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# The Global Information and Communications Technology Industry

## Where Vietnam Fits in Global Value Chains

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## Abstract

The information and communications technology sector has undergone a dynamic process of globalization and fragmentation in the past few decades, leading to the creation of global value chains. Global value chains are populated by a constellation of specialized actors collectively responsible for bringing goods and services to market. Most prominently, these key actors include lead firms (brands), contract manufacturers, platform leaders, and increasingly, information and communications technology services and information and communications technology—enabled services providers. Like other emerging markets, Vietnam is coming to play an important role in this global industry. The recent influx of foreign investors, driven by the country's low wages and easy access to regional supply chains, as well as the emergence of various local information and communications technology services and information and communications technology-enabled services firms opens opportunities, yet raises important questions for policy makers about how best to leverage global engagement for local capacity building. This paper situates Vietnam in the global information and communications technology industry, and identifies several constraints to future growth, including the limited availability and quality of trained information and communications technology professionals, ineffective supplier development initiatives, and weak entrepreneurial ecosystem, especially in management skills. The paper concludes with a set of policy recommendations and forward-looking statements aimed at helping Vietnam move into higher-value activities in the coming years. The analysis is based on relevant statistics published by the United Nations, Organisation for Economic Co-operation and Development, World Trade Organization, Government of Vietnam, and Vietnamese industry associations, as well as interviews and site visits conducted by the authors during January 19–30, 2015.

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## Introduction

The information and communications technology (ICT) sector has become the driving economic force of the current era. It is widely seen as a tool for modernizing entire economies: a driver of innovation and productivity, a catalyst for global integration, and a source of high paying, knowledge-intensive jobs. At the same time, the changes wrought by ICT can be thoroughgoing and come with breathtaking speed, regularly upending the status quo. The fortunes of incumbent firms, occupations, and entire industries can be disrupted or even rendered entirely obsolete in short order. As such, the ICT sector is of strong and growing interest to policy makers and a host of other stakeholders (NGOs, labor, standard-setting bodies, etc.). The ICT sector can be difficult to define because it consists of a rapidly changing and broadening mix of electronic hardware and ICT-related services, from telecommunications to software and information technology (IT) services, including cloud-based services and platforms.

The goal of this paper is to delineate the main characteristics of the ICT sector, identify the central actors that produce ICT goods and provide ICT services, describe Vietnam's current and potential position in ICT global value chains (GVCs), and provide forward-looking recommendations for improving that position. As is common in GVC analysis, we focus on the roles played by key firm-level actors in the value added chain and highlight if and how specific countries and geographic areas have come to specialize in various activities — such as R&D, product design, production, marketing, consumption, etc. This is important in the case of Vietnam because the country is currently specialized in a narrow, low value-added range of GVC functions, namely hardware assembly and outsourced software and ICT services.

Part I of the paper outlines the electronic hardware industry's central role in ICT GVCs, and especially the dramatic shift of production to Mainland China over the past 15 years. This section identifies three key firm-level actors in the hardware sector: lead firms, contract manufacturers, and platform leaders, and discusses their development, or "co-evolution" over time. The paper then defines and discusses ICT- and ICT-enabled services.

Part II of the paper focuses on Vietnam's role in ICT GVCs. It provides an overview of how the country's ICT industry first emerged post-liberalization and the position it occupies in GVCs today. A close examination of key trade and FDI statistics reveals Vietnam's emergence as an export-oriented final assembly hub, especially for mobile phone handsets. Vietnam's ICT services firms appear to hold a great deal of promise, and could be where most of the opportunities for future development lie. The paper then examines the rules and regulations that most directly shape and impact the sector's development. Finally, in Part III, we offer a set of policy recommendations aimed at supporting entrepreneurship, skills development, and technological and industrial upgrading in Vietnam's ICT sector.

## Part I: The Global ICT Sector

While the innovative power of ICT has been felt since the early days of radio, the pace of change has accelerated dramatically since the advent of low-cost, high capacity digital information technologies, which now underpin voice, video, and data communications. More than ever, the ICT sector is transforming business and government transactions, driving productivity and efficiency improvements across entire economies, unleashing innovation and creative destruction, and requiring regular and significant changes to business strategies and work processes. IT systems, which combine software and hardware, have become the backbone for almost all corporate and government functions and services.

**Main Features of the ICT Sector**

The ICT sector has several important features. First, the sector is extremely dynamic and fiercely competitive. Innovation in the sector is so rapid that new products and services are regularly disruptive to long-time incumbents.[2] ICT applications with no real precedent are less common, but can, in a matter of a few years, create vast new industry segments, such as Internet retailing, social media and cloud computing. ICT hardware and services can find markets in many ways, as components and elements of larger systems, to operating systems and platforms that run higher level-applications, to the applications and services experienced directly by end users. Revenues can come from selling products or services, from selling advertising on free applications, by selling user-generated data, or by some combination of the three. All this dynamism and complexity occurs in a context where new software, IT, computer and communications systems must retain a large degree of backward compatibility with older systems. While this high industry 'clockspeed' (Fine, 1998) and ongoing need for interoperability can create a steady flow of new business and employment opportunities, it also increases pressure on industry stakeholders[3] to keep up with new developments to stay relevant and connected. Some have referred to the need for constant updating and new investment as the "ICT treadmill."[4] For policy makers, simply keeping up to date with trends in the ICT sector can be a daunting proposition.

Second, ICT is propulsive and increasingly pervasive. ICT is an example of what Hirschman (1958) calls a 'propulsive sector.' The adoption of ICT has driven vast improvements in economic efficiency, broadly speaking (Mann and Kirkegaard, 2006), and in both business and institutional environments, ICT systems have moved beyond their earlier role as labor saving tools to become core platforms on which work takes place, products are built, and services are delivered. The heavy adoption of computers and information technology across sectors, including agriculture; transport; retail and wholesale trade; manufacturing; finance, insurance, and real estate; as well as in education, entertainment and professional services; make it clear how pervasive the changes wrought by ICT have been (UNCTAD, 2012). Indeed, ICT has become commonplace, even in developing countries. As people in advanced and developing countries alike spend more time online than was imaginable even a few years ago, platforms and applications have proliferated. Users expect ICT-based products and services to meet their specific needs, be affordable and easy to use, and fit seamlessly into their lives. Innovation in electronic hardware and software has enabled a host of downstream services such as location-based services (e.g., utilizing GPS); 'big data' analytics; and on-line shopping, gaming and distance education. An entire class of ICT-enabled services — ranging from the remote provision of simpler business processes, such as accounting and forms processing, to more complex knowledge processes, such as financial research and R&D — has emerged so quickly that official classification systems are unable to capture them. Because it is both pervasive and propulsive, the ICT sector demands the attention of policy makers concerned with economic and social development.

Third, as is the case in many sectors, ICT goods and services are increasingly produced in highly fragmented global value chains (GVCs), with value often added in a variety of countries before goods and services make their way to end users (Fernandez-Stark *et al*, 2011; Sturgeon and Kawakami, 2011). Famously, Apple's product packaging includes the label: "designed in Cupertino and assembled in China." But fragmentation is not confined to hardware. Rendering features in a video game, for example, might be spread across many small firms and even individual contractors working in several different countries; one creating the character's hand, another facial

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[2] For example, the near replacement, since 2007, of Nokia, Motorola, and Blackberry feature phones with smart phones running Apple iOS and Google Android operating systems.

[3] Governments, consumers, workers, companies and industry associations can all be considered to be 'stakeholders' in this context.

[4] http://www.wired.com/2014/02/security-treadmill-doom/

features, another background elements, another textures to be used by other programmers, and so on. Or, an enterprise software 'IT consultancy' might rely on 'platform' software from Oracle, Microsoft, or SAP to build systems customized for particular 'vertical' applications, such as for taxation or for the capture, storage, search, and analysis of medical records. Shifting parts of the value chains to low-cost locations lowers prices, which speeds adoption of information technologies across the world, leading to productivity spillovers (Mann and Kirkegaard 2006). However, fragmentation in GVCs can also mean that companies and even entire countries and regions can sometimes participate in the industry yet be walled off from higher value added activities and from innovation and the processes of new industry creation (Dedrick, et al., 2010). For policy makers, the focus is shifting to capturing high-value added niches in GVCs; abandoning attempts to create fully vertically integrated national industries — an increasingly anachronistic approach. For statisticians, fragmented GVCs put a premium on the identification and tracking of intermediate goods and services flows (Sturgeon and Memedovic, 2010; Escaith and Timmer, 2012).

Generally speaking, the ICT industry is too international and too important to broader economic development to be a significant target for protectionist policies. Electronic hardware and systems are rightly perceived as having a positive effect on other industries. Furthermore, expertise related to innovation has tended to be concentrated in only a few places (for example, in Silicon Valley, California, and in large firms based in the United States, Europe, and Japan). As a result, politicians and policy makers have been loath to put too much pressure on firms to produce locally or to put up barriers to trade, even during economic crises. Intense competition, at first between American and Japanese producers, along with a series of boom and bust cycles driven by forces both internal and external to the industry (Brown and Linden 2009), are what pushed early fragmentation of electronics GVCs, rather than trade barriers and local content rules alone, as has been the case in the textile/apparel and automotive sectors.[5] Because trade barriers have been minimal in this industry worldwide, the main impact of the 2008-2009 economic crisis was to sharply reduce demand, driving the full absorption of operating inventories and accelerating existing trends toward industry consolidation and shifts to low-cost production geographies.

**ICT Hardware**

The ICT hardware industry is the world's most important goods-producing sector. Each year, the industry generates a mushrooming array of products and services. Now deeply entwined in our social fabric, ICT products and systems support critical aspects of communication, education, finance, recreation, and government. While statistics on global manufacturing employment are not available, consider the case of the United States, where innovation in ICT hardware, which employed 1,054,700 in 2014, has helped spawn a host of upstream and downstream ICT service industries, including computer systems design services, telecommunications, as well as data processing, hosting, and related information services, which together employed 3,205,300.[6] Maintenance and repair, and wholesale and retail trade of electronic goods accounted for another 329,800 US jobs in 2014.

Worldwide, thousands of companies from dozens of countries contribute to the industry on a daily basis. Even a single product can contain work carried out by dozens of firms in multiple countries. Because there is less need for co-location of engineers than in other technology-intensive sectors, it is relatively easy for ICT firms to engage in the twin strategies of outsourcing and offshoring. As a result, international sourcing is common. Business functions can be separated and

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[5] Local production in autos is also driven by high product variation, the heavy and bulky nature of some components, and the low inventory demands of "lean production" practices.

[6] U.S. Bureau of Labor Statistics Current Employment Statistics program, http://www.bls.gov/data/#employment, accessed Janurary 15, 2010.

relocated with relative ease. Accordingly, GVCs in the ICT industry are more geographically extensive and dynamic than in any other sector.

Evidence of the importance of the ICT hardware sector in GVCs can be found in statistics on intermediate and final goods trade. Trade in intermediate goods is indicative of GVCs because fragmented production processes require that parts, components, and partially manufactured subassemblies cross borders—sometimes more than once—before finished goods are shipped to final markets (Feenstra 1998; Dean, Fung, and Wang 2007; Brülhart 2008). Data on trade in intermediate and final goods can be found in the World Bank's MC-GVC database, which in addition to electronic hardware covers the automotive and textile/apparel/footwear industries. As Table 1 shows, world merchandise exports have grown faster than world GDP since from 1988, until 2011, when the current collapse of international trade began to reverse the trend (from 2011-2014 world GDP slowed to 2.2% per year while world merchandise exports grew at less than 1%). Trade in ICT hardware is the largest of the three sectors covered by the World Bank's MC-GVC database, and its importance has grown from 11% of total merchandise exports in 1988 to 16% in 2014 (from US$ 69 billion to US$ 2.7 trillion). Intermediate ICT goods exports grew faster than final goods in the period 1988-2011, but slightly more slowly since.

From a GVC perspective, countries with very high levels of intermediate goods imports tend to act as hubs for final assembly and export of finished goods (unless they are large re-exporters). Historically, the United States was the top location for electronics manufacturing and export, followed by Japan and Germany. Today, these countries are still in the game, in regard to production (especially of intermediates), ownership of intellectual assets, and orchestration of the GVC, but their importance as traders of ICT goods as China has become the most important location for final assembly, by a wide margin. While pioneering electronics producers from the United States, Japan, and Germany began experimenting with re-locating labor-intensive aspects of production in low cost locations in the 1970s and 1980s, the offshoring of ICT hardware assembly gathered steam in the 1990s, and exploded after the bursting of the "dot-com" bubble in 2001. These trends are reflected in Figure 1, which show the rise of China (and SAR Hong Kong mainly as a re-exporter to China) as the largest importers of intermediate ICT hardware goods, by far. Vietnam's more recent recent appearance as a location for the high volume final assembly of ICT final goods is suggested by rising imports of intermediates, which can be detected at the bottom of Figure 1.

**Table 1. World Exports ICT Hardware in 1992, 2008, and 2014, millions of current US$**

| | 1988 | 2011 | 2014 | *CAGR 1988-2011* | *CAGR 2011-2014* | *CAGR 1988-2014* |
|---|---|---|---|---|---|---|
| **World GDP** | 18,042 | 68,009 | 72,680 | *5.9%* | *2.2%* | *5.5%* |
| **World Merchandise Exports** | 627 | 16,472 | 16,910 | *15.3%* | *0.9%* | *13.5%* |
| **ICT Hardware Exports** | 69 | 2,487 | 2,690 | *16.8%* | *2.7%* | *15.1%* |
| *% of World Merchandise Exports* | *11%* | *15%* | *16%* | | | |
| Final Goods | 41 | 1,291 | 1,410 | *16.2%* | *3.0%* | *14.6%* |
| *% of ICT Hardware* | *59%* | *52%* | *52%* | | | |
| Intermediates | 28 | 1,196 | 1,280 | *17.7%* | *2.3%* | *15.8%* |
| *% of ICT Hardware* | 41% | 48% | 48% | | | |

Note: all values in millions of US dollars at current prices and exchange rates.
Sources: Merchandise Exports: UNCTADstat, http://unctadstat.unctad.org/wds. World GDP: World Bank World Development Indicators, http://data.worldbank.org/data-catalog/world-development-indicators ICT Hardware trade: World Bank MC-GVC Database using a consistent 175 country panel that accounts for 95-98% of world trade, see:
http://wits.worldbank.org/WITS/WITS/AdvanceQuery/GVC/GVCQueryDefination.aspx?Page=GVCIndicator

**Figure 1. Top 13 Importers of Intermediate ICT Goods, 1988-2014, billions of current US$**



Authors' note: While Singapore does import intermediate ICT goods, a significant portion is re-exported. Hong Kong SAR, China, and the Netherlands also have extremely high re-exporters.
Source: World Bank MC-GVC Database using a consistent 175 country panel that accounts for 95-98% of world trade, see:
http://wits.worldbank.org/WITS/WITS/AdvanceQuery/GVC/GVCQueryDefination.aspx?Page=GVCIndicator

Complete data on imports and exports of intermediate and final goods for the world's top 15 traders in 2014 clearly shows China position as the world's leading production hub for ICT hardware more fully (see Table 2). China is the largest importer and exporter of intermediate electronic goods, and the largest exporter of final ICT goods with an astonishing 43% of world exports. Most of this activity is concentrated in the vicinity of the Yangtze and Pearl River Deltas (near Shanghai and Shenzhen respectively). China's dominant share (34%) of intermediate ICT goods exports reflects the growth of local component manufacturing in the country to supply local assembly factories, mainly by foreign-invested enterprises headquartered in Chinese Taipei, China. China is also a large market for finished ICT goods, and ranks second in imports after the United States, when figures are combined with those of Hong Kong SAR, China, which re-exports much of what it imports to China. The higher share (nearly 95%) of intermediate goods than final goods imports (about 83%) in the top 15 traders reveals that production of both intermediates and final goods are significantly more concentrated than markets for final goods.

**Key Private Sector Actors in ICT GVCs[7]**

The ICT hardware sector includes three principal actors: lead firms, contract manufacturers, and component suppliers, with 'platform leaders' such as Intel, Microsoft, and Qualcomm being the most important of the latter category. The value captured by the most powerful firms in GVCs—lead firms with global brands—can be extremely high. Of course, dozens of other entities play important roles in the broader industry, including software vendors

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[7] This section drawn on Sturgeon and Kawakami, 2011.

(including software platform leaders such as Microsoft, SAP, and Oracle), production equipment manufacturers, distributors, and producers of more generic components and subsystems. The following analysis of how these three firm-level actors have evolved in the industry's GVCs provides a useful if simplified portrait of the global ICT industry.

**Table 2. Top 15 Importers and Exporters of Intermediate and Final ICT Goods, 2014, billions of current USD, and share of top 30 exporters and importers**

| Intermediate ICT Goods | | | | | |
|---|---|---|---|---|---|
| | Exporters | | | Importers | | |
| Rank | Top 15 * 2014 | US$ Billion | Share Top 30 | Top 15 * 2014 | US$ Billion | Share Top 30 |
| 1 | China | 360.4 | 33.7% | China | 284.6 | 27.6% |
| 2 | Korea, Rep. | 140.5 | 13.1% | Hong Kong SAR, China | 194.5 | 18.7% |
| 3 | Japan | 92.4 | 8.6% | United States | 84.0 | 8.1% |
| 4 | Malaysia | 92.2 | 8.6% | Singapore | 52.5 | 5.0% |
| 5 | United States | 75.6 | 7.1% | Korea, Rep. | 49.8 | 4.8% |
| 6 | Singapore | 61.1 | 5.7% | Japan | 46.1 | 4.4% |
| 7 | Germany | 41.7 | 3.9% | Germany | 41.1 | 4.0% |
| 8 | Philippines | 31.6 | 3.0% | Malaysia | 35.8 | 3.4% |
| 9 | Thailand | 23.7 | 2.2% | Mexico | 33.7 | 3.2% |
| 10 | Costa Rica | 21.8 | 2.0% | Netherlands | 26.2 | 2.5% |
| 11 | Netherlands | 18.9 | 1.8% | Vietnam | 22.2 | 2.1% |
| 12 | Vietnam | 14.2 | 1.3% | Thailand | 20.3 | 1.9% |
| 13 | France | 11.7 | 1.1% | Philippines | 16.9 | 1.6% |
| 14 | United Kingdom | 11.2 | 1.0% | United Kingdom | 16.7 | 1.6% |
| 15 | Mexico | 10.5 | 1.0% | France | 16.6 | 1.6% |
| | Top 15 | 1,007.35 | 94.1% | Top 15 | 940.93 | 90.4% |
| | Total Top 30 | 1,070.61 | 100.0% | Total Top 30 | 1,040.79 | 100.0% |

| Final ICT Goods | | | | | |
|---|---|---|---|---|---|
| | Exporters | | | Importers | | |
| Rank | Top 15 * 2014 | US$ Billion) | Share Top 30 | Top 15 * 2014 | US$ Billion) | Share Top 30 |
| 1 | China | 580.5 | 42.9% | United States | 269.9 | 23.0% |
| 2 | United States | 107.3 | 7.9% | Hong Kong SAR, China | 115.6 | 9.9% |
| 3 | Germany | 85.3 | 6.3% | Germany | 89.1 | 7.6% |
| 4 | Japan | 60.2 | 4.5% | China | 78.4 | 6.7% |
| 5 | Mexico | 59.0 | 4.4% | Netherlands | 70.3 | 6.0% |
| 6 | Netherlands | 47.5 | 3.5% | Japan | 55.4 | 4.7% |
| 7 | Korea, Rep. | 45.5 | 3.4% | United Kingdom | 51.0 | 4.4% |
| 8 | Vietnam | 43.6 | 3.2% | France | 38.4 | 3.3% |
| 9 | Switzerland | 43.3 | 3.2% | Korea, Rep. | 34.3 | 2.9% |
| 10 | Malaysia | 35.9 | 2.7% | Canada | 33.1 | 2.8% |
| 11 | Thailand | 34.0 | 2.5% | Mexico | 30.8 | 2.6% |
| 12 | United Kingdom | 22.1 | 1.6% | United Arab Emirates | 30.0 | 2.6% |
| 13 | Singapore | 21.5 | 1.6% | Italy | 26.4 | 2.3% |
| 14 | France | 21.3 | 1.6% | Singapore | 24.4 | 2.1% |
| 15 | Ireland | 19.1 | 1.4% | India | 24.3 | 2.1% |
| | Top 15 | 1,207.03 | 89.3% | Top 15 | 971.26 | 82.9% |
| | Total Top 30 | 1,352.01 | 100.0% | Total Top 30 | 1,171.79 | 100.0% |

* While Singapore does import intermediate ICT goods, a significant portion is re-exported. Hong Kong SAR, China, and the Netherlands also have extremely high re-exporters.
Source: World Bank MC-GVC Database using a consistent 175 country panel that accounts for 95-98% of world trade, see: http://wits.worldbank.org/WITS/WITS/AdvanceQuery/GVC/GVCQueryDefination.aspx?Page=GVCIndicator

*Lead Firms*

Lead firms create and sell branded products and systems in final markets to individual consumers, other businesses, or government agencies. These firms initiate, or 'lead,' the GVC's activities by placing orders with suppliers, giving them market power in the supply chain. This 'buyer power' is earned, if not by technological leadership and large investments in brand development, then by the financial risk taken on when placing orders.[8] Of course, the size of orders matters, and this connects the power derived from market performance to the buyer power wielded by lead firms in GVCs. Because the electronics industry has diversified as it has grown, lead firms compete in a widening array of end markets. Applications for electronics technology have grown almost too numerous to list, with new companies formed and new products introduced on an ongoing basis. Moreover, many of these market segments contain companies that resell hardware products by integrating them into larger systems, adding software and offering after-sales services that tailor the systems for use in specific situations and settings.[9] The ICT "ecosystem," therefore, is vast.

Most of the important lead firms in the electronics industry are based in industrialized countries, especially the United States, Western Europe, and Japan. Of newly industrialized countries, the Republic of Korea (hereafter, 'Korea') stands by having several important lead ICT firms, most prominently Samsung and LG. Because of their role in the GVC as assembly and contract manufacturing hubs, only a handful of lead ICT firms from emerging economies such as China have made significant inroads in global markets with their own brands. These 'exceptions to the rule' include Acer, a PC company based in Chinese Taipei; HTC, and mobile phone handset makers also based in Chinese Taipei; Huawei and ZTE, Chinese manufacturers of networking equipment and mobile handsets; and Lenovo, a Chinese PC company that leapt onto the world stage with the acquisition of IBM's PC division in 2004. However, this is likely to change in the future, as lead firms successful in the huge Chinese market, such as mobile handset maker Xiaomi, seek to expand in international markets.

*Contract Manufacturers*

Contract manufacturers make products for lead firms and sometimes provide design services as well. The popularity of contract manufacturing in the electronics industry is a direct result of 'value chain modularity,' which enables a clear technical division of labor between design and manufacturing at multiple points in the value chain, most notably between the design and assembly of final products and the design and fabrication of integrated circuits (ICs). At the product level, some lead firms still assemble products in their own factories, but the use of contract manufacturers has been a strong and growing trend since the late 1980s.

Production services alone—comprising component purchasing, circuit board assembly, final assembly, and testing—are generally referred to in the industry as 'electronics manufacturing services' (EMS). Historically, the largest EMS contract manufacturing firms have been based in the United States and Canada (see Table 3). These firms tend to have global operations and produce for lead ICT firms active in various end markets. In recent years, however, Foxconn (Hon Hai), based in Chinese Taipei but with very large production facilities in China, Vietnam, and the Czech Republic, has emerged as the industry's largest contract manufacturer, in part on the basis of huge orders received from Apple for the production of the iPod, iPhone, and iPad product lines. A number of firms in other countries have also risen in the EMS ranks, as Table 3 shows.

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[8] While this risk-taking is a source of lead firms' advantage over suppliers, lead firms often seek to pass on as much financial exposure to suppliers as possible. One such mechanism is 'vendor managed inventory,' where suppliers own the parts until the moment they pass onto the factory floor.

[9] Markets associated with specific industrial settings are sometimes referred to as "vertical markets," including banking, legal and accounting services, airline security, shipping, and so on.

Manufacturing plus product design services are known collectively as original design manufacturing (ODM) services. Most large ODM contract manufacturers are based in Chinese Taipei, with manufacturing now concentrated in China. These firms have historically focused on producing for lead firms in the personal computer (PC) industry. Because manufacturing process technology, especially at the circuit board level, is quite generic, EMS contract manufacturers can aggregate business from lead firms in many electronics subsectors. Design expertise is far less generic, however, which explains why ODM contract manufacturers have historically been confined to the PC industry (Sturgeon and Lee 2005), and more recently, mobile phone handset industries, where design is driven at the component level by platform leaders such as Intel and Qualcomm.

**Table 3. Top-Five Electronics Contract Manufacturers Different Regions, 2013**

| | Primary service | Profit as % of Revenue | Revenue (USD Million) |
|---|---|---|---|
| **Chinese Taipei, China** | | | |
| Foxconn/Hon Hai | EMS | 2.72% | 136,024 |
| Quanta Computer | ODM | 2.17% | 30,300 |
| Pegatron | ODM | 1.50% | 29,867 |
| Compal Electronics | ODM | 0.36% | 23,840 |
| Wistron | ODM | 1.28% | 18,577 |
| **North America** | | | |
| Flextronics (U.S. & Singapore) | EMS | 1.18% | 23,569 |
| Jabil Circuit (U.S. | EMS | 2.79% | 18,337 |
| Sanmina-SCI (U.S.) | EMS | 1.34% | 5,917 |
| Celestica (Canada) | EMS | 2.04% | 5,796 |
| Benchmark Electronics (U.S.) | EMS | 4.43% | 2,506 |
| **Other locations** | | | |
| Cal-Comp Electronics (Thailand & Chinese Taipei) | EMS | 0.44% | 3,982 |
| Shenzen Kaifa Technology (China) | EMS | 1.06% | 2,412 |
| Venture (Singapore) | EMS | 4.57% | 2,330 |
| SIIX (Japan) | EMS | 1.49% | 2,387 |
| Universal Scientific Industrial (China) | EMS | 4.42% | 2,312 |

*Source:* Digitimes (Chinese Taipei, China) and company annual reports
*Note:* EMS = electronic manufacturing services; ODM = original design manufacturing (services)

Despite their differences, both the EMS and ODM contract manufacturing segments have been characterized by rapid growth and geographic expansion, making them key actors in electronics GVCs. For example, contract manufacturers now purchase the bulk of the world's electronic components, albeit on behalf of their lead firm customers. Even with large market shares in specific product segments (for example, ODM contract manufacturers produce more than 90 percent of the world's notebook computers), their market power (and profitability) has generally remained low because they are highly substitutable. In fact, the electronics contract manufacturing sector has long been characterized by intense competition, low profitability, and dramatic consolidation, even as it has experienced rapid growth (see the third column of Table 3).

Whatever the competitive battles and complementarities that have emerged among developed and developing country suppliers, the most important change is that increasing supplier capability is allowing lead firms to implement global production strategies in ways that were unimagined 20 years ago. Sustained efforts by the largest lead firms to expand and consolidate their sourcing networks have helped to create a new class of huge 'global suppliers'. Suppliers that have developed 'full package' capabilities can now provide one-stop shopping for lead firms seeking regional and global supply-chain solutions. This new class of supplier has internalized many of the most difficult and costly aspects of cross-border integration such as logistics, inventory management, and the day-to-day management of factories (Sturgeon and Lester 2004).

**Platform Leaders**

In some industries, such as PCs, mobile phones, and a few industries unrelated to electronics such as bicycles, platform leaders play a crucial role (Galvin and Morkel 2001; Fixson and Park 2008). Platform leaders are companies that have been successful in implanting their technology (in the form of software, hardware, or combination) in the products of other companies (Gawer and Cusumano, 2002). In extreme cases, platform leaders can capture the bulk of industry profits and retain tight control over the innovative trajectory of the industry.

Using the language of Baldwin and Clark (2000), it can be said that Intel, as the dominant platform leader in the PC industry, has the technological capability and market power to unilaterally change the location of key "pinch points" in the GVC. In other words, Intel can decide how to bundle tacit, proprietary design features and where to locate the points in the chain where codified handoffs can occur and open standards can begin. In mobile phones platform leadership is also present, if more diffuse, across companies such as Qualcomm, Nvidia, ARM. Key underlying patents are held by a broad array of companies, most notably Nokia (Finland), Ericsson (Sweden), Qualcomm (USA), Motorola (USA), and NTT DoCoMo (Japan). In most industries, however, system architecture is more completely defined by lead firms, providing them with the market power to select among alternative vendors and capture the lion's share of value created within the chain. Personal computers and mobile phone handsets are important and well-known cases of industries where platform leaders dominate, but it is important to note that such cases are in fact quite unusual.

Very few platform leaders have as yet emerged from the developing world. In the electronics industry a notable exception is MediaTEK, a "fabless" semiconductor design company founded in 1997 in Chinese Taipei. The company has moved along with the market, providing chipsets for reading compact disks (CDs), digital video disks (DVDs), digital video recorders (DVRs), and high-definition televisions (HDTV). Most recently MediaTEK mastered the difficult art of combining fundamentally different design technologies, such as analog and digital signal processing, on the same chip, in what is known in the industry as "system-on-chip" (SOC) technology. Using SOC design capabilities, the company began offering single-chip "platform solutions" with the advantages of lower cost, smaller size, and lower power consumption, while sacrificing, to some degree, the ability to customize platforms in the interest of product variety. Low cost chipsets have played a central role in supporting the development of low-cost phones suitable for the Chinese market (Brandt and Thun, 2010; Imai and Shiu, 2011).

# Part II: The ICT Sector in Vietnam

Information and communication technologies (ICTs) have been a key area of focus in Vietnam for nearly two decades. The Vietnamese government has long recognized that ICTs can drive productivity improvements across the economy and in government services. Therefore, it has undertaken a number of policy initiatives focused on the sector.

Vietnam's hardware sector 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). These firms' investments – largely due to Vietnam's low cost of labor, proximity to regional suppliers and a relatively stable investment climate – have helped to transform the country's industrial landscape in a very short period of time. While the number of software and services firms has grown considerably as well, employment and particularly revenue are only a fraction of hardware manufacturing, and foreign firms are less visible. The software and services sector includes a few large software and IT services firms, a few state-owned telecommunications firms, and many small- and medium-sized software outsourcing and ICT-enabled services firms (often referred to in Vietnam as business process outsourcing

(BPO) or digital content), many with an international orientation in regards to investors, management, and markets.

Notebook computers, mobile phone, software and other ICT-enabled BPO services are now among Vietnam's most important exports. Global lead firms are now among the county's largest employers; Samsung alone employs 75,000 in the country, and is projected to reach 100,000 employees in the coming year. But aside from significant job creation, much of the growth in hardware exports has been hollow from a technological learning and industrial upgrading point of view. Specifically, spillovers based on backward linkages between foreign investors and domestic 'supporting industry' firms remain weak or non-existent. On the services side, Vietnamese software firms have found success both at home and abroad. Companies like TMS Solutions and FPT Software have expanded their base of operations, and are able to deliver services in multiple locations around the world. However, they occupy a relatively low-value niche in the GVC, as they do not have successful products of their own.

As the overview of Vietnam's ICT industry in Table 4 shows, the ICT sector in Vietnam, while modest in scale, has demonstrated growth across a broad range of metrics. From 2009 to 2013, the number of hardware firms increased at an annual rate of 26 percent, employment grew by 24 percent, and revenues soared by 68 percent. Revenue growth was mainly driven by the entry and expansion of foreign investors operating labor-intensive assembly plants. Samsung has been especially important, expanding and shifting away from producing low-end handsets for the domestic market toward higher-end models for export.

What follows is a brief overview of Vietnam's ICT sector, including an exploration of key lead firms, suppliers and other GVC actors operating in the country. The section will also examine key rules and regulations that shape the ICT landscape and help determine the range of opportunities available. We identify several constraints to future growth, including the availability and quality of ICT-related education, effective programs for supporting industries, and support for ICT startups. Our analysis is based on relevant statistics and policy documents as well as a brief period of field research during January 19-30, 2015. We conclude with a set of policy recommendations and forward looking statements aimed at helping Vietnam capture higher value activities in the ICT GVC in the coming decades.

**Table 4. Vietnam ICT Industry Snapshot, 2009-2013**

| Area | Metric | 2009 | 2010 | 2011 | 2012 | 2013 | CAGR 2009-13 |
|------|--------|------|------|------|------|------|------|
| ICT Hardware | Firms | 992 | 1,273 | 2,763 | 2,431 | 2,485 | 26% |
| | Revenue (Million) | $4,627 | $5,631 | $11,326 | $23,015 | $36,762 | 68% |
| | Employment | 121,300 | 127,548 | 167,660 | 208,680 | 284,508 | 24% |
| Software | Firms | 1,756 | 2,958 | 44 | 7,246 | 6,832 | 40% |
| | Revenue (Million) | $850 | $1,064 | $1,172 | $1,208 | $1,361 | 12% |
| | Employment | 64,000 | 71,814 | 78,894 | 80,820 | 88,820 | 9% |
| ICT-enabled Digital Content (BPO) | Firms | 2,844 | 2,312 | 3,289 | 3,883 | 4,498 | 12% |
| | Revenue (Million) | $690 | $934 | $1,165 | $1,235 | $1,407 | 19% |
| | Employment | 41,000 | 50,928 | 60,200 | 63,242 | 67,680 | 13% |
| Total | Firms | 5,592 | 6,543 | 6,096 | 13,560 | 13,815 | 25% |
| | Revenue (Million) | $6,167 | $7,629 | $13,663 | $25,458 | $39,530 | 59% |
| | Employment | 226,300 | 250,290 | 306,754 | 352,742 | 441,008 | 18% |

*Source*: Ministry of Information and Communication (MIC) White Book 2014.
*Notes*: The MIC does not collect data on ICT-enabled services on aggregate

**The ICT Hardware Sector in Vietnam**

Vietnam's ICT hardware sector has grown significantly in the last five years. Once a marginal sector of the economy, the government sought a more central role for ICT goods in the

late 1990s and early 2000s (see below for description of key pieces of legislation). From 2009 to 2013, exports grew at an annual rate of 89 percent, with exports accounting for 80% of ICT hardware production. Export of final ICT goods grew most rapidly, overtaking intermediate goods in 2010. On the import side, final and intermediate goods imports grew at rates of 35 percent and 47 percent from 2009 to 2013. Vietnam's trade deficit in intermediate goods has grown considerably in recent years, reaching $9.8 billion in 2013 (see Table 5), reflecting Vietnam's emerging role in the ICT GVC as a hardware assembly hub. This role is also reflected in soaring final goods exports, which reached $15.7 billion surplus in 2013.

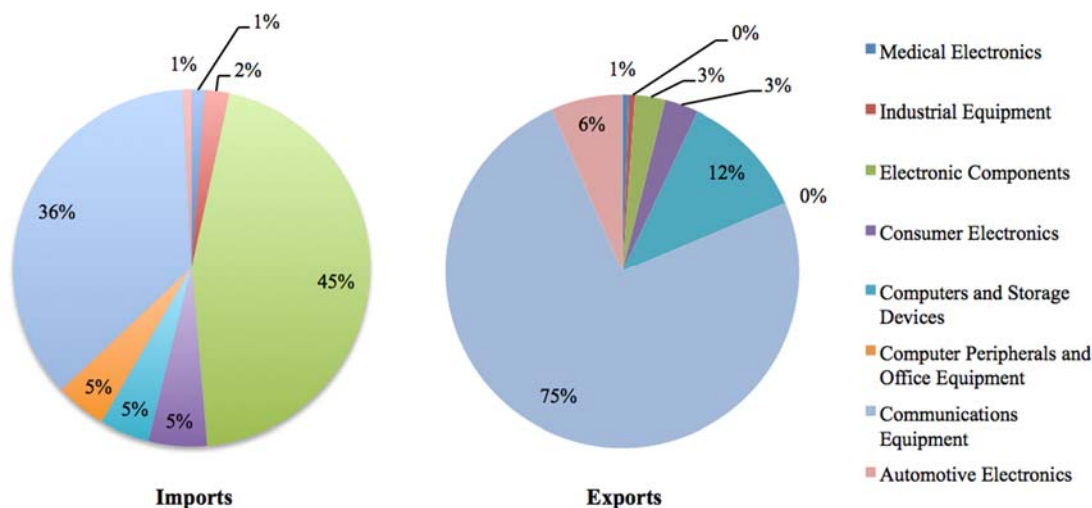**Table 5. Vietnam Hardware Trade Balance, 2009-2013, USD millions**

|  | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| Intermediate Goods | -$1,416 | -$1,230 | -$2,950 | -$6,052 | -$9,839 |
| Final Goods | -$2,262 | -$982 | $2,853 | $8,185 | $15,746 |
| Total | -$3,678 | -$2,211 | -$97 | $2,133 | $5,907 |

*Source:* UN Comtrade

A closer look at the trade statistics reveals that Vietnam's hardware trade is concentrated in a few narrow product groups (See Figure 2). Eighty-one percent of imports are in intermediate electronic components such as integrated circuits and LEDs, while final goods imports are concentrated in communications equipment such the base stations needed for rapid expansion of Vietnam's mobile communications infrastructure (China's Huawei, a leader in low cost mobile telephony infrastructure for developing markets, is a major vendor). Exports are even more concentrated, with 75% of exports in communications equipment, mainly mobile handsets, which account for 88% of communications equipment exports. But Vietnam's ICT hardware exports are even more concentrated than these figures suggest. According to Vietnam's General Statistics Office, Samsung Electronics Vietnam (SEV) is responsible for 98 percent of the country's mobile handset and component exports. Other product groups that are important in Vietnam's ICT goods export basket are computers and storage devices (12 percent ICT hardware exports) and automotive electronics (6 percent). Vietnam is also an important producer and exporter of automotive wire harnesses, with $1.9 million in exports in 2013.

Trade statistics also indicate that Vietnam is well integrated into regional value chains, with most intermediate goods, particularly electronic components, imported from neighboring China, Korea, Singapore, Japan, Chinese Taipei, Hong Kong SAR, China, and Thailand. In fact, 72 percent of intermediate ICT goods come from these seven countries (see Tale 6). While the top ten export destinations show that most final goods are exported to advanced market countries (USA, Europe, and Japan), export destinations are not as concentrated as sources of intermediate goods imports; the top ten destinations account for approximately 60 percent of final ICT goods exports.

**Figure 2. Vietnam Hardware Trade by Sector, 2013**



*Source:* UN Comtrade

**Table 6. Vietnam Top Ten Trading Partners for ICT goods, 2013**

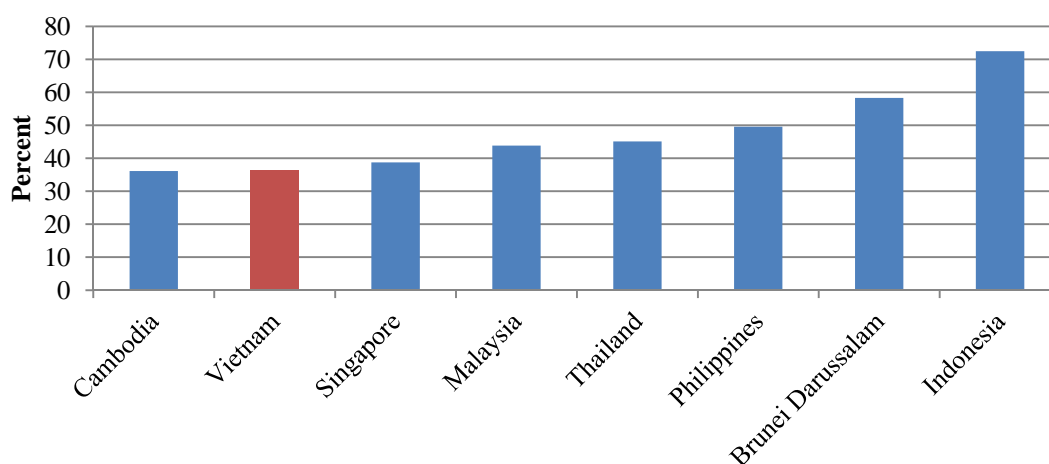| | Final Good Exports | | Intermediate Good Imports | |
|---|---|---|---|---|
| Rank | Country | Value (USD M) | Country | Value (USD M) |
| 1 | United Arab Emirates* | $3,509 | Japan | $1,543 |
| 2 | United States | $1,851 | United States | $513 |
| 3 | Germany | $1,813 | China | $251 |
| 4 | Austria | $1,755 | Korea, Rep. | $172 |
| 5 | United Kingdom | $1,587 | Singapore* | $153 |
| 6 | Italy | $1,106 | Hong Kong SAR, China* | $126 |
| 7 | France | $1,084 | Thailand | $102 |
| 8 | Hong Kong SAR, China* | $1,084 | Canada | $97 |
| 9 | China | $1,060 | Netherlands* | $48 |
| 10 | India | $1,021 | Other Asia (mainly Chinese Taipei) | $42 |
| | Rest of World | $10,407 | Rest of World | $274 |

*Source:* UN Comtrade
* Authors' note: While Singapore does produce and export semiconductors and other intermediate and final ICT goods, a significant proportion of ICT trade for Singapore, the Netherlands, and United Arab Emirates are likely due to re-export.

A large percentage of Vietnam's hardware exports can be linked to foreign investors, and production mainly consists of assembly of imported intermediate inputs, as the case of Samsung illustrates. According to estimates from the OECD-WTO's Trade in Value Added (TiVA) data set,

36% of Vietnam's electronics exports[10] in 2009 were comprised of local value added.[11] Vietnam ranks low relative to its ASEAN counterparts in this regard: next to last among the eight ASEAN countries for which TiVA data are available (See Figure 3). Thus, while Vietnam's ICT hardware export growth in recent years has been impressive; a closer look suggests that it has depended heavily on imported components. In fact, the foreign content of Vietnam's hardware exports has grown relative to domestic content since 1995 (See Figure 4). While TiVA data are only available since 2009, our field research suggests that local content remains a small portion of Vietnam's electronics hardware exports today, and that TiVA estimates exaggerate local value added. The consensus among the respondents interviewed in Vietnam was that FDI has grown markedly since liberalization, but that linkages between foreign investors and local Vietnamese firms remain very weak.

**Figure 3. Electronics Domestic Value Added as a Percentage of Exports, 2009**



*Source:* OECD-WTO TiVA Dataset
*Note:* Myanmar and Lao are not included in the TiVA dataset
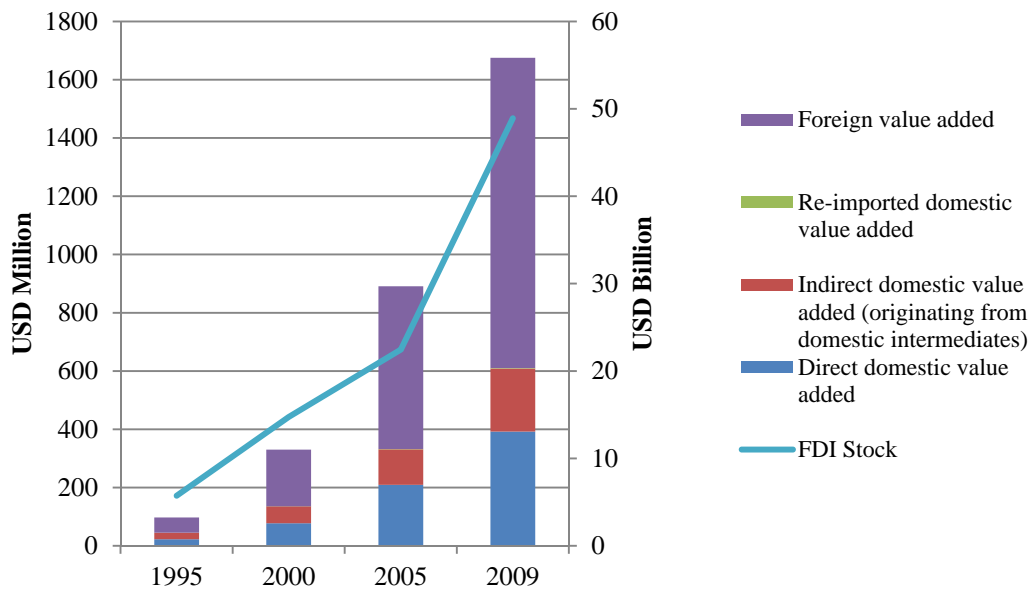
*Global Lead Firms in Vietnam*

A number of global lead firms are directly active in Vietnam, most prominently Samsung, LG, Panasonic, and Nokia (now Microsoft). Samsung is one of the largest foreign investors in Vietnam with $9 billion invested to date, and an additional $3 billion smartphone factory under development. Its existing investments include a smartphone production facility in the northern Bac Ninh province, a smartphone and tablet display assembly facility, an electromechanical assembly operation for camera modules, and the Samsung Vietnam Mobile R&D Center. The Bac Ninh

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[10] The TiVA data set defines industries using the International Standard Industrial Classification (ISIC) system, revision 3. The electronics category is titled "electronics and optical equipment" and includes manufacturing codes for office, accounting and computing machinery; electrical machinery and apparatus; radio, television and communication equipment and apparatus; and medical, precision and optical instruments, watches and clocks. Thus, the definition of the electronics industry used by TiVA differs from the definition we are using for the UN Comtrade data presented above. The two data sources have not been harmonized, and therefore should not be compared directly.

[11] "Trade in value-added describes a statistical approach used to estimate the source(s) of value (by country and industry) that is added in producing goods and services for export (and import)." For more information, see http://www.oecd.org/sti/ind/TIVA_FAQ_Final.pdf.

facility is the largest smartphone factory in the world, producing 120 million units per year.[12] The new smartphone production facility will be set up in the Saigon Ho-Tech Park just outside Ho Chi Minh City. Samsung currently employs 75,000 production workers and software engineers, hiring an average of 2,000 people a week for its production facilities. The company will reach 100,000 employees in Vietnam by the end of the year. Vietnam is now responsible for 1/3 of Samsung's global output.

**Figure 4. Vietnam's Electronics Exports and Inward FDI, 1995-2009**



*Source:* OECD-WTO TiVA Dataset; UNCTAD FDI Database

Samsung relies heavily on Korean suppliers that have co-located in Vietnam to produce intermediate inputs. Of the company's 67 suppliers in the country, only four are Vietnamese. They include Goldsun Packaging and Printing JSC (corrugated paper packaging materials), the Thang Long Packaging Production Export–Import JSC (thin-film packaging), Viet Hung Packaging Company Ltd (corrugated paper packaging) and Nam A Company Ltd (packaging). The prominence of packing companies mentioned here is no accident. Packaging is one of the lowest value added inputs to any manufacturing operation. Fifty-three of Samsung's suppliers are from Korea, seven are from Japan, one is from Malaysia, one is from Singapore and one is from the United Kingdom.[13] Thus, while the TiVA data states that 37 percent of the value of production for export is domestic, most of that accrues to global suppliers in Vietnam, with Vietnamese suppliers making up a negligible portion of total local content.

Efforts to increase local content by local firms have largely failed. Last year, the Ministry of Industry and Trade announced that Samsung would source 91 parts for the Galaxy S4 and 53 parts for tablets from local suppliers. Targeted components included relatively simple parts: batteries, earphones, USB storage devices, insulation tape and parts of data transmission cables among others. Samsung held a workshop with the Vietnamese government and 200 local firms to

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[12] Bloomberg News article available from http://www.bloomberg.com/news/2012-11-07/vietnam-luring-tech-companies-narrows-trade-gap-southeast-asia.html.

[13] Details on Saumsung's supplier network in Vietnam in Viet Nam News:
http://vietnamnews.vn/economy/261534/samsung-chooses-few-vietnamese-suppliers.html and
http://vietnamnews.vn/economy/264165/local-firms-to-make-144-samsung-components.html.

see which of these components could be sourced locally. Samsung presented its purchasing policy for different components and had individual meetings with interested potential suppliers. Given that the phones and tablets being produced in Vietnam are in Samsung's high-end range, parts are complex and quality requirements are high (for example, phone cases are now made of precision-machined aluminum, not plastic). None of the 200 local firms was able to meet Samsung's requirements. Samsung next step will be to organize a workshop in which its tier 1 suppliers can meet with local firms to see if they can integrate them at a lower level in the supply chain. Interviews with various firms suggest that government efforts to create a support industry have been ineffective, and that they have been forced to develop the local supply base on their own.

A new player in the handset market, Microsoft recently acquired Nokia's Lumia smartphone factory in Bac Ninh (11,000 employees). Assembly of Nokia's smartphones was moved from China due to rising labor costs, and is now concentrated in Vietnam, Brazil and Mexico. Vietnam is now Microsoft's second largest employment base after the US. There are only a few local suppliers, but a company manager interviewed for this study expected the support industry to grow as more lead firms enter the country. Other global lead firms with investments in Vietnam include LG and Panasonic, which have set up a number of production facilities in the north to manufacture white goods (e.g. refrigerators, washing machines and air conditioners). Many of these products are heavy and difficult to transport, and are thus produced mainly for sale in the domestic market.

*Local Lead Firms in Vietnam*

As has been discussed, lead firms coordinate GVCs, and tend to earn the lion's share of profits through the sale of branded products and systems to end-users. In the ICT sector, they are often diversified in terms of the market segments they serve, and are highly recognizable due to their global branding efforts (See Table 3). Because of their technological leadership and large investments in brand development, they are able to exert power over all but a few of their suppliers through their purchasing practices (Sturgeon and Kawakami, 2011). The costs and time associated with launching a successful product brand as well as the competition from established global firms limits the ability of developing country firms to compete at this level of the GVC. Even so, there are some Vietnamese lead firms leveraging the global supply base to develop and commercialize their products.

One such firm is BKAV, a company started by three students at the Hanoi University of Technology in 1995. The founders saw antivirus software as an emerging area of need in the market, and believed that Vietnam had the capacity to build an effective solution locally. They licensed their antivirus software for free until 2006, when they developed and began to distribute a commercial version. Around the same time, they started developing general software solutions for e-government. Since they lack both the relationships with government and the scale necessary to offer them solutions, they mostly serve government at the provincial and municipal levels. As soon as the antivirus product began to sell (they now have 17 million users in the country), the company began to push revenues into their budding hardware area.

They now offer 60 hardware products and employ 500 hardware and software engineers for R&D. Their core products include the BKAV Smarthome (home security) and BKAV Smartphone. The Smartphone took four years and $20 million to develop. During that time, they found suppliers worldwide and adapted the Android operating system to their needs. They source their chipsets from Qualcomm, which introduced them to other international suppliers for PCBs, batteries, camera modules and other key components. While BKAV does paint, do some basic CNC work and make plastic molds in house, most inputs come from a set of nearly 100 global suppliers. BKAV has grown considerably in the last 10 years, now employing 1,500 people in Vietnam and opening offices overseas. It will be moving into a new 23 million sq. ft. headquarters building in the Hoa Lac Hi-Tech Park, outside Hanoi, soon.

Another local lead hardware firm is Tosy, a humanoid robot manufacturer that has been successful worldwide, garnering awards in consumer electronics and toy exhibitions around the world and selling its products in over 60 countries. Finally, Dinhviso has successfully scaled from entrepreneurial startup focused on digital GPS product development to a maker of its own brand of hardware 'black boxes' that can be mounted to taxis and motorbikes to track their location, and retrieve them in case of theft. While it is difficult for developing country firms to lead value chains, access to the global supply base as well as to existing platforms allows small lead firms to bootstrap and grow more quickly than if they developed all tools and components internally.

*Contract Manufacturers in Vietnam*

Some lead firms like HP and Apple produce in Vietnam indirectly through contract manufacturers. In fact, it is becoming unusual for lead firms making high-volume consumer electronics to do all of their own final assembly, Samsung and Microsoft being notable exceptions. The modular nature of ICT goods and services has allowed lead firms to delegate an increasing range of functions to contract manufacturers, including the two types described earlier: Electronics Manufacturing Services (EMS) firms, which provide manufacturing and ancillary services, and Original Design Manufacturers (ODMs), which provide manufacturing plus non-strategic (iterative) product design services. Given Vietnam's emerging role as a low-cost manufacturing hub, the number of global contract manufacturers settling in the country will likely rise in the future.

Jabil Circuit (USA) set up its 273,00 square foot facility in the Saigon Hi-Tech Park just outside Ho Chi Minh City in 2007, and uses it for medium- to high-volume manufacturing of industrial, energy and health care goods. The facility has traditionally depended heavily on Hewlett Packard, for whom it dedicates 70,000 square feet for the production of one million inkjet printers per year. But company documents suggest that Jabil has diversified its client base since entering the country. Jabil, much like other contract manufacturers, will often make new investments if it has at least one anchor client on board. Once the initial investment has been made, the firm begins to seek out new clients to fill capacity.

Other notable contract manufacturers in the country include Hon Hai Precision Industry (Chinese Taipei), also known as Foxconn. The company established two $80 million production facilities in 2007, one in the Bac Ninh Province and the other in the Bac Giang Province. These facilities focused on the production of digital camera modules, computer motherboards and cable connectors. While Foxconn made written commitments to establish plants in another four cities and provinces when it first signed an agreement with the Ministry of Planning and Investment in 2007, many of these factories have not yet been built. Compal (ODM) invested $500 million in a laptop production facility in 2007. However, the factory, which started production in 2010, is still underutilized. Despite the delays and difficulties, Foxconn and Compal are likely to remain important players in Vietnam's ICT industry for years to come given the country's growing importance as a low-cost manufacturing hub.

It is important to note that contract manufacturers provide certain advantages for policy makers. First, they work for a range of end customers, while the "captive" operations of a lead firm such as Samsung work only for the parent company. Working for a diverse set of customers requires additional competencies (materials management, design, frequent line changes), accelerates learning, and opens the possibility that local lead firms can take advantage of world class manufacturing services nearby. Contract manufacturers can also provide a conduit for the local assembly of final products that may have otherwise been imported. As such, the contract manufacturers operating in Vietnam, now and in the future, constitute a valuable resource for policy makers: world class manufacturing services for hire.

*Platform Leaders in Vietnam*

Platform leaders are companies that have been successful in implanting their technology (in the form of software, hardware, or combination) in the products of other companies (Gawer and Cusumano, 2002). One of the most powerful platform leaders in the global ICT industry, Intel, was one of the first electronics firms to invest in Vietnam. Intel first announced that it would be investing $300 million in an assembly and testing facility in Vietnam in January of 2006. Within ten months, the estimated figure had risen to $1 billion. Intel received significant investment incentives from the beginning, including a four-year corporate tax holiday followed by a nine-year period paying 50% of the country's 28% corporate tax rate (Atkinson and Ezell 2012). The facility has been operational since 2010, and is still the company's largest assembly and testing operation outside the US. The plant assembles two of Intel's core products; the system on chip (SOC) for tablets and smartphones and the Haswell CPU, the fourth generation Intel Core Processor. While the plant is packaging cutting-edge chips for the global market, linkages to local suppliers remain weak. When the facility came online in 2010, Intel had only three Vietnamese suppliers. Today, that number is up to 16, and Intel hopes to reach higher levels of local content in the future, although the quality of local suppliers remains too low for sourcing of core inputs.[14] It is unclear whether or not the company has a supplier upgrading program in place.

## The ICT Services and ICT-Enabled Services Sectors in Vietnam

Almost all of the defining features of services: that they are non-tradable, non-storable, customized, and insensitive to price competition are changing in ways that enable and motivate international sourcing. Task fragmentation and trade in services is burgeoning, both domestically and internationally. Services have become the focus of intense international competition and dynamic innovation. With standardization, commodification, and increasing scale, labor inputs to services have become more sensitive to costs, providing enterprises with the motivation to take advantage of the new domestic and international sourcing options for a wide range of services and business functions, including software coding, "back office" administrative tasks, sales, customer service, and even elements of R&D.

While ICT services (software and enterprise computing) and ICT-enabled services (BPO and digital content) are promising sources of growth and competitiveness for Vietnam, detailed, internationally comparable statistics on these ICT sub-sectors are not readily available. There is no harmonized and internationally agreed upon definition of what constitutes ICT-enabled services, nor does the Vietnamese government collect systematic data on this segment of the ICT sector. As a result, available data on ICT services in Vietnam vary by source. The Government Statistical Office (GSO), the Ministry of Information and Communication (MIC), and key industry associations offer different figures for number of firms, revenue, and employment. An executive at a software outsourcing firm interviewed for this study claimed that none of these data sources was accurate. Data-related issues will be discussed at greater length in the section on policy recommendations.

Nevertheless, from the disparate data sources available, we can surmise that Vietnam's role in these segments of the ICT sector has expanded considerably. According to the Vietnam Software Association (VINASA), which publishes data from the MIC and other sources, the software sector generated $2.7 billion from software and IT services in 2013; $1.3 billion from software and $1.4 billion from digital content.[15] Employment stood at 88,820 in software and 67,680 in digital

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[14] See Tuoi Tre News article for details http://tuoitrenews.vn/business/21324/80-of-worlds-computer-chips-will-be-made-by-intel-vietnam-by-2015-ceo.

[15] VINASA counts on 240 member companies that account for 70% of Vietnam's software production and 60% of its software workforce. Data available from http://goglobal.jisa.or.jp/Portals/0/data/library/20120718_000042/VINASA_Vietnam.pdf.
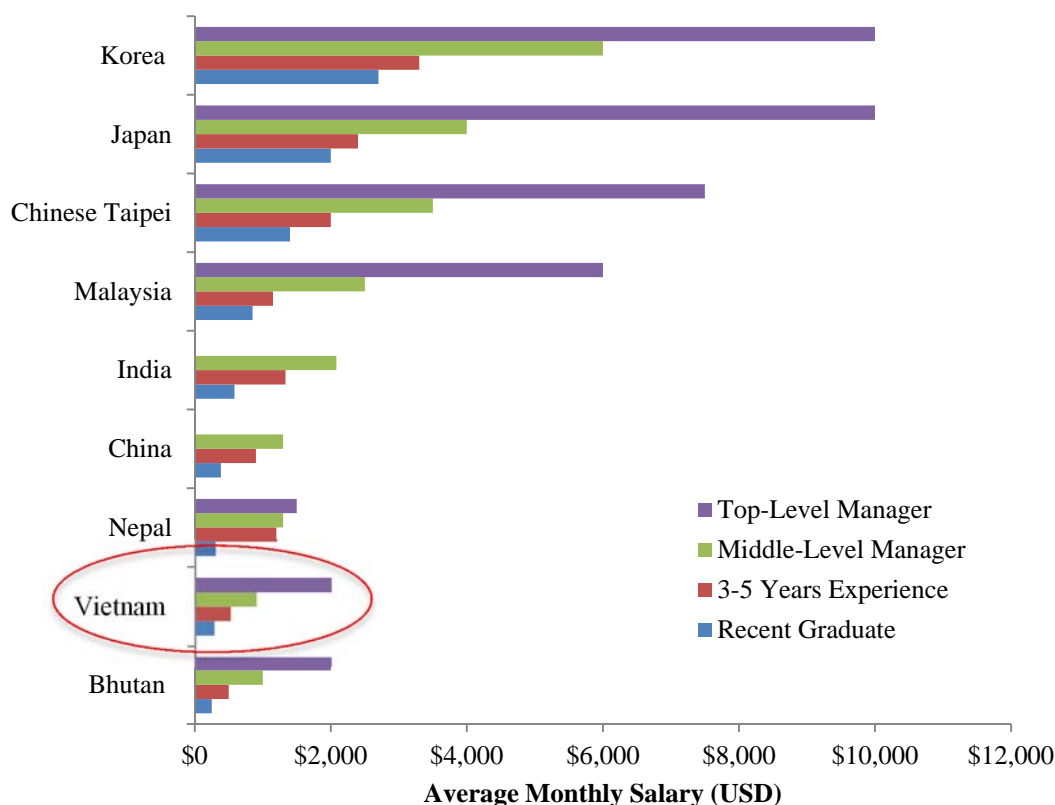
content.  Data on software and services trade are not collected systematically. However, as the data in Table 7 suggest, revenue from exports has grown more rapidly than revenue from domestic sales. Exports made up just 29 percent of total revenues in 2005, but grew to 43 percent by 2010.   On an annual average basis, software exports grew at 45% per year, while domestic sales grew by 28% per year. VINASA representatives estimate that software exports in 2014 amounted to about $500 million.[16]

**Table 7. Vietnam Software Industry and Export Revenue, 2005-2010**

| Year | Domestic Revenue | | Export Revenue | | Total Revenue |
|---|---|---|---|---|---|
| | Value (USD Million) | Share of total revenue % | Value (USD Million) | Share of total revenue % | Value (USD Million) |
| 2005 | $169 | 72% | $68 | 29% | $236 |
| 2006 | $219 | 68% | $101 | 31% | $321 |
| 2007 | $285 | 66% | $147 | 34% | $432 |
| 2008* | $371 | 64% | $213 | 36% | $584 |
| 2009* | $463 | 60% | $309 | 40% | $772 |
| 2010* | $579 | 57% | $432 | 43% | $1,011 |
| Annual growth | 28% | | 45% | | 34% |

*Source*: Jang, Lee and Ko, 2010; data/forecasts from Ho Chi Minh City Computer Association * Projections.

**Table 8.  Average Monthly Salary for Software Engineers (USD), by Country 2012**



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[16] According to one software outsourcing executive, when VINASA was asked from whence its export statistics came, it indicated the Ho Chi Minh City Computer Association (HCA). When HCA was asked the same question, it said the export data came from VINASA.

An important reason for Vietnam's growing exports is its cost advantage over competitors in the region. As Table 8 indicates, Vietnam's workforce is far less expensive than China's or India's. Entry-level computer programmers in Vietnam earn just 54% of what their Chinese counterparts make, and 36% of what entry-level Indian programmers make. According to data collected by the MIC, ICT workers in Vietnam have a lower attrition rate (5-7%) than workers in China (10-30%) and India (50%). In 2014, Vietnam surpassed India to become the second largest exporter of software services to Japan (China is still the largest).[17] While Vietnam will not compete on cost forever, human capital will be important in supporting upgrading efforts in the ICT services sector in the near term.

Cost competitive wages have driven growth in industry segments like software outsourcing and BPO. Software outsourcing is generally less capital-intensive than hardware manufacturing, creating opportunities for domestic firms to enter the market and grow quickly. Most of the larger software outsourcing firms in Vietnam are local firms serving the global market. Generally, these firms have their production sites in Vietnam and small sales and marketing presences in key markets around the world, especially the USA and Japan. Interviews with BPO firms confirm that Vietnam has attracted a great deal of work that was previously done in places like China, India and Eastern Europe. However, this niche is primarily occupied by foreign firms taking advantage of Vietnam's cheap labor. Upgrading opportunities in the BPO space remain limited given the low complexity of the work and limited availability of skilled personnel necessary to shift into higher value added ICT-enabled services, sometimes referred to as knowledge-intensive business services (KIBS).

*Highlighting four types of ICT Services firms in Vietnam*

While large, multinational firms dominate the hardware manufacturing industry in the country, Vietnam's ICT services and ICT-enabled services sector includes a wide range of firms. As Figure 5 shows, ICT firms in Vietnam typically fall into one of four categories: 1) state-oriented firms focused on the local market, 2) locally-owned firms focused on the export market, 3) foreign-owned firms and consultants focused on the local market and 4) foreign-owned firms focused on the export market. Finally, there are a number of small but growing entrepreneurial firms developing products for the local, regional and global markets. We will discuss some illustrative cases in the pages that follow. See Table 9 for a list of the top 15 IT services and ICT-enabled services firms in Vietnam.

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[17] Viet Nam News article available from http://vietnamnews.vn/economy/245585/viet-nam-climbs-it-software-exports-ladder.html.

**Figure 5. Four types of IT services firms in Vietnam by ownership and market orientation**

|  | Local market (65% of output) | Export market (35% of output) |
|---|---|---|
| Locally owned | **Type 1: state-oriented**<br>Dominated by a few medium- to large-sized local IT services firms that are state-owned or formerly state-owned, with residual connections to government (e.g. FPT, CMC). These firms generally sell customized solutions based on global platform software from firms like Microsoft and SAP. | **Type 2: local SME exporters**<br>Many small- to medium-sized locally-owned software development firms producing for export, several with connections to Overseas Vietnamese (e.g. TMA Solutions, KMS Technology). |
| Foreign owned | **Type 3: Global IT Services Firms**<br>Many medium- t large-sized MNC IT services and system integration firms, the only firms qualified for large systems, often with onsite consultants for support, customization and maintenance (e.g. IBM). Some of these firms also sell customized solutions based on global platform software. The main clients are other MNCs operating in Vietnam (e.g., banks). | **Type 4: MNE exporters**<br>A few MNC branch operations providing software development and ICT-enabled series (digital content and BPO) for export (e.g. Harvey Nash, Robert Bosch). Some of this work is for to external clients and some is for parent companies (captive operations). |

*Source*: VINASA (export shares), authors

**Table 9. Top 15 ICT services and ICT-enabled services firms in Vietnam, 2013**

| Rank | Company Name | HQ | Main Markets | Emp. | Revenue (USD Million) | Key Competences | Type |
|---|---|---|---|---|---|---|---|
| 1 | Joint Stock Company for Telecoms and Informatics | Vietnam | Vietnam | 502 | $168 | Software Application Development, Renting Telecommunications Infrastructure, IT Consulting | 1 |
| 2 | FPT Software Company | Vietnam | Japan, US, EU, Vietnam | 6,000 | $101 | BPO, Cloud Computing, Mobility, IC Design | 1 |
| 3 | FPT Information System | Vietnam | Vietnam | 5,000 | $34 | Enterprise Resource Planning, E-Government | 1 |
| 4 | TMA Solutions | Vietnam | US, Canada, EU, Australia, Japan | 1,700 | $27 | Cloud Computing, Big Data & Analytics, Mobile | 2 |
| 5 | HiPT Group | Vietnam | Vietnam | 262 | $25 | Systems Integration, Software Development, IT Equipment | 1 |
| 6 | Harvey Nash | United Kingdom | US, UK, EU, Vietnam | 945 | $20 | Software Development, BPO | 3 |
| 7 | Elcom Corp | Vietnam | Vietnam | 335 | $20 | Software Development, R&D, Systems Integration | 1 |
| 8 | Tinhvan Technologies | Vietnam | Vietnam | 363 | $14 | Software Development, Digital Content, IT Consulting | 1 |
| 9 | Global Cybersoft (Hitachi Consulting) | United States | US, Japan, EU, Vietnam | 850 | $12 | Enterprise Application Integration, Testing, Software Development | 3 |
| 10 | KMS Technology | Vietnam | US | 459 | $9 | Product Development, Software Testing | 2 |
| 11 | MK Smart | Vietnam | Vietnam, Japan, Southern Africa, Latin America | 409 | $8 | Card Printing, Payment Card Security, Automatic Payment | 2 |
| 12 | NTT Data | Japan | Japan, Vietnam | 190 | $8 | Software Development, IT Consulting, Manufacturing and Logistics | 4 |
| 13 | Technology and Media Investment Development | Vietnam | Vietnam | 90 | $6 | BPO, Cloud Computing | 1 |
| 14 | SPi | Philippines | US, EU | 800 | $4 | Digitization Services, Content Solutions | 4 |
| 15 | Fuji Computer Network | Japan | Japan | 350 | $4 | Software Development, Systems Integration, Computer Aided Design | 4 |

*Source*: VINASA 30 Leading IT Companies 2014

*Type 1: Locally-Owned IT Services Firms Producing for the Local Market*

The Financing and Promoting Technology Corporation (FPT) is one of the largest and most important formerly state-owned enterprises (SOEs) in the country. In 2003, the government restructured the organization, dividing it into three nominally independent firms: FPT Information System Company (a state owned systems-integrator and software developer), FPT Distribution (the firm which owned the master distribution contracts with IBM, HP, Cisco, Microsoft, Oracle and other large firms), and FPT Internet (controlled Internet activities in both Hanoi and Ho Chi Minh

City) (Phan 2008). [18] Today, some of its most important divisions include FPT Information Systems, which employs 5,000 people and provides 40% of the government's outsourced IT services; FPT Retail, which is comprised of 200 stores in Vietnam, Cambodia and Laos; and FPT Telecom, which provides two million customers with fixed line internet. The FPT Information System Company is focused primarily on serving the local market, especially the public sector.

In 2013 alone, the company was granted contracts to implement treasury and budget management information systems for the Ministry of Finance, to manage the personal income tax system for the General Department of Taxation (GDT), and to provide and implement an ERP system for Vietnam National Petroleum Corporation (Petrolimex). In 2014, the Vietnam Railway Corporation agreed to lease its new e-ticketing system from FPT IS, the intelligent transportation system (ITS) solution, and it has recently begun implementation. Other government agencies and SOEs that have relied on FPT for the Enterprise Resource Planning (ERP) systems include: the Sai Gon Paper Corporation, Vinamilk and the Cables and Telecommunication Materials Corporation (SACOM), among others. Other local firms that work primarily for local clients include the Joint Stock Company for Telecoms and Informatics (CT-IN), the HiPT Group Joint Stock Company and CMC Software Solution. These companies provide government ministries, telecommunications SOEs and foreign embassies with products that range from tailored enterprise resource planning (ERP) solutions to call center services. These firms typically adapt products from global platform leaders such as IBM, Microsoft, Oracle and SAP to meet the specific needs of their Vietnamese customers, a practice typical in the ICT services sector.

*Type 2: Locally-Owned ICT Services Firms Producing for the Export Market*

Because it serves export markets and has established itself and an MNC, FPT Software spans firm types 1 and 2 in Figure 5. It has expanded to 17 countries including Japan, the United States, Germany, France, Australia and Singapore. It has 300 Vietnamese employees based in Japan and another 30 Japanese employees in Vietnam. Much of this work was initially for Hitachi, which FTP has had a relationship with for 10 years. Initially, the firm was doing basic coding and testing in Vietnam. Over time, it captured higher value segments of the GVC, namely software engineering and architecture. Operating as a global supplier, FPT Software recently set up an outsourcing hub in Myanmar to service 40 of its largest Japanese clients. As a director of Quang Trung Software City indicated in an interview, switching costs in the software outsourcing niche are higher than one might imagine. This, along with the tendency of Japanese lead firms to form long-term relationships with suppliers, helps to explain the progression of FPT Software's capabilities and operations for Japanese customers.

Another leading domestic Vietnamese ICT services firm is TMA Solutions, a private firm started by six engineers in 1997. It expanded abroad in the ensuing years, opening sales offices in Canada, the US, Australia and Ireland. All of TMA's work in the early days was in telecommunications software (mostly for Nortel). With Nortel's bankruptcy six years ago, business fell by 50% and they started to diversify into finance, health care, logistics, education and e-commerce software services. Their core sectors are now telecommunications (700 employees), finance and insurance (150 employees) and e-commerce (250 employees). Furthermore, they recently established an R&D center in Vietnam's most important software development zone, Quang Trung Software City. The aim of this 30-person team is to develop TMA-branded products to commercialize overseas. One product they are working on with a partner in Australia is a software solution to reduce human genome mapping time from several days to about 40 minutes. While software outsourcing remains TMA's main line of business and source of revenue, the company, and others like it in Vietnam, has staged efforts to develop proprietary products with very limited success. It is evident that upgrading from software outsourcing to own-product development

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[18] The government retains a small share in the company.

is difficult due to the lack of Vietnamese management, sales and marketing professionals capable of sowing confidence in potential customers and investors.

  The case of KMS Technologies further illustrates these issues. Much like FPT Software and TMA Solutions, the company's main line of business is software outsourcing. The company generally provides software architecture, design, development and testing services for clients. The work is highly collaborative, with daily virtual meetings and 2-3 month-long trips by software engineers to the US to meet with clients at their facilities. KMS has developed only a few of its own products in the last two and a half years. Its 15-person R&D group has been separated from KMS to avoid conflicts of interest with outsourcing clients. One of their spinoffs is QASymphony.com, a company that licenses a software testing tool. QA now has a US-based executive team and has raised $2.5 million in investment capital. KMS also spun off SuperBrightyStudio, a gaming studio developing games for the domestic and regional markets. Their game studio has put out one game called WiTurn, which has become popular in Vietnam and China. The company is now analyzing how to monetize its base of 600,000 subscribers. Company executives indicate that upgrading from software outsourcing to product development is complex for the aforementioned reasons, and hindered by limited access to risk capital. Management indicated that having an international management team and access to capital abroad are keys to success.

*Type 3: Global IT Services Firms Producing for the Local Market*

  There are not many global IT services firms serving the local Vietnamese market. This is because serving the public sector requires strong links to government and the local private sector is not mature enough to require direct investment by multinational service providers. However, IBM is an illustrative exception. IBM returned to Vietnam in 1994 with offices in Hanoi and Ho Chi Minh City. It focuses on the public sector as well as banking and telecommunications and has set up a number of industry-specific centers in the country, including: a Banking Center of Excellence, a Cloud Computing Center, and a Global Delivery Center in Hanoi and Ho Chi Minh City. Another example is Microsoft, which has a small software operation (140 employees evenly split between Hanoi and Ho Chi Minh City) that provides support to local clients. The team includes a 10-person group of engineers that help developers use the MS enterprise platform, Azure. Software piracy is an issue in Vietnam. To combat this, Microsoft runs a program that provides 800,000 students and teachers with free access to cloud-based software (Office), in the hopes that they will buy the software once they are working in companies, or starting firms of their own.

*Type 4: Foreign-Owned ICT Services Firms Producing for Export*

  Foreign-owned ICT services firms producing for export are typically multinational affiliates using Vietnam as a base to provide software outsourcing and ICT-enabled (BPO etc.) services to clients around the world. For these firms, cost of labor is a key driver of investment and expansion. SPi is a Philippines-based content solutions BPO company with approximately 20,000 employees in countries around the world. Their Vietnam branch employs 800 people to provide global clients with non-voice BPO services for the publishing, health care, and entertainment industries. Specific services include PDF conversion of previously published materials, creation of eBooks, and the generation and enhancement of digital content (e.g., to make content searchable). The company also earns approximately 40% of its revenues from contracts with the post offices of The Netherlands and the UK to provide real time entry of data collected from images of scanned packages, letters, and postcards. The Vietnam branch has 500 clients, all of which are foreign.

  Similar to SPi, Digi-Texx was started in Vietnam in 2003 with German capital. It began by offering library indexing services to European libraries, and has since expanded its range of services to include invoice processing, eBook development, scanning services, software development and IT solutions, and image processing. While most of their work is for export (90%), they are

developing local clients. For example, they process personal loan applications for local branches of international banks. They are able to process small motorbike loans in 30-60 minutes, enabling motorbike salespersons to offer potential customers financing on the spot. According to one business development executive, the BPO market in Vietnam is small relative to other sectors, such as outsourced software.

Harvey Nash is a UK-based executive search, professional recruitment, and IT outsourcing company with 7,000 employees in 43 offices worldwide. It began operating in Vietnam in 2000 and now has 1,000 employees. Vietnam is Harvey Nash's only low cost production platform. The local office focuses on software services, including application development, mobile application services, product development and support, migration and transformation, embedded technology, testing Q&A services, and support and maintenance and BPO services, including data processing, call center services, and recruitment. Other foreign firms exporting software and services to clients around the world include Hitachi Consulting Services (US; formerly Global Cybersoft), Fuji Computer Network (Japan) and Luvina Coftware (Japan).

While opportunities for upgrading remain limited in ICT-enabled services, the BPO firms interviewed for this project have demonstrated that opportunities do exist. For example, SPi began by offering simple digitization services, but has since begun hiring people with Chinese, Korean, Japanese, Dutch, and German language skills, increasing the range of markets they can reach with more complex service offerings. Digi-Texx has developed its own software tools to help their employees process handwritten documents quickly and efficiently. The local Vietnamese market for BPO services has not yet developed. Companies interviewed indicate that they are able to offer quality services to multinational clients abroad, but that such services are not yet in demand locally. These multinational firms may also face difficulties breaking into the local market given their limited access to government.

*Entrepreneurial ICT Services Firms in Vietnam*

Despite the difficulties associated with establishing an ICT startup in Vietnam, a number of entrepreneurs have found success in the local, regional and even global markets. Mobivi is an innovative firm started by a successful overseas Vietnamese entrepreneur who returned to Vietnam to start a mobile payment platform similar to the successful Kenyan product called M-Pesa. In 2011, the company pivoted away from mobile money, given the low margins and opacity of the Vietnamese banking sector. Instead it developed iCare, an employee benefits program for factory workers in Vietnam. It allows factory workers making between $200 and $250 a month to buy consumer products (i.e. refrigerators, mobile phones, TVs) on an interest-free installment plan. Mobivi generates revenue by selling products at retail prices and buying at wholesale (20-30% margin). The service has been successful in Vietnam, and is now being rolled out in Laos, Cambodia, Indonesia and India. The company uses existing local e-commerce firms, local distributors and existing ERP tools to provide, sell and deliver products to an underserved segment of the Vietnamese population.

Another example is VNG, which began in game development and recently shifted into social networking, and Appota, which began 10 years ago by licensing games from China and has now created its own mobile platform for digital content. While there is no shortage of success stories, these cases read more like anomalies than products of a carefully calibrated startup ecosystem. Sources with knowledge of Vietnam's startup ecosystem claim that the technical talent exists, but that managerial skills are difficult to find. Furthermore, venture capital firms like IDG Ventures (US) and Cyber Agent Ventures (Japan) are active in the country, but the VC network is not robust enough to support the volume of activity in the country. Exit strategies in Vietnam are limited to larger venture capital firms or IPO abroad. The only ICT firms listed on the Vietnamese stock market are large SOEs. The need to improve Vietnam's entrepreneurship ecosystem will be discussed in greater depth in the section on policy recommendations.

## Vietnam's Institutional Framework for the ICT Sector

The policy choices made by the Vietnamese government in recent years have had profound effects on the country's industrial structure. In the 1990s, most industrial output came from either state-owned enterprises (SOEs) or foreign firms. The Enterprise Laws of 2000 and 2005 facilitated the development of many new private businesses. Furthermore, WTO accession and greater regional integration forced the government to withdraw some support from SOEs. More than 160,000 new domestic firms were established between 2000 and 2005. During these same years, SOE industrial output shrank as a percentage of total industrial output, from 32% in 2000 to 18% in 2005 (Perkins and Anh 2010). FDI remained relatively stable during this period. Domestic private firms grew despite continued difficulties associated with access to capital and land. While SOEs and private enterprises are now nominally on equal legal footing, various sources indicate that private firms are still at a considerable disadvantage when it comes to access to land, capital, and government contracts.

What follows below is a brief discussion and assessment of the key institutional features that affect the development of the country's ICT sector. While the space for industrial policy has shrunk in recent years due to WTO accession and regional agreements, the government continues to influence the trajectory of ICT development in a number of ways. The Investment Law (2005) has helped to attract new foreign investors, many of whom have fueled the tremendous growth in electronics exports in recent years. The Law on High Technologies (2008) uses fiscal incentives to drive innovation in ICT and a number of other advanced technology areas. Finally, the government has focused a great deal on supporting the development of ICT services and ICT-enabled services, beginning with the first national five-year ICT plan (1993) and the first resolution on the development of the software industry (2000), and continuing today with efforts to increase public sector outsourcing of ICT services. While Vietnam has made significant advances in recent years, there are still real barriers to local development. These constraints will be addressed by the policy recommendations towards the end of this paper.

### Law on Investment

Vietnam's inward stock of FDI reached $22.4 billion in 2013. Japan is the largest investor in the country, with $8.4 billion invested as of 2012. Other large investors include Korea ($5.8 billion), Malaysia ($2.8 billion) and Singapore ($2.6 billion).[19] While foreign firms have been active in Vietnam for quite some time, regulatory clarity, attractive incentives and the establishment of various economic zones, industrial zones, high-tech zones, and export processing zones have accelerated the rate of investment in the last ten years. The Law on Investment has been an important driver of foreign activity in Vietnam since it was passed in 2005. Incentives for new investors include import duty exemptions for equipment, materials, means of transportation, reduction in corporate tax, an exemption from tax on technology transfer activities, the ability to carry losses for up to five years for tax purposes, accelerated depreciation of fixed assets, and preferential access to and tax reduction on land. A government decree passed in 2006 defined key areas eligible for investment incentives. These areas include biotechnology, advanced manufacturing, ICT, agriculture, labor-intensive factories, infrastructure development and social services, among others. The law outlines investor rights and obligations, and reinforces the notion that investments and intellectual property are protected from expropriation and theft. It defines economic zones, industrial zones, high-tech zones and export processing zones, and outlines investment procedures for companies wishing to invest in one of these areas.

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[19] Data come from UNCTAD Bilateral FDI Statistics. Data from Korea were last updated in 2010. As of this year, Korea passed Japan as the largest investor in Vietnam.

**Law on High Technologies**

The Law on High Technologies was passed in 2008 with the expressed aim of driving industrial development in a range of areas, including biotechnology, automation, materials and information technologies. Although it has been marginally effective to date, the law remains one of the few policy instruments aimed at accelerating the process of local technological upgrading. Companies that manufacture high-tech products and have a presence in Vietnam are eligible for a range of fiscal incentives in exchange for spending on local research and development (R&D).[20] Firms must obtain a certificate from the Ministry of Science and Technology to certify that they are indeed high-tech enterprises, are working on high-tech projects and are engaged in R&D that follows the contours of the state's priorities (Decision No. 55/2010/QD-TTg). Technologies eligible for promotion include visualization, cloud computing, high-definition display and image identification software among various others (Full list available in Decision No. 49/2010/QD-TTg).

Companies that establish R&D facilities or high-tech business incubators in the country are exempt from land use levies and benefit from significant reductions in enterprise income tax, value-added tax and import and export duties. They are also eligible for funding from the National Hi-Tech Development Program, a 1 trillion VND fund earmarked for high-tech enterprise development. In exchange for these incentives, companies must spend at least 1% of annual revenues (in Vietnam) on R&D in the country. Researcher salaries, conference travel and other professional development activities, facility and equipment rental, material purchasing and transportation are all admissible expenses for tax deductions under the law (Circular No. 32/2011/TT-BKHCN). Other middle-income countries like Brazil have pursued similar policy-driven approaches to technological upgrading.

**Education Policy**

According to the Law on High Technologies, at least 5% of the workforce conducting R&D projects must have at least a university degree. Herein lies the law's principal limitation. Vietnam does not have the human capital necessary for firms to embark on large-scale R&D projects. The Samsung Vietnam Mobile R&D Center (SVMC) was established in 2012, and remains the company's largest R&D facility in Southeast Asia. In order to address the talent bottleneck, Samsung has channeled $2.5 million towards grants and scholarships at the Hanoi University of Science and Technology. Furthermore, it has agreed to provide $1.4 million in scholarships and laboratory equipment for students at the Posts and Telecommunications Institute of Technology (PTIT). While Samsung has invested heavily in university-led workforce development programs, one company executive claims that students leave universities unprepared to work at the SVMC. Thus the company trains its new hires extensively to get them up to speed.

Much like Samsung, Intel found the lack of technical and managerial human resources to be a serious problem. Since launching the Intel Study Abroad Program in 2009, the company has invested $7 million to sponsor 73 Vietnamese students' bachelor degrees at Portland State University. The program has been successful in that it created the foundation of engineering talent that Intel sorely needed. Furthermore, Intel has developed and sustained a partnership with Arizona State University, whereby Vietnamese students and teachers are sent to study overseas. A few thousand Vietnamese have been sent to the US in the last 3-4 years through this partnership. Given that the factory has now successfully trained and hired the managers and engineers it needs, future workforce development efforts will focus on training students at local institutions like the Royal Melbourne Institute of Technology in Ho Chi Minh City.

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[20] Average turnover from high-tech products must be 60% for three consecutive years. This figure increases to 70% from the fourth year onwards.

Recognizing that human capital is key to further development in Vietnam's ICT services industry, FPT started an IT university in 2006 with the aim of training the next generation of IT professionals. The university has 16,000 students that pick from 10-15 different programs and learn either English or Japanese during their studies (Jang, Lee and Ko, 2010). FPT uses the university to meet its own human resource needs. Together, FPT Information Systems and FPT Software hire approximately 60% of graduates. FPT University, along with the other 289 colleges and universities with IT faculties, will be critical if the government is to reach its goal of training 600,000 IT professionals by 2020.

**Laws Supporting ICT Services and ICT-Enabled Services in Vietnam**

The first five-year ICT plan (1995-2000) focused on computerizing the public sector in order to improve Vietnam's standing vis-a-vis neighboring countries on the UN's annual E-Government Survey. However, it was not long before the Vietnamese government began to see ICT as a potential leading economic sector in the country. The 2002-2005 ICT Master Plan reflected the importance of developing ICT outside the public sphere. The 2006 Law on Information Technology and subsequent decrees (Decree No. 71/2007/ND-CP and Decree No. 56/2007/QD-TTg) reinforced the state's emphasis on ICTs, particularly on the development of software and digital content. While Vietnam first exported software in 1997, it was not until 2000 that the government set out to establish a domestic software industry with an outward orientation (Hong 2005). Prime Minister Phan Van Khai put the first five-year plan for software development into effect in June 2000. The plan sought to create the human capital necessary for a viable software industry. Between 2000 and 2005, the Ministry of Science Technology and Environment and Ministry of Education and Training coordinated efforts to train 25,000 IT specialists and computer programmers. Targets have become far more ambitious as of late; the government aims to train 600,000 IT professionals by 2020.

The government has put forth a range of incentives aimed at supporting the growing number of ICT services firms in the country. Software companies benefit from an exemption on VAT, an exemption on export taxes, a reduced corporate income tax rate of 10 percent in accordance with the Law on Domestic Investment Encouragement and the Law on Foreign Investment, an allowance of 10 percent of pre-tax revenue for R&D spending, accelerated visa procedures for foreigners and a reduced personal income tax rate for ICT professionals. Finally, software firms are granted preferential access to credit and land. These incentives have been instrumental to industry growth in both domestic and foreign markets. By 2013, software turnover in Vietnam surpassed $1 billion, half of which was exported (according to VINASA).

Another important factor has been the reduction in the state's role in the ICT sector. Since 2003, the state's role in FPT has diminished considerably. According to company executives, the state now owns a negligible share in the company and exercises no nominal control over operations. While FPT remains a dominant player in the market, the state's retreat has opened up room for more private firms. Last year, Prime Minister Nguyen Tan Dung decreed that government agencies could outsource IT services to the private sector in an effort to cut down on labor costs and increase productivity. This decision could have a profound impact on the domestic ICT services sector, although it remains to be seen whether or not smaller firms will be able to take advantage. Finally, the state has created a number of IT development zones, which have been effective for creating clusters of ICT services and ICT-enabled services providers. A large percentage of Vietnam's ICT services and ICT-enabled companies are distributed among the country's eight IT development zones.[21] The 300 companies based in these IT development zones employ 46,000 people. It is clear

[21] They include: Saigon Hi-Tech Park, Saigon Software Park, Quang Trung Software Park, Hanoi IT Trading Center, Da Nang ICT Infrastructure Development Center, National University of Ho Chi Minh City's IT Park and Can Tho University Software Center.

that the party has decided that ICT is a propulsive sector with the potential to transform Vietnam's economy. Below we offer a number of recommendations that aim to support Vietnam's ICT push in the coming years.

## Part III: Policy Recommendations

**Develop Local Suppliers to Support Global Hardware Exporters**

As the trade, production and FDI data indicate, Vietnam has become a production base for a number of lead ICT hardware firms, platform leaders and contract manufacturers looking to leverage the country's low wages and favorable institutional profile to improve profit margins on global sales. While lead firms like Samsung and Nokia (Microsoft), platform leaders like chip maker Intel, and global contract manufacturers such as Foxconn and Jabil have large manufacturing facilities in Vietnam, linkages to the local supply base remain extremely weak across the board. Local suppliers mainly supply paper and plastic packaging and in many cases, even these very basic products are provided by foreign-owned suppliers. Because these firms have global suppliers, it is difficult for local firms to participate in the GVC in any meaningful way. This is not unique to Vietnam; it is true in many countries that serve as production platforms in GVCs, including China, where Foxconn's 11 subsidiaries accounted for an astonishing 17.3% (USD 79.3bn) of the aggregate export value of China's top 200 exporters in 2012 (Grimes, 2015).

However, given the scale of recent and planned investments, these global firms have indicated a willingness and desire to develop the local support industry. **We see a short but very significant window of opportunity for supplier development, inclusion, and upgrading. This opportunity will exist only while Vietnam remains a favorable manufacturing location for these global firms. Interviews with key lead firms indicate that government efforts to foster development of supporting industries for ICT hardware have been ineffective so far.** We believe that efforts by global firms have also been half-hearted. For example, Samsung's strategy for growing its Vietnamese supply base has been to organize workshops in which it explains the components it would like made locally, and audits the quality of specific suppliers. The first of these workshops was a fruitless endeavor. It quickly became clear to Samsung that local suppliers lacked the capabilities to meet the company's requirements. But we could not detect any aggressive follow up or outreach to help local suppliers overcome these capability deficiencies.

To develop a cadre of competent local suppliers in the short time horizon that exists, we recommend the following steps. First, a committee composed of members from the Ministry of Industry and Trade, the Vietnam Association of Foreign Invested Enterprises (VAFIE), the Ministry of Planning and Investment, the Foreign Investment Agency and the Vietnam Association of Mechanical Industry (VAMI) should identify top potential suppliers through transparent and competitive means. The committee should have access to lists of components that key global firms like Samsung, Microsoft and Intel would like to source locally. The committee should use these lists to match local suppliers with specific global firms on a one-to-one basis. These firms should then provide their potential partners detailed instructions and hands-on assistance in regard to fulfilling requirements related to business systems, process technology, machine selection and financing. Other company-specific considerations, like environmental or social requirements, should also be transmitted to the Vietnamese suppliers as well. The government should then set up a dedicated fund from which it can draw capital to subsidize investments in facilities, equipment and training.

Subsidies from the "National Support Industry Fund" should be tied to firm performance. Subsidies should be given for up to five years, at which point they should be withdrawn. If companies do not meet annual performance targets set by the new "Committee for Support Industry Development," they should have subsidies revoked. When the five years of state support have

elapsed, these Vietnamese suppliers should be able to continue growing with their anchor customers, and/or sell their products to new lead firms or global suppliers in Vietnam and elsewhere. The Committee for Support Industry Development could then tap these successful local tier 1 suppliers to help develop tier 2 suppliers. For example, Seongji Industrial Co. Ltd, a Korea-based global supplier to Samsung producing touch screens, cables, and PCB assemblies in Vietnam, could support tier 2 supplier development efforts at its client's behest. This path would involve a global Tier 1 supplier replacing lead firms and platform leaders, working directly with the government to support the development of local tier 2 suppliers. These newly developed tier 2 suppliers could then work to develop tier 3 level suppliers.

**Promote Semiconducor Design, not Semiconductor Manufacturing**

The Vietnamese government has made clear its desire to develop semiconductor fabrication capabilities. It is set to invest $300 million in a wafer fab in Saigon Hi-Tech Park. Output is expected to reach 400 million chips a year, and annual revenues are expected to reach $120 million. We believe that the focus on developing semiconductor fabrication (i.e., of silicon wafers) is misguided. While it is true that Vietnam is forced to import most of its semiconductor devices, the finance and technology required to build a leading-edge fab is prohibitive, upwards to US$2-5 billion, with costs for large plants topping $10 billion, with capital depreciation running 50-80% of manufacturing costs. Moreover, the profit margins on semiconductor production can be low, because of intense competition, short product life cycles, and regular periods of excess capacity due to market instability (Brown and Linden, 2009). Efforts to compete in the semiconductor industry should focus instead on chip design. There are a number of design houses currently active in Vietnam. The ten largest comprise 90 percent of the Vietnamese market (See Table 10). Only Intel is engaged in manufacturing, and this is in the low value added function of "chip assembly" where semiconductor chips are fabricated elsewhere, and placed in their final package. Chip design, on the other hand, can be profitable, and is often a critical portion of final product functionality and design.

**Table 10: Top Semiconductor Firms in Vietnam**

| Rank | Company name | Location | Core Competences |
|---|---|---|---|
| 1 | Intel | Ho Chi Minh City | Assembly and packaging |
| 2 | Renesas | Ho Chi Minh City | ASIC digital IC design (Front-End) |
| 3 | Acrosemi | Ho Chi Minh City | ASIC digital IC design (Front-End) |
| 4 | E-Silicon | Ho Chi Minh City & Da Nang | ASIC digital IC design (Back-End) |
| 5 | Splendid Technology | Ho Chi Minh City | RFID design & solutions |
| 6 | Signet Design Solutions | Ho Chi Minh City | ASIC digital IC design (Back-End) |
| 7 | Dolphin Technology | Hanoi | Silicon proven IP design |
| 8 | Active-Semi Vietnam | Hanoi | Power management chip design |
| 9 | Viet Vmicro | Ho Chi Minh City | Analog IC design |
| 10 | VSMC | Ho Chi Minh City | Power management chip design |

*Source*: Trinh and Demidenko 2013

Following the Government's announcement that it would make a push for local semiconductor fabrication, many universities around the country began to offer chip design courses. More than 15 institutions including the RMIT, the Saigon Institute of Technology, the Ho Chi Minh University of Science and the Hanoi University of Technology now offer integrated chip design courses that use global electronic design automation (EDA) software tools developed by global vendors like Synopsys, Cadence and Mentor Graphics. We believe that efforts to develop local semiconductor fabrication capabilities should begin and end with the $300 million fab under development. This would give students learning IC design the opportunity to test their products before sending them to global companies for full-scale production. However, efforts to develop a large, commercial fab should not be pursued given difficulties related to high capital costs, rapid technological change in fabrication processes that speeds depreciation, and the consolidated and

saturated nature of the market. Because of the fragmentation of the semiconductor industry into design and fabrication for hire in "foundries," semiconductors designed in Vietnam can easily be fabricated in the few places in the world that dominate the foundry business: Chinese Taipei, Singapore, Malaysia, and the United States. In 2005, world foundry capacity for logic semiconductor fabrication surpassed capacity in "integrated device manufacturers" such as Intel, Samsung, and ST Microelectronics that produce their own designs of logic semiconductors in their own fabrication plants for the first time (Houseman et al, 2014)

**Requirements for Upgrading the ICT Services and ICT-Enabled Services Sectors**

A number of software outsourcing and BPO firms interviewed for this study indicated a desire to grow in Vietnam and upgrade in the ICT services and ICT-enabled services segments of the value chain. Surveys including Gartner's "Leading Global Locations for Offshore Services," A.T. Kearney's "Global Services Location Index" and Tholon's "Top Outsourcing Destinations" indicate that Vietnam is emerging as "India+1" location for ICT and ICT-enabled services. However, many interviewees cited significant barriers to growth and upgrading, some of which will be highlighted here. Below we discuss how Vietnam can address training issues to support growth and upgrading into higher value industry niches. We focus specifically on language, technical and managerial training.

*Language Skills*

The lack of foreign language skills in Vietnam is a serious impediment to growth in these segments of the GVC. As already indicated, Japan is an increasingly important software outsourcing market for Vietnam. In fact, Vietnam recently overtook India as the second largest exporter of software services to Japan.[22] Future growth in this market will depend in part on the availability of Vietnamese professionals with Japanese language skills. A similar problem exists with the US market, which requires English language skills. Many companies have developed strategies to overcome these deficiencies and continue serving key clients in foreign markets. Thirty-one percent of Global Cybersoft's (now Hitachi Consulting) clients are based in Japan. However, very few of the company's software engineers speak Japanese, and very few of their client's software engineers speak Vietnamese. Therefore, the company employs boundary-spanning individuals – Vietnamese software engineers who speak Japanese – to coordinate projects. This means that the teams can only collaborate through these "bridge software engineers."

Other companies have been able to develop ICT solutions to partially address the shortage of language skills. Digi-Texx, a German BPO service provider, serves a number of German clients including the postal service, the library system and medical insurance companies. However, the company only has 20-30 German speakers. German is not needed to analyze and index the important information in the documents because key terms are presented to the operator based on an in-house ICT system that checks the name or term being entered against a database and then offers the operator suggestions (similar to an "autofill" feature). Difficult items are "dual keyed," that is, entered by two operators, and sent to a quality control operator if the first two operators' entries disagree. Digi-Texx has an in-house software group to develop IT tools to increase operator efficiency.

Such coping mechanisms enable Vietnam-based software outsourcing and BPO firms to participate in the global market. However, they are not sound platforms on which to build in the ICT sector. The fact that firms must find creative ways to overcome language barriers only underlines the problem of inadequate foreign language training in Vietnam. An apparently

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[22] Viet Nam News article available from: http://vietnamnews.vn/economy/245585/viet-nam-climbs-it-software-exports-ladder.html.

successful case is FPT University, which has made it a point to include Japanese and English as key components of their programs. The inclusion of foreign language requirements should be made mandatory in IT training programs across the county. The government has set a goal of producing 600,000 IT professionals by 2020. If few of these graduates have foreign language skills, their career options will be limited, and the firms they join poorly prepared to serve foreign markets.

*Technical Skills*

The second significant limitation to upgrading in the ICT services and ICT-enabled services segments is the availability and quality of technical skills. The most common complaint that companies in these niches make is that few IT graduates are prepared for the workforce. Companies have tried to persuade universities to update their curricula, but remain unsatisfied. As a result, most firms interviewed run internal training programs to get new hires up to speed. One executive interviewed stated that if he could start a 10,000-person software outsourcing company, he would. The issue is that there are not enough skilled graduates to fill the jobs because the university they hire from, which provides good training, only produces 300-400 qualified IT graduates a year. This company filled its 2015 capacity in January, and has not been able take on more contracts because of a lack of skilled personnel. There are two issues that need to be addressed here. The first is the quantity of graduates; the second is the quality.

While Vietnam's brightest pupils flocked to ICT careers in the early 2000s, the booming stock market drew them away from programming and towards finance and real estate starting in 2006-2007. It has not helped that most Vietnamese students' introduction to computer programming involves a compulsory course in Pascal in high school, an antiquated and extremely difficult to learn Soviet-era programming language. A number of local educational institutions and firms have tried to rekindle student interest in ICT. The Saigon Institute of Technology runs an "IT boot camp," where it invites students from Ho Chi Minh City high schools for a week of fun programming. Among the many activities offered, students get to write simple lines of code that make Lego robots move. Intel has developed a program called "Young Maker Challenge," which involves getting students in selected schools (30 of them in the pilot program) to learn some basic programming and develop applications for the real world. The government should fund initiatives like IT boot camps and robotics competitions in order to increase interest in ICT.

The second issue is the quality of training. Employers often find that university graduates need to be trained extensively once they are hired. In fact, one executive opined that Vietnamese students "learn nothing" in university, and must be trained from scratch once they are brought on board. There are two potential solutions to this problem. The first is to foster greater alignment between employer needs and academic curricula. One instructive case is "Shifting Code," a mentoring program started in Southeast Michigan in 2012 to address the shortage of qualified IT professionals for the local market. The program seeks to develop the pipeline of IT talent in the region by asking IT firms to collectively decide upon specific skills that they would like to see developed in the local workforce. These wishes are then imparted upon local community colleges, which create customized programs aimed at meeting employer needs. Shifting Code costs students a nominal fee of $100. The true cost of this program is absorbed by the community colleges and the state of Michigan; it costs the state $1,700 per student and the community college $1,300 in technology, services and teachers. The companies provide mentorship, instruction, internships and potential hiring opportunities. Thus, employers outsource some of their training and reserve the right to hire or not to hire graduates. Vietnam could implement a similar program, relying on colleges and vocational schools to develop curricula in collaboration with ICT firms. A pilot program could be run in Quang Trung Software City, with the Saigon Institute of Technology and local ICT firms.

The second potential solution is for the government for fund internal training programs. Global Cybersoft trains its new software engineers for three months before they start doing real

work. That means three months where new employees are not generating revenue. BKAV trains its new software engineers for up to a year. Companies complain that poaching reduces their willingness to invest in new hires. As a means of offsetting the cost and risk of running these programs, the government should subsidize training of new hires for up to six months. Through this program, each registered ICT firm would have an annual quota of funded traineeships, giving firms a greater incentive to invest in workforce training. Finally, many emerging markets have successfully developed programs that send their top students overseas for tertiary studies, with the caveat that they return once they are finished. Brazil's "Science Without Borders" granted 100,000 fellowships to undergraduates, graduate students and postdoctoral fellows for up to three years. The purpose of the program has been to send Brazilian students abroad to study STEM in leading institutions around the world. A similar program to send Vietnamese students overseas for one to three years could pay enormous dividends in terms of technical skills coming back to Vietnam. It would be important however, to ensure that students have opportunities to apply their new skills upon return, whether it be in corporate jobs, in academia or as entrepreneurs.

*Managerial Skills*

Companies trying to upgrade from software outsourcing and BPO to developing their own products indicated that finding people with the sales, marketing and managerial skills necessary to grow these spin-offs is difficult in Vietnam. A potential solution could be to attract a global business school to set up executive education programs either in collaboration with a local university, or as a stand-alone unit. The Royal Melbourne Institute of Technology (RMIT) in Ho Chi Minh City has the closest thing to a global business program in Vietnam. The RMIT was invited to set up the first international university campus in Vietnam in 1998. Since its launch in 2001, it has grown to 6,000 students distributed between two campuses. The largest programs are the MBA the EMBA and other business programs, although engineering courses are now on offer as well. Universities are eager to meet the growing demand for higher education in emerging markets. It is clear that there is sufficient demand to merit more foreign investment in education. The government should engage with some of the best executive education providers in the world to gauge interest in setting up a facility in Vietnam (List of top 10 in Table 11).

**Table 11: Leading Executive Education Programs, 2013**

| Rank | School | Ownership | Partnerships |
|---|---|---|---|
| 1 | Duke Corporate Education | US | Duke University (US), London School of Economics (UK), Indian Institute of Management (India) |
| 2 | HEC Paris | France | London School of Economics (UK), New York University (US), MEDEF International (France), and others |
| 3 | Iese Business School | Spain | Indian School of Business (India), Lagos Business School (Nigeria), HEC Paris (France) and others |
| 4 | Esade Business School | Spain | Fudan University (China), The Wharton School (US), Stanford University (US), and others |
| 5 | Center for Creative Leadership | US | JMA Management Center (Japan), Mt. Eliza Executive Education (Australia), and others |
| 6 | IMD | Switzerland | Massachusetts Institute of Technology (US), Irish Management Institute (Ireland), Tsinghua University School of Economics & Management (China), and others |
| 7 | Babson Executive Education | US | Tecnológico de Monterrey (Mexico), HEC Paris (France) and others |
| 8 | Cranfield School of Management | UK | University of Virginia (US), Melbourne Business School (Australia), Universitat St. Gallen (Switzerland), and others |
| 9 | University of North Carolina: Kenan-Flagler | US | None Listed |
| 10 | Stanford Graduate School of Business | US | National University of Singapore (Singapore) |

*Source*: Financial Times Executive Education Rankings, 2013

Much like in other areas of higher education, executive education is slowly moving online. Nevertheless, for now, most programs maintain an on-site delivery approach. According to the

Financial Times, 82% of courses delivered had less than a quarter of their content delivered online. At the same time, most companies surveyed foresee more and more of executive education taking place online in the future. Reservations about online delivery relate mainly to perceived losses in interaction and networking opportunities. Efforts to attract a top brick-and-mortar institution should be complemented by efforts to increase consumption of Massive Open Online Courses (MOOCs) by Vietnamese students. Software outsourcing firm executives interviewed for this study claimed that the reason for the lack of consumption of MOOCs in Vietnam is the language barrier. A number of initiatives to make MOOCs accessible to non-English speakers are underway. Coursera has partnered with the Carlos Slim Foundation to deliver MOOCs in Spanish to Mexico and the rest of the Spanish-speaking world. The Queen Rania Foundation in Jordan has partnered with edX to deliver courses in Arabic. While the likelihood of convincing leading MOOCs producers such as Coursera or edX to translate lectures to the Vietnamese language is low, the government could support local MOOC initiatives like GiapSchool, a platform started by an overseas Vietnamese, which has now engaged over 100 lecturers in the country. This could make technical knowledge more accessible, bringing Vietnamese students closer to what prospective employers require of them.

**Growing an Effective ICT Ecosystem in Vietnam**

There are significant barriers to starting and growing ICT startups in Vietnam. The following vignette illustrates the point. Executives at TMA Solutions explain that through the years, many of their high-level employees have left to start their own companies. However, these companies have all been software outsourcing firms. Software outsourcing is a tried and tested model in Vietnam; therefore, potential investors can be relatively certain that they will see returns. Starting a software product company in Vietnam is difficult for a variety of reasons, including limited access to finance, limited access to managerial talent, limited innovation infrastructure (i.e. incubators and accelerators) and a lack of freedom to do business. Vietnam has an abundance of innovative and highly motivated entrepreneurs. We believe that with a well-structured innovation ecosystem, Vietnam could create regionally and globally competitive product firms in the ICT sector.

To begin to address these barriers, the government should redouble its efforts to provide risk capital for technology entrepreneurs. The Ministry of Science and Technology tried to develop a "high tech" venture fund 6-7 years ago. They submitted a proposal to the Prime Minister, but were unsuccessful in getting financial support from the government. By law, government spending must yield some sort of return, but with venture capital, returns are uncertain. MOST is now embarking on a second effort to develop a public venture capital fund. We believe that this effort should receive support. Furthermore, local private venture capital funds are in short supply. IDG Ventures (US) and Cyberagent Ventures (Japan) are among the few companies targeting ICT startups. Traditional investment banks like VinaCapital, Deutsche Bank and JP Morgan are unlikely to take an interest in Vietnamese start-up firms. In order to be successful, Vietnamese ICT startups will need reliable access to risk capital.

Risk capital is only one of many components of a successful ICT ecosystem. Another is infrastructure and managerial talent. The country now has 20 accelerators and incubators, as well as a growing ecosystem of organizations like the Founder Institute focused on building on Vietnam's strong entrepreneurial spirit. However, these organizations have not found much success to date. Based in the Saigon Hi-Tech Park, mLab was one of these organizations developed with a mandate to build an entrepreneurial space in Ho Chi Minh City. It organized "hackathons" and provided start-ups with seed capital. The government got involved directly, with MOST investing $10 million to develop "Vietnam Silicon Valley." However, in seven years of operation, only five companies "graduated."

These efforts need to be expanded with the assistance of partners who understand local and global markets. Furthermore, Vietnam needs to make far better use of one of its most valuable resources: its diaspora community. There are approximately four million overseas Vietnamese, many of which have settled in the US. While many have returned to start companies in Vietnam, they have found government support difficult to come by. There are a number of bureaucratic hurdles for returnees to get over before they can be fully integrated into the country. These procedures should be simplified, and incentives like resettlement support should be granted to make a return to Vietnam a more attractive prospect. Overseas Vietnamese can bring connections to foreign capital markets, management teams and other tools that would help local entrepreneurs grow companies. Furthermore, bureaucratic hurdles for foreigners wishing to enter the country should be relaxed as well. One executive quipped that with the rules as they are, Bill Gates could not get a working visa in Vietnam.

Finally, Vietnamese startups need **freedom to do business**. A few vignettes below illustrate this point. In one high profile case, Haivl, a satirical GIF and video sharing website had amassed 37 million daily visitors. It was unable to monetize its traffic, and had to reach out to 24h Online Advertising JSC for investment and support. However, the site was shut down and the company was fined for publishing law-violating content. In another case, the entry of companies like Uber and Easy Taxi to Vietnam has spurred debate over whether or not they should be allowed to operate in the country. While many countries have harbored similar unease over these "unofficial" taxi service providers, the Vietnamese government went a step further by setting up a service of its own: the Ho Chi Minh City Department of Science and Technology introduced the taxi app LiveTaxi to compete with the likes of Uber and Easy Taxi. Finally, over-the-top services like Viber, Whatsapp and Vine have faced difficulties in Vietnam given the implications for leading state-owned telecommunications service providers. The ICT GVC offers entrepreneurs in Vietnam valuable opportunities to enter the industry at multiple levels, including from the top, as lead firms with branded products. These efforts should be supported so long as companies conform to existing laws.

**Reimagining "high tech" and fostering R&D in Vietnam**

Much like many other emerging economies, Vietnam has made it a priority to increase R&D spending in the country. The government has sought both to attract multinational R&D centers and to encourage companies already in the country to invest a small portion (1%) of their revenues in R&D. The "Law on High Technologies," while less than successful so far, has the potential to increase R&D spending if it is broadened and applied in a fair and consent manner. Vietnam's cost advantage and large domestic market gives it some leverage to make these requirements of foreign investors. Moreover, when the cost advantage has receded, the country will likely be an attractive consumer market for ICT firms, giving it the opportunity to continue requiring local R&D spending. Brazil has high wages relative to many of its neighbors, yet is able to require companies to spend 4% of revenues on R&D because its internal market is so attractive.

The Law on High Technologies should be revisited to ensure that it encourages participation from a range of actors across industries. To accomplish this, the definition of what constitutes a "high tech" enterprise should be broadened. There are currently only approximately ten certified high tech enterprises in Vietnam. The requirement that 70% of revenue must come from "high tech" products rules out participation by many companies that could benefit from R&D funding. The government has selected new materials, ICT, biotechnology and automation as key areas for R&D promotion. While the focus on general purpose technologies is useful in that it opens up space for participation by companies in many sectors, it is likely to be quite some time before MNCs work on such advanced technologies in Vietnam.

One area that should receive more attention is the weak link between universities and the private sector. Companies rely on universities to train their employees, but not to develop new

products that can then be commercialized. This is because the quality of research carried out in Vietnamese universities is generally regarded as being poor. Funding channeled from the Law on High Technologies would create opportunities to engage in higher quality research that could eventually be commercialized. Public universities should all have technology transfer offices with the inward function of educating researchers about why and how to patent their products, and the outward function of finding capable private actors to commercialize these new technologies through license agreements. Research support from the Law on High Technologies, as well as the development of technology transfer offices could create a sustainable platform on which to develop and commercialize new products well into the future.

## Concluding Remarks

If we are to draw a single most important lesson from this study of the ICT GVC, it is one of continuous change and opportunity. Assumptions about industry life cycles, where product segments stabilize as the industry matures, and then shift do developing countries, do not seem to apply any more. At the same time, long exposure to the industry's rapid but volatile growth and the sudden emergence of immense new market opportunities (for example, the PC, the mobile phone, and the Internet), has allowed ICT companies in the developing world to quickly build up extraordinary capabilities. We need to ask, not how emerging economies can repeat the experiences of successful recent developers like Chinese Taipei and Singapore, but what roles might be available in ICT GVCs in the future. Newcomers should seek to avoid the pitfalls and limits of bottom-up, supplier-led upgrading. In an integrated global industry, this has proven to be exceedingly difficult, and the risks of becoming trapped in low value added GVC segments such as assembly are high. Even for firms with established roles in the industry and deep expertise in their GVC niche, such as Nokia and Motorola, changes can be swift and devastating. Supplier upgrading should be pursued, but with an eye toward specialization, scale, and exporting rather than contributing to a fully vertical industry ecosystem in Vietnam. In the current environment, no country's ICT industry is fully integrated or vertically complete at the national level. The question should be less "how do we catch up?" and more "how do we fit in?"

Forward-looking policy makers and entrepreneurs in Vietnam must instead consider the possibilities of tapping into the same palette of globally distributed capabilities that global firms in the industry see, as well as acknowledging the expanding potential for new combinations. Capabilities in the ICT sector are now widely distributed across the globe, and these will continue to create huge opportunities for both suppliers and lead firms in ICT GVCs. Going forward, new industries and value chain combinations will inevitably include more firms—lead firms, contract manufacturers, component suppliers, and even platform leaders—based in newly developed and developing countries such as Vietnam. We can anticipate, given the right conditions, a spate of new lead firms born in developing countries without the expectation that they will need to move up the supply chain ladder in their efforts to become branded companies. Today, more ICT platforms, functions, and services are available than ever before, either for sale or for hire, and it is only a matter of time before one, and then several new, world-beating ICT companies from Vietnam find a way to combine these elements and come to dominate some as-yet-unknown product or market area in the ever-expanding ICT industry.

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