also reflects a constant concern to balance unifying and centrifugal forces in a country whose need to overcome two-dimensional divides (rural *vs.* urban, north *vs.* south) is culturally and politically important.
- *Economic structure and social challenges*. Despite the rapid development of the "modern" primary, secondary and tertiary sectors, traditional agriculture and necessity, rather than opportunity-driven entrepreneurship, continue to determine an important share of economic activities that must satisfy the needs of a large and growing population. Job creation, poverty reduction, modernisation of agriculture and sustainable urbanisation are therefore important objectives to which any policy that receives significant budget resources must contribute. In Viet Nam, more than in developed countries, STI policy is likely to be held accountable for particularly broad socioeconomic impacts.
- *Geopolitical context and logic of catching-up*. Viet Nam is a relative newcomer to a highly competitive race to achieve economic development. Where the challenge for China is "to become rich before getting old", for Viet Nam it is to exploit a latecomer advantage while avoiding the pitfall of a "low/middle-income trap". As discussed in Chapter 2, catch-up based on low wages and technology transfer will not be enough, even before reaching the "Lewis turning point". In "co-opetition" with neighbouring and other emerging economies, Viet Nam must build its own knowledge-based comparative advantages in higher value-added activities.
- *Initial factor endowment*. Viet Nam lacks some of the resources needed for a dynamic, self-sustained catch-up. The endemic shortage of qualified human resources is documented in Chapter 4. This chapter is therefore concerned with the lack of critical mass in most scientific and technological (S&T) activities, even when carried out by public S&T organisations of respectable size. The low level of business-sector investment in innovation is particularly striking and worrying.[1] Overall, Viet Nam has not yet accumulated a sufficient stock of

knowledge capital, even to make the best use of what it receives from abroad. Despite some improvement from the mid-1990s, a long period of insufficient public investment in research and development (R&D), aggravated by the fragmentation of the S&T system, leaves Viet Nam with a narrow and shaky springboard for more innovation-driven development.

Viet Nam's current STI policy framework and orientations must be examined and evaluated with an understanding of its current place on the development ladder and of the ways in which the government could either hinder or strengthen the main economic mechanisms for moving to higher levels. Figure 5.1 provides an overview of the relevant issues.

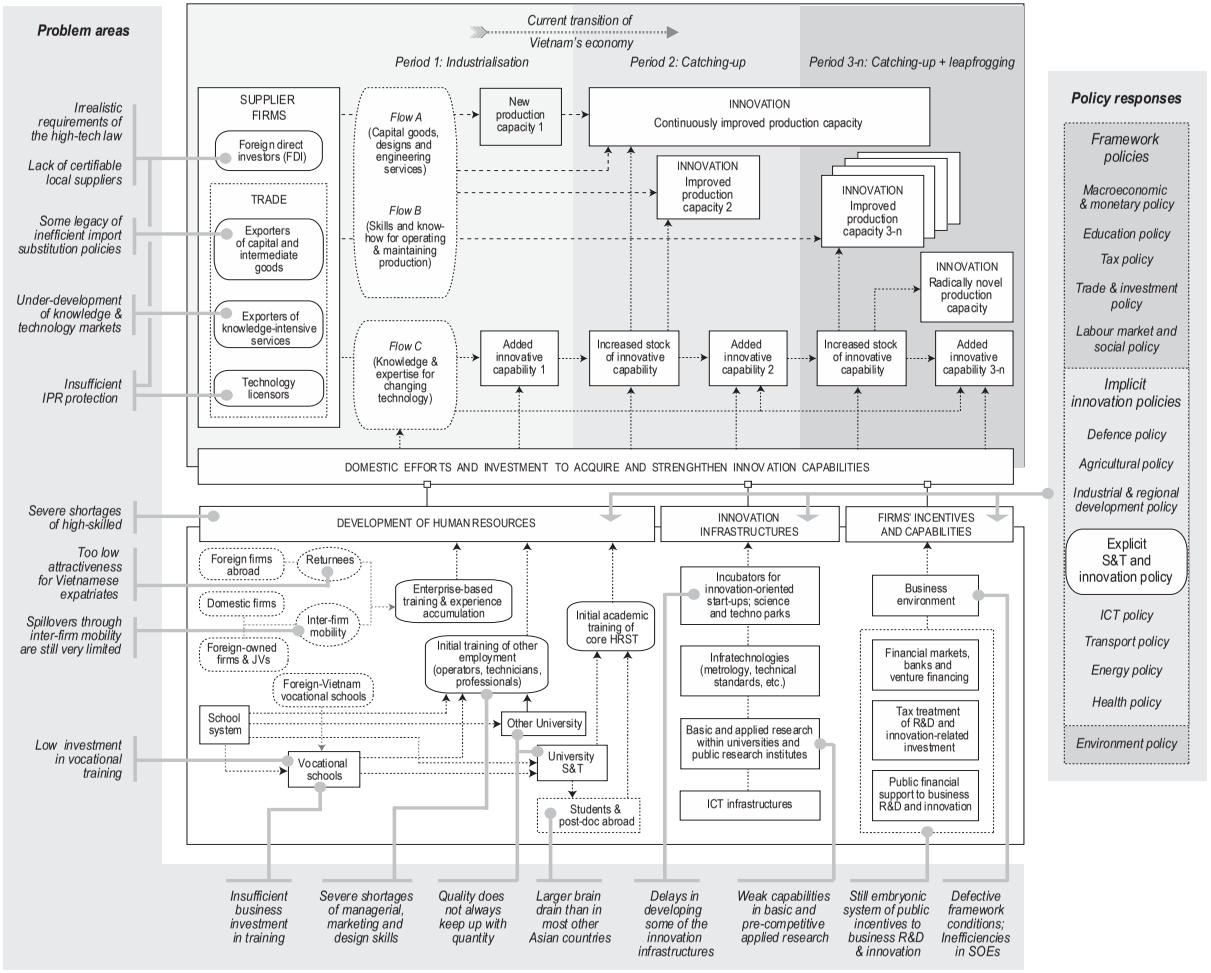
Viet Nam is currently moving from an industrialisation process which reallocates resources from low-productivity activities (agriculture and other traditional activities) to "modern" sectors to fuel economic growth and allow the initial accumulation of capital (Lewis, 1954) to a catch-up phase during which reallocation between and within "modern" sectors and increasing microeconomic (firm-level) efficiency become the main drivers of growth (Abramovitz, 1986; Baumol, 1986).

Two aspects of this transition have important policy implications. First, the conditions for catch-up have become more stringent over time, owing to the radical technological changes of the last two decades, the emergence of new economic powerhouses, notably China, and intensified competition on more open but also more demanding global markets for products and production factors. In the past, the main factors in the initial phase of catch-up in countries such as Korea were capital accumulation, a sufficient manufacturing base and human resource development; today, advanced technological capabilities and specialised skills and infrastructures are needed earlier (Fagerberg and Verspagen, 2002).

Second, acquisition of the required technological capabilities and related skills cannot mainly rely for long on technology transfer from abroad. The appropriate proportion of foreign technology, which changes over time, and the means of blending imported knowledge with complementary domestic knowledge is an issue of the utmost importance. This raises tricky issues that are well encapsulated in the concept of "technological congruence".[2] In essence, the idea is that the technological upgrading of an economy can be sustainably successful only if, at any point of time, the characteristics of the technologies of production processes match the relative abundance of production inputs in local factor markets (Abramovitz and David, 1996).

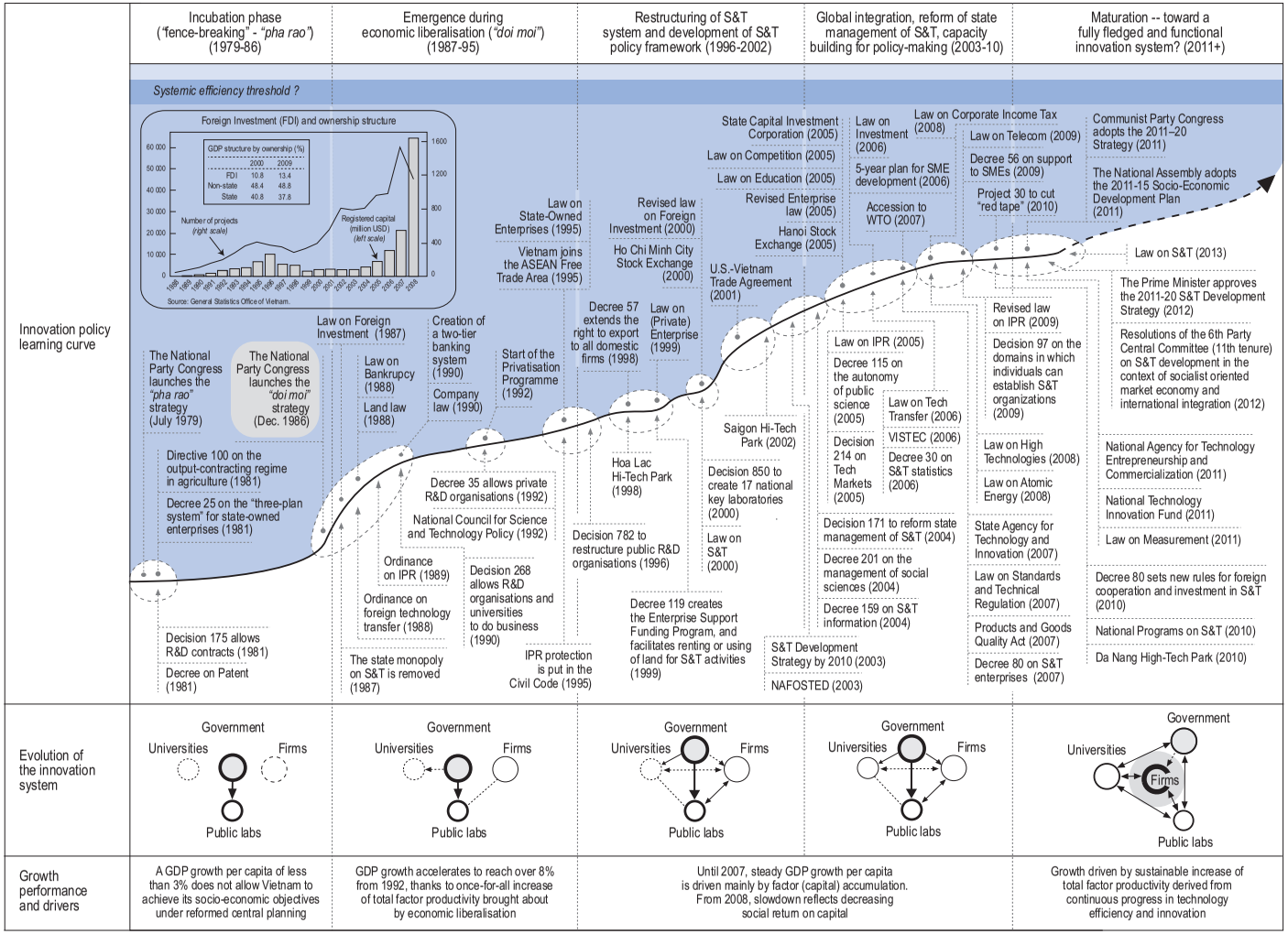
At the microeconomic level, multinational enterprises use this concept in the management of their global value chains, taking the factor endowments of different locations as a given. From a macroeconomic perspective, changing factor endowments to ensure their congruence with a broader mix of more sophisticated technologies is a key government policy objective. In countries still at a relatively early stage of catch-up, the most important task is to initiate a virtuous circle of mutually reinforcing spillovers from imported know-how (through foreign direct investment [FDI] and other channels) and the upgrading of domestic capabilities (Bell, 2011). In practical terms, the implications for S&T and innovation policy in Viet Nam are two-fold:

Figure 5.1. Economic catching-up through technology transfer and own innovation



Source: OECD, partly based on Bell (2011), presentation at the OECD Committee for Science and Technology Policy Workshop on Innovation for Development, Paris, October.

Figure 5.2. STI policy learning in Viet Nam



Source: OECD.

- Whereas it is vital for the country to pursue an open development strategy in order to acquire advanced foreign knowledge through various trade and investment channels, generous incentives to attract more R&D-intensive FDI will provide the expected benefits only if complementary efforts enrich the national factor endowment, especially with respect to qualified human resources and competent local suppliers.
- A wide range of policies must be implicated. Figure 5.1 suggests distinguishing between framework policies, implicit STI policies and explicit STI policies.

This chapter focuses on the latter issue. It first provides a brief record of the evolution of Viet Nam's STI over the last three decades. It then describes and assesses in more detail how Viet Nam's government and government agencies currently support innovation, acknowledging their achievements and identifying areas in which changes should be considered.

It is based on information from several sources: the background report prepared by the Vietnamese authorities in support of this review (Tran Ngoc Ca, 2011a), published literature and documentation, and the results of interviews with many stakeholders conducted by the OECD-World Bank review team during a field mission to Hanoi and Ho Chi Minh City.

5.2. Institutional profile and system governance

The current policy setting – the institutions in charge of policy formulation, implementation and evaluation as well as the tools they use – is the result of three decades of radical reforms and incremental initiatives aimed at the progressive creation of a socialist-oriented market economy.

It is important to understand the context.[3] Like China, Viet Nam has chosen a "system-improving, gradualist" approach to transforming the former centrally planned economy into a market-driven one. In the Russian Federation and eastern Europe the "big bang" strategy (or "shock therapy") of immediate price liberalisation and mass privatisation came at the price of a transitory output decline (OECD, 2008). Viet Nam liberalised prices and established a single official exchange rate in 1989 with a strongly devalued dong (VND),[4] but did not undertake large-scale privatisation. It did not suffer from a lasting and pronounced decline in output, at the price of maintaining state-owned enterprises' (SOEs') "soft budget constraints", with some reduction of subsidies. New market entrants were primarily joint ventures between SOEs and foreign companies and small-scale private enterprises. These new economic entities have grown much faster than the SOEs and, with the opening of trade, have contributed to market competition and discipline. However the inefficiency of many SOEs still hinders overall national economic and innovation performance.

In its "marketisation" process, Viet Nam was mainly influenced until the late 1980s by what happened in the former Soviet Union. Since the early 1990s when the former Soviet Union collapsed and Sino-Viet Nam relations improved, features of the trajectory and content of reform in Viet Nam have been more similar to those of China, especially for the reform of SOEs. However, as regards the restructuring of the S&T system and its transformation into a modern innovation system, Viet Nam has continued to lag behind China (OECD, 2008).

The evolution of Viet Nam's STI policy over the last three decades

There have been three main phases in the evolution of Viet Nam's STI policy (Figure 5.2).

Incubation during "pha rao" *(1979-86)*

The central planning economic system of the Democratic Republic of Viet Nam (DRV)[5] came under serious strain in the late 1970s, not long after its reunification with the south. A trade embargo imposed by the West following military intervention in Cambodia, cuts in Soviet aid and bad harvests revealed the inherent weaknesses of the economic model of a very poor country, profoundly marked by three decades of war.[6] The inability of state entities to supply the inputs needed to achieve the planned economic objectives and even to guarantee food security to the population prompted a "reform from below", as individuals, agricultural co-operatives and SOEs developed alternative ways of obtaining resources. This was first tacitly allowed and in 1979 officially formalised by the authorities as the *pha rao* ("fence-breaking") reform. The most important initiative, which appears in hindsight as the last attempt to rescue the central planning system, was the introduction of a three-plan system for state-owned industry, which provided SOEs some leeway for input and output transactions.

In the S&T field there was a strict top-down system of control and allocation of resources and a complete separation of R&D, production and educational activities. In 1981, Decision 175, which allowed R&D contracts, can be seen as the precursor of the series of reforms that would follow in the next decades.

Table 5.1. Early stages of S&T policy development: some landmarks

1981	Decision 175 is the first initiative to break strict vertical state management of the S&T system, by allowing the signing of R&D contracts. Resolution 37 emphasises the need to increase the rate of financial investment on R&D to around 2% of national income during the 5-year plan 1981-1985.
1987	Decision 134 (complemented by Decree 35 in 1992) is the first initiative to break the state monopoly on S&T activities by allowing R&D organisations to enter into contractual relationships with individuals and non-state organisations.
1988	Following the 1987 Law on Foreign Investment, the Ordinance on Foreign Technology Transfer provides for its implementation in the S&T area in a way compatible with international rules.
1989	The Ordinance on Industrial Property Rights sets the legal basis for IPR protection (integration in the Civil Code in 1995).
1990	Decision 268 gives R&D organisations and universities the right to do business.
1992	Decree 35 increases public expenditure on S&T to 2% of the state budget and allows the establishment of non-state R&D organisations. This increase has been authorised in 1991 by Resolution 26 of the Political Bureau on S&T in the innovation context. Circular 1292 creates the S&T development fund of ministries and local governments.
1995	Decision 270 is the first demand-oriented measure. It creates a loan scheme to help firms adopt new technologies.

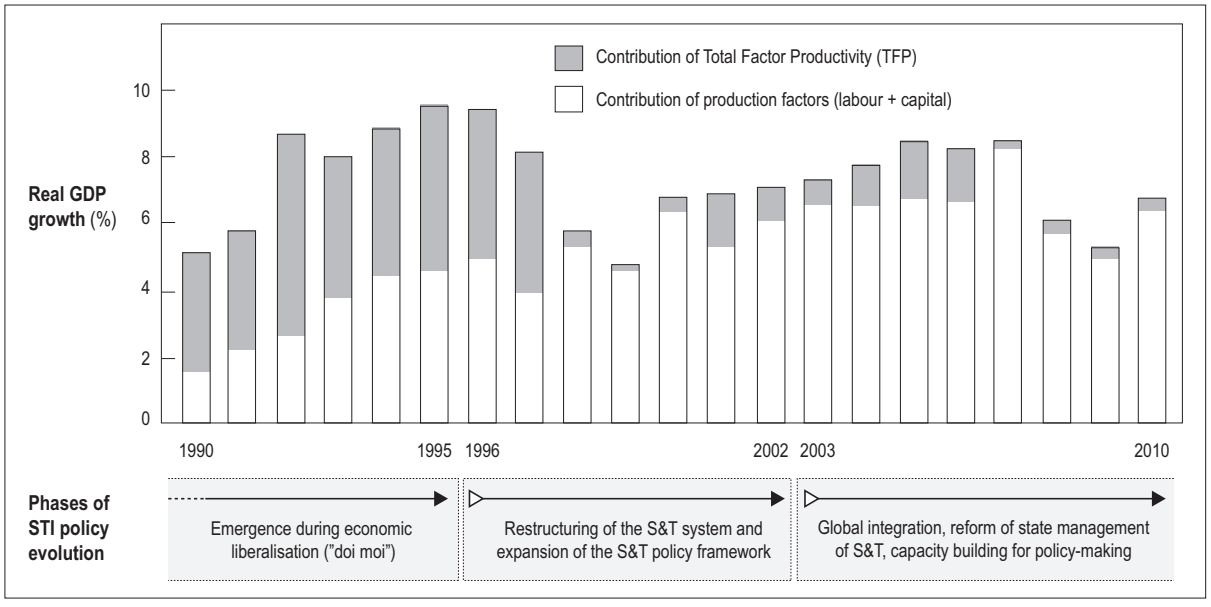
Source: OECD, based on various sources.

Emergence during economic liberalisation: "doi moi" *(1987-95)*

The *pha rao* reform did not achieve its goals. In particular, divergences between official and free-market prices, as well as the SOEs' financial crisis, which fuelled the budget deficit, exploded during the hyperinflation of 1986. That year was a turning point in what had been a moderate and to some extent hesitant reform process. Difficulties prompted the Sixth Party Congress in December to launch the *doi moi* reform, an irreversible choice in favour of radical market-oriented reforms. During 1987-88 central controls over FDI, land, foreign trade, banking, SOEs, private and household enterprises, and the agricultural sector started to ease significantly. In the following years a series of decisions – the transfer of land use rights to farmers, the creation of a two-tier banking system, unification of the exchange rate and pricing systems, reduction of subsidies to SOEs – along with new market-friendly laws, notably concerning private enterprise and foreign investment, marked the dismantlement of the two-sector centrally planned economy[7].

During the same period *doi moi* ended the Soviet-style management of S&T activities and introduced the first elements of a new legal framework for S&T-based development in the newly liberalised economic context. The very first initiatives broke the state monopoly on S&T activities, by allowing R&D organisations to enter into contractual relationships with individuals and non-state organisations, by introducing rules for technology transfer in line with the open door policy regarding FDI, and by establishing the legal basis for intellectual property rights (IPR) (introduced in the Civil Code in 1995). Importantly, it was decided in 1991 almost to double the budgetary effort in favour of S&T to 2% of the state budget. However, it was not until 2000 that this decision of the Political Bureau came into effect. In 1993, the National Centre for Scientific Research (NCSR), established in 1975, was renamed the National Centre for Natural Science and Technology (NCNST) and given the broader mission to conduct both fundamental and applied research.

Figure 5.3. The macroeconomic context of the evolution of Viet Nam's STI policy



Source: OECD, based on Central Institute for Economic Management, Asia Competitiveness Institute and National University of Singapore (2010), *Vietnam Competitiveness Report 2010*.

However, these initial reforms did not significantly modify the key features of the S&T system. Public funding of S&T continued to go exclusively to governmental S&T organisations, and S&T prioritisation and evaluation mechanisms remained unchanged. New technology transfer arrangements did not suffice to alter the situation markedly, owing to the poorly developed systemic linkages between R&D institutions and the state and a nascent private business sector.[8]

Restructuring of the S&T system and expansion of the S&T policy framework (1996-2002)

This period was marked by the Asian crisis, which severely affected Viet Nam, especially in terms of FDI. It saw also the end of rapid GDP growth driven by the one-off efficiency gains brought about by *doi moi* (Figure 5.3). From 2000 GDP growth accelerated, driven by factor (mainly capital) accumulation. While the legal framework and institutions for the "socialist-oriented market economy" continued to evolve (*e.g.* the Enterprise Law to foster private-sector development in 1999, the opening of the Ho Chi Minh City Stock Exchange in 2000), most efforts were devoted to adapting regulations and policies to the requirements of the "open door" strategy, including the promotion of export-oriented industries and the attraction of foreign capital inflows. For example, in 1998 a decree extended the right to export to all domestic companies, irrespective of their ownership status, and the Law on Foreign Investment was amended and supplemented in 1996 and 2000.

Table 5.2. Main S&T policy initiatives since the mid-1990s

1996	Central Resolution No. 2 of the 8th National Assembly sets out a S&T development strategy as part of the industrialisation and modernisation mission until 2000. Decision 782 reorganises state R&D organisations and eliminates public subsidies to some of them.
1998	Decision 198 establishes the high-technology (Hoa Lac) park.
1999	Decree 119 sets the legal basis for public support to firms in the S&T area.
2000	First Law on Science and Technology. Decision 850 creates national key laboratories.
2003	Science and Technology Development Strategy by 2010.
2004	Decision 171 on the public management of S&T activities.
2005	Law on Intellectual Property Rights. Decision 214 on the development of technology market. Decree 115 on the autonomy of public research organisations.
2006	Law on Technology Transfer.
2007	Law on Standard and Technical Regulation. Creation of the State Agency for Technology and Innovation (SATI). Decree 80 on S&T enterprises.
2008	Law on High Technologies. Decree 29 on industrial, export processing and economic zones.
2010	Decree 80 on foreign co-operation and investment in S&T. Decree 96 amends and supplements a number of articles of Decree 115 (2005) and of Decree 80 (2007).
2011	Plan to foster international integration in S&T.
2012	Adoption of the 2010-20 Science and Technology Development Strategy.
2013	Central Resolution No. 6 of the 11th Plenum on the development of S&T in the context of a socialist-oriented market economy and international integration. Law on Science and Technology.

Source: OECD, based on various Vietnamese sources.

Box 5.1. Reforming state management of S&T: main objectives

Decision 171 of the Prime Minister (2004) assigned the following main objectives to the reform of state management of S&T:

1. Improve the definition, selection and implementation of publicly funded R&D projects:
   - increased involvement of the different stakeholders;
   - a competitive process for selecting the implementers of projects;
   - better evaluation of the R&D projects;
   - improved regulation of the Scientific Consultation Committee;
   - faster application of projects' results in production and social processes.
2. Reform state management of public R&D institutions:
   - give R&D institutions more autonomy in terms of R&D focus, financing, personnel management and international collaboration;
   - transform the public applied R&D institutions into either S&T enterprises or self-financed R&D organisations;
   - promote the establishment and development of S&T enterprises in high-technology sectors;
   - evaluate the performance of publicly funded R&D institutions;
   - improve R&D activities in universities.
3. Reform S&T financing:
   - promote the financing of S&T by the business sector;
   - prioritise the state budget for S&T according to national priorities;
   - reform regulations governing the use of the state budget to support R&D activities with a view to incentives for researchers.
4. Reform human resource management in S&T:
   - give more autonomy to R&D institutions in human resource management;
   - take policy initiatives in favour of S&T talent;
   - increase state budget for educating and retraining people working in S&T;
   - take policy initiatives to attract foreign experts in S&T activities.
5. Develop a technological market:
   - better link R&D with education and production and promote the development of the technological capacity of the business sector;
   - provide budget support for the commercialisation of R&D results;
   - develop technological intermediary agencies;
   - improve regulations pertaining to IPR and technology transfer, as well as their enforcement.
6. Improve the organisation of the state S&T management system:
   - separate R&D institutions from the state S&T administration;
   - improve the division of labour within and decentralisation of state S&T management.

Source: Extract from Decision 171 of the Prime Minister (2004), cited in Vu Xuan Nguyet Hong (2007). "Promoting Innovation in Vietnam: Trends and Issues", Central Institute for Economic Management.

The restructuring of the S&T system began in earnest in the mid-1990s, triggered by the decision to eliminate subsidies to a number of governmental research organisations. Several institutes under line ministries were transferred to newly created corporations and state-owned enterprises, the number of state orders to R&D institutions increased (Meske and Day Dung Thinh, 2000), and the S&T budget was enhanced since 2000. Research centres were established under corporations in accordance with Decision 782 in order to create a close relation between S&T and production.[9] Relations between public research organisations (PROs) and industry began to take shape and new innovation infrastructures appeared (*e.g.* the Hoa Lac high-technology park in 1998 and the Saigon high-technology park in 2002). In 2000 17 Key National Laboratories were created; they were not only meant to change significantly the shape of the S&T system, but more importantly to bring about breakthrough research in some priority sectors of national socio-economic development. These laboratories are mostly located in research institutes and universities to take advantage of the available infrastructure and human resources. As mentioned in Chapter 3 their development has been much slower than planned. In the same year the first Law on Science and Technology was passed, providing a basis and orientations for further development of the S&T policy framework.

Global integration, reform of state management of S&T, and capacity building for policy making (2003-10)

Up to the global financial crisis Viet Nam enjoyed steady investment and export-driven growth supported by economic policy initiatives to integrate the country better in the multilateral trade system (accession to the World Trade Organization in 2007) and to improve microeconomic efficiency (in 2005, Competition Law, revised Enterprise Law, creation of the State Capital Management Corporation and of the Hanoi Stock Exchange, Law on Investment; in 2006 Five-Year Plan for SME Development).

The Law on Science and Technology opened a new phase in the relatively slow but constant transformation of Viet Nam's S&T system and policy. The S&T Development Strategy (2003), too, played a significant role, but it mainly focused on identifying priority technology routes and infrastructure for a developed S&T system, rather than on guiding institutions and policy. In the following years, the government was active in providing new legislation and regulations, new financing instruments, and new institutional arrangements and infrastructures, with three overriding objectives.

First, it sought to integrate the country's emerging innovation system into the global system. It improved the Law on IPR in 2005 and again in 2009, and in 2006 passed the Law on Technology Transfer, which defines the areas in which transfers are allowed and even encouraged. In 2007, the Law on Standards and Technical Regulation aligned relevant national norms with international standards. In the same year a Plan to Foster International Integration in S&T was adopted to stimulate and orient further efforts in this area. In 2010 Decree 80/2010/ND-CP aimed to facilitate foreign investors', firms' and research institutes' to investment in setting up of R&D units and subsidiaries in Viet Nam.

Second, the improvement of public management and financing of S&T was made a priority. The 2004 Decision of the Prime Minister (Box 5.1) laid down very ambitious and commendable objectives, which were challenging given current levels of implementation capability (see below). Important measures radically changed the funding mechanisms of public R&D organisations, especially Decree 115 of 2005 which cut public funding of some and required many others to self-finance a significant share of their operations. In parallel, new legal frameworks and new public support mechanisms

were introduced, notably the National Foundation for Science and Technology Development (NAFOSTED) which began operation in 2008, the National Technology Innovation Fund (NATIF), founded in 2011 but not yet operational, and the Law on High Technologies in 2008.

Third, the institutional capability of the government, particularly the Ministry of Science and Technology (MoST), to formulate, co-ordinate and implement S&T and innovation policy was reinforced by the creation of a series of relevant bodies: the National Council for Science and Technology Policy (1992) directly advising the Prime Minister on national S&T development policy, the State Agency for Technology Innovation (SATI) (2007), the Viet Nam Science and Technology Evaluation Centre (2006), and the National Agency for Technology Entrepreneurship and Commercialisation (NATEC) (2011).

The main institutions and their role

Certain features of the institutional landscape reflect the socialist character of Viet Nam: the role of the Communist Party at different levels of policy governance, and the still overwhelming dominance of PROs in the execution of R&D and thus the role of Viet Nam Academy of Science and Technology (Figure 5.4). At the central level, there are two major governance levels: overall policy guidance and supervision by the top level of the state (the Communist Party, the Prime Minister on the executive side, and the National Assembly on the legislative side), with detailed policy design and implementation in the hands of ministries and affiliated agencies and of a few independent bodies that report directly to the government, mainly the Academy of Science and Technology (VAST) (Box 5.2).

Box 5.2. Viet Nam Academy of Science and Technology (VAST)

The beginning

In 1967, a decision was made to develop S&T capabilities to help rebuild after the war. The prime minister sent a delegation to the Soviet Union and eastern Europe to study the organisation of S&T. The plan for the establishment of a national centre was developed during 1970-75. The National Centre for Scientific Research (NCSR) covering basic science (physics, mathematics and biology) was established in 1975, with Soviet assistance.

Reorientation towards applied research (1993-2004)

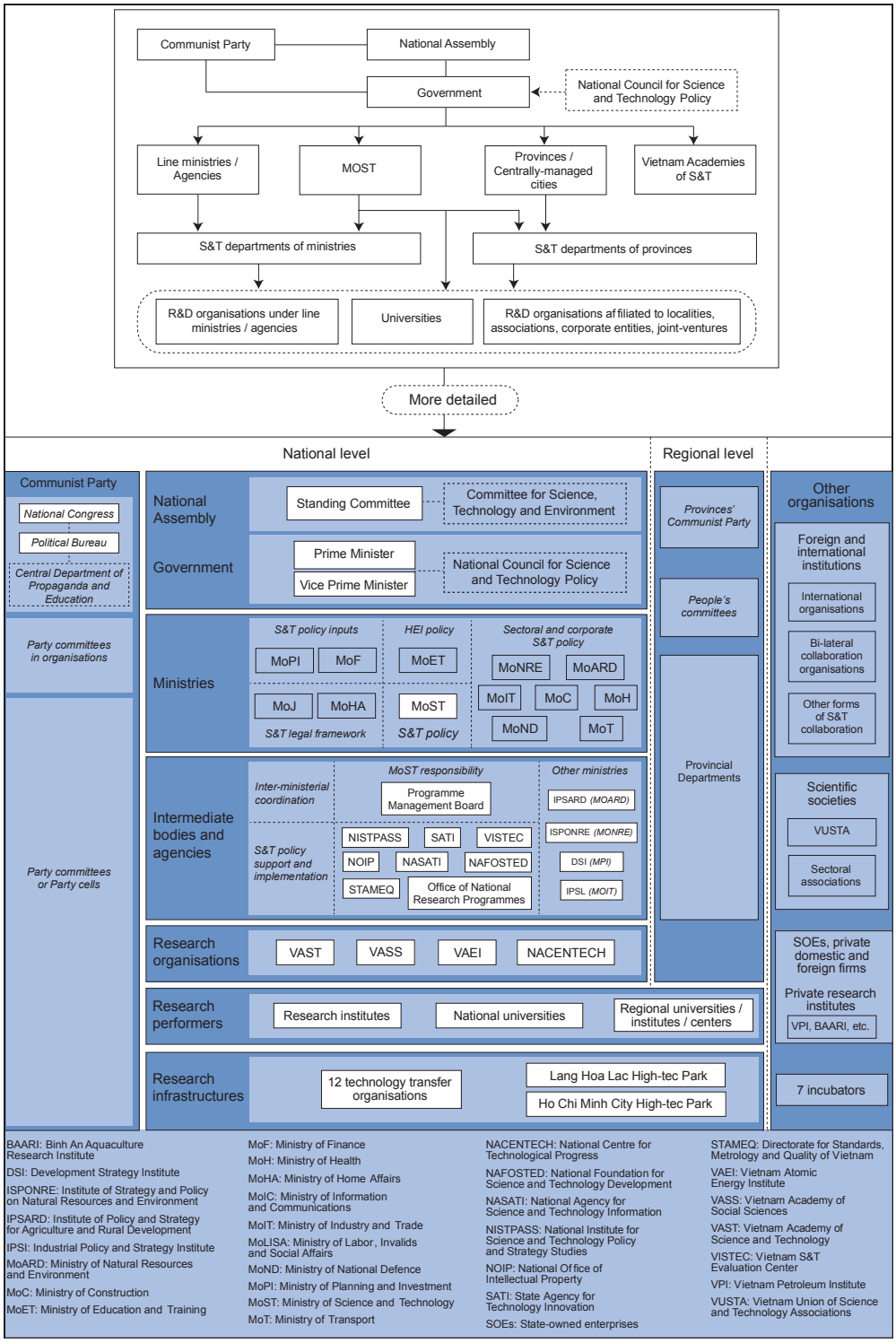
In the context of *doi moi* reforms the NCSR was renamed the National Centre for Natural Science and Technology (NCNST) and was to devote around 30% of its activities to applied research. The restructuring was inspired by the Korean Institute of S&T and involved the regrouping of some institutes and the creation of new ones (geology, marine geology and geophysics, geography, applied materials science).

VAST (2004 to present)

Next, the NCNST was renamed the Viet Nam Academy of Science and Technology (VAST). In 2000 VAST was entrusted with the task of supporting the newly created National Key Laboratories. Restructuring led to the establishment of new institutes, such as the Institute of Environmental Technology and the Centre for Training, Consulting and Technology Transfer in 2002.

Source: Baark *et al*. (2010), "The Role of the Vietnam Academy of Science and Technology in Vietnam's Innovation System", paper presented at the 7th Asialics International Conference "Global Recession and Reform of Innovation Systems in Asia", April, Chinese Taipei.

Figure 5.4. Institutional profile of Viet Nam's S&T and innovation system



Source: OECD, adapted from Manh Quan Nguyen (2011), "Current Situation of the Vietnam Science, Technology and Innovation System: The role of S&T Development Strategy for 2011-2020", presentation at NISTPASS, MOST, Hanoi, and information provided by Michael Braun (VISTEC).

The national structure is replicated to some extent at the regional level. S&T policy management at the regional level is ensured by the provincial Departments of Science and Technology (DoSTs). DoSTs are sub-units under city/provincial people's committees and under vertical technical guidance of MoST. They receive local budgets allocated for S&T and decided by city/provincial people's committees and people's councils.[10] Overall the decentralisation of S&T policy remains very limited.[11]

In terms of the steering and funding of public R&D organisations there are three levels of governance: the national research institutes/centres under the prime minister (VAST, VASS); research institutes and technological branch institutes under line ministries, cities and provinces; and focal points for S&T in districts, co-operatives, large enterprises – which are themselves not classified as public research organisations – manage the application of S&T results of R&D organisations of the first and second levels.

Policy prioritisation, guidance and supervision

The national assembly and the government are in charge of setting national legal regulations and deciding on broad social and economic agendas (*i.e.* the socioeconomic development strategy and associated plans). They are assisted in these tasks by the Committee for Science, Technology and Environment (under the national assembly) and the Department of Science, Education, Cultural and Social Affairs (under the Office of the Government). The government is also responsible for balancing S&T development and innovation with other policy priorities. The National Council for Science and Technology Policy is a consultative body which advises the prime minister on S&T development issues.

Policy design and implementation

Many institutions are involved in detailed policy design and implementation, especially the line ministries and, to a lesser extent, the provincial governments. However, MoST, the Ministry of Planning and Investment (MoPI), and the Ministry of Finance (MoF) play a special role, with MoST as the cornerstone of this level of governance. While other ministries and local governments focus on the development and design of support measures to promote S&T and innovation in particular sectors or regions, MoST, MoPI and MoF have important responsibilities for cross-sectoral policy initiatives, in addition to their prerogatives *vis-à-vis* subordinated departments and research organisations.

MoST is responsible for overall management of S&T activities nationwide, designing S&T policies and incentive programmes, and monitoring the implementation of the national S&T strategy and plans. These functions cover S&T activities, development of technological potential, intellectual property, standardisation, measurement and quality control, atomic energy, radiation and nuclear safety, and management of public services in these domains.[12]

MoST must co-operate with MoF in establishing the financial mechanisms for S&T development and with MoPI in allocating the portion of public funds for S&T to be devoted to capital expenditure for development investment (mainly S&T infrastructure and equipment), as well as in supervising the implementation of annual S&T budgetary plans. While the extent and detail of involvement of MoF in S&T financing may be a matter of discussion,[13] it is, in principle, in line with international practices; but this is not necessarily the case of the separate financing (by MoPI) of S&T projects' capital expenditure, *i.e.* around 40% of the total S&T budget.

In theory, MoST can co-ordinate sectoral S&T policies undertaken by line ministries during the budget allocation process. For example, the budget allocation for S&T projects at the Ministry of Education and Training (MoET) is first sent to MoST and then to the Department of Science and Technology at MoET. In practice, this budgetary process-based co-ordination power seems rather limited.

"Embedded" supporting organisations and agencies

In addition to functional ministerial departments, some other bodies support policy design and implementation. These have different types of legal status and roles but can be grouped into two broad categories. Some are "strategic intelligence units" which contribute to evidence-based policy making. Others are agencies to which ministries have delegated responsibility to manage and/or fund some governmental S&T functions, measures and programmes.

Among the former, and considering only those affiliated with MoST, one should mention NISTASS, a think tank advising on S&T policy issues (Box 5.3), the National Agency for Science and Technology Information (NASATI), which is in charge of developing, analysing and diffusing S&T-related information, statistics and indicators, and VISTEC, a reduced-scale and still young evaluation agency.

Among the latter, important ones under MoST are the State Agency for Technology Innovation (SATI), the National Office of Intellectual Property (NOIP), and NAFOSTED, a new major funding agency.

Box 5.3. National Institute for Science and Technology Policy and Strategy Studies (NISTPASS)

NISTPASS is a governmental advisory body – a think-tank in the field of science, technology and innovation policy and strategy studies.

It has the status of a research organisation under MoST. It was established in 1996 from the merger of two former organisations, the National Institute for Science and Technology Forecasting and Strategy Studies (NISTFASS), founded in 1983, and the Institute for Science Management (ISM), founded in 1978.

NISTPASS has four research departments: Department of S&T Strategy; Department of S&T Human Resources Policy and Organisation; Department of Innovation and Technology Market; and Department of S&T Finance. It has run a postgraduate programme since 1991.

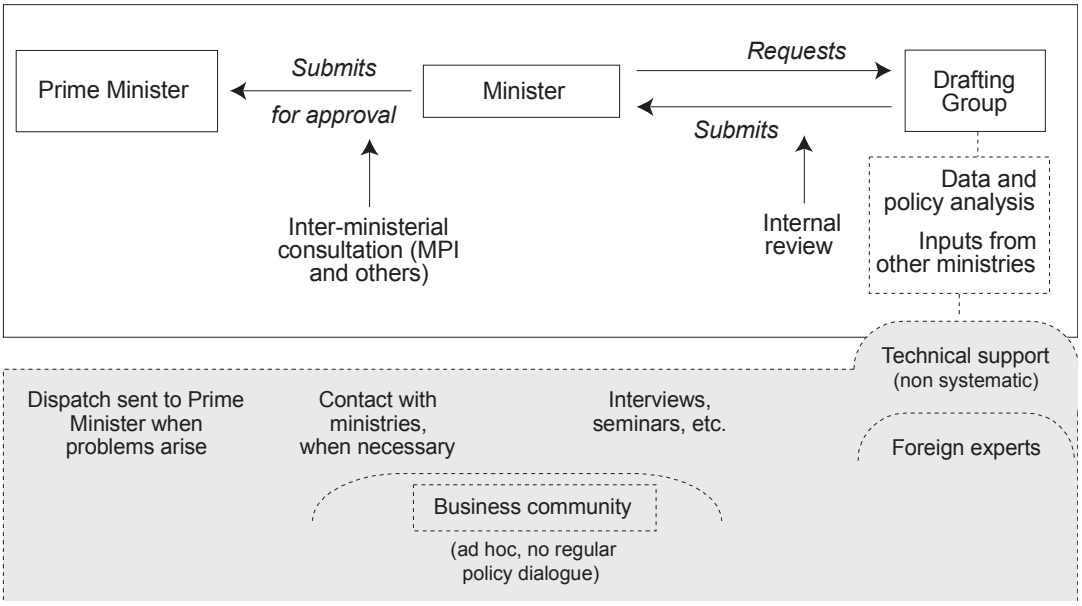
In addition to its staff the institute has a number of collaborative fellows and co-operates with a number of international research institutions, universities, non-governmental organisations (NGOs) and individual researchers from a large number of countries.

Source: NISTPASS.

Other non-governmental or non-Vietnamese organisations

The participation of non-governmental Vietnamese organisations in the governance of the S&T and innovation system is modest (Figure 5.5), although some associations, such as the Viet Nam Union of Science and Technology Associations (VUSTA) and the Viet Nam Intellectual Property Association (VIPA), are active in providing advice and proposals to government authorities.

Figure 5.5. Traditional policy making in Viet Nam



Source: OECD, adapted from Manh Quan Nguyen (2011), "Current Situation of the Vietnam Science, Technology and Innovation System: The Role of S&T Development Strategy for 2011-2020", presentation at NISTPASS, MOST, Hanoi.

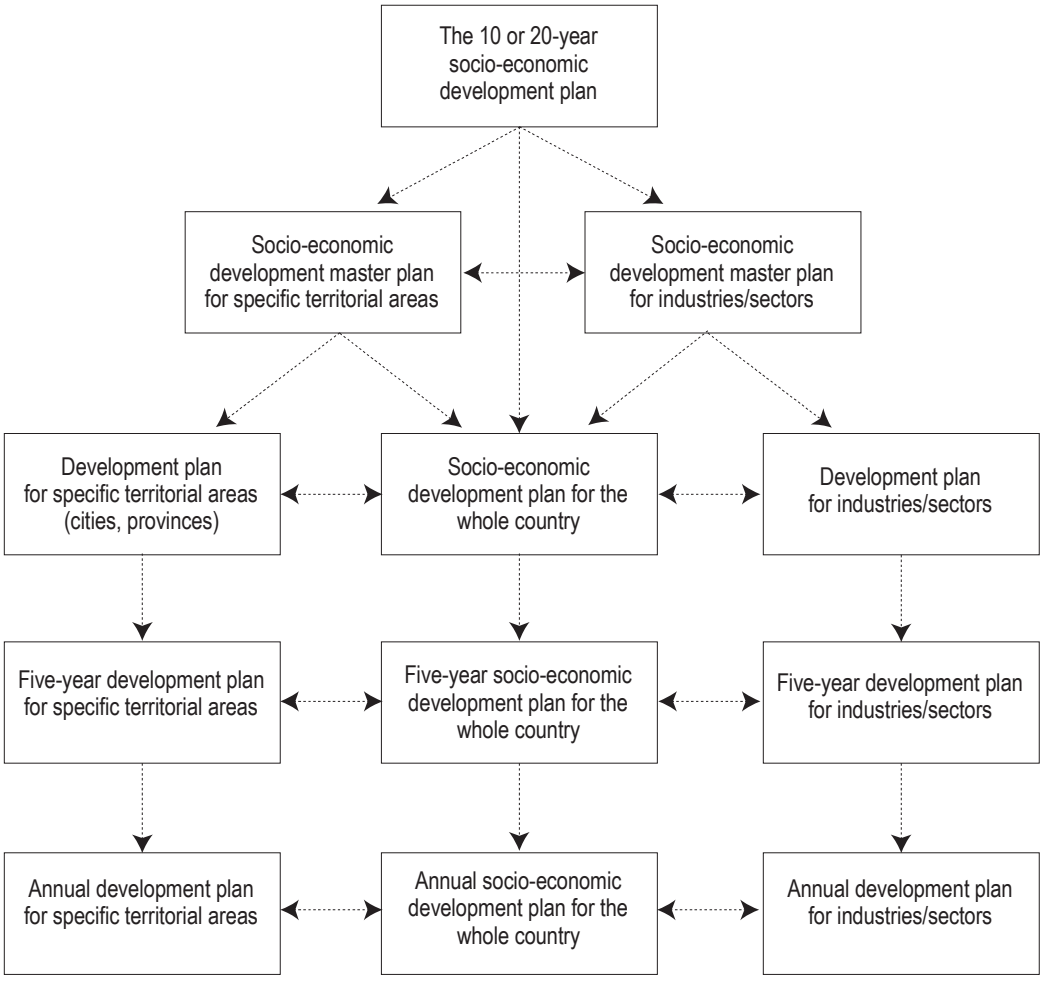
International or foreign organisations – the United Nations Development Program (UNDP), the World Bank, the Asian Development Bank, Korea's International Co-operation Agency (KOIKA), the Canadian International Development Agency (CIDA), the Japan International Cooperation Agency (JICA), Finland-Viet Nam Innovation Partnership Programme (IPP), etc. – provide financial support to promote R&D activities. They also have a *de facto* advisory role on policy issues of importance in their field of intervention.

Decision making and prioritisation processes

Alignment with overriding socioeconomic development goals

Viet Nam's S&T and innovation policy objectives are still formulated in the context of a planning approach to defining broader socioeconomic goals. As shown in Figure 5.6 the long-term socioeconomic development plan is the basis of the formulation of five-year regional and sectoral plans which are then translated into annual plans.

Figure 5.6. Co-ordination of long-term and short-term socioeconomic development policy



Source: Huong Lan Nguyen (2011), "The Role of the State in Industrial Upgrading in Vietnam", Development Strategy Institute, Ministry of Planning and Investment.

Since 1991 three socioeconomic development strategies (SEDS) have been formulated:

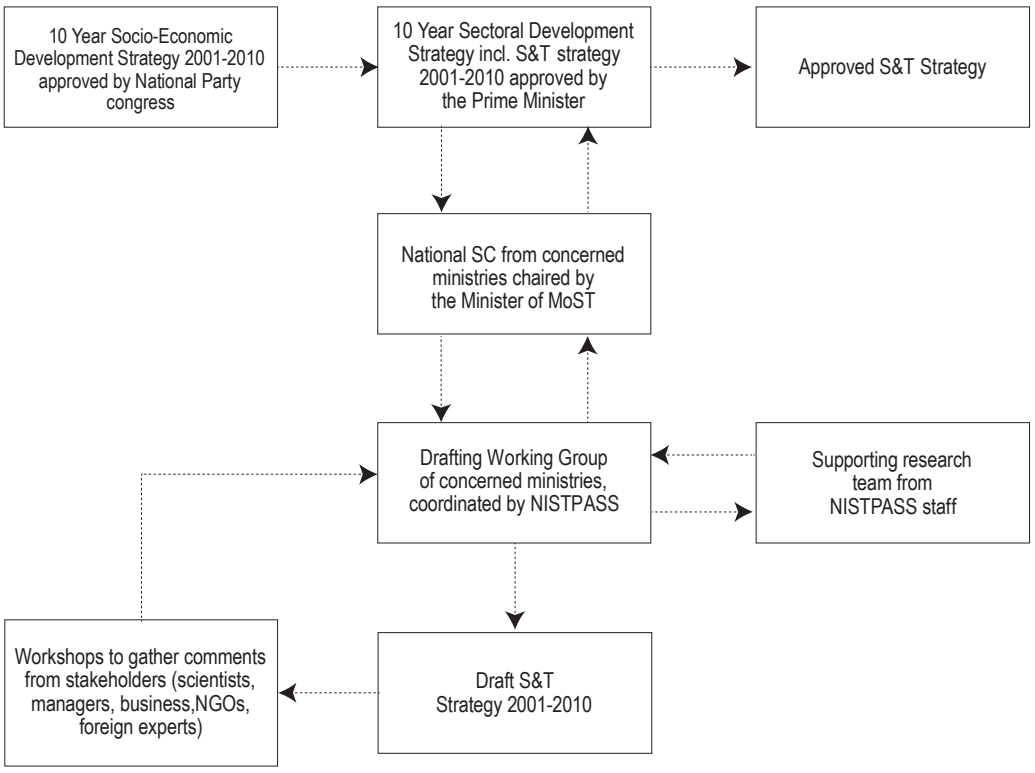
- "Strategy for socioeconomic stabilisation and development" (1991-2000);
- "Strategy for accelerating industrialisation and modernisation with a socialist orientation to basically become an industrialised country by 2020" (2001-10);
- "Socioeconomic development strategy 2011-20".[14]

On the basis of SEDS, ministries have to set lower-level strategies and master plans for their respective sectors. Figure 5.7 shows how this was done for the S&T strategy 2010.

Prioritisation

The political and economic culture of Viet Nam overwhelmingly encourages sectoral rather than thematic prioritisation, although the latter has attracted more attention in recent years, notably in the context of the Science and Technology Development Strategy for 2011-20 (Box 5.4).

Figure 5.7. Decision-making process in S&T policy: The case of Strategy 2010



Source: Le Dinh Tien (2005), "S&T Policy for Sustainable Development in Vietnam", presentation at the first S&T Forum, Tokyo, August.

Box 5.4. The Science and Technology Development Strategy for 2011-20

In April 2012, the Prime Minister of Viet Nam approved the Science and Technology Development Strategy for 2011-20 which sets the following main targets:

1. To raise the value of high-technology and applied science products to about 45% of GDP by 2020, and ensure 15-17% annual growth in the science and technology market.
2. To increase the ratio of scientific researchers and professional staff in science and technology to nine or ten per 10 000 people. Up to 5 000 highly skilled engineers will be trained to operate in Viet Nam's spearhead fields by 2015.
3. To develop 60 basic and applied science research centres of international standing by 2020.

The Viet Nam Academy of Science and Technology and the Viet Nam Academy of Social Sciences will play a leading role in implementing the strategy, but development of S&T activities by the business sector will also be encouraged.

Regarding central public governance, S&T management will gradually shift from a state-owned model to self-reliant mechanisms in accordance with the law.

Table 5.3. Sectoral prioritisation in Viet Nam's S&T and industrial policy

Strategy to become an industrialised country by 2020	Internationally competitive sectors	Agriculture	Forest and processing of aquatic products	Garments, leather and footwear	Electronics and informatics	Selected medical products and consumer goods			
	Selected heavy industry	Petroleum	Metallurgy	Machinery	Basic chemicals	Fertilisers	Construction materials		
High-technology priorities of Government Action Plan 2005-10		New materials and nano products	Biotechnology	Automation	Mechatronics	ICT			
The S&T Development Strategy by 2010 (MoST, 2003)	Natural and basic sciences[3]	Application-oriented basic research	Research on natural resources	Marine basic research	Selected areas of theoretical research				
	Technical and engineering sciences	ICT	Biotechnology	Advanced materials	Automation and mechatronics	Machine engineering	Nuclear and new energies	Space technology	Food processing technologies
	Key technological directions	Nuclear and new energies	Biotechnology	Advanced materials	ICT	Automation and mechatronics	Mechanic technologies	Cosmology	
Development Strategy and Protective Measures of Domestic Industrial Production in line with international commitments, WTO regulations by 2020 (MoIT, 2007)	Potential industrial sectors	Products from new technologies	Pharmaceutical and cosmetic products	Electronic accessories	Software, digital information and informatics	Telecommunication			
	High-competitive export-oriented industries	Agriculture	Forest and processing of aquatic products	Garments and textiles	Electronics production-assembly	Leather and footwear			
	Fundamental industrial sectors with dominant SOEs role	Energy	Metallurgy	Chemical industry	Mineral mining and processing	Construction materials and machinery industry (incl. automobile)			

.../...

Table 5.3. Sectoral prioritisation in Viet Nam's S&T and industrial policy *(continued)*

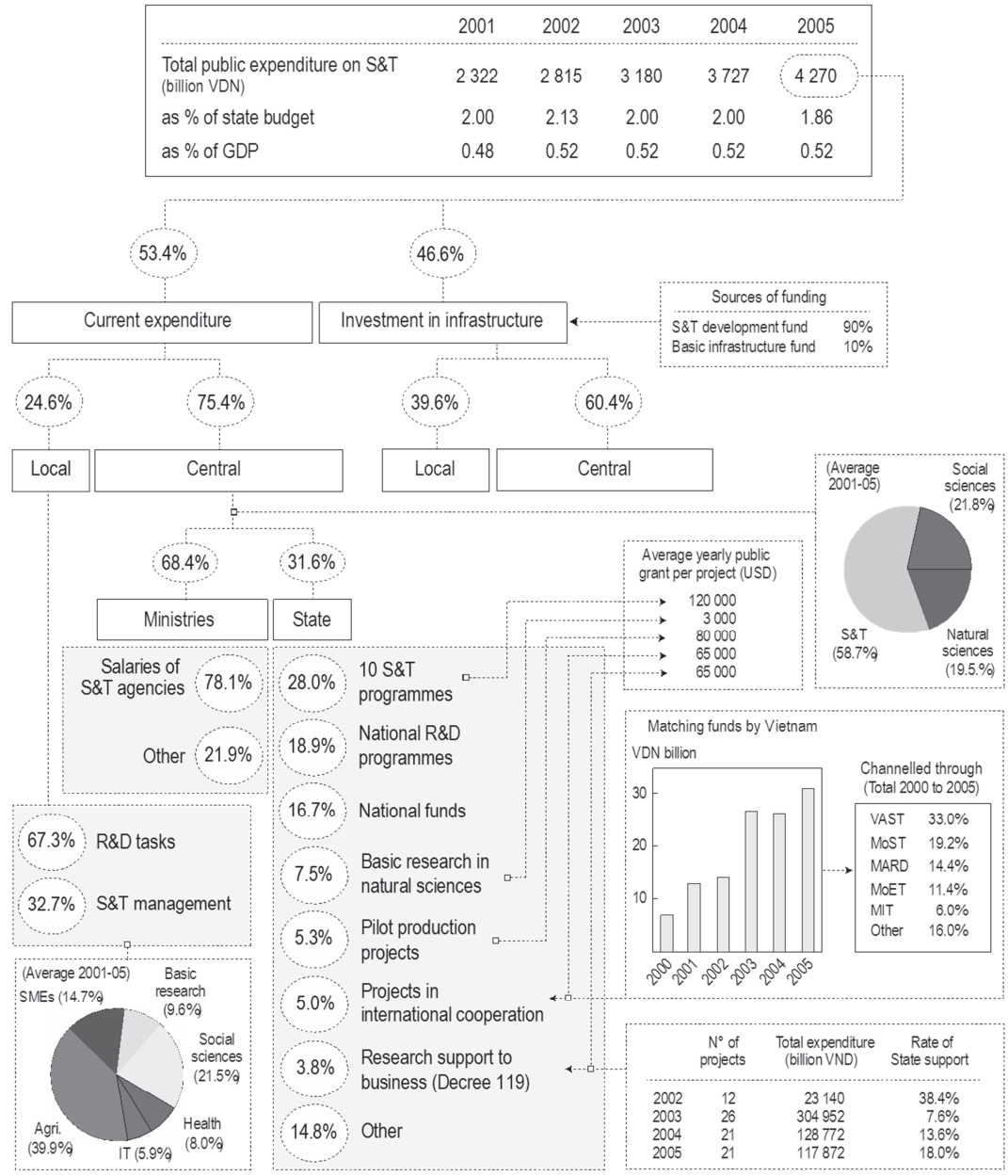
Prioritised technologies as stipulated in Law on High Technologies (2008)	High-technology industries	Information technology	Biotechnology	New materials	Automation technologies			
	High-technology in agriculture	Selection, creation and diffusion of plant varieties and animal breeds of high yield and quality	Epidemic prevention and control	High-yield cultivation and breeding of animals	Manufacture of farm supplies, machinery and equipment	Preservation and processing of agricultural products	High-technology applications in agricultural enterprises	High-technology agricultural services
Development Strategy for Industrial Sectors Applying High Technology by 2020 (MoIT, 2008)		Metallurgy	Chemical industry	Electronics	Informatics	Machinery	Energy	Food processing
S&T Development Strategy for 2011-2020	Key industrial sectors	ICT	Biotechnology	Advanced materials	Electronics and semiconductor	Manufacturing mechanics and automation	Spatial technologies	

Note: For each technology a detailed list of sub-items is provided (paragraph 4.3 of the S&T Development Strategy by 2010).

Source: Hong Ha Nguyen (2005), "S&T Development in Vietnam and Suggested Policies for International Cooperation in Biotechnology", 5th CSA Conference, Hanoi, May; Huong Lan Nguyen (2011), "The Role of the State in Industrial Upgrading in Vietnam", Development Strategy Institute, Ministry of Planning and Investment; Manh Quan Nguyen (2011), "Current Situation of the Vietnam Science, Technology and Innovation System: The Role of S&T Development Strategy for 2011-2020", presentation at NISTPASS, MOST, Hanoi; Tran Ngoc Ca (2011b), "Science, Technology and Innovation for the University System in Vietnam", Vietnam-UK Education Conference, Ho Chi Minh City, October.

In addition there is a proliferation of partly duplicating, partly inconsistent lists of sectoral targets (Table 5.3). Besides those defined by SEDS, many others are set out within or outside of the planning framework because of new legislation (*e.g.* the Law on High Technologies) or of *ad hoc* strategic plans, such as the Development Strategy and Protective Measures of Domestic Industrial Production Consistent with International Commitments by 2020 adopted in 2007, following accession to the WTO. In addition, regional S&T departments add their own sectoral priorities to the national ones.[15]

Figure 5.8. Evolution and allocation of Viet Nam's public expenditure on S&T



Source: OECD, based on data from NASATI and NISTPASS.

Public funding of R&D

The main steering mechanisms in Viet Nam's STI system are direct control over R&D organisations, conditional provision of public goods (information) and basic infrastructures, financial support to R&D organisations and activities in the form of grants (expenditures) and, marginally, tax incentives (foregone revenues) especially for FDI. Other instruments such as open procurement policies, public-private partnerships (PPPs) and other more demand-side instruments do not play at present any significant role.

Overall trends and allocation patterns

Figure 5.8 provides an overall view of the main financial flows from the national budget to S&T actors and activities *via* central or local allocation mechanisms. It is based on the most recent available information allowing the most comprehensive coverage of these financial flows. It does not take into account subsequent changes in the institutional landscape, notably the commencement of operations in 2008 of the funding agency NAFOSTED, and the even more recent creation of new funding tools that are not yet fully operational (see below). As Viet Nam does not yet collect internationally comparable R&D statistics, the present analysis uses S&T expenditure as a proxy. The need for the government to intensify efforts to change this situation is discussed later.

STI activities in Viet Nam depend heavily on budget support, which represents around 65-70% of total national expenditure on S&T. Public expenditure on S&T grew from around 0.2% of GDP in 1995 to about 0.5-0.6% in 2012. More than two-thirds goes to applied research and technological development and the rest to basic research.

In absolute terms this public investment remains modest; it was VDN 4 270 billion in 2005, or half of what China's MoST spent in that year on just one of its flagship programmes, and VDN 14 442 billion in 2011, VDN 13 186 billion in 2012 and VDN 14 114 billion in 2013.[16] Low overall budgets, as well as fragmented, dispersed investment, is among of the causes for a small average size of grant per project supported. Even adjusting for lower labour costs, the available data suggest that many projects are below critical mass and can be justified at best as capacity-building trials. This points to the need for the Vietnamese government to ensure the greatest efficiency in the use of limited budgetary means (concentration to ensure impact) while filling major gaps in the system (comprehensiveness to increase systemic efficiency).

Another striking feature is that public expenditure on S&T is mostly channelled through ministries and entails significant management costs. Although the available data do not allow for estimating precisely the amount that ultimately benefits those undertaking research activities, there are concerns that a considerable part of the S&T budget is absorbed by the administrative machinery of ministries and beneficiary organisations. Widespread red tape complicates and slows all administrative processes in Viet Nam, an issue that is further discussed below.

In addition, beneficiaries are mostly PROs.[17] Little research support goes to business, partly owing to a lack of demand but primarily because the support system is structured to serve a different clientele. This is also true of universities. Until the mid-1980s, as in other planned economies, universities were exclusively dedicated to education and training. During *doi moi* the government decided they should undertake research activities, as they do in all market economies. However, this did not result in a significant increase in budget support to university-based R&D. According to Tran Ngoc Ca and

Vo Hung Nguyen (2011), only 4% of public expenditure on S&T currently goes to universities; this represents about 15% of universities' investment in R&D, which is financed mostly by international donors (50%) and by enterprises (30%).

Funding agencies and programmes

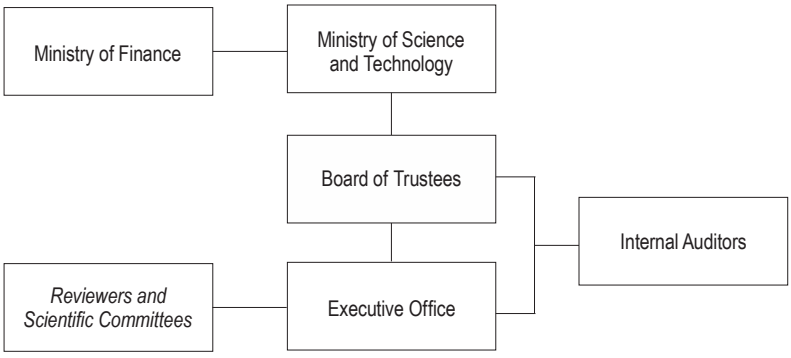
"Agencification", whereby ministries delegate functions such as research funding to semi-autonomous bodies, is a relatively new phenomenon in Viet Nam, where the traditional political culture has always privileged hierarchical rather than partly contractual arrangements for the delivery of public services. The creation in 2003 of the National Foundation for Science and Technology Development (NAFOSTED) was therefore an institutional breakthrough (Box 5.5).

Box 5.5. National Foundation for Science and Technology Development (NAFOSTED)

Created in 2003, but operational only since 2008, NAFOSTED is an independent legal entity affiliated with MoST. As a funding agency its mission is to:

- Create a stimulating environment for research activities at universities and institutes.
- Improve the research capacity of young scientists; establish research centres of international standing; enhance the quality of scientific research and increase the number of Vietnamese publications in ISI journals; help Vietnamese scientists to integrate in international research networks; and attract external funding to Viet Nam's scientific projects.
- Promote research efforts in enterprises, with a focus on development of core technologies that contribute to national economic growth and competitiveness.

Figure 5.9. NAFOSTED organisational structure

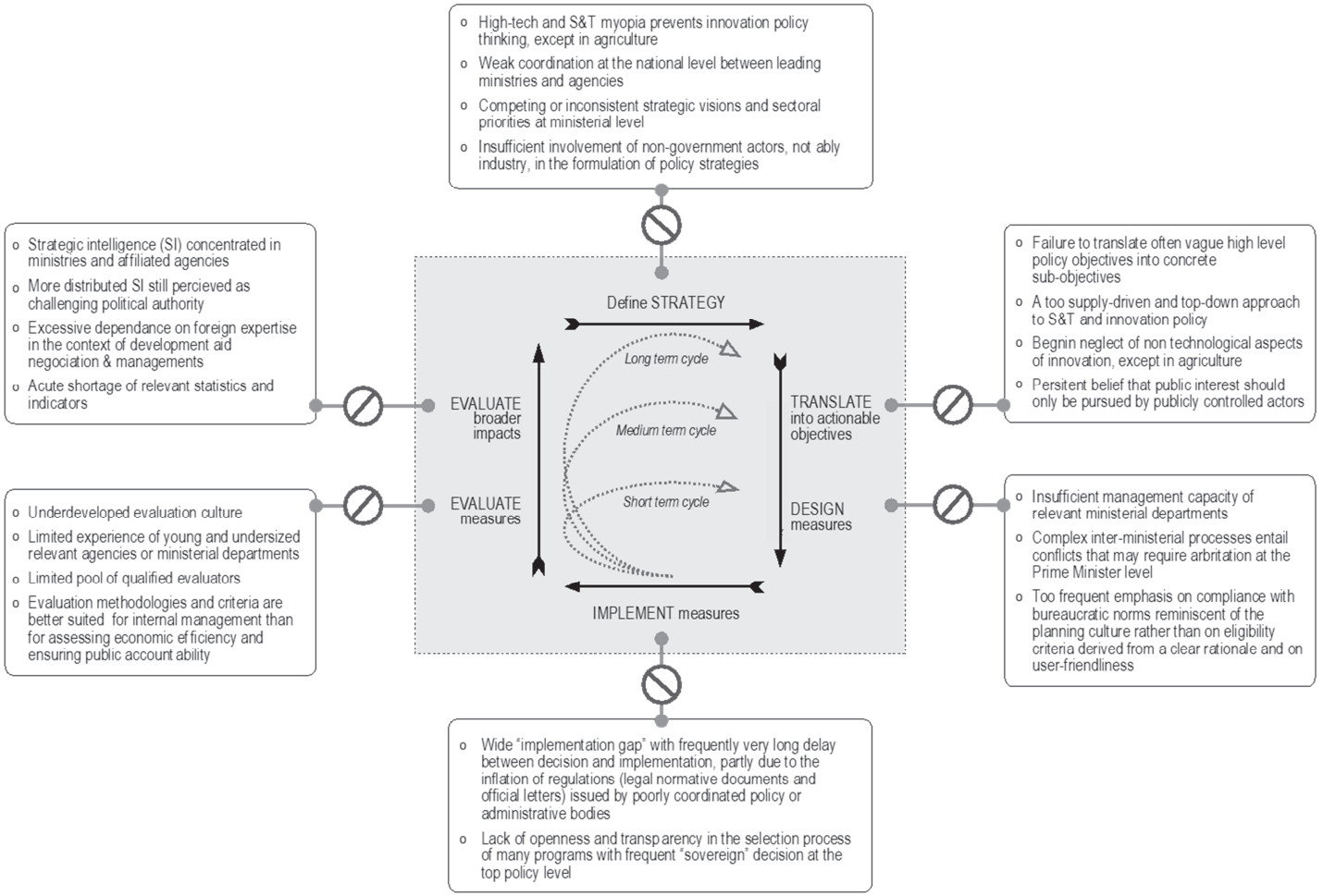


NAFOSTED is organised and run according to international practices (Figure 5.9). Its board of Trustees, which is nominated by the Minister of MoST "based on recommendations made by S&T organisations", appoints several scientific committees that advise on research directions to be supported and select the projects to be funded, based on recommendations of qualified reviewers.

During its first two years of operation, NAFOSTED funded about 500 basic research projects in the natural sciences and around 100 in social sciences and humanities, for a total approved funding of around VND 400 billion.

Source: NAFOSTED website, www.nafosted.gov.vn/en/.

Figure 5.10. Governance as an institutionalised learning process: Main hindrances in Viet Nam



NAFOSTED had a slow start but is now a very significant player in R&D funding. It funds basic research projects in universities, research institutions and other S&T organisations. It provides additional support to participants in funded projects (*e.g.* organisation of international conferences/workshops, participation in collaborative research or scientific exchanges with important labs abroad, grants for publication of scientific articles in recognised international scientific journals).

NAFOSTED also operates an Enterprise Support Programme (under Decree 119/1999/ND-CP), which is open to most enterprises that carry out R&D activities (basic, applied or experimental research) in order to apply R&D results for technology improvement, undertake new product development or provide S&T services.[18] NAFOSTED will soon launch a new support programme on Emerging Issues, whose scope and mode of operation are not yet known.

Two additional funding agencies are under launch or being planned:

- The National Technology Innovation Fund (NATIF) was established under Decision No.1342/QD-TTg of the Prime Minister in 2011 but has yet to become operational. It will provide financial support for technology transfer, assist technological innovation and improvement in small and medium-sized enterprises (SMEs), support start-ups, and support the development of skills needed for technology transfer and technical improvements. NATIF will be endowed with an initial capital of VND 1 000 billion.
- The National Venture Capital Fund will be endowed with an initial capital of VND 450 billion. Although foreseen in the 2008 Law on High Technologies it has not been officially established to date.

5.3. Strategic S&T and innovation policy tasks: A functional assessment

Fostering policy learning through advanced system governance

The OECD Innovation Strategy has identified desirable "qualities" of STI policy governance, including legitimacy and, most importantly, self-adaptation through policy learning (OECD, 2010).

In Viet Nam, science, technology and innovation have long been neglected on the policy agenda in favour of factors that would allow the country to achieve rapid economic growth. Credible and sustained commitment and close involvement of political leaders is crucial for convincing other policy makers and actors that innovation and S&T-based development are now vital for accelerating the economic catch-up process. The recent, albeit delayed, approval of the new S&T strategy is good news from this perspective.

But top-down legitimacy and stimulus must be complemented bottom-up. The key is to raise the public's confidence in and expectations of broad and tangible benefits from increased budgetary efforts and investment in human resources for innovation. Greater public awareness of past achievements of innovation policy in agriculture and of its potential future contribution to the well-being of the population (*e.g.* in terms of health, better paid jobs, a cleaner environment) would help ensure society's adherence to a more ambitious overall national innovation strategy.

To ensure that legitimate policy is pursued efficiently, a number of other conditions must be fulfilled at different points of what Figure 5.10 represents as a policy learning cycle. The figure shows that the cycle is impaired at many points. The diagnosis of the

OECD-World Bank review team points in particular to three major weaknesses: defective policy co-ordination, an "implementation gap", and a shallow basis for evidence-based policy making.

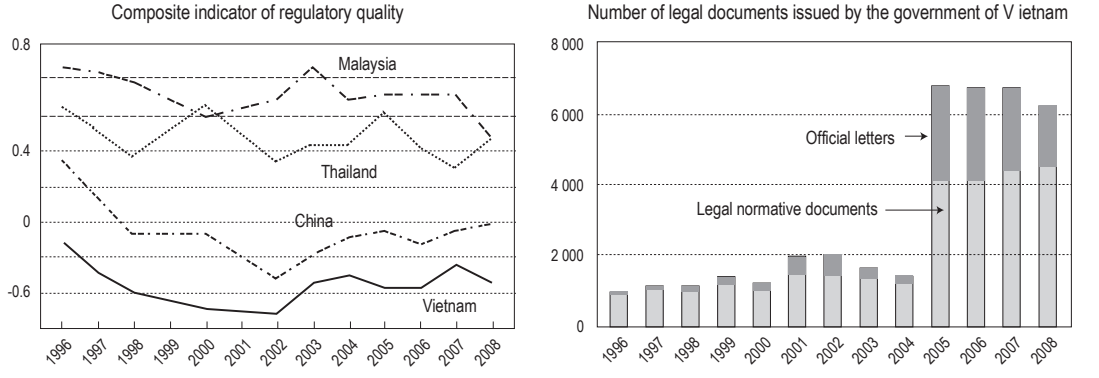
Insufficient co-ordination of the policies that promote or influence innovation is a common problem which no country has as yet solved entirely. In Viet Nam it is particularly acute and potentially even more severe given the need to speed up the transition from an S&T-centred innovation policy to a more broadly based one.

As mentioned, the role of MoST in the preparation and allocation of the S&T budget shows that it has relatively little power as co-ordinator. The National Council for Science and Technology Policy does not seem to be equipped or empowered to help align the objectives pursued and to ensure the consistency of policy instruments used by various powerful ministries with a significant stake in the innovation policy agenda.

Failure to implement fully or rapidly the decisions taken is endemic, affecting STI policy as well as other policy areas. Examples abound. Some have already been mentioned: the very slow start of the Hoa Lac high-technology park, of NAFOSTED, and of the NATIF. This "implementation gap" has two main roots.

First, high-level policy strategies and plans may be over-ambitious, expressed in imprecise terms and unable to be easily translated into more concrete sub-objectives. This leaves room for inaction or uncoordinated interpretation by implementing ministries or agencies.

Figure 5.11. Quality and quantity of regulations in Viet Nam



Source: OECD, based on *Worldwide Governance Indicators* (Kaufmann *et al*., n.d.); and Ketels *et al*. (2010).

Second, when moving towards a market economy Viet Nam succumbed to a "regulatory fever", opening space for free initiatives but submitting them to a constant flow of new rules that created red tape and complicated the tasks of economic and S&T actors that were eager to exploit the new opportunities, while giving more conservative or less motivated or opportunistic agents tools to resist or impede change.[19] The situation does not seem to have improved in the last decade, on the contrary (OECD, 2011a; World Bank, 2009). The total number of regulations that affect businesses has in fact increased dramatically since 2005 (Figure 5.11).[20] Fortunately, several substantial efforts at regulatory and administrative reform are under way, notably the Prime Minister's Master Plan to Simplify Administration (Project 30).[21] It remains to be seen how fast this will clear the way for a more efficient STI policy.

Policy-making is insufficiently "evidence-based". The capacity to develop and make use of "distributed strategic intelligence", nourished by objective data and information of high quality, is a key attribute of innovation policy governance in the most developed and best-performing countries. In Viet Nam such capacity is minimal. Two main bottlenecks must be removed to allow the "quantum leap" improvement that is urgently needed.

First, the acute shortage of statistics and indicators must be addressed, so that government and other stakeholders can rely on relevant, internationally comparable information to monitor the evolution and assess the strengths and weaknesses of the national STI system, and to evaluate the efficiency of their efforts to improve it. In its new shape, NASATI (Box 5.6) has the potential to lead this task, provided that it has appropriate legal, financial and other means. The second bottleneck is the insufficient development and use of existing strategic intelligence units. As mentioned earlier, NISTPASS (Box 5.3) is well positioned to become a more visible focal point in the web of distributed intelligence (in universities, NGOs, other research organisations, business associations, etc.) and VISTEC could become a more fully fledged evaluation agency.

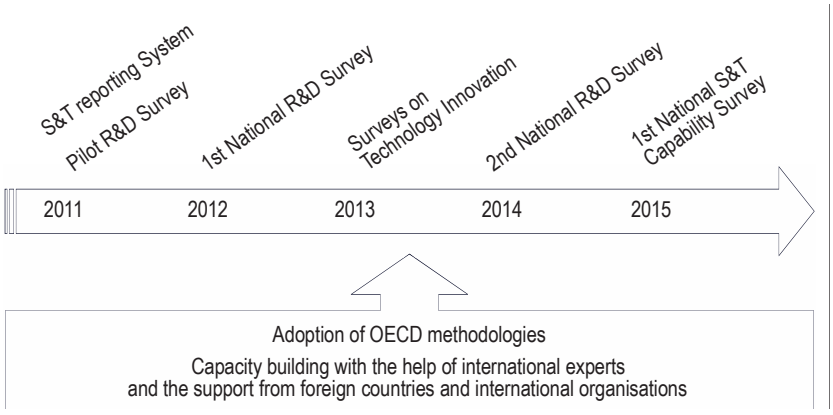
Box 5.6. National Agency for Science and Technology Information (NASATI)

The National Agency for Science and Technology Information (NASATI) is a subordinate body of the Ministry of Science and Technology (MoST). Its function is to advise and assist the minister in implementing state policy on science and technology information and library and statistics activities.

NASATI results from a long institutional evolution. It was officially formed in 2009 and replaced the National Centre for Scientific and Technological Information, but its earliest precursor was the Central Library of Science and Technology, created in 1960. Its creation and mandate respond not only to changes in government objectives regarding the content and modes of production, storage and diffusion of S&T information that is relevant to professional communities and society, but also to the changing needs of government itself regarding the empirical basis for policy formulation, monitoring and evaluation.

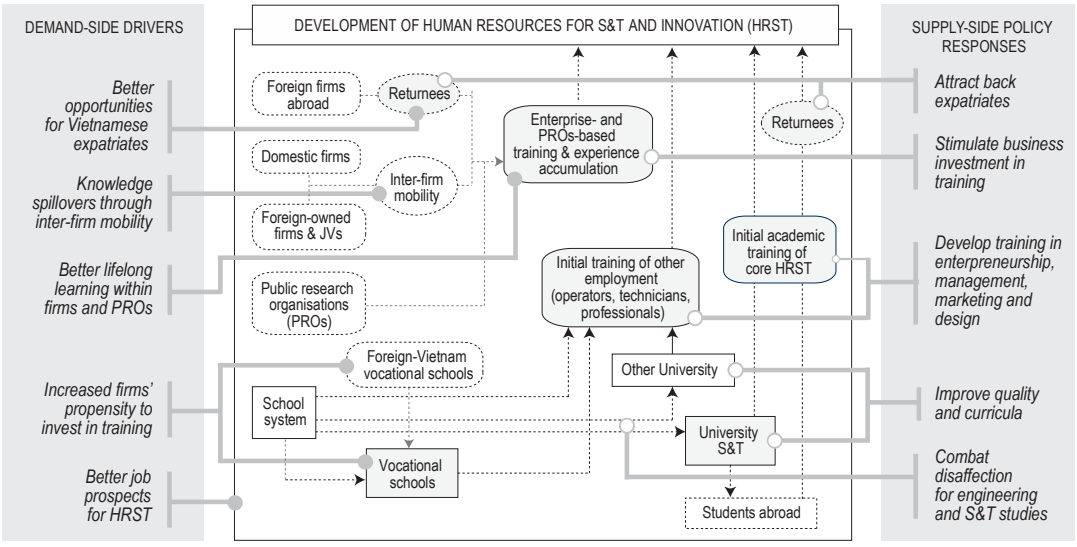
The Centre for S&T Statistics of NASATI has now undertaken to bridge the gap between Vietnamese and best international practices in the field of R&D statistics and indicators. Its working plan for the short to medium term is laid out in Figure 5.12.

Figure 5.12. NASATI roadmap



Source: OECD, based on NASATI website and Minh Ngoc Nguyen (2011), Vietnam Science & Technology Statistics", presentation at the 2011 South East Asian Regional Workshop on Science, Technology and Innovation Indicators, organised by UNESCO and NASTI, Hanoi, December.

Figure 5.13. Removing bottlenecks in the HRST pipeline



Securing the availability of qualified human resources

This subject is important enough to deserve a review of its own. The discussion of all of the aspects of education and training policies that have a direct or indirect impact on the national level of innovation capacities is obviously beyond the scope of this report. In light of the findings of Chapter 4 this section focuses on issues concerning human resources in science and technology (HRST) that lie at the interface of S&T and education policies and deserve particular attention.

Figure 5.13 illustrates the interdependence of the two policy areas, one of which usually attracts more attention. The education system, as well as formal in-house training in enterprises and other organisations, provides the innovation system with its most precious resource: literate and skilled people. But an efficient innovation system itself acts as a "fast breeder" reactor that enriches the skills it uses, thus complementing the formal education system in developing a more productive and creative workforce. Most importantly, it improves job prospects for students in S&T-related subjects and thus affects the disciplinary distribution of enrolments in universities.

From this perspective all the S&T policy measures that are proposed in this chapter to boost innovation dynamics will create, on the demand side of the labour market, some of the conditions that are necessary for the success of initiatives to remove bottlenecks on the supply side of the HRST pipeline.

Combating the lack of interest in S&T studies

The rejection of science and engineering studies is a widespread source of concern, particularly in the most developed countries. Compared to older cohorts, young people increasingly graduate in the social sciences, business and law, and there has been a relative decline in the share of S&T graduates. In the most advanced countries the HRST pipeline is often shrinking at the beginning (decreasing enrolment in S&T studies) and at the end (*e.g.* brain drain to better-paid jobs outside the fields of science and engineering [S&E]), even if it remains healthy in the middle (the vast majority of world-class universities and a large but ageing stock of S&T specialists). Viet Nam suffers from this

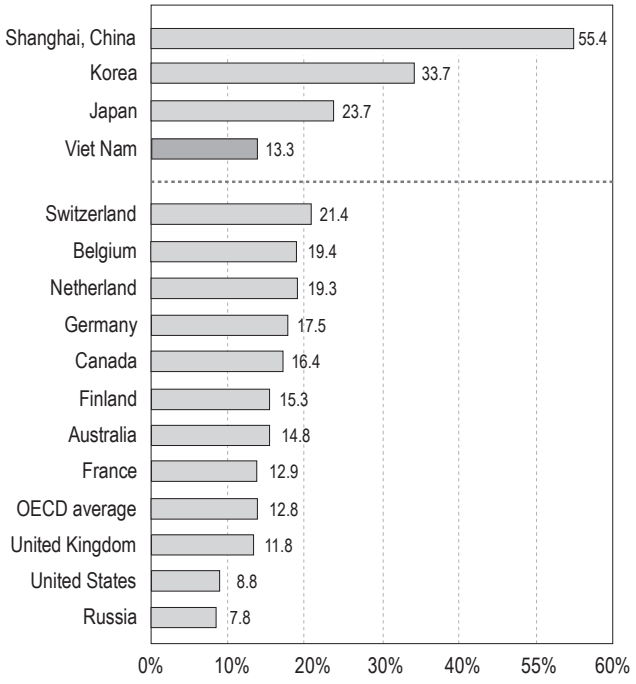
trend more than most other Asian catch-up countries. This is worrying, given prospective skill requirements and the fact that the present number of highly qualified engineers and scientists is already far too low. Moreover, the situation is aggravated by an intensive brain drain. It therefore has at once problems of "flow", "stock" and "leakage".

Box 5.7. The OECD Programme for International Student Assessment (PISA)

PISA is an international study that was launched by the OECD in 1997. It aims to evaluate education systems worldwide every three years by assessing the competencies of 15-year-olds in the key subjects of reading, mathematics and science. To date over 70 countries have participated in PISA.

Figure 5.14. Proficiency in mathematics at age 15

2012, percentage of top performers



Source: OECD, based on PISA, www.oecd.org/pisa.

A strong policy response is needed. First, it is important to ensure that a larger number of pupils in primary and secondary schools acquire the level of basic capabilities needed to contemplate enrolment in S&T in higher education. High-quality exposure to maths and science should start early in the education cycle so as to shape future choices.[22] In this respect, the last results of the OECD PISA benchmarking exercise to which Viet Nam participated for the first time are very encouraging (Box 5.7, and the discussion in Chapter 3). Second, as private rates of return to S&T degrees remain relatively low, compensatory measures should be implemented at the higher education level. Among measures to be considered are scholarships to encourage secondary school and college graduates to earn advanced S&T degrees in domestic or international universities. If used to study in foreign universities, scholarships should be made conditional on the recipient's return to Viet Nam at the end of the programme of study.

This should of course be complemented by measures to leverage the Vietnamese diaspora. For example, conditional scholarships will only work if measures are taken to make going back to Viet Nam for an academic career easier and more rewarding than it is at present. The Vietnamese diaspora is very large, with many very good students, researchers and other highly educated individuals who have acquired precious skills and experience and who are often located in the most advanced countries of Asia, Europe and North America. Attracting more of them back into the Vietnamese education or productive system should be a top priority. This question is further discussed below. This would help to raise the quality of higher education in S&E.

Improving the quality of higher education and fine tuning curricula in accordance with labour market signals

The expansion and institutional differentiation of higher education in Viet Nam has been spectacular. The number of students has risen 13-fold (from 133 000 in 1987 to 1 720 000 in 2009) and the number of universities has more than tripled (from 101 in 1987 to 376 in 2010). In 1987, there were only public universities; in 2009, there were also 81 private institutions, which accounted for over 20% of total enrolments, including the campuses of foreign universities.

Now, quality must catch up with quantity. University staff qualifications remain low on average. As of 2011, only 52% of Vietnamese academic staff had postgraduate qualifications, and most of these were at the master's level (see also below). One relatively cheap, but not necessarily easy, way to improve the situation is to reduce some of the disincentives that discourage talented young Vietnamese from considering an academic carrier at home and make them decide instead to go abroad or to choose more lucrative but non-S&T-related jobs. Among such disincentives the most important are: heavy teaching loads (which also prevent positive synergies between training and research), a tradition of "seniorism" that limits the possibilities of merit-based carrier development (fewer than 1% of academic staff are full professors), and pervasive bureaucracy in the management of universities (Bastos, 2001).

As pointed out in Chapter 4, curriculum design needs to be more demand- and needs-driven, with increasing input from industry and other employers. Consultation mechanisms and professional practice groups on curriculum design should be set up, and governing councils of tertiary institutions should have more "external" members.[23] This would also facilitate the development of student internships. The movement towards university autonomy should also continue to allow institutions to adapt their curriculum to economic and labour market needs more easily. The new Higher Education Act, approved in 2012, is a good step in this direction. Greater autonomy and closer relations with the business sector should also allow for better identification and exploitation of opportunities for business-led educative initiatives and institutions (Box 5.8).

Box 5.8. The OMEGA Institute: Bringing training closer to research and production

The Institute of Science, Technology and Training OMEGA was created as the research and training arm of POLYCO, the leading Vietnamese company in food processing equipment, created in the mid-1990s by a visionary entrepreneur, professor at the Hanoi University of Technology. Over the years POLYCO has developed a large product portfolio, including engineering services and the production of beer which serves as a "cash cow" to support research and training in industrial, measurement and control engineering. The training activities have been boosted recently, in co-operation with a German partner.

Source: Field visit by the OECD-World Bank Review team.

Putting more emphasis on "soft" skills for innovation

As pointed out in Chapter 4, Viet Nam currently underestimates the importance of "soft" skills for innovation. It needs to reform its curriculum and pedagogical approach in order to produce more "soft" skills – problem solving and creativity; behavioural and managerial skills, such as leadership, entrepreneurship, risk-taking; communication and teamwork skills – at all levels of its education and training system. It has a good opportunity to do so with the upcoming 2015 curriculum reform. One effective way would be to encourage a transition towards multidisciplinary and trans-disciplinary courses, at least in tertiary education. Another would be to encourage and support all sound private initiatives that contribute to the development of "soft" skills and to the generation and diffusion of an innovation culture (Box 5.9).

Box 5.9. The ADS International Design & Art Centre: Training for non-technological innovation

The ADS International Design & Art Centre was established in Ho Chi Minh City as the first private school of design in Viet Nam. Students undergo a two-year training course on how to combine modern technologies and tradition to improve the design of existing or new products in a variety of sectors, notably furniture.

The centre also runs a Design Promotion Centre to raise awareness among Vietnamese enterprises of the importance of design for increasing competitiveness at the higher end of their markets. As a member of the Viet Nam Creative Entrepreneurs Network it contributes to spread a new innovation culture that emphasises design, branding and marketing.

Source: Field visit by the OECD-World Bank Review team.

Enhancing the contribution of public research to innovation

Viet Nam's public-research sector has undergone many reforms but still retains some features of its initial Soviet-type architecture, including separation from production activities and the limited amount of university-based research, thereby limiting its efficiency in a more market-oriented economy. This is due not only to institutional and policy inertia in the area of S&T, it also reflects the absence of demand-driven factors of institutional change, namely the low level of innovation in the business sector (see Chapter 4) and, more broadly, longstanding societal neglect of domestic innovation as a factor of socioeconomic progress, except in a few mission-oriented R&D areas.

Box 5.10. Vabiotech: A world-class public research institute

The Company for Vaccine and Biological Production (Vabiotech) was established in March 2000 by the Minister of Health as a state-owned company belonging to the National Institute of Hygiene and Epidemiology. In May 2007 supervision of the Institute was removed and it is now an independent company under the Ministry of Health. It has become a world-class manufacturer of vaccines.

The main mission of the Institute is to supply vaccines for the Vietnamese population, but surplus vaccines are exported abroad, including to developed countries such as Japan. Vaccines being manufactured include those for hepatitis A and B, cholera, Japanese encephalitis, rabies, H5N1 and H1N1.

The Institute reinvests 10% of its revenues in R&D and related facilities. It has 180 employees, including 20 scientists with a master's or PhD degree. The professional staff includes local university graduates, all of whom receive two years of additional training from foreign universities, and visiting fellows from developed countries who facilitate knowledge updating and transfer. Vabiotech collaborates with institutions such as the World Health Organization (WHO) and other foreign institutions in Europe, notably in Sweden, and in Japan, the United States and Korea.

Source: World Bank and National Institute of Science and Technology Policy and Strategic Studies (NISTPASS) (2010), "Innovation Policy in Vietnam: Policy Discussion Note", prepared as part of a Rapid Innovation Action Learning (RIAL) activity, March, www.vabiotechvn.com.

Main problems to be addressed

The Vietnamese public research sector is very large relative to other actors of the national innovation system, but is quite small by international standards, owing to the modest share of R&D in total government expenditures. Some success stories (Box 5.10) should not hide the fact that, overall, many factors limit the contribution that Vietnamese public research organisations and universities can currently make to innovation, as illustrated by the case of agricultural research in Box 5.11. The main problems requiring urgent attention and corrective action are:

- *Overly complex organisational features* and a very large number of often overlapping laboratories and R&D units in ministries or under the control of VAST and various government agencies, many of which are of sub-optimal scale. This leads to wasteful allocation and use of limited resources.
- *Lack of resources.* Whereas many research bodies suffer from insufficient funding, almost all, including universities, suffer from a lack of sufficiently qualified personnel. A worrying development is the continuous erosion of the S&T human resource base, starting with declining enrolments in S&T-related higher education (in Viet Nam most postgraduate students are in social sciences and humanities in contrast to the situation in the leading emerging Asian economies) and possibly aggravated later by a disciplinary bias in public procurement of research (Table 5.4).

Box 5.11. Public agricultural research in Viet Nam: Achievements and shortcomings

The development of Vietnamese agriculture has contributed significantly to overall economic growth and even more to poverty reduction and has thereby provided one of the main foundations for economic reforms. Some part of public agricultural research can claim a share of this success, although technological change has so far made only a modest contribution to the sector's growth. Today, the declining availability of resources and weaknesses at several points in the value chain raise serious doubts about the sustainability of the agricultural growth model. The role of public research in the agricultural innovation system must be reconsidered from this forward-looking perspective. The rice and coffee sectors provide good examples of achievements, chronic shortcomings and new challenges.

If Viet Nam was to become self-sufficient in food grains and subsequently a net exporter of rice, the development and adoption of new varieties were of paramount importance, after the initial impulse given by land reform. It is estimated that in the last two decades the introduction of new varieties accounted for about one-third of the growth of rice production. Public research played a pivotal role. Research in hybrid rice was initiated as far as the late 1970s in Viet Nam's Institute of Agricultural Science. The development of new rice varieties was later conducted not only in research institutes such as the Cuu Long Rice Research Institute (CLRRI) in the Mekong Delta, the Institute of Agriculture for South Viet Nam (IAS), and the Agricultural Genetics Institute in the north, but also in universities such as the Hanoi University of Agriculture, the Can Tho University and An Giang University. However, up to now Vietnamese exports of rice remain, in terms of quality, concentrated at the low end of the international market. Considerable efforts are needed to upgrade the various stages of production and marketing, including through technological innovation.

Viet Nam is the biggest exporter of coffee after Brazil and the largest shipper of the robusta beans that are used to make instant drinks. Coffee is second only to rice in terms of the value of Vietnamese agro-product exports. In spite of the importance of coffee as a source of income for large communities and of export revenues, Viet Nam's public research long devoted limited resources (mainly the Ba Vi Coffee Research Centre) to R&D to improve coffee production and commercialisation, making Viet Nam more dependent on the research strategies of leading agro-food multinationals than countries such as Colombia, where Cenicafé on the research side and Colcafé SA on the global marketing side have developed important capabilities (Roldán-Pérez *et al*., 2009). The government has sought for some time to improve the quality of coffee exports, including more widespread planting of more value-adding Arabica beans, the development of mixed-bean coffees, and specialty coffees such as the prestigious *kopi luwak*. The restructuring of the agricultural R&D system under the supervision of the Ministry of Agriculture and Rural Development (MoARD) has been part of this effort.

In September 2005 the number of agricultural R&D agencies under direct MoARD control was reduced from 28 to 12. The Ba Vi Coffee Research Centre was merged with eight other institutes into the Viet Nam Academy of Agricultural Sciences. These amalgamations helped eliminate duplication of research efforts, but they do not appear to have solved problems such as the extreme geographic centralisation of Vietnamese agricultural R&D (most activities take place in the immediate vicinity of Hanoi and Ho Chi Minh City) which prevents R&D from being closely connected with Viet Nam's rural development programmes, and the low productivity of many research institutes, resulting from defective incentives combined with a lack of an adequate level of human and other resources.

Source: Adapted from Do Anh Tuan Nguyen (2009), "Agricultural Innovation in Vietnam", report prepared for the World Bank Institute, and Stads et al. (2006), "Vietnam", *ASTI Country Brief* no. 33, Agricultural Science and Technology Indicators, July.

Table 5.4. Number of articles by Vietnamese scientists

Field	2005	2006	2007	2008	2009	2010
Natural sciences	1 216	1 256	2 059	1 549	1 634	9 65
Engineering and technology	515	1 041	1 099	1 082	749	800
Medicine and health	1 133	1 017	1 466	555	639	1 245
Agricultural sciences	1 162	1 004	958	644	897	834
Social sciences	2 927	2 863	7 910	9 503	9 769	7 481

Source: NASATI (data from the Ministry of Science and Technology harmonised with the OECD FOS classification).

Table 5.5. Number of scientific articles in all fields

	2005	2006	2007	2008	2009
Cambodia	21	26	25	23	27
Indonesia	205	215	197	219	262
Laos	9	18	12	12	12
Malaysia	615	724	808	951	1 351
Philippines	178	181	195	224	223
Thailand	1 249	1 568	1 728	1 960	2 033
Viet Nam	**221**	**225**	**283**	**363**	**326**

Note: Article counts from the set of journals covered by the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI).

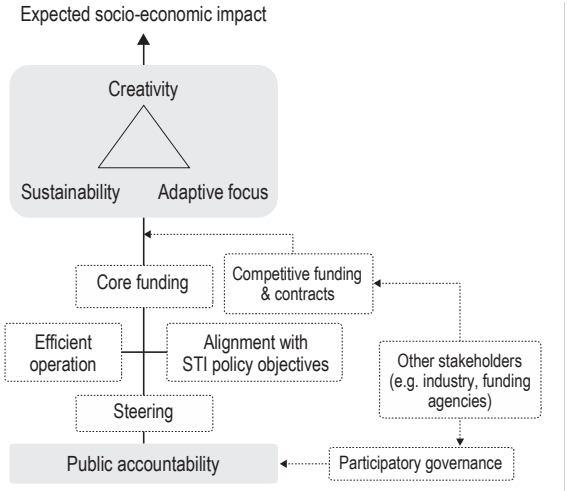
Source: US National Science Foundation, Science and Engineering Indicators 2012.

- *Distance from national end-users and from global knowledge networks.* At both ends of the research spectrum – basic research and near-market technological development – some organisations or teams have been able to grasp the opportunities created by economic liberalisation, international opening and new innovation infrastructures to become credible and useful partners of business or the world academic community. However, there are many more whose research fails to reach the level necessary to gain international recognition (Table 5.5) and/or fails to deliver real value to others actors of the economy and society.
- *Inconsistent government policies.* Overall past government initiatives to rationalise the public research sector have improved the situation but some have had ambiguous effects, partly because they were not complemented by other measures, as part of a larger and more comprehensive reform agenda. For example, Decree 115 of 2005 accelerated the transformation of actors with appropriate human resources and a potential "customer base", but it also brought others into a position in which their survival is at stake given their lower capability to access competitive funding or contract research. For Decree 115 to have a more positive impact, government policy needs to differentiate among PROs according to their mission and potential and adapt the mechanisms of their public funding accordingly, e.g. moving towards larger grants as well as more transparent and better co-ordinated allocation procedures.

Box 5.12. Steering and funding public research institutes: good international practices

Over the last two decades, reforms of PROs have been widespread and almost continuous throughout the OECD area and beyond (OECD, 2011b). Despite their diversity (in terms of size, organisational features, main functions, research portfolio, disciplinary or sectoral focus, etc.), and the considerable cross-country variability of their role *vis-à-vis* universities and other actors in the innovation system, these reforms present some common directions. A few fundamental lessons can be learned from this quite long period of policy experimentation.

PROs are accountable to society for their use of taxpayer money, but they must have the capability and incentives to accomplish their public mission; the ultimate outcome of their activities depends on joint activities with or follow-up action by other stakeholders, notably industry. Critical capability has three main attributes: sustainability (sufficient stability and continuity for developing competencies through learning), creativity (eagerness to explore new solutions to standard problems and imagination in using existing knowledge to address new issues), and adaptive focus (flexibility to capture unexpected opportunities and respond to changing demand).



Steering (definition of mission, evaluation, performance contracts, etc.) and funding are mechanisms to enforce the contract between society/government and PROs in a way that stimulates their creativity, ensures their sustainability and allows their research focus to be adaptive.

Steering and funding – two key balancing acts

The first balancing act is to reconcile public accountability with creativity. Even in the best PROs, projects, individuals or teams are distributed in some form of Gaussian curve according to their quality/creativity. A rigid and too bureaucratic enforcement of accountability cuts the two tails of the distribution. A more advanced approach preserves space for the most creative individuals, teams and projects. The experience of OECD countries suggests the importance of the following: a high degree of autonomy in human resource management by individual PROs; systematic use of international benchmarks and reviewers in evaluations; active partnerships with universities, other PROs and industry in the practical application of results at the borderline of the core business.

The second important balancing act concerns the appropriate funding mix (relative shares of competitive funding, earmarked block funding, and untied block funding) to allow PROs to attract and retain talented people working with up-to-date equipment on good projects.

It is recognised that too much block funding favours incumbents and reduces performance incentives and agility, whereas too much competitive funding prevents institutions or research teams from developing strategies, hinders renewal of infrastructure, increases reliance on short-term recruitment of "cheap" researchers, leads to "mission creep".

The current debate is about how block funding should be delivered to provide stability without curbing the excellence and social relevance of the research output. The fact that core funding can be delivered in different forms, with different degrees of conditionality, is a crucial issue to be considered. Core funding earmarked for capacity building is a common practice. Core funding for "venture funding" is an interesting option given the need to support novel, unproven approaches.

Source: Guinet (2012), "Adapting Public Research Institutes to New Dynamics of Innovation", *STI Policy Review*, Vol. 3, No. 1, pp. 117-38, STEPI, Seoul.

The way forward in light of international experience

In the search for solutions Viet Nam can learn from international experience. There is an increasing consensus at the international level on some key ideas concerning the evolving role of public research in a socioeconomic development model that emphasises environmental sustainability and innovation-driven growth (Box 5.12).

Firms operating on increasingly competitive and globalising markets will remain the main locus of value-creating innovation, but public research will retain a vital role as a springboard for market-oriented research and as an invaluable source of impartial expertise and specialised knowledge in support of public missions and policies.

For Viet Nam this means that accelerating the development of a vibrant business sector should be a top priority (see below), with a view to creating the demand pull needed to align the public research agenda with national economic development priorities.

The new dynamics of innovation have important consequences for the *division of labour and co-operation between universities and PROs, and the desirable balance between the main tasks of PROs*. More emphasis should be placed on "strategic" pre-competitive research, and demand-driven applied research or technological inter-mediation should be more narrowly focused in areas with clear evidence that market failures prevent business from acting efficiently alone.

For Viet Nam, it is therefore urgent to: complete the process of "corporatisation/ privatisation" of some PROs and the consolidation of others initiated in 2005; clarify the missions of those that would remain partly or fully publicly financed to remove overlaps, ensure critical mass and align their research directions with socioeconomic priorities; remove barriers to and provide platforms and incentives for co-operation between PROs and universities; and find a better match between PROs' missions and the way they are steered and funded.

Steering and funding mechanisms have evolved in the search for a better balance of unconditional core funding, conditional funding, competitive funding and self-financing. In parallel, *governance and steering mechanisms* have changed to ensure that the funding formula can be customised according to the nature of PROs' missions and research agenda rather than to individual PROs' "political proximity" to primary budget sources, for example. Also, PROs were given greater autonomy, including in terms of human resource recruitment and management, with a view to stimulate their creativity and responsiveness to the evolving needs of their stakeholders, in exchange for greater accountability through the introduction of performance contracts and tougher evaluation procedures.

The implications for Viet Nam are far reaching and should take due account of the country's specific history, level of development, policy tradition and institutional arrangements. The governance of Vietnamese PROs and research universities should be fundamentally restructured on the basis of five fundamental principles or objectives: *consolidation* based on national research priorities rather than amalgamation based on administrative/political logic; *streamlining through agencification,* with one or a very limited number of research agency(ies)/foundation(s) made responsible for funding, monitoring and evaluating PROs' performance contracts using transparent criteria and procedures); *no sacred cows* (*i.e.* no research institutions with a privileged or direct access to budget money); *no orphans* (no research institutions in survival mode under the control of a lenient but indifferent caretaker); and *decentralisation* (bringing some research capabilities closer to end users, including poor and remote populations). In more

concrete terms, the government could enforce more effectively the co-ordinating role of MoST at the policy supervision level and could consider adopting – with the necessary adaptation to national conditions, notably the presence of VAST – the Korean model of management at the agency level of a highly diversified portfolio of PROs (OECD, 2009).[24] This should be done without complicating an already over-populated institutional landscape by building around existing organisations such as NAFOSTED.

Promoting business R&D and innovation

Inducing the business sector to become more involved in innovation is an issue of paramount importance for Viet Nam and calls for a whole-of-government approach. Chapter 2 discussed the need to improve key framework conditions (competition policy, public procurement, labour market regulations, the tax system, IPRs, etc.). The business sector would obviously benefit from greater availability of human resources with higher-level S&T-related qualifications; it should contribute more actively to achieving this through in-house or sponsored training activities, as discussed above. Vietnamese firms would also benefit from the improvement of the public research sector advocated above, from the further development of innovation infrastructures (discussed below), and from policies to embed skilled foreign firms in the national innovation system (also discussed below). This section focuses on the contribution of S&T and innovation policy in a narrower sense.

More equal access to a leaner, better managed and better endowed financial support system

Financial incentives aimed at boosting the business sector's investment in R&D and innovation by lowering its cost, either through direct support (*e.g.* in the form of grants or subsidised loans which entail budget expenditures) or indirect support (tax incentives which result in foregone revenues). The balance between these two types of financial incentives varies from country to country, although in the OECD area there has been over the last two decades a general trend towards rebalancing policy mixes in favour of tax incentives. Publicly available information does not allow for assessing the balance between direct and indirect support in Viet Nam but it points to a number of issues that require government attention.

Considering the urgent need to encourage as many firms as possible to adopt more innovation–oriented strategies, and the relatively small size of the S&T budget allocated to the business sector, the relevant funds and programmes need to have maximum leverage. This does not seem to be the case for three reasons. First, relationships between the government and the business sector are somewhat biased; second, the support system focuses on technological innovation in manufacturing to the detriment of the services sector and non-technological innovation; third, the design and management of existing programmes are often inappropriate.

In almost all countries it is more difficult for SMEs than for larger firms to remain well informed about opportunities provided by government policies and to shoulder the bureaucratic burden of preparing applications for support. In Viet Nam, however, size is not the only matter but ownership also seems to play an important *de facto* role at this stage as regards access to public support, albeit some progress has been made. Owing in part to a persistent belief in some government circles that the public interest is always best pursued by publicly controlled actors, state-owned enterprises may have at times preferential access to government promotional schemes in priority areas than privatised

("equitised") ones, which are in turn generally better treated than private firms (Box 5.13). As a result, the distribution of funds may not follow the same criteria, irrespective of ownership. This entails a misallocation of scarce public resources and weakens the impact of otherwise commendable policies. For example, some S&T and R&D programmes may be used in part to continue to subsidise R&D units that were incorporated in or attached to state-owned enterprises during the last decade with a view to making them self-sustaining. Also, government needs to make sure that private companies are not put at a disadvantage by unsurmountable administrative burdens and bureaucratic barriers in order to be registered as R&D-performing companies that can enjoy dedicated public support (Manh Quan Nguyen, 2011).

Box 5.13. Privatisation ("equitisation") of state-owned enterprises

In many eastern European countries, Russia and other CIS (Community of Independent States) countries privatisation was primarily a means of establishing private property rights. In Viet Nam, the situation was somewhat different since a viable private sector existed before the implementation of the privatisation programme.

The Vietnamese government classifies state-owned enterprises into three groups. The first consists of public enterprises which are considered strategically important and should therefore remain under state ownership and control. The second consists of SOEs in which the government wants to keep controlling (or golden) shares if they are privatised. The third consists of the remaining SOEs, which can be privatised in one of four ways: *i)* keeping the state shares intact and issuing new shares (*i.e.* corporatisation); *ii)* selling a fraction of the state shares; *iii)* detaching and then privatising parts of an SOE (mostly applied to the state general corporations); and *iv)* selling all state shares to workers and private shareholders (mostly applied to loss-making SOEs).

Privatised firms enjoy privileged treatment compared to fully private firms. For example, the Law on Encouraging Domestic Investment allows them to exempt up to 50% of their profit from taxation in the first several years following their privatisation. They are also permitted to borrow from the state commercial banks and other state credit institutions at the same rates and terms as SOEs. In practice SOEs enjoy generally better treatment.

Overall, the costs and possibilities of doing business in Viet Nam are significantly different for private, privatised, and state-owned firms.

Privatisation has not substantially changed the overall structure of ownership in Viet Nam. The main reason is that the state general corporations (SGCs), the largest conglomerates in Viet Nam's economy, have been left intact. Although the number of SOEs has declined as a result of the "equitisation" process, the scale of the state sector has not been shrinking because it has been restructured into conglomerates and refinanced to create economies of scale. For its part, the non-state sector has grown in terms of quantity and employment, but it still lacks the dynamism to become a driver of growth.

However, the non-state sector now outperforms the state sector in industrial production. This is important from an innovation policy perspective. In 1995, the state and non-state sectors had an equal share in the total value of industrial output. By 2009, the share of the non-state sector was three times that of the state sector, and the state sector's contribution to industrial growth decreased sharply from more than 40% in 1995 to less than 10% in 2009.

Source: OECD, adapted from Vu (2006), "Competition and Privatization in Vietnam: Substitutes or Complements?", presentation at the second VDF Conference on the development of Vietnam, Vietnam Development Forum Tokyo (VDF Tokyo), July, and Ketels *et al.* (2010), *Vietnam Competitiveness Report 2010*, Central Institute for Economic Management, Asia Competitiveness Institute, National University of Singapore.

It is understandable that Viet Nam attaches high priority to the development of a competitive manufacturing sector in order to improve its terms of trade and to create jobs for those leaving a modernising agricultural sector. But it should devote more attention to innovation in services and to non-technological innovation. In this regard the Ho Chi Minh government seems to lead the way. Its approach to SME support (with a focus on training and innovation management), as well as its new initiative to promote the development of an innovative service sector ("service science", in co-operation with IBM), should be replicated in some way at the national level.

The consequences of unfair access to sectorally biased government financial support are compounded by many deficiencies in the design and management of the schemes that channel such support. Some ongoing renewal (*e.g.* the promising beginnings of NAFOSTED and the ongoing launch of NATIF) will not be enough to solve three deep-rooted problems: the wide gap between the imprecise definition of high-level policy objectives (as stated in laws or master plans) and the very fragmented implementation procedures that are poorly aligned with those objectives; the insufficient professional management capacity in relevant agencies and ministerial departments; the inflation of regulations which complicates decision processes. As a result many government schemes are poorly designed, with bureaucratic norms hindering the adoption of sound eligibility criteria and procedures that are too slow and not user-friendly for distributing grants that are too small.

Similar remarks can be made about indirect support. Tax incentives have mush-roomed over the years,[25] probably to substitute rather than complement direct forms of support. It may be thought that the Ministry of Finance has found easier and/or wiser to weather the pressure from interest groups by accepting foregone revenues than increase budget expenditures. In any case there is an urgent need for a "spring cleaning" of the tax system, along the lines followed by many countries in the last two decades: a larger tax base, with fewer exemptions, investment in R&D remaining one of them. The government should simplify the tax treatment of R&D, considering that international good practices in this field consist of three main tax measures: accelerated depreciation of investment in machinery and equipment used for R&D activities; full deductibility of current R&D expenditure from taxable income; and extra allowance (which enables firms to deduct more than 100% of their R&D expenditure from taxable income) or a volume-based tax credit (which allows firms to deduct a percentage of their R&D expenditure from their tax liabilities). It should make an effort to resist the temptation to add extra benefits in favour of certain types of research, certain sectors or certain categories of firms, with the possible exception of SMEs (Table 5.6).

To sum up, if Viet Nam wants the business sector to become, as it is in more advanced countries, the main locus of innovation, it must not only improve the general business climate but also be prepared to increase its budgetary effort to fund good cost-sharing programmes in favour of the corporate sector. Currently there are too many programmes but too few good ones, *i.e.* schemes with a clear rationale and well-articulated objectives and that are well managed (transparent and expedient procedures of selection and delivery of grants of a size that can make a difference). An evaluation from this perspective of all existing schemes, starting with an exhaustive inventory, would provide precious guidance to the top level of government on how to improve present practices. This could be entrusted to MoST-VISTEC and undertaken in co-operation with MoPI and in consultation with the S&T departments of the key sectoral ministries. The current tax treatment of R&D and innovation-related investment should also be assessed in co-operation with MoF and MoPI, with a view to moving towards a leaner but more effective tax incentive system.

Table 5.6. R&D tax incentives: A decision tree

Policy choice		Practices	Evaluation
Whether or not to use tax incentives to promote R&D		Over two-thirds of total OECD business R&D expenditures benefit from tax incentives	Tax incentives are cost-effective for increasing private R&D, but their inducement power is moderate and contingent on the level of corporate income tax. Their superiority over alternative uses of government resources is clear only with regard to non-selective subsidies. At an aggregate level the effectiveness of tax incentives tends to increase (decrease) with the decrease (increase) in R&D subsidies. For an R&D fiscal measure to induce substantial and worthwhile R&D at low cost to taxpayers there must be high spillovers from the modest amount of induced R&D. This is unlikely to be the case in countries in which R&D activities are more concentrated in large firms operating in oligopolistic industries.
If yes, choose between or combine	Extra allowance or volume-based tax credit	One-third of OECD countries	The most generous form of tax incentives. Appropriate as part of a catching-up strategy in terms of R&D intensity. But effective inducement is achieved at high cost. The generosity of the scheme can be reduced as countries catch up. The generosity of support can be limited for large firms and/or eligible expenditure can be defined in a restrictive way. A switch to an incremental mechanism always needs to be given careful consideration.
	Incremental and mixed schemes	One-third of OECD countries	More cost effective than volume-based schemes for increasing R&D. However, the effective rate of support varies considerably across industries and firms and the choice of the reference base for calculating eligible incremental R&D raises difficult problems. An incentive proportionate to the intensification of R&D efforts (as a % of turnover) is more cost-effective than one proportionate to the increase in R&D expenditure, unless the objective is to favour fast-growing young SMEs.
Provide privileged treatment to certain types of research, sector or firm		Over one-third of OECD countries give preferential treatment to SMEs. Only a few offer specific tax incentives for basic research, "selected technology areas" or collaborative research	Preferential treatment of SMEs might be justified on the grounds that small firms are more affected than large ones by liquidity constraints stemming from capital market failures. However, it is difficult to design a scheme that will meet the various needs of all types of SMEs, as demonstrated by the relatively low participation rate in some countries. The quality of the financial and infrastructural environment of SMEs varies greatly. R&D tax incentives can be seen as a transitory remedy which may become less effective as the business environment improves. Ceilings on benefits of general schemes can make them more generous to smaller firms. Superior targeted grant-based policy tools exist to provide capital to start-ups as well as to promote specific technologies or basic research.

More coherent and "smarter" sectoral selectivity

A striking feature of Vietnamese business and industrial development policy already noted earlier is the proliferation of sectoral programmes, with no mechanism in place to ensure their effective co-ordination and to ensure a balance between such selective approaches and more horizontal/thematic ones, notably economy-wide support for R&D and innovation-related investment. For example, in the past decade MoIT has developed no fewer than 80 development strategies, master plans and plans for industrial sectors (*e.g.* automobile, motorbike, garment and textile, chemistry, electricity, coal, informatics, electronics, milk processing, vegetable oil). The government has also implemented promotional programmes for a number of technology-intensive sectors (*e.g.* information technology, especially software, biotechnology, automation technology, building materials) (Goel *et al*., 2009). In 2010 the Ministry of Industry and Trade launched a scheme to develop high-technology agriculture through 2020 (Decision No. 176/QD-

TTg). Preferential loans are provided by the Viet Nam Development Bank to firms in many sectors, and sectoral differentiation of tax policies is widespread (Huong Lan Nguyen, 2011).

Box 5.14. Designing a public-private partnership to foster collaborative R&D and innovation: A template

Launch

The government defines terms of reference (regarding the minimum number and identity of partners, their research field and agenda and their readiness to commit the necessary level of resources), states the form, conditions and duration of its support (four to seven years to allow for ambitious R&D), and invites consortia (of firms and public research organisations) to submit proposals in the form of "business plans", together with the credentials of would-be participants.

There are two main variants: *i)* the government does not express a preference regarding technological fields; and *ii)* the government selects specific technological areas as eligible for support. This second option would be preferable for Viet Nam at this stage. It would require a governmental commission, in consultation with representatives of public research and industry, to determine the area(s) offering a greater chance to find competent and motivated participants, especially on the industry side, and in which enhanced innovation would yield significant benefits for the Vietnamese economy.

Eligible participants

These include private firms, state-owned industrial firms, research institutes and universities. Subsidiaries of foreign firms should be allowed and even encouraged to participate. A candidate consortium should have a minimum number of firms and at least one institute and one university. A possibility to be considered is the inclusion of geographical breadth among the selection criteria.

Selection process

This should be a transparent competitive process, with clear criteria and impartial referees. The scientific quality of proposals should be assessed through an independent peer review. A joint panel involving VAST and top universities in the field could select peers, including foreigners. Ideally, the economic and organisational dimensions should be assessed with the help of a consultant company with international experience. The final decision would be taken by MoST, in consultation with MoIT regarding substance, and in consultation with MoPI regarding funding issues.

Organisation/management

There are two basic models: virtual institutes with a lean organisation at the core and research carried out at participating PROs and firms; or co-operative research labs with most activities taking place at a central location. Each has advantages and disadvantages and the government should impose only minimal requirements. The choice should be made on a case-by-case basis, depending on the technological area and capabilities of actors.

Co-operative research centres or networks should not be just *ad hoc* contractual arrangements but have an institutional identity (*e.g.* legal status of foundations). Their governing board (with industry holding if possible a majority of votes in order to ensure its commitment and avoid a drift towards research with no end users) should enjoy broad autonomy in determining the detailed research plans.

Financing

The basic principle is a tripartite arrangement with resources (in cash or in kind) from three sources: government budget, industry and PROs. There are different formulas, but as a rule, the government subsidy should not exceed 50% and the industry contribution should be at least 20%.

…/…

Box 5.14. Designing a public-private partnership to foster collaborative R&D and innovation: A template *(continued)*

Monitoring and evaluation

A representative from MoST would be part of the governing board of each PPP. In addition, annual reports on activities would be mandatory. A light mid-term evaluation (after two or three years) would check progress in achieving stated goals. A full-fledged evaluation would be carried out after four to seven years. Depending on the results, public support could be renewed for another term, reduced or removed, in which case the co-operative venture would close or become self-sustaining. Self-sustainability should be an important objective. However, there should be some degree of flexibility so that some pre-competitive research in important areas could have permanent public support.

In the more advanced economies, sectoral targeting lost favour some time ago, in favour of more horizontal policies and new approaches to sectoral selectivity, such as cluster-based policies, and, more recently, "smart specialisation" (Foray *et al*., 2009). The main reasons were the blurring of sectoral borders brought about by accelerated technological change, and the difficulty of devising sectoral programmes that yield more benefits than the unavoidable costs they entail by distorting the economy-wide allocation of resources. However, at the same time, "clever" and adaptive sectoral prioritisation proved quite successful in the most dynamic catch-up economies as a means to accelerate the redeployment of resources towards higher value-added activities and escape the low- and then middle-income traps. Viet Nam can learn from both experiences. Currently its approach looks more influenced by past planning practices than by the best "catch-up" models. The increasing priority given to innovation-driven development provides Viet Nam with a golden opportunity to implement its own variant of "smart specialisation" to catch up. This requires re-engineering existing sectoral policies to make them better tuned with the global market and knowledge dynamics, as well as more congruent with other national policies, especially S&T policy.

This is an ambitious goal but as a first step some initiatives could trigger further helpful changes. One to be considered is the launch of a public-private partnership (PPP) programme. OECD countries' experience indicates that PPPs are both the desired outcome of effective industry-science relationships and the best catalytic measure to boost the intensity and productivity of such relationships. PPPs take various forms and can be used to address various policy issues,[26] but their major contribution is to create sector- or technology-specific platforms for private firms and PROs to create or adapt jointly new advanced knowledge with a view to concrete application in the economy and society. In Viet Nam, in addition to a most welcome contribution to closing the wide gaps between public research and firms, a PPP initiative would ensure that each programme in favour of priority sectors would include a strong R&D and innovation component. It would also open a new channel for knowledge sharing and exchange between foreign firms and Vietnamese actors. A pilot programme, following a proven model (Box 5.14), could be launched by MoST, in collaboration with MoIT, in the relevant technological areas.

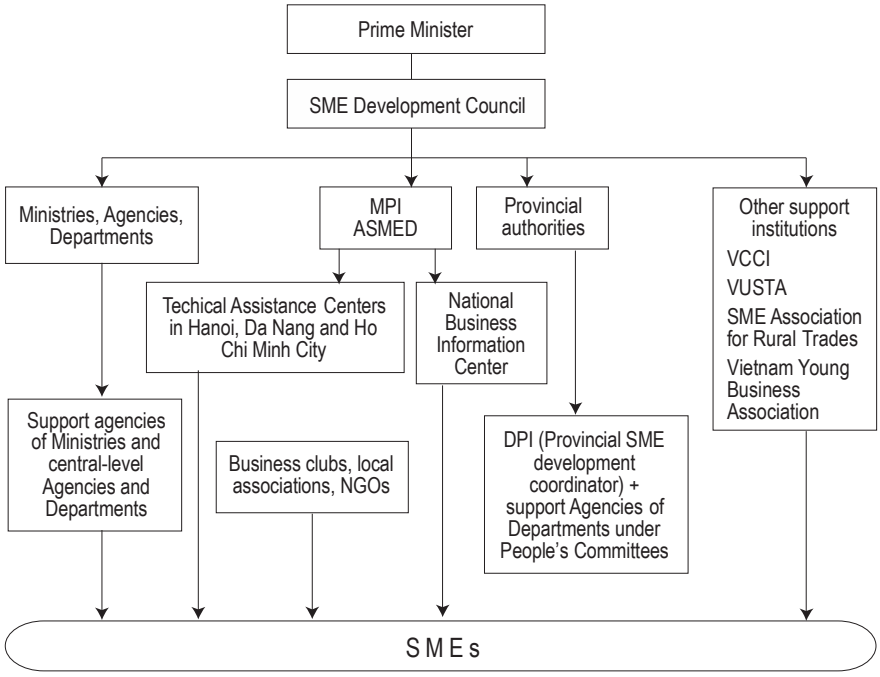
Promoting innovation in small and medium-sized enterprises

The Vietnamese private sector comprises a large number of micro, small and medium-sized enterprises. The vast majority are far from any innovation agenda, especially those that are based on various forms of necessity-driven entrepreneurship,

primarily but not only in rural areas. SME policy in Viet Nam has long pursued two main goals: poverty reduction and technical upgrading through the adoption of foreign technologies. The remarkable achievements in poverty reduction that led necessity-driven entrepreneurship to move rapidly towards more opportunity-driven entrepreneurship, the continuous development of a more sophisticated private sector, and the emergence of innovation hotspots around knowledge institutions and in high-technology parks allow Viet Nam to pursue a further ambition and engage SMEs as participants in the national innovation agenda.

When placing greater emphasis on innovation in their SME policies, Viet Nam will face two challenges. First, the variety of factors that influence firms' capabilities and incentives to innovate means that actions in a variety of areas of government policy must be co-ordinated on the basis of a clear-cut strategy. The quite well-developed SME policy framework can be used for this purpose (Figure 5.15). Second, the diversity of the population of small firms precludes any "one-size-fits-all" approach. In some sectors the bulk of innovations are due to new entrants or start-ups that challenge incumbents' market shares. But in most industries, SMEs contribute to the innovative process in a very different way. They operate in medium- to low-technology environments and innovate without engaging in formal R&D activities. They focus on improving production processes through the use of codified knowledge embedded in up-to-date equipment and on improving product design and marketing techniques through the use of tacit knowledge embedded in human resources.

Figure 5.15. SME support institutions in Viet Nam



ASMED: Agency for SME Development
MPI: Ministry of Planning and Investment
VCCI: Vietnam Chamber of Commerce and Industry
VUSTA: Vietnam Union of Science and Technology Associations

Source: OECD, based on ASMED, 2012.

OECD countries' experience demonstrates the importance of finding the right balance between measures addressing generic problems related to firms' size or novelty and more targeted actions to solve problems that are specific to particular types of firms. As noted above, the Ho Chi Minh City government is more advanced than the central government in learning from this experience. Best practice policies that should be implemented nationwide include the following main components:

- *Conducive framework conditions*. Their improvement, discussed in Chapter 2, would create a favourable climate in which entrepreneurs can more easily create firms, and would have more incentives to innovate and grow, and more means to do so, especially better access to the necessary resources at a reasonable and predictable cost.
- *Measures to build innovation capacities*. The Vietnamese government should not equate promotion of innovation in SMEs with support for technology diffusion. A too exclusive focus on supply-led technology transfer neglects the fact that the obstacles to innovation in most SMEs are internal to the firm and stem from deficiencies in labour skills and in organisational and managerial capacities. More emphasis should be given to: *i)* fostering an entrepreneurial culture; *ii)* building the "innovative and absorptive capacity" of firms through skills development and improved management; and *iii)* promoting e-business and developing innovation infrastructures that are easy to use by small innovative firms (see below).
- *Measures to facilitate financing of innovation.* For the vast majority of SMEs, policies to reduce financing gaps consist of tax incentives, grants, subsidised loans and loan guarantees (see above). For new technology-based firms (NTBFs), which play a vital role in dynamic innovation systems,[27] however, the provision of seed financing and the promotion of the development of venture capital (VC) are the most important measures. In this regard, the recent initiative to create the Venture Capital Fund for High Technology, which will have an initial capital of VND 450 billion, is most welcome, provided that it is managed as a complement rather than a substitute to private VC. However other initiatives might be warranted to ensure that the VC funds in Viet Nam can develop on the basis of an increasing flow of viable innovative projects. Here the development of seed funding plays a vital role, in addition to providing other benefits, most importantly a way to attract talented Vietnamese expatriates. There are different possible approaches to government provision of seed funding to would-be innovative entrepreneurs. One interesting example is the Russian Foundation for Assistance to Small Innovative Enterprises (Box 5.15).
- *Measures to promote networking and partnerships*. Even more than larger firms, SMEs depend on external sources of information, knowledge, know-how and technologies to build their innovative capability and reach their markets. For complementary knowledge and know-how, innovative firms increasingly rely on collaborative arrangements in addition to market-mediated relations (*e.g.* purchase of equipment, licensing of technology). Inter-firm collaboration within networks is now by far the most important channel for sharing and exchange of knowledge. Interactions are also intensifying between firms and a number of other institutions involved in the innovation process: universities, private and public research labs, providers of consultancy and technical services, regulatory bodies, etc. In OECD countries, government initiatives that explicitly address networking have developed quite recently, and this is thus an area in which

Viet Nam could attempt to leapfrog average practices. These initiatives address market failures at different stages of the networking process through SME-specific or less targeted measures: raising awareness of networking opportunities and helping to search for partners; organising, financing and operating networks; interfacing scientific and innovation networks through public-private partnerships (see above); and creating international linkages and building global networks.

Box 5.15. The Russian Foundation for Assistance to Small Innovative Enterprises

The Russian Foundation for Assistance to Small Innovative Enterprises (FASIE), also known as the Bortnik Foundation after the name of its initiator, was created in 1994 to support the creation and initial development of innovative SMEs. Today, with resources amounting to 1.5% of the total civil R&D budget, FASIE channels its support through seven main programmes:

- START provides assistance to would-be innovators in two stages: seed money for prototype development, test, patenting, etc., and start-up support. Up to RUB 6 million can be granted over three years, with RUB 1 million the first year, RUB 2 million the second, and RUB 3 million the third. There is no project selection in the first stage: all submitted projects can be funded; projects for the second stage are selected through competition. The support takes the form of fee-free, non-repayable grants (federal contracts).
- UMNIK (clever) supports young scientists who wish to undertake innovation projects. It benefits students, postgraduates and young researchers aged 18 to 38. Winners receive RUB 200 000 to advance their innovation projects and get training and, if selected for a second phase, they again receive RUB 200 000.
- PUSK (launch) supports projects developed through a partnership between a company and a higher education institution.
- TEMP (technologies for small enterprises) supports the acquisition by small companies of new technologies and engineering solutions by paying the licensing costs and the subsequent R&D expenditures for exploiting it (to be completed within three to four years).
- RAZVITIE (development) supports development and commercialisation projects in established small companies through a competitive process.
- STAVKA (interest rate) repays part of the interest costs of bank credits provided to small companies engaged in specific R&D projects.
- INTER supports small companies that are residents of special economic zones and designated techno-parks.

Source: OECD (2011c), *OECD Reviews of Innovation Policy: Russian Federation*, OECD Publishing, doi: 10.1787/9789264113138-en.

Providing supportive infrastructures to innovators

The availability of and easy access to appropriate physical and intangible infrastructure is crucial to the success of innovative firms. Among generic infrastructures, telecommunications are probably the most vital for an innovation community that is well connected internationally. Successive reforms and the positive contribution of public research[28] have allowed rapid progress in terms of the availability and cost of all forms of telecommunication equipment and services, with broadband penetration rates still low compared with the most advanced countries but at a fairly good level in the South Asian context, only below those in Malaysia (Box 5.16). For more innovation-specific infrastructures the situation is a bit bleaker.

Box 5.16. Sequence of reforms of the telecommunication sector in Viet Nam

Reform initiatives	1988	1993	1996	1998	2000	2002	2003	2004	2005	2006	2007	2008	2009
Foreign participation through "Business Co-operation Contract"													
Separation of the operator (VNPT) from the regulator (DGPT)													
Second operator (Saigon P&T) enters the market													
Signature of the US-Viet Nam Bilateral Trade Agreement													
Creation of the Ministry of Post and Telematics													
Post and Telecommunications Ordinance of 2002													
Accession to the World Trade Organization (WTO)													
Creation of the Ministry of Information and Communications													
Licensing of 3G mobile market													
Passage of the Law on Telecommunications in 2009													

The new law on telecommunications

In accordance with its WTO commitments, at the end of 2009 Viet Nam formally passed a Law on Telecommunications. This law established only a general framework for regulations to be developed in the future. For example, it divides telecommunications services into two categories – basic and value-added – without defining precisely the scope of each category. Also, it provides a new legal basis for foreign investment in the telecommunications sector but does not specify any ceilings for each of the service categories. It includes provisions for a pro-competitive regulatory regime, covering aspects such as abuse of market power, regulation, interconnection rules and access to essential facilities. The government retains control over fixed telephone service charges but operators are now free to determine retail tariffs for other services. Yet for "important" services, such as mobile services and the Internet, operators need to pre-register their proposed tariffs with the Ministry of Information and Communications (MIC). The law creates a regulatory authority in charge of competition issues in the telecommunications sector and of the settlement of disputes regarding interconnection and infrastructure sharing.

Source: Adapted from Lee (2011).

Table 5.7. Asia's broadband markets ranked by household penetration rate, June 2011

High (over 60%)	Medium (5-40%)	Low (0-5%)
Singapore (100%)	Malaysia (35%)	Indonesia (3%)
Korea (95%)	People's Republic of China (30%)	Cambodia (1%)
Hong Kong, China (83%)	**Viet Nam** (21%)	Laos (1%)
Chinese Taipei (70%)	Thailand (15%)	
Japan (65%)	Philippines (10%)	
	India (5%)	

Source: BuddeComm, www.budde.com.au.

First, Viet Nam's legal framework for technical norms and standards is of recent origin. The Law on Standards and Technical Regulations took effect in January 2007 contributed to improving Vietnam's legal framework to facilitate its accession to WTO in the same year. The Law on Goods and Product Quality in July 2008, and the Law on Metrology was enacted at the end of 2011. Following accession to the WTO, Viet Nam's Directorate for Standards, Metrology and Quality (STAMEQ) became the central inquiry and notification point under the WTO Agreement on Technical Barriers to Trade. Initially established under STAMEQ, the Bureau of Accreditation was placed directly under MoST in 2010. Viet Nam's system of standards still reflects the current state of industrial development although it has much improved in recent years. For example, some items are either subject to national standards or to multiple agencies standards (some are subject to both), and the level of harmonisation with international standards remains to be improved In order to help innovators that require easy access to world markets to build fluid user-producer relationships, the government should speed up its effort to build a modern national and fully internationally compatible system of norms and standards.

Second, the physical research infrastructure in universities and public institutes remains underdeveloped. Many R&D subsidies do not have the expected impact because the beneficiaries lack the scientific instruments needed to implement the projects concerned. The high cost of mostly imported up-to-date equipment is a major problem. Capital expenditure represents a larger share of total S&T expenditures in Viet Nam than in many other countries because of the relative prices of labour and imported equipment. There are some indications, however, that the composition of expenditure has become more balanced in recent years. International aid, which is mainly granted to universities, does not bridge the gap between present budget appropriations and real needs, and even less if one considers that it is often channelled through organisation-specific bilateral agreements. The fragmentation of the public research landscape aggravates the problem. Also, the traditional division of labour separating the management of capital investment and funding of S&T activities – between MoPI / MoF and MoST – is not optimal. Recent regulations (Decision No.1244/QD-TTg of the Prime Minister in 2011 and the 2013 Law on Science and Technology) stipulates that "the Ministry of Planning and Investment and Ministry of Finance will develop financing schemes for capital expenditure and S&T expenditure on the basis of MoST's proposal" to ensure the focal role of MoST in the management of nationwide S&T activities. The efficiency of investment could be improved by exploiting more systematically the opportunities of shared use of the most expensive scientific instruments, which – as a side effect – would foster co-operation between research bodies; or creating a single fund to channel S&T capital expenditures according to national priorities. Pooling foreign aid would be preferable but might be difficult to achieve without running the risk of draining some sources. An exhaustive and up-to-date inventory of medium and large scientific instruments would be necessary to implement both measures.

Third, as an institutional legacy of the past policy paradigm which emphasised almost exclusively supply-driven transfer of technology from public research or abroad to non-R&D-performing industrial organisations, Viet Nam has an unusually large number of organisations dedicated to this one-way knowledge diffusion with a variable thematic or geographical focus. They operate within an extremely complex legal framework.[29] Their functioning, if not their very existence, must be questioned now that the government wants to boost business-led domestic innovation and the development of a knowledge market, using Techmart activities as a stepping-stone. Only a systematic and comprehensive evaluation could tell which of these organisations remain relevant as they are

(e.g. probably the organisations in charge of technology transfer to farmers and SMEs in rural areas), which have the capacity to transform themselves into (two-way) bridging institutions, and which must be closed down to leave room to the private services sector.

Finally, the experience with techno-parks is mixed. The Saigon high-tech park (Chapter 3, Box 3.3) is now operational – helped, among others, by the generosity of the tax incentives to attract tenants (Box 5.17) – and its potential looks good. The high-technology park in Da Nang, which is still under development, looks promising, with over half the land designated for facilities related to scientific and technological R&D as well as high-technology human resource training. However, the Hoa Lac high-tech park, the first large-scale project of this kind, has met with various problems which have stalled its development for years. Some strategic decisions need to be taken to put it on the right track and to meet the requirements of foreign firms', delays in land clearance, and to overcome the reluctance of some institutions to relocate some of their facilities.

Box 5.17. Incentives to attract companies to the Saigon High-Tech Park

Investment is welcomed in four priority sectors: micro-electronics, information technology and telecommunications; precision mechanics and automation; biotechnology applied in agriculture, pharmaceuticals and the environment; and nanotechnology and new and advanced materials. Investment in SHTP can take various forms: high-technology manufacturing, high-technology services (call centres, data centres, software development), R&D, incubation and training.

Incentives to attract companies to the Saigon High-Tech Park include:

- No corporate income tax (CIT) for the first four years, followed by nine years at 5% and ten years at 10%, plus CIT exemption and reduction for five years for expansion of investment.
- VAT and import duty exemption for: equipment and machinery; construction materials that are not locally produced; materials and supplies; and specialised means of transport.
- Exemption from VAT and export duty for high-technology products.
- Similar personal income tax (PIT) for both local and foreign workers.
- Other, softer incentives include:
  - Multiple entry visas for expatriates
  - One-stop investment application service
  - On-site and electronic customs clearance.

Source: SHTP website, www.eng.shtp.hochiminhcity.gov.vn/.

Harnessing global opportunities

A country like Viet Nam, which made heroic efforts and paid a high cost to achieve political independence, might have chosen inward-focused development, with very narrow open door policies, as the basic catch-up strategy. This has not happened. Vietnamese policy decision makers are well aware that the Chinese model, which features trade liberalisation and openness to foreign investment, is more appropriate than the past successful Korean and failed Latin American models which featured import substitution and development through national champions. In addition, Viet Nam experienced early on the benefits of international co-operation and knowledge exchange for remediating and reducing poverty, modernising agriculture, and developing not only basic education but also, as noted above, research in universities.

WTO accession was the highlight of this gradual but irreversible integration in the multilateral trading system. Today, "the devil is in the details" and if Viet Nam wants to harness global opportunities to achieve a more innovation-driven catch-up process rapidly, it needs to remove the obstacles that hinder its progress. It should obviously continue to use intensively and develop an already quite dense web of international relationships between the public sector and foreign counterparts (inter-governmental bilateral and multilateral co-operation on S&T, participation of PROs and universities in global research and educative networks), but its bureaucratic approval processes would probably need to be lightened (Box 5.18). It should also clarify its strategy on two more burning issues: how Viet Nam should play its card in the global competition for attracting the best parts of the value chains of multinational enterprises and in the global competition for talent.

Box 5.18. New rules for foreign co-operation and investment in S&T

Decree 80/2010/ND-CP (2010) on foreign co-operation and investment in S&T sets the following new rules for foreign investment in S&T:

- The authorities must be informed when an agreement takes effect within 15 days of the date of execution.
- S&T organisations using foreign funding must first obtain approval from the authorities and fulfil investment conditions and meet environmental standards. These include applying for an investment certificate and submitting a charter detailing the scope of activities, human resources and facilities.
- The local people's committee where the office is located must approve the project.
- Foreign S&T organisations wishing to open representative offices in Viet Nam will only be allowed to do so after one year of operation in Viet Nam. They will only be allowed to open a branch after five years of operation in their country.

Decree 80/2010/ND-CP (2010) is under revision to be in line with the 2003 Law on Science and Technology and to help remove bottlenecks which in practice.

Source: Vietnam Briefing, 22 July 2010, www.vietnam-briefing.com/news/decree-sets-rules-foreign-investment-science-technology-industry.html/.

Embedding better foreign investment in the national innovation system

How can Viet Nam induce foreign investors that are primarily attracted by low labour costs to contribute more to the development of higher value-added activities, directly through more R&D-intensive projects and indirectly through localised knowledge spillovers? This is a difficult challenge, one that countries with more attraction power, *e.g.* larger domestic markets for innovative products and a larger pool of highly qualified labour, have been struggling with for some time. Their experience provides interesting lessons.

The first is that the host government must be patient. Spillovers from foreign firms to domestic enterprises take time to materialise, as different channels (labour mobility, informal contacts, user-producers relationships, inter-firm research co-operation) need to become more and more effective. This points to the importance of opening the PPP initiative advocated above to foreign actors and of measures to upgrade the innovation infrastructures and the capacities of domestic firms.

The second is that governments cannot neutralise through regulation or extra incentives the factors that prevent multinational firms from investing in high value-added activities in some locations and/or from developing linkages with domestic suppliers, such as the shortage of a highly skilled workforce and/or of competent local partners, and the uncertainty of the business environment.

In this regard, some provisions of the new Law on High Technologies (Box 5.19) are problematic: a minimum of 1% of annual turnover to be spent on R&D, and staff with master's or higher degrees to account for at least 5% of the total workforce in a country which has a shortage of highly skilled labour, and an average turnover from high-technology products of at least 60% of the firm's total annual turnover during the first three years and to 70% from the fourth year. As regards the latter criterion, for example, it should be noted that industries operating in modern global value chains classified as "high technology" on the basis of standard international classifications may actually perform low value-added assembly activities using high-value imported intermediates; an uncritical application of this criterion may overstate the sophistication of the activity performed and therefore be misleading. In fact the law proved inapplicable during negotiations with leading high-technology companies. Projects by firms like Intel, Samsung and Nokia failed to meet the criteria spelled out by the law, and it took a decision of the prime minister to grant them the incentives. At the same time it is probable that many smaller firms with lower visibility and bargaining power were discouraged.

Box 5.19. The Law on High Technologies

The Law on High Technologies of 2008 aims at boosting the development of technology-intensive sectors, notably by attracting foreign investors. It provides a number of incentives to eligible firms and projects, notably:

- Very favourable conditions on the corporate income tax, the value-added tax, import duty and export duties, and the land-use levy.
- Access to financial support from the national high-technology development programme and other relevant public funds, for the development of human resources, technology transfer, the development of R&D infrastructures and the promotion of high-technology incubation.
- Access to the newly established high-technology venture fund.

To be classified as high-technology and thus eligible for these incentives, an investment project must meet the following main legal requirements:

- At least 1% of the total annual turnover in the first three years of operation must be spent on R&D and more than this amount from the fourth year on.
- The number of workers with master's or higher degrees personally involved in R&D activities must account for at least 5% of the project's total workforce.
- The average turnover from high-technology products must be at least equal to 60% of the firm's total annual turnover during the first three years and to 70% from the fourth year.
- The project must also apply environmentally friendly and energy-saving solutions to production and product quality management and meet Viet Nam's standards or technical regulations. If Viet Nam does not yet have standards or technical regulations, the standards of international specialised organisations apply.

Source: Tran Ngoc Ca (2011a), "Review of Vietnam's Innovation Policy", background paper prepared for the Joint OECD-World Bank Review of Vietnam's National Innovation System", NCSTP-MoST.

Turning brain drain into brain gain

Increased R&D-intensive foreign investment will provide opportunities for some highly skilled expatriates to return home. But as noted above, it will be hard to remove the HRST bottleneck that hinders a rapid strengthening of the national innovation system without tapping more directly into the Vietnamese diaspora. The question is the stage of the brain circulation process that Viet Nam should emphasise: encourage more Vietnamese students to study and/or gain professional experience abroad; raise the country's attractiveness to potential returnees; or both. Both would probably be best, but a particular emphasis should be placed on attracting back expatriates, as the proportion of students studying abroad has been increasing continuously and is now already quite large by international standards, and brain drain has been particularly strong for S&T researchers.

Box 5.20. NANOGEN: Cumulative brain gain in high-technology activities

NANOGEN was founded in 2000 and became in 2002 one of the first tenant of the Saigon High-Tech Park. It is a leading company in research and manufacture of biopharmaceutical active ingredients and therapeutic injections from recombinant DNA and protein technology in the Asia-Pacific region.

It was created by a returnee from the United States and has built a team of highly qualified scientists in diverse fields of biotechnology, pharmaceutical and support personnel in health care, which includes foreigners and younger returnees.

Source: Field visit by the OECD-World Bank Review team.

Success stories demonstrate the possibility and immediate positive impact of attracting qualified S&T expatriates (Box 5.20). However, it is often serendipity rather than government initiatives which explains these achievements. The existing initiatives are too piecemeal and sectorally segmented *(e.g.* the government has recently launched specific training programmes as part of large software projects, including some measures to attract expatriates with the relevant skills). There is a case for a more forceful approach whereby government would concentrate significant means to scout potential returnees and provide them with powerful incentives to return.

The government should feel encouraged by the fact that many countries have implemented some form of an integrated "home sweet home" programme, with reasonable success. Chinese Taipei pioneered by making the Hsinchu Science and Industrial Park a very powerful magnet. Lately, Russia – which suffered a huge exit of engineers and scientists in the 1990s – has taken measures to attract leading foreign scholars and scientists to universities and research organisations, with the Russian diaspora the main target.[30]

Notes

1. A pilot enterprise survey of over 200 000 firms showed that in 2008 they spent on average only 0.27% of their pre-tax profits on innovation, of which one-third for R&D and two-thirds for technological modernisation.
2. "Technological congruence" is a concept proposed to explain countries' differing capabilities to participate in the benefits of technological change (Antonelli, 2010).
3. The following paragraphs on the general features of economic reforms in Vietnam draw on De Vylder and Fforde (1996); Rondinelli and Litvack (1999); Le Khuong Ninh (2003); Le Huu Tang and Liu Han Yue (2006); and Thi Kim Cuc Nguyen (2010).
4. From VND 368/USD in 1987 to VND 4 300/USD in 1989.
5. The official name of North Viet Nam from 1945 to 1976.
6. It was among the 20 poorest countries in the world, in terms of GDP per capita.
7. Before 1986 there were only two main economic sectors, the state and the co-operatives.
8. Thien Tran *et al*. (2011).
9. Initially six centres were put under the management of corporations, paving the way for many centres to be transferred from Ministries to state-owned enterprises in the coming years. Thus, in essence, Decision 782 is the launch for Decree 115 afterwards.
10. DoSTs only receive a portion from the central budget (through MoST) in case of unexpected tasks.
11. As stated in the Proposal on the Reform of the S&T Management Mechanism, there is no "clear delegation and decentralisation of rights and responsibilities from Ministries, branches and the central government to localities" (Decision 171/2004/QD-TTg).
12. According to Decree No.20/2013/ND-CP, issued in 2013, defining the functions, tasks, powers and organizational structure of the Ministry of Science and Technology.
13. The 2013 Law on Science and Technology made some improvements in this regards. A Decree on financing and investment regarding S&T activities is currently drafted by MoST.
14. Approved by the Communist Party Congress in 2011, the corresponding 2011-15 Socioeconomic Development Plan was then passed by the National Assembly.
15. For example in Ho Chi Minh City, activities such as energy saving and renewable energies, chemicals and pharmaceuticals, and nine service sectors were added to the national priority list.
16. Such as the 863 Programme (OECD, 2008).

17. The national research institutes (NRI) that report administratively to the prime minister and are supervised by the VAST and the VASS and the R&D units (laboratories and institutes) under line ministries or under the control of other government agencies.

18. The eligibility criteria are stipulated by Decree 119/1999/ND-CP on financial support to enterprises.

19. "In the new market economy, the number and extent of regulations have become one of the principal barriers to Vietnam's industrialisation. These regulations, we were told, make it impossible to compete. They result in confusion, conflict, and corruption." (Bezanson et al., 1999)

20. Over 2005-08, Vietnam issued more legal normative documents that affected business than in the previous 18 years (1987-2004). In addition, during 2005–08, the number of official letters containing legal standards more than tripled compared to the previous 18 years (Ketels et al., 2010).

21. Project 30 took a comprehensive approach to simplifying at least 30% of all administrative procedures in 2010. Over 5 700 administrative procedures at all four levels of government in all 63 provinces have been collected in an electronic database. They will be reviewed and then abolished, simplified or remain. The review process is using the principles of regulatory impact analysis (RIA) to assess the legality, necessity and business friendliness of these procedures. Project 30 has been conducted by a special task force in the Office of Government (OOG) with the involvement of international agencies (mainly USAID) and the private sector through the Advisory Council for Administrative Procedures Reform (ACAPR). A new agency, the Administrative Procedures Control Agency, has been set up in OOG to continue the work of Project 30.

22. Following the practice followed successfully for years in countries such as Korea and Singapore.

23. The current Charter places a cap of 70% on the proportion of "internal" members (including the rector, Party secretary, lecturers, researchers, management staff). By international standards, this cap is too high.

24. From 2001 until 2008, Korea had the Korea Science and Engineering Foundation (KOSEF) under the Ministry of Science and Technology (MoST), the Korea Industrial Technology Foundation (KOTEF) under the Ministry of Commerce and Industry (MCIE), and the Korea Research Foundation (KRF) under the Ministry of Education (MoE). From 2008 and following the merger of MoST and MoE (MEST) and the creation of the Ministry of Knowledge Economy (MKE) these were consolidated into two foundations: the Korea Foundation for Industrial S&T under MKE and the Korea Foundation for Fundamental S&T under MEST. Lately the Korean government has envisaged merging these two foundations into a single institution, the National R&D Institute.

25. Income from R&D is exempted from corporate tax; equipment, machinery and material used directly for R&D that cannot be produced in Vietnam are exempted from import duty and VAT; pilot projects are exempted from corporate tax and VAT; newly created firms in the context of high-technology or R&D projects enjoy a reduced corporate tax of 10% for 15 years; profits from products manufactured by technology applied in Vietnam for the first time are exempted from corporate tax; etc. (Manh Quan Nguyen, 2011).

26. These include: funding early-stage technology development; providing a means by which universities, and public and private research contractors can be funded to help companies (usually SMEs) to upgrade their technological competences and receive expert advice; fostering the development of technical standards and developing the technologies needed for innovation-friendly regulation; enhancing the capacity for innovation and economic competitiveness of individual regions or local areas and the development of high-technology geographical clusters; enabling innovation in goods and services purchased by public-sector bodies; and promoting the development of technologies, products and services to meet the needs of the public sector and social needs more generally.

27. A long time ago Schumpeter argued that new firms are indispensable "agents of technological change", not only because they open new routes for the commercialisation of knowledge, but also because their competitive pressure prompts incumbent firms to become more innovative. Recent economic research has expanded this argument and adduced substantial evidence that NTBFs fulfil an increasingly important role in a knowledge-based economy, both directly as generators of new products and services and indirectly as catalysts to improve knowledge interactions in national innovation systems.

28. The VAST Institute of Information Technology nurtured the first Internet provider, NetNam, and has subsequently helped to implement telecommunication solutions adapted to lagging and remote regions (e.g. WIMAX).

29. Decree 119, the Law on S&T, the Law on Technology Transfer, the Law on Investment, and the Law on High Technologies all have provisions regarding technology transfer.

30. It is estimated that more than 200 000 qualified scientists fled Russia during the most difficult times of the economic transformation. A programme was launched in April 2010 (with a budget of RUB 12 billion for 2010-12) to attract Russian scientists working abroad and other world-class foreign scientists. Funding is provided on a competitive basis to Russian teams that work under the guidance of the selected scientists. They must spend at least two months each year in Russia.

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