European Commission. Science and Technology Innovation in Europe, 2013 Edition. Luxembourg: Publications Office of the European Union, 2013.

Krugman, Paul R. "Making sense of the competitiveness debate." Oxford review of economic policy 12.3 (1996): 17-25.

Lall, Sanjaya. "Competitiveness indices and developing countries: an economic evaluation of the Global Competitiveness Report." World development 29.9 (2001): 1501-1525.

OECD (Organization of Economic Cooperation and Development). OECD Science, Technology and Industry Scoreboard. Paris: OECD, 2003.

Christian Ketels, Nguyen Dinh Cung, Nguyen Thi Tue Anh and Do Hong Hanh. Vietnam Competitiveness Report 2010. Ha Noi: Central Institute for Economic Management (CIEM), 2010.

World Economic Forum. The Global Competitiveness Report 2012. Geneva: World Economic Forum, 2012.

2 Technology and Innovation Policy in Vietnam

This section provides a brief overview of the policies in place to promote technology transfer in Vietnam, particularly through FDI. A broad range of policies suggest that the government continues to promote FDI as the main technology transfer channel, and the past two decades have seen the development of an extensive legal framework to support this.

The 11th Congress of the Communist Party of Vietnam (CPV) set ambitious targets for modernization: the Ten-Year Social-Economic Development Strategy and the Five-Year Plan call for the "…value of high-tech products and technology application products to reach 35% of GDP in 2015 and 45% of GDP in 2020" (CPV, 2012).

Following the Doi moi Policy that has been decided by sion the VIth Congress of the CPV in 1986, the Vietnamese state prioritized attracting both capital and modern production equipment. Immediately after the promulgation of the Law on Foreign Investment 1987, the State Council issued the Ordinance on Technology Transfer in 1988 which provided incentives to foreign investment expected to generate technology transfers to local firms. These key pieces of legislation have been regularly updated to meet firms' increasing demands for autonomy. Generally, the State's role is evolving towards one of inspection and monitoring.

In 2005, investment incentives were regulated by an updated and unique Law on Investment. This legislation applied to both domestic and foreign investors. According to the Law, projects with transfer of advanced technologies are listed in the fields for investment promotion, including production of new materials or energy, high-tech, bio-technology, information and communication technology, pharmaceuticals, robotics, education and training, healthcare and sport. Both new projects and existing projects that expand can benefit from a range of incentives (this preferential treatment regime is consistent with Vietnam's commitments as a member of the WTO).

The Law on Technology Transfer was approved by the National Assembly on November 29, 2006 and took effect from July 01, 2007. This was the first time the legislature had directly addressed the degree of autonomy domestic firms would have in negotiating technology transfer agreements. This was followed by Decree No. 133/2008/ND- CP dated December 31, 2008, detailing and guiding the implementation of a number of articles of the law on Technology Transfer. Simultaneously, the High Technology Law was enacted in 2008 to provide policies and incentives to promote specific "high-tech" sub-sectors.

2.1 Financial Incentives for Technology Transfer

The state also provides several direct benefits to firms operating in “strategic” sectors, through the National Focal Technical – Economic. These programs provide for direct capital support to firms operating in specific sectors; support can even extend to services from the state including consultancy, technology transfer, or training. In addition, the Focal Science -Technology Programs have been developed as part of each five-year plan.

The Ministry of Science and Technology has responsibility for coordinating and implementing these programs through provincial science and technology projects. Accordingly , enterprises engaged in specific sectors are entitled to take out medium-term and long-term capital loans at preferential rates, and up to 70% of the capital needed for expansion or new investments can be borrowed from the publicly-financed Development Support Fund, the Export Support Fund, or the Scientific and Technological Development Support Fund.

In some cases, the desire to support investment in sectors perceived as modern has resulted in the creation of new government agencies, such as the National Foundation for Science and Technology Development (NAFOSTED), founded by the Decree 122/2003/NĐ-CP. The body began operations in 2008 as a financing body for scientific and technological projects which can issue preferential loans, loan guarantees, and provide direct financial support tofirms that fall within its mandate.

2.2 Tax Policies to Promote Technology Transfer

The government’s strategic goal of encouraging higher-value industrial development and increased investment in modern production methods and equipment has been mainstreamed into the tax code. Table 2.1 below summarizes how technology transfer entitles some firms to preferential treatment.

Table 2.1: Incentives for Technology Transfer

Type of taxes	Incentives	Documents
Value Added Tax	Special-use machines, equipment and means of transport which cannot be produced domestically are not liable to value-added tax of they are used in the context of contracts stipulating technology transfer	*Item 3, Article 44, Law on Technology Transfer*
Enterprise Tax Law	Firms that use their own capital for investment in some sectors can deduct up to 10% of taxed income for scientific or technological investments.	
Import and Export Tax	Import tax exemptions for goods imported for direct in research and development.	*Item 2, Article 44, Law on Technology Transfer*
Corporate Income Tax	Income from technology transfer under projects eligible for investment preferences is exempt from income tax.	*Article 33, Investment Law in 2005*
	Income tax exemption shall be given to organizations and individuals that contribute capital in the form of patent or technology	*Item 1, Article 44, Law on Technology Transfer*
	Income tax exemption for increased incomes for four years and a 50% reduction of payable tax amounts for seven years for firms that invest new production chains, expansion of the production scale, renewal of technologies, improvement of the ecological environment, or raising of the production capacity.	*Item 4, Article 44, Law on Technology Transfer*
	Income tax exemption for four years for enterprises that invest in technological renewal and invest in specific strategic technologies.	*Item 5, Article 44, Law on Technology Transfer*

2.3 Other Incentives

In addition to foregone taxes and other financial instruments, the state has used the national Investment Law to create a preferential environment for firms likely to import technologies that can then diffuse to other domestic firms. A partial list of incentives provided in the law includes:

- Land use preferences**:** Investors in preferred sectors shall enjoy reduction or exemption of land rents, land use levies or land use taxes in accordance with the provisions of land law and tax law (*Article 36).*
- Protection of intellectual property (IP) rights: committing to protect the IP of investors (*Article 7).*

- Firms in some sectors that begin operations in special economic zones (SEZs) are entitled to additional tax exemptions (*Article 10, Decree No 80/2007/ND-CP*).

Firms conducting research and development of new technology are seen as particularly important. Accordingly, Decree No 06/2000/NĐ- CP dated March 06, 2000 explicitly promotes investment cooperation with foreign countries in medical examination and treatment, education and training, and scientific research. In accordance with this decree, FDI-financed research firms in Vietnam are entitled to:

- A 10% income tax rate throughout their term of operation.
- An exemption from income tax for four years after they start making profits; and income tax reduction by 50% for the four subsequent years.
- Reimbursement of all the income tax paid on the profits used for re-investment or expansion of operations.
- Pay a reduced 5% tax rate on any repatriated profits.
- The lowest land rental rates available.
- Exchange rate guarantees from the State Bank of Vietnam.

2.4 Implementation

While the government provides generous financial support to firms investing in technology or performing research and development, and the majority of these funds have been allocated to large, state-owned enterprises. Data from the General Statistics Office's business survey 2001 -2004 (Dinh et al., 2004) showed that 86% of state owned enterprises received state support for research and development (R&D) projects, while no firms with foreign investment (either portfolio or FDI) received government support for research and development.

Similarly, a conference report prepared by the Ministry of Planning and Investment (MPI) in 2013 concluded that only 838 technology transfer projects were registered with the Ministry from 1999 to 2012, of which half were associated with FDI projects. While registered technology transfer may not be a perfect indicator of spillovers or other channels, it suggests that official schemes to promote transfers are not effective, particularly given the over fourteen thousand registered FDI-financed firms reported to be operating in Vietnam at the end of 2012. Private firms and investors have had limited success taking advantage of these schemes because of difficult, complex, and unclear administrative procedures for accessing funding, and risk aversion by Government agencies that prefer awarding funds to State-owned enterprises rather than private firms. Similarly, most small or medium sized enterprises have not been able to access indirect funding through credit schemes. It is apparently difficult for smaller firms to access loans because they do not have or are unwilling to risk putting up collateral and can only rarely meet the usual requirement of 30% counterpart funding.

This is not an argument against the effectiveness of state finance for firms. For example, Hansen et al. (2009) use firm-level survey data to show that government-financed credit and tax exemptions helped fledgling Vietnamese firms begin operating. However, existing schemes to specifically promote technology transfer and innovation may not be as effective. While Vietnam's legislative environment appears to actively promote investment and technology transfer, in practice the various incentive schemes are difficult to access for non-state firms. Despite numerous capital investment and tax reimbursement programs, the majority of firms surveyed by the TCS report rely on internal financing for research, adaptation, and other forms of technology investment.

References

Communist Party of Vietnam: XXIth National Party Congress Document, National Politics Publishing House, Hanoi, 2012.

Dinh Van An (head): Mechanisms, policies and measures for promoting investment in technology renovation and technology transfer and application of high-tech, Ministerial Research Project. Ha Noi: Ministry of Planning and Investment, 2004.

Hansen, Henrik, John Rand, and Finn Tarp. "Enterprise growth and survival in Vietnam: does government support matter?." The Journal of Development Studies 45.7 (2009): 1048-1069.

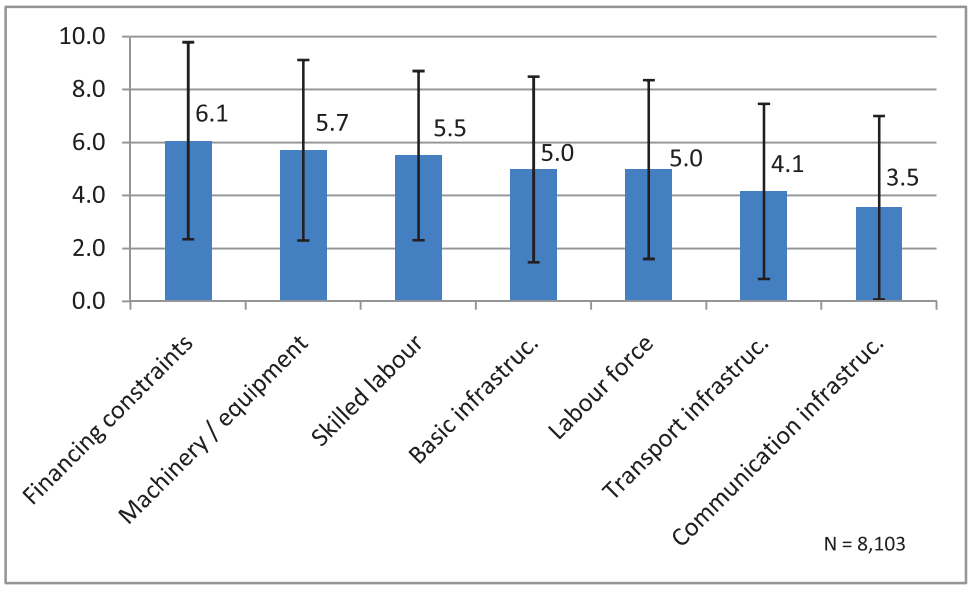
Ministry of Planning and Investment. Summary of Conference: 25 Years of Foreign Direct Investment in Vietnam (Kỷ yếu hội nghị 25 năm đầu tư trực tiếp nước ngoài tại Việt Nam). MPI, Hanoi, 2013.

3 Technology and Competitiveness: Evidence from the 2012 TCS

With increasing regional competition and slowing economic growth, developing or importing technology to produce sophisticated final goods will help to ensure that rising prosperity continues to increase overall living standards, particularly for the rural and urban poor. Firms often realise that innovation is good for business, but lack the capacity or resources to implement a plan to upgrade their production equipment or processes.

Figure 3.1 below summarizes over eight thousand responses to a question asking firms to rank constraints on their economic performance on a ten-point scale; the error bars represent one standard deviation above and below the average score across all firms. These constraints range from financial to macroeconomic issues like poor road networks or inadequate wharf infrastructure impeding the import of intermediate or the sale and export of final goods. Firms consider financing the greatest single constraint. While this is consistent with a number of reports produced by analysts, government institutions, and development partners, the band of one standard deviation shows that financial constraints are not dramatically worse than difficulties accessing machinery or equipment and skilled labour.

Figure 3.1: Constraints on Firms' Economic Performance



This suggests that, firstly, the range of government-initiated programs discussed above are not meeting firms' needs and, secondly, that solving financial constraints alone is probably not sufficient if firms cannot access improved machinery or find skilled operators and managers to oversee production. A general point is that we should not rely on survey averages to diagnose underlying economic problems: averages hidea lot of variation and this variation shows that no single category of

constraint is the "worst." To be effective, industrial policy must confront a range of constraints on growth.

Simple averages are not very precise (as the overlapping ranges of the error bars above makes clear), and there are many other factors that affect firms' perceptions of constraints that we cannot capture in a graph. Multivariate regression is the natural framework to study the relative effect of constraints and other outcomes of interest to policymakers. Table 3.1 below summarises the coefficients of interest and their standard errors from a regression of the sum of total constraints each firm reports against factors that could explain those constraints. The coefficients are reported relative to the "base" categories of small, wholly FDI-owned firms in region seven (Ho Chi Minh City).

Table 3.1: Firm Constraints, Regression Analysis

Dependent variable: Total constraints						
	(1)		(2)		(3)	
	coef	se	coef	se	coef	se
Micro (1-9)	-1.5	(0.8)	-1.6*	(0.8)	-1.5	(0.8)
Medium (50-299)	1.4+	(0.5)	1.8+	(0.5)	1.7+	(0.5)
Large (300+)	4.0+	(0.7)	4.3+	(0.7)	4.6+	(0.7)
State-owned	1.0	(3.3)	-0.1	(3.3)	-0.2	(3.3)
Collective	3.9+	(1.4)	2.8	(1.5)	2.6	(1.5)
Private Ent.	1.7*	(0.8)	1.5	(0.8)	1.4	(0.8)
Limit'd Liab. Co.	2.8+	(0.6)	2.8+	(0.6)	2.8+	(0.7)
Joint Stock, no State	4.7+	(0.7)	4.0+	(0.8)	3.9+	(0.8)
Joint Stock, State	2.9*	(1.3)	2.6*	(1.3)	2.8*	(1.3)
FDI and State	6.4+	(2.3)	6.0+	(2.3)	6.0+	(2.3)
FDI and Private	-1.0	(1.6)	-1.0	(1.6)	-0.7	(1.6)
Observations	8,109		8,109		8,109	
Region Effect	N		Y		Y	
Sector Effect	N		N		Y	
Pseudo R-squared	0.0014		0.0024		0.0031	

Tobit estimates, left censored, standard errors to right of coefficients clustered at firm level. Base: Small, FDI, Region 7 (HCMC), Food Processing (ISIC 15). Sector effects are at 2-digit level. Coefficient on constant term not reported. Robust standard errors in parentheses. + p<0.01, * p<0.05.

The final column of the table controls for the all the listed firm characteristics in addition to region- and sector-specific effects, so we are effectively looking at the effect of firm characteristics on total constraints within sectors in regions, and the "precision" of the estimate is roughly analogous to the width of the error bars in Figure 3.1. Larger firms are relatively more constrained: since the relatively small number of the largest firms employs over 70% of workers in our sample, they could be targeted

for narrowly-focused industrial policy. Similarly, limited liability firms, joint stock companies with and without state involvement, and FDI firms with state involvement perceive themselves as relatively more constrained even when we control for the region and sector in which they operate.

There are two main findings from examining firms' reported constraints on performance along a single dimension and in a regression (multidimensional) framework. Because no single constraint dominates the others, industrial policies will have to tackle numerous different constraints simultaneously. This requires coordination across a large number of agencies, government ministries, and development partners. However, a positive point to take away from examining these survey datais that a large number of firms of different legal structures and sizes perceive themselves to be relatively constrained. This suggests that where industrial policy is successful, it can act as a rising tide, improving the performance of numerous different kinds of firms without necessarily privileging any particular type of company, region or sector.

3.1 Technology Transfer

While improving access to appropriate technology will not solve all the constraints on performance perceived by firms, improving production methods, organisation, and machinery will enable Vietnamese firms to compete in higher-quality and higher-value added market segments. This ultimately delivers higher wages to workers and may cause improved working conditions (an aspect of employment studied by the TCS and discussed in section 7 below).

Markusen and Venables (1999) provide a simple theoretical framework to evaluate the different channels (and countervailing effects) under which foreign investment promotes domestic productivity increases (they consider the specific case of industrialisation) through technology transfer. However, while economic theory has identified channels through which technology transfer and spillovers might occur, economic evidence is mixed, and whether or not researchers actually detect beneficial spillovers through linkages between foreign and domestic firms depends on the outcome measure (for example, profitability or productivity), the time period, the empirical methodology used, and the country or countries in the sample. Görg and Greenaway (2004) present a summary of this evidence and find that it is very mixed: we should not automatically conclude that foreign investment will lead to technology transfers or spillovers.Table 3.2 below summarises the different channels for technology transfer.

Table 3.2: Types of Spillover

Type of spillover	Description
***Forward* linkage**	The firm based in Viet Nam is a customer. Technology is transferred from suppliers.
***Backward* linkage**	The firm based in Viet Nam is a supplier. Technology is transferred from customers.
Horizontal	The firm based in Viet Nam is a competitor. Technology is transferred from a foreign firm / foreign-owned domestic competitor to the firm based in Viet Nam.

To give researchers an overall picture of the relative importance of these channelsin Vietnam, the TCS asks firms to rank various mechanisms for technology transfer by importance on a 10-point scale. Embodied technology refers to improving production by buying new machinery or equipment (for example, installing upgraded welding equipment in a metal fabrication shop). The firm could also purchase technology (for example, licensing a new production process) from an outside firm, or receive technological know-how from an entity within the firm ("Group") or from a supplier or customer. Finally, new employees could improve the firm's method of production, generally by bringing with them skills acquiredat another firm operating in a similar sector or with similar equipment.

Figure 3.2 below summarises the average importance of each channel by type of firm and overall, while Figure 3.3 does this by firm size. The average importance ascribed to these channels varies widely across types of firms, but new employees and embodied technology dominate across firm types and size categories (and certainly do on average across the whole sample, the last grouping in each figure). This suggests that firms perceive horizontal spillovers and physical technology transfers to be the most important channels for improving production.

Figure 3.2: Ranking of Transfer Channels by Firm Size

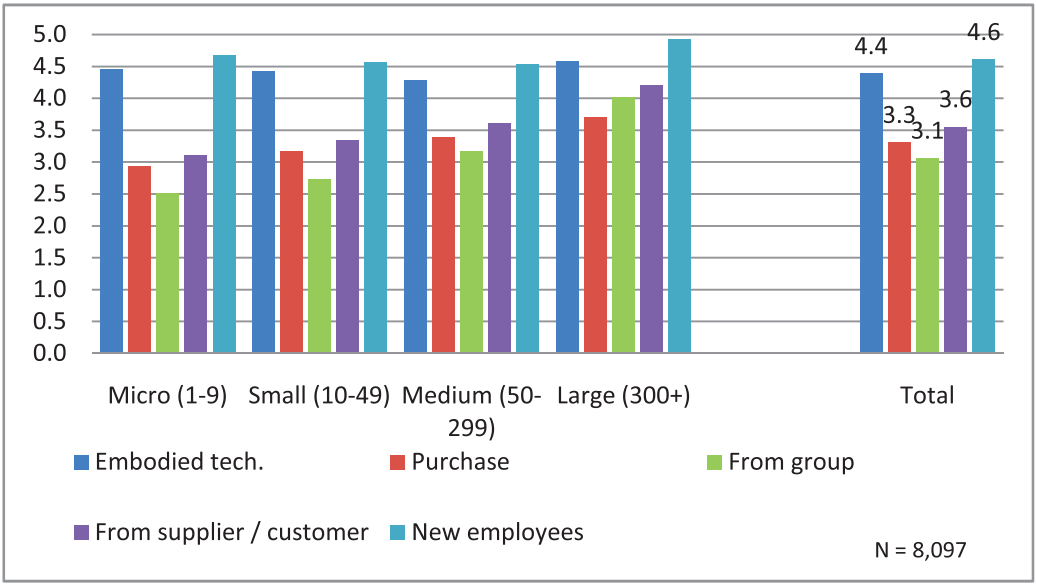
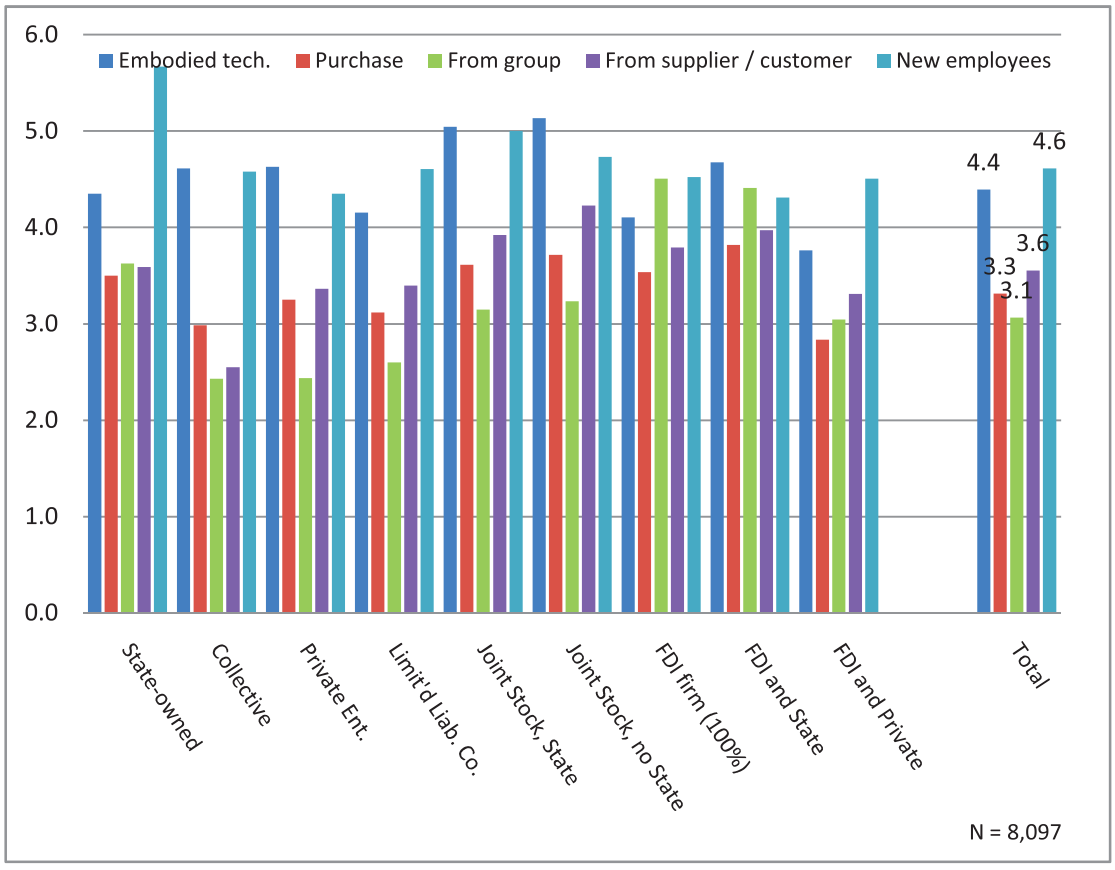


Figure 3.3: Ranking of Transfer Channels by Legal Structure



3.2 Horizontal Spillovers

Horizontal spillovers occur when firms competing in the same sector or closely-related sectors see innovations occurring in their competitors and copy them. One argument for encouraging FDI and

exporting is domestic firms absorb the technologies used by foreign-owned firms through these horizontal spillovers. For example, domestic firms learn about new technologies or processes by competing with foreign firmsin international markets, referred to as the internationalisation effect.For example, Kafournos et al. (2008) argue that the reason some innovative firms do not outperform others is because they are not sufficiently internationalised: competing internationally is actually what enables firms to take advantage of innovation.

A horizontal spillover can also occur when a domestic firm improves efficiency by copying technologies by observing a foreign competitor, which has come to be called the demonstration effect. Alternately, a foreign competitor could train Vietnamese workers, making them more productive creating a horizontal spillover due to the worker mobility effect when the workers are hired by local firms. Nguyen and Nguyen (2008) use the earlier rounds of the Vietnam Enterprise Survey and argue the evidence suggests horizontal spillovers do occur, but are mainly limited to the service sector through the worker mobility effect. A related paper is Machikita et al.(2011), who provide an interesting study of how targeted exchanges of skilled workers (in their case, engineers) improved the efficiency of a sample of Vietnamese firms.

Capturing the benefits of these spillovers isone of the main motivations for governments to give tax breaks and other benefits to foreign firms. These firms can both sell better embodied technology to local firms, improving their output and quality, and employ workers who become more productive and bring new production techniques with them when they leave. However, when we look at data from the TCS about where firms actually procure their technology (Table 3.3 below), local firms are the dominant source, though foreign firms in the same and other sectors are certainly important as the main suppliers of machines and equipment to over 28% of the nearly eight thousand respondents.

This suggests that diffusion of better technology amongst local firms, instead of just from foreign firms operating locally, is an important element of overall technology transfer. Given the costs involved in creating incentives for FDI like foregone tax revenue, policymakers should continue to explore how local firms can cooperatively diffuse appropriate technology. The TCS data suggests that while technology provided by foreign firms is important, it is not the only mechanism through which local firms can alleviate key constraints.

Table 3.3: Main Supplier of Technology

Source	Total	%
Vietnamese firm, same sector	1,640	20.26
Vietnamese firm, other sector	3,885	47.99
Foreign firm, same sector	1,487	18.37
Foreign firm, other sector	875	10.81
Total	7,887	100%

Evidence on the worker mobility effect is difficult to collect, since the survey does not capture the full work history of each employee.[1] Of the firms reporting that the skills and experience of new employees were the most important source of technology transfer, 82% of firms said that the main employees responsible for these transfers were Vietnamese nationals, while a further 17% attributed thetechnology transfer to foreigners working in Vietnam, with the tiny remainder coming from Vietnamese repatriates (the total sample was 7,999 respondents).

Similarly, the average share of transfers firms attributed to Vietnamese national employees who had previously worked for FDI firms is 29% (2,141 observations), compared to 81% (4,706 observations) attributed to Vietnamese employees who had previously worked for a non-FDI and non-state enterprise. We take this evidence to suggest that the domestic private sector can also be a robust source of technology transfer or diffusion through the worker mobility effect, and that industrial policy should not exclusively focus on FDI-financed firms.

A necessary condition for horizontal spillovers is a competitive market. Vietnam's transition to a dynamic market economy has created competition between firms that try to improve quality or reduce price to capture bigger market shares or, in the case of exporters, attract and retain discerning international customers. A larger number of competitors implies a greater overlap in common production problems, and a greater number of workers with experience in the sector. Cumulatively, more competition in a given sector increases the chance that a firm will capture horizontal spillovers. At the same time, greater competition also means lower average profits because prices are driven down by new entrants. Whether the benefits of competition exceed its costs is ultimately an empirical question.

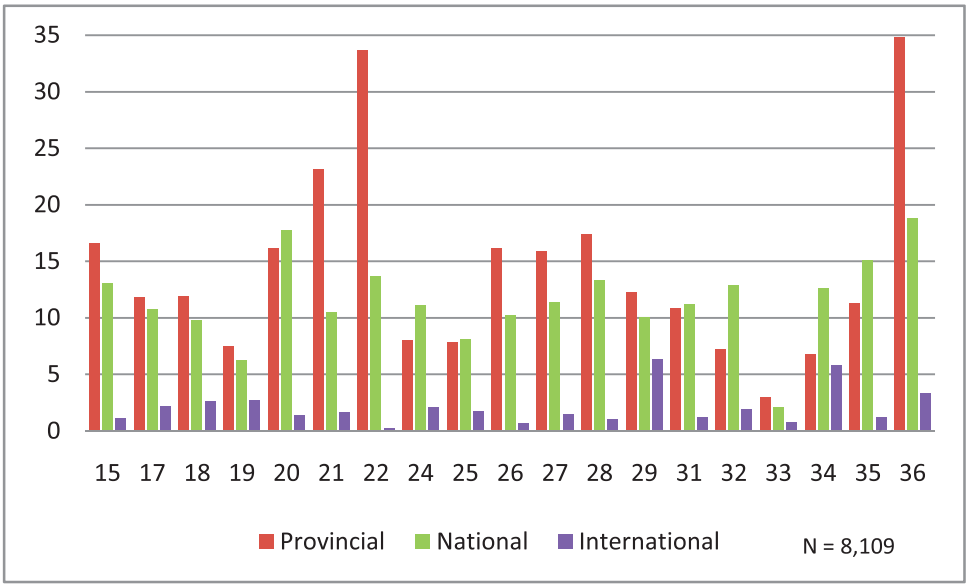
The data in the 2012 round of the TCS summarised in Figure 3.4 below suggests that some sectors are particularly competitive, with firms in eight sectors reporting more than 15 competitors on average, and firms in three sectors reporting an average of more than 20. The majority of this competition, however, is intra-provincial, not national or international. Most firms continue to compete in very

[1]This data would allow researchers to see whether firms that hire more employees that previously worked for FDI-financed firms are more productive because of the knowledge and human capital these employees "took with them" when they stopped working for the foreign-invested firm.

local markets, indicating internationalisation difficulties (possibly compounded by poor transport infrastructure discussed above) and limited exporting.

This indicates that the next hurdle for most firms is actually selling in non-local domestic markets; this may be a more achievable short-term goal for industrial policy than encouraging exports, and will also generate a larger number of domestic firms more likely to grow to export status and compete successfully.

Figure 3.4: Average Number of Competitors by Sector



Overall, the TCS provides some preliminary evidence that domestic firms can learn effectively from one another, and that technology transfer even within the same sector may not require an emphasis on encouraging foreign entrants to the domestic market. Export-oriented policies are certainly beneficial for long-run economic growth, but expanding the domestic market of local firms is a reasonable and more easily attainable first step towards export growth and international competition in future.

References

Görg, Holger, and David Greenaway. "Much ado about nothing? Do domestic firms really benefit from foreign direct investment?." The World Bank Research Observer 19.2 (2004): 171-197.

Kafouros, Mario I., et al. "The role of internationalization in explaining innovation performance." Technovation 28.1 (2008): 63-74.

Markusen, James R., and Anthony J. Venables. "Foreign direct investment as a catalyst for industrial development." European economic review 43.2 (1999): 335-356.