



On the Application of Information Technology of Vietnamese Firms

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Abstract: This paper aims at describing the current situation of the application of information technology (IT) in Vietnamese enterprises from 2001 to 2011. The analysis is taken in different dimensions: over time, by sector, and especially by firm ownership. We have evidence to state that in the research period, IT usage of Vietnam is rather limited. Especially for small firms, IT is still considered to be luxury. Only foreign firms or joint-stock companies pay enough attention to IT usage. From this analysis, policy discussions are withdrawn, mostly on how to speed up firms' usage of IT to catch up with world business practices.

Keywords: Information Technology (IT), application of IT, Vietnamese firms.

1. Introduction

Although experimental Internet connectivity began in the early 1990s, Vietnam was officially connected to the global Internet in December 1997 when the Government approved the operation of the first five Internet Service Providers (ISPs). In 2000, the number of Internet users in Vietnam first exceeded 100,000. Internet service via ADSL was introduced in 2003 and 3G mobile service was launched in 2009. The country began using CDMA technology in 2002, and 3G mobile networks based on W-CDMA technology in late 2009. Vietnam licensed four companies to test and deploy 4G/LTE technology in 2010,

but the new technology was planned to be officially launched only in 2015. Development of the Internet and telecommunications in the 1990s and 2000s benefited also from the Renovation reforms that include reform of the telecommunications sector. In 1993, the separation of commercial functions from regulatory functions within the Department General of Posts and Telecommunications (DGPT) established the Vietnam Posts and Telecommunications Corporation (VNPT), the national state-owned company in charge of the development of Vietnam's telecommunication industry. Since then, the telecommunication industry has gradually been liberalized. Although there were still some limitations such as poor coordination and inefficiency, the regulatory framework governing Vietnam's Information and Communication Technology (ICT) services and investment was relatively

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transparent and predictable. By 2014, the ICT market featured both domestic and international providers, and intense competition and aggressive investment in infrastructure had brought down access prices and broadened coverage.

With regard to firm usage, a survey of 3,270 enterprises conducted in 2013 by Vietnam E-Commerce and Digital Economy Economy (VECITA) provided insights into firms' Internet use in Vietnam [1]. According to the survey, more than three quarters (78%) of the businesses accessed the Internet through an ADSL connection, while less than one quarter (22%) of them owned a leased line, a result unchanged since the year before, 2012. Among the major types of management software, accounting and finance software were used by 87% of the surveyed companies, followed by personnel management (57%), while a much smaller share of companies had adopted more sophisticated CRM (26%) or ERP (16%) software. All the enterprises that responded to the survey had high-speed access to the Internet, but only 45% of them had a web presence; the trend in web presence had increased gradually, up from 38% in 2009 and 42% in 2012. By sector, the share of companies with a web presence was highest in "Finance and Real Estate" (70%) and lowest in "Construction" (39%); it was 50% in "Manufacturing" and 59% in "Education and Training". Among companies with a web presence, websites varied largely in the level of sophistication, which the survey categorized into four levels, from 1 to 4. At level 1, the website simply introduces basic information about the company and its products; 26% of companies assessed themselves at this level. At level 2, which accounted for 41% of companies surveyed, the website has interaction features, which allow viewers to interact with the company. At level 3, 26%, the website has certain features for online transactions but it is limited in the tools for database management and security. At level 4, the website is ready for online transactions and e-commerce; only 7%

of the companies with a website said they had reached this level.

In this paper, we conduct an analysis of the application of IT in Vietnamese enterprises from 2001 to 2011 to have an overview of the situation which is considered as one of the core factors allowing Vietnam to join the 4th industrial revolution [2]. We first summarize the statistics used in the paper. We then analyze the dataset by different ways to find out characteristics of IT applications among Vietnamese firms. Policy implications conclude the paper.

2. Analysis of information technology usage of Vietnamese enterprises

2.1. Data description

Our analysis is based on the large-scale annual survey of enterprises (ASOE) data provided by the General Statistics Office of Vietnam (GSO) which covers all registered firms in Vietnam over the period from 2000 to 2013 [3]. The data covers firms operating in every economic sector, including agriculture, manufacturing, construction and services. Firms included in the survey are all registered firms that were in operation on December 31st of the previous year. The survey information includes firm identification (tax registration number), assets and liabilities, the number of employees (by qualification), sales, wages, capital stock, industry (5-digit), obligations to the government, exports, imports, debts, date of birth... The ASOE dataset has also some limitations. First, industry classification has changed over the period of observation. Second, some key information is missing for some years. In particular, the information relating to technology is not available for the years 2006, 2012 and 2013. Accordingly, we have to reduce our sample by dividing the dataset into 2 periods: the first one from 2001 to 2005 and the second one from 2007 to 2011.

In order to build a workable dataset from the GSO database, we clean the data as follows.

First, only firms with no missing information on sales, labor, capital, age and wages are kept. In addition, as the equity share of foreign-owned firms is not available for the year 2001, we thus have to define by an alternative way a firm of this year as a foreign-owned firm if it registers as a foreign-owned firm under the Investment Law of Vietnam issued in 2005. Finally, in our final sample, we drop all firms with less than 10 employees in order to minimize measurement error issues but also in order to promote the comparability of our study with the earlier literature. Indeed, this size threshold makes our descriptive statistics more comparable to the existing ones in other countries as most of the firm-level databases available worldwide are confronted with size thresholds [4].

To sum up, after the cleanup, our sample consists of about 699,950 firms over the period 2001-2011, in which, 197,088 firms are in the period 2001-2005 and 502,862 firms are in the period 2007-2011. Statistics of variables are summarized in Table 1. In general, our global sample from the period 2001-2015 shows that on average, the number of private computers (PC) equipped by Vietnamese firms is about 7 PC per firm, *the number of PC connecting to LAN is 4, the number of PC connecting to the Internet is 2*, while these figures for the period 2007-2011 are 10, 9 and 8 respectively. That means the number of firms applying high technology in their business activities has increased over years. Furthermore, online

business transactions have also risen during these years from 564 million VND on average in 2001-2005 to 3055 million VND in 2007-2011. *This fact demonstrates that E-commerce is progressively developing in the Vietnamese market*¹.

2.2. Information technology usage analyzed by year

Figure 1 allows us to observe the enhancement of the firm numbers as well as PC numbers by year. From 2001 to 2011, the number of Vietnamese firms has multiplied 516 times from 25,007 firms in 2001 to 129,179 firms in 2011; meanwhile the number of PCs has multiplied 1,102 times from 126,960 pieces in 2001 to 1,400,000 pieces in 2011.

In conformity with the findings, the number of PCs connecting to LAN and to the Internet has recorded a strong increase over 10 years, as indicated in Figure 2.

That might be explained partly by the amount spent on R&D during those years. However, these amounts are not heterogeneous across the years, as shown in Figure 3, meaning a large part of Vietnamese firms do not pay attention to R&D yet.

These figures suggest that by the end of 2011, the majority of Vietnamese firms had been well aware of the importance of e-commerce in their business and were willing to develop e-commerce to a higher extent in the future.

Table 1. Summary of statistics

Variable	Obs	Mean	S.D	Min	Max
2001-2005					
N. of PC	197,088	7.107531	67.46862	0	9999
N. of PC connecting to LAN	197,088	4.084673	63.70605	0	9999
N. of PC connecting to Internet	197,088	2.33447	25.16482	0	4500
R&D expenditure	104,287	143.1183	4564.484	0	1192310

¹ However, it should be noted that the data on online business transactions is only available in 2004, 2005, 2007, 2008 and 2009.

Online business transactions	102,107	564.0343	105920.9	0	28200000
2007-2011					
N. of PC	459,301	10.84413	142.2618	0	38570
N. of PC connecting to LAN	195,665	9.521836	146.2017	0	34000
N. of PC connecting to Internet	217,956	8.272468	133.6042	0	34000
R&D expenditure	502,862	21.17166	5443.812	0	3728252
Online business transactions	232,403	3055.221	681913.7	0	223000000

Source: Authors' calculations based on GSO database.

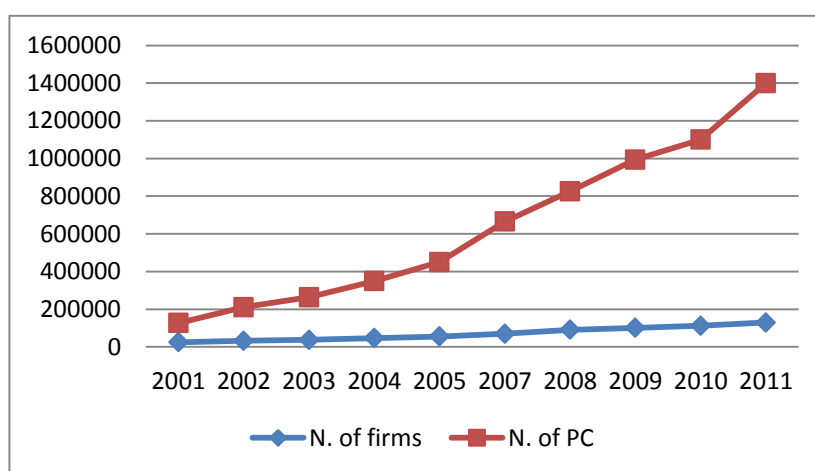


Figure 1. Number of firms and PCs by year.

Source: Authors' calculations based on GSO database.

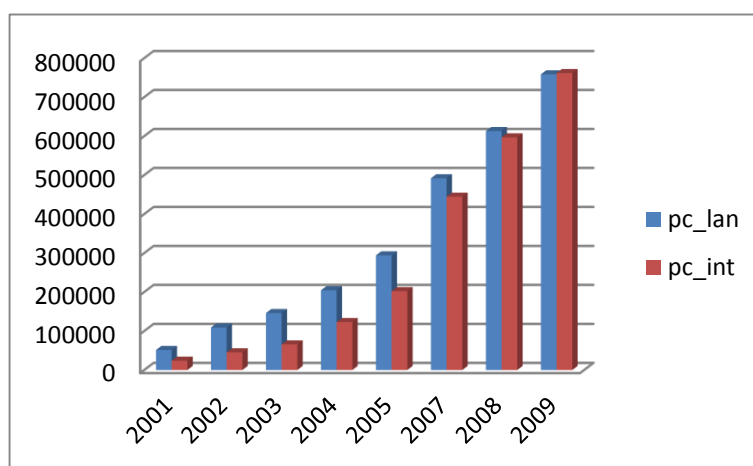


Figure 2. Number of PCs connecting to LAN and Internet by year.
(Unit: millions VND).

Source: Authors' calculations based on GSO database.

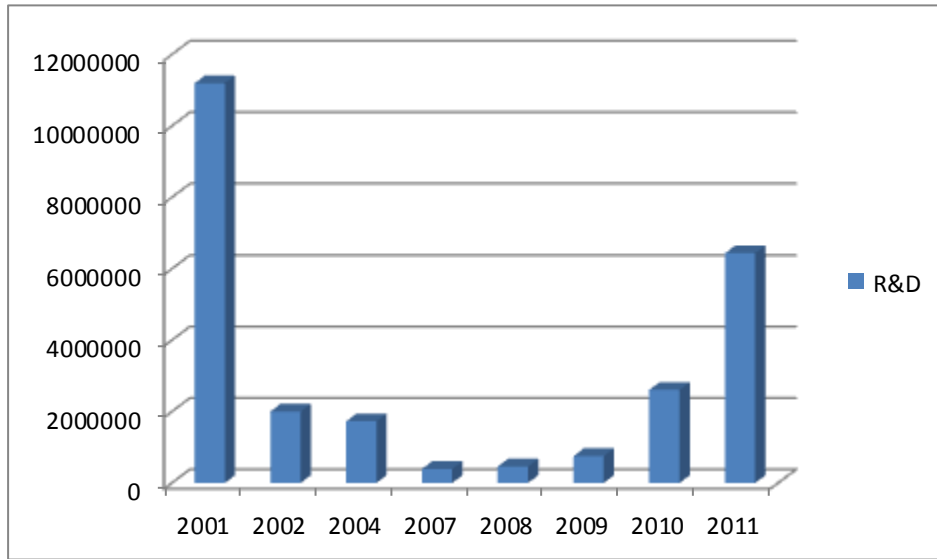


Figure 3. R&D expenditure by year.
 Source: Authors' calculations based on GSO database.

2.3. Information technology usage analyzed by sector

According to the results in Figure 4, the two sectors that most highly applied IT were the services and manufacturing sectors: The Service sector accounts for 52% of the total number of PCs, while the manufacturing sector accounts for 29% of the PCs. Effectively, most of the Vietnamese enterprises concentrate on these two sectors. For example, in the service

sector, educational institutions are stepping up E-commerce teaching. On the other hand, many agencies and localities started to develop online public services. Ministries and agencies have actively engaged in, and achieved positive outcomes for, a number of important public services, such as electronic customs, electronic tax declaration and clearance, electronic certificate of origin issuance, and e-commerce applications in public procurement.

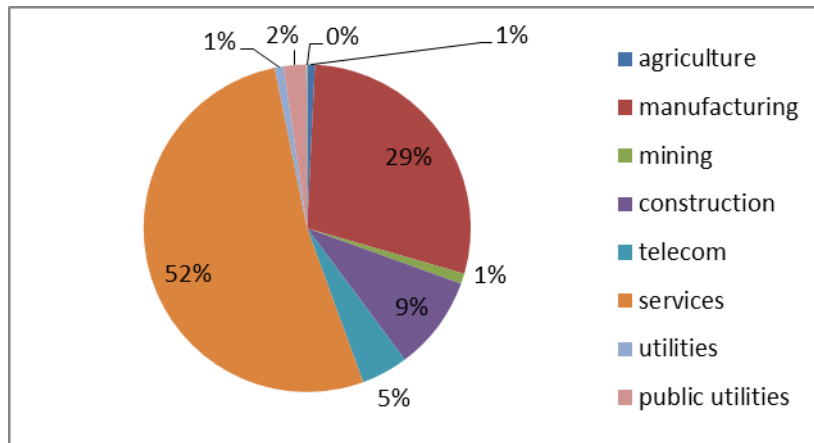


Figure 4. Number of PCs by sector.
 Source: Authors' calculations based on GSO database.

Evidently, the number of PCs connecting to LAN as well as the Internet in these sectors is highly intensive compared to the other sectors as demonstrated in Figures 5 and 6. It should be known that e-commerce is widely used with increasing effectiveness among firms in manufacturing and service sectors.

One of the highlights of e-commerce applications among enterprises is the rapid growth of R&D expenditure. Consequently, the

manufacturing and service sectors are also two groups of sectors that have the highest percentage of R&D spending, as shown in Figure 7.

Figure 8 demonstrates that the service sector maintains its robust momentum of growth in comparison with other sectors in terms of online business transactions, meaning e-commerce is strongly developed in this sector.

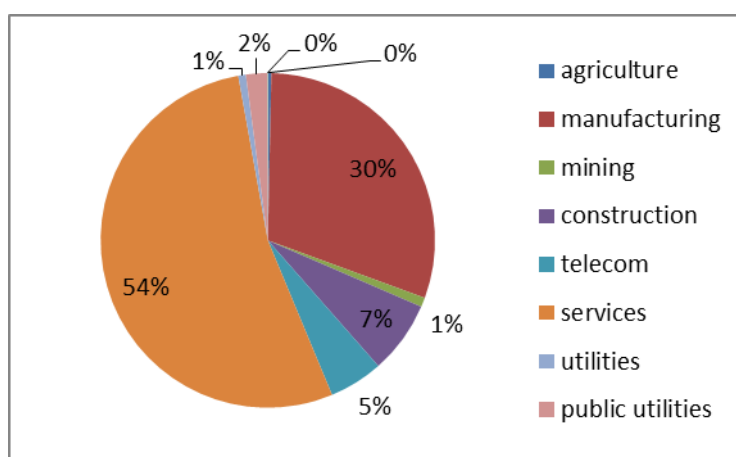


Figure 5. Number of PCs connecting to LAN by sector.
 Source: Authors' calculations based on GSO database.

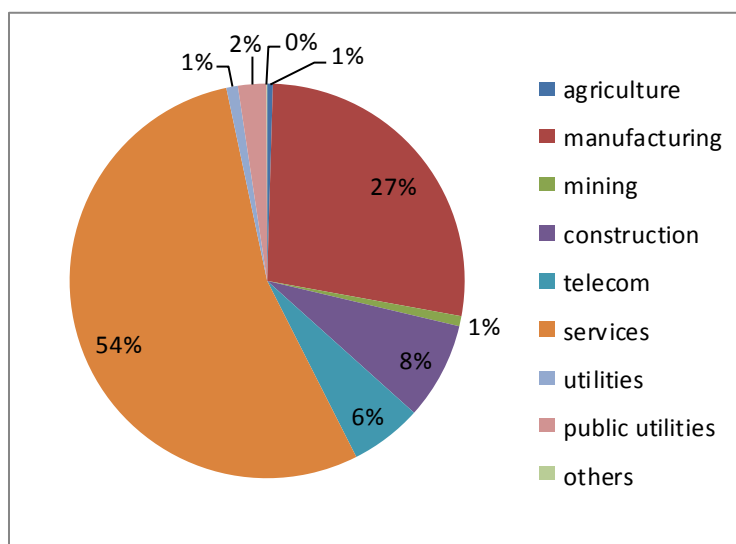


Figure 6. Number of PCs connecting to Internet by sector.
 Source: Authors' calculations based on GSO database.

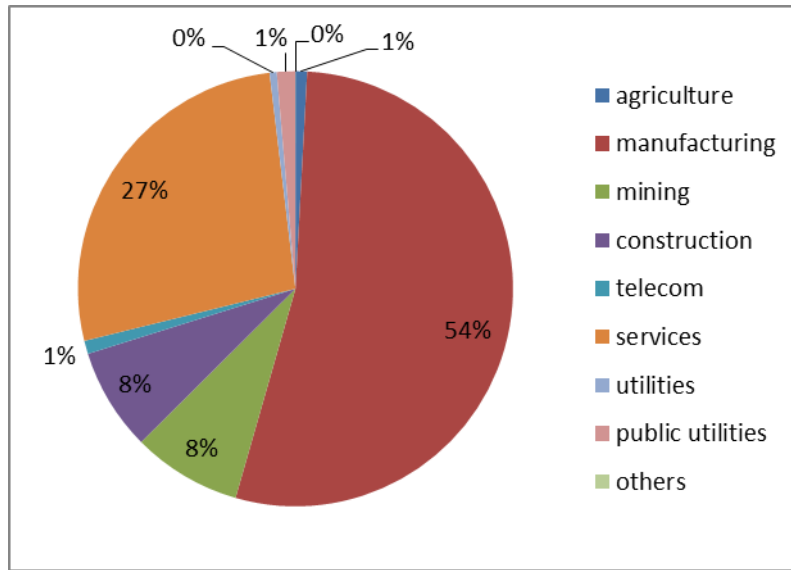


Figure 7. R&D expenditure by sector.
 Source: Authors' calculations based on GSO database.

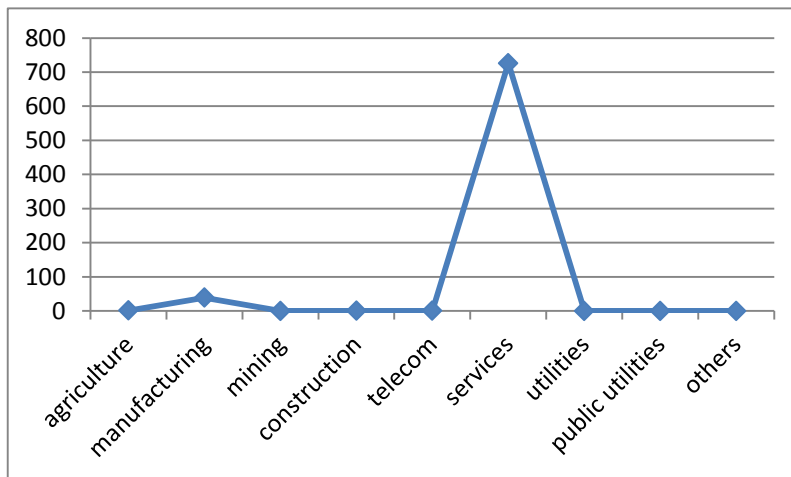


Figure 8. Online business transactions by sector.
 (Unit: millions VND)
 Source: Authors' calculations based on GSO database.

2.4. Information technology usage analyzed by firm ownership

Figures 9-13 describe the situation of IT applications in Vietnamese firms according to their ownership firm type, discriminating between State-owned enterprises (SOE), collective-owned enterprises (COE), joint-ownership enterprises (JVT), private

enterprises (PRI), foreign enterprises (FOR) and others (OTH).

Firstly, the surprise is that PCs are equipped mostly in state-owned firms (27%), joint-venture firms (JVT) and foreign firms (23%). That's to say the Government has paid attention to invest in high technology to improve the performance of firms owned by the State.

Secondly, SOE also accounts for a large share of PCs connecting to the intranet (29%, Figure 10) and having Internet connections (51%, Figure 11). These results suggest that IT applications among SOEs have been increasing dramatically.

Nonetheless, SOEs are not the group investing the most in R&D. Instead, foreign firms and joint-stock firms are investing strongly in research and development. Indeed, foreign firms account for 52% of the total R&D expenditure; the figures of joint ventures and SOEs are 30% and 15% respectively (Figure 12).

On the other hand, Figure 13 shows that the top three firm groups, which have the highest online business transactions, include joint-stock enterprises accounting for 40% of total e-transactions; SOEs accounting for 35% and FORs accounting for 7%.

Two important points can be drawn from the results in Figures 12 and 13: joint stock companies have used R&D capital effectively to develop online transactions; meanwhile SOEs and especially FORs are likely to use less effectively this capital source, or R&D capital is used to improve production activities rather than e-transactions.

We can also compare IT applications of SOEs relative to Non-SOEs (Figures 14, 15, 15). As demonstrated in Figure 4, Non-SOEs are more likely superior to SOEs in IT applications according to all criteria: number of PCs, number of PCs connecting to the intranet and number of PCs having Internet connections.

Nevertheless, Figure 15 shows that SOEs account for 70% of total R&D expenditure, while Non-SOEs account for only 30%. Similarly, Figure 16 also shows that 63% of e-commerce transactions belong to Non-SOEs, while the percentage of SOEs is only 37%. This once again reaffirms that the using R&D capital for IT applications as well as the promotion of e-commerce activities of SOEs is not really effective.

Furthermore, we can also compare foreign firms and domestic firms in IT applications. Figure 17 shows that domestic firms are more likely to invest in IT applications than foreign firms, according to all of these terms: number of PCs, number of PCs connecting to LAN and number of PCs connecting to the Internet. This fact may be explained by the number of domestic firms as well as their size compared to foreign firms.

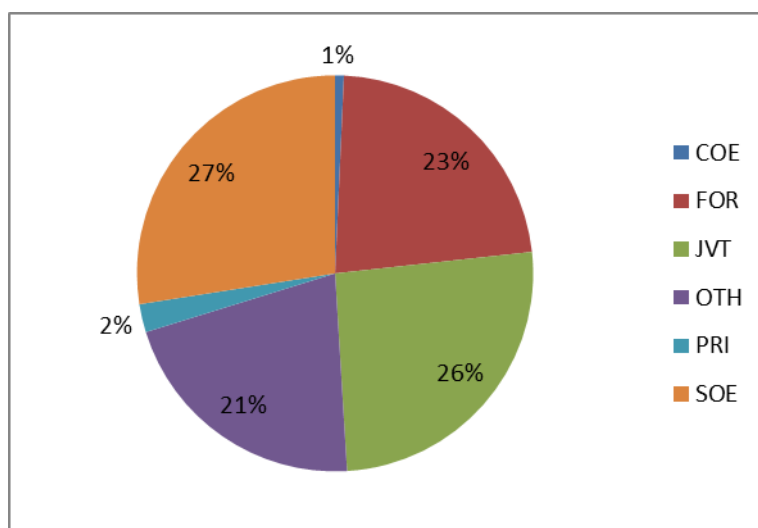


Figure 9. Number of PC by firm ownership.
 Source: Authors' calculations based on GSO database.

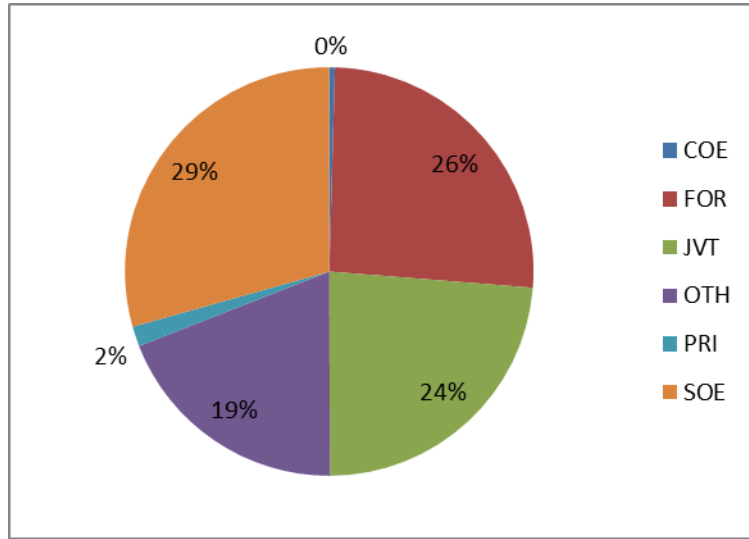


Figure 10. Number of PCs connecting to LAN by firm ownership.
 Source: Authors' calculations based on GSO database.

Domestic firms are also dominated in terms of R&D expenditure (Figure 18) and e-transactions (Figure 19). Many reasons can explain that, one of which is the difference in orientation between these two groups of firms:

domestic firms tend to improve e-commerce on the intra-market while foreign firms are usually MNCs which prefer to invest in production activities and focus on the exporting market

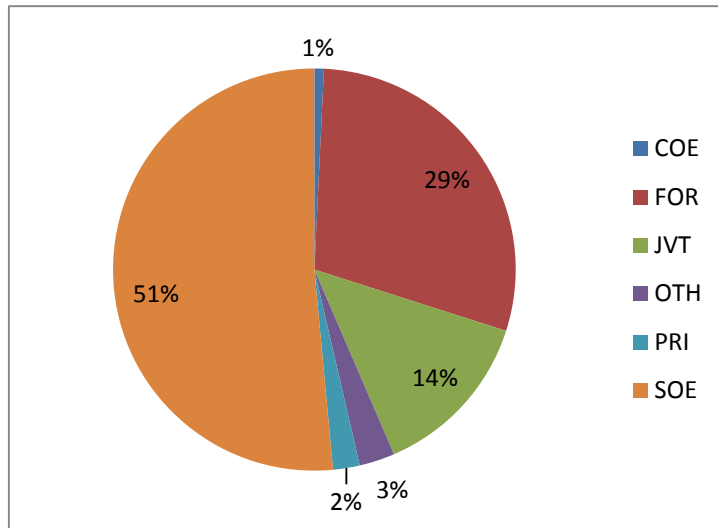


Figure 11. Number of PCs connecting to Internet by firm ownership.
 Source: Authors' calculations based on GSO database.

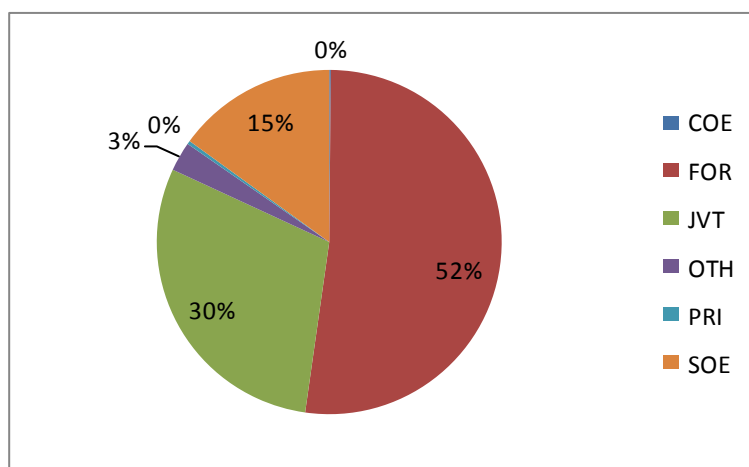


Figure 12. R&D expenditure by firm ownership.
 Source: Authors' calculations based on GSO database.

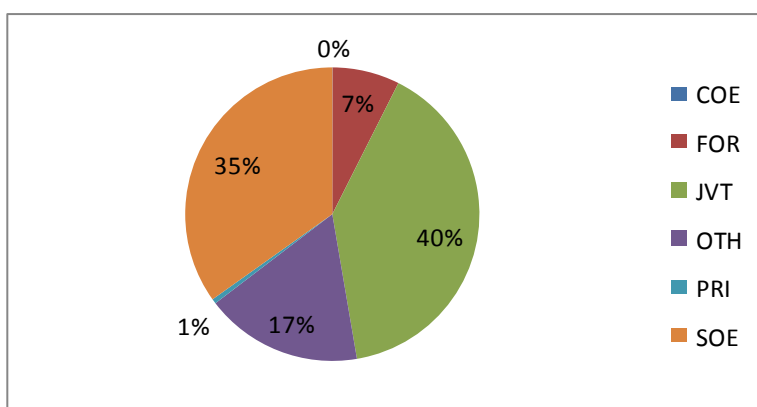


Figure 13. Business transactions by firm ownership.
 Source: Authors' calculations based on GSO database.

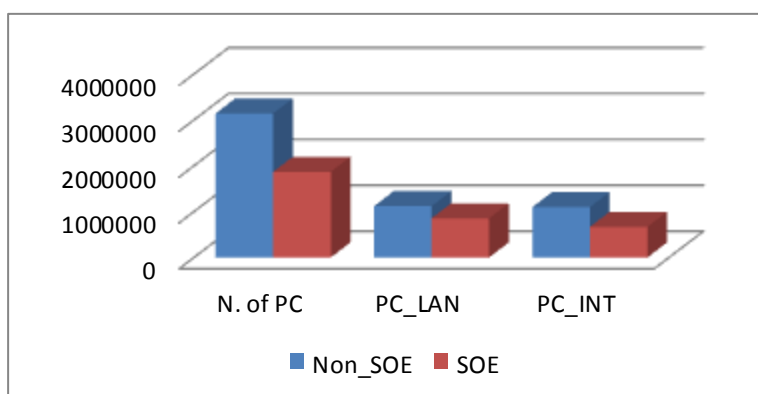


Figure 14. Number of PCs, number of PCs connected to LAN, Internet of State-versus Nonstate-ownership.
 Source: Authors' calculations based on GSO database.

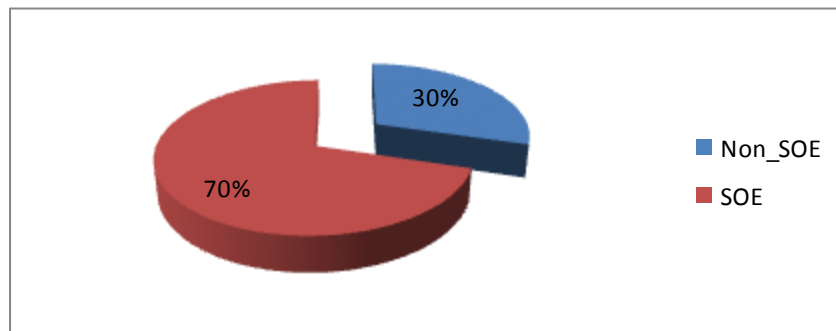


Figure 15. R&D expenditure of State- versus Nonstate-Ownership.
 Source: Authors' calculations based on GSO database.

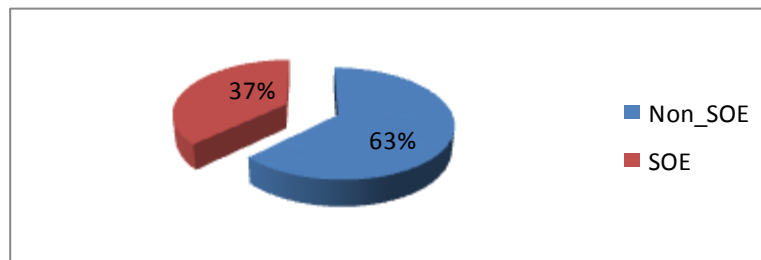


Figure 16. Business transaction of State- versus Nonstate-Ownership.
 Source: Authors' calculations based on GSO database.

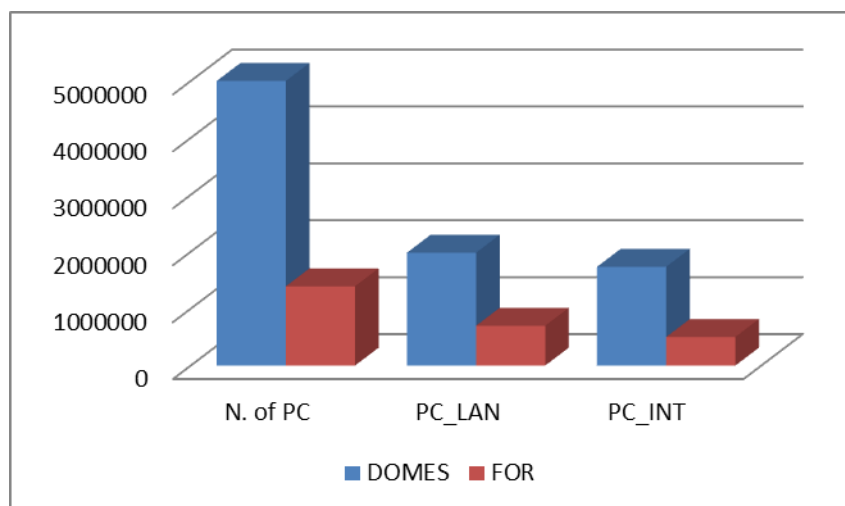


Figure 17. Number of PC, number of PC connecting to LAN, Internet of foreign versus domestic firms.
 Source: Authors' calculations based on GSO database.

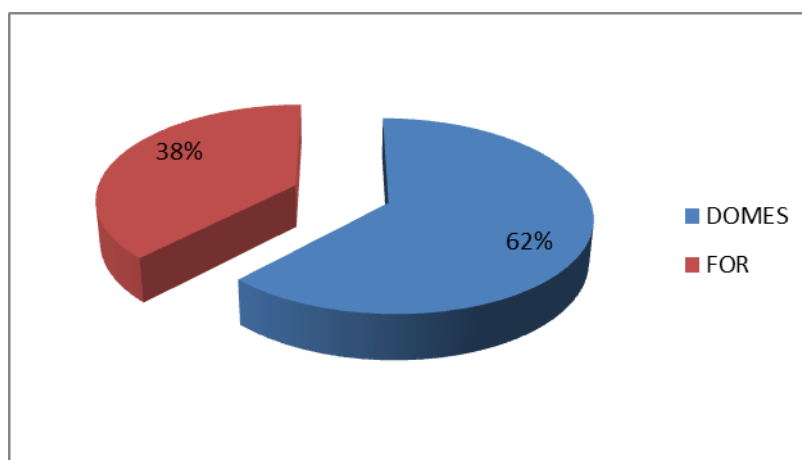


Figure 18. R&D expenditure of foreign versus domestic firms.
Source: Authors' calculations based on GSO database.

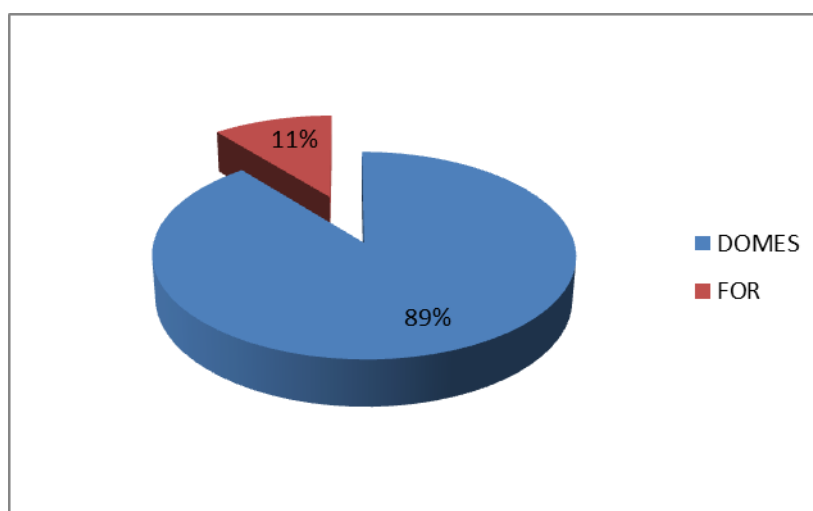


Figure 19. Business transactions of foreign versus domestic firms.
Source: Authors' calculations based on GSO database.

3. Discussion and conclusion remarks

IT is applied in many settings of knowledge management under the premise that a manufacturing organization will gain direct benefit from the investment. However, direct links from investment in IT to organizational performance have always been elusive [5]. IT may result in changes of firms' boundaries by saving internal production costs and market coordination costs [6]. Vietnamese firms' application of IT has been changing

significantly overtime, and varies a lot across different firm types.

In 2014, Vietnam faced a number of policy challenges as it pursued its ambition to fully benefit from the ICT revolution. Among these were challenges important for the country to sustain its progress on ICT readiness and also those that had critical implications for the long-term development of its Internet ecosystem. Sustaining progress on ICT readiness between 2012 and 2014, the pace of Vietnam's progress on ICT readiness slowed, especially in

comparison to peer countries in the region, such as the Philippines and Indonesia. In fact, Vietnam's global rank on ICT readiness declined by one place (from 83rd to 84th) while Indonesia's was up by 16 places (from 80th to 64th) and the Philippines jumped 8 places (from 86th to 78th). Vietnam continued to significantly improve its ranks on affordability (by 68 places, from 76th to 8th), and business environment (by 9 places, from 109th to 100th). At the same time, however, Vietnam's rank deteriorated substantially on Infrastructure and digital content (by 20 places, from 101st to 121st), Skills (15 places, from 73rd to 88th), Political and regulatory environment (12 places, from 79th to 91st), Business usage (10 places, from 78th to 88th), and Government usage (10 places, from 48th to 58th). In contrast, Indonesia and the Philippines did not enhance their ranks on affordability, but made considerable improvements on the Political and the regulatory environment (by 20 places), Government usage (26 places for Indonesia and 12 places for the Philippines), Business usage (13 places for Indonesia and 20 places for the Philippines). It should also be emphasized that Indonesia and the Philippines far outperformed Vietnam on Economic impacts in both rank and improvement over 2012-2014 (Vietnam: 6 places, from 102nd to 96th; Indonesia: 20 places, from 106th to 86th; Philippines: 29 places, from 77th to 48th). Urgent issues to be addressed if Vietnam was to sustain its progression on ICT readiness included fostering e-government application, addressing the shortage of ICT skilled labor, and expanding the mobile network coverage.

IT usage of Vietnamese enterprises is at an average level and needs to be improved. There are positive signs of implementing IT, yet big challenges for Vietnamese enterprises, especially SMEs in IT usage: they do not have enough resources for investing and developing IT within their enterprises. They find it difficult to figure out their real need and direction, which leads to a pitfall in implementing a proper information technology system.

The fourth industrial revolution is redrawing the world map, with the declining power of those countries which rely mainly on the exploitation of resources and increased power of countries which rely on technology and innovation. For enterprises, the high-tech revolution improves quality, speed or cost, enhances transparency, and consumers' engagement based on mobile networks and data networks, thus forcing companies to reorient the design, market and supply chain of products and services. Under the impact of the fourth industrial revolution, customers are increasingly becoming the center of the economy.

It is a real challenge for developing countries such as Vietnam when the wave of technological innovation in parallel with international integration and liberalization of global trade will create enormous competitive pressure on businesses, forcing businesses to review business models, improve product and service supply, and constantly innovate to adapt to the changing market. Challenges to businesses, especially small and medium-sized enterprises, are the lack of long-term vision, financial resources, information and skilled human resources to conduct technological innovation.

Therefore, Vietnamese firms should be more invested in R&D and innovation activities as well as using effectively capital sources in order to improve the performance of domestic enterprises in the context of the high competition coming from international trade. If Vietnam can take advantage of opportunities and overcome challenges, it will be able to narrow the development gap with advanced countries and achieve the goal of becoming, as soon as possible, a modern industrialized country.

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