AUSTRALIA-WORLD BANK GROUP STRATEGIC PARTNERSHIP IN VIETNAM

Vietnam: Enhancing Innovation System

Vietnam: Science, Technology and Innovation Report 2020

BỘ KHOA HỌC VÀ CÔNG NGHỆ

WORLD BANK GROUP

Vietnam: Science, Technology and Innovation Report

2020

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The STI Report is co-task managed by Asya Akhlaque (Lead Economist) from the Finance, Competitiveness and Innovation (FCI) Global Practice (GP), and Kurt Larsen (Senior Education Specialist) from the Education GP starting from July 2019 and prior to that, Dilip Parajuli (Senior Education Economist). The STI Report consists of the Main Report and an accompanying Policy Brief. The main report is authored by Asya Akhlaque, Jaime Frias (Senior Economist), Xavier Cirera (Senior Economist), with skills inputs from Kurt Larsen, Dilip Parajuli, Koji Miyamoto (Senior Economist) and Syd M. Dinlemez (Consultant), and innovation ecosystem inputs from Lien Anh Pham (Senior PSD Specialist), Anne Lopez (Economist, Consultant), Gaurav Nayyar (Senior Economist), Brian Mtonya (Senior Economist) and Shanthi Divakaran (Senior Financial Specialist). Excellent logistical support is provided by Nga Thi Phuong Bui, Huyen Thi Thanh Le, Hoa Chau Nguyen, Mary Dowling, and Susana Rey.

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- Review of Vietnam's STI Strategy 2011-2020, and STI policies and Resolutions was authored by Dr. Le Dinh Tien with key inputs from Dr. Tran Ngoc Ca, Lien Anh Pham and Anne Lopez.
- Vietnam: Policy Effectiveness Review was jointly authored by Jaime Frias and Xavier Cirera with valuable background inputs and support from Nguyen Thu Oanh, Lien Anh Pham and Dilip Parajuli.
- The Future of Manufacturing-led Development in Vietnam was authored by Gaurav Nayyar.
- Enterprise Innovation System Diagnostic was authored by Asya Akhlaque and Anne Lopez with inputs from Lien Anh Pham, Brian Mtonya, Kurt Larsen, Koji Miyamoto and Dilip Parajuli.
- Early stage financing – Venture capital industry and Angel investing note was authored by Shanthi Divakaran (Senior Financial Specialist) drawing on a background study by Stoxplus and core inputs from Lien Anh Pham and Asya Akhlaque. Alwaleed Fareed Alatabani (Lead financial Specialist) provided valuable guidance.
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Motivation & objective

1. The science, technology and innovation (STI) report provides analytical support for Vietnam's upcoming ten-year science and technology innovation (STI) strategy 2021-2030 and the socio-economic development strategy (SEDS) 2021-2030. The STI report has been prepared in response to a request from the Ministry of Science and Technology (MOST). The new STI strategy is expected to contribute to a strengthened national innovation system (NIS) that would promote a more innovation-driven enterprise sector, and in turn lead to sustained high-growth in Vietnam (Box 1). As the Covid-19 triggered economic shock continues to spread globally and its impact deepens in Vietnam,[1] the importance of innovation and technology adoption for business resilience as well as for productive growth has been amplified.

1 Vietnam has had impressive success in limiting the human costs of the COVID which is attributed to the effective early action on social distancing and mobility restrictions. At the same time, there has been massive reduction in economic activity as the virus has spread throughout the world – including Vietnam's trading partners – with countries implementing various forms of lockdown. Vietnam's economy grew by 2.9 percent in 2020 – the lowest growth since the last three decades. While the medium-term outlook for Vietnam is overall favorable, significant downside risks are present, including the potential for more severe and longer impacts of COVID and weaker external demand, as well as greater than anticipated constraints on growth due to the unfinished structural reforms (EAP Economic update, World Bank, April 1, 2020). COVID-19 is also expected to impact human capital through disruption of schooling and skills development; the costs are expected to be substantial. Learning and skill formation is crucial to Vietnam's human capital and innovation capacity.

BOX 1. **Conceptualizing innovation beyond formal R&D**

Innovation is defined as the introduction and adoption of new products, technologies, business processes, business models and ideas in the market, as well as invention of new ideas.

Traditionally, innovation has been viewed through the narrow lens of science, formal research and development (R&D) and inventions. This report conceptualizes innovation more broadly as enterprises adopting existing knowledge that has already been generated as well as new knowledge as salient for enhancing productivity and growth. The potential gains from adoption and diffusion of existing technology are vast, yet paradoxically limited effort is invested by governments, including in Vietnam, to realize these gains.

Source: Cirera and Maloney (2017).

2. In undertaking the analysis, the following three questions are addressed:

- What progress has been made towards meeting the broad directions set out in the 2016 *Vietnam 2035* report in terms of strategic shifts in the STI policy framework and its implementation?
- What are the remaining critical gaps within the NIS – from the demand and supply side – that are hindering Vietnamese firms from improving their capacity to adopt technology and innovate? In light of global shifts that have become more acute with the evolving covid-19 crisis, are there new policy areas that deserve attention?
- What are the priority recommendations, and how can solutions be devised?

Context

3. Vietnam has been a trail-blazer in its development journey over the last 3 decades. The country has emerged as a vibrant middle-income economy in just one generation. The economy has expanded at an annual average of nearly 7 percent since 1988 leading to an almost five-fold increase in its per capita income and a continuing decline in poverty. Growth has been partly propelled by trade openness and export-orientation that capitalized on the country's comparative advantage in low-cost labor-intensive manufacturing.[2] Vietnam has successfully carved out a role for itself within global value chains (GVCs) and continues to attract high levels of foreign direct investment (FDI).

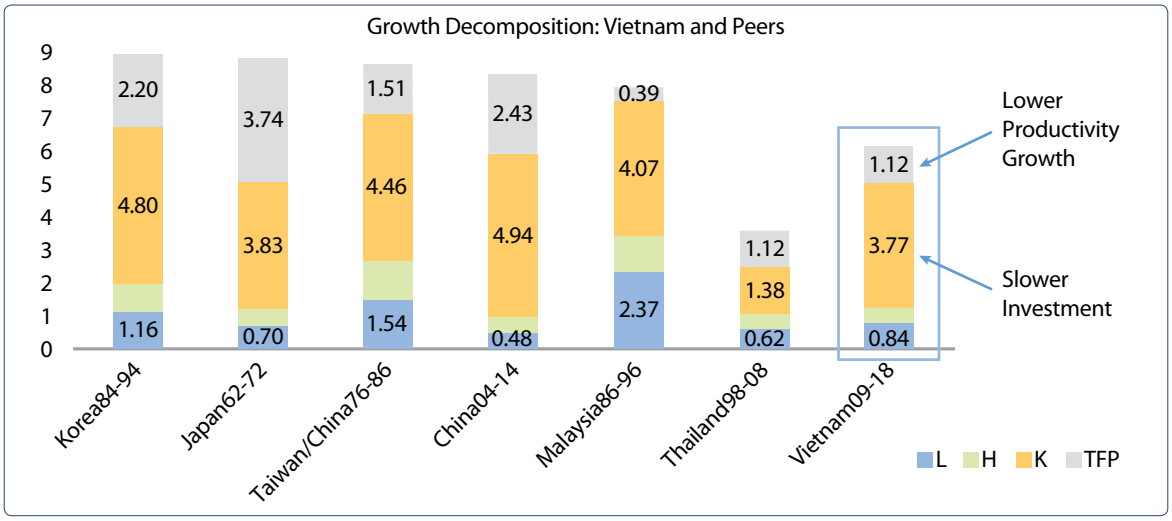
4. Vietnam is now making preparations for its next economic transformation *but* at a time of an increasingly challenging domestic and global operating environment. After outpacing countries that were at similar levels of development 30 years ago, Vietnam's ambition is to catch up with an impressive set of aspirational peers in the region.[3] Gains from structural transformation – workers moving from lower productivity agriculture to higher productivity manufacturing and services – is however running its course. The growth drivers of the past were heavily reliant on an expanding labor force and capital deepening – both foreign direct investment (FDI) and domestic – and less

2 In addition to outward orientation, Vietnam's "miraculous" growth is attributed to policies that led to investment in basic human capital and sound economic governance (Mason and Shetty, 2018).

3 The Government requested the Bank team to select as benchmark countries the following regional and other Asia-Pacific aspirational peers: Malaysia, Singapore, South Korea, China, Philippines, Thailand, Indonesia, South Africa, Turkey and Australia. It is well-worth noting all these countries have higher incomes than Vietnam – albeit not all of these countries are performing at their potential.

on productivity growth (Figure 1). With wages rising, Vietnam's current comparative advantage in relatively labor-intensive and low value segments of global value chains is eroding. Demographic shifts of an aging population and shrinking work force also have implications for its labor-intensive growth model.[4] As the country's demographic dividend begins to dissipate, neighboring countries – such as Cambodia and Myanmar – are emerging as competitors for Vietnam for low-skilled production jobs. There is also limited fiscal space to address development investment needs in infrastructure and human capital in light of the emerging macroeconomic vulnerabilities that have led to rapid accumulation of public debt.[5]

FIGURE 1: **Growth in productivity and investment has been slower than in most peers**



Source: WB 2019.

5. Domestic challenges are compounded by dimming global growth prospects and trade policy uncertainties; prospects for new growth pathways, nonetheless, exist. Vietnam is facing slower global growth and shifting trade patterns.[6] The rise in protectionism and the escalating China-US trade war makes Vietnam's economy vulnerable, given its strong trade and investment links. On the other hand, while Vietnam is likely to be negatively impacted by a slowdown in global growth, trade diversion could lead to Vietnamese exports replacing some Chinese exports to the us that could be subject to higher import tariffs.[7] The expanding Asian consumer markets with increasing demand for processed goods present growth opportunities for Vietnam. The rise of the knowledge economy and service exports is promising but requires a new and complex set of skills and production processes.

4 Vietnam is one of the top 5 countries in the world in terms of the speed of population aging. The share of the population that is of working age peaked in 2013, and the rate of increase of the labor force has slowed to about 1% per year. By 2050, the share of the population aged 65 or above is expected to reach 21% (*Vietnam Future Jobs Report,* 2017).

5 Vietnam has maintained stability in recent years but the macroeconomic buffers remain thin with sizable and persistent fiscal deficits leading to the rapid accumulation of public debt, which increased from 52.3 percent of GDP in 2010 to 58.4 percent of GDP in 2018 despite the high rate of growth. This could potentially inhibit future growth.

6 Global growth is expected to slow down over the next two years with risks of greater trade tensions and volatility in financial markets. The growth in trade and investment flows are thus likely to be more moderate. Refer to World Bank's *2019 Global Economic Prospects* report.

7 Both the US and China are major trading partners for Vietnam, and according to one estimate the country is expected to "incur non-trivial but manageable impacts". See the note on "Trade War and Implications for Vietnam", World Bank, Sept. 2018.

The new trade agreements like the *Comprehensive Progressive Agreement for Trans-Pacific Partnership* (CP-TPP) *and the EU-Vietnam Free Trade Agreement* (EVFTA) can be similarly leveraged.[8]

6. New technologies[9] that are associated with industry 4.0, combined with existing digital and information technologies,[10] are disrupting production processes and changing the nature of work. Technological change has always been a driver of productivity. What is different and disruptive about these technological changes now is the pace of the change, and the types of tasks that can be substituted by machines and software. Furthermore, there is a concern that labor-saving technologies, which are among the most emphasized in industry 4.0, may alter the nature of comparative advantage and the structure of demand for labor worldwide. These forces are expected to reshape Vietnam's manufacturing-led export strategy with the potential for losses in jobs, but also to open opportunities for technological catch up and new avenues of growth.[11] Having the right skills mix and institutions can potentially transform "replacing" technologies into "enabling" technologies.[12]

7. Vietnam's tremendous achievements notwithstanding, looking forward the pace of convergence to high-income status will depend on its ability to move towards an innovation-driven growth model. Vietnam's future growth trajectory will depend on its preparedness to tackle risks and take advantage of the emerging realities. Government is cognizant of the need to focus its attention squarely towards improving productivity and innovation to serve as a bulwark against the forces changing global and regional economies, and to realize its future development ambitions.[13] The industry 4.0 Paradigm is likely to be more demanding in some of the complementary factors – including core competences in relation to key business and management practices, the regulatory business environment and digital infrastructure – needed for innovation and technology adoption. Vietnam's governance institutions and public sector capabilities will need to evolve in step with the needs of a market economy as well as to meet the complexities of industry 4.0 Transformation.

8. The challenge for Vietnam is to urgently identify and unlock the policy, institutional and governance levers that are binding and holding back productivity and innovation.[14] As figure 2 indicates, productivity and innovation are inter-twined. Productivity growth can be decomposed into three main components: the reallocation of resources from low-productivity firms

8 The EU-Vietnam Free Trade Agreement (Secutresd) was ratified by the National Assembly in June 2020.

9 These technologies include robotics (particularly artificial intelligence [AI]-enabled); digitalization and Internet-based systems integration (IoT), including sensor-using "smart factories" (that may also be AI-enabled); and 3-D printing.

10 These represent the key elements of Industry 3.0, the integration of which into business operations remains far from complete across and within countries.

11 World Bank (2017). "Trouble in the Making? The future of manufacturing-led growth development."

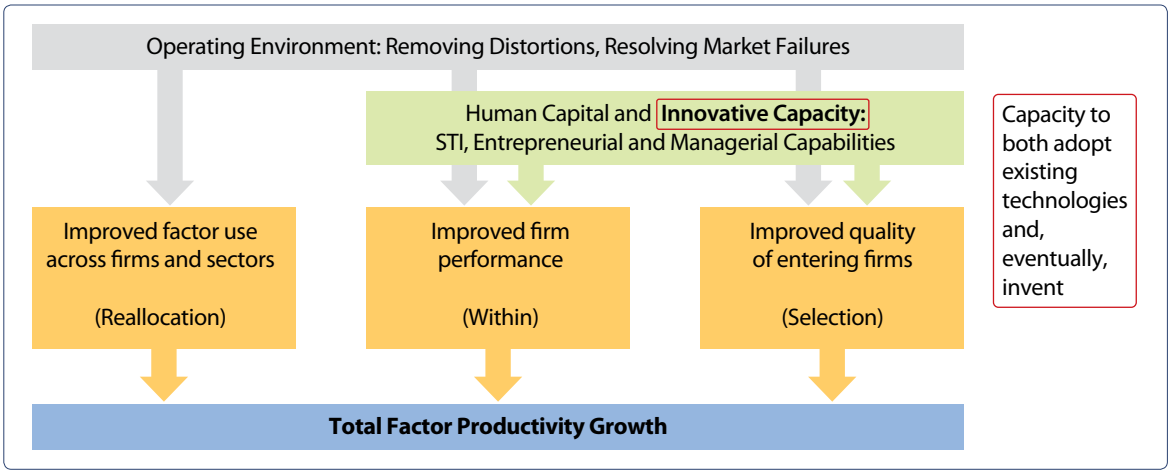
12 Enabling technologies expand the productivity of labor and lead to higher employment and wages. Examples include computer-aided design (CAT) and statistical software for economic analysis. Replacing technologies, in contrast, substitute for labor, making workers less useful and lowering their wages. For instance, investments in cargo handling machinery can reduce the demand for loaders at shipping ports. Instead, workers with more knowledge intensive skills, such as computer literacy and logistics, will be needed to ensure that the shipments run accurately and on time. Source: Acemoglu and Restrepo (2017) and Acemoglu and Autor (2011).

13 A growing body of evidence has shown that increased innovation activity has a measurable and positive impact on firms' productivity, which in turn improves a country's overall competitiveness. Refer to Mohnen & Hall, 2013.

14 The recent World Bank study (2018), *"A Resurgent East Asia: Navigating a changing world"* has also emphasized that policy makers in East Asian countries, including Vietnam, should focus on enhancing productivity and innovation to sustain future growth.

to high-productivity firms (the "between" component); increases in productivity through upgrading within existing firms (the "within" component) and entry of high-productivity and exit of low-productivity firms (the "selection" component).[15] Two of the three channels i.e., upgrading of existing firms and entry of new firms – are partly driven by the innovation capacity within enterprises. While improving the operating environment of the enterprises – be it through resolving market failures, removing distortions, and/or opening to trade – is necessary,[16] it may not be sufficient to improve productivity unless the government and firm level capabilities are addressed.[17]

FIGURE 2. **Technology adoption is a critical driver of productivity growth**



Source: WB 2019.

9. This report will highlight specific changes in policies and propose institutional options to strengthen technology adoption and innovation in enterprises to inform the new STI strategy 2021-2030 and the SEDS 2021-2030. Towards this end, section 2 presents the conceptual framework for the study. A brief overview of the current STI policy institutional framework is presented in section 3. The aim is to understand if the strategic shifts identified are translated down to the level of relevant STI laws and policy framework. It also provides a snapshot of the enterprise sector in Vietnam. Section 4 reviews the state of Vietnam's developing national innovation system (NIS), and identifies the recurring gaps that hinder Vietnamese enterprises from adopting and applying technology. The coherence and quality of STI policies – the last pillar of the NIS – is examined in section 5. Section 6 reviews the implication of the emerging domestic and global shifts and how they inform the new STI strategy. Section 7 provides a roadmap of priority reform actions that are needed to reset the new STI strategy towards business innovation and technology adoption.

15 This framework is drawn from Cusolito and Maloney (2018).

16 All three channels of productivity are influenced by external factors that pertain to government policies and market conditions and are deemed outside the control of individual firms. These may include, among other things, the policy environment for competition and private-sector investment; trade integration; spillovers from FDI; access to finance and capital allocation; and education and skills quality and labor market regulations. While this categorization has its limitations, as many within-firm factors are also affected by the external environment, it provides a useful tool to gain insights into the main determinants of productivity growth.

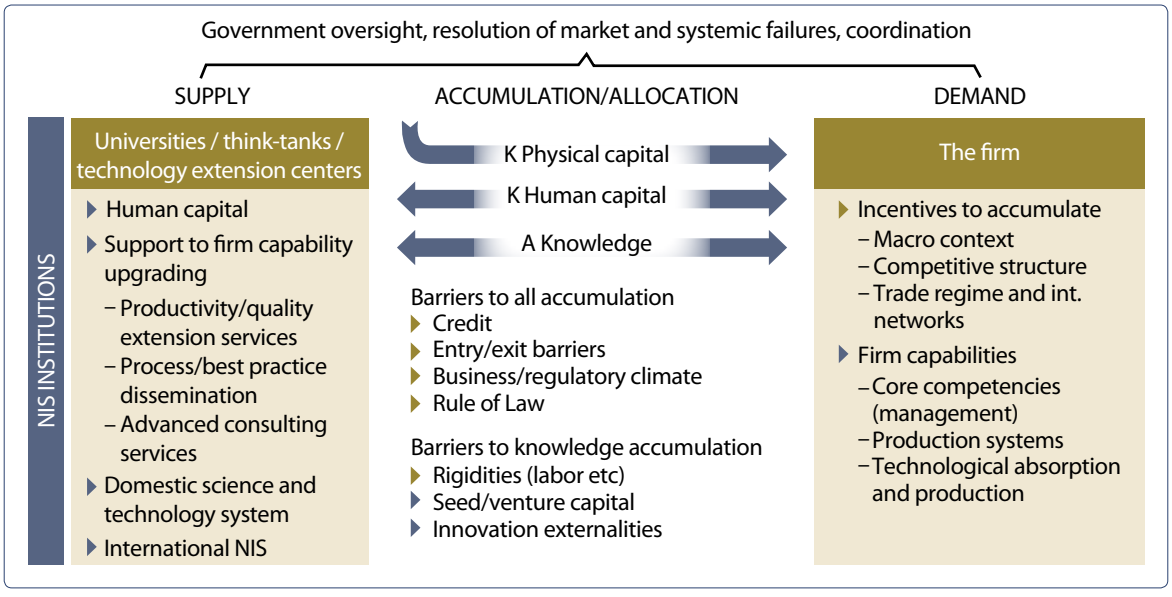
17 See Cirera, X. and W. Maloney, 2017 "The Innovation Paradox: Developing-Country Capabilities and the Unrealized Promise of Technological Catch-Up" World Bank, Washington, DC.

II Conceptual framework

10. The conceptual framework for undertaking the analysis adopts a systematic view of the innovation process. The expanded national innovation system (NIS) framework (Cirera and Maloney, 2017) is deployed to shed light on the factors that constrain Vietnamese enterprises from adopting existing global know-how and technical knowledge – to upgrade their products, technologies, and business processes. As figure 3 shows, the NIS – the array of institutions, policies and actors that enable innovation – are broad and inter-linked. Supply side institutions include quality human capital, knowledge and R&D institutions that need to evolve and be matched by adequate absorptive capabilities on the part of firms (i.e., the demand for knowledge).[18] Importantly, the framework recognizes the critical role of the government in fostering innovation and resolving market failures, as well as overseeing the innovation system. In line with *Vietnam 2035*, it is important to identify the priority fixes required for Vietnam's move into an efficiency-driven economy from a factor-driven economy.

18 This includes market knowledge suppliers i.e., private firms that generate knowledge through their own R&D and foreign investors that supply knowledge through commercial relationships.

FIGURE 3. **Expanded & improved national innovation system**



Source: Cirera and Maloney (2017).

11. The challenge for Vietnam is that parts of the NIS are underdeveloped and the linkages between elements of the innovation ecosystem are weak or absent. As cirera and maloney (2017) underline, for enterprises to reach the technological frontier, policies and institutions need to focus on removing the constraints to developing a more mature NIS and on promoting the gradual development of innovation capabilities of the private sector, moving from building solid managerial and organizational capabilities to supporting R&D and technological generation. The appropriate policy mix to reach this goal will depend on the extent of innovation capabilities and complementary institutional and policy factors available in the country. One must be realistic about the current strength of institutions and the capabilities to formulate policies that can effectively enable the innovation process.

12. Three dimensions are highlighted in the expanded NIS ecosystem. The framework presents a systemic view of innovation, the relationship between the supply and the *demand* of knowledge, the centrality of the firm in the innovation process, and the fact that bottlenecks to investment are also barriers to the accumulation of knowledge skills and, therefore, innovation. On the demand side of the extended NIS, *firms* are the main actors while on the *supply* side knowledge institutions are the key players. Factors that affect firm productivity and innovation are both internal and external to the firm (see Figure 2).[19] Knowledge institutions supply sources of knowledge that support firm demand for innovation, and encompass the supply of human capital, institutions to support firm innovation, the science and the technology system that generates new or adapts existing

19 Internal to the firm factors include capabilities that encompass core managerial competencies, production systems, and higher-end capabilities for technological absorption and innovation. These enable a firm to identify opportunities and quantify the associated risks of accumulating capital knowledge, as well as to mobilize resources to reap the benefits from innovation. The set of external factors that influences firms' incentives to innovate include the macro context, competitive structure and trade regime.

knowledge, and the international innovation system where most new knowledge is generated and transferred to developing countries like Vietnam.[20]

13. Improving firm innovation and productivity requires action on multiple fronts of the NIS in Vietnam. R&D investments require a range of complementary factors to ensure that innovation projects boost productivity.[21] As documented by cirera and maloney (2017), developing countries innovate less than advanced countries, despite the potential vast returns to innovation from acquiring existing technology. This phenomenon – called the "innovation paradox" – can be partly explained by multiple types of market and systems failure that lead to weaknesses and fragmentation in the NIS. These include: (i) inadequate firm level capabilities to innovate, such as weak management capabilities and limited incentives to undertake innovation; (ii) absence of complementary factors that pertain to conditions for accumulation of knowledge – such as the intellectual property framework (and its enforcement), the business environment,[22] specialized laboratories, testing and R&D infrastructure, stem skills and innovation finance; and (iii) lack of government capabilities to formulate and implement the complexity of innovation policy. Any attempt to strengthen innovation in Vietnam therefore must begin by assessing the NIS, particularly firm capabilities, complementary factors and government capabilities at the central, regional and city level. Once the specific gaps and weaknesses in the NIS system are identified, appropriate policy and institutional reform measures to improve the functioning of the NIS, and in turn innovation, can be proposed.

14. The next section examines the current STI policy institutional framework in Vietnam vis-à-vis the challenges and broad direction emphasized in key strategic directions outlined in *Vietnam 2035* (2016) and the *OECD Innovation Policy Review* (2014). The aim is to understand if the strategic shifts identified in *Vietnam 2035* are reflected in key policy resolutions as part of the STI policy framework under implementation.

20 It may be noted that not all the supply of knowledge is demanded by firms. Some R&D is undertaken by some of the largest multinational firms, especially in tech sectors. In some cases, companies like Alphabet (Google) now outspend other knowledge institutions combined.

21 It is useful to underline that the NIS system concept is similar to productivity and entrepreneurship, as they all recognize the relevance of the interaction between external and internal factors to the firm that can significantly affect productivity, Moreover, the factors recognized as relevant by these diverse concepts, for example human capital, finance, firm capabilities, also tend to be common although the specifics and intensity may vary.

22 This includes presence of distortionary policies such as such as: stifling labor regulations that prevent mobility of knowledgeable/ STI staff, restrictions to specialized FDI investments, predatory policy to force technology transfer; and clientelism in allocation of innovation capital.

III

Vietnam's STI framework and enterprise sector

15. The review of the STI framework is undertaken at two levels: the strategic high level that reviews government priorities and goals/targets as set in the key national documents and laws to support business innovation; and the program and policy level (i.e., instrument level). This section briefly assesses the alignment and progress since 2016 and lays out the priorities set in *Vietnam 2035*. It also sets the stage for the program level analysis that will be undertaken in section VI, using the PER methodology.

16. The *Vietnam 2035* report emphasizes four broad areas of reforms to tackle demand and supply side dimensions of the NIS. To raise the demand for knowledge in firms, it recommends addressing the constraints that firms face in the operating environment as well as improving firm capabilities for technological learning. On the supply side, improving the quantity, quality and relevance of workforce, and raising the quality and relevance of knowledge production and R&D, are recommended. In addition, improving Government coordination and capacity to design and implement policies is emphasized, given the cross-cutting nature of the innovation process with multiple institutions and actors involved.

Current STI Framework[23]

17. Based on Vietnam's current growth context and prospects in view of trade and technological shifts at the global level, a review of STI-related laws and policies in Vietnam can inform how its STI-related legal and policy frameworks align with (and address) current and future innovation policy needs. This review also assesses whether these are aligned with the government's strategic development vision (articulated in two key strategies – *Vietnam 2035* and *S&T Strategy 2011-2020*). On the one hand, *Vietnam 2035* highlights the country's strategic vision of attaining high-income country status by 2035. On the other hand, Vietnam's S&T Strategy 2011-2020 sets ambitious objectives to develop a robust national innovation system, underpinned by well-performing research institutions and science-industry linkages, to reach international S&T levels in key areas by 2020 (e.g. 15-17% annual growth in the S&T market).[24] Overall, to be able to meet current needs and the government vision for future growth, Vietnam's STI legal and policy framework as well as institutions should be able to facilitate technological catch-ups by promoting diffusion, adoption and application of knowledge and enhance the effectiveness of R&D institutions.

18. An assessment of four STI-related laws – anchor points of Vietnam's STI legal framework – shows that these laws are riddled with implementation bottlenecks, thereby hindering the achievement of intended objectives. Implementation bottlenecks include fragmentation of delegation of S&T policymaking and implementation, inconsistencies in stipulations and priorities between different STI-related laws, and lack of context in defining the target audience of certain laws (e.g. high-tech enterprises). Further, some areas require additional amendments to strengthen enforcement, particularly intellectual property rights (IPRs). A snapshot of these laws can be found in Annex 2.

19. There are two main policies focused on Vietnam's STI development for the 2011-2020 period[25] (Annex 2). For one, *Resolution 20-NQ/TW (2012)* is the most important document reflecting the Central Committee of the Communist Party's STI development orientation until 2020 and vision until 2030. This resolution was written to address the growth slowdown due to the 2008 global financial crisis; it set an ambitious S&T objective of developing Vietnam's science and technology systems as a growth driver and increasing the productivity, quality, efficiency and competitiveness of the economy. This objective also focuses on protecting the environment and ensuring national defense and security, and aims at "turning the country into an industrial country in the modern direction by 2020 and a socialism-oriented modern industrial country by mid XXIth century". Another is *the Science and Technology Development Strategy 2011-2020,* which outlined specific objectives on S&T and reiterates the Resolution's objectives on contributing to economic growth and strengthening S&T capacity in Vietnam. Both policies support the broader S&T objectives under the Socio-economic Development Strategy 2011-2020.[26]

23 This draws on a paper led by Dr. Le Dinh Tien, VISTI, MOST, Government of Vietnam (2019).

24 Refer to Annex 2, table 3 captures all the objectives, targets and implementation timeline.

25 Vietnamese STI policies were fully and comprehensively reviewed in the Report on "Science, Technology and Innovation in Vietnam" (OECD & WB, 2014).

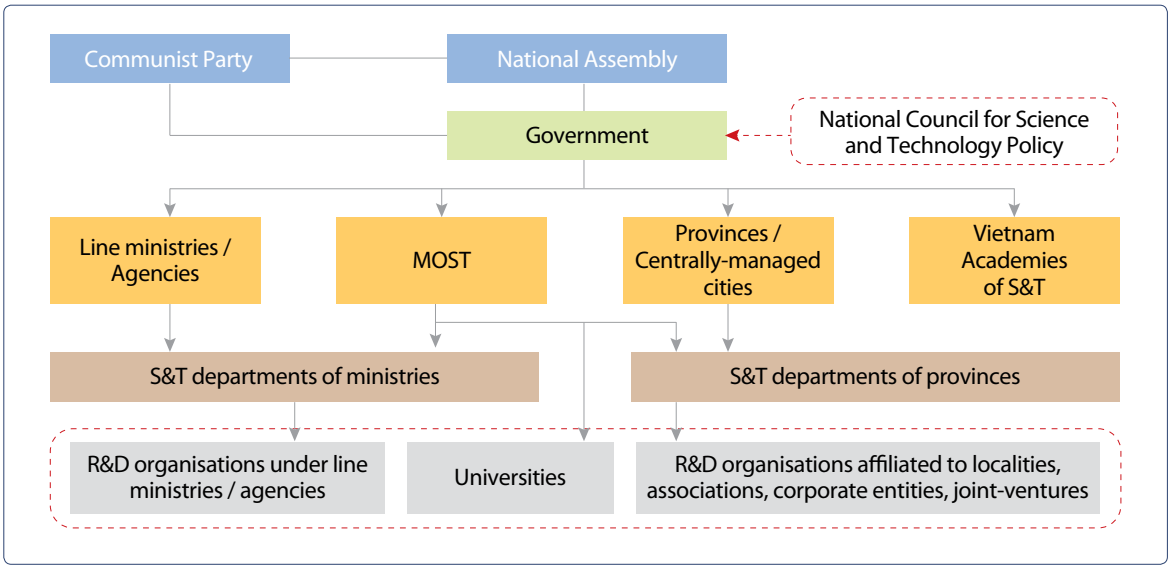
26 This strategy focused on two groups of objectives for STI: (i) S&T must meet the requirements for the country's socio-economic development in the next 10 years; (ii) S&T regulations must be reformed, and S&T potential must be developed to reach regional advanced level and high quality to meet the requirements for socio-economic development.

20. A recent implementation review of S&T strategy from 2011 to 2020 (and of the Resolution 20-NQ/TW (2012) in light of similar objectives) suggests that progress towards meeting objectives has been slower than expected.[27] At the end of the 2011-2015 period, only three out of eleven objectives (i.e., contribution of TFP to GDP, speed of innovation and annual growth of international publications) set out in the STI Strategy had been achieved (Annex 2). According to the latest Report[28] by MOST (2021) further progress was recorded during the period 2016-2020, resulting in seven out of eleven objectives being achieved. Part of the explanation for not fully achieving the objectives can be attributed to a top-down approach that does not appear to have set realistic targets. In addition, the key principles of a good strategy, which involve setting up clear objectives that are measurable and can be achieved, are not consistently adhered to in Vietnam.

STI Institutions

21. The institutional structure and governance of STI is complicated, with multiple players and potential areas of overlaps (Figure 4). There is a lot of scope for strengthening coordination across multiple levels and programs.

FIGURE 4: **Vietnam's STI institutional system for strategic policy formulation and implementation**



Source: OECD/World Bank (2014).

27 The review has been undertaken by VISTI, MOST team, and shared with the Bank team in May 2020.

28 Refer to MOST (2021)"The Report in 2019 on the Situation of implementing the Strategy for Development of Science and Technology during 2011-2020" of the Ministry of Science and Technology was submitted to the Prime Minister. The two objectives that have not been achieved are related to the national investment in science and technology and the number of STI institutions recognized as the world class ones. Annex 2 (table 3) provides the list of all objectives.

22. The STI policy framework and government capacity should be strengthened. A new STI strategy in Vietnam requires building capabilities in the public sector to influence capabilities in the private sector. The further away a country is from the "technological frontier", the higher the number and importance of market failures, missing complementary factors and weak institutions that it faces, which increases policy complexity (Cirera and Maloney, 2017). This dilemma underlines that conventional innovation policies that focus primarily on research and development are unlikely to be effective in this scenario. Vietnam should focus on addressing government and firm level capabilities gaps that can help unlock its growth potential by moving the country closer to the technological frontier. The capabilities of relevant ministries and agencies – in terms of human capital and effective organizational structures – in Vietnam need to be strengthened, especially at a time when designing and implementing innovation policy is becoming even more complex. Effective innovation policy requires choosing the appropriate combination of policy instruments in the context of scarce government capabilities.

BOX 2: **STI – Gender Dimension**

Policies: Vietnam has well established commitments to gender equality at work, and laws and policies are supportive of equal treatment of men and women in terms of recruitment and promotions in all fields, including STI activities. Women and men have equal rights in the recruitment policies of all public scientific and technological organizations, access to funding and training for S&T activities, and policies governing appointments to leadership positions. The *National Gender Equality Strategy (2011-2020)* (Prime Minister Decision 2351/QD-TTg) seeks to narrow the gender gap in labor force participation and employment. GoV endorses the agenda to 'diversify images of women with different roles and occupations' and specifies a range of targets, including women's entitlement to a 40 per cent share of newly created jobs.

Outcomes have been mixed: Many of these targets remain unrealized as 2020 approaches. For instance, despite the high labor force participation rates for men and women, at 83.5 per cent and 73.2 per cent respectively, this gap has been static for the past 5 years (ILO, 2018; UN Women, 2016). Women in practice are disadvantaged in recruitment and promotion to leadership positions in certain S&T organizations. The average monthly salary of paid workers is 5,715,000₫ (Vietnamese Dong) for men as compared with 5,225,000₫ for women. This gap is equivalent to women effectively 'working for free' for one month each year, as compared with male peers. Source: ILO (2018).

What gets measured gets done: Despite a sound policy and legal framework supporting gender equality, institutional capacities in the area of reporting, gender analysis, data collection and monitoring remain weak and unsystematic. Looking ahead, a priority is to establish clear accountabilities and timeframes so that specific gender related intervention and outputs can be measured according to the plan and evaluated according to the desired result.

23. According to some S&T experts in Vietnam, there are multiple reasons for implementation weaknesses in achieving S&T Development Strategy objectives. These include:

- *Qualitative objectives and lack of realism in target setting:* Qualitative objectives (e.g. S&T becoming a key driver of growth and meeting the requirements of an industrial country) are more achievable in the long-term, rather than within a 10-year time period. Similarly, S&T targets are determined in a subjective manner based on the decision of policy makers.
- *Lack of specificity of S&T tasks:* Similar to objective-setting, S&T tasks are not concrete enough to be implemented immediately. Rather, it is necessary to design and develop policy instruments

to achieve each target (for example, 60 research institutions will be recognized at the regional and world-class by 2020; or having 3,000 and 5,000 S&T enterprises by 2015 and by 2020, respectively).

- *Implementation arrangements:* In addition, the capacity to design, develop and arrange the implementation of the Strategy is limited; there is a lack of an effective mechanism to coordinate implementation of the S&T Strategy.
- *Coordination among members of the Strategy Steering Committee:* MOST established the Steering Committee for development and implementation of S&T Strategy 2011-2020,[29] comprising representatives from the ministries, sectors, and localities and relevant agencies (headed by the MOST Minister). This Committee was only operational during the development of the Strategy, but not during implementation.

24. Because Resolution 20-NQ/TW, the Socio-economic Development Strategy and the S&T Strategy were issued early in the period 2011-2020, the Central Committee of the Communist Party and the Government recently issued complementary policies to align Vietnam's policies to global changes (Annex 2). More recently issued policies complement existing STI initiatives, with a focus on enhancing the quality of growth through skills improvement, improving the business environment for firms, and supporting innovative ideas. These polices, some of which are partially based on the recommendations provided in *Vietnam 2035* and OECD-WB reports, act as pilot policies for the development of STI Strategy 2021-2030. Because of the more recent promulgation of these policies, it is difficult to make a credible assessment of their implementation.

Vietnam's Enterprise Performance dynamics

25. Prior to presenting the innovation dynamics in Vietnam, the section sets the stage by briefly profiling the structure and performance of the enterprise sector in Vietnam. Section 4 reviews the current state and incidence of innovation in Vietnam and benchmarks it with its comparators.

26. The private sector in Vietnam has grown substantially from a low base and has been largely responsible for job creation both through the entry of new firms as well as the growth of incumbents.[30] The country's private sector has dual characteristics with a high performing FDI sector integrated in GVCs and a domestic private sector where firms tend to be small at entry – and lacks dynamism to grow over time. The domestic private sector lacks scale, business sophistication and technology needed to boost productivity for market expansion. Only 20 percent of domestic enterprises export. Earlier studies focusing on the enterprise sector have consistently pointed to weaknesses in the operating business environment, as well as internal constraints related

29 It is interesting to note that the "I" component of the STI Committee was missing. Similarly, a number of key documents also focused on ST.

30 This draws on the analysis undertaken by Reyes Aterido R. and M. Hallward-Driemeier (2015) that uses Govt.'s panel census data of formal firms from 2004 to 2012.

to firms' capabilities that undermine competitiveness. Key factors in the external environment include the regulatory environment, access to finance, infrastructure and lack of a level playing field.

27. FDI has expanded dramatically and brought enormous gains to Vietnam in terms of growth, exports and jobs. Currently the contribution of large firms, primarily the foreign-invested sector, accounts for about 30 percent of employment in Vietnam's enterprise sector and 70 percent of total exports. Vietnam specializes in the labor-intensive and final assembly stage of the GVCs – primarily exporting apparel, shoes and mobile phone handsets – which limits technological spillovers for domestic firms. FDI has remained largely disconnected from the domestic private sector including SMEs – that represent the bulk of the domestic private sector in Vietnam. While Vietnam's significant FDI offers potential for domestic firms to integrate into global value chains (GVCs) and benefit from technological catch up, in reality the sector has not been a catalyst for generating spillovers to the domestic private sector – either in the form of increased demand for inputs, access to new technology and managerial skills or agglomeration benefits. This is reflected in low domestic value addition and a weak domestic supplier base. Vietnamese firms are mostly concentrated in the third-tier supplier industry, characterized by production of low value-added inputs and/or tasks such as basic materials and packaging. With increasing global competition, and its ambition to move up the value chain, Vietnam has a unique window of opportunity to exploit its current position in GVC if it can strengthen domestic firm capabilities as well as resolve market impediments.

28. The state-owned enterprise (SOE) sector remains a dominant player in the economy, with the state still involved in productive activities. SOEs in Vietnam account for a large part of the economy, but suffer from low productivity.[31] As of 2017, Vietnam had 2700 SOEs, accounting for 0.5 percent of the enterprises in the country but producing nearly 30 percent of GDP, compared to less than 10 percent of GDP by the formally registered domestic private sector.[32] Given the significant share of assets held by SOEs, a successful reform of inefficient SOEs would potentially lead to a considerable increase in the overall productivity and competitiveness of the economy. The Government's aim is to privatize SOEs on a large scale but the number of equitized Vietnamese enterprises to-date is still much lower than envisaged.

Current state of innovation capacity

29. In examining the current state of innovation capacity, Vietnam's performance is benchmarked vis-à-vis its structural peers, and its regional and aspirational set of countries.[33] The comparators include: China, Philippines, Thailand, Indonesia, South Africa,

31 The majority of SOEs record poor performance, but there are some well-performing firms. The telecom sector is a case in point.

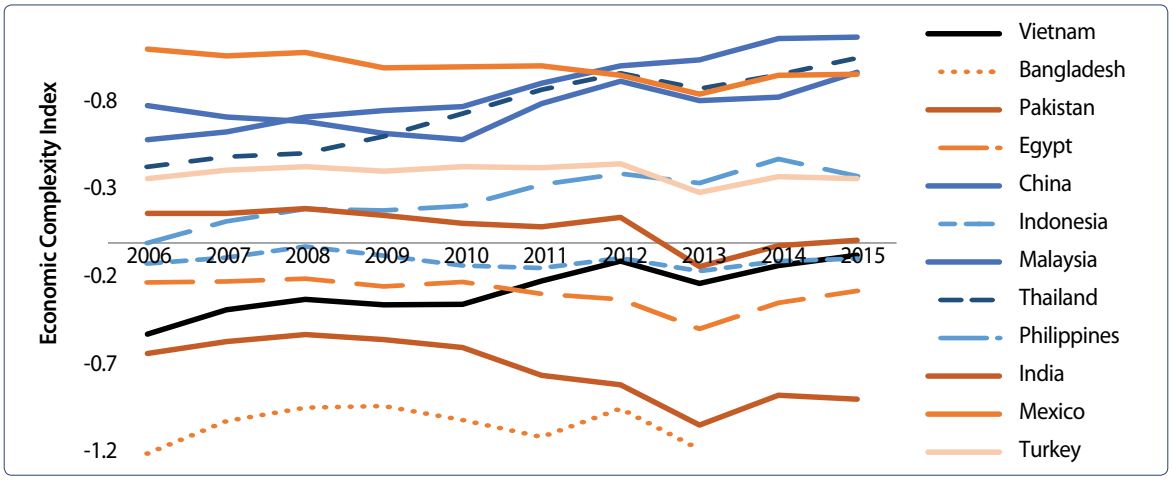
32 In addition, FDI accounts for about 20 percent of GDP while the rest is attributed to collectives and households.

33 Vietnam's structural peers follow the World Bank (2016) Vietnam Systematic Country Diagnostics, which used the following criteria to find structural peers: (i) low or upper middle income, (ii) not a fragile state, (iii) not classified as a commodity exporter, (iv) population of at least 35 million. Vietnam's structural peers include: Bangladesh, China, Egypt, India, Mexico, Pakistan, Philippines, Thailand, and Turkey. Regional and other Asia-Pacific aspirational peers include Australia, Indonesia, Malaysia, and Singapore. Note that these peer countries are an impressive list of comparators. While not all are performing at their potential, they have higher incomes than Vietnam. *The Government requested the Bank team to select sub-sets of these countries to benchmark and also to include South Korea and South Africa, where feasible.*

and Turkey, Australia, Malaysia, Singapore and South Korea.[34] In undertaking the benchmarking assessment, this section focuses on innovation performance (outcomes) as well as outputs and inputs associated with innovation. It then examines the incidence of innovation across firm characteristics within Vietnam. The incidence of innovation is analyzed through a selective use of micro-data from the World Bank Enterprise Survey (WBES)[35] and the Government's NASATI Innovation survey data set.[36] This section concludes by summarizing the achievements and strengths in the innovation system and lays out the broad challenges going forward from the demand perspective, including the issues that will be examined in detail in the ecosystem work.

30. Relative to its peers as well as its development aspirations, Vietnam's current competitiveness performance indicates plenty of room for improvement. Vietnam's TFP growth has been on a declining trend in the last twenty years, albeit its recent growth has been positive though muted. According to the *Global Competitiveness Index 2017-2018*, Vietnam ranks 55th out of 137 countries, behind Singapore (3rd), Malaysia (23rd), China (27th), and Indonesia (36th), and just above Philippines (56th). Vietnam has successfully expanded and diversified its exports but structural change towards high-technology and more knowledge-intensive production (i.e., complex content) has been slow compared to its peers (Figure 5). In 2016, Vietnam ranked 95th in the Economic Complexity Index (ECI), while China ranked 18th.[37]

FIGURE 5. **Vietnam's shift to more complex production has been slow compared to peers**



Source: Harvard/MIT; Observatory of Economic Complexity.

34 The comparators are highlighted whenever data are available. The macro performance review draws on aggregate indicators (e.g. Global Innovation Index (GII), Global Competitiveness Index) data sets.

35 Enterprise Surveys are comparable firm-level surveys of representative samples of different countries' private sectors, regularly conducted by the World Bank since 2002 (see: http://www.enterprisesurveys.org). The latest survey for Vietnam, conducted in 2015-2016, covered 996 firms, including 294 panel firms also covered by the previous survey in 2009. The survey includes firms from manufacturing and services sector.

36 The NASATI innovation survey was undertaken by the Ministry of Science and Technology (MOST) under the World Bank FIRST project. A total of 7,641 enterprises were surveyed during the period July 2017 to February 2018. The objective of the survey included examining the innovation activities of the enterprises operating in the processing and manufacturing industry sector and identifying barriers and obstacles in the implementation of innovation.

37 ECI is a function of ubiquity and diversity of products and reflects the knowledge intensiveness of products.

31. Vietnamese firms innovate[38] less than would be expected for the country's level of development as well as relative to its chosen peers. Figure 6 shows a negative correlation in developing countries between innovation outcomes (measured in terms of the share of firms engaged in product or process innovation, or that introduce products that are new to the market)[39] and the level of income.[40] In particular, Vietnamese firms innovate less than expected for the country's level of development, particularly in terms of product or process innovation.[41] Relative to their peers[42], firms in Vietnam innovate more than those in Malaysia, Indonesia, Thailand and Turkey but less than those in China, South Korea, Singapore and Philippines (Figure 6). However, Vietnamese firms lag firms in every country peer on radical product innovation (i.e., new to the market).[43] That is, fewer firms in Vietnam (53% of product innovators) report their main innovation to be new to their market, compared to Malaysia (75%), Philippines (62%), and Thailand (86%).

32. Similar rates of innovation incidence can be observed when considering innovation in Vietnam's manufacturing and processing sector alone.[44] The most recent innovation survey (NASATI, 2018) finds that 49 percent of firms reported innovating in terms of product or process, similar to the rates found in the non-agricultural private sector (WBES, 2015). Product/process innovators mainly conduct their own methods to generate new or improved products/processes rather than outsource the innovation or engage in a combination of both (Figure 7).

38 Innovation measures used in this STI Note -sourced from the World Bank Enterprise Survey and FIRST-NASATI survey data sets – are all self-reported. It is important to underline that self-reported data can be subject to measurement bias. For example, different firms may have various interpretations of what constitutes 'innovation' per se. In fact, firms in developing countries tend to overestimate innovation rates (see Cirera and Muzi, 2016). Because of this, care is necessary in interpreting the data.

39 Product innovation is measured as whether firms introduced new or significantly improved products or services. Product innovation that is new to the market is measured as whether firms' new or significantly improved products or services were also new for the establishment's main market. Process innovation is measured as whether firms introduced any new or significantly improved (i) methods of manufacturing products or offering services, (ii) logistics, delivery, or distribution methods for inputs, products, or services, or (iii) supporting activities for firms' processes, such as maintenance systems or operations for purchasing, accounting, or computing.

40 This negative correlation can be due to measurement bias since innovation outputs are self-reported by firms. For one, firms can have differences on what constitute 'innovation' per se. Also, firms in developing countries tend to overestimate innovation rates (see Cirera and Muzi, 2016). Considering Vietnam and its peers alone, an opposite result is observed for introducing products that are new to the market: richer countries tend to engage more in novel innovation.

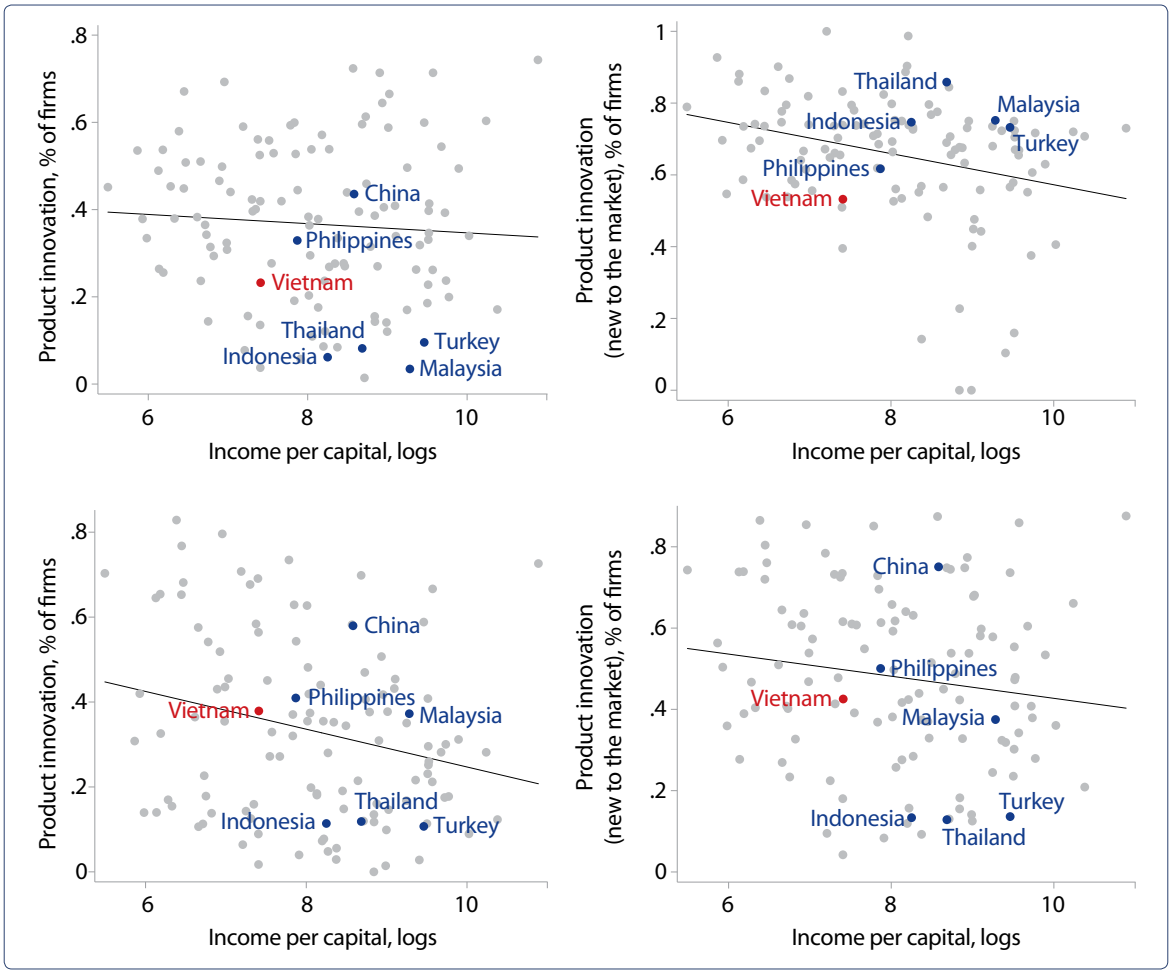
41 This can be seen in that the dot for Vietnam is located below the fitted line. In general, dots above the linear fit mean that these countries have innovation rates higher than the level generated by this simple regression, given their income per capita, whereas countries below the line have lower innovation rates than this level.

42 Vietnam's comparators in this note include: China, Philippines, Thailand, Indonesia, South Africa, and Turkey, Australia, Malaysia, and Singapore, S. Korea. The comparators are highlighted whenever data points for these countries are included.

43 Cirera and Sabetti (2016) distinguish between 'new to the firm' innovation (imitation) and 'new to national and international markets' innovation. The former type of innovation is likely to be largely incremental in improvements, whereas the latter is more radical or disruptive.

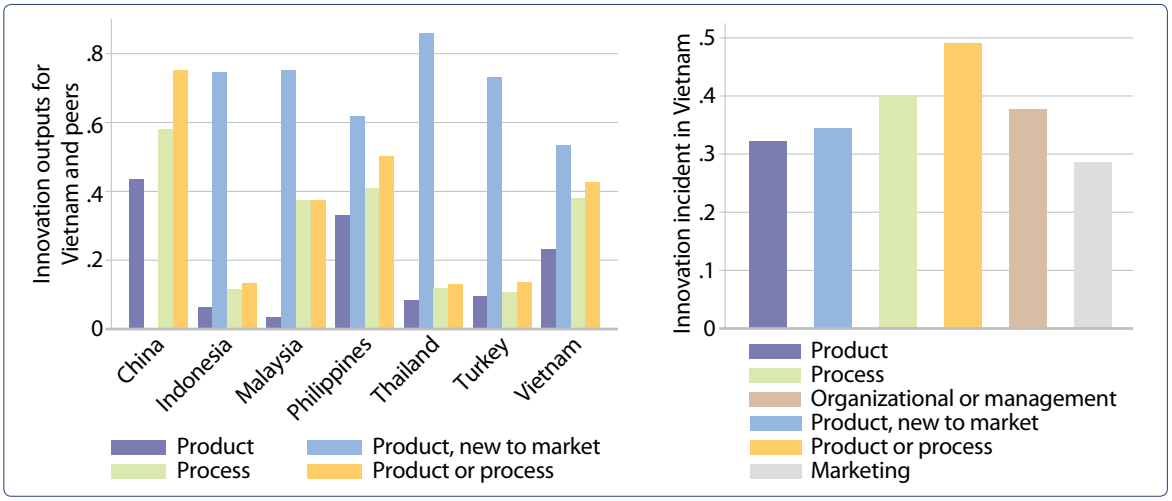
44 This analysis is based on NASATI-FIRST Survey (see footnote 35 for details). Industry classification is based on the 2-digit Vietnam Standard Industrial Classification. A tabulation of these sectors and their number of observations can be found in Annex 1.1.

FIGURE 6. **Vietnamese firms innovate less than expected, given per capita income**



Source: Authors using WBES and World Bank WDI.

FIGURE 7. **The manufacturing and processing sector has similar innovation rates as the economy as a whole**

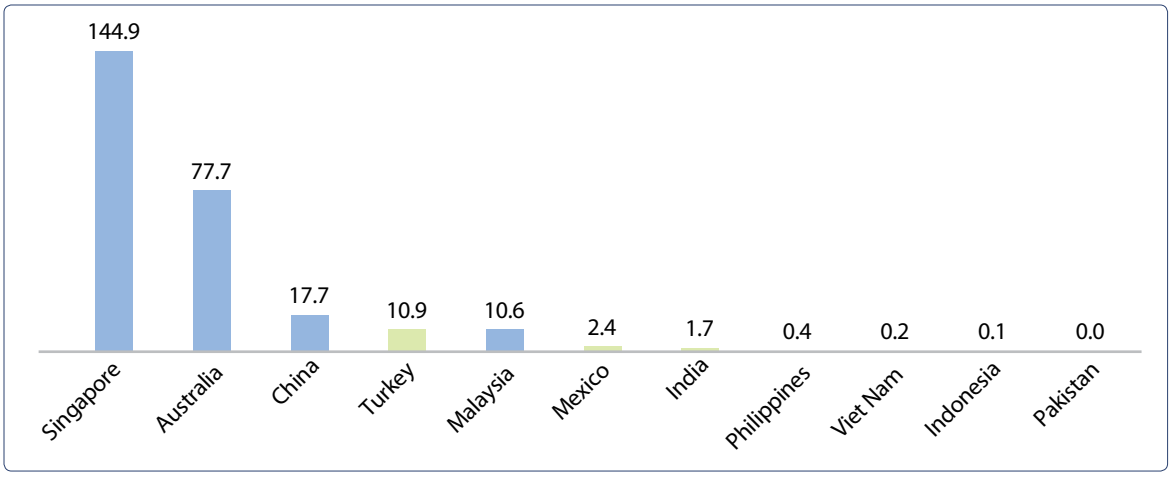


Source: Authors using WBES, 2015 (left)and NASATI, 2017 (right).

33. Vietnam's performance in key innovation output measures needs improvement. Innovation related activity includes, among other things, conducting research & development (R&D), upgrading technology through purchase of technology licensing or reorganization of the use of labor, and making new and improved products and services. Expenditure on R&D as a percentage of GDP is about 0.4 percent in Vietnam in the last years,[45] compared to Australia (2.2%), Singapore (2.2%), China (2.1%), and Malaysia (1.3%). R&D expenditures are likely to be related to knowledge generation (i.e., pushing the frontier), and thus a low level is likely to be in line with the overall message of this report to focus on technological adoption and diffusion. These investments, however, remain highly dependent on the public sector (49% in 2017)[46] compared to China (22%) and Singapore (37%) where R&D expenditures are primarily undertaken by the private sector. While patent applications have increased over the decade, patent applications[47] in Vietnam are one of the lowest (per million residents) among peers (Figure 8).

FIGURE 8. **Patenting is low in Vietnam compared to peers**

(Patent Cooperation Treaty patent applications per million residents, 2017-18)



Source: World Bank Development Indicators; WEF GCI.

Role of firm characteristics in innovation within Vietnam

34. Innovation propensities vary across firm-level characteristics in Vietnam.[48] Larger and joint-venture firms in Vietnam are more likely to undertake product innovation than are smaller and domestic firms, respectively, but are no more likely to undertake radical product (new to the market) or process innovation. On balance, firms operating in the services sector are less likely to undertake innovation compared to firms in the manufacturing sector.[49] In comparison, in a

45 Refer to S&T White Book 2018, – page 72 – Government of Vietnam.

46 Refer to S&T White Book 2018 – page 78 – Government of Vietnam.

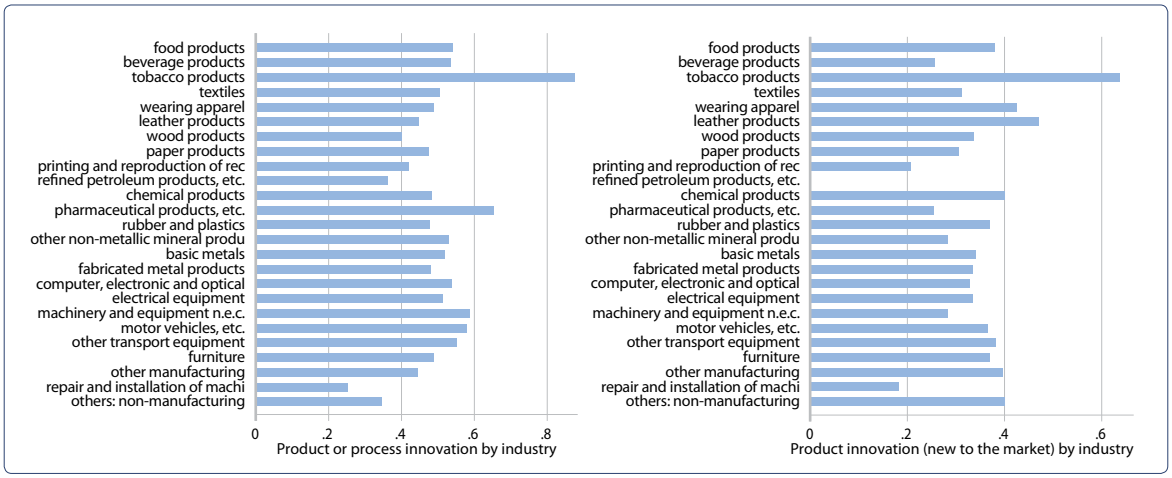
47 Apart from patents, special types of contracts enabling the enforcement of industrial secrets through non-disclosure and non-compete contracts can be a source that stifles innovation activity. Due to the nature of these contracts (i.e.,, hidden), there is no publicly available data to capture this.

48 This section is based on regressions using World Bank Enterprise Surveys (WBES, 2015). The use of WBES data enables us to draw inferences for the non-agriculture private sector as a whole.

49 For instance, firms in the retail and other services sectors report less product innovation than do firms in the fabricated metals subsector of the manufacturing sector.

cross-country analysis (including Vietnam and peers) larger firms are more likely to innovate across all innovation output dimensions. And unlike in Vietnam, in the cross-country analysis joint venture firms are no more likely to engage in innovation than are domestic firms. Interestingly however, a joint-venture firm tends to innovate significantly less than a domestic firm in terms of product that is 'new to the market' and on process in Vietnam. In both Vietnam and the cross-country samples, 100 percent foreign-owned firms innovate less than domestic firms across most innovation output measures. Overall, weak innovation outcomes for both joint venture and foreign-owned firms is related to the types of activities these firms implement in Vietnam – focusing on the less innovative and assembly stages of production. Further, more innovative activities tend to be implemented in head office locations of foreign firms rather than in Vietnam. Lastly, having a female top manager increases the likelihood of innovating in terms of product or process in the Vietnam sample, although the coefficients are not significant.

FIGURE 9. **Innovation variation within the manufacturing and processing sector by industry**



Source: NASATI, 2018.

Note: Each bar represents the ratio of the number of firms undertaking the indicated innovation to the total number of firms in the subsector.

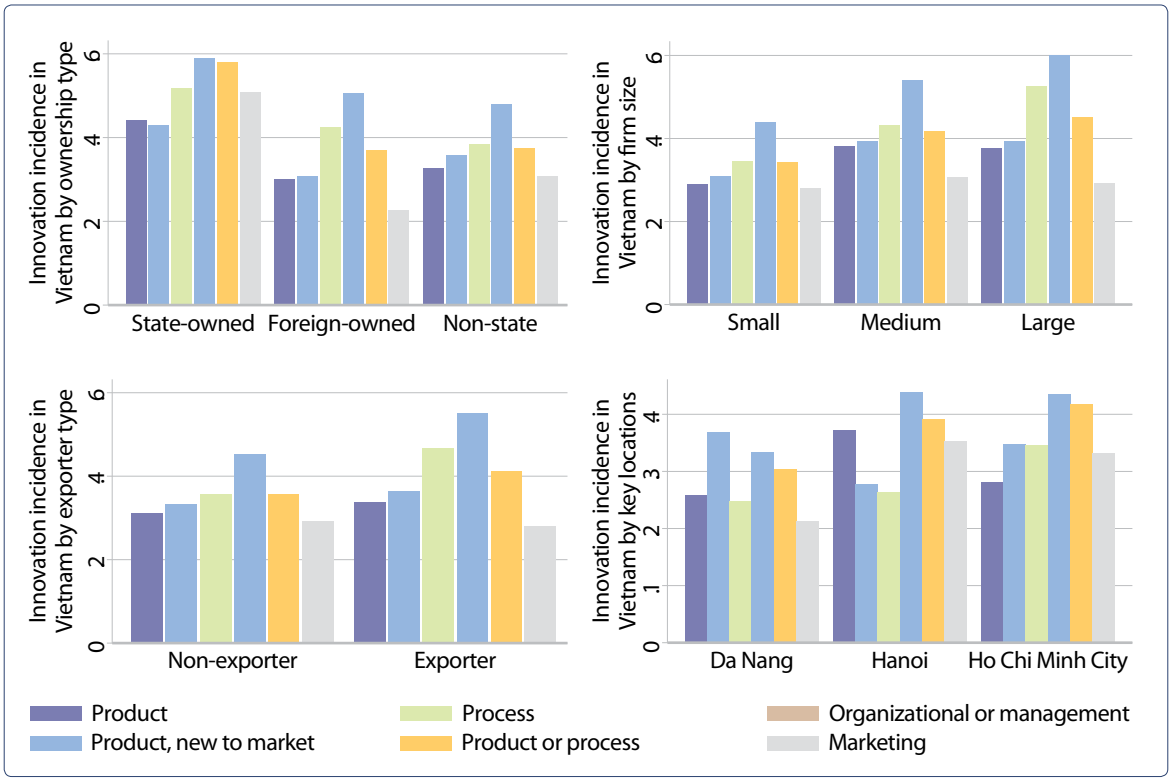
35. The findings from the recent NASATI Innovation Survey (2018) of firms in Vietnam's manufacturing and processing sector largely confirm the above-mentioned results using the WBES data. Larger and exporting firms are more likely to innovate than smaller and non-exporting firms, respectively across all innovation output measures. Foreign-owned firms tend to innovate less than state owned enterprises do (e.g. about 33 percent less in terms of product innovation).[50] In terms of geographic location, a firm in Hanoi is more likely to engage in product innovation than a firm in Da Nang or Ho Chi Minh City. A snapshot of these variations is graphically presented in Figures 9 and 10. For example, in terms of ownership, 59 percent of state-owned enterprises engage in product or process innovation, compared to foreign-owned firms (51 percent) and non-state domestic firms

50 There may be multiple reasons. It may be due to preferential government treatment that SOEs receive preferential treatment, most R&D is in public sector. Innovation measures are also self-reported and thus subject to measurement bias.

51 The fact that domestic private firms innovate less than SOEs and foreign firms can be due to lack of complementary factors, such as access to capital and talent.

(48 percent).[51] As for firm size, 44 percent of small-sized firms conduct product or process innovation compared to medium-sized firms (54 percent) and large firms (60 percent). Lastly, 55 percent of direct exporters innovate compared to 45 percent of non-exporters.

FIGURE 10. **Innovation within the manufacturing and processing sector varies by ownership, firm size, export status, and location**



Source: Authors using FIRST-NASATI data.

Note: Each bar represents the ratio of the number of firms undertaking the indicated innovation to the total number of firms with the indicated characteristic.

36. In summary, achieving Vietnam's ambitions is likely to require an improvement in innovation outcomes. Firms in Vietnam innovate more than do firms in its structural peers, but much less than do firms in its aspirational set of counties, including China, South Korea, and Singapore. Any attempt to strengthen innovation outcomes must begin by reviewing the current state of the NIS: the demand for knowledge by firms and the supply of knowledge by the various knowledge institutions, as well as the public governance of innovation system. The review below builds on the findings of the flagship *Vietnam 2035* (2016)[52] report that, among other things, analyses the key determinants of innovation performance in Vietnam by using the NIS framework.

52 It also draws on the Vietnam OECD Innovation Policy Review (2014), among other documents.

IV Assessing Vietnam's national innovation system

37. This section assesses the existing state of NIS to provide a more in-depth understanding of the various elements at play and their interaction. As Figure 3 indicates, the range of demand and supply side elements as well complementary factors[53] is wide. In undertaking the analysis, nonetheless, it will be important to be selective and focus primarily on areas that have been identified by recent empirical work as more binding to innovation and entrepreneurship in Vietnam. These include policy and regulatory constraints, human capital and capabilities, financing, and infrastructure and connectivity (predominantly ICT infrastructure). This selective approach will allow for more in-depth policy recommendations that can be aligned to Government priorities and capacity.

53 Complementary factors, including physical capital, human capital and knowledge, as well as the enabling conditions for accumulating these factors, play a critical role in innovation. For example, complementary factors may include a capital market that would enable entrepreneurs to access venture capital, human capital and knowledge, and the availability of managers able to take new ideas to market.

Demand for Innovation– the Firm

Firm capabilities

38. Firm capabilities matter for improving innovation and productivity outcomes. Innovation at the firm level requires enhancing firm capabilities for technology learning. Gaps in these capabilities – for instance, managerial competencies, production systems, and higher-end capabilities for technological absorption and innovation – hinder the accumulation of knowledge and engagement in innovative processes. According to the Global Innovation Index Report (2019)[54] – that ranks innovation capabilities across world economies – Vietnam is pegged 42nd out of 129 countries, behind Singapore (8th), China (14th) and Malaysia (35th).

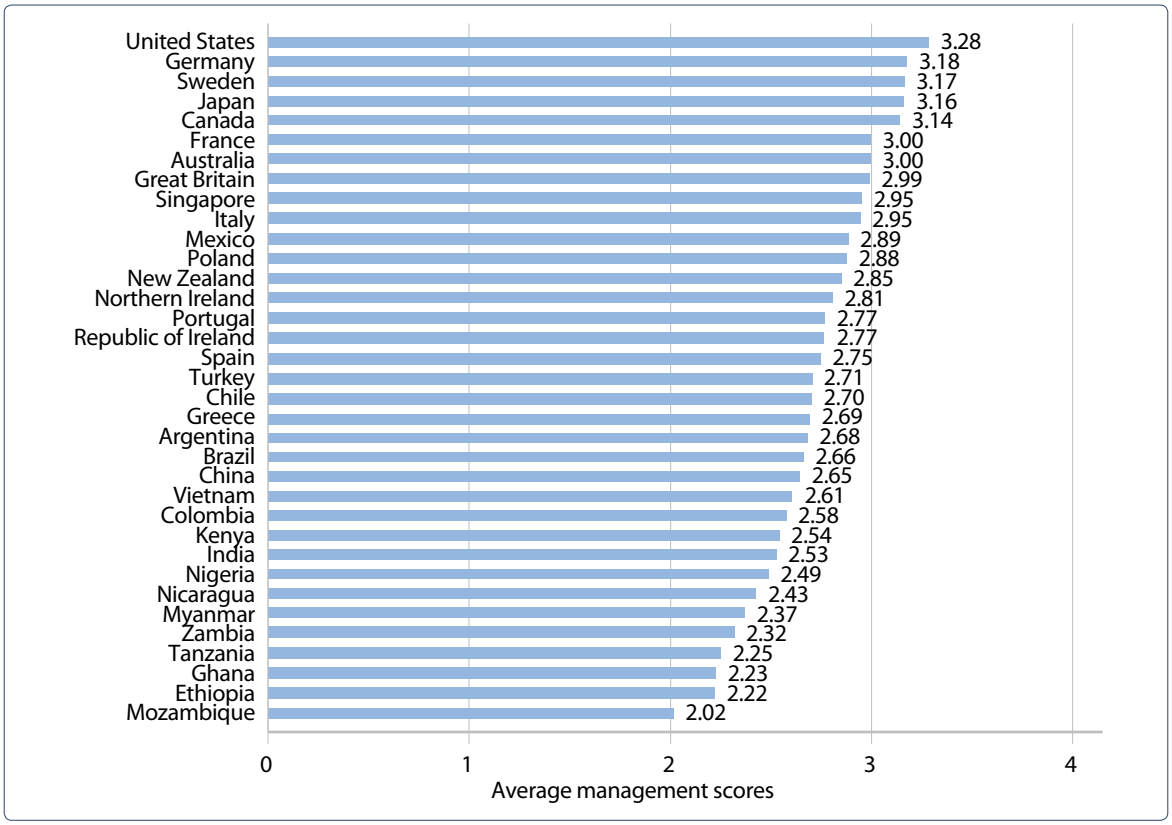
39. Vietnam has substantial scope for improving its management practices. Evidence from cross-country survey work that measures management practices systematically across firms and industries provides evidence that persistent differences in productivity at the national level (and in turn at the firm level) can be due to variations in management practices.[55] Not only do better managers enable firms to absorb new technologies, adopt new processes, efficiently utilize inputs and acquire and act on information to integrate into new markets, they also are more willing to invest in workforce training. Vietnam's score in a survey of management practices, on average, is (expectedly) lower than the scores of Asia-Pacific regional aspirational peers such as Australia and Singapore (see Figure 11). However, Vietnamese management scores are also lower than those of its structural peers such as Turkey and China, albeit higher than India's score. Relative to the frontier (US), Vietnam lags at every quantile although the same result can be found for its comparators. This indicates that the whole distribution of firms must shift to improve management practices across Vietnam's firms.

54 The Global Innovation Index (GII) is an annual ranking of countries by their capacity for, and success in, innovation. The GII is a composite of 80 indicators and relies on two sub-indices – the Innovation Input Sub-Index and the Innovation Output Sub-Index – each built around key pillars. Five input pillars capture elements of the national economy that enable innovative activities: (1) Institutions, (2) Human capital and research, (3) Infrastructure, (4) Market sophistication, and (5) Business sophistication. Two output pillars capture actual evidence of innovation outputs: (6) Knowledge and technology outputs and (7) Creative outputs. The indicators predominantly focus on the quantity rather than quality of innovation. Each pillar is divided into sub-pillars, and each sub-pillar is composed of individual indicators (80 in total in 2019). Sub-pillar scores are calculated as the weighted average of individual indicators; pillar scores are calculated as the weighted average of sub-pillar scores.

55 Bloom, N. et al (2015) Management Practices in Vietnam, March 2015 (Draft). The World Management Survey in Vietnam was conducted from November 2014 to April 2015, covering 150 manufacturing firms which were randomly picked from the population of firms with 50 to 5000 employees. The Vietnamese firms are compared and evaluated with over 15,000 similarly selected manufacturing firms in 35 countries around the world.

FIGURE 11: **Vietnam firms' management practices are lower than many comparators**

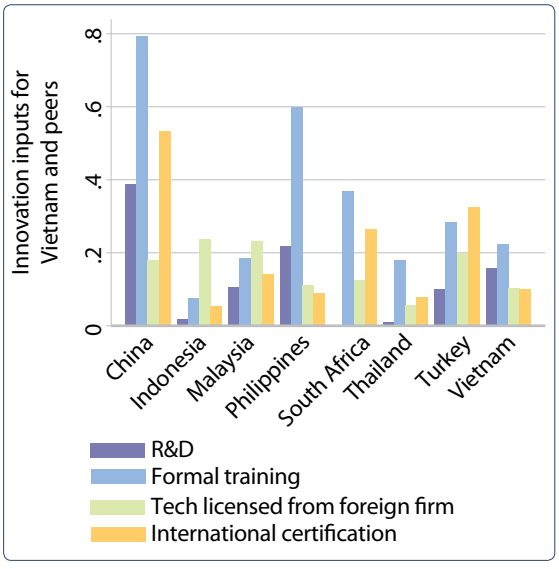
Core competencies affecting innovation outcomes



Source: World Management Survey (WMS).

40. Employers identify managerial skills as the hardest skill to fill in Vietnam. When asked about the difficulty of finding different type of skills, employers in Vietnam ranked managerial and leadership skills at the top, across different categories of firm size (Akhlaque, Lopez 2017). A similar result was obtained in a more recent World Bank Survey on Innovation and Skills (Annex 1), where 74% of the enterprises in the Survey face difficulties finding employees with sufficient managerial and leadership skills.

FIGURE 12. **Innovation inputs are lower in Vietnam than in peers**

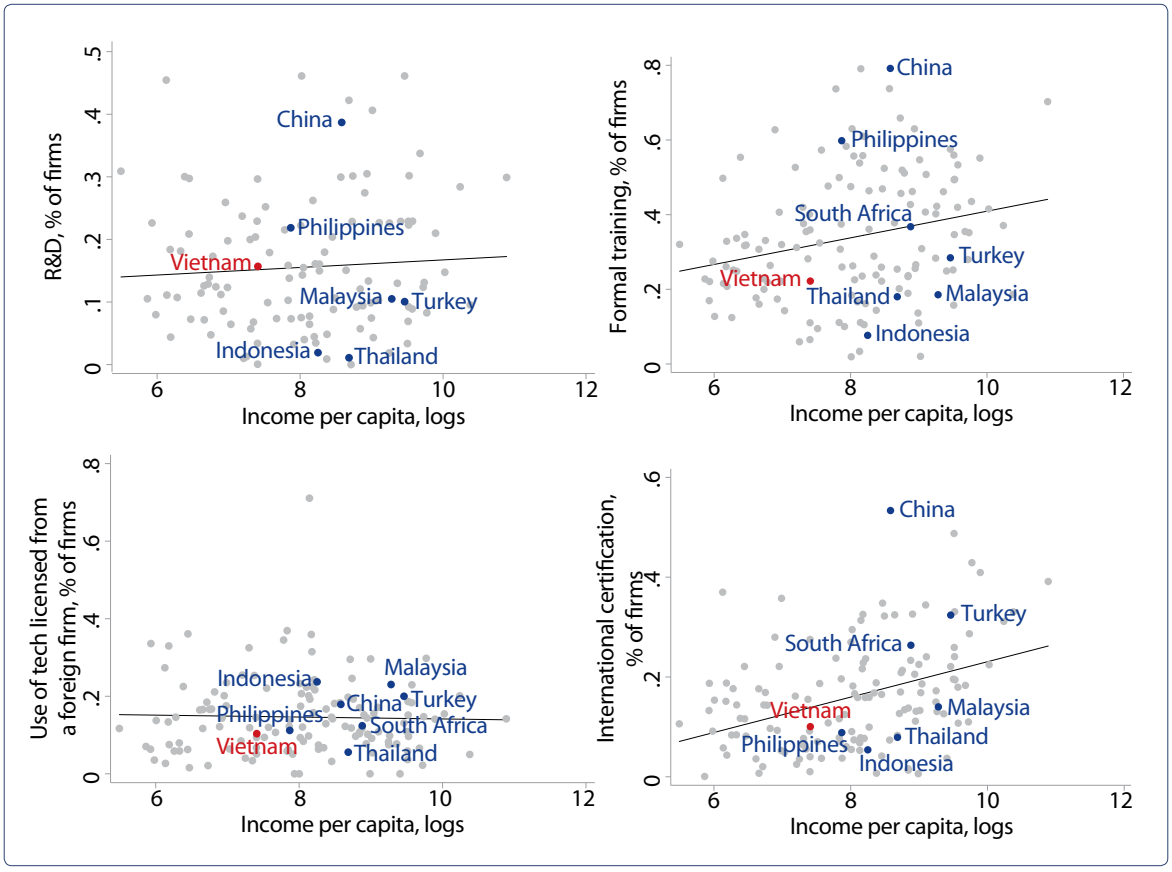


Source: Authors using WBES.

41. Overall, Vietnam ranks below most peers (except Indonesia and Thailand) across most innovation inputs (Figure 12). WBES captures a limited number of capability-related indicators (i.e., innovation inputs): research and development (R&D), formal training for workers, use of technology licensed from foreign firms, and internationally-recognized certification. These inputs are relevant for innovation capabilities;

for example, lack of a high-quality workforce hinders technological adoption and efficient production. Figure 13 shows that the shares of firms undertaking formal training, using foreign technology and achieving internationally-recognized certification are all below that expected for Vietnam's income level. Vietnam is, however, at par in conducting R&D (as a share of firms) for its level of development.

FIGURE 13. **Innovation inputs in Vietnam are mostly lower than expected, given per capita income**



Source: WBES and World Bank WDI.

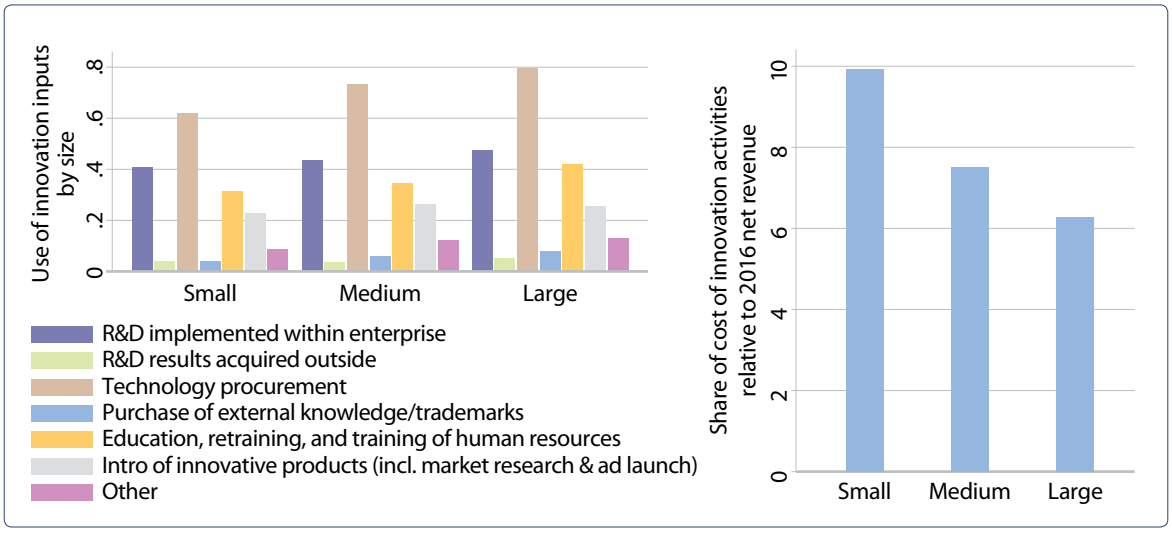
42. Assessing how innovation outcomes vary across innovation inputs, WBES results show that R&D matters across all types of innovation in Vietnam. Formal training increases the chances of process innovation, while use of technology licensed from foreign firms increases firms' chances of radical product innovation. Interestingly, possessing international certification weakly decreases the likelihood of radical product innovation, perhaps because this certification requires firms to comply with products already in the market, rather than create disruptive products. While certification reduces the probability of disruptive innovation (true for both Vietnam and cross-country sample), firms that have this certification are nonetheless more prone to product and process innovations than firms without certification.

43. Data from the Innovation Survey (NASATI, 2018) largely confirm the WBES results. The FIRST-NASATI survey covers a wider range of innovation inputs or activities than does the WBES, namely (i) R&D implemented within the enterprise, (ii) R&D results acquired/bought from other enterprises, (iii) technology procurement, (iv) purchase of external knowledge/trademarks,

(v) education, retraining, and training of human resources, (vi) introduction of innovative products (incl. market research and ad launches), and (vii) other innovation activities. For example, R&D implemented within the enterprise increases the likelihood of introducing new products by a factor of 3 among innovative firms[56], and of introducing new products that are also new to the market by a factor of 1.3. All of these innovation inputs increase the odds of innovation, especially for product innovation. This indicates that apart from R&D (the most commonly used innovation input), complementary inputs such as technology procured from outside the firm and investment in human capital are crucial complementarities for innovating in Vietnam.

44. The use of innovation inputs varies across firm characteristics. Specifically, within the manufacturing and processing sector, being a large-sized innovative firm increases the likelihood of acquiring all types of innovation inputs/activities. Still, the most commonly used innovation input across firm size is technology procurement[57] (followed by R&D implemented within the enterprise and education and training of workers) (Figure 14). An exporting firm tends to acquire more R&D and technology than do non-exporters, but not purchase more external knowledge (e.g., trademarks, licenses) or invest more in education or training of its human resources. The cost of these innovation activities represented about 8.6% of firms' total net revenue in 2016; these costs took a slightly higher share of revenues in small firms.

FIGURE 14. **Innovation inputs (left panel) and their cost (right panel) vary by size of firm**



Source: Authors using FIRST-NASATI.

56 Innovative firms are measured as to whether firms engaged in product, process, organizational or management, or marketing innovation.

57 While technology procurement is most common across firms, the intensity to which this is used varies. Small firms procure less technology than medium and large firms in Vietnam. Sources of technology also differ across firms, as small firms tend to procure more within Vietnam. In contrast, there is more variation in the countries in which large firms procure their technology (including from Japan and the EU). In practice, technology diffusion requires absorptive capacity and complementary factors such as access to capital and a knowledge pool. Lack of these factors may explain weak procurement outcomes. For one, while own capital and credit are most commonly used across firms, a higher proportion of large firms also have more access to loans from their parent company than do small firms.

45. In addition to the low level of R&D expenditures, R&D is mostly conducted in the public GRIs. These GRIs generally suffer from low quality and relevance due to: (i) fragmentation (there are more than 600 GRIs in the country managed by multiple ministries), (ii) lack of competition (funding is based on block-grants, not on merit or performance), (iii) inefficiencies (much of the expenditure goes to salaries of GRI staff, many of whom are not even involved in actual research), and (iv) lack of linkages with industry. The Government is seeking to enhance the autonomy of GRIs, promote their proactiveness and creativity, and facilitate greater linkage between S&T research and production, thereby improving the performance of these institutes and the innovation potential of the country. However, much more needs to be done. If Vietnam wants to connect to the global knowledge network, it needs to move faster to restructure the GRIs to fewer but larger institutes, with higher quality and market-orientation, and at the same time strengthen the university sector by enhancing the research and innovation capacity of its key national and regional research universities. There is a need to invest more in existing research at high-performing universities, conferring more autonomy to them and allocating research funding based on performance rather than plans. It will also be necessary to achieve a more productive division of labor between research in the universities and the GRIs (Marginson, S., 2014).

Complementary factors

Competition and regulatory environment

46. Competition policy should be strengthened. A large state-owned sector, incomplete market institutions and a cumbersome investment climate impede allocation of resources in the economy. The state's involvement in productive activities and resource allocation due to institutional legacies raises questions about a level playing field and the independent regulation of markets. There is an effort underway to move towards a level playing field between SOEs and private enterprises, but the process is slow given the urgency for reform.

47. More needs to be done to reduce operating environment constraints facing firms. Impediments in the operating environment can influence firms' incentives to innovate. In this context, *Vietnam 2035* recommended strengthening regulatory policies, removing distortions and promoting a level playing field through an improved regulatory framework for competition. The regulatory constraints involved in setting up enterprises and expanding businesses in Vietnam, while improving, remains cumbersome. The World Bank's *Ease of Doing Business* (2018) ranks Vietnam 68th out of 190 countries, below Singapore (2nd), Malaysia (24th), Thailand (26th) but above China (78th). Specifically, with regard to starting a business Vietnam ranks 123rd – behind Singapore (6), Malaysia (111), Thailand (6), and China (93) – underlining the unfavorable business environment for entrepreneurs who are agents of innovation. In addition, due to the lack of a level playing field, domestic private enterprises are unable to compete effectively against SOEs. The continued heavy presence of SOEs in certain sectors, particularly those that provide important input services to other firms, is a key constraint. SOE reform continues to be slow, despite its being regularly identified as a top priority in Government policy resolutions.

Finance for innovation

48. The availability of finance for innovation is slowly improving but more needs to be done. Innovative activities are inherently risky and generally entail investments in intangible assets that have limited collateral value, due to difficulties in gauging their proper financial value and the high transaction costs in dealing with them. Equity financing (angel investors and venture capitalists), rather than debt, is thus generally considered better suited for funding activities in industries where investments in intangible assets are relatively large and informational concerns are severe (such as biotechnology, computer software, etc.). In case of "routine" start-ups (such as restaurants, retail outlets, etc.), they are relatively easy to monitor by conventional financial intermediaries.

49. Despite rapid credit growth, access to innovation finance remains a constraint. Firms continue to require different means of financing as they move from one phase to the next in their life cycle. Vietnam has some representation in most phases of the start-up life cycle; however, it remains small. This is attributed to both demand and supply side issues. On the demand side, many firms are unable to produce business plans to seek out funding and lack investible ventures that indicate capacity to grow. Moreover, many incentives remain "on paper" as cumbersome guidelines, so that the administrative burden involved impairs access. Regulatory mechanisms are unable to catch up with innovation start-up development and serve as barriers rather than facilitators on the supply side.

50. The development of capital markets, as a complement to banking, has been on the radar screen of policy makers. Vietnam is a potentially dynamic startup market. Driven by the country's position as a vibrant growth hub, rising middle class and young demographics, it is an increasingly attractive emerging market destination for Venture Capital and Private Equity (VCPE) investors. According to the 2018 VCPE Country Attractiveness Index (Table 1), Vietnam ranks 43rd out of 125 countries, and within ASEAN region, it is competing with highly dynamic countries, like Singapore (ranked 6th) and Malaysia (ranked 13th). The year 2016 was an inflection point of growth for Vietnam's Venture capital (VC) industry as reflected by the tremendous jump in VC funding from $205mn in 2016 to $889mn with 92 deals in 2018.[58] In 2018, in a high-profile venture capital exit, Yeah1 – an entertainment group and investee of DFJ VinaCapital – was listed on the Ho Chi Minh City Stock Exchange (HSX).

TABLE 1: **Vietnam is less attractive to venture capital than are many East Asian comparators**

VCPE Country Attractiveness Index

Country	Rank	Score
Singapore	6	90.7
Malaysia	13	83.1
China	18	80.7
Thailand	27	72.2
Indonesia	37	64.3
Philippines	42	61.3
Vietnam	43	60.7
Kenya	53	57.6
Sri Lanka	55	57.3
Pakistan	63	53.2
Morocco	64	52.9

Source: Groh A et al (2018) Global Venture Capital and Private Equity.

58 Overall, the top sectors for VC investments in 2018 include fintech, e-commerce, travel, logistics and education.

The recent expansion in bond and equity markets notwithstanding, the outstanding market value of these markets remains low compared to peers in the region, suggesting that there is still ample room for growth. Programs that increase the availability of innovation financing should also work with intermediaries to ensure investees possess the technical capacity to utilize the capital effectively.

51. Angel investing, which is another financing source for start-ups, remains nascent in Vietnam. Despite the potential role that angel investors can play as a formal source of finance for start-ups, serving both as financier and experienced mentors, there are only 7 active angel investor networks and about 35 visible angel investors (out of over 14,000 high net worth individuals). Nevertheless, informal investment opportunities seem prevalent in Vietnam: ten percent of the population engages in such activities (GEM Study, 2015), compared to 8.6 in China and 3.7 in Australia.

52. In general, the start-up financing market faces constraints on both the supply and demand sides. On the supply side, difficulties in accessing start-up financing tend to appear in the ideation and exit stages of the firm life cycle. Innovative startups face difficulties in accessing capital from traditional sources such as banks due to lack of collateral and historical financial statements, thereby making the role of alternative financing more important (e.g., VC and angel financing). And firm exit is problematic due to an underdeveloped merger and acquisition (M&A) market and a high capital gains tax, among other exit issues. On the demand side, there is a lack of investible ventures that indicate capacity to grow. Many incentives provided to support start-ups remain "on paper", as cumbersome guidelines and the resulting administrative burden make it challenging to access. Regulatory mechanisms are unable to catch up with innovation start-up development and serve as a barrier rather than a facilitator.

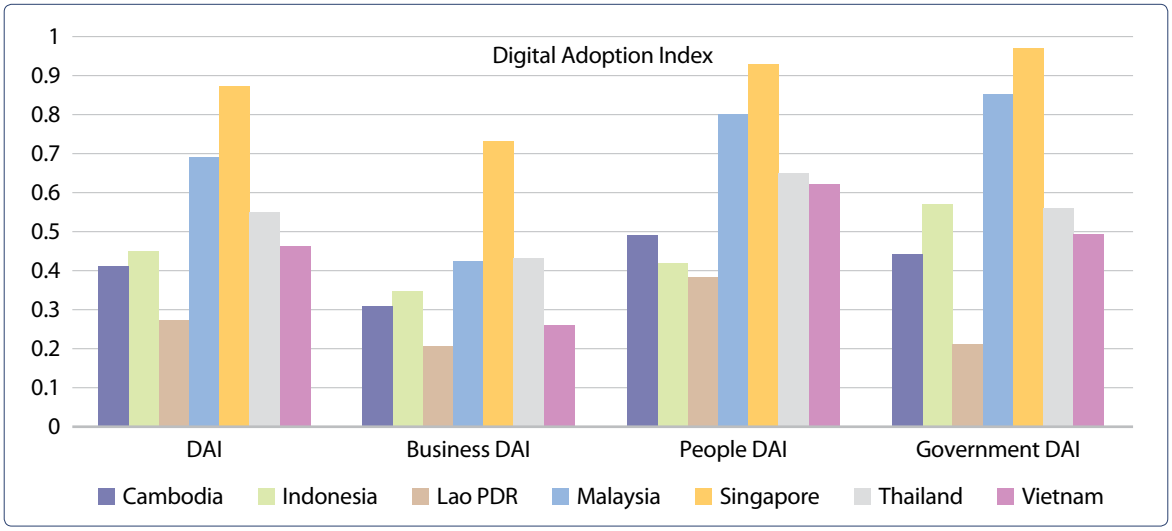
Digital infrastructure and connectivity

53. Digital-related infrastructure and regulations are central to realizing the promise of Industry 4.0. In 2019, one out of three Vietnamese still lacked internet access.[59] While ahead of Malaysia and Indonesia, Vietnam's fixed broadband is available to only about 12% of the population (Figure 16). Strengthening broadband infrastructure will also enable the use of new technologies to adapt to new business models. For instance, mobile payment systems are an increasingly integral part of ensuring that services can be embedded in goods. This will be an important complement to the Industry 4.0 agenda. ASEAN has witnessed visible growth in the use of financial technologies (Fintech) to offer new ways of delivering financial services. In 2016, investments in the Southeast Asian Fintech market increased to US$252 million, compared with US$190 million in 2015, a rise of about 33 percent. The upward trend in ASEAN continued in 2018 and is projected to rise in 2018 (World Bank 2018d).

59 Refer to Vietnam ICT White Book 2019 that states that 66% of Vietnam's population has access to the Internet. At the same time, only about 12% of the population are fixed broadband subscribers (page 29). This may indicate that Vietnamese people use broadband access primarily for entertainment (news reading, social networks) rather than work.

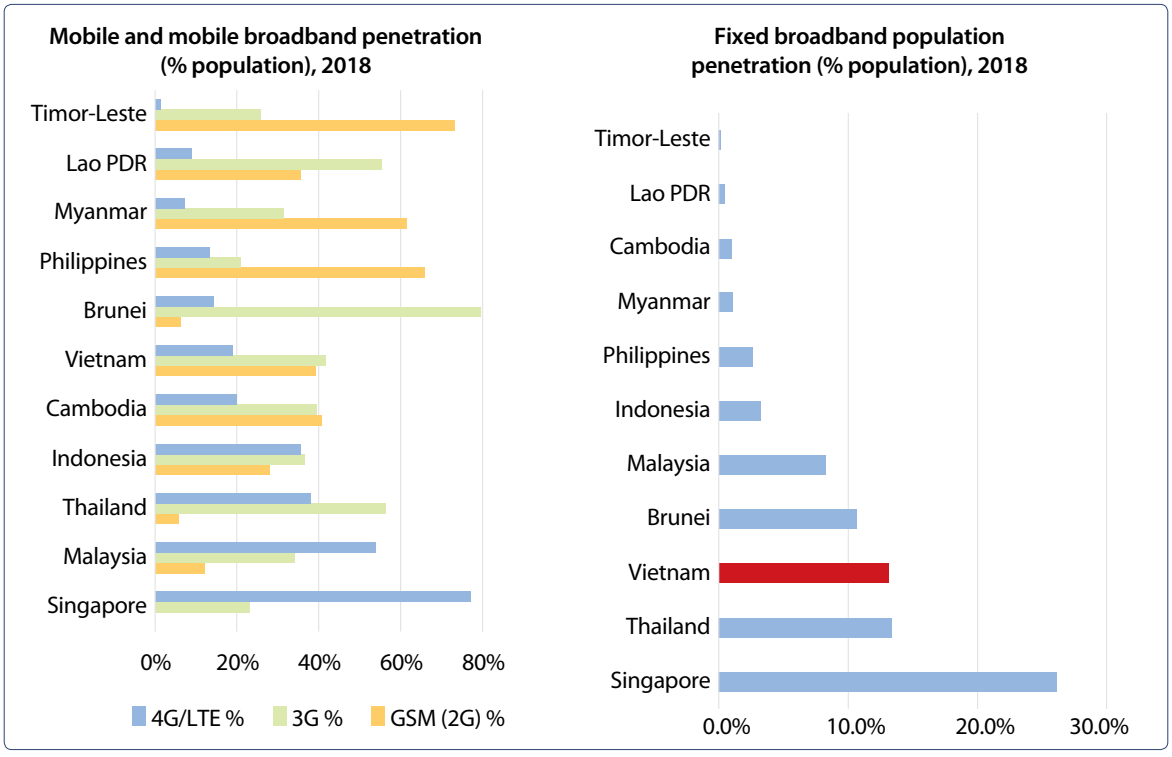
54. Firm-level adoption of digital technology in Vietnam and South East Asia remains low. Use of technology is important for increasing productivity and promoting innovation. The World Bank's Digital Adoption Index (DAI) indicates that the level of digital adoption by business and government is lagging that of people in Vietnam and the region (Figure 15).

FIGURE 15: **While digital adoption by people is relatively high, businesses and governments are lagging behind**



Source: World Bank-Digital Adoption Index (DAI).

FIGURE 16: **Mobile broadband penetration is lower in Vietnam than in many South East Asian countries, although fixed broadband penetration is higher**



Source: Telegeography, 2018.

55. The system of certifying quality standards will become central to participating in global value chains. With more complex products and processes, improving quality infrastructure (QI) systems can facilitate opportunities for export-led manufacturing to the extent that certification of internationally recognized standards enables firms to sell in major markets. New technologies may also change the content of some standards and increase the pressures to meet them. For example, QI is increasingly embedded in the physical and software components of deeply interconnected manufacturing processes associated with Industry 4.0: sensor-based applications, control systems, and continuous monitoring devices (Hallward-Driemeier and Nayyar 2017).

56. The lack of potential suppliers able to conform to MNEs' quality, price and reliability standards for existing production processes has been identified as a major constraint in Vietnam (World Bank and MPI 2016). For example, while half of foreign-invested firms hold an internationally-recognized quality certification, such as ISO 9001 on quality management systems, less than 10 percent of domestic firms do. An SME support program in Vietnam specifically provides training on standards and certification of quality management systems. The program, which runs till 2020, aims to develop 4,000 national standards, of which 45% is targeted to be in-sync with international standards. To date, the program has disseminated information on standards, conducted training, and implemented a quality management system ISO for over 300 SMEs. As part of this program, JICA experts, SME facilitators of the Northern and Southern SME Support Center, AED, and MPI have also collaborated to deliver an on-site consulting model to support firm implementation of 354 initiatives in technical improvements and improvement of 3S/5S production processes during the last three years (World Bank 2017).

Supply Side of the NIS

Tertiary education as provider of skills and research

57. The supply side of the NIS is associated with the education system, particularly tertiary education (including post-secondary TVET), which is seen to be one of the main providers of skilled manpower and knowledge. There are two main aspects: the quantity and quality of skilled workers provided by tertiary education institutions, and the relevance of science research and technology produced by STI institutions, including universities and public research organizations.

58. For a country like Vietnam, with aspirations to become a knowledge-led economy, workers need to acquire a more balanced set of cognitive, socio-emotional and vocational skills than they did in the past. While job-specific technical skills are identified as very important, a range of cognitive skills (including problem-solving, oral and written communications), socio-emotional skills (ability to work independently, and teamwork) – are also underlined (Enterprise Survey on Innovation and Skills Survey for Vietnam). Many socio-emotional skills are malleable throughout the individual's lifecycle, but there are several socio-emotional skills that are much more malleable between early childhood until adolescence. Policies to foster socio-emotional skills should take into account skills development across the lifecycle, including in primary and secondary education. In the age of Industry 4.0 and disruptive technologies, workers will also increasingly need to be able to utilize and interact with technology. Digital literacy, while increasingly important, is not systematically taught in the country.

59. The 2019 World Bank Enterprise Survey on Innovation and Skills (Box 3) showed that a large proportion of firms reported difficulties hiring employees with the required levels of managerial and leadership skills, socio-emotional skills, foreign language skills, and technical (non-IT) vocational or job-specific skills. The survey also revealed that the firms with a more literate and engaging workforce were more likely to engage in product and marketing innovations.

BOX 3: **The Enterprise Survey on Innovation and Skills in Vietnam**

The World Bank's Enterprise Survey on Innovation and Skills took place in 5 provinces, namely Hanoi, Bac Ninh, Da Nang, Ho Chi Minh City and Binh Duong from May to July 2019. This survey targeted firms in the manufacturing and ICT services sectors and included state-owned enterprises. 201 firms representing four strategic sectors (i.e.,, high-skilled innovator, medium-skilled innovator, labor intensive and ICT services firms) were randomly selected from the Vietnam Enterprise Registry 2017 data. The four strategic sectors were based on the "Future of Manufacturing-Led Development" framework which also considers the services sector as part of the whole value chain (Hallward-Driemeier and Nayyar, 2018). It is likely that firms representing these four strategic sectors within the five provinces are more likely to have engaged in innovation compared to other types of firms in other provinces. This survey collected information on firm characteristics from 201 managers as well as employee background and skills from 849 staff.

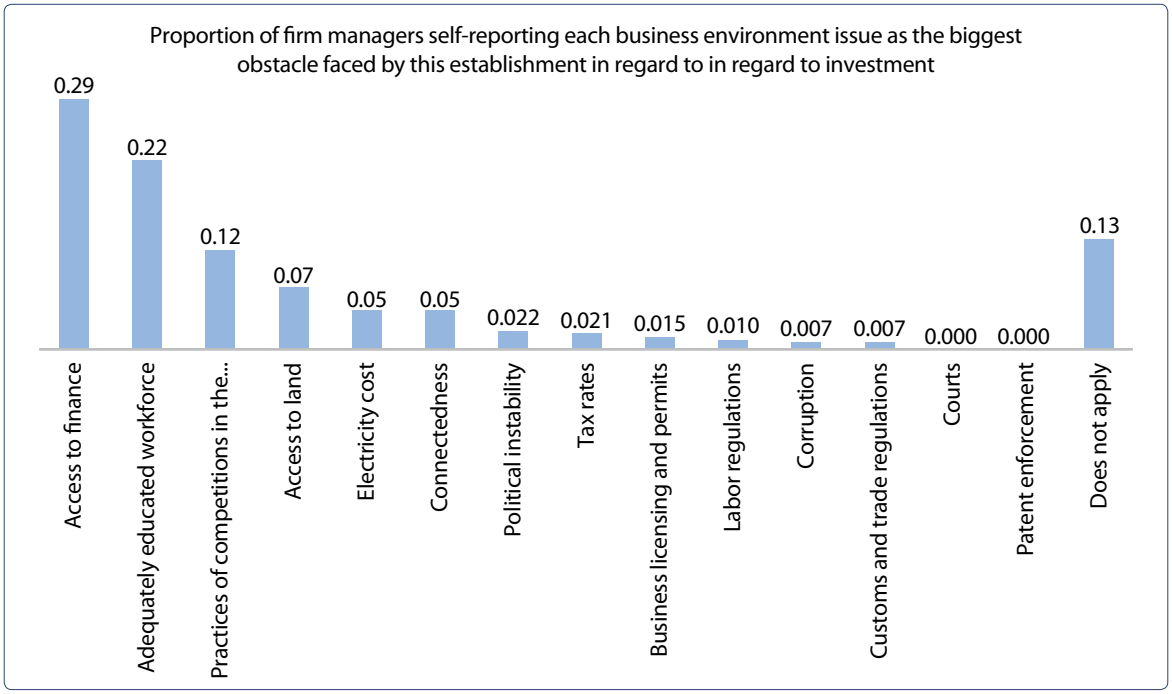
The *firm assessment* was designed to capture general background information, innovational practices, and firms' perception of factors that hampered innovative practices. The *employee assessment* was designed to assess employees' literacy and socio-emotional skills, as well as demographic and socio-economic background. One of the most important contributions of this enterprises survey is the linked information on innovation practices and employers' and employees' skills.

60. Some of the key results from the Enterprise Survey on Innovation and Skills are:

- **A considerable proportion of firms considered limited access to a skilled workforce a major reason for not investing in innovative practices.** Firms self-reported limited access to finance (29%) and adequately educated workforce (22%) as the two most significant obstacles to fostering innovation (Figure 17).
- **The literacy level of employees was generally low in the companies participating in the survey.** Over 54% of employees performed below the literacy proficiency level 3, a level that is considered vital in 21st century workplaces in which an increasing proportion of workers are required to act autonomously in non-routine tasks.
- **The general low literacy level in the firms is worrisome, since the Survey also showed that firms with high levels of literacy and socio-emotional skills were more likely to engage in innovation practices.** Indeed, firms with employees with (a) average literacy proficiency level of 3 and above, and (b) higher levels of socio-emotional skills – 'engaging with others' and 'managing emotions' – were much more likely to engage in innovation practices.
- **There were signs of skills shortages across various skills dimensions.** A large proportion of firms highlighted difficulties hiring employees with the required levels of managerial and leadership skills (73%), socio-emotional skills (53%), foreign language skills (58%), and technical and vocational skills (68%). Hiring difficulties were particularly salient among medium-skilled

and labor-intensive firms. Moreover, medium-skilled firms and labor-intensive firms showed a higher proportion of managers, professionals, technicians and clerks with lower levels of literacy and socio-emotional skills.

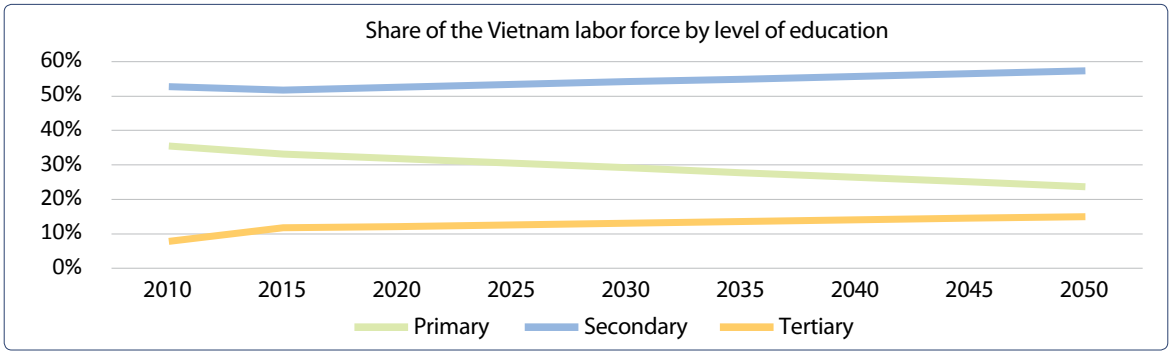
FIGURE 17: **Access to finance and skilled workforce are the two major obstacles firms face in fostering innovation**



Source: World Bank Enterprise Survey on Innovation and Skills in Vietnam, 2020.

61. While today's youth tend to have stronger foundational skills than their elders, the workforce at large has low levels of education and serious skill gaps. The Survey also showed that the younger generations (e.g., below 35) generally demonstrate higher literacy proficiencies than older generations (e.g., 35+). The results hold for both female and male workers. The growth of knowledge-intensive exports, the service industry, and automation will require a labor force with a range of skills and a means to upskill over the lifetime. The Vietnam Future Jobs Report (2018) estimates that if Vietnam were to follow the current trend, the overall share of the labor force 15 years-old and above with a tertiary education degree will only marginally increase by 2050 (as shown in Figure 18 below), reflecting the low level of current enrollment and expected slow future expansion. The 2018 Global Competitiveness Index ranks Vietnam 127th of 140 countries on the industry-relevant skills set of university graduates. While Vietnam is recognized globally for its high and equitable level of PISA scores that are par with OECD countries, the country has not yet been able to capitalize on this great potential of high school graduates because of the low quality and relevance of the tertiary education system.

FIGURE 18: **The share of the workforce with tertiary education is likely to increase only marginally through 2050**



Source: Vietnam Future Jobs (2018).

62. Vietnam's tertiary education has made notable progress in the past two decades. First, Vietnam has significantly expanded access to tertiary education. The gross enrolment rate at the tertiary level increased dramatically from 10 percent in 2000 to 28 percent in 2016, more than doubling the total tertiary enrollment from 0.9 million to 2.2 million in the same time period. This was driven by both demand-side factors, such as rise of the middle class and increased high-school graduation rates, and supply-side policies, such as the move towards diversification including the growth of non-university VET institutions and the private sector TEIs. Secondly, tertiary education graduates today have the best labor market outcomes among all educational subgroups in Vietnam. Salaries, the likelihood of formal employment and better paid jobs are the highest for university graduates, reflecting high demand for university education, justifying further public and private investments in the expansion of the sector. Thirdly, there has been clear policy intent by the Government to transform the sector. The Higher Education Reform Agenda 2006-2020 and Resolution 29 on Fundamental and Comprehensive Education Reform on Education move towards institutional autonomy, which coupled with the recently-amended Higher Education Law and the Government's ongoing work on the formulation of a new higher education strategy aim to make the system more responsive to today's skills and research needs. It should be noted that research outputs have also improved recently, as seen from a five-fold increase in the number of International Scientific Indexing (ISI) publications in the last 10 years and the number of Vietnamese universities listed in the global and regional university rankings.

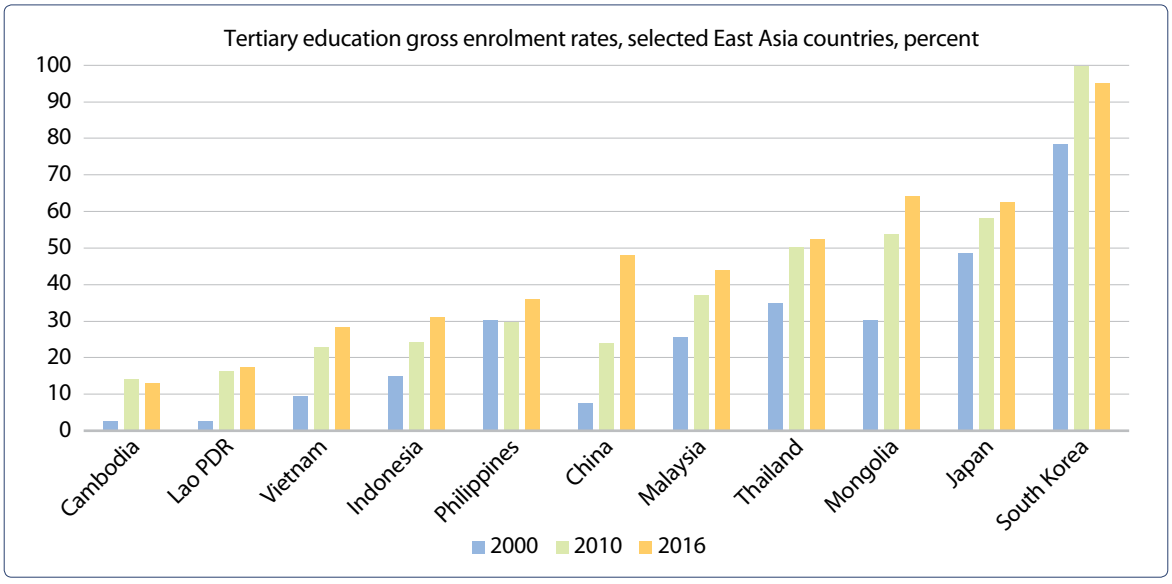
63. There is however significant room for improvement across different dimensions of tertiary education. Despite the large increase, the gross enrollment rate in higher education is below 30 percent, low compared to the regional peers such as China, Malaysia and Thailand whose GERs are closer to 50 percent (Figure 19). Vietnam should make a major effort to increase the enrollment in tertiary education. TVET institutes and universities will have to pay attention to 35, 45 and 55-year-olds, not just 20-year-olds, since over 54 percent of employees performed below the literacy proficiency level 3. This level is considered vital in 21st century workplaces, in which an increasing proportion of workers are required to act autonomously in non-routine tasks according to the Enterprise Survey of Innovation and Skills. This requires significant changes in the way institutions and the system function. Without a massive increase in the workforce with a higher level of skills, Vietnam will not be able to get the basics right for an improvement of its national innovation system. Importantly, as mentioned earlier, 2018 Global Competitiveness Report puts

Vietnam in the bottom 3rd of the ranked countries on the skills-set of university graduates and capacity for innovation.

64. Recent changes to the Higher Education Law distinguish between application-oriented and research-oriented universities. The application-oriented universities focus on developing the graduates' practical skills using technologies to create solutions, while the research-oriented universities put their emphasis on research-oriented bachelor and master's degrees with a critical mass of Ph.D. programs. The majority of universities (application-oriented) and the TVET institutes should focus on providing their graduates with skills that would facilitate enterprises' need to adopt and apply new and existing technology to increase their productivity. The total R&D personnel per million population (measured in FTE) was 887 in Vietnam in 2017, compared to Thailand (1632 in 2016), Malaysia (2859 in 2016) and China (2862 in 2017). Graduate enrolment at universities was 121 thousand in 2017 (Masters-106 thousand and Ph.D.-15 thousand), which is very low for a country with Vietnam's population and economic development. An additional effort should be made to increase the supply as well as quality of Master's and Ph.D. degrees significantly, as it is important that Vietnam has sufficient capabilities to take advantage of new developments in frontier research, but the main focus of innovation policy should for the foreseeable future be on technology adaptation. Universities have recently initiated financial incentives for their faculty to produce publications – but in general there is no well-developed research talent management program for researchers in the country.

65. The ongoing analytical work on a strategy for higher education has identified the following five factors responsible for low performance in the sector. One, Vietnam's higher education receives a low level of public funding (only about 0.33% of its GDP) and has a high-level of cost-sharing (more than 60% of public universities' income comes from students/households), making the system one of the least invested (compared to its peers) and less affordable for economically disadvantaged students. At the same time, the allocation of limited public funding for tertiary

FIGURE 19: **Tertiary education enrollment is low in Vietnam**



education is fragmented, based on historical norms and not on performance, thus severely limiting competition and efficiency. Two, the tertiary education quantitative expansion strategy has not been implemented as planned. The university and TVET sectors have expanded in an uncoordinated manner, within and between the two sub-sectors, and is not aligned with the real labor market needs. The private higher education sector has not developed as expected, accounting for only about 15 percent of total higher education students.

66. Three, the current curriculum is deemed to be inadequate, with a focus on theoretical knowledge and less on applied skills, including soft skills such as entrepreneurial, leadership, communication and teamwork. There is limited linkage with employers and international partners. Pedagogical practices still entail lecturing as the predominant teaching method, and there is limited national steering, incentives and quality assurance to promote innovations in curriculum and pedagogy. Entrepreneurial Learning (EL) is not yet an integrated part of Viet Nam's national education system. The country has not developed a national standard curriculum on entrepreneurship subjects, and EL elements are hard to discern at the primary and secondary education level. Entrepreneurship elements are more clearly defined at the university level. Recognizing the importance to embed EL in the national education system, MOET introduced a plan called "Supporting Student Entrepreneurship 2017-2020 with a Vision Towards 2025". The plan intends to equip university students with basic knowledge and skills on entrepreneurship.

67. Four, tertiary education governance is outdated and not well-defined. There are two ministries – MOET and MOLISA – managing the higher education sub-sector (universities) and TVET sub-sector (colleges) respectively, with little coordination between each other. On the whole, the Government is still far from fulfilling its role and responsibility as financier (does not invest adequately and competitively) and steward (does not sufficiently fulfill its role on policy formulation, coordination with labor market and international partners, capacity building of university leaders and performing M&E). There is a need to establish good information systems such as Labor Market MIS (LMIS) and Higher Education MIS (HEMIS) for policy makers, employers and students. On institutional governance, Vietnam is moving in the right direction by introducing the autonomy reform but is yet to produce the desired results as there are significant gaps between policy intent and implementation. Similarly, institutional accountability mechanisms are still in a nascent phase. There are disconnects between sectors and institutions: between the university and TVET sub-sectors on articulation of pathways between the two streams, between TE institutions and employers on skills and research, between universities and GRIs on research resources and collaboration.

68. And five, weak research and technology transfer capacity of the tertiary education institutions is largely due to lack of required talent as well as policies and incentives to attract and retain those talents. In addition, limited financial resources on research and technology transfer are spread too thin, managed by multiple agencies (41 national & 63 provincial agencies) and allocated in ways that do not often promote performance. As already documented, there is a sharp divide between public universities (171) and GRIs (>600) with R&D resources going mostly to GRIs. Going forward, talent management, coherent policies and appropriate financial incentives will be critical for Vietnam to promote research, innovation and technology transfer through its tertiary education system. The Government is currently working towards preparing a higher education

strategy 2021-2030 that seeks to improve the quality and relevance of higher education by renovating the curriculum and pedagogical practices, reforming governance and financing mechanisms, and encouraging university-enterprise partnerships.

Summary

69. Figure 20 below summarizes the key challenges and recurring weaknesses in Vietnam's NIS that deter firm-level innovation. These challenges should inform the priorities of public policy. The policy effectiveness review in the next section assesses the last pillar of the NIS, i.e., the coherence and quality of the STI Policy Mix vis-à-vis the needs of the enterprises.

FIGURE 20: **Vietnam National Innovation System – Priority Areas of Reform**

	Priority area	Status
Firm level	Support firm capabilities	• Domestic firms, esp. SMEs, have weak managerial and organizational capabilities that deter them from technology adoption and upgrading. SMEs owners typically are not aware of their limitations, and how to overcome them. SMEs lack access to information networks, universities, field experts, and do not have the in-house expertise to solve problems. Specialized private sector advisory services tend to be underdeveloped.
External to the firm (complementary conditions)	Improve business env.	• The regulatory and policy environ. reforms need to be expedited to improve business entry, operation & exit. Strengthening competition policy as well as promoting competitive neutrality through reforming SOEs can play a key role in leveling the playing field between SOEs and private domestic firms.
	Strengthen IP protection enforcement	• To encourage MNCs to share their technologies with local firms a comprehensive IP protection system needs to function in Vietnam. Despite improvements in IPR legal framework, concerns remain with IP protection enforcement and adequate coverage of on-line enforcement of copyrights.
	Enhancing financing for innovation	• Vietnam has attracted venture capital and private equity (VCPE) financing, however, investees lack ability to create business plans to seek out funding and lack of investible ventures that indicate capacity to grow. Insolvency law, tax write offs for tech transfer, and new debt financing instruments needs to be reformed.
	Digital infrastructure & connectivity	• Digital infrastructure and regulations remain central to realizing the promise of Industry 4.0. In 2019, 2 out 3 people in Vietnam have internet access but firm level digitalization remains low. Deepening the data ecosystem, including regulatory frameworks available to support cross-border data flows, data security, and privacy will promote use of technology and knowledge flow.
	Building relevant skills	• Vietnam will need to emphasize soft and cognitive skills such as creativity, team work and problem solving and digital literacy skills with greater urgency for a large section of the population. In addition, building advanced STEM skills will also be critical. TVET system in Vietnam needs to be improved so that the quality and quality of skilled professionals can be expanded through better collaboration between TVET institutes and firms.
Knowledge supply	Links between university and industry	• There is a very low level of university-industry collaboration that takes place in Vietnam. There is not enough industry relevant research taking place at the Government Research Institution (GRI). Placements of university researchers in industry join collaboration projects, and private participation in university governance may help to bridge this gap. In addition, a sound monitoring framework to assess the effectiveness of research will help in funding allocation.
	Effective allocation of public R&D	• While there has been recent reform to advance research under competitive, peer-reviewed, and merit-basis, procedures still need of strengthening to foster open competition and fund thematic priorities in special projects and programs. Accountability could be enhanced by distinguishing funding for basis applied research, and by establishing a competition based funding where GRIs compete for funding.

Source: Author's presentation.

V Policy effectiveness review[60]

70. The PER assesses one of the fundamental pillars of the expanded NIS (Cirera and Maloney (2017), i.e., the coherence and quality of STI policies. In line with the *Vietnam 2035* report, the emphasis is on placing enterprises at the center of innovation policies. The objective of the PER is to review how the GoV encourages innovation activities – through policy interventions that require public expenditure – and assess the choice of instruments and the quality of their design and implementation. The analysis excludes block funding to GRIs and universities and focuses on direct and indirect interventions often articulated through calls for proposals and competitive allocation of resources. The PER methodology, developed by the World Bank, is presented in the companion volume of the STI Report titled Policy Effective Review, Volume III (WB, June 2020).

71. The first component of the PER evaluates the coherence of the policy mix for innovation in addressing the key challenges to foster innovation and the needs of the enterprises, which should be the priorities for public policy. The focus is on the alignment between policy objectives and private sector needs. The second component is the functional review, which involves a detailed evaluation of the quality of the design and implementation of a sample of programs under multiple ministries/agencies in Vietnam that focus on innovation. Existing design and implementation practices are assessed in relation to the use of best practices. In this section, we first summarize the key

60 The PER section is authored by Jaime Friars and Xavier Cirera (Aug. 2019).

conclusions for each of the two sections of the PER. Based on the analysis, the final section proposes a set of actions and recommendations to improve STI policies and discusses the appropriate sequencing for their implementation.[61]

The STI policy mix

72. Limited availability and sharing of data across agencies undermine policy evaluation and learning, which are critical for improving existing policies. A first important element that needs to be stressed before summarizing the key findings of the analysis is the limited access to data, especially regarding time series data of budget allocation, that exists in Vietnam. This has limited the scope of the analysis, but more importantly, the lack of data sharing practices across agencies constrains the work of planning and monitoring offices in evaluating policies, and the ability to learn and adjust existing policy instruments. One critical example was the lack of knowledge and inability of innovation agencies to determine the exact amount of foregone revenues for the tax incentives to high-tech firms. Stakeholders engaged in advancing innovation policy, should have easy access to information on the level of resources allocated to specific science and technology policies. Good policy practice, e.g. Brazil, includes regular publishing (i.e., quarterly) of foregone tax revenue devoted to innovation by the competent tax authority. More data-sharing and common systems is needed across government agencies, particularly to understand performance of existing programs, but also more external transparency towards citizens in relation to subsidies and incentives.

An incoherent STI policy mix

73. The analysis of the STI policy mix reveals significant incoherencies in the choice of policies instruments and especially in the allocation of resources, which is likely to result in a lack of additionality of STI policies. In what follows, we highlight the most important incoherencies and in the last section, some policy actions to address these problems are proposed.

A very skewed resource allocation for STI

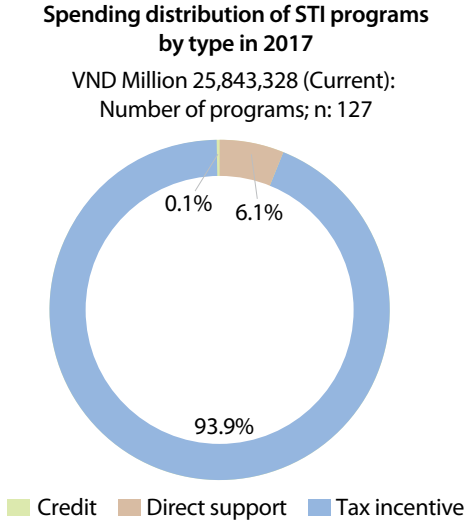
74. The existing STI policy mix in Vietnam is very narrow in the allocation of resources and highly concentrated in promoting R&D spillovers, which compromises its ability to tackle the wider set of challenges for enhancing innovation found in Vietnam. Figure 20 summarizes some of the key constraints that Vietnamese firms face and that undermine their ability to become more innovative. These constraints belong to different areas of policy making and should form the key priorities for policy support. However, the allocation of public resources does not largely address these demands, and it is highly biased towards the high-tech program and directed mostly at a few large companies (Figure 21). The largest STI program targets R&D activities by MNEs and in terms of resources had an allocation of VND 21 trillion (US$ 913m)[62] of foregone tax revenue in 2017

61 Detailed analysis and findings are available in the standalone Vietnam PER Report which is the third volume of the STI Report.

62 This Figure was provided by the Ministry of Finance, and it is related to the foregone revenue in corporate tax from tax incentives for high-tech companies with the objective of attracting R&D activities. It is this objective of attracting R&D that justifies its inclusion in the analysis as part of the policy mix. The full amount of foregone revenue is likely to be higher given that these companies tend to have other incentives, sometimes at the regional level.

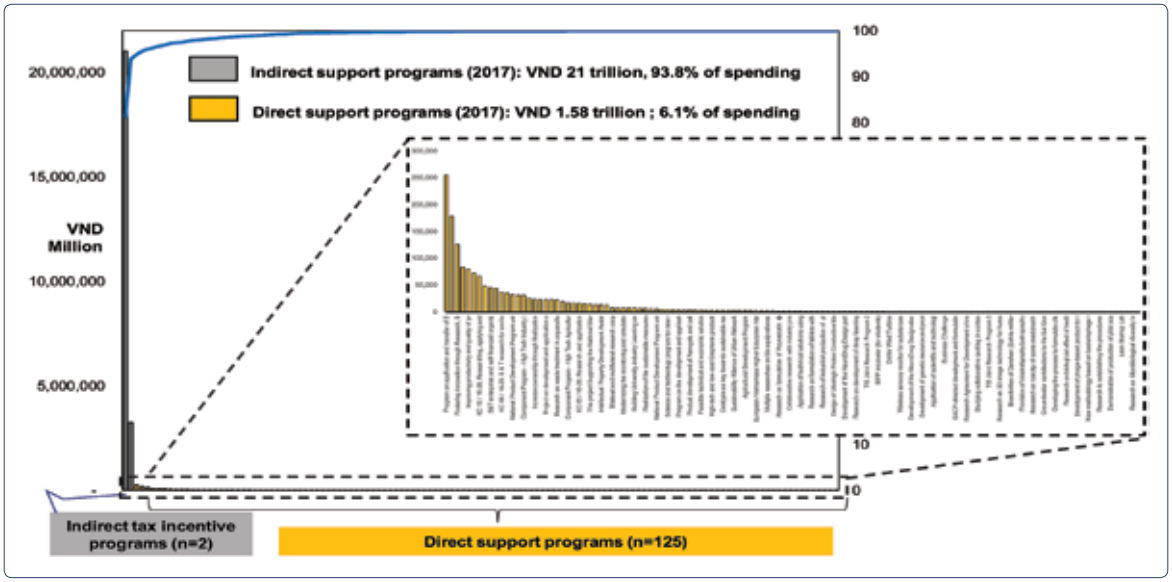
(equivalent to 94% of STI expenditures in our portfolio mapping exercise), providing fiscal exemptions to 38 large foreign companies (Figure 22. Box 4 below provides a brief reference to some of the most prominent R&D tax incentive schemes in Vietnam.

FIGURE 21: **Tax incentives presented a large share of costs in the policy mix in 2017**



- Spending in tax incentives for Science and Technology seems high, representing 93.9% of all spending for the selected programs under the study in 2017.
- The foregone tax revenue was associated to a small number of very large Multinational enterprises (MNEs), implying that the benefits remain highly concentrated in a few participants of these schemes.
- Conducting an assessment of these tax incentive schemes seems important to understand if the knowledge spillovers are indeed occurring and whether these schemes are effectiveness in generating impart additionality[1]

FIGURE 22: **Programs that relied on direct support were underrepresented in the innovation policy portfolio**



Source: Authors calculations based on various ministries, city and university sources, interviews with representatives of program management units, and implementing agencies. Indirect tax incentive programs (n=2).

75. The concentration of resources in promoting business R&D-based innovation is risky and neglects other key innovation objectives. Overall R&D expenditure as percentage of GDP in Vietnam was about 0.5 percent in 2017,[63] falling below GoV's expectations of 1.5 percent of GDP (Strategy for Science and Technology Development 2011-2020). Thus, attracting foreign companies to invest in R&D in Vietnam seems a reasonable strategy to generate benefits to the local economy through knowledge spillovers associated with R&D. However, these positive externalities do not occur automatically, just by attracting investment from technology intensive firms. Recent work on FDI-domestic firms' linkages has shown that while FDI investment has brought enormous gains to Vietnam in terms of growth, exports and jobs, there has been limited success in developing linkages with the domestic economy (Akhlaque 2017). FDI has remained largely disconnected from the domestic private sector.[64] Furthermore, tax incentive schemes for ST enterprises rely heavily on tax holidays, but recent evidence indicates that performance-based incentives[65] are far more effective than the existing profit-based schemes. Incentives delivered through allowance and credit schemes are independent of profits earned by the company but instead depend on the size of the investment, which can lead to higher additionality (Andersen, 2017). Allowances and credit are less prone to abuse of profit-shifting and more tightly linked to the policy outcome to which they are conditioned. Vietnam has already made use of performance-based instruments to achieve related objectives, including job creation, linkages and the development of green technologies[66]. Based on these findings, this study proposes to review the incentive schemes to identify opportunities to transition from relying heavily on profit-based incentives to either allowances or tax credits linked to investment or activities around knowledge spillovers and technology transfers. Also, getting local firms to do R&D, when linkages are successful, is not necessarily the largest return to public investments, given that most firms in Vietnam would benefit greatly from introducing incremental innovations that may not require formal R&D activities. Thus, it is urgent for policy makers to understand whether these tax incentives are achieving the intended goals and create knowledge spillovers and productivity growth that justifies their high fiscal cost.

63 S&T White Book 2018 (page 72).

64 Some of the binding factors identified for lack of linkages between foreign-owned firms and domestic companies include lack of skills, and information gaps on FDI sourcing strategies, and their quality, cost and delivery (QCD) standard requirements. Access to finance appears to be a binding concern for nascent firms in the electronics/ICT software sector, and for domestic firms aiming to make a breakthrough to become suppliers. Policy and institutional constraints, such as insufficient policy alignment, and poor implementation and capabilities constraints in the public sector, are also emphasized. For details, refer to Akhlaque A. and A. Lopez and A. Coste. 2017, *Enhancing Enterprise Competitiveness and SME Linkages in Vietnam: Lessons from International and National Experience*, World Bank, 2017.

65 Such as investment tax credits, allowances and/or accelerated depreciation which align more closely to the investment in either R&D or technology-intensive activities. While more complex to administer, these types of incentives tend to be both more effective and less distortive in promoting private investment. Performance-based incentives can also help tackle issues around tax holidays and how to address reinvestment or expansion (World Bank, 2018).

66 For example, Vietnam currently offers a 50% exemption on income from the transfer of technology for enterprises supporting technology transfer to local enterprises in regions with difficult socio-economic conditions.

BOX 4: **R&D tax incentives in Vietnam**

R&D tax incentive schemes are a common instrument in developed countries used to induce firms to invest in R&D. These incentives reduce the tax burden of firms that invest in eligible R&D activities. Their justification rests on the case of supporting knowledge spillovers, considering most firms do not invest enough when imitation prevents firms investing in R&D from reaping the benefits of such investments. Most R&D tax incentive schemes in developed countries use the OECD Frascati Manual to define eligibility of expenditures (Cirera et al, 2020).

Vietnamese policy practitioners have favored the use of this instrument given the importance of increasing business R&D, particularly through its base of foreign investment. Vietnam has a variety of tax incentives for innovation, which include import duty exemptions, exemptions for land use tax, reduced VAT, and tax holidays. The existing schemes do not focus on promoting R&D activities per se, but rather on promoting high tech sectors, where the eligibility of expenditures is based implicitly on R&D investments (EY, Global report, 2019). The Incentives (tax exemptions) for High-Tech Enterprises was the scheme that accounted for the highest value of foregone tax revenue in 2018, as registered through this report. The scheme enables firms to enjoy a preferential income tax rate of10% for 15 years.

The process to participate in this scheme implies that prior to qualification, companies need to obtain a certificate of registration of scientific research activities, which is given by a state management agency. Firms prepare the proper documentation, which is submitted to the tax authority. Companies need to submit receipts and invoices for eligible expenses. The tax authority reviews the data and decides whether to approve the application. Incentives apply according to the area in which the company operates – e.g. difficult socio-economic conditions, economic zones, and hi-tech parks or to specific activities carried out by the company – e.g. scientific research and technology development and high-tech applications. The law does not make any distinction by a firm's size, but it allows for supporting newly established enterprises that qualify based on location or that perform the activities described earlier. The scheme does not include provisions to carry over the benefits from one year to the next, nor does it offer cash refunds (for young firms).

Sources: Law No. 14/2008/QH12 on Enterprise Income Tax; Law No. 78/2006/QH11 dated 29/11/2006 and related documents: Law on Tax Management; Decree No. 218/ND-CP dated 26/12/2013 guiding the implementation of the law on Enterprise Income; Ernest & Young; Worldwide R&D incentives Reference Guide 2019.

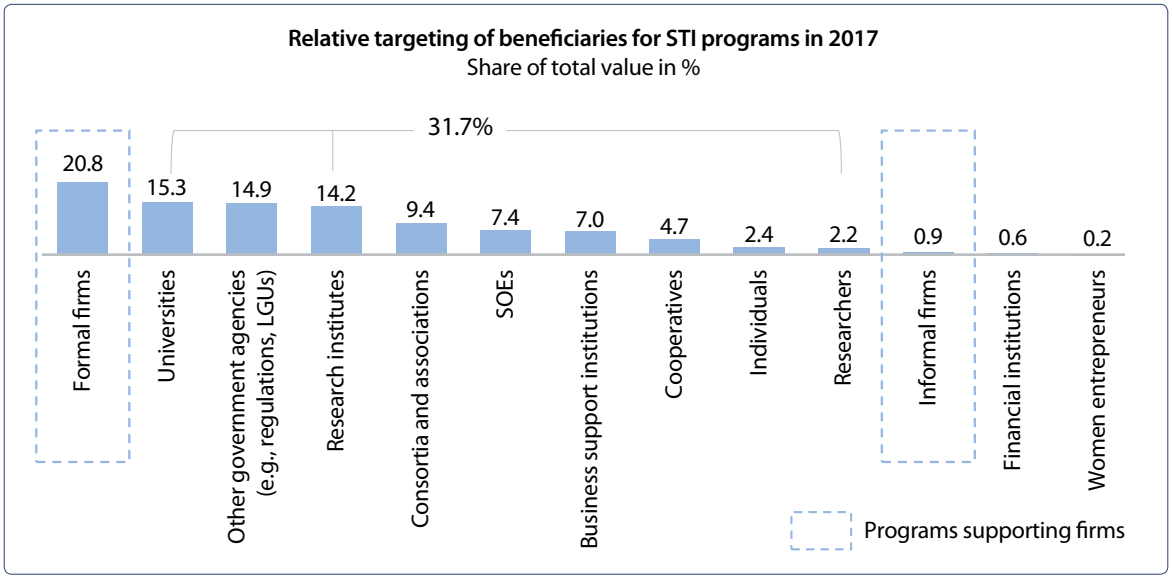
STI policies are hardly reaching key beneficiaries: the domestic private sector

76. The aggregate resources going to other potential private sector beneficiaries beyond the large technology-based, FDI enterprises, remain very limited. The level of spending available for programs that do not rely on tax exemptions to promote innovation seem insufficient to achieve meaningful and nation-wide results. Excluding tax incentives to high-tech enterprises, this pattern of financial resource allocation (Figure 22), appears to be inconsistent with the country's aspirations laid out in *Vietnam 2035*, and its much lower that the levels of spending found in other countries such as Chile, Colombia, Argentina or the Philippines. As an example, in 2017, the level of financial allocation for direct support to business innovation was US$ 237 million in the Philippines (World Bank, 2019). By contrast, in 2017, the amount of funding for direct support to innovation in Vietnam was VND 1.5 trillion (~US$ 69m).

77. Furthermore, when tax incentives are excluded, academic and research institutions are the main beneficiaries of STI policies, rather than the domestic private sector. Around

31.7 percent of these funds[67], which were scoped to back-up business innovation, supported research and academic institutions, leaving only 20.8 percent of the spending available to support domestic formal private businesses in 2017 (Figure 23). This is even the case for programs that support startups, which often target spinoffs from universities. This fact also suggests that the change of focus towards firms mandated in the last STI strategy remains incomplete, and that a significant bias lingers towards public institutions in STI policy.

FIGURE 23: **The balance of direct support programs supported academic and research institutions, leaving meager support to businesses**



Source: Authors calculations.

Note: Instruments excluding tax incentives (n:125).

Limited coverage of the target population of beneficiaries with high geographical concentration in Hanoi, the northern region, and high spending per project

78. There is a very limited number of projects by program, and coverage is further reduced by a limited geographical coverage of beneficiaries. The typical government-run innovation program had 11 active projects in 2017, implying a strikingly low rate of outreach within the target population of innovators (Table 2). Although the number of beneficiaries that should be the target would depend on the number of potential beneficiaries, which in turn will depend on the type of program, and each project could include more than one beneficiary; the average number of projects remains very small to have significant nation-wide effects. This is exacerbated by the fact that as found in the functional review, most beneficiaries are concentrated in the northern region, predominantly around Hanoi, due to lack of adequate geographical/provincial targeting. It is worth noting that the composition of the sample of 32 programs from table 25 may not be representative, as their inclusion

67 Allocation of funds correspond to expected beneficiaries in the design of the program. We do not have the final list of beneficiaries disaggregated by type. But it is important to assess how many of the final list of beneficiaries are private sector firms without necessary academic connection.

followed data availability. These programs are likely to be heterogeneous, particularly in their relative size and scope of influence. Thus, a deeper analysis of the composition of beneficiaries per project, the scope of activities, and the efficiency of programs in obtaining outputs should be done to understand their value. Widening the targeting of existing innovation programs to include a larger population of domestic firms may be necessary if these policies were to meaningfully contribute to the STI goals in Vietnam.

TABLE 2: **Coverage of target beneficiaries seems low among ministry programs**

Summary of project coverage and benefits for selected STI programs in 2017

VND Million 1,358,615 (Current); Number of programs; n:32

	Average	Median	Standard dev.	Min	Max.
Number of projects (# of)	16	11	19	1	91
Ratio of total spending to projects (VND Million)	6,382	3,234	14,930	n.a	83,400
(US$ '000)	277	141	649	n.a	3,626
Max spending per project (VND Million)	14,155	7,563	18,692	n.a	70,000
(US$ '000)	615	329	813	n.a	3,043

Source: Authors calculations.

Note: The term 'project' refers to either individual firms or consortiums of firms.

79. The amount of funds allocated by project appears to be high, which could only be justified by the existence of very large returns by beneficiary to minimize capture. The ratio of the average yearly spending to the number of projects selected in the same year across program was VND 6.3 billion (US$277 thousand) in 2017[68] (Table 3). The project as unit of analysis sometimes refers to consortiums, often featuring more than one beneficiary, but also in some cases it includes a single beneficiary. In addition, the measure of the number of new projects selected in a given year is lower than the stock of active projects in that same year, which may be overestimating the amount spent per project. However, the amounts still seem large. While the figures are a bit distorted by the large tax incentives given to the MNEs for the high-tech program, the median value is still very high – USD$141 thousand per project. More detailed information was made available for a sub-sample of MST programs for 2017, differentiating on-going from new projects (Table 3). The data reveal that spending in a given year in relation to on-going projects among these 6 programs reached a median of VND 1.2 billion (US$ 54,597) and an average of VND 1.7 billion (US$ 77,294). While more moderate than the figures of yearly spending on new projects, spending per program for ongoing projects was still high. These can only by justified by large returns to these programs; otherwise, there is a serious risk of large capture by some firms that receive large amounts of subsidies directly or indirectly.

68 This ratio represents a measure of resource allocation per project, albeit imperfect. Overtime, as project implementation gain pace, the number of projects selected represent the inflow at steady state, but a fraction of the stock of active projects. At the time of writing this report, the authors are actively working with VISTI and MOST to obtain additional data on the number of active projects per program, and the number of beneficiaries from these active projects. However, obtaining this information has proven to be a challenging undertaking.

TABLE 3: **Spending on projects differentiated by new and ongoing projects**

Budget for existing and new project for a selected STI programs in 2017

VND Million 117,845 (Current); Number of programs; n:6

Unit: million dong

No	Program	Total state budget in 2017							On-going Budget per project
		Total	The min. budget	The max. budget	On-going project		New project		
					Number of projects	Budget	Number of projects	Budget	
1	National Technology Innovation Program until 2020	56,616	160	5,532	16	36,416	7	20,200	2,276.0
2	Program on research, training and construction of hi-tech technical infrastructure NPHTD until 2020	28,885	880		5	19,685	1	9,200	3,937.0
3	National product development program until 2020	6,323	450		4	5,023	1	1,300	1,255.8
4	Development of S&T enterprises and public S&T organizations implementing autonomy and self-responsibility mechanism	7,179	22		9	3,129	5	4,050	347.7
5	Bilateral and multilateral research cooperation program on S&T up to 2020	15,942	660		13	13,942	2	2,000	1,072.5
6	Foreign technology search and transfer program till 2020	2,900	2,900		-	-	1	2,900	-
	Median				*7.0*	*9,482.5*	*1.5*	*3,475.0*	*1,255.8*
	Average				*7.8*	*13,032.5*	*2.8*	*6,608.3*	*1,777.8*

Source: Authors calculations.

The STI policy mix needs to be rebalanced to focus on key objectives of an incipient NIS

80. The current policy mix leaves many gaps in addressing the key constraints that Vietnamese firms face when trying to invest in innovation activities (Figure 24). Based on the PER analysis findings and the recent demand analysis for innovation policy interventions summarized in the companion STI review,[69] there is a need to realign public investment in innovation policy towards addressing private sector constraints to innovation. Figure 24 summarizes key gaps and priority areas for rebalancing the STI policy mix. Bridging these gaps by reallocating public spending will improve the coherence of the policy mix and increasing its efficiency.

69 See World Bank (2019). *Vietnam: Science and Technology and Innovation (STI) Review note (Phase 1).* June 30, 2019.

FIGURE 24: **Gaps in the policy mix**

Gaps	Findings
Recalibrating STI policies towards supporting domestic firm-level innovation	• Great focus has been put on promoting foreign R&D-based innovation. However, without clarity on the spillovers and transfer of know-how to local firms, STI policies may be having limited impact to support innovation of domestic firms. • More importantly, most of the gains in terms of productivity in Vietnam are likely to come from upgrading managerial practices, incremental innovation of products and processes and adoption of existing technologies. Currently little or no support to these objectives. • GoV continues to try to 'push the technological frontier" by supporting university and research institutions over domestic firms. Supporting a wide base of Vietnamese firms would enable them to move "towards the frontier" through adoption and diffusion of existing technology.
Placing enterprises at the center, promoting adoption and application of knowledge	• GoV has recently decided to put firms at the center of innovation, but the PER findings suggest that the transition from supporting public research to supporting firm innovation remains incomplete. • The firms' absorptive capacity plays a key role in their ability to learn, adapt and implement new technologies (Cohen and Levinthal, 1990). However, policy instruments that support collaboration and the building of managerial and technical capacity remain underrepresented in the policy mix. Weak managerial practices and worker skills is likely hindering their ability to acquire technology, and to conform to buyer's quality and reliability standards. However, the amount of funding from the portfolio that is spent on promoting adoption of technology and enhancing managerial skills remains low, at 16.6 and 7.6% respectively.
Promoting access to markets (and linkages with foreign investors)	• Export promotion programs represented 0.9% of the value of the portfolio, and domestic market access programs represented 3.7% of the value of the portfolio. The predominant model for exports and insertion in global value chains in Vietnam remains FDI-led and focused on import-dependent, final-stage assembly tasks, with limited backward linkages. It is critical to invest in developing these linkages but also on increasing export capabilities of domestic firms.
Improving access to innovation finance	• Availability of start-up finance for innovation is constrained domestically. However, financing for innovation at the level the firm, particularly private firms, is basically nonexistent in the policy portfolio. • Instruments that are aimed at addressing financial imperfections for innovation require as a precondition that firms have the necessary capacity to absorb knowledge and to invest the financial resources effectively.

Source: Authors based on reviews of reports, and consultations with key stakeholders.

81. A priority for rebalancing the mix of policies is a greater focus on building basic managerial and innovation capabilities and supporting the adoption of existing technologies. As shown above, STI policies in Vietnam are largely focused on increasing R&D activities. However, most firms in Vietnam are not ready to perform R&D activities and would benefit greatly from programs improving basic innovation capabilities – managerial practices, quality upgrading and facilitating the adoption of existing technologies (see Cirera and Maloney, 2017). While some initiatives focusing in these areas already exist, these remain underdeveloped and under resourced, and could bring larger returns to public spending.

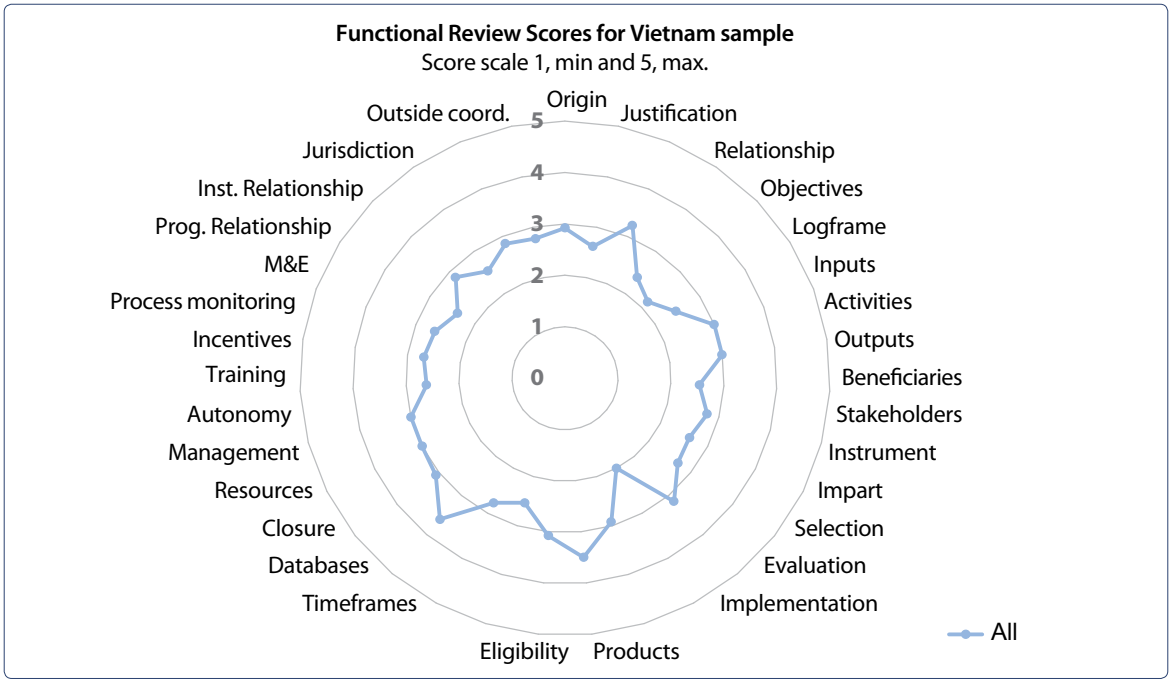
The quality of design and implementation

The urgency of building agencies competencies to design and implement STI policies

82. Good design and implementation are central to policy effectiveness. Even when the right priorities are well identified, the effectiveness of innovation instruments largely depends on the quality of their design and implementation. If agencies do not design instruments that are adequate for the problem they want to address – for example, providing a tax incentive when the root of the innovation problem may require technical assistance, or implementation is business-unfriendly and involves large and burdensome application procedures – it is unlikely that these interventions will achieve the desired impact. Thus, adopting good practices for design and implementation is central to effectiveness.

83. The quality of design and implementation of STI programs in Vietnam is far from using best practices, which is likely to severely impair effectiveness. The functional review looked at key features of functionality for a sample of policy instruments based on the quality of design and implementation processes as well as complementarities between instruments, both within and across institutions. The scope of analysis included a comparison of the sample of programs against the values for metrics from best practices (1 being poor practice and 5 being best practice) in 31 key processes for design, implementation and governance/coordination.[70] The analysis is summarized in Figure 25. The average test score for processes across the sampled programs stood at 2.8 in 2018, below the middle value of the frontier scores; this suggests the urgency of investing in agencies' competencies.

FIGURE 25: **Vietnam is still far from the design and implementation frontier**



Source: WBG, based on interviews and available documentation from MOST, MOIT, MPI, City and University programs

70 The detailed description of the PER methodology is presented in the companion volume of the STI Report titled Policy Effective Review, Volume III (WB, June 2020).

VI The changing environment and industry 4.0

The bar is rising[71]

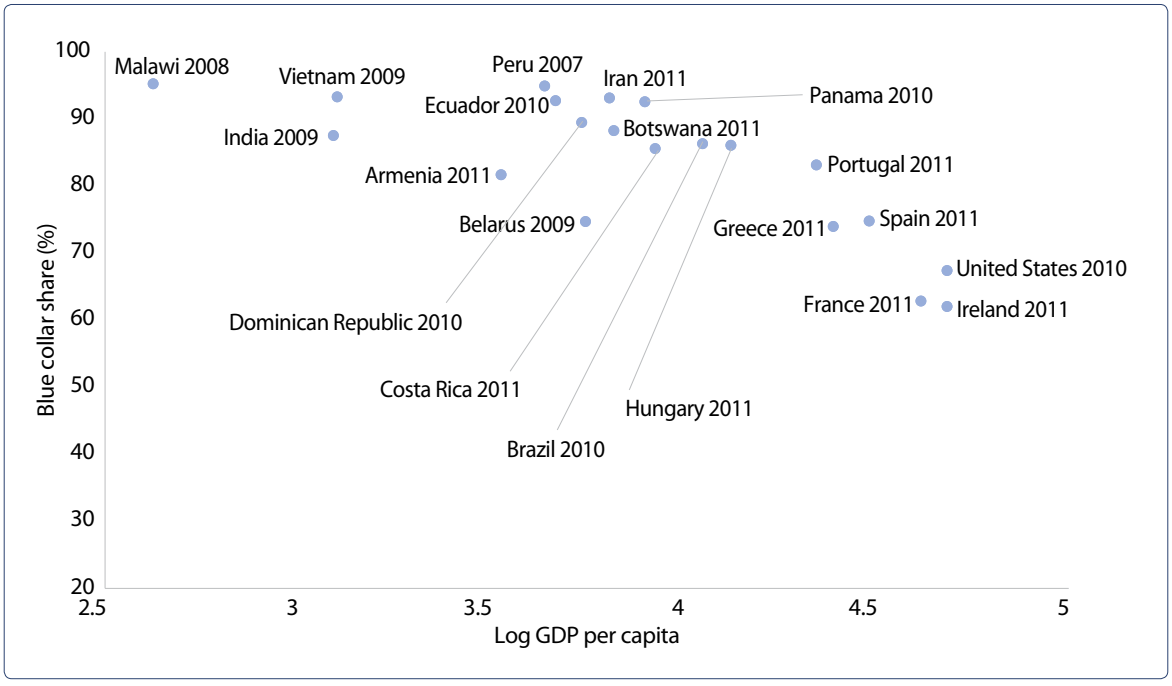
84. As Vietnam seeks to reach high-income status by 2035, global trends in automation, export concentration and servicification[72] present new opportunities and challenges for Vietnam's export-led manufacturing growth model. While remaining a small player in global manufacturing, Vietnam is among the few countries, including South Korea, Thailand and Mexico, that have recently experienced an increase in the relative size of the manufacturing sector – accounting for 15% of GDP and 0.23% of global manufacturing value added in 2015. Its success in export-led manufacturing, however, is largely confined to labor-intensive/low-skill global innovator industries, particularly tradables (textiles, garments, and leather products, and manufacturing n.e.c. consisting of furniture, toys, jewelry, sports equipment, and musical instruments) and commodity-based manufactures (food processing; wood products; paper products; basic metals; fabricated metal product; nonmetallic mineral products; rubber and plastic products). As an example, the share of blue-

71 This draws on a background paper authored by Nayyar G. (2018), WB.

72 Servicification of manufacturing is defined as the use of services as inputs into manufacturing. For example, telecom and transport services can be used in the manufacture of certain goods. In this regard, services and manufacturing are inter-linked and complementary sectors.

collar workers in total employees of the wearing apparel sector is higher than in the wearing apparel sectors of high-income countries such as France and the United States (Figure 26). However, this focus on less innovative tasks may no longer offer an accessible pathway for lower middle-income countries such as Vietnam to continue to grow rapidly. For example, the Internet of Things (IoT) advanced robotics and 3-D printing are shifting what makes locations attractive for production by reducing the importance of low-skilled labor. Further, the world is seeing slower demand for trade coupled by an increase in demand for services embodied in the production of goods. This presents opportunities[73] for lower-income countries such as Vietnam with a sizeable manufacturing to keep up with these shifts by innovating through technological adoption, harnessing agglomeration economies and developing services.

FIGURE 26. **Most workers in the Vietnamese wearing apparel sector are blue collar workers**
Share of blue-collar workers in wearing apparel sector and GDP per capita



Source: IPUMS International, selected countries based on year of data availability.

85. New technologies[74] associated with the 4th industrial revolution are transforming production processes by reducing the importance of low wages in determining competitiveness. Vietnam has banked on low wage costs to bolster export competitiveness for decades, although reliance on this is not sustainable as countries grow (currently, wages and salaries reported by the median Vietnamese firm are about twice as high as comparators such as Laos and Myanmar. Further, there is a concern that labor-saving technologies, which are among the most

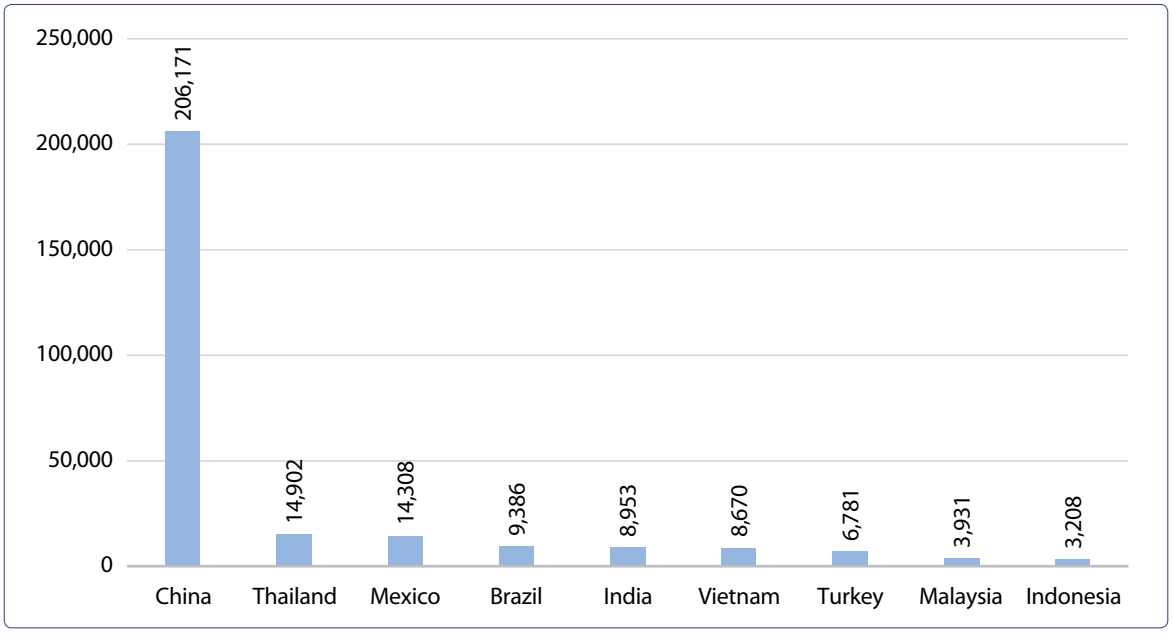
73 Another opportunity for Vietnam is external: worries about trade tensions and rising threats of protectionism may harm Vietnam's export-led growth model. However, it is also possible that Vietnam could be a beneficiary if tensions between the US and China encourage more firms to operate outside China to serve the US market.

74 These technologies include robotics (particularly artificial intelligence [AI]-enabled); digitalization and Internet-based systems integration (IoT), including sensor-using "smart factories" (that may also be AI-enabled); and 3-D printing.

emphasized in the Industry 4.0 literature (Cirera et al. 2017), could significantly shift which locations are attractive for production, thereby challenging established patterns of comparative advantage. In response to declining wage competitiveness for example, Vietnam's comparator, China, has engaged in rapid robotization and now has the highest number of installed industrial robots in the world[75]. In comparison, Vietnam barely registers a presence in terms of the use of industrial robots compared to China (Figure 27). In fact, a survey conducted by Supporting Industry Enterprise Development Center (SIDEC) in October 2014 revealed that few firms in Vietnam use up-to-date technology. Firms manufacturing metal components commonly use either Japanese machinery that was produced a decade ago or Chinese machinery, which have lower accuracy and quality (MOIT 2016).

FIGURE 27: **Vietnam has few industrial robots**

Operational stock of industrial robots, selected countries and regions, 2015



Source: IPUMS International, selected countries based on year of data availability.

86. The advent of robotics, 3D printing, and a new wave of digitalization through the Internet of Things (IoT) emphasizes the growing importance of services in the broader manufacturing process. The generation of data and its subsequent use in "smart" factories will be central to this servicification of manufacturing. For instance, interconnected manufacturing where machinery and equipment are connected to the Internet requires the transmission of data across the entire production chain. And ICT-related services are the predominant producer and user of these data. For example, data processing services, such as cloud computing, produce data for "smart" factories while advanced data analytics use this real-time information to optimize production processes (Bamber et al. 2017). Similarly, 3-D printing eliminates the need to move manufactured goods over long distances from production centers and instead puts the premium on trade in services – primarily data flows – as part of the manufacturing process. For example, designs, data, and other

75 Standard Chartered Global Research (2016) found that 48 percent of 290 manufacturers surveyed in the Pearl River Delta would consider automation or streamlining processes as a response to labor shortages. Less than a third would consider moving capacity either inland or out of China.

information from a product designer/producer in an exporting country will be delivered digitally for printing in a target market (Arvis et al. 2017).

87. Global trends in automation and servicification and changing trade patterns affect manufacturing sub-sectors differently. The use of robots in high-income economies, which brings into question the feasibility of the labor-intensive production processes used in less industrialized countries, varies across manufacturing subsectors.[76] The rise of services as a necessary complement to the success of manufacturing also deserves emphasis – the focus is on the share of professional, scientific, and technical service inputs into manufacturing value added which vary across subsectors and particularly matter for the adoption of new technologies. Similarly, manufacturing subsectors whose exports are concentrated among a few countries illustrate where it may be harder for others to maintain their competitiveness, let alone enter or expand production, owing to large scale and agglomeration economies. The impact of these trends on the feasibility of production will be influenced by the extent to which subsectors are traded. The more they are traded, the more the demands on competitiveness will rise, whether a country tries to adopt new technologies or simply to remain viable using traditional technologies. Categorizing the relative magnitude of automation, tradedness, export concentration, and services intensity as "high" or "low," Table 4 shows that the bar to be a competitive production location is rising more in some subsectors than others.

TABLE 4. **New pressures will affect the competitiveness of Vietnamese production differently by sub-sector**

Sectors (grouped by the common combinations of trends they face)	Extent of impacts of new technology and globalization			
	Increasing concentration of international production	Traded	Robots/3D printers	Use of Services
Transportation	High	High	High	High
Electronics	High	High	High	High
Pharmaceuticals	High	High	High	High
Electrical machinery	High	High	High	High
Machinery and equipment	High	High	High	Low
Manufacturing nec.	High	High	High	Low
Textiles	High	High	Low	Low
Rubber and plastics	Low	Rising	High	Low
Fabricated metals	Low	Rising	High	Low
Food	Low	Low	Low	High
Chemicals	Low	Low	Low	High
Coke and refined petroleum	Low	Low	Low	High
Wood products	Low	Low	Low	Low
Paper products	Low	Low	Low	Low
Basic metals	Low	Low	Low	Low
Non metalic minerals*	High	Low	Low	Low

* Given non-metalic minerals are minimally traded, the increased concentration of international trade is of less importance and this is grouped with the other sectors facing limited impact of the 3 trends.

Source: Hallward-Driemeier and Nayyar (2017).

76 The greater use of robots is likely correlated with the adoption of other "smart" technologies.

88. The potential impacts for selected manufacturing sub-sectors (where Vietnam has comparative advantages) are the following:

- *Textiles, apparel, and footwear:* This subsector has been slow to automate – including in China where wages continue to rise – and the migration of low-skilled jobs to lower-cost locations is likely to continue. This is good news for Vietnam, which has maintained its revealed comparative advantage in this sector between 1995 and 2014, and has attracted FDI investments in apparel and leather products from China (Hallward-Driemeier and Nayyar, 2017).
- *Manufacturing n.e.c.:* As a sector that is traditionally low-skill, labor-intensive and highly traded internationally, this subsector stands out as being highly automated. Comprising furniture, jewelry, toys, sports equipment, and musical instruments, this subsector has a robot-to-labor ratio that is even higher than transportation equipment and other machinery and equipment. Some of these products, such as furniture (including consoles, desks, cabinets, and seats) and light manufactures (such as spectacles), are also susceptible to 3-D printing (Arvis et al. 2017). International competition could therefore intensify in these light manufactures, where Vietnam has a comparative advantage.
- *Autos, electronics and other advanced manufactures:* Maintaining the labor-intensive assembly in these sub-sectors will be harder for Vietnam since there are increasing trends of relatively high automation, export concentration, and professional services intensity. Electronics, computers, and optical instruments; pharmaceutical products; transportation equipment; other machinery and equipment; and electrical machinery and apparatus are the most internationally traded manufacturing sectors, typically organized in GVCs with the labor-intensive assembly located in low-wage economies. They combine a relatively high Herfindahl-Hirschman index of export concentration with a relatively high number of robots per 1,000 workers currently in use. Robotization threatens the reshoring of this labor-intensive assembly to advanced economies by reducing the importance of wage costs. China too is rapidly automating in these subsectors and might therefore be at an advantage compared to less established manufacturing centers such as Vietnam, given that scale and agglomeration matter more in ecosystem-intensive industries such as autos, electronics, and heavy machinery. In addition, electronics, computers, and optical instruments; pharmaceutical products; and transportation equipment also have relatively high shares of professional services input in total value added. The growing servicification of these manufacturing industries means that Vietnam's lagging ICT (and other professional) services sector places it at a disadvantage. While Vietnam's hardware sector, especially in electronics, has expanded dramatically in the last few years with large investments from lead firms (i.e., Samsung and LG), contract manufacturers (i.e., Foxconn and Jabil Circuit) and platform leaders (i.e., Intel and Microsoft), employment and revenue in ICT services are only a fraction of hardware manufacturing, and foreign firms are less visible (Sturgeon and Zylberberg 2015).
- *Commodity-based manufactures:* These sub-sectors are less automated, less intensive in the use of professional services, less traded and have export locations that are geographically less concentrated. Thus, international competition is likely to increase least in a range of commodity-based manufactures. These sectors typically produce goods that are bulky to transport or those that require proximity to raw materials: basic metals, nonmetallic mineral products coke and refined petroleum, wood products, paper products, and food processing. This is good news

because Vietnam had a revealed comparative advantage in at least one of these sectors in 2014. Among them, however, food processing and coke and refined petroleum are among the manufacturing subsectors that are relatively more intensive in the use of professional services. Further, fabricated metal products and rubber and plastic products are quite automated, but with less export concentration and a lower overall trade intensity – overall, global competition will likely intensify less.

BOX 5. **Defining and method for measuring the 3Cs**

- *Competitiveness* addresses the shift from low wages to broader considerations of the business environment in determining low unit labor costs, which will be particularly important in sectors where global production is becoming more concentrated.
- *Capabilities* address the need for workers and firms to strengthen their ability to adopt and use new technologies – and the additional regulations and policies needed to support this.
- *Connectedness* highlights not only shifts in the trade agenda, but also the growing synergies across sectors to achieve success in manufacturing.

Methodology:

- A country's *competitiveness* combines the dimensions of the ease of doing business, the rule of law, and the use of mobile technologies to complete financial transactions.
- A country's *capabilities* to support technology diffusion and innovation combine the dimensions of ICT use, tertiary school enrollment rates, and the share of royalty payments and receipts in trade.
- A country's *connectedness* to markets combines the dimensions of logistics performance, restrictions on trade in manufactured goods, and restrictions on trade in professional services.

For each summary measure, these relevant indicators are converted to z-scores to normalize their scales and are then averaged. On the capabilities and connectedness indexes, countries are categorized as "high" or "low" based on the median z-score value. On the competitiveness index, countries are categorized as "high," "medium," or "low" (shown by the color shading of the markers) based on partitioning the data into terciles.

89. Based on Vietnam's current innovation and growth status underpinned by global trends in automation, increased use of professional services input, and shifting trade patterns, Vietnam's preparedness can be assessed based on the 3Cs: competitiveness, capabilities, and connectedness (Box 5). Table 5 links these global trends to what they are likely to imply for priorities in the 3Cs agenda for Vietnam's manufacturing sub-sector. The trends do not map one-for-one to each of the 3Cs, but there are some associations. The closest association is between the adoption of new technologies and "capabilities." However, if countries can compete using traditional technologies, they may not need to have the same "capabilities," but they would need to be that much stronger in "competitiveness" and "connectedness" to be viable (at least in the short to medium terms). International concentration in trade is associated with rising demands on both "connectedness" and "competitiveness," if the sector is one characterized by international trade. The last trend is services intensity, which is most closely tied with "competitiveness" – the ability to have the complementary elements of professional services in the ecosystem for manufacturing to take place successfully. To the extent that these services can be traded, services intensity could also be linked to "connectedness," particularly if services are embodied in a widely traded good (Hallward-Driemeier and Nayyar 2017).

TABLE 5: **New pressures will raise different priorities within the 3Cs agenda by subsector**

Sectors (grouped by the common combinations of trends they face)	Extent of impacts of new technology and globalization				Priorities within 3Cs agenda		
	Increasing concentration of international production	Traded	Robots/3D printers	Use of Services	Competitiveness	Capabilities	Connectedness
Transportation	High	High	High	High	Yes	Yes*	Yes
Electronics	High	High	High	High			
Pharmaceuticals	High	High	High	High			
Electrical machinery	High	High	High	High			
Machinery and equipment	High	High	High	Low**			
Manufacturing nec.	High	High	High	Low**			
Textiles	High	High	Low	Low	Yes		Yes
Rubber and plastics	Low	Rising	High	Low		Yes+	
Fabricated metals	Low	Rising	High	Low			
Food	Low	Low	Low	High	Yes		
Chemicals	Low	Low	Low	High			
Coke and refined petroleum	Low	Low	Low	High			
Wood products	Low	Low	Low	Low			
Paper products	Low	Low	Low	Low			
Basic metals	Low	Low	Low	Low			
Non metallic minerals	High	Low	Low	Low			

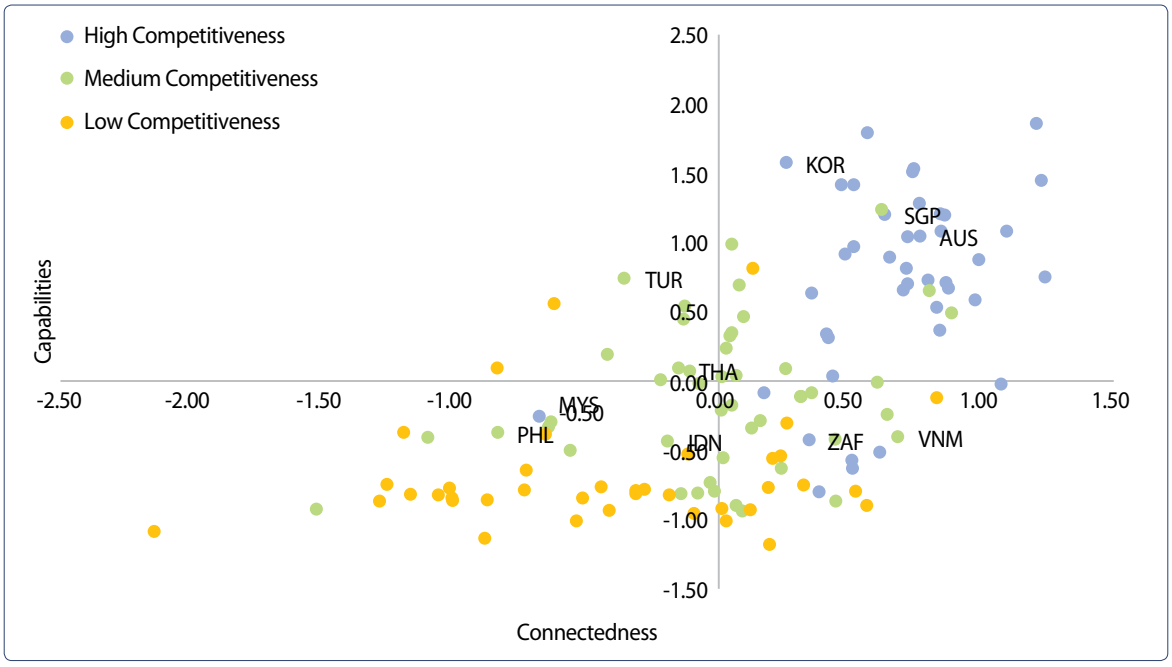
(Note: if want to use smart factories for any of the sectors, need to address all 3Cs)

* It may not be necessary to have high capabilities if can still compete with older technologies – but competitiveness will need to be high

***While* the need for services is lower, the openness to trade and concentration in trade makes competitiveness important

90. Vietnam is characterized as "low capabilities-medium competitiveness-high connectedness". Figure 28 shows Vietnam's relative preparedness in terms of the 3Cs: the axes represent countries' capabilities and connectedness and the color of their markers indicates their levels of competitiveness. Based on methodology described in Box 5, Vietnam falls in "low capabilities-high connectedness" quadrant with "medium competitiveness". There is a large number of countries in this lower-right quadrant, which includes, among Vietnam's comparator countries, South Africa and Mexico. Few countries have high capabilities but low connectedness (upper-left quadrant), including Thailand and Turkey among Vietnam's comparator countries. Those considered to be high capabilities – high connectedness – medium/high competitiveness include China and high-income countries such as Australia, Singapore, South Korea. In general, countries that score highly in terms of the 3Cs are better placed to address the higher requirements that changes in technology, trade, and increased servicification may bring.

FIGURE 28: **Vietnam has low capabilities, high connectedness and medium competitiveness**



Source: Hallward-Driemeier and Nayyar (2017).

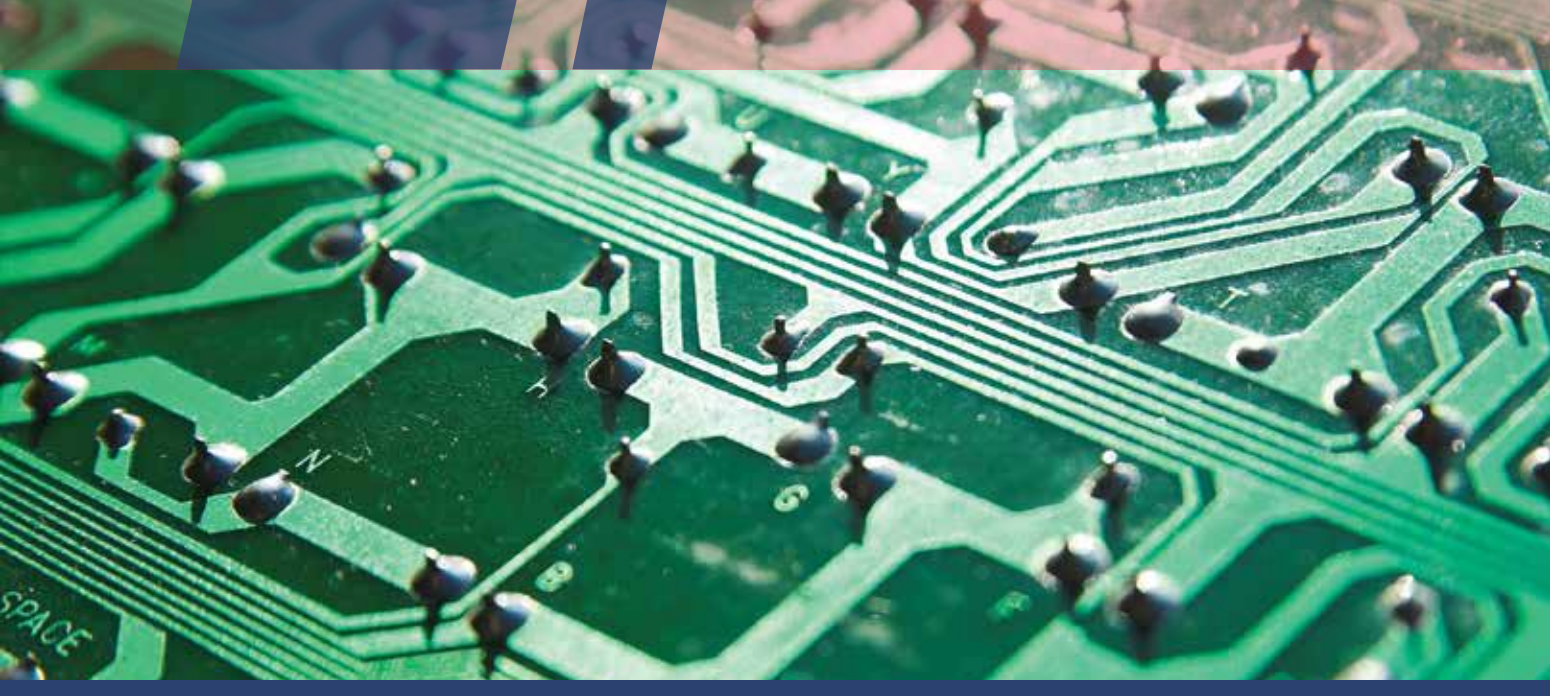
91. These 3Cs also offer opportunities and challenges (e.g., possibilities of labor displacement) for some of Vietnam's subsectors:

- *Textiles, garments, and footwear:* This subsector is highly traded and exports are concentrated, but there is little exposure to automation. Therefore, capabilities matter less, but competition from trade means that low wages are not sufficient and more needs to be done to improve the competitive environment and connectivity. Vietnam, which has a revealed comparative advantage in these industries, is not at risk of displacement because (like China) it combines high connectedness with medium competitiveness. However, to the extent that Vietnam is competing with other countries in Asia for space in GVCs, the bar might be rising even in sectors with low exposure to automation, such as wearing apparel (and other light manufacturing). That is, despite doing better than Indonesia and the Philippines on connectedness for example, Vietnam may need to improve competitiveness and connectedness even more to attract greater manufacturing FDI.
- *Manufacture of transportation equipment, electronics, electrical machinery, and machinery and equipment n.e.c.:* Vietnam is at risk of displacement in these sub-sectors because these sectors are characterized by high tradedness, export concentration, exposure to new technology, and services intensity. In fact, only countries in the upper-right quadrant and blue (high in competitiveness) are not at risk of displacement in these sectors. Among Vietnam's comparator countries, this includes Singapore and South Korea. Thus, to maintain its revealed comparative advantage, Vietnam needs to bridge the capabilities gap (although the gap is not too large) if it wants to use more of the new processes or combine its high connectedness with high competitiveness (in the top tercile, as indicated by blue) to make competing with existing technologies viable in the short to medium run.

92. Changes in trade (increased demand for services) and technology offer Vietnam opportunities beyond manufacturing, particularly in ICT services. The ICT services sector demonstrates productivity-enhancing characteristics including in low- and middle-income countries. For example, based on World Bank Enterprise Survey data across manufacturing and service industries from a sample of six low- and middle-income countries (LMICs), information technology (IT) services are not very different from advanced manufactures such as electronics, in that both are classified as "high" or "medium" across a range of international trade, learning-by-doing and innovation characteristics. At the same time, they also belong to the group that is "high" in skill intensity (Nayyar, Cruz and Zhu 2017). To-date, Vietnam's role in export-oriented ICT and ICT-enabled professional services has been expanding, exemplified by rapidly growing export revenues and share in total revenues in ICT services. On an annual average basis, software exports grew at 45 percent per annum, while domestic sales grew at 28 percent per annum (Sturgeon and Zylberberg 2015). This recent success is attributable to multinational companies establishing subsidiaries in Vietnam to provide software outsourcing and ICT-enabled (BPO etc.) services globally, as well as being home to a few dynamic entrepreneurial firms (e.g., TMA Solutions, FPT software, KMS Technologies, VNG). On the one hand, given "low" capabilities comprising both tertiary education and ICT infrastructure, coupled with the fact that other developing economies already have a first-mover advantage in the sector, Vietnam might be at a disadvantage. On the other hand, a large middle class educated in Vietnam's top universities can provide a critical mass to kickstart the development of an ICT services sector. Its cost advantage over competitors in the region is most relevant. Entry-level computer programmers in Vietnam, for example, earn 54 percent and 36 percent, respectively, of what their Chinese and Indian counterparts make (Sturgeon and Zylberberg 2015).

Conclusion

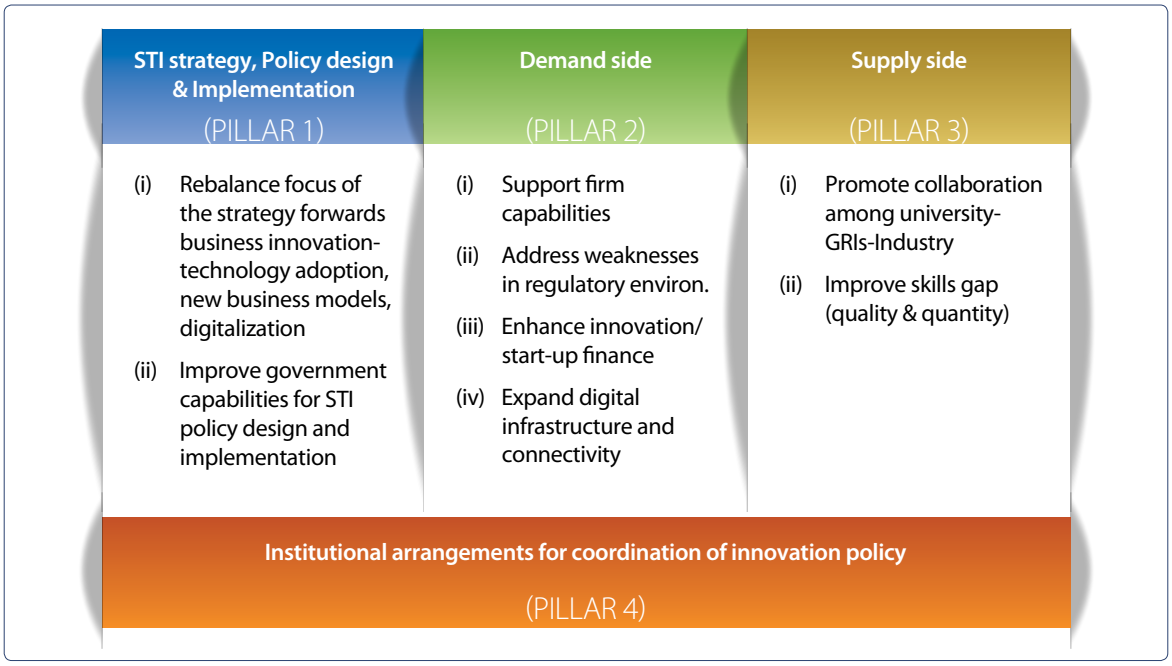
93. This analysis has two important implications for policy. First, the challenges exposed through the 3C framework imply that Vietnamese policy makers need to act on improving technological capability of firms. It is well known that a firm's absorptive capacity plays a key role in its ability to learn, adapt and implement new technologies (Cohen and Levinthal, 1990). In Vietnam, weak managerial practices and worker skills are likely hindering firms' ability to acquire technology. Thus, mitigating the risk of displacement will likely require policies that directly support firms, inducing them to improve management, facilitate access to technology service networks and consultants, and enable access to innovation finance. Second, the assessment reveals that targeted improvements are needed for specific sectors: i) strengthen competitiveness and connectedness in the textile and apparel sector to sustain its current performance in attracting FDI investments, ii) bridge the capability gap for manufactures of transport equipment and electric machinery, sectors that are highly susceptible to agglomeration and high intensity of competition, revealing a significant exposure of Vietnam to potential displacement of its labor force, and iii) develop the ICT service sector, taking the initial wins from FDI investment in the software sector to the next level.



VII Roadmap ahead: recommendations & key actions

94. This concluding chapter summarizes the key recommendations emerging from the analysis to inform the upcoming STI Strategy 2021-2030 and the (SEDS) 2021-2030. Resetting the new STI Strategy towards business innovation will hinge on strengthening policy design and implementation in Vietnam's national innovation system. The unfinished reform agenda includes improvements on the demand side – i.e., building firm capabilities for technology adoption and addressing constraints in the policy environment, as well as strengthening complementary factors related to innovation finance and expansion of digital infrastructure and connection; and on the supply side – i.e., addressing human capital constraints. Lastly, more work is needed to strengthen government institutional arrangements to formulate, implement and coordinate effective innovation policies. Figure 29 captures these four broad categories of reforms under the new STI strategy. Vietnam has made progress in tackling weaknesses in the national innovation system (NIS) but the pace and quality of reform is mixed. As Annex 1 shows, more effort is needed to address the remaining weaknesses in the NIS that continue to deter firm upgrading and innovation. The following discussion includes good practice examples from other countries who have tackled similar reforms. A matrix summarizing the policy recommendations is provided at the end.

FIGURE 29: **Vietnam: Reset a new STI strategy towards business innovation**



Source: Hallward-Driemeier and Nayyar (2017).

Pillar 1: STI Strategy, policy design and implementation

Rebalancing the focus of the new STI Strategy and policy mix towards firm capabilities and upgrading

95. Looking ahead, the Government needs to formulate and implement a STI strategy that shifts to promoting adoption and diffusion of technology, rather than R&D (this would mean recalibrating the financing and not halting the funding of instruments to foster applied research). As discussed above, most public support for innovation in Vietnam focuses on generating new technologies, contrary to the *Vietnam 2035* recommendation of promoting adoption and diffusion of technology among enterprises. Some programs under MOST (national technology innovation programs) do contain features that promote technology application and dissemination. However, these activities are not the focus of these programs.[77] Market access and entrepreneurship – key priorities for the Government – were also found to be underrepresented in the policy mix.[78] Promoting spillovers and linkages requires active instruments to develop the technological capabilities of potential local suppliers and the flow of knowledge spillovers from MNEs to domestic firms, policies to build the necessary skills, and high-quality engineering departments with incentives

77 There are a few programs that seem to be promoting technological upgrading among SMEs e.g. the national technology innovation program and the national industry support program (based on the decree 111/2015/NĐ-CP), the program to promote a science and technology market in Ho Chi Minh City 2016-2020, and the S&T Market Development Program until 2020. However, most of these programs are in their inception phase or have very little funding.

78 In 2017, less than 1% of the budget was devoted to support young technology startups (and only 7.4% of the value of the portfolio excluding the tax incentive programs).

to commercialize and work on contract research or on collaborative R&D programs with some of these MNEs. The key program focus should include: management extension; technology extension; linkages to high-tech MNEs; collaborative R&D programs with high-tech MNEs; and early stage technology-based companies. The range of beneficiaries should be expanded to a wider number of domestic firms with potential for scale up, digitalization, adoption of new business models and developing linkages with FDI. However, before designing any program, policymakers need to understand the clear market failure and demand for policy support and accordingly define the segment of potential beneficiaries that present the highest propensity to absorb the technology and yield additionality.

Investing in government capabilities

96. Adopting good practices in the design and implementation of policies is critical for effectiveness and achieving impact. In this regard, building competencies of technical staff in relevant innovation agencies in the area of design and implementation of innovation programs is critical. Also, having up-to-date knowledge about appropriate instruments is important. In the short term, capacity building initiatives can be undertaken to train program managers to develop logical frameworks when designing a program and to set up monitoring and evaluation systems. In the medium term undertaking rigorous impact evaluation of selected policy instruments would be valuable to draw lessons.

Pillar 2: Demand side – the firm

Building firm capabilities should be a priority for promoting access to new technologies

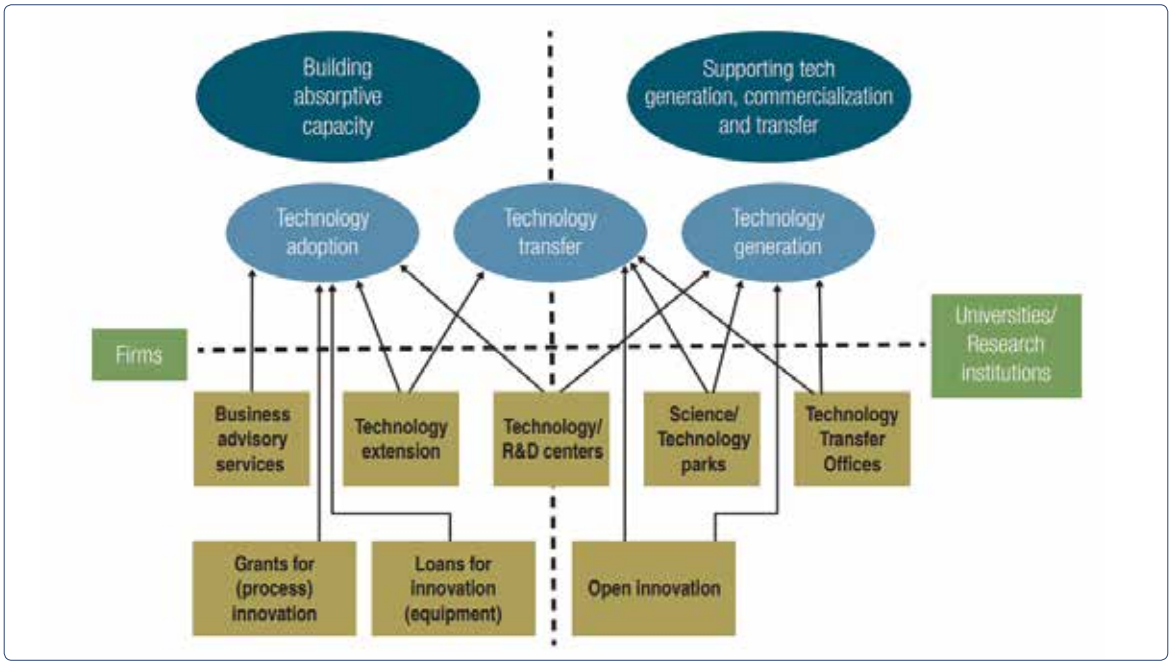
97. Firm capabilities matter for improving innovation and technology adoption in Vietnam. Successful adoption of a new technology is not just about purchasing machinery, but requires integrating that machinery into the full production and business processes of the firm. This is particularly important for SMEs, which must be able to adjust rapidly to evolving markets and changing circumstances but are often limited by knowledge, expertise and financial constraints. Support to SMEs thus needs to start with improvement of more basic managerial and organizational practices, which will enable them to use and adapt new processes, and to proceed to more sophisticated technological knowledge associated with Industry 4.0 further along. Bridging the capabilities gap is just as important for the absorption of new technologies in manufacturing processes as it is for the development digital services.

How can firm capabilities be supported?

98. Countries have successfully deployed an array of instruments – along with complementary policies – for building firm capabilities and non-R&D activities that in turn facilitate adoption and absorption of technology. At one end of the spectrum, governments want to promote technology upgrading among SMEs by building firms' absorptive capacity (Cohen and Levinthal, 1990) and providing information and know-how on how to adopt new technologies. At the other end is the objective of transferring and commercializing new technologies from universities and Public Research Institutions (PRIs). As figure 30 indicates, there are multiple instruments that can be

used directly in equipping firms with the capabilities of using and/or generating technologies. These include business advisory services (BAS), technology extension services (TES), technology centers, and tech transfer offices. Specifically, BAS focuses on building absorptive capacity for technology adoption, for example the recent efforts to pilot demand-driven business advisory services for facilitating FDI-SME linkages.[79] TES focuses on helping SMEs to adopt technologies.

FIGURE 30: **International experience – instruments to support firm capabilities and technology**



Source: World Bank (2020). A Practitioner's Guide to Innovation Policy

99. There is considerable heterogeneity in the models for BAS and TES. For example, Malaysia's Cradle Investment Program 300 (CIP300) is a conditional grant under the portfolio of the Cradle Fund. It provides financial assistance of up to RM300,000, with a range of value-added assistance, including coaching and mentoring, matchmaking with investors and Cradle's partners, business advisory services, and media and public relations support. Figures 31-32 provide good practice examples of how countries have deployed a range of policy instruments that have successfully built SMEs' capabilities to facilitate technology adoption and diffusion. These can help inform the design of similar programs in Vietnam.

79 The business advisory services program is a key component of the supplier development program under the *Vietnam Private Sector Development Project* that is jointly being implemented by the WBG with Ministry of Industry and Trade. The objective is to facilitate linkages between domestic firms and MNCs in electronics and automobiles GVCs.

FIGURE 31: **Vouchers for innovation – example of Korea**

Program definition	Case: Vouchers for exporters in Korea
Instrument: Vouchers are small non-repayable grants allocated to non-innovative SMEs to purchase services from external knowledge providers. The main objective is to induce non-innovator SMEs to start collaborating with knowledge organizations and knowledge providers. Vouchers are often entitlement-based rather than competition-based, and they typically require light management with effective auditing	The program supports SMEs by providing export vouchers that list programs in various categories (since 2017 with the budget of 14 mill. U$). All services listed on the service menu are available for all participants regardless of the program engaged. All services are co-financed by SMEs as well to avoid moral hazard, promote accountability and leverage financial resources.
Justification • Voucher schemes aim to address capability failures faced by smaller firms by inducing behavioral changes towards more proactive learning and sustainable collaboration with knowledge providers • There is often severe information asymmetry between knowledge providers (particularly public-sector research organizations) as suppliers of innovation knowledge and SMEs as potential users	**Intervention** Depending on the level of export experience, the voucher program is structured along the following stages: • Preparation stage: translation of webpages and data in foreign languages; optimizing design; education on trade and marketing • Beginning stage: marketing through media/ SNS; support for global market research and matchmaking; participation in exhibitions • Contract stage: checking buyer's credit, writing a contract paper; managing export distribution • Global expansion stage: support to build local branches; consulting on M&A
Evidence • The bulk of the existing evidence draws upon evaluations and surveys of voucher programs in Europe • The review of the evidence detects project additionality and some positive impact on sales and value added in the short-run (Cirera et al, 2020). Behavioral additionality is detected in follow up projects, evidence of a change of attitude towards collaboration, and spillover effects (an improved firm public profile after collaboration with universities). For knowledge providers, benefits included introduction to new research areas, commercial opportunities, and new teaching opportunities	**Design recommendations (Do's)** • Take stock of supply/demand for knowledge services and have 'accredited' providers • Design simple application and selection procedures • Define the range of services covered • Design (small) voucher amounts • Adopt proactive advertising to reach SMEs that are not typically targets for support • Set up brokerage services • Have strong audit function to reduce fraud

Source: Cirera et al. (2020); Yong-Seok Choi, Professor, Kyung Hee University (2019).

FIGURE 32. **Managerial extension/business advisory – example of Colombia**

Program definition	Case: Group Management Extension in Colombia
Typically includes direct specialized advice in management strategy, business functions (marketing, financial management, sales) and legal aspects of a business. This type of instrument addresses key absorptive capacity issues, since adopting a new technology is not only about purchasing machinery but also about integrating it into the full production and business processes of the firm.	• The program congregates groups of firms to enhance the efficiency of the intervention. • In Colombia (Iacovone et al, 2018), groups were assembled comprising 3 to 8 firms located in the same region, such that members are not direct competitors to one another, but are instead producing complementary products with similar management problems.
Justification • SMEs owners have trouble identifying what their constraints are and how to overcome them. • SMEs do not have the same access as large firms to information networks, universities, national laboratories, field experts, technical information and know-how, so they face higher search costs. • Firms are unlikely to have the in-house expertise to solve problems and work through the change process. • SMEs tend to operate in isolation and with little access to networks. • Information and advisory markets are not well-developed.	**Intervention** • Leaders from the firms in a group signed an agreement to work together and help each other improve. • The group treatment model was compared to an individual consulting model on a cost-benefit basis and appears to offer a promising approach to scaling management. • Like the individual treatment, the group treatment began with training classes that covered theoretical aspects of management.
Evidence • When designed appropriately, developing country interventions have had significant impact on performance (output additionality), at least in the short term. • Some programs have experienced a few issues with SME take up rates, particularly when the interventions were delivered by government agencies (lack of awareness problems, delayed implementation, etc.)	**Results** • Both approaches led to improvements in management practices of a similar magnitude (8-10 percentage points), so that the new group-based approach dominates on a cost-benefit basis. • The group-based intervention led to increases in firm size over the next 1.5 years, including a statistically significant increase in employment, while the impacts on firm outcomes are smaller and statistically insignificant for the individual consulting. **Design recommendations (Do's)** • Conduct market and feasibility analyses before launching programs. • Ensure that appropriate resources are available to build program awareness. • Have high-quality delivery staff. • Ensure that managers are versed on technology.

Source: World Bank (2020). A Practitioner's Guide to Innovation Policy

Pillar 2: Demand side – business environment and complementary factors

More needs to be done to improve the operating environment and complementary factors

100. *Vietnam 2035* recommended strengthening regulatory policies, removing distortions and promoting a level playing field through improving the regulatory framework for competition.

In recent years, Vietnam has made efforts to improve its regulatory environment, as captured by the World Bank's *Doing Business Report* (World Bank 2020).[80] However, the DB indicators show some slowing of the pace of reforms compared to Vietnam's regional peers in the last couple of years.[81]

101. Intellectual property right (IPR) protection enforcement is instrumental for fostering innovation and technology adoption.[82] To encourage MNCs to share their technologies with local firms as well as enable them to undertake R&D in Vietnam, without the risk of property rights infringements, an effective IPR protection system and its sustained implementation is critical. An IPR protection regime that is consistently enforced is also more likely to attract venture capital and private equity firms to Vietnam to help tech start-ups scale up.[83] As Vietnam continues to deepen its regional integration through new free trade agreements (FTAs) – like the CPTPP, EVFTA, ASEAN and RCEP – the agenda has gained urgency as these agreements commit the country to higher levels of IPR protection enforcement standards.[84]

102. Vietnam has made progress on its IPR protection legal framework, and multiple efforts are underway in combating violations. In April 2018, new Guidelines for Certain Number of Articles of the Intellectual Property Law and Law on Amendments to the Intellectual Property Law 2009 in Terms of Copyright and Related Rights entered into force.[85] In October 2018, Vietnam's Market Surveillance Agency was upgraded to the General Department of Market Surveillance under the Ministry of Industry and Trade, inter alia, to improve the fight against IPR infringements.[86] In 2019 the Law Amending and Supplementing a Number of Articles of the Law on Insurance Business and the Law on Intellectual Property (Law No. 42/2019 / QH14) was approved.[87] The government has recently approved an "Intellectual Property Strategy until 2030" that aims to develop a comprehensive

80 This is reflected in Vietnam's improved ranking in the Doing Business index which has jumped to 70th place in 2020 from 104th in 2007 (World Bank, 2020). The Doing Business index provides an important metric for the cost of doing business for enterprises as it measures the regulatory costs and time taken to interface with government.

81 According to the World Bank's Ease of Doing Business (2020), Vietnam's ranking slightly declined from 68th in 2018 to 70th out of 190 countries, and remained well below Singapore (2nd), Malaysia (12th), Thailand (21st) and China (31st).

82 IPR protection spans multiple categories and includes patents, copyrights and related rights, industrial property rights and rights to plant varieties, enforcement, and membership and ratification of international treaties.

83 Refer to www.uschamber.com/ipindex, Global Innovation Policy Center.

84 For instance, the EU-Vietnam Free Trade Agreement, signed on 30 June 2019 and ratified by Vietnam's National Assembly on June 8, 2020, includes a substantial IPR chapter in which Vietnam has committed to a high level of protection, going beyond the standards of the TRIPS Agreement.

85 Decree No. 22/2018/ND-CP Decree No. 22/2018/ND-CP of February 23, 2013, on Guidelines for Certain Number of Articles of the Intellectual Property Law and Law on Amendments to the Intellectual Property Law 2009 in Terms of Copyright and Related Rights, available at https://wipolex.wipo.int/en/text/472667

86 Decision No. 34/2018/QD-TTg dated 10 August 2018 of the Prime Minister, providing for the functions, tasks, powers and organizational structure of the General Department of Market Management directly under the Ministry of Industry and Trade. Provincial-level market surveillance departments are expected to be established under this department.

87 This Law was passed on June 14, 2019 by the National Assembly in shortened order and procedures to timely reflect the obligations to be the CPTPP which came into effect in Vietnam from January 14, 2019.

and effective intellectual property system in Vietnam.[88] According to the latest official data on administrative IPR violations, the number of cases fell from 2954 in 2017 to 1811 in 2018.[89]

103. More effort is needed towards IPR protection enforcement. Vietnam's IP protection ranking stands at 105th out of 141 countries, well behind Singapore (2nd), Malaysia (25th), South Korea (50th), Indonesia (51th), China (53rd) and Philippines (55th), according to the latest *Global Competitiveness Report* (GCR, 2019). Third parties' reports and assessments of IPR protection in Vietnam, while noting improvements in Vietnam's IPR legal framework in terms of bringing it in line with international standards, express concern with the lack of IPR enforcement and adequate coverage of on-line enforcement of copyrights.[90] Vietnam also remains an important producer and trader of counterfeit goods in many sectors.[91] Areas of improvement and action include:

- *Online enforcement of copyrights:* The weak enforcement of the legal framework has led to increased copyright piracy and domain name infringements. To address this issue, implementing regulations must be amended to accommodate enforcement of IPRs in the online environment as well as strengthen capacity to underpin enforcement efforts against infringing websites and their owners. In addition, regulations and guidelines on the responsibilities of intermediary service providers, such as the provision of "notice and take down" measures, must be developed and applied.
- *Criminal enforcement:* Enforcement heavily relies on administrative proceedings. Vietnamese law allows for IPR criminal lawsuits, but implementation faces numerous obstacles due to a dearth of specific rules and procedures to guide investigations, prosecutions and adjudications of criminal proceedings in IPR infringement cases. This has posed challenges for IPR criminal enforcement, and copyright piracy remains rampant. Also, sanctions against infringers have an insufficiently deterrent effect and there is still a lack of trained IP officials, including in the customs authorities. More generally, Vietnam's IPR enforcement system has remained highly complex and the capacity weak, which makes it challenging for right holders to take effective and efficient action against IPR infringements. Vietnam should improve IPR enforcement standards and related procedures and make IPR dispute resolution mechanisms simpler and more accessible, to motivate enterprises to utilize them. China, facing similar challenges, has strengthened IPR enforcement through the launch of specialized IP courts. Among other things, this entails adjustments to IP court procedures, such as strengthened specialized enforcement units, and applying more significant fines and sanctions for non-compliance.[92]

88 Decision No. 1068/2019/QD-TTg dated 22 August 2019 of the Prime Minister. The IP strategy covers all stages of creation, establishment, protection, and enforcement of IP rights, creating an environment to encourage innovation, meeting international integration requirements, making intellectual property become an important tool to enhance national competitiveness; and includes IPR policies on copyright, related rights, industrial property rights.

89 Refer to 2018 Annual Report on IP activities, Intellectual Property Office of Vietnam, MOST. Along with the 39% decrease in IP violation cases, there was a concomitant increase in total amount of fines. Infringements were still found mostly in trademarks, accounting for 97.8% of the cases and 99.1% of the total fines.

90 For example, refer to EU's: https://trade.ec.europa.eu/doclib/docs/2020/january/tradoc_158561.pdf, and US's: https://ustr.gov/sites/default/files/2019_Special_301_Report.pdf.

91 Refer to 2019 OECD-EUIPO report Illicit Trade – Trends in Trade in Counterfeit and Pirated Goods of 2019.

92 See Innovate China: New Drivers of Growth (2019), World Bank Group and Development Research Center of the State Council, The People Republic of China.

104. Despite rapid credit growth, access to innovation finance remains a constraint facing firms in Vietnam. Firms require different means of financing as they move from one phase to the next in their life cycle. Vietnam has some representation in most phases of the start-up life cycle; however, this representation remains small. The development of capital markets, as a complement to banking, has been on the radar screen of policy makers. Vietnam is a potentially dynamic startup market. Driven by the country's position as a vibrant growth hub, a rising middle class and young demographics, it is an increasingly attractive emerging market destination for venture capital and private equity (VCPE) investors. The recent expansion in bond and equity markets notwithstanding, the outstanding market value of these markets remains low compared to peers in the region, suggesting that there is still ample room for growth. Programs that increase the availability of innovation financing should also work with intermediaries to ensure investees possess the technical capacity to utilize the capital effectively. In Korea, credit guarantees for innovation have been used successfully (see figure 33).[93]

FIGURE 33: **Credit guarantees for innovation – case of Korea**

<table>
<tr><th>Program definition</th><th>Case: Technology Financing in Korea</th></tr>
<tr><td>Loans and loan guarantees are instruments for debt financing to support business innovation, typically targeting SMEs, although large firms can also be targeted. Credit guarantees can cover a portion of the losses experienced by lenders extending credit to firms investing in innovative projects, when firms default on loans. It applies exclusively to assets that have been explicitly covered under its provisions, in return for a fee. Credit guarantees become relevant in the late phases of the innovation cycle when risk is lower.</td><td rowspan="4">Korea Technology Finance Corporation (KOTEC) provides technology innovation-oriented SMEs with an evaluation of their technology and its marketability.

Intervention
In Korea, including KOTEC,11 public institutions are designated as Technology Credit Bureaus for evaluating firms' technology. Based on the technology evaluation, KOTEC's Technology Credit Guarantee Program has been operating to provide financing opportunities for SMEs' that have insufficient tangible collaterals but have promising technologies.

Results
While the evidence for additionality of credit guarantees for innovation is limited, results from implementation suggest that this instrument can lead to tangible results, particularly for SMEs with insufficient or intangible assets as collateral that remain credit constrained[94]. As indicated earlier, access to finance for innovation in the EAP region remains an issue, and the use of credit guarantees for purposes other than innovation is widespread (Cirera et al, Forthcoming). Other attractive features include the ability to leverage financial capital</td></tr>
<tr><td>Justification
• Imperfections in financial markets
• Information asymmetry
• Lack of collateral of SMEs</td></tr>
<tr><td>Evidence</td></tr>
<tr><td>• Evidence of the profile of participants is mixed, with some programs featuring older firms (20-years-old on average, CDTI in Spain) while others feature younger firms (less than 5 years old on average in Korea's KOTEC). Most programs showed higher take up from exporters in high-tech sectors and who owned intangible assets, such as patents. CEO education was also linked with higher amounts of guarantees.</td></tr>
</table>

93 SATI from MOST and the Korea Technology Finance Corporation (KOTEC) have been engaged in adopting a similar scheme in Vietnam, under the Knowledge Sharing Partnership program (KSP), funded by the Korean Ministry of Finance.

94 Input additionality evidence suggests 30-82% incremental lending value, and about 25 percentage point increase in the probability of investing in R&D.

FIGURE 33: **Credit guarantees for innovation – case of Korea (cont.)**

Program definition	Case: Technology Financing in Korea
• Input additionality of lending seems positive and robust, with the majority of schemes reporting between 35-68% in incremental loan value. Evidence on additionality of R&D investments is scarcer, but at least one program showed an incremental 25 percentage points in the probability of investing (CDTI), and in technologically advanced firms (KOTEC).	from the market, reduce the burden on the government budget (balance sheet) and improve financial records for borrower SMEs. Notwithstanding, the dissemination of this instrument for specific purposes of innovation has not been widespread (Korea and Spain represent 2 case studies featured in the forthcoming innovation policy instrument guide). **Design Recommendations (Do's)** When designing these schemes, policy makers should: • Promote and advertise credit guarantee schemes (CGS). • Provide financial and operational independence to • Provide transparency and disclosure of public funding available, rules, procedures, arrangements. • Build an adequate governance structure for the credit guarantee schemes

105. Some policy options to expand the availability of early-stage capital include:

- Support the development of the capital markets through a continued focus on creating the eco-system that includes a sound legal and regulatory framework, relevant financial products, diversified investors and improved governance, disclosure and infrastructure and better coordination among government agencies.
- Reform the insolvency regime and the secured transactions regulations to further promote movable collateral to be used by SMEs and startups.
- Amend regulations to allow new debt-related financial instruments suitable for innovation.
- Review the matching grants process and administration to reduce the burden for potential applicants.
- Enhance access to innovation finance through credit guarantees for innovation.

Enhancing digital infrastructure and connectivity

106. Enhancing digital infrastructure, connectivity and access is a necessary condition but not sufficient to realizing the promise of the digital dividends. While the diffusion of internet has been increasing rapidly in Vietnam access to fixed broadband is available to only about 12 percent of the population.[95] Clearly, the digital infrastructure is a necessary but not sufficient condition for the use of digital technologies.

95 Refer to Vietnam ICT White Book 2018, which states that 58.14% of Vietnam's population had access to internet (page 14). At the same time, Vietnam *fixed* broadband subscribers only accounts for about 12% of the population (page 29). Also, in 2017, 47.9% of the population had a subscription for mobile broadband Internet access (3G&4G) (Page 29). This may indicate that Vietnamese use broadband access primarily for entertainment (news reading, social networks) rather than work.

107. Firm level investment of digital technology infrastructure in Vietnam remains low as indicated by the digital enabling index.[96] The index measures the average investment compared to a situation of full use of digital infrastructure – from cloud services to computers – and ranges between 0 and 100 where a value of 100 indicates complete access of each digital enabler. The enabling index for Vietnam suggests that on average firms are operating at 38 of the full digital infrastructure index.[97] While on average internet infrastructure is at 75 of having full internet infrastructure, the access/use to digital platforms is only 27 of potential and 4 for cloud services (Figure 34).[98]

Strengthening this digital infrastructure will enable the use of new technologies to adapt to new business models. For instance, mobile payment systems are an increasingly integral part of ensuring services can be embedded in goods. This will be an important complement to the Industry 4.0 agenda. ASEAN has witnessed significant growth in the use of financial technologies (FinTech) to offer new ways of delivering financial services. The development of a data ecosystem, including regulatory frameworks to support cross-border data flows, will also become increasingly important. With an increasing emphasis on the use of data processes in production, issues relating to intellectual property rights, data security, and privacy must be addressed, in line with international best practices, for firms to adopt these data-driven technologies.

108. In Vietnam, as in other ASEAN countries, policies and regulations pertaining to e-commerce (secure electronic transactions, data protection and privacy and consumer protection for online purchases) are much further developed than for other digitization trends associated with Industry 4.0 such as big data analytics, cloud computing or the internet of things (World Bank 2018d). ASEAN can provide a forum to develop an integrated digital market in the region with regulations to govern cross-border data flows. The CPTPP is also seeking to secure open cross-border data flows, with safeguards for personal privacy.

Pillar 3: Supply side – skills & knowledge

Supply of skills

109. A balanced set of cognitive, socio-emotional and technical skills are needed to engage in more innovative and complex production. Education and training policies will need to be redesigned to ensure that workers have the skills needed to engage in more complex production processes. The Government needs to do a better job at steering the education system and its education institutions – this can be done this through suitable governance, financing, quality assurance, and

96 The digital enabling index is a composite index that measures the extent of firms access to cloud services, computers, internet, online platforms and phone. The index uses for each of these general-purpose digital technologies a composite of indicators that measure the number of firms that have access to these technologies with the share of use per worker. For example, phone coverage index measures the extent to which firms have phones and mobile phones and the use per worker. The infrastructure pertains to general purpose technologies and includes access/use of internet, computers, stock of phones and use of cloud services, and on-line platforms. *Source: Technology adoption survey for Vietnam (World Bank, 2020).*

97 As a point of comparison, the index value in one of the lagging states in Brazil (i.e., Ceara) is 55. More comparison data points will be available when similar surveys are completed in other countries.

98 For the case of cloud computing this also corresponds to the percentage of firms using cloud services, 4%.

incentives for institutions to innovate their education delivery. It should furthermore seek to make a major effort to increase the enrollment in adult education, including tertiary education. This requires significant changes in the way institutions and the system function. Without a massive increase in the workforce with a higher level of skills, Vietnam will not be able to get the basics right for an improvement of its national innovation system. The Government is formulating its higher education strategy 2021-2030, and one of the objectives of that strategy would be to make the system more responsive and produce skilled graduates to meet labor market needs. Vietnam will need to emphasize socio-economic skills such as creativity, team work and problem solving with greater urgency for a large section of the population; the Enterprise Survey for Innovation and Skills showed that firms with high levels of literacy and socio-emotional skills were more likely to engage in innovation practices.

110. Vietnam needs furthermore a comprehensive national skills development strategy that: (a) invests in the three broad skills types – cognitive, socio-emotional and job-specific technical skills; (b) builds and implement a national skills standards framework and a national qualification system; (c) develops a well-articulated strategy for expansion of tertiary education within and between the university (overseen by MOET) and the TVET (overseen by MOLISA) sub-sectors as well as through increased private sector provision; and (d) establishes meaningful partnerships between TE institutions and enterprises in delivering and renovating the curriculum towards 21st century skills and innovating learning/pedagogy practices towards more active/blended learning through the use of disruptive technology where appropriate, and through work-based/project-based training such as internships and apprentices.

111. The Technical and Vocational Education and Training (TVET) system in Vietnam needs to be improved so that the quantity and quality of skilled professionals can be strengthened and expanded through better collaboration between TVET institutes and firms. First, increasing the number of vocational education and training centers of excellence will be critical, if the government is to reach its goal of training 600,000 IT professionals by 2020. Second, programs that ensure greater alignment between curricula and employer needs are necessary to improve the matching process of determining the relevant skills needed in the market. Third, the government could expand their scholarship programs, sending exceptional students overseas for tertiary education with the caveat that they return once they are finished.[99] Brazil's "Science Without Borders", which grants 100,000 fellowships to undergraduates, graduate students and postdoctoral fellows to study STEM in leading institutions around the world, is a case in point (Sturgeon and Zylberberg 2015). Fourth, in addition to investing in university-led skill development programs, governments could subsidize firms' internal training programs for up to 6 months through, for example, an annual quota of funded traineeships. As a means of offsetting the costs and risk of training new hires to only lose them to competitors, it provides firms with a greater incentive to invest in skills development. Fifth, Vietnam need to develop a national skill strategy and strengthen the application of the national qualification system in order to ensure the relevance and coherence of education and training programs as well as to increase incentives of workers to invest in skills. This will also help Vietnam gain recognition from the region and the world and to offer qualified labor forces for national and international demands.

99 Currently about 5500 scholarships to study abroad are paid by the Vietnamese Government. However, more than 130,000 Vietnamese students are studying abroad, many of them supported by their families.

112. A focus on building advanced skills for a larger part of the population must also be emphasized. For large countries such as Vietnam, such policies would help building a critical mass of highly skilled individuals. This might involve greater investment in the development of advanced ICT-related skills, such as software programming, engineering and coding or complementary language skills as well as soft skills that foster creativity, problem solving, and initiative. These programs should also be more responsive to changing industry demands if firms are to be able to find the employees they need. The private sector in Vietnam is already undertaking several training initiatives to overcome the inadequacy of relevant technical skills to meet industry demand.[100] More generally, the private sector can (a) partner with TVET colleges and universities to shift the curriculum towards 21st century skills (technical skills, STEM skills, advanced skills and socio-behavioral skills) and innovative learning practices such as work-based training through internships, apprentices, challenge-based learning, and (b) reinforce digital literacy, ICT skills, and other 21st century skills in the current workforce through online platforms, short-term training and continuous professional development at work.

Supply of knowledge

113. Links between university research and industry could be strengthened. A very low level of university-industry (U-I) collaboration takes place in Vietnam. This is the result of a low demand from the private sector as well as insufficient industry-relevant research taking place at the Government Research Institutions (GRIs). Key policy options to strengthen linkages may include:

- Encouraging Universities and/or GRIs to apply for matching grants together with industry to ensure projects are industry relevant. This would entail an innovation funding scheme targeted for joint/collaborative R&D projects between universities/GRIs and enterprises.
- Introducing policies to provide research/university personnel to incentives to rotate into firms.
- Issuing innovation vouchers for SMEs to purchase services from universities/GRIs on innovation projects.
- Including in-the-firm training as part of course curriculum for masters and doctoral students,
- Exploring mutual board memberships whereby universities/GRIs invite industry members to sit on their boards and vice versa.
- Conducting a robust evaluation mechanism to gauge the quality and relevance of research outputs and activities and link funding decisions to the quality and effectiveness of past research.

114. The allocation of public R&D expenditure could be improved. There have been reforms in the right direction, such as the creation of the National Foundation for Science and Technology that places research resources under competitive, peer-reviewed, and merit-based allocation procedures. Also, an evaluation and accountability framework has been put in place to measure research funding. There is a need to have a clear allocation of resources between basic and applied research and a need to foster research through open competition and fund thematic priorities in special projects and programs.

100 The Samsung Vietnam Mobile R&D Center, for example, has channeled $2.5 million towards grants and scholarships at the Hanoi University of Science and Technology. Intel's Study Abroad Program has invested $7 million to sponsor Vietnamese students' engineering degrees at Portland State University and Arizona State University (Sturgeon and Zylberberg 2015).

115. A pipeline of innovation talents should be constructed. As highlighted above, there is a need for highly skilled personnel if the economy is to move towards more knowledge-**based industries.** There is a premium placed on hiring and retaining these skills and talent, the supply of which is often not generated within the domestic economy. There is thus a need to have policies in place to produce these skilled talents domestically as well as attract skilled personnel from the global knowledge pool. One of the unintended consequences of having a tuition cap is that higher education institutions will be cash strapped and unable to provide the high-quality skills required in the economy. Steps might include:

- Removal of the restrictions on revenue created by de facto tuition caps with adequate provision of needs-based scholarships.
- Adoption of specific action plans to streamline procedures for foreign talent workers.
- Establishment of programs to attract prospective researchers from global institutions to work on short-term assignments with the options of pathways to longer-term engagements.

Pillar 4: Strengthening institutional coordination and delivery of innovation policy

116. To respond to the strategic focus on business innovation, Vietnam needs to step-up efforts toward effective inter-institutional coordination and strengthen inter-agency policy coordination and institutional capacities. The shift in the policy framework towards a focus on facilitating non-R&D innovation and diffusion of existing technology has important institutional ramifications. Policy support for STI will require implementing agencies to work increasingly closer with industry representatives, particularly SMEs. And policy makers should enable beneficiaries to access a set of multidisciplinary solutions that underpin the cross-cutting nature of business innovation. New institutional capabilities are necessary for a greater focus on firm needs and delivery of quality program design and implementation. Addressing these two key policy issues may require different institutional responses.

117. The institutional structure and governance of STI in Vietnam is fragmented, with multiple players and limited coordination. The Ministry of Science and Technology (MOST) plays the lead role in the formulation of the STI strategy and has been given the responsibility of overall management of S&T activities at the national level (Decree No. 95/2017 / ND-CP). In this role, MOST is mandated with formulation and monitoring implementation of the S&T strategy and coordinating the budgetary process. However, this arrangement does not appear to be effective when the scope of policy extends beyond the realm of S&T to include non-R&D based innovation among firms. Other challenges that hamper coordination include the lack of consistency among different laws that impact innovation,[101] and the involvement of multiple institutions in the design and implementation of innovation programs. There are also limited mechanisms for regular consultation with the private sector to help inform policy design and provide feedback on program effectiveness. There is thus substantial scope for strengthening coordination across multiple levels and programs in Vietnam.

101 For instance, the State Budget law and the financial law are not always aligned.

118. Given the inherently complex and multi-sectoral nature of the innovation process, effective coordination is needed across a range of institutions. Figure 35 lays out a diverse set of institutional arrangements that are needed for executing innovation policy, underlining the imperative of coordination. When looking at institutional functions along the stages of the policy life cycle (Angelleli et al. 2017), at least four sequential but iterative steps can be distinguished: i) formulation of innovation strategies (long-term policy aspirations), ii) design of innovation policies, iii) innovation policy implementation and supervision, and iv) deployment of innovation instruments and innovation activities. It is also necessary to add the non-sequential functions of coordination and planning, given their importance in the context of innovation policy.[102]

FIGURE 35: **Multi-sectoral nature of innovation makes coordination essential**

Function \ Scope	Innovation skills & Human Capital	Research and development	Innovation	Enterpre-neurship	Enterprise development	Investment and trade
Coordination & Strategic planning	National Planning Agencies / Ministries of Finance					
Strategy formulation	National Councils (Public and Private)					
Policy design	Education / Labor ministries	Science and technology ministries	Economic development and production ministries			Line ministries (Trade / Investment)
Implementation	Science and technology agencies		Innovation (and entrepreneurship agencies		Other complementary agencies	
Deployment of instruments and activities	Universities HE & VTEs	R&D institutes / Universities	Intermediaries / firms and entrepreneurs			

Focal Comlementary

Source: Adapted from Angelleli, et al. (2017). World Bank (2000). A Practitioner's Guide to Innovation Policy.

Advocates for a bold approach suggest that establishing a new innovation agency can tackle the coordination challenge

119. Establishing a dedicated innovation agency may not be an optimal option in Vietnam's context as it presents significant costs and requires important building blocks for success (Figure 36). Some countries have established a dedicated innovation agency for centralizing and coordinating innovation policy across institutions. However, the typical motivation behind the creation of such an agency rests not on improving coordination but rather on strengthening design and implementation of innovation policies. Innovation agencies can build technical specialization

102 World Bank (2020).

on innovation policy and attract highly competent professional skills that are necessary to deliver innovation policy. This option entails the flexibility of government to attract and retain talent and offer prospective staff competitive wages. Furthermore, it implies that agencies can operate with political independence, bringing agility to policy implementation – i.e., operating in a less bureaucratic environment than agencies acting directly under line ministries.

FIGURE 36: **Seven Building blocks of performing innovation agencies**[103]

Source: Aridi A. and N. Kapil (2019. Innovation agencies, Cases for developing economies (forthcoming).

120. Examples of creating and upgrading some of these agencies can be found in Eastern Europe, where countries like Poland and Serbia have successfully introduced modernization and professionalization of these agencies. While there is no single model for an ideal innovation agency, a recent review of innovation agencies across countries sheds light on common success factors that include recruitment of capable staff, effective governance and management structures, diagnostic-based interventions, M&E system, sustainable funding, and forging strategic partnerships with private sector and key stakeholders (see Figure 36).

121. In practice, setting up and nurturing a new agency can involve significant costs and risks. Practitioners should draw on international best practice to find potential solutions to their challenges. However, policy makers seeking to copy institutional forms and arrangements from developed countries into their own institutional landscape often fall into a trap (Cirera et al, 2020). Agencies can take many forms depending on the degree of autonomy and staffing, but their effectiveness tends to be highly correlated with the overall level of institutional quality and availability of talent endowment in the country. Singapore's SPRING is a good example of a well-functioning

103 These lessons have been gained through an investigation of 13 innovation agencies located in developing countries, and one comparison case of Singapore. Other countries include Malaysia, Poland, Croatia, Serbia, Georgia, Columbia, Turkey, Lebanon, Armenia among others.

agenda (Box 6). Setting up an agency like SPRING requires human capital and a long-term financial commitment, both of which are currently absent in Vietnam. Vietnam has seen a fair share of similar 'special-purpose' institutions already that did not deliver the expected outcomes. A more gradual approach for building competencies to support business innovation in strategic areas may be an option to consider in Vietnam as it responds to challenges ahead.

BOX. 6. **SPRING Singapore – enabling enterprise**

- *Objective:* promote competitiveness of local SMEs and start-ups, SPRING is a Government agency and statutory board under the Ministry of Trade and Industry (MTI)
- In 2018, SPRING merged with International Enterprise Singapore to form *Enterprise Singapore*. The aim of the revamped agency is to enable the growth of Singapore's companies through an integrated support network, providing opportunities to develop business capabilities and access overseas markets.
- *Program:* includes financing, capability upgrading, management development, market access, and other technology and innovation services.
- *Direct Financial Support:* co-investment initiatives offered under Startup SG Equity- matches investments in eligible start-ups with investors
- *Non-financial support:* facilitates collaboration between large corporations and SMEs.

Key principles behind successful institutional coordination mechanisms for innovation policy

122. Vietnam's current STI coordination model needs bolstering but there is not a one-size-fits-all solution. Most countries do not have a designated ministry mandated to coordinate and promote innovation, as this is typically shared across several agencies and ministries. In some countries, this lead coordinating role is given to cross-cutting institutions, like the Prime Minister's office or a Presidential advisory council, as is the case in South Korea (Box 7). The latter has become popular, and in some cases the Prime Minister chairs the innovation council cross-sectoral meetings to coordinate the implementation of innovation policy. While the institutional arrangements for coordination of innovation policy that work for one country may not be transferable to another, there are key principles that can be considered and adapted in Vietnam's political economy context. First, policy makers should aim to understand what the short-comings of the current top-down model are, and identify the key factors inhibiting innovation outcomes. Second, a key lesson from the international experience is that the process of coordination needs to be bottom up, relying on consultations among the relevant agencies and the provincial governments. Third, deep engagement from ministries that are close to industry – i.e., with responsibility for industry, trade or SME development policy – is critical when the greatest challenge for advancing innovation is beyond public and private R&D (i.e., extending to adoption and diffusion of existing innovations). Finally, sustained consultation with the private sector remains key to ensure that support is demand-driven and that there are learning loops embedded during the implementation phase.

BOX 7: **Korea's High level Strategic and Coordination Institutional Mechanisms**

Vietnam considers South Korea as an aspirational economic model for its economic transformation. In Korea, innovation policies are closely coordinated between the Ministry of Science and ICT (MSIT), the Ministry of Economy and Finance (MOEF), and increasingly the Ministry of Trade, Industry and Energy (MOTIE). Over time policy leaders in Korea have evolved their innovation policies – R&D and non-R&D – in line with changing development priorities and country and global circumstances. Given the multi-faceted nature of innovation, policy and institutional coordination mechanisms have played a defining role in Korea's success. The institutional mechanisms and coordination may be multi-layered: i) the strategic level that sets the national economic development goals and brings together relevant innovation ministries/agencies stakeholders to realize the objectives; ii) coordination of key ministries; and iii) the technical level coordination for design and implementation for innovation and competitiveness policy. What are the key institutional mechanisms that have evolved in Korea over time to support both R&D and non- R&D innovation?

Strategic-level Coordination – Presidential Advisory Council on Science and Technology (PACST)

PACST is a national council, chaired by the President, with the purpose to adopt innovations in science and technology. PACST deliberates on matters concerning national R&D projects as well as coordinating major policies and plans for promoting science, technology and innovation in general. Specific *functions* include:

- formulating and coordinating major policies and plans for promoting science and technology;
- budget allocation, and adjustment for R&D annually and recommendations for public S&T institutions; and
- evaluation of national research and development projects and inspection

Membership: A cross-sectoral mechanism, it includes civilian members from academia and the private sector. PACST is composed of several committees based on priority areas and expertise required. The R&D committees are supported by the STI Office of MSIT.

Special Committee on Innovation Growth Engine, chaired by the Vice Minister for Science, Technology and Innovation of MSIT, is pertinent for policy coordination for non-R&D innovation activities. Composed of government officials from major innovation-related ministries and agencies including MSIT, MOTIE, MOEF, the Ministry of SMEs and Startups (MSS), and the Ministry of National Defense (MND), as well as experts from academia and the private sector, this Committee coordinates government policies and programs on next-generation engines for innovative growth.

Coordination at the level of policy design and implementation

The Enforcement Decree of the Framework Act on Science and Technology mandates MSIT and other line ministries to plan, operate and review R&D activities in close cooperation. For instance, Article 21-2 of the Decree states that MOEF and MSIT "shall operate a consultation committee to discuss matters concerning the allocation, adjustment, etc. of the budget for national research and development projects." Furthermore, in order to facilitate collaborative planning of national R&D projects, Article 25 of the same Decree states that "MSIT may designate projects requiring collaborative planning between the relevant central administrative agencies in consultation with the heads of the relevant central administrative agencies, from among the national research and development projects involving two or more central administrative agencies."

Lessons learnt:

- High level strategic vision backed by legal mechanisms that enable close policy coordination among relevant ministries and agencies.
- Strong leadership to set the road map, prioritization and oversight
- Consultation with the private sector and academia
- Setting up technical working committees for coordination of policies, reforms and implementation arrangements
- Promoting non-R&D with R&D activities for innovation

123. There is scope to strengthen coordination across thematic areas of innovation policy. In Vietnam, the coordinating role for STI strategy has been designated to the Ministry of Science and Technology as per the existing legal framework. Under this mandate, MOST can facilitate coordinated responses to redress the most pressing problems inhibiting business innovation. An enhanced coordination model should adopt an approach that is evidence-based and driven to problem solving in key thematic areas of innovation. Under this framework, the relevant stakeholders can agree (collectively) to deploy measures and allocate resources for addressing agreed policy priorities, that can range from adopting existing technologies, upgrading of SMEs, innovation startups or complex R&D projects. Unlike the high-level measures specified in a typical 5-year strategic plan, the scope of the activities under this multi-stakeholder framework will be action oriented and highly focused on removing concrete barriers to innovation. In this model, MOST could facilitate the implementation of these measures (even when implementation is delegated to another highly competent agency under a different ministry), serving as a secretariat, organizing strategic planning and prioritization, and tracking progress toward the defined goals. The response program would be organized under technical working committees for deployment of policies and decentralized field activities.

124. This model offers two distinctive advantages. First, the implementation of measures will draw on the skills and expertise from different agencies, providing a truly multidisciplinary approach to advancing innovation policy. Second, the involvement of specialized agencies will reinvigorate the existing coordinating role of MOST, giving substance to technical meetings and a sense of urgency to a collective and action-oriented agenda, which will contribute to attaining the aspirations of the national STI strategies. An example of this approach is the National Competitiveness and Innovation Commission from Colombia. The President of Colombia chairs the annual meeting of the Commission's public and private sector stakeholders, which includes the sector ministries and the private sector's competitiveness council.

125. Matrix 1 captures the full gamut of reform actions that are needed to strengthen Vietnam's NIS for improving innovation outcomes. It provides a roadmap in terms of timeline i.e., short-term versus longer-term actions. In each case, the responsible implementing agency is identified. As the reforms are needed across a spectrum of ministries and agencies, a coordinating and monitoring mechanism to track progress will be important. The government is cognizant of the need for these reforms, and the challenge is more about operationalizing these actions by learning from good practices in other countries, as well as expediting the pace of reforms.

Matrix 1: A new STI strategy for enhancing business innovation in Vietnam

Issue	Policy reform actions	Sequencing actions (Implementing agency)	
		Short-term	Longer term
PILLAR 1: Re-orientation of the STI Policy and Development Framework			
Current STI Policy Framework and its implementation is not aligned to the key *Vietnam 2035* **priorities** including fostering innovation in enterprises. Specifically, there is: • Resource allocation is skewed towards R&D and neglects support to non-R&D based innovation • Narrow scope of policies and instruments for business innovation • Weaknesses in the NIS not adequately addressed	**Rebalancing the STI policy mix and improving its composition** • Strengthen business innovation programs to support innovation capacity of SMEs and tech start-ups by focusing on: - Maximizing spillovers from FDI by facilitating linkages between MNEs and domestic SMEs - Improving managerial practices as core innovation capabilities - More emphasis on university-GRI – Industry linkages and collaboration	• The new STI Strategy reflects the focus on technology adoption and diffusion in businesses (esp. SMEs) underpinned by resource reallocation and broadening of policy instruments and beneficiaries • Scale up of management, technology extension and linkages programs [MOST + MOIT + MPI] • Minimize policy gaps by creating working groups in the following areas: - Promote SME upgrading and innovation - Early stage innovative ventures and finance • Formal review of instruments to improve management quality and to facilitate technology adoption. [MOST as lead]	• Introduce new thematic strategies by working groups aligning all agencies. • Formal review and evaluation of existing tax incentives to high-tech firms • Design a new technology transfer program and university-industry collaboration • Design a new R&D strategy [MOST as lead]

Issue	Policy reform actions	Sequencing actions (Implementing agency)	
		Short-term	Longer term
	Improving program targeting of beneficiaries and geographical coverage	• Review and simplification of existing application process for government support • Increase and make mandatory a minimum share of industry representatives in panel experts reviewing proposals • Increase funding available for program dissemination outside Hanoi and HCM City	
• **Government competencies** and processes to generate effective policies needs strengthening	**Building agencies' competencies to design and implement STI policies**	• Make fully developed logical and M&E frameworks mandatory with harmonized indicators • Provide capacity building activities on: - Logical and M&E frameworks - Instruments to support STI • Establish a clear template for the diagnostic of the problem to be addressed, identification of the market failure and justification of the instrument design • Program for training of civil servants in international level STI studies [MOST Lead; with other agencies]	• Implement rigorous impact evaluations of selected policy instruments • Implement a single information system for applicants – single window • Implement a new common IT system for managing beneficiaries' information across agencies [MOST Lead; with other agencies]

Issue	Policy reform actions	Sequencing actions (Implementing agency)	
		Short-term	Longer term
Strengthening Selected areas of Vietnam's National Innovation System			
PILLAR 2: Demand – the firm			
Firm capabilities deter technological adoption and diffusion	Managerial skills and organizational practices in firms need to be strengthened.	• Attract skilled Vietnamese from abroad to fill the gap • Introduce new policy instruments that can be used directly in equipping firms with the capabilities of using and/or generating technologies; for e.g. Business Advisory Service (BAS) and Technology Extension Service (TES) • Raise awareness among SMEs of the importance of managerial skills for innovation through business associations networks • Facilitate measures (auto-administered) for SMEs to conduct self-diagnostics and enable understanding of their own capacity limitations. [MOIT + MOST + MPI]	• Strengthen quality of business administration programs • Seek public-private sector collaboration • Increase allocation of resources to instruments to improve managerial quality and firm capabilities, and to facilitate technology adoption based on extension models
Competition policy is weak due to large role of SOEs that deters innovation	Unlock private sector innovation through increased competition and bold SOE reforms • Accelerate and deepen SOE reforms • Implement competitive neutrality • Remove distortions to create a level playing field/entry/exit	• Strengthen separation between ownership and regulatory functions of SOEs • Remove barriers for SOEs in using R& D funds [MOIT + MOF]	• Enforce competitive markets (independent competition agency) • Improve corporate governance • Open up services sector [MOIT + MOF]

Issue	Policy reform actions	Sequencing actions (Implementing agency)	
		Short-term	Longer term
PILLAR 2: Demand Side – *Operating Business Environment and Complementary Factors*			
Regulatory and doing business environment	Improve the business environment and competitiveness of domestic enterprises by improving entry barrier (starting a business), and exit of firms (Insolvency law reform).	• Introduce appropriate regulations to implement Government Resolution 02 that aims to accelerate regulatory reforms to improve the business environment. • Key regulatory steps have been identified in the Doing Business report for Vietnam	• Reform the insolvency law and the secured transactions regulations to further promote movable collateral in lending to SMEs and startups.
Intellectual property rights regime is not well-enforced. This deters knowledge transfer as it relies on investor protection. This is particularly important for Vietnam as it attracts large amounts of FDI.	• Intellectual property rights protection regime in Vietnam requires stronger enforcement efforts along with strengthened capacity to adapt to the needs of Vietnam's entrepreneurial ecosystem and specifically SMEs.	• Patent protection enforcement can be strengthened by establishing clear guidelines on how benefits from commercialization of new ideas should be divided among collaborators from universities and think tanks/ industry and research/ foreign and local.	• Strengthen the overall capacity of the IPR protection system to enforce patent protection copyrights, and industrial property rights.
Innovation and start-up finance constrained	Start-up finance is constrained by both demand and supply side factors. On the demand side, the inability of firms to produce business plans to seek out funding and lack of investible ventures that indicate capacity to grow; many incentives remain "on paper" as cumbersome guidelines and the administrative burden impairs access. Regulatory mechanisms are unable to catch up with innovation start-up development and serve as barriers rather than facilitators.	• Stimulate the supply of early stage finance using public capital in the stage with the largest market failure i.e., pre-seed and seed stage. • Government can initiate investment readiness programs that improve CEOs/ founders business management and leadership skills, networking and matchmaking.	

Issue	Policy reform actions	Sequencing actions (Implementing agency)	
		Short-term	Longer term
	Address demand and supply side issues for increasing availability of start-up finance	• Further reform regulations on secured lending to encourage Vietnamese banks to move away from traditional real estate secured lending and develop more movables financing (i.e., secured by broader types of assets, i.e., tangible and intangible or in other words, receivables, inventory, value paper, Intellectual property, etc.) (MoJ as lead with other agencies) Review the matching grants administered to make the processes less burdensome for potential applicants.	• Continue to reform the insolvency law and the secured transactions regulations to further promote movable collateral in lending to SMEs and startups. • Change regulations to allow new debt related financial instruments. • Undertake an evaluation of the tax write off permissible under the Law on High-Tech to gauge the effectiveness of these write offs.

Issue	Policy reform actions	Sequencing actions (Implementing agency)	
		Short-term	Longer term
PILLAR 3: Supply of skills and knowledge			
Human Capital: Skills Gaps (poor quality of skills) and **Skills Shortages** (inadequate quantity of workforce with required skills) are major constraints for engaging in/investing in firms' innovation practices. Vietnam should make a major effort to increase the enrollment in tertiary education. Tertiary education institutions will have to pay attention to 35, 45 and 55-year-olds, not just 20-year-olds. This requires significant changes in the way institutions and the system function. Without a massive increase in the workforce with a higher level of skills, Vietnam will not be able to get the basics right for an improvement of its national innovation system.	Develop a national skills development strategy in the education and training systems for (a) re-skilling of current workforce (stock) and (b) investing in skills of new cohorts (flow) through more relevant tertiary and TVET as well as primary and secondary education systems. To a larger extent bring enterprises (employers) into the skills development system • Revisit the roles of Government as a Steward (quality assurance, autonomy and accountability, LMIS) and Financier (performance-based, matching grant, student aid) • Investing in all three broad skills types are critical: cognitive, socio-emotional and job-specific technical skills • Incentivize enterprises, TVET institutions, and universities to partner on investing in continuous learning and training through design and implementation of more relevant and innovative curriculum and pedagogy, work-based training (internships)	• Design and pilot output- based financing for TVET Institutes and universities, with enhanced autonomy and accountability (output can be number of graduates with relevant skills) • Provide policy support and incentives for private sector to invest in (internships and ICT skills at work and TEIs) and provide advice (e.g. on curriculum and information) for a more labor market-oriented skills development sector. • Provide incentives for enterprises on employee tuition support and attracting skilled Vietnamese from abroad • Hand-over the institution-based learning to TVET institutes and universities via greater autonomy and accountability in the design and provision of their services. • Strengthen adult education programs designed to enhance technical skills literacy and socio-emotional skills	• Institutionalize the Steward and Financier roles of the Government (next HE or TVET Law Amendments) • Strengthen the national qualification framework to make Vietnam's education and training system more transparent so that students, workers and employers better understand the required qualifications for the type of occupations and tasks envisaged • Integrate socio-emotional skills into curriculum and extra-curriculum programs in primary, secondary, and tertiary education • Build a well-functioning labor-market driven skills development system by designing and implementing a Labor Market Information System (LMIS) for systematic data analysis and managing dissemination platforms for all stakeholders. [MOET +MOLISA+ Enterprises + Vocational + Tertiary Education Institution (TEIs)]

Issue	Policy reform actions	Sequencing actions (Implementing agency)	
		Short-term	Longer term
Today's skills needs cannot be met solely by the current practice in the education and training sector which includes programs that target a narrow set of population and limited coherence across life stages. Instead, Vietnam should provide a range of skill development opportunities across a broad population for continuous learning, which will involve both a larger set of actors and will change the roles of the education and training sectors.		• Design and pilot labor market information schemes, job search programs, and data analytics (disruptive technology) for informed decision-making. [MOET +MOLISA+ Enterprises + Vocational + Tertiary Education Institution (TEIs)]	
University/GRI-Industry research linkages are weak: enterprises rarely find public sector R&D a useful source of knowledge for their innovative activities A key challenge lies in inappropriate incentive schemes for the academic system for collaboration with enterprises and the lack of mechanisms to diagnose the innovation needs of firms	Build stronger University/GRI-Industry research linkages as the intensity and quality of collaboration between companies and universities/GRI play an increasing important role in determining returns to R&D investments, firm competitiveness, long term economic growth and job creation. It also plays an important role in the ability of countries to attract and retain highly qualified and mobile personnel.	• Strengthen University/GRI-Industry partnerships by scaling up existing and introducing new innovation funding schemes targeted for joint/collaborative research and innovation projects between universities/GRIs and enterprises • Support master's and PhD students to pursue targeted research projects in enterprises including spending part of their studies in an enterprise	• Rebalance public funding at universities and GRIs based on national priorities and performance-based funding. The GRIs should be restructured into sustainable, larger, fewer, and better performing organizations with clear missions and funding criteria, including performance-based ones set at the appropriate level.

Issue	Policy reform actions	Sequencing actions (Implementing agency)	
		Short-term	Longer term
		• Establish mutual board memberships whereby universities/GRIs invite industry members to sit on their boards and vice versa • Rebalance R&D support. For example, NAFOSTED funds should also be opened to start ups and R&D investments in enterprises to help commercialization potential • Innovation vouchers for SMEs to purchase services from universities/GRIs on innovation projects • Establish organizations dealing with market and technology brokerage, technology agents, and centers for leasing and contracting manpower for science and technology activities. [MOST +MOET+ Enterprises + GRIs+ Universities]	• Increase autonomy and accountability in the governance of learning, teaching and research at universities and GRI. Modern R&D management practices at universities and GRIs such as peer review, advisory committees, and performance-based evaluations should be thoroughly applied. • Establish a better incentive system to encourage innovative research at universities/GRIs and allow them to keep the revenues from commercialization of the research results. • Create and improve a legal system for a technology market (including regulations on science and technology contracts). [MOST + MOF Enterprises + GRIs+ Universities]

Issue	Policy reform actions	Sequencing actions (Implementing agency)	
		Short-term	Longer term
PILLAR 4: Strengthen Coordination and Partnership Across Agencies and Public-Private Stakeholders			
Strategic socio-econ development strategy (SEDS) needs to adjust towards a productivity-led growth model for achieving upper-middle income status	GoV's *Socio-economic development Strategy (SEDS)* brought in alignment with the *Vietnam* 2035 vision that highlights the importance of an innovation and productivity-led growth model	• STI identified as a thematic pillar of the new SEDS/P framework for pursing an innovation and productivity-led growth model for Vietnam [MPI and MOST]	• Implement and monitor the new SEDS Strategy [MPI with MOST]
Coordination among **innovation agencies** as well as sustained partnership/consultation with **private sector** in advancing the STI agenda appears to be ad hoc and needs strengthening	Improve coordination across public innovation agencies and forging partnership with private sector & other stakeholders	• Identify champions in the Government to improve coordinating mechanism across agencies • Seek private sector inputs on a systematic basis to develop demand-driven policies	• Evaluate the pros and cons of setting up an innovation agency vs. a high-level coordination mechanism • Establish a self-sustaining community of practice with key stakeholders from private and public sector to create "feedback loops" to strengthen design and implementation of innovation policies and outcomes

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Annex 1: Results from the enterprise survey on innovation and skills in Vietnam

Koji Miyamoto (World Bank) and Miguel Sarzosa (Purdue University)

1. Introduction

While Vietnam has achieved impressive economic development during the last decades, there is a sign of struggle to sustain its productivity growth compared to regional peers such as China, Japan and Malaysia. To continue fostering growth, Vietnam cannot only rely on further investments in labor and capital. Innovation offers opportunities to enhance productivity to help maintain growth and lower the incidence of poverty. The experiences of Japan and Korea offer an example in which long-term efforts to invest in innovation went hand in hand with rapid development. Despite the potentially considerable gains from investing in innovation, firms in developing countries invest relatively little (Cirera and Maloney, 2017). This is also the case in Vietnam, where investment in innovation has been low for its level of development.

Human capital, which includes a broad set of employees' skills and capabilities, is considered a key driver of innovative practices in enterprises. Investments in innovation may not happen, if firms do not have a capable leadership who can identify novel business opportunities and effectively mobilize available resources to translate innovation into enhanced production processes. Investment in innovation is likely to have a limited impact on production, if firms do not have qualified leaders, professionals and technicians who are capable of absorbing new ideas and effectively drive the new operational process. Furthermore, the innovation-driven transitions in the production process may not be smooth, if clerks and assistants do not have the foundational literacy and socio-emotional skills to facilitate changes.

This report presents initial results from the World Bank's Enterprise Survey on Innovation and Skills in Vietnam (see Box 1 for a summary of this survey), which provides linked employer-employee data. This survey is designed to identify the nature and intensity of innovation practices, as well as employees'

levels of cognitive and socio-emotional skills. This report also points to the relationship between employees' skills and firms' innovation practices, as well as the extent to which firms perceive skills shortages as an obstacle to fostering innovation. Finally, the report presents policy implications based on the nature of skills shortages, and the constraints employers face in either hiring skilled employees or investing in enterprise training.

BOX 1: **The Enterprise Survey on Innovation and Skills in Vietnam**

The World Bank's Enterprise Survey on Innovation and Skills took place between May 29 and July 5, 2019 in 5 provinces, namely Hanoi, Bac Ninh, Da Nang, Ho Chi Minh City and Binh Duong. This survey targeted firms in the manufacturing and ICT services sectors and included state-owned enterprises. 201 firms representing four strategic sectors (i.e.,, high-skilled innovator, medium-skilled innovator, labor intensive and ICT services firms) were randomly selected from the Vietnam Enterprise Registry 2017 data.[104,105] The four strategic sectors were based on the "Future of Manufacturing-Led Development" framework which also takes into account the services sector as part of the whole value chain (Hallward-Driemeier and Nayyar, 2018). It is likely that firms representing these four strategic sectors within the five provinces are more likely to have engaged in innovation compared to other types of firms in other provinces. This survey collected information on firm characteristics from 201 managers as well as employee background and skills from 849 staff. The staff's job categories included managers, professionals, technicians and clerks. The survey was designed to capture firms' engagement in four types of innovation practices as defined in the OECD's Oslo Manual 2018, namely product, process, organizational and marketing innovations (OECD, 2018). The assessment was conducted using laptop computers which mobilized an online survey platform to maximize efficiency of data collection while minimizing errors inherent in the data entry process.

The firm assessment was designed to capture general background information, innovation practices as well as firms' perception of factors that hampered innovation. The employee assessment assessed employees' literacy and socio-emotional skills as well as demographic and socio-economic background. The literacy assessment was designed to measure document literacy, which can be scaled by internationally recognized proficiency levels used in the International Adult Literacy and Life skills Survey (IALS) and Adult Literacy and Life skills survey (ALL). The socio-emotional skills assessment, designed to measure the five broad dimensions of employees' socio-emotional capabilities, mobilized the Big Five Factor models as described in Annex 1.2 (Soto and John, 2018; John, Miyamoto and Willroth, 2019). Evidence from around the world suggest that literacy and socio-emotional skills have been shown to play an important role in driving the success of youths and adults success in the labor market and society (OECD, 2015), while almost any survey of employers that collects information on skills shortages suggests that skills, particularly, socio-emotional skills, are key areas of skills shortages (Cunningham and Villasenor, 2016). Yet results from the STEP Household Survey in Vietnam (2014) suggest that a large share of adults aged 15-64 lacked the foundational literacy proficiency to function in the 21st century labor markets.

The firm assessment was adapted from the World Bank's Enterprise Survey for Vietnam, the National Agency for Science and Technology Information (NASATI) Vietnam survey, and the World Bank's STEP Employer Survey. The employee assessment used TOWES Prime[106] for the document literacy assessment, and Big Five Inventory (BFI-2) for the socio-emotional skills items. The socio-emotional skills assessment used two formats of BFI-2, specifically: five-point Likert scale, separate for at work and at home, and anchoring vignettes, which were separate for males and females. One of the most important value-added of this enterprise survey is the linked information on employers' and employees' skills. Annex 1.3 presents summary statistics by firms across four strategic sectors.

104 See Annex 1.1 for the mapping of Vietnam's Standard Industrial Classification (VSIC) code into the four strategic sectors.

105 This survey represents firms located in the above mentioned 5 provinces, engaged in the 4 strategic sectors, with a revenue of at least 3 billion VND (in 2018), and with 30 or more employees. This survey provides a representative sample of these firms and employees who engaged in the skills assessment.

106 See http://www.towes.com/en/products-and-services/assessments/assessments-overview.

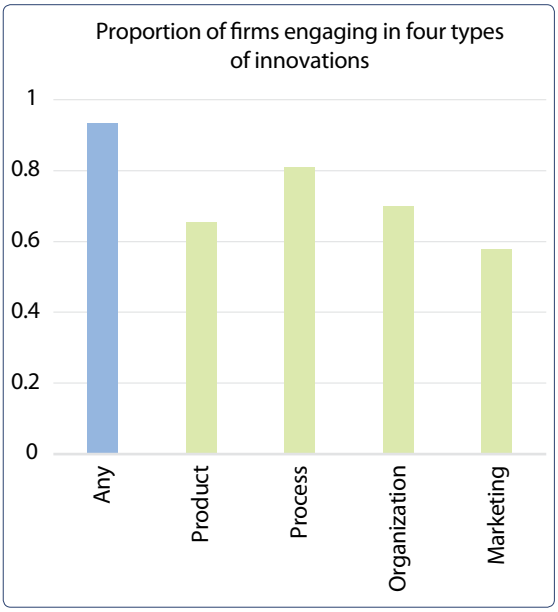
2. Innovation practices in Vietnam

The OECD's Oslo Manual is an international reference guide for collecting, using and reporting data on innovation. This manual defines the following four types of innovation practices:[107]

- **Product innovation:** A good or service that is new or significantly improved. This includes significant improvements in technical specifications, components and materials, software in the product, user friendliness or other functional characteristics.
- **Process innovation:** A new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.
- **Marketing innovation:** A new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
- **Organizational innovation:** A new organizational method in business practices, workplace organization or external relations.

The Enterprise Survey on Innovation and Skills in Vietnam adopted the conceptual framework and assessment methodologies proposed in the Oslo Manual, and has measured the four types of innovational engagement. This study also generated a composite index of innovation engagement that combines the incidence of 4 innovation practices as well as whether or not a firm has a research and development (R&D) department, which follows a similar methodology adopted in Park and Xuan (2019) for their analysis of innovation in China.[108]

FIGURE 1: **Firms tend to invest less in product and marketing innovations**



Source: Enterprise Survey on Innovation and Skills in Vietnam.

Note: 'Any' captures firms that have engaged in at least one of the four types of innovation practices.

Figure 1 presents the overall incidence of innovation practices among Vietnamese firms across the four strategic sectors (i.e.,, high-skilled innovator, medium-skilled innovator, labor intensive and ICT services) within the 5 target provinces (Hanoi, Bac Ninh, Da Nang, Ho Chi Minh City and Binh Duong). While 93% of firms engaged in at least one type of innovation, there were smaller proportions of firms that invested in product (65%), organizational (70%), and marketing (58%) innovations. The incidence of process innovation was high (80%) on average. The relatively high incidence of

107 See https://www.oecd.org/site/innovationstrategy/defininginnovation.htm.

108 The compositive index is an unweighted sum of dummy variables that captures the existence of each of the four innovational engagement and a R&D department.

innovation activities is likely due to the focus of this study on four strategic sectors in manufacturing and services, including ICT services and high/medium-skills innovator firms, which are likely to represent firms that exhibit higher tendencies to invest in innovation compared to firms from other sectors.[109]

Correlations between the four types of innovations and total factor productivity (TFP)[110] suggest that ***product Innovations show particularly strong associations with TFP.*** Firms that engage in product innovations are likely to exhibit 49.9 percentage points (of a standard deviation) higher TFP than firms that do not engage in product innovations.[111] Moreover, the composite index of engagement in innovation (a score ranging from 0-5) also shows strong correlations with TFP, with a threshold level at the composite score of 3 and higher. These results suggest that innovation engagement measures employed in this study are among the key correlates of firm productivity.

Figure 2 decomposes the incidence of each of the four innovation types by sectors.[112] ***A large proportion of ICT (87%) and high-skilled innovator (83%) firms engaged in product innovation, while a much smaller proportion of medium-skilled innovator (60%) and labor intensive (64%) firms did so.[113]*** For marketing innovation, the low overall engagement (58%) masks a relatively high engagement among ICT services firms (72%). These patterns are consistent with the assumption that a large proportion of medium-skilled and labor intensive firms in Vietnam are subcontractors of multinational enterprises (MNEs) that bring their own patented production technologies.[114] If a large proportion of these Vietnamese firms dedicate their production capacities to meet the demand from the MNEs, there will be limited incentives to engage in product or marketing innovations.

109 The NASATI Innovation Survey suggests that 62% of Vietnamese firms engage in at least one form of innovation.

110 Total Factor Productivity (TFP) is a measure of economic efficiency, which can be captured by estimating the proportion of growth in output not explained by growth in traditionally measured inputs for production such as labor and capital.

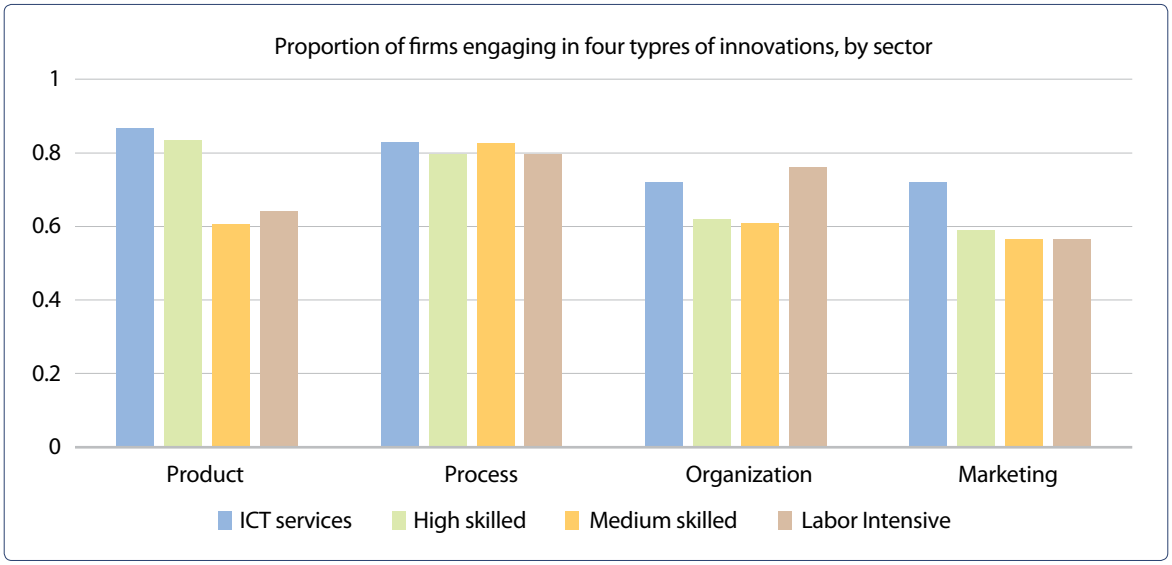
111 Other forms of innovations (i.e.,, process, organization and marketing) did not show statistically significant associations with TFP. Note that there are no comparable figures of innovation-TFP links available from other countries.

112 Moreover, some (though not large) differences emerge when decomposing the incidence of each of the four innovation types by regions and firm size. For instance, larger firms tend to invest more in all forms of innovations, compared to smaller firms. A particularly high proportion of large firms engaged in process and organizational innovations. Firms in the Northern region tend to engage more on process and organizational innovations while firms in the Center region tend to engage more on marketing innovations. This partly reflects the fact that the Northern region has a larger share of high skilled innovator and ICT services firms compared to other regions. Firms in the Southern region tend to engage the least in most forms on innovations.

113 There are no comparable data from other countries given the specific target sectors and definitions this study adopts. By focusing on a representative sample of private sector firms within a country (World Bank's Enterprise Surveys), Demmel, et. al., (2017) shows that a large proportion of firms in Argentina (81.8%), Colombia (79.6%), Mexico (57.9%) and Peru (85.4%) engage in product innovations.

114 The data suggests that larger proportions of medium-skilled and labor intensive firms (18% and 16%, respectively) acquired or bought research and development (R&D) results from other enterprises or organizations compared with ICT and high-skilled firms (13% and 9%, respectively).

FIGURE 2: **A large proportion of ICT firms and a smaller proportion of medium- skilled and labor intensive firms invest in product and marketing innovations**



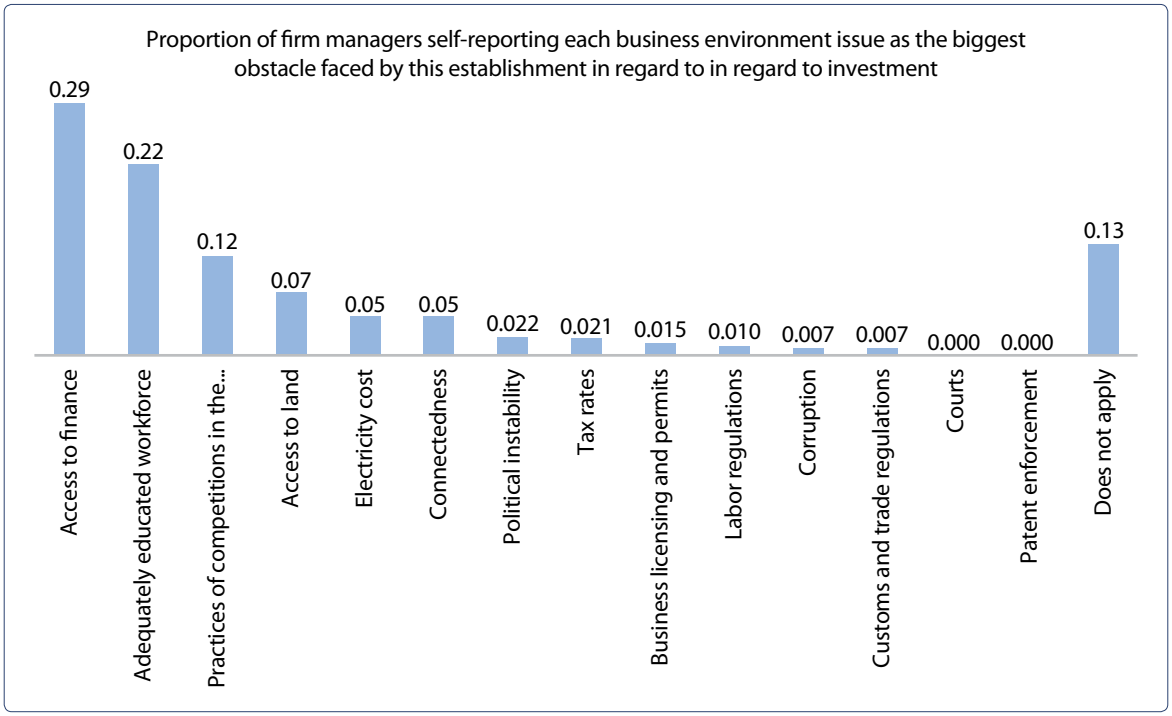
Source: Aridi A. and N. Kapil (2019. Innovation agencies, Cases for developing economies (forthcoming).

3. Employee skills and innovational practices

Figure 3 ranks the incidence of various obstacles firm managers perceived with respect to engagement in innovation. Not surprisingly, 'access to finance' was perceived to be the most significant obstacle for the largest proportion of firms (29%) that participated in this study. This may have been due to some of the product, process, organizational and marketing innovations requiring substantial amounts of prior investments that firms couldn't afford to make. The second major obstacle was 'lack of adequately educated workforce', which 22% of firms reported. This highlights the importance of addressing the skill needs before firms can explore engagement in innovation.[115] By contrast, policies and business climate issues appeared to be much less of a constraint on firms' engagement in innovation compared to the financial and human resource constraints.

115 These results are consistent with the results of the NASATI Innovation survey (Figure 6.1: Enterprises' assessment on the impact level of major causes hampering the innovation activities).

FIGURE 3: **Access to finance and skilled workforce are the two major obstacles firms face in fostering innovation**



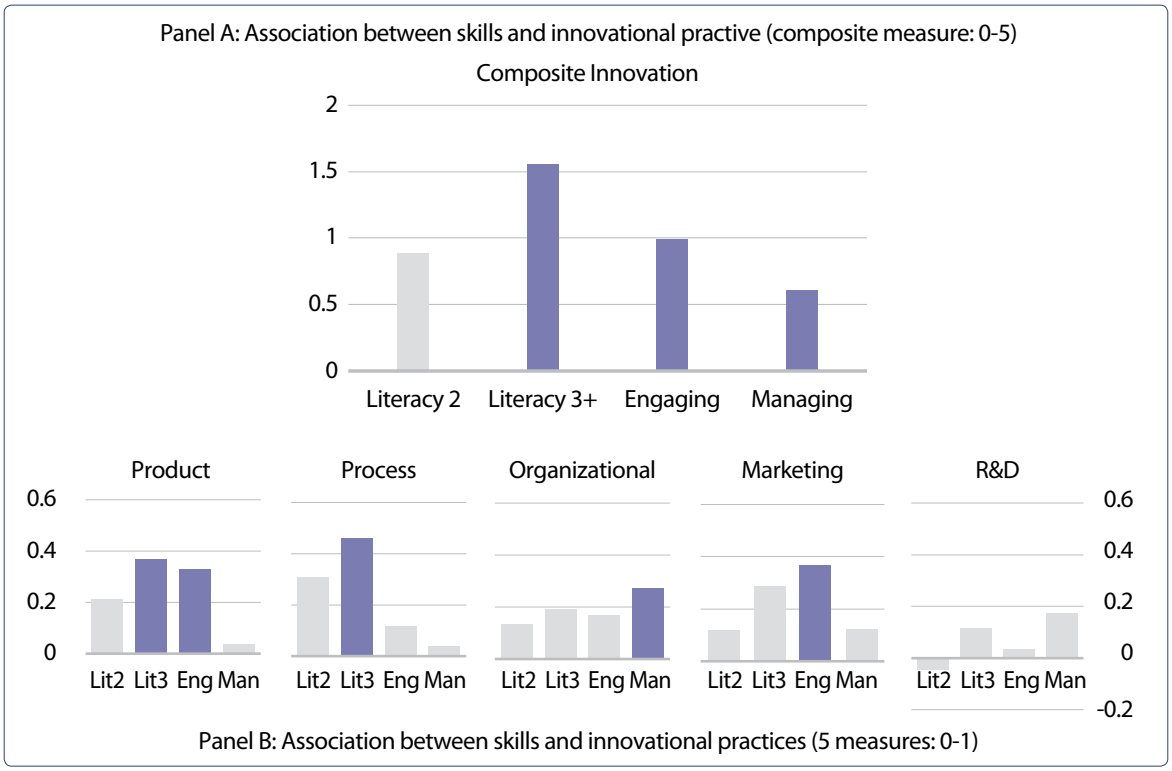
Source: Enterprise Survey on Innovation and Skills in Vietnam.

In examining the role of workforce skills in fostering innovation, this report focuses on foundational skills, including literacy and socio-emotional skills, both of which have been shown to drive labor productivity and growth across a large number of studies (Hanushek, et.al., 2015; OECD, 2015). Note that the report does not follow the colloquial notion of literacy which mainly encompasses individual's ability to read and write. A more holistic ***concept of literacy*** adopted here captures "the ability to understand, evaluate, use and engage with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential" (OECD, 2013). The description of literacy proficiency scales (0-5) characterize what individuals can do in everyday life (see Annex 1.4 for the full description of the proficiency scales). Note that level 3 is considered the minimum proficiency level individuals need in order to function autonomously in nonroutine tasks, which represents capabilities that are required in 21st century workplaces. The ***concept of socio-emotional skills*** captures a broad range of individuals' psycho-social capabilities that drive labor market and social outcomes (OECD, 2014 and OECD, 2015). Socio-emotional skills cover a wide range of construct domains and include an individual's capacity to 'engage with others (e.g., assertiveness)', 'care for others (e.g., empathy)', 'manage emotions (e.g., self-confidence)', 'work towards goals (e.g., responsibility)', and 'explore new horizons (e.g., creativity)' (see Annex 1.2).

Figure 4 sheds light on the hypothesis that a workforce's literacy and socio-emotional skills are key complements of firm's engagement in innovation practices. The first panel in Figure 4 presents correlations between skills (literacy and socio-emotional skills) and the composite measure of innovation practices (with a score range of 0-5) at the firm level. 'Literacy 2' denotes the marginal effects of having employees with an average literacy proficiency level 2, compared to a baseline firm

that has employees with an average literacy proficiency level 1 and below. 'Literacy 3+' denotes the marginal effects of having employees with an average literacy proficiency level 3 and above, compared to the baseline. The results suggest that ***having employees with an average literacy proficiency level 3+ has a significant association with the composite measure of innovation practices. Moreover, Panel A suggests that firms that have employees with higher average levels of either 'engaging with others' (Eng) or 'managing emotions' (Man) are much more likely to score higher on the composite innovation score.***[116] The effect-sizes are considerable. For instance, firms with employees with an average literacy proficiency level 3+ (a level that is associated with employees that can behave autonomously in non-routine tasks) are 1.5 points of a compositive innovation score (out of 0-5) more likely to invest in innovation. Moreover, one standard deviation increase in the firm's level of 'managing emotions' and 'engaging with others' is associated with 0.6-1 point of a compositive innovation score, respectively, more likely to invest in innovation.

FIGURE 4: **Literacy and socio-emotional skills are associated with innovational practices**



Source: Enterprise Survey on Innovation and Skills in Vietnam.

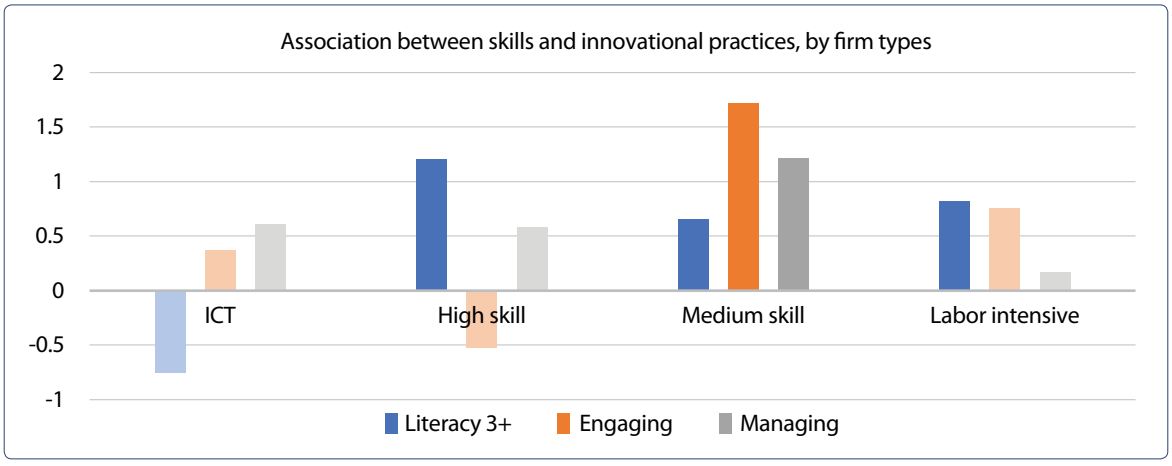
Note: Light colored figures represent statistically insignificant estimates at 5%. The results are based on separate regression analyses at the firm level which include one of the five socio-emotional skills. Employees' skill measures are aggregated at the firm level. Other explanatory and control variables include literacy, age, gender, educational attainment, technical training and overtime work. Literacy 2 (or, Lit 2) and Literacy 3+ (or, Lit3+) denote regression coefficients for dummy variables which take the value of 1 if a firm's average literacy proficiency score is at level 2 or level 3 and above, respectively. The excluded category is literacy proficiency level 1 and below. For simplicity of exposition, the results for literacy are average effects of literacy on innovation outcomes across 5 regressions. Panel B only presents results for two of the five dimensions of socio-emotional skills, namely 'engaging with others' and 'managing emotions'. Results using other socio-emotional skills dimensions were statistically insignificant.

116 The regression results showed that the rest of the socio-emotional skills (i.e.,, caring, working and exploring) were not correlated with the composite innovation scores. Figure 4: Panel A therefore omitted these results.

Panel B presents separate results by 5 different types of innovation, namely product, process, organizational, marketing and R&D[117]. The results suggest that having employees with literacy proficiency level 3+ is strongly associated with firm-level engagement in product and process innovations, with a high effect-size of about 0.4 of a standard deviation (more likely to product/process innovate). Panel B also suggests that firms with employees with 1 standard deviation higher levels of 'engaging with others' are 0.33 and 0.37 of standard deviation more likely to engage in product and marketing innovations, respectively. Firms with employees with 1 standard deviation higher levels of 'managing emotions' are 0.27 of standard deviation more likely to engage in organizational innovation.

Are skills associated with innovation practices differently across firm types? Figure 5 presents correlations between skills (literacy and socio-emotional skills) and the compositive measure of innovation, separately by ICT, high-skilled innovator, medium-skilled innovator and labor-intensive firms. The results suggest that ***the association between literacy and innovation practices is strong and robust for high-skilled, medium-skills and labor intensive firms, but not for ICT firms.*** Firms with employees with an average literacy proficiency level 3+ or above were more likely to show 0.5-1.2 additional levels of composite innovation scores. ***While the association between socio-emotional skills and innovation practices is only statistically significant for medium-skilled firms, these correlation are high.*** One standard deviation increase in the levels of 'engaging with others' and 'managing emotions' among employees of medium-skilled firms were associated with about 1.2-1.7 additional levels of composite innovation scores.

FIGURE 5: **Association between skills and innovational practices is strong and robust among medium-skilled firms**



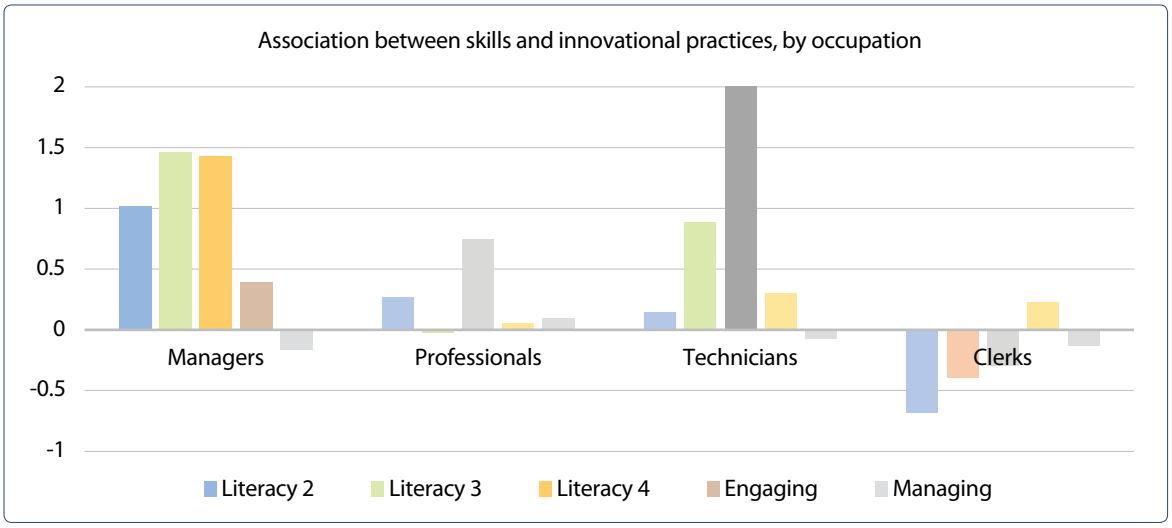
Source: Enterprise Survey on Innovation and Skills in Vietnam.

Note: Light colored figures represent statistically insignificant estimates at 5%. The results are based on separate regression analyses at the firm level which include one literacy measure (i.e.,, whether the firm average literacy level is at or above the proficiency level 3 or not) or one of the five socio-emotional skills. Other explanatory and control variables include literacy, age, gender, educational attainment, technical training and overtime work. Figure 5 only presents results for two of the five dimensions of socio-emotional skills, namely 'engaging with others' and 'managing emotions'. Results using other socio-emotional skills dimensions were statistically insignificant.

117 R&D depicts whether a firm has a research and development (R&D) department.

Are skills associated with innovation practices differently across occupations? Figure 6 presents correlations between skills (literacy and socio-emotional skills) and the composite measure of innovation, separately for managers, professionals, technicians and clerks. The results suggest that ***firms with managers that show higher levels of literacy (particularly at proficiency level 3 and above) and 'engaging with others' tend to score much higher on composite innovation scores. Moreover, firms with technicians that show higher levels of literacy (at proficiency level 3 and above) tend to score much higher on composite innovation scores***. Firms with professionals and clerks that demonstrate higher skills do not show statistically significant differences in the levels of innovation.

FIGURE 6: **Managers' and technicians' skills are strongly associated with firm-level innovations**



Source: Enterprise Survey on Innovation and Skills in Vietnam.

Note: Light colored figures represent statistically insignificant estimates at 5%. The results are based on separate firm-level regression analyses by occupations, which include multiple literacy measures (i.e.,, whether the firm average literacy level by occupation is at proficiency levels 2, 3 or 4 and above) or one of the five socio-emotional skills. Other explanatory and control variables include literacy, age, gender, educational attainment, technical training and overtime work. Figure 6 only presents results for two of the five dimensions of socio-emotional skills, namely 'engaging with others' and 'managing emotions'. Results using other socio-emotional skills dimensions were statistically insignificant.

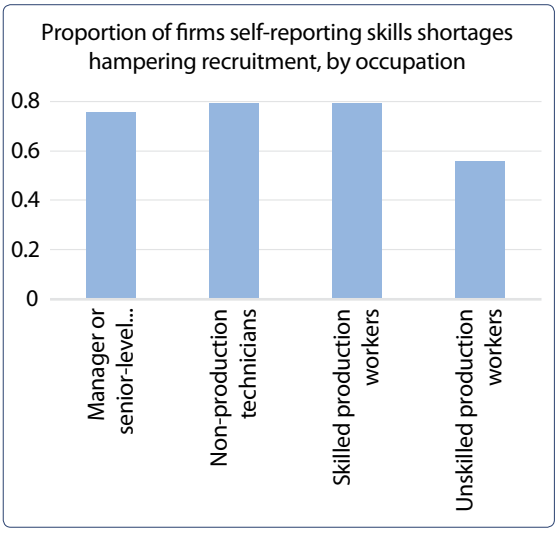
To sum-up the main findings thus far, (a) there is a large association between measures of innovation and TFP, (b) a significant proportion of firms, particularly medium-skilled innovator and labor-intensive firms, do not engage in product and marketing innovations, (c) skills shortages and access to financing are the two major obstacles that prevent firms from engaging in innovation, (d) firms with a larger proportion of employees with literacy at proficiency level 3 or higher as well as capacity to 'engaging with others' and 'managing emotions' are much more likely to engage in innovation, (e) the relationship between skills and innovation is particularly strong and robust among medium-skilled innovator firms, and (f) managers' and technicians' skills are particularly associated with firm-level innovations.

4. Constraints firms face in recruiting a skilled workforce

Although employees' skills are strongly associated with innovation practices and productivity, why don't Vietnamese firms mobilize staff with sufficient levels of literacy and socio-emotional skills? In general, firms can secure skilled employees through recruitment or training. This section analyzes recruitment constraints, while the next section looks at challenges firms face in training employees.

In which occupations do Vietnamese firms face more difficulties in securing skilled workers? Figure 7 presents the proportion of employers reporting skills shortages by occupation. It suggests that ***approximately 80% of firms self-report difficulties in securing recruitment of skilled managers, professional, technicians and skilled production workers.*** The figure also suggests a much smaller proportion of firms face difficulties recruiting manual laborers with the required skills.

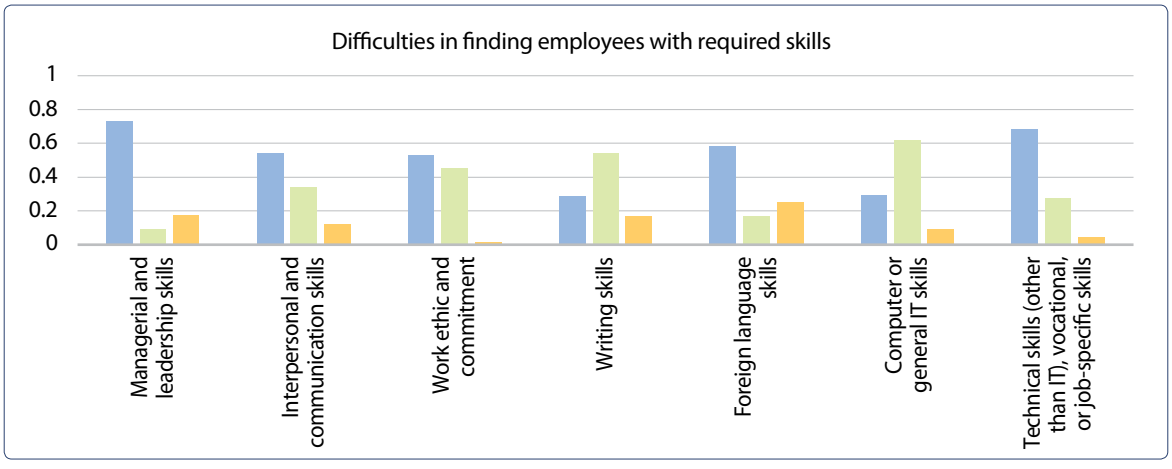
FIGURE 7: **A large proportion of firms perceive skills shortages hampering recruitment**



Source: Enterprise Survey on Innovation and Skills in Vietnam

What are the types of skills that employers find difficulties in securing during recruitment? Figure 8 suggests that ***firms face difficulties finding employees with managerial, socio-emotional, technical and foreign language skills.*** 74% of firms have difficulties in finding employees with sufficient managerial and leadership skills, 53% of firms have difficulties finding employees with sufficient interpersonal, communication and work ethic and commitment, and 68% of firms have difficulties in identifying employees with technical (non-IT), vocational or job-specific skills.

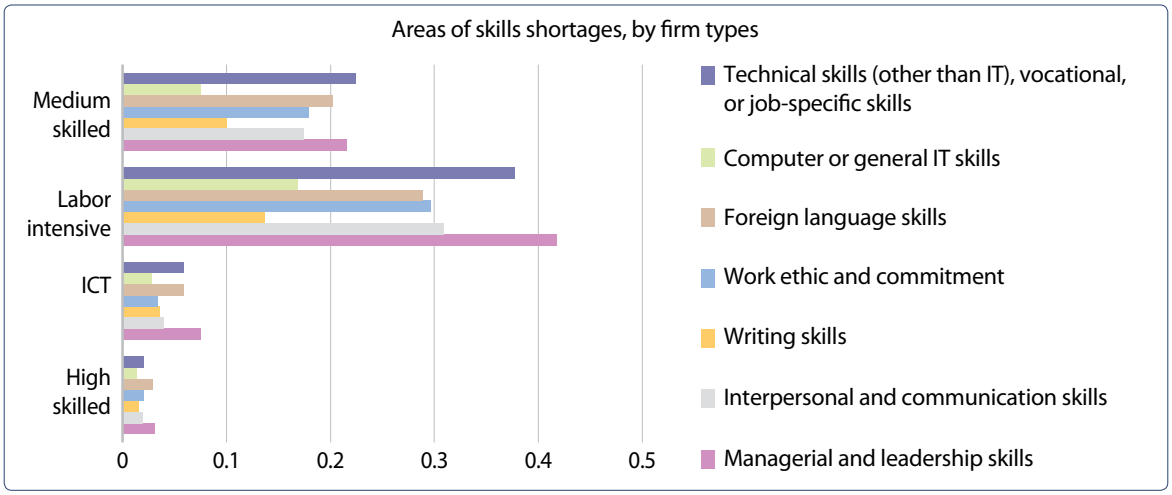
FIGURE 8: **Firms face difficulties finding employees with managerial, socio-emotional and technical skills**



Source: Enterprise Survey on Innovation and Skills in Vietnam

Which types of firms are more likely to face difficulties hiring employees with sufficient managerial, technical and socio-emotional skills? Figure 9 suggests ***a large proportion of medium-skilled innovator and labor intensive firms report shortages of workers with these skills.***

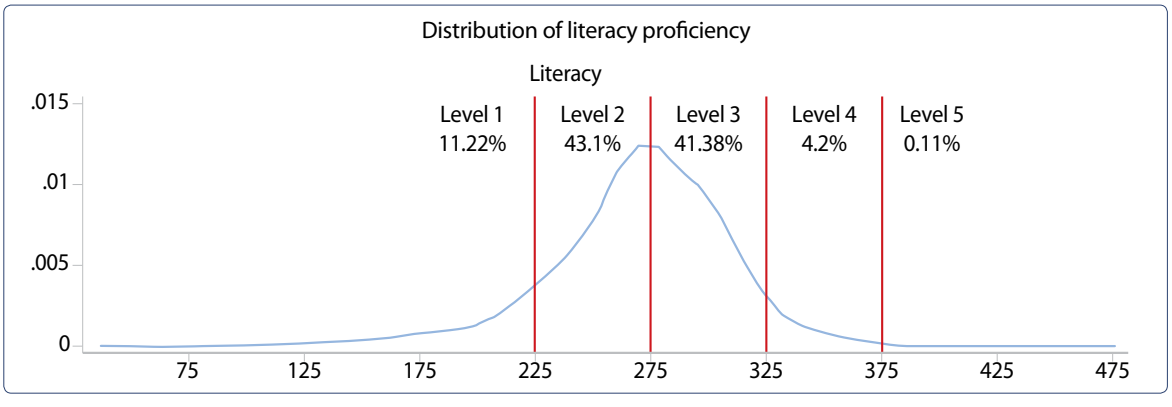
FIGURE 9: **Medium-skilled innovator and labor-intensive firms face difficulties hiring employees with managerial, technical and socio-emotional skills**



Source: Enterprise Survey on Innovation and Skills in Vietnam

Moreover, Figure 10 suggests that over 54% of employees perform below literacy proficiency level 3, which: (a) is considered the minimum proficiency level that allows individuals to engage autonomously in non-routine tasks, which is increasingly becoming a requirement for 21st century workplaces, and (b) corresponds to the threshold skill level above which firms are much more likely to engage in innovation practices. This result is worrying given that the targeted firms under the Enterprise Survey on Innovation and Skills in Vietnam are likely biased towards those that employ a larger share of educated and literate workforce. Note that employees below age 35 have higher literacy proficiency levels on average compared to those at or above age 35, which shows that literacy proficiency appears to have improved across generations. Moreover, employees' literacy proficiency is positively correlated with their educational attainment. Therefore, skills shortages due to recruitment difficulties may partly reflect the challenges initial education (including tertiary education) face in supplying youths with a sufficient level of skills.

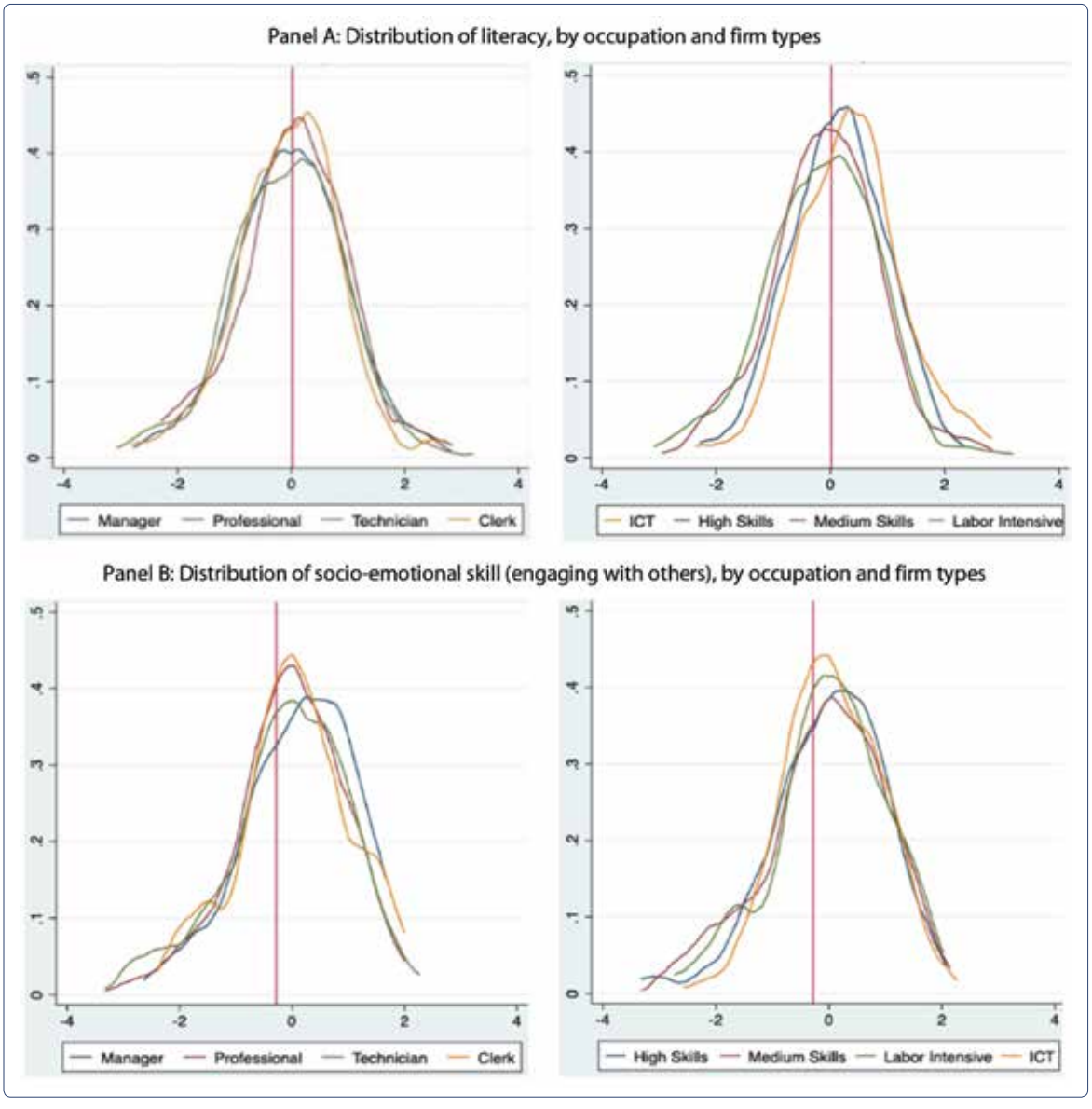
FIGURE 10: **A large share of employees are below literacy proficiency level 3**



Source: Enterprise Survey on Innovation and Skills in Vietnam.

Are skills shortages particularly prevalent within certain firm types and occupations? Figure 11 suggests that ***medium-skilled and labor-intensive firms tend to have a larger share of employees in the lower tail of both literacy and socio-emotional skill (engaging with others) distribution compared to ICT and high-skilled firms.*** Figure 11 also suggests that employees' literacy skills distributions do not appear to vary much across employee categories. While managers tend to have a higher average level of socio-emotional skills at the upper-half of the distribution, the socio-emotional skills distribution of all employees at the lower half of the distribution do not vary much. This implies that medium-skilled and labor-intensive firms tend to have lower-skilled employees across the employee categories.

FIGURE 11: **Medium-skilled innovator and labor-intensive firms have a larger share of employees at the lower tail of the skills distribution**



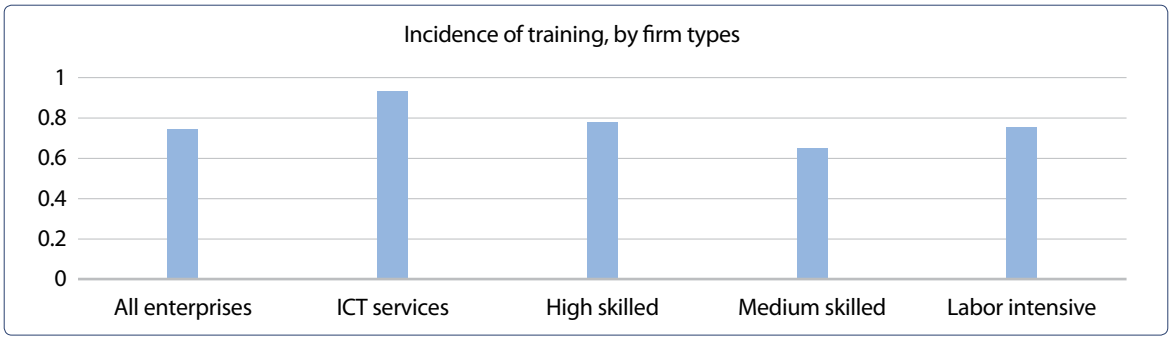
Source: Enterprise Survey on Innovation and Skills in Vietnam.

5. Constraints firms face in training employees

While increasing recruitment of skilled workforce can be one way to address the skills shortages that hamper firm's engagement in innovation, continuous education and training can also be another approach. In particular, firms have the option to provide in-house training programs, on-the-job training or external training (e.g., by sending employees to universities or training institutions).

What is the incidence of firms' investment in training among the sampled firms? Figure 12 suggests that on average, 74% of firms invest in training. ***Training incidence varies considerably, with a large proportion of ICT services firms (93%) provide training, while a much smaller proportion of medium-skilled innovator firms (65%) do so.***

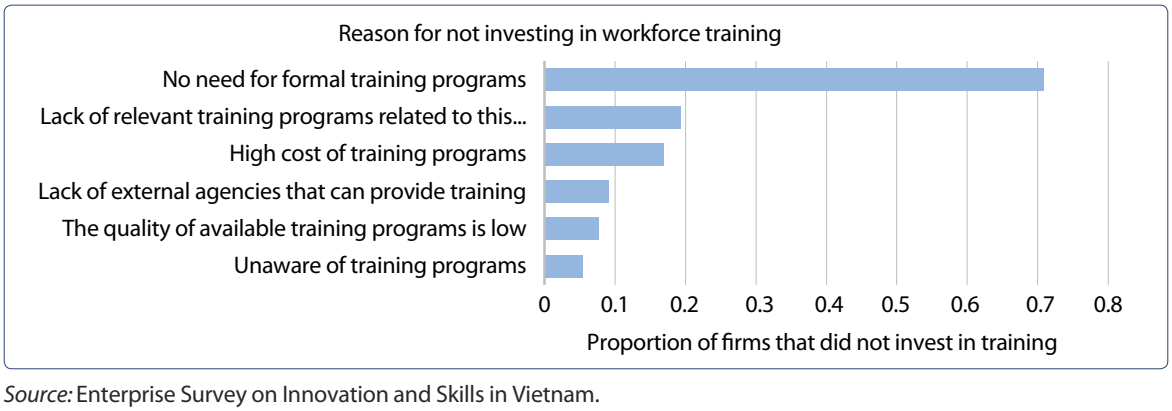
FIGURE 12: **Medium-skilled innovator firms invest less in training**



Source: Enterprise Survey on Innovation and Skills in Vietnam.

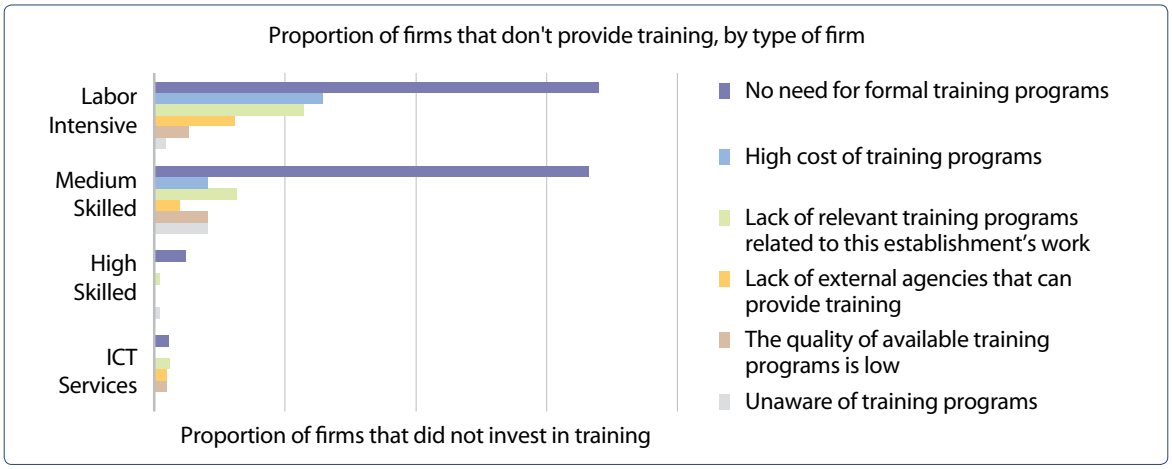
Why do certain firms not offer training to employees? Figure 13 ***suggests a large proportion of firms report not offering training given that they don't perceive the need to invest in training programs.*** This high proportion is driven by medium-skilled innovator and labor-intensive firms that do not invest in training (Figure 14). This result is in sharp contrast with the result showing that medium-skilled and labor-intensive firms face more difficulties hiring employees with managerial, technical and socio-emotional skills (Figure 8).

FIGURE 13: **A large proportion of firms that don't offer training do not consider the need to provide formal training programs**



Source: Enterprise Survey on Innovation and Skills in Vietnam.

FIGURE 14: **Firms that do not consider the need to provide formal training programs are mainly labor-intensive and medium-skilled firms**

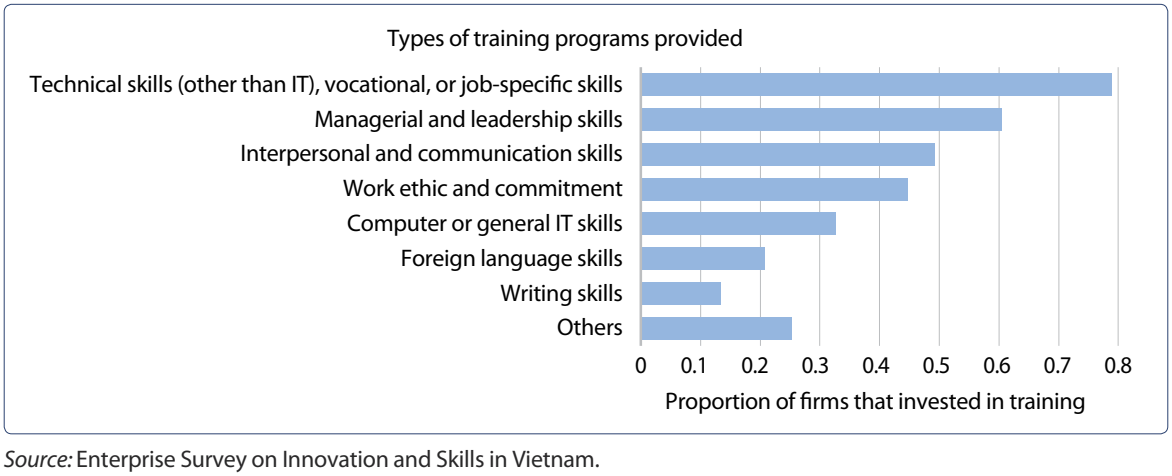


Source: Enterprise Survey on Innovation and Skills in Vietnam.

The second and third most important reasons for not providing training include "lack of relevant training programs available" and "high costs of training programs", which 19% and 17% of firms that didn't provide training (respectively) reported. These findings point to the need to explore ways to expand available training options as well as to lower the financial burden of training costs.

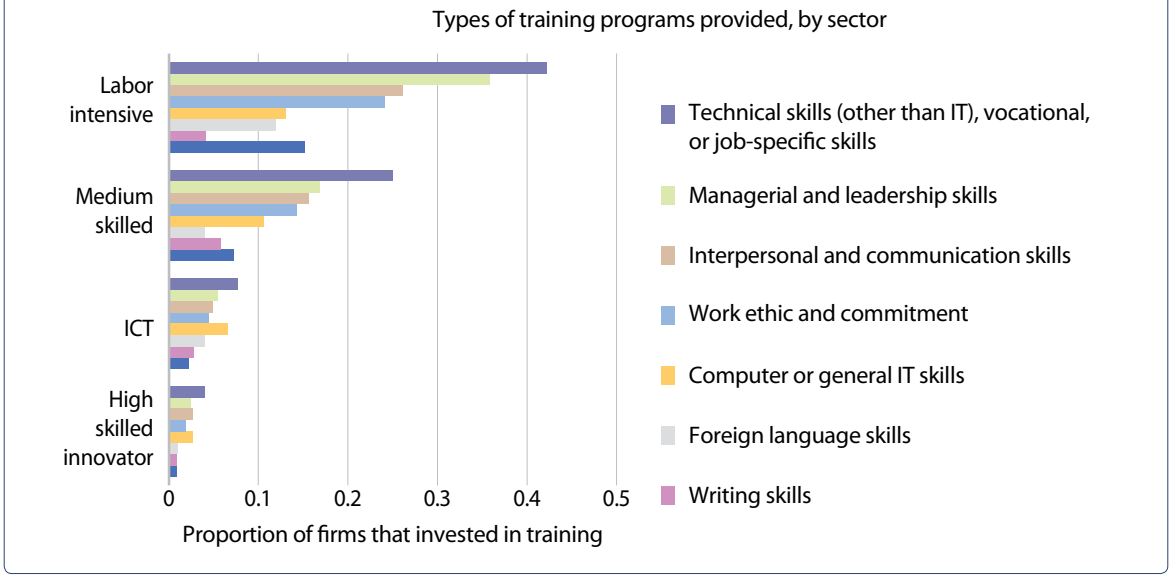
Among those firms that already provide training, what are the domains of skills they tend to concentrate on? Table 15 presents the incidence of different forms of training. It suggests that ***firms generally offer training to foster technical, managerial and socio-emotional skills, which corresponds to the skill needs.*** Figure 16, which presents the incidence of training by firm types, suggests that, ***among firms that invest in training, the large investments in technical, managerial and socio-emotional skills are driven by a large proportion of labor-intensive and medium-skilled firms offering training in these skills.***

FIGURE 15: **Technical, managerial and interpersonal skills are the prevalent forms of training programs, among firms that provide training**



Source: Enterprise Survey on Innovation and Skills in Vietnam.

FIGURE 16: **Technical, managerial and interpersonal skills are the most prevalent forms of training programs in medium-skilled and labor-intensive firms**



Source: Enterprise Survey on Innovation and Skills in Vietnam.

Medium-skilled innovator and labor-intensive firms that already invest in training need to ensure that their training programs take into account the need to improve employees' literacy at a much higher proficiency level. These firms also need to consider improving literacy and socio-emotional skills among managers as well as other employees.

It is worth noting that employees who receive training were much more likely to have (a) literacy proficiency at level 3 or higher, (b) self-reported tendency to explore new horizons -be curious and creative, and (c) self-reported tendency to be able to manage emotions -be resilient and self-confident. While these correlations may suggest the effectiveness of training programs that workers receive, it may also point to (a) firms' tendency to provide more training to educated/skilled employees, and/or (b) educated/skilled employees' tendency to be employed by firms that offer training programs.

6. Key conclusions from the Enterprise Survey on Innovation and Skills

The World Bank's Enterprise Survey on Innovation and Skills collected information on innovation practices and employee skills from over 200 firms, covering 4 industrial sectors (i.e.,, ICT services, high-skilled innovator, medium-skilled innovator and labor-intensive firms), and across 5 major provinces (i.e.,, Hanoi, Bac Ninh, Da Nang, Ho Chi Minh City and Binh Duong). The initial analysis suggests that:

- ***A considerable proportion of Vietnamese firms, covering the three industrial sectors and the ICT service sector across the five provinces, do not engage in product and marketing innovations.*** Most notably, 35% of firms do not engage in product innovations which is the most significant correlate of total factor productivity (TFP). Among all sampled firms, ***medium-skilled global innovator and labor intensive firms are much less likely to engage*** in these forms of innovations.

- ***A considerable proportion of firms considered limited access to skilled workforce as a major reason for not investing in innovational practices.*** Firms self-report limited access to finance (29%) and adequately educated workforce (22%) as the two most significant obstacles to fostering innovation. Indeed, firms with employees with (a) average literacy proficiency level of 3 and above, and (b) higher levels of socio-emotional skills – 'engaging with others' and 'managing emotions', are much more likely to engage in innovation practices. ***The correlations between skills and innovational practices are particularly strong among managers and medium-skilled innovator firms.***
- ***There are signs of skills shortages across various skills dimensions.*** Most importantly, ***over 54% of employees perform below the literacy proficiency level 3, a level that is considered vital in 21st century workplaces in which an increasing proportion of workers are required to act autonomously in non-routine tasks.*** Moreover, a large proportion of firms highlight ***difficulties hiring employees with the required levels of managerial and leadership skills (73%), socio-emotional skills (53%), foreign language skills (58%), and technical and vocational skills (68%).*** Hiring difficulties are particularly salient among medium-skilled and labor-intensive firms. Moreover, medium-skilled firms and labor-intensive firms show a higher proportion of managers, professionals, technicians and clerks with lower levels of literacy and socio-emotional skills.
- ***A large proportion of firms report difficulties in securing recruitment of skilled managers and senior-level professionals (76%), non-production technicians (79%), and skilled production workers (79%).*** Difficulties in hiring skills workers are particularly pronounced among medium-skilled and labor intensive firms.
- ***The incidence of training is much lower among medium-skilled (65%) and labor-intensive (75%) firms than for ICT (93%) firms.*** Many firms that didn't invest in training, in particular medium-skilled and labor-intensive firms, report perceptions that there is no need to invest in training programs, in spite of a large proportion of under-skilled employees and difficulties firms face in hiring employees with sufficient skills.

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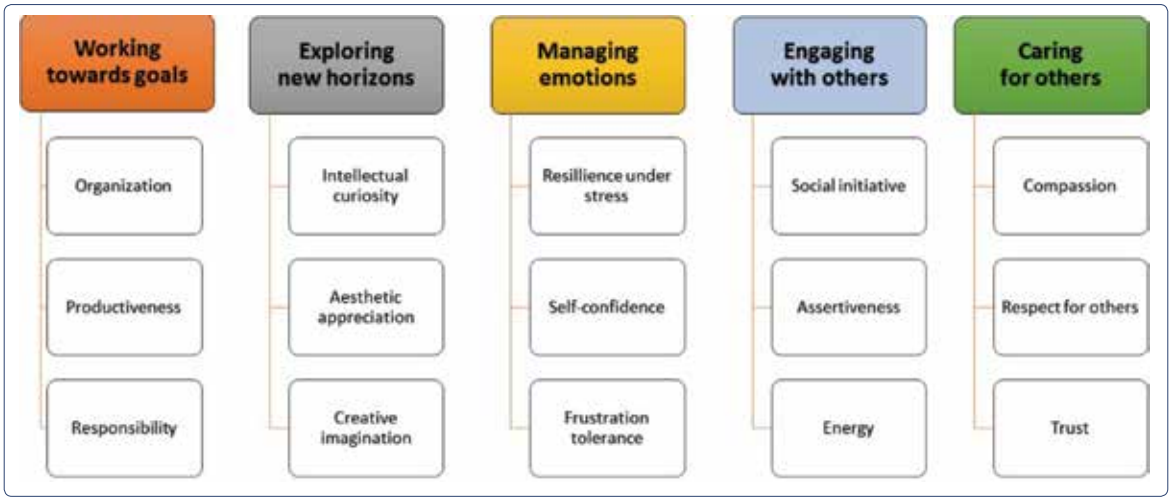
ANNEX 1.1: MAPPING OF VSIC CODE TO THE FOUR STRATEGIC SECTORS

VSIC code – 2 Digit	VSIC definition	
1	Agriculture and related service activities	
2	Forestry and related service activities	
8	Other mining and quarrying	
10	Manufacture of food products	Labor intensive firms
11	Manufacture of beverages	
12	Manufacture of tobacco products	
13	Manufacture of textiles	Labor intensive firms
14	Manufacture of wearing apparel	Labor intensive firms
15	Manufacture of leather and related products	
16	Manufacture of wood and of products of wood and cork,except furniture; manufacture of articles of straw and plaiting materials	
17	Manufacture of paper and paper products	
18	Printing and reproduction of recorded media	
20	Manufacture of chemicals and chemical products	
21	Manufacture of pharmaceuticals, medicinal chemical and botanical products	High-skilled innovator firms
22	Manufacture of rubber and plastics products	Medium-skilled innovator firms
23	Manufacture of other non-metallic mineral products	
24	Manufacture of basic metals	
25	Manufacture of fabricated metal products, except machinery and equipment	Medium-skilled innovator firms
26	Manufacture of computer, electronic and optical products	High-skilled innovator firms
27	Manufacture of electrical equipment	Medium-skilled innovator firms
28	Manufacture of machinery and equipment n.e.c	Medium-skilled innovator firms
29	Manufacture of motor vehicles; trailers and semitrailers	Medium-skilled innovator firms
30	Manufacture of other transport equipment	
31	Manufacture of furniture	
32	Other manufacturing	
33	Repair and installation of machinery and equipment	
35	Electricity, gas, steam and air conditioning supply	
36	Water collection, treatment and supply	
37	Sewerage and sewer treatment activities	
38	Waste collection, treatment and disposal activities; materials recovery	

VSIC code – 2 Digit	VSIC definition	
41	Construction of buildings	
42	Civil engineering	
43	Specialized construction activities	
45	Wholesale and retail trade and repair of motor vehicles and motorcycles	
46	Wholesale trade except of motor vehicles and motorcycles	
47	Retail trade, except of motor vehicles and motorcycles	
49	Land transport, transport via railways, via pipeline	
50	Water transport	
52	Warehousing and support activities for transportation	Labor intensive firms
53	Postal and courier activities	
55	Accommodation	Labor intensive firms
56	Food and beverage service activities	Labor intensive firms
60	Broadcasting and programming activities	
62	Computer programming, consultancy and related activities	ICT firms
64	Financial service activities, except insurance and pension funding	
66	Other financial activities	
68	Real estate activities	
69	Legal and accounting activities	
71	Architectural and engineering activities; Technical testing and analysis	
73	Advertising and market research	
74	Other professional, scientific and technical activities	
77	Renting and leasing of machinery and equipment (without operator); of personal and household goods; of no financial intangible assets.	
78	Employment activities	
80	Security and investigation activities	
81	Services to buildings and landscape activities	
82	Office administrative and support activities; other business support service activities	
85	Education	
86	Human health activities	
92	Lottery activities, Gambling and betting activities	
93	Sports activities and amusement and recreation activities	

ANNEX 1.2 : BIG FIVE FACTORS (SOCIO-EMOTIONAL SKILLS)



Source: John and De Fruyt (2015) and John, Miyamoto and Willroth (2019).

ANNEX 1.3: SUMMARY STATISTICS (201 FIRMS)

Category	Variables	All firms (SD)	ICT firms (SD)	High skilled (SD)	Medium skilled (SD)	Manu-facturing (SD)
Innovation	Composite score (0-5)	3.061 (1.842)	3.779 (1.478)	3.600 (1.593)	2.887 (1.516)	3.033 (1.708)
	Product innovation (0-1)	0.654 (0.599)	0.866 (0.349)	0.824 (0.334)	0.606 (0.493)	0.641 (0.562)
	Process innovation (0-1)	0.809 (0.480)	0.828 (0.391)	0.795 (0.423)	0.825 (0.382)	0.797 (0.453)
	Organizational innovation (0-1)	0.700 (0.555)	0.720 (0.469)	0.621 (0.556)	0.609 (0.493)	0.760 (0.494)
	Marketing innovation (0-1)	0.578 (0.620)	0.720 (0.469)	0.589 (0.548)	0.566 (0.500)	0.565 (0.580)
	Research and development (R&D) (0-1)	0.320 (0.573)	0.644 (0.502)	0.761 (0.423)	0.288 (0.457)	0.263 (0.530)
Literacy	Proficiency level (0-5)	2.353 (0.718)	2.504 (0.521)	2.388 (0.542)	2.328 (0.692)	2.347 (0.634)
	Proficiency scores	266.9 (32.85)	277.14 (20.79)	271.14 (16.11)	264.36 (42.69)	266.81 (23.21)
Socio-emotional skills	Engaging with others (1-5)	3.837 (0.368)	3.556 (0.294)	3.792 (0.330)	3.886 (0.338)	3.819 (0.328)
	Managing emotions (1-5)	2.817 (0.536)	2.714 (0.342)	2.679 (0.455)	2.759 (0.529)	2.878 (0.456)
	Caring for others (1-5)	4.228 (0.348)	4.242 (0.278)	4.244 (0.276)	4.279 (0.330)	4.193 (0.303)
	Working towards goals (1-5)	4.274 (0.410)	4.123 (0.348)	4.315 (0.344)	4.343 (0.322)	4.247 (0.382)
	Exploring new horizons (1-5)	3.863 (0.380)	3.893 (0.296)	3.887 (0.354)	3.866 (0.328)	3.856 (0.350)
Educational attainment	Lower-secondary and below	0.368 (0.597)	0.140 (0.363)	0.189 (0.357)	0.509 (0.505)	0.323 (0.546)
	Upper secondary and TVET	0.350 (0.597)	0.294 (0.471)	0.442 (0.570)	0.349 (0.482)	0.369 (0.560)
	Tertiary	0.272 (0.559)	0.566 (0.516)	0.369 (0.562)	0.143 (0.351)	0.308 (0.538)
Gender	Female	0.431	0.430	0.409	0.367	0.473
Age		34.117 (14.56)	30.448 (10.24)	33.749 (7.93)	34.798 (11.81)	34.238 (13.43)
Region	North	0.353	0.518	0.420	0.451	0.266
	Center	0.048	0.016	0.045	0.032	0.062
	South	0.599	0.466	0.535	0.518	0.672

Category	Variables	All firms (SD)	ICT firms (SD)	High skilled (SD)	Medium skilled (SD)	Manu-facturing (SD)
Firm size	Small	0.178	0.153	0.144	0.251	0.138
	Medium	0.406	0.605	0.582	0.438	0.346
	Large	0.416	0.243	0.274	0.311	0.517
Ownership	State	0.110	0.076	0.162	0.077	0.131
	Domestic	0.848	0.812	0.759	0.892	0.831
	Foreign	0.042	0.112	0.079	0.031	0.038
Education and training experience	STEM Education	0.657 (0.599)	0.930 (0.267)	0.599 (0.551)	0.766 (0.429)	0.556 (0.574)
	Technical Training	0.524 (0.621)	0.611 (0.507)	0.565 (0.553)	0.550 (0.502)	0.493 (0.582)
	Soft Training	0.650 (0.597)	0.822 (0.403)	0.584 (0.565)	0.576 (0.500)	0.679 (0.554)

Source: Enterprise Survey on Innovation and Skills in Vietnam.

ANNEX 1.4: LITERACY PROFICIENCY SCALES

Level	Score range	Literacy
Below level 1	Below 176 points	Tasks at this level require the respondent to read brief texts on familiar topics and locate a single piece of specific information. There is seldom any competing information in the text. Only basic vocabulary knowledge is required, and the reader is not required to understand the structure of sentences or paragraphs or make use of other text features.
1	176 to less than 226 points	Tasks at this level require the respondent to read relatively short digital or print texts to locate a single piece of information that is identical to or synonymous with the information given in the question or directive. Knowledge and skill in recognising basic vocabulary, determining the meaning of sentences, and reading paragraphs of text is expected.
2	226 to less than 276 points	Tasks at this level require the respondent to make matches between the text, either digital or printed, and information, and may require paraphrasing or low-level inferences.
3	276 to less than 326 points	Texts at this level are often dense or lengthy. Understanding text and rhetorical structures is often required, as is navigating complex digital texts.
4	326 to less than 376 points	Tasks at this level often require the respondent to perform multiple-step operations to integrate, interpret, or synthesise information from complex or lengthy texts. Many tasks require identifying and understanding one or more specific, non-central idea(s) in the text in order to interpret or evaluate subtle evidence-claim or persuasive discourse relationships.
5	Equal to or higher than 376 points	Tasks at this level may require the respondent to search for and integrate information across multiple, dense texts; construct syntheses of similar and contrasting ideas or points of view; or evaluate evidence based arguments. They often require respondents to be aware of subtle, rhetorical cues and to make high-level inferences or use specialised background knowledge.

Source: OECD (2013)

Annex 2: Review of Current STI Framework – selected STI related laws and policies

TABLE 1. **STI-related laws, focus areas, and implementation results**

Law	Focus areas	Implementation results
Law on Science and Technology (2013)—amended from 2010 S&T Law	-Intended STI management reforms include: improvements in identifying and organizing the implementation of S&T tasks, policies to cultivate and solidify linkages between S&T institutes and firms, investment policies and financial mechanisms for S&T activities.	-An assessment by the National Assembly's Standing Committee in 2016 finds the S&T legal framework to be cumbersome and complex, leading to numerous impediments in implementation, especially at local and grassroots levels[118]. -Implementation bottlenecks are found in the following areas: i. *Policy design and implementation:* While the Ministry of Science and Technology (MOST) is responsible for nationwide S&T cross-sectoral and national policy initiative activities, these tasks have been decentralized to line ministries and local governments. This results in fragmentation and opaque delegation and decentralization of rights and responsibilities. ii. *Public S&T tasks identification and implementation:* There no effective mechanisms to ensure that determination and implementation of S&T tasks stem from business practices or the country's socio-economic development needs. iii. *Administration of S&T organizations:* While the law grants greater autonomy to S&T organizations in sectoral activities, there is a lack of autonomy in planning, human resources, finance and international cooperation to enable more agile responses to market demands and stronger linkages to the business sector.

118 Dân Trí, 27/10/2016, https://dantri.com.vn/khoa-hoc-cong-nghe/he-thong-van-ban-phap-luat-ve-khoa-hoc-va-cong-nghe-cong-kenh-phuc-tap-20161007081934556.htm

Law	Focus areas	Implementation results
		iv. *S&T financing and investment:* S&T funding is small (at least 2% of the annual state budget as required by the law). Yet, the complicated process of establishing financial mechanisms for S&T development between MOST, MOF and MPI contribute to increased management costs and inconsistencies in guiding localities on how to conduct S&T investments. v. *Firm-level STI:* Firm level S&T activities do not match international practice: investments from enterprises are mainly driven by large SOEs (e.g., Viettel, VNPT, Vietnam Petroleum Corporation) rather than private firms. Further, opportunities for innovation collaboration between firms and research institutes are limited; while the law established some mechanisms to incentivize research institutions to commercialize their research (financed by the State budget), in practice, institutes still face difficulties in exercising ownership of S&T research results due to inconsistencies between S&T and other laws, such as the Public Asset Management law.
Law on Technology Transfer (2017)—amended from 2006 law	-2006 Law intended to improve technology transfer to help firms (especially domestic ones) globally integrate into the country's emerging innovation system. -2017 Law revised to enhance transfers of knowledge and technologies with an expectation of more foreign advanced/high technologies transferred into Vietnam.	• 2006 implementation results: Technology transfers were mainly achieved by foreign-invested enterprises from parent companies for closed circle manufacturing, with limited spill-over effects for Vietnamese enterprises. • Given the recentness of the amendment of the law, lessons learned from 2006 were incorporated. 2017 law puts enterprises at the center of innovation in the S&T market and national innovation system (NIS) and defines areas in which transfers into Vietnam were encouraged, such as high, new, clean, defense, security technologies and those key for the national economy. Further, with the intention of preventing backward/environmentally harmful technologies entering Vietnam, as well as allowing the government to prevent fraud and transfer pricing through technology transfer activities, the amended law introduced regulations on technology appraisal of investment projects and registration of technology transfers. However, these new measures may place additional administrative and financial burdens on the parties involved, and possible threats to transactional confidentiality and delays to the technology transfer process.
Law on Intellectual Property (2013)	-Intended to provide firms with confidence to develop patentable products and encourages innovative companies to invest in local industry, including technology transfers.	• A number of IP-related laws and regulations have been revised or issued in recent years to comply with the country's international commitments. Further, Vietnam's recent ratification of the milestone Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and approval of the EU-Vietnam Free Trade Agreement (EVFTA) are expected to bring significant improvements in the IP field. • Still, Vietnam has yet to amend IP legislation in certain areas such as online copyright enforcement, IP protection in agro-chemicals and pharmaceuticals, and IP criminal enforcement.

Law	Focus areas	Implementation results
Law on High Technologies (2008)	-Intended to create a comprehensive legal framework and a breakthrough in high-tech application and R&D, and enshrines the government's highest priorities and incentives for high technology application and R&D -Sectors prioritized include: IT, biology, new materials and automation.	• Criteria applied in the law for high-tech enterprises[119] is impractical and likely to be misleading due to the exceedingly high R&D spending and education requirements (particularly as Vietnam is suffering from skilled labor shortages) • The law has proven inapplicable during negotiations with leading high-technology companies. According to OECD Reviews, projects by leading international firms (Intel, Nokia and Samsung) failed to meet criteria spelled out by the law and it took a prime ministerial decision to grant incentives. At the same time, it is probable that many smaller firms with lower visibility and bargaining power were discouraged. • The four areas highlighted for high-tech development are narrower than the targeted list of the S&T Strategy 2011-2020[120], thus creating inconsistencies in sectoral targets.

TABLE 2 **Key STI policies and objectives**

Policy	Objectives
Resolution No. 20-NQ/TW, 2012, of XIth Party Central Committee on Development of science and technology to serve industrialization and modernization in conditions of socialist-oriented market economy and international integration (2012)	*Contribution to economic growth:* • TFP contributes about 35% of economic growth by 2020. Value of high-tech products and high-tech application products reach about 40% of total industrial production; speed of technology and equipment innovation reaches about 20% per year; technology market transaction value increases on average by 15% per year; strongly developing S&T enterprises. *Strengthening of S&T capacity:* • Vietnamese S&T reaches development level of leading ASEAN countries by 2020; certain fields at advanced global levels by 2030; S&T potential meets basic requirements of an industrial country in the modern direction. • Comprehensively developing the fields of social science and humanism, natural science, technical science and technologies. Some scientific fields reach leading regional levels and high rankings globally; mastering, applying, and developing technologies that have decisive impacts on the economic growth speed and quality. • There are 10 R&D staff per 10,000 people; quickly increasing the number of internationally-released researches and nationally and internationally protected inventions. • Prioritized fields of technologies: a. Information technology and communication meeting international standard in advantageous fields; Vietnam soon becomes a strong country in information technology and communication.

119 The law defines high-tech enterprises, no matter the size, as those with a minimum 1% of annual turnover spent on R&D and staff with master's or higher degrees accounting for at least 5% of the total workforce, an average turnover from high technology products of at least 60% of the firm's annual turnover during its first three years and to 70% from the fourth year.

120 The priority list of the S&T Development Strategy includes ICT, biotechnology, advanced materials, electronic and semi-conductors, manufacturing mechanics and automation and spatial technologies.

Policy	Objectives
	b. Biotechnology: gene, cell, microbial, enzyme-protein technologies, bio-informatics, nanobiology; efficient application of these technologies in the key fields of agriculture, forestry, fisheries, medicine and pharmacy, processing industries, and environmental protection. c. New and advanced technologies: electronic materials and photons, nano-materials, medicinal and pharmaceutical materials, advanced materials, using domestic materials, particularly bio-materials, rare earth, precious minerals; materials with special features for use in industry, agriculture, construction, transport, medicine and pharmacy, environmental protection, national defense and security. d. Machine manufacturing technology and automation: technologies for designing, manufacturing of uniform equipment and production lines in oil and gas, thermal power, shipbuilding, exploitation and processing of minerals. e. Environmental technologies: Wastewater, solid waste, hazardous waste, and exhaust-gas treatment; application of clean production technology, environment-friendly technology in production and trading; development of waste recycling technologies. • Social investment in science and technology reaches 1.5% of GDP by 2015, over 2% of GDP by 2020 and about 3% of GDP by 2030; of which, State's investment in S&T is not less than 2% of total annual state budget expenditures.
Science and Technology Development Strategy in the period of 2011-2020	*Contribution to economic growth:* -Value of high-tech products and high-tech application products reaches about 45% of GDP. Speed of technology and equipment innovation reaches about 10-15% per year in the period of 2011 – 2015 and over 20% per year in the period of 2016 – 2020. Technology market transaction value increases on average by 15 – 17% per year. *Strengthening of S&T capacity:* 1. General objectives: - Comprehensively developing the fields of social science and humanism, natural science, technical science and technologies. - Science and technology becomes a real key driver, basically meeting the requirements of an industrial country in the modern direction. - A number of fields reach advanced and modern development levels of ASEAN and global countries. 2. Specific objectives: a) The number of international publications increases on average by 15 – 20% year. The number of invention applications during the period of 2011 – 2015 increases by 1.5 times against that in the period of 2006 – 2010, 2 times during 2016 – 2020 against 2011 – 2015. b) There are 9 – 10 R&D staff per 10,000 people by 2015 and 11 – 12 R&D staff by 2020; 5,000 international standard engineers by 2015 and 10,000 international standard engineers by 2020. c) There are 30 basic and applied research institutions meeting regional and international standards by 2015 and 60 by 2020; there are 3,000 science and technology enterprises; 30 high-tech incubators, high-tech enterprise incubators by 2015; there are 5,000 science and technology enterprises; 60 high-tech incubators, high-tech enterprise incubators by 2010; d) Total social investment in science and technology reaches 1.5% of GDP by 2015, over 2% of GDP by 2020; of which, State's investment is not less than 2% of total annual state budget expenditures.

Policy	Objectives
	• In order to implement the set objectives, the Strategy identified prioritized fields of technologies: (i) Information technology and communication; (ii) Biotechnology: gene, cell, microbial, enzyme-protein technologies, bio-informatics, nano-biology; (iii) Machine manufacturing technology and automation; and (iv) Environmental technology.[121] Further, the Strategy identified orientations for science and technology development in 8 sectors, including: Agricultural science and technology; Medicine and pharmacy science and technology; Energy science and technology; Transport science and technology; Construction science and technology; Science and technology for management and use of natural resources; Space science and technology; Science and technology in regions and localities.

TABLE 3. **Results of implementation of S&T Strategy**

Objectives	Target	Implementation
Increase value of high-tech products, high-tech application products in GDP	2020: 45%	2011: 11.7% 2012: 19.1 % 2013: 28.7% 2019: 43% 2020: 45%
Contribute to increase in TFP (as percentage of GDP)	2020: 35%	2011-2015: 33,6% 2016-2020: 43.5%
Boost speed of annual average technology and equipment innovation	2011-2015: 10-15% 2016-2020: 20%	2011-2014: 10.68%; 2016-2017: 10.21% 2018: 14.61% 2019: 15.24% 2020: 12.44[122]
Increase annual average growth of the technology market	15-17%	20,9%[123]
Increase average annual growth of international publications	2011-2020: 15-20%	2011-2015: 19.5 % Increase to 28,5% in 2018 compared to 2017 Increase to 42,57% in 2019 compared to 2018[124]
Boost speed of increase of invention applications	(2011-2015)/ (2006-2010): 150% (2016-2020)/ (2011-2015): 200%	2011-2015/ 2006-2010: 175 % 2016-2020/2011-2015: 200%
Improve total national S&T investments	2015: 1.5% of GDP 2020: 2.0% of GDP	2015: 0.42%GDP 2017: 0.52% of GDP
Improve S&T investments using State budget	2% of total State budget expenditures	2% of total State budget expenditures
Increase R&D staff/ 10,000 people (FTE)	2015: 9-10 persons 2020: 11-12 persons	2016: 6.86 persons 2019: 7.59 persons

121 There is a lack of focus on Industry 4.0 technologies (e.g., AI, IoT) in this Strategy.

122 Report of Department of technology application and development on 06/10/2020.

123 Report of Department of S&T market and enterprise development on 06/10/2020

124 Report of National Agency on S&T Information on 06/10/2020.

Objectives	Target	Implementation
Increase number of international standard engineers	2015: 5,000 persons 2020: 10,000 persons	2015: n/a 2019: 51.000 persons
Increase high-tech incubators and high-tech enterprises	2015: 30 establishments 2020: 60 establishments	2018: 43 establishments 2019, 2020: n/a
Boost STI enterprises	2015: 3,000 enterprises 2020: 5,000 enterprises	2015: 2,800 enterprises[125], of which 204 enterprises were granted with certificates. 2020: 303 enterprises were satisfied with State requirement on STI enterprises[126].
S&T institutions meeting regional and international level	2015: 30 institutions 2020: 60 institutions	2016: 6 institutions 2020: 34 institutions

Sources of basic data: (i) MOST (2011-2020), Annual Reports on the implementation of 2011-2020 Science and Technology Development Strategy; (ii) MOST (2021), Report on implementation of 2011-2020 S&T Strategy.

TABLE 4. **Complementary policies for STI development**

Objectives	Target	Implementation
Policy on growth model reform (Resolution 05-NQ/TW, 2016)	Reform Vietnam's growth model from extensive growth to intensive growth (i.e.,, improve the quality of growth rather than rely on capital widening and low-wage competitiveness) and highlight the key role of STI in socio-economic development	• During the period of 2016 – 2020, there are annually about 30 – 35% enterprises with innovative activities. • The annual rate of increase of labor productivity is higher than 5.5%; and industrial productivity increase contributes more than 60% of labor productivity by 2020. • The proportion of trained labor increases by approximately 25% by 2020; the proportion of agricultural labor decreases to less than 40%. • Total factor productivity (TFP) contributes about 30 – 35% of growth during the period of 2016 – 2020; narrowing the national competitiveness gap with ASEAN countries 4.
Annual Resolution 19/NQ-CP for 2014-2018; Resolution 02/NQ-CP, 2019	Improve the business environment	• Resolution No. 19/NQ-CP focused on improving the business environment, strengthening administrative procedure reform, shortening processing time, reducing administrative time, ensuring disclosure and transparency, and improving responsibilities of state administrative agencies. • Resolution No. 02/NQ-CP (dated 01 January 2019) on "Continued implementation of the key tasks and solutions to improve the business environment, enhance national competitiveness and orientation until 2021" reiterates the objective for Vietnam to join ASEAN 4 group with the following objectives expected to be achieved by 2021:

125 Of 2,800 S&T enterprises being able to meet the standards as required, only 204 enterprises were granted with certificates. Most of the remaining enterprises did not register to be granted with certificates.

126 Report of Department of S&T market and enterprise development on 6/10/2020.

Objectives	Target	Implementation
		(i) Raising the ranking of WB's Ease of Doing Business (EoDB) by 15-20 steps; with 5-7 steps in 2019. (ii) Increasing WEF's Global Competitiveness Index – GCI 4.0 by 5-10 steps; with 3-5 steps in 2019. (iii) Increasing the WIPO's Global Innovation Index by 5-7 steps; with 2 – 3 steps in 2019. (iv) Climbing 5-10 steps in the UN's Logistics Performance Index. (v) Raising WEF's Travel & Tourism Competitiveness Index by 10 – 15 steps; with 7-10 steps in 2019. (vi) Improving the results in UN's e-Government Survey by 10 – 15 steps in 2020.
Policy to support the national innovative startup ecosystem (Decision 844/QD-TTg, 2016)	Support innovative enterprises	Project 844 set out the following objectives: 1. Creating an enabling environment to promote and support the formation and development of enterprises that are able to grow quickly based on intellectual assets, technologies, new business models. 2. Improving the legal system to support innovative startups; establishing the national innovative startup website; supporting 800 projects, 200 startup enterprises, including 50 startups successful in calling for venture capital, carrying out merger and acquisition, with total estimated value of VND 1,000 billion. 3. By 2025: - Supporting the development of 2,000 innovative startup projects; - Supporting the development of 600 innovative startup enterprises; - 100 enterprises participating in the Project are successful in calling for venture capital, carrying out merger and acquisition, with total estimated value of VND 2,000 billion.

Annex 3: Examples of potential interventions

Some examples would include:

Managerial extension/– Example of Management extension

Program definition	Case: Group Management Extension in Colombia
Typically includes direct specialized advice in management strategy, business functions (marketing, financial management, sales) and legal aspects of a business. This type of instrument addresses key absorptive capacity issues, since adopting a new technology is not only about purchasing machinery but also about integrating it into the full production and business processes of the firm.	• The program congregates groups of firms to enhance the efficiency of the intervention. • In Colombia (Iacovone et al, 2018), groups were assembled comprising 3 to 8 firms located in the same region, such that members are not direct competitors to one another, but are instead producing complementary products with similar management problems.
Justification • SMEs owners have trouble identifying what their constraints are and how to overcome them. • SMEs do not have the same access as large firms to information networks, universities, national laboratories, field experts, technical information and know-how, so they face higher search costs. • Firms are unlikely to have the in-house expertise to solve problems and work through the change process. • SMEs tend to operate in isolation and with little access to networks. • Information and advisory markets are not well-developed.	**Intervention** • Leaders from the firms in a group signed an agreement to work together and help each other improve. • The group treatment model was compared to an individual consulting model on a cost-benefit basis and appears to offer a promising approach to scaling management. • Like the individual treatment, the group treatment began with training classes that covered theoretical aspects of management.
Evidence • When designed appropriately, developing country interventions have had significant impact on performance (output additionality), at least in the short term. • Some programs have experienced a few issues with SME take up rates, particularly when the interventions were delivered by government agencies (lack of awareness problems, delayed implementation, etc.)	**Results** • Both approaches led to improvements in management practices of a similar magnitude (8-10 percentage points), so that the new group-based approach dominates on a cost-benefit basis. • The group-based intervention led to increases in firm size over the next 1.5 years, including a statistically significant increase in employment, while the impacts on firm outcomes are smaller and statistically insignificant for the individual consulting.

Source: Cirera et al. (Forthcoming); Instruments to Support Business Innovation in Low- and Middle-Income Countries. A Guide for Policy Makers and Practitioners

A second illustration under the same action steps is technology extension interventions.

Technology extension services (TES)

Program definition	Case: Network of technology centers in India
These are different from BAS as they focus on promoting technological upgrading of firms. TES may overlap with BAS as they rely on availability of management practices (or skills) to become fully effective. TES include quality management and process efficiency (Cirera et al. Forthcoming), and the installation and use of technology.	• The Technology centers are dedicated public or public-private infrastructure dedicated to providing TES and skills training. They provide a range of technological services to business from the provision of innovation and technological services, to more sophisticated R&D projects and technological development.
Justification	**Intervention**
• Existing technology providers prefer to service larger firms because they are more experienced, are easier to locate than SMEs and are more likely to pay for these services. • In such cases, the government needs to support the supply of these services to SMEs and signal their quality to encourage their demand. • Research organizations often do not have the knowledge on how to protect or commercialize the new technology created. • SMEs and research organizations also have significant gaps in culture, motivation and timelines, and effective partnerships between the two require brokering.	• Construction of 13 Technology Centers across India spread across states(provinces) • Appointment of Technology Cluster Manager (TCM) to plan and design technical specification for the procurement of equipment according to industry requirements • Map industry cluster and their technology services demand and provide training and capacity building for the technology center.
Evidence	**Results**
• The evidence from implementation is limited in developing countries but overall, it suggests they have been effective in leading to increased performance of businesses (but respond differently to different contexts) • Overall, moderate but highly customized services in the product development and marketing areas lead to greater benefits, while routine services focused on quality and process improvement achieved less significant benefits (SRI and Georgia Tech 2008; Youtie and Shapira 1997; Thompson 1998).	• Increase in technology support facilities at the Industrial estates for Small and Medium Industry (eg: tooling, design, prototyping etc.) • Increase in capacity building and skill development facilities for SME at the Industrial cluster/Industrial estate • Increase in capacity utilization of existing technology centers • Increase in training/certification opportunities and in turn employability of youth in industrial clusters

Source: Cirera et al. (Forthcoming); Instruments to Support Business Innovation in Low- and Middle-Income Countries. A Guide for Policy Makers and Practitioners

Enhanced market access and export promotion

These programs could include support to internationalization of domestic firms along the export cycle (pioneers, recent, consolidated) and Indirect exporters (suppliers)

Some examples would include:

Supply chain development programs

Program definition	Case: Supplier development program in Chile
Supply chain development (SCD) programs support firms in upgrading product quality and processes with the objective of linking them with existing large buyers, often MNEs. They help link supply and demand within global value chains by scoping opportunities and assisting suppliers and potential suppliers to upgrade so that they can meet the demands of large buyers.	• The program sought to promote mutually beneficial, long-term commercial relations between large buying potential exporters and their small and medium-sized enterprise (SME) suppliers, with the goal of increasing competitiveness. **Intervention** • Program was launched in 1998 and motivated by the trade agreements signed by Chile that created the need for compliance with international production standards by Chilean exporters and potential exporters. The intervention was led by CORFO (Chilean agency), and included: - Provision of information on linkage opportunities (information exchanges). - Matchmaking – through active arrangements between buyers and suppliers. - Provision of tax exceptions and subsidies to promote training and technology transfer. **Results** • An evaluation was able to identify the beneficiaries of the program and to construct a pool of potential control firms. Both groups benefited from the coordination efforts. But suppliers were found to increase their sales, the number of workers they employ and the salaries their employees received, while also increasing their sustainability or survival capabilities. The program also increased the sales of large firms and raised their ability of becoming exporters (Arraiz, et al 2011).
Justification • SDPs are commonly used to facilitate linkages between domestic SMEs and foreign investors, or other large firms present in the country. • The justification of programs that support supplier development typically rests on the need to address coordination problems. For example, the channels for communication between foreign investors and domestic SMEs is not smooth, and frequently face challenges driven by work standards, organizational practices and business culture.	
Evidence • The evidence of supplier development programs in developing countries is not ample, and thus we are unable to come up with conclusive statements about the effectiveness of these programs. • The impact evaluation of a Chilean program demonstrated results in the form of increased revenues, additional employment, increase in wages, and increased survival of SMEs (Portugal, 2018). In a study of the PROVEE (supplier development) program from Costa Rica, effective between 2001 and 2014, revealed that during this period, the intervention led to 126 new product and service linkages per year.	

Source: Cirera et al. (Forthcoming); Instruments to Support Business Innovation in Low- and Middle-Income Countries. A Guide for Policy Makers and Practitioners.

Another illustration comes from the use of vouchers, which can be used for a wide range of goals, and may be valuable to expand market access.

Vouchers for innovation

Program definition	Case: Vouchers for exporters in Korea
Vouchers are small non-repayable, grants allocated to non-innovative SMEs to purchase services from external knowledge providers. The main objective is to induce non-innovator SMEs to start collaborating with knowledge organizations and knowledge providers. Vouchers are often entitlement-based rather than competition-based, and they typically require light management with effective auditing.	The program supports SMEs by providing export vouchers that list programs in various categories (since 2017 with the budget of 14 mill. U$). All services listed on the service menu are available for all participants regardless of the program engaged. All services are co-financed by SMEs as well to avoid moral hazard, promote accountability and leverage financial resources.
Justification • Voucher schemes aim to address capability failures faced by smaller firms by inducing behavioral changes towards more proactive learning and sustainable collaboration with knowledge providers • There is often severe information asymmetry between knowledge providers (particularly public-sector research organizations) as suppliers of innovation knowledge and SMEs as potential users	**Intervention** Depending on the level of export experience, the voucher program is structured along the following stages: • Preparation stage: translation of webpages and data in foreign languages; optimizing design; education on trade and marketing • Beginning stage: marketing through media/ SNS; support for global market research and matchmaking; participation in exhibitions • Contract stage: checking buyer's credit, writing a contract paper; managing export distribution • Global expansion stage: support to build local branches; consulting on M&A
Evidence • The bulk of the existing evidence draws upon evaluations and surveys of voucher programs in Europe • The review of the evidence detects project additionality and some positive impact on sales and value added in the short-run (Cirera et al, 2020). Behavioral additionality is detected in follow up projects, evidence of a change of attitude towards collaboration, and spillover effects (an improved firm public profile after collaboration with universities). For knowledge providers, benefits included introduction to new research areas, commercial opportunities, and new teaching opportunities	**Results** • Program is currently under evaluation.

Source: Cirera et al. (Forthcoming); Instruments to Support Business Innovation in Low- and Middle-Income Countries. A Guide for Policy Makers and Practitioners

Enhanced access to innovation finance

Innovation finance remains constrained, particularly in the absence of early stage / risk financiers (equity and grants), and in the presence of information asymmetries for existing firms (credit, and reimbursable loans). Programs that enable availability of innovation financing should also work with intermediaries to ensure investees possess the technical capacity to utilize the capital effectively.

We present a reference from credit guarantees for innovation. SATI from MOST and Korea Technology Finance Corporation (KOTEC) have been engaged in adopting a similar scheme in Vietnam, under the Knowledge Sharing Partnership program (KSP), funded by the Korean Ministry of Finance. However, it is worth assessing the adequacy of this program in Vietnam and tacking a stock in the process of implementation and revising progress of this undertaking.

Credit guarantees for innovation

<table>
<tr><th>Program definition</th><th>Case: Technology Financing in Korea</th></tr>
<tr><td>Loans and loan guarantees are instruments for debt financing to support business innovation, typically targeting SMEs, although large firms can also be targeted. Credit guarantees can cover a portion of the losses experienced by lenders extending credit to firms investing in innovative projects, when firms default on loans. It applies exclusively to assets that have been explicitly covered under its provisions, in return for a fee. Credit guarantees become relevant in the late phases of the innovation cycle when risk is lower.</td><td rowspan="4">Korea Technology Finance Corporation (KOTEC) provides technology innovation-oriented SMEs with an evaluation of their technology and its marketability.

Intervention
In Korea, including KOTEC,11 public institutions are designated as Technology Credit Bureaus for evaluating firms' technology. Based on the technology evaluation, KOTEC's Technology Credit Guarantee Program has been operating to provide financing opportunities for SMEs' that have insufficient tangible collaterals but have promising technologies.

Results
While the evidence for additionality of credit guarantees for innovation is limited, results from implementation suggest that this instrument can lead to tangible results, particularly for SMEs with insufficient or intangible assets as collateral that remain credit constrained[127]. As indicated earlier, access to finance for innovation in the EAP region remains an issue, and the use of credit guarantees for purposes other than innovation is widespread (Cirera et al, Forthcoming). Other attractive features include the ability to leverage financial capital from the market, reduce the burden on the government budget (balance sheet) and improve financial records for borrower SMEs. Notwithstanding, the dissemination of this instrument for specific purposes of innovation has not been widespread (Korea and Spain represent 2 case studies featured in the forthcoming innovation policy instrument guide).</td></tr>
<tr><td>Justification</td></tr>
<tr><td>• Imperfections in financial markets
• Information asymmetry
• Lack of collateral of SMEs</td></tr>
<tr><td>Evidence</td></tr>
<tr><td>• Evidence of the profile of participants is mixed, with some programs featuring older firms (20-years-old on average, CDTI in Spain) while others feature younger firms (less than 5 years old on average in Korea's KOTEC). Most programs showed higher take up from exporters in high-tech sectors and who owned intangible assets, such as patents. CEO education was also linked with higher amounts of guarantees.
• Input additionality of lending seems positive and robust, with the majority of schemes reporting between 35-68% in incremental loan value. Evidence on additionality of R&D investments is scarcer, but at least one program showed an incremental 25 percentage points in the probability of investing (CDTI), and in technologically advanced firms (KOTEC).</td></tr>
</table>

127 Input additionality evidence suggests 30-82% incremental lending value, and about 25COM% increase in percentage points in the probability of investing in R&D

Annex 4: The European Innovation Scoreboard[128]: list of indicators

FRAMEWORK CONDITIONS

- **Human resources**
  - 1.1.1 New doctorate graduates
  - 1.1.2 Population aged 25-34 with tertiary education
  - 1.1.3 Lifelong learning
- **Attractive research systems**
  - 1.2.1 International scientific co-publications
  - 1.2.2 Top 10% most cited publications
  - 1.2.3 Foreign doctorate students
- **Innovation-friendly environment**
  - 1.3.1 Broadband penetration
  - 1.3.2 Opportunity-driven entrepreneurship

INVESTMENTS

- **Finance and support**
  - 2.1.1 R&D expenditure in the business sector
  - 2.1.2 Venture capital expenditures
- **Firm investments**
  - 2.2.1 R&D expenditure in the business sector
  - 2.2.2 Non-R&D innovation expenditures
  - 2.2.3 Enterprises providing training to develop or upgrade ICT skills of their personnel

INNOVATION ACTIVITIES

- **Innovators**
  - 3.1.1 SMEs with product or process innovations
  - 3.1.2 SMEs with marketing or organisational innovations
  - 3.1.3 SMEs innovating in-house
- **Linkages**
  - 3.2.1 Innovative SMEs collaborating with others
  - 3.2.2 Public-private co-publications
  - 3.2.3 Private co-funding of public R&D expenditures
- **Intellectual assets**
  - 3.3.1 PCT patent applications
  - 3.3.2 Trademark applications
  - 3.3.3 Design applications

IMPACTS

- **Employment impacts**
  - 4.1.1 Employment in knowledge-intensive activities
  - 4.1.2 Employment fast-growing enterprises of innovative sectors
- **Sales impacts**
  - 4.2.1 Medium and high-tech product exports
  - 4.2.2 Knowledge-intensive services exports
  - 4.2.3 Sales of new-to-market and new-to-firm product innovations

Source: The European Innovation Scoreboard Methodology Manua

128 The European Innovation Scoreboard "provides a comparative analysis of innovation performance in EU countries, other European countries, and regional neighbours. It assesses relative strengths and weaknesses of national innovation systems and helps countries identify areas they need to address". From: https://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en

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