APPLICATION OF INFORMATION ECHNOLOGY(IT): EVIDENCE FROM MANUFACTURING S ES IN VIETNAM

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Abstract:

In Vietnam, small and medium sized enterprises (SMEs) account for a large proportion in terms of both number of enterprises and number of jobs created. Despite the fact that information technology is widely acknowledged to play an increasingly important role in an ever modern business environment, SMEs are often considered to have weak capacity in applying information technology in doing their businesses. Based on data from an SME survey conducted in Vietnam in 2011, this study shows that human resources,formality of the SMEs, and physical infrastructureare the key determinants of their application of information technologyandperformance.

Keywords: *Information technology, SMEs.*

1. Introduction

The economic development in Vietnam has seen the emergence of the SMEs as a dynamic force for many years(Hansen et al., 2006). More than 97% of the total number of enterprises in Vietnam is the SMEs. The SMEs created about a half of the total employment in the economy and generated about a half of the total revenue of all enterprises in Vietnam.

There are a number of studies about SMEs in Vietnam (Hansen et al., 2006; Nguyen et al., 2008; Rand et al., 2009; Vu et al., 2009). Some studies tried to figure out determinants of innovation in product, production, marketing management, and performance of the SMEs. Other studies focused on difficulties that the SMEs in Vietnam have faced and how they have survived competition. Among these studies, Nguyen et al. (2008) and Vu et al. (2009) are two exceptions that analyzed the roles of human capital, which is measured by education and experience of either managers or workers, in innovation and performance of the SMEs. Further, Vu et al. (2009) argue that apart from human capital social capital is no less important in determining the SMEs' innovation and performance. Only a few studies touched upon the issues related

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to application of information technology of SMEs. Market Behavior Limited (1999) shows that managers of private enterprises in Vietnam have limited capacity in information technology and little knowledge of computers. According to Mai (2008), it is costly for the SMEs in Vietnam to look for information sources outside of Vietnam. It is partly due to language barriers that managers of the SMEs face and partly due to the fact information infrastructure to channel information to state companies.Nguyen (2005) argues that even though there are great efforts to promote application of IT in SMEs, a large proportion of government resources for IT development and application were directed to large State-owned enterprises. SMEs often lack supports for the initial phase of IT application. As a result, the application of IT in SMEs is limited.

Nevertheless, there has been no rigorous study to help us better understand why only some SMEs apply IT and others do not given that all of them face not much different constraints in the same business environment. Based on the dataset from an SMEs survey conducted in Vietnam in 2011, this study inquires into determinants of the application of IT in the SMEs in Vietnam. It is found that such determinants are not only limited to human capital of the SMEs measured by general education of the owners/managers and quality of the labor force. Physical infrastructure and formality of the SMEs are also important factors that determine their application of IT and their performance measured by export and operation size.

The rest of the paper is organized as follows. Part 2 presents descriptive statistics and advances testable hypotheses. Part 3 is followed with regression results. Part 4 concludes the paper with some policy implications.

2. Descriptive statistics and hypotheses

2.1. Data

Data in this paper are from a survey of manufacturing SMEs in Vietnam conducted in 2011. The survey was jointly conducted bythe Central Institute of Economic Management (CIEM) under the Ministry of Planning and Investment (MPI), the Institute of Labor, Science and Social Affairs(ILSSA) under the Ministry of Labour, Invalids, and Social Affairs (MOLISA), The University of Copenhagen, UNU-WIDER, and the Embassy of Denmark in Vietnam. Data were collected for 2010. Apart from the data about production and marketing of the SMEs, the dataset contains data about application of IT of SMEs. The total number of interviewed enterprises in the survey is 2,552. Due to missing values, we dropped 46 observations and, thus, a total of 2,506 observations remain for the analysis in this paper. The dataset contains information aboutwhether the SMEs use internet, emails, web, and computers; sell their products online; procure inputs online; and the operation size measured by value added.

2.2. Personal characteristics of the owners/managers

According to Table 1, there were more male owners/managers than female in the sample. The average age of the owners/managers was about 44 and most of the owners/managers belong to the Kinh ethnicity group. It is not surprising that the average educational level of the owners/managers, which is measured by percentage of those who have completed college or university, was not high. The owners/managers are, however, very knowledgeable about various laws as about

85% of them know at least one law among many others.[1]

Even though not shown in Table 1, about 29% of the female owners/managers graduated from college or university, while only around 21% of the male owners/managers could do the same. There is, however, not much difference in the age, Kinhethnicity, and knowledge about laws between the male and femaleowners/managers in the sample.

Table 1: Characteristics of the owners/ managers in the SMEs in 2010

Percent of male (%)	62.70
Average age (years)	44.73
Kinh ethnicity (%)	93.06
Percentwho have completed college or university (%)	23.86
Percentwho have knowledge about laws (%)	84.99
Number of owners/managers	2,506

Source: author's calculation from the SME survey

2.3. Characteristics of the SMEs

As presented in Table 2, the average firm age of the SMEs is about 12.4 years. The majority of the SMEs are household establishments and a minimal percentage of the SMEs were located in industrial zones or parks. On average, there was roughly only one worker who completed college or university degree, which accounts for about 7% of the total number of regular workers, in an SME. Even though not shown in this table, only30% of the sampled SMEs had at least one worker who holds college or university degree.

Table 2:Characteristics of the SMEs

Average firm age (years)	12.4
Percent of SMEs that are not household establishments (%)[a]	35.36
Percent of SMEs that are located in industrial/high tech/export processing zones/parks (%)	4.83
Average number of professional workers with college/university degrees	1.03
Average number of regular workers	14.86
Number of SMEs	2,506

[a] SMEs are either private, partnership, cooperative, limited liability, joint stock, joint venture, or state enterprises.

Source: author's calculation from the SME survey

Table 3 presents the state of application of information technology and performance of the SMEs measured by export and value added by various groups of SMEs that have different characteristics. The SMEs are divided into two groups based on the following criteria: 1) SMEs of which owners/managers hold college or university degrees and the others; 2) SMEs of which owners/managers know at least one law among the laws mentioned earlier and the others; 3) SMEs of which there is at least one worker who holds college or university degrees and the others; 4) SMEs that are not household establishments and the others; and 5) SMEs that are located inside industrial/ export processing zones/parks and SMEs that are located outside.

[1] This variable takes on the value of 0 if the owners/managers have no knowledge about either enterprise law, cooperative law, labor code, customs law, insurance law, tax law, environmental law, land law, investment law, social insurance law, or gender equality law. It is 1 otherwise.

Table 3: Percentage of SMEs that apply information technology

	Internet (%)	Email (%)	Web (%)	Average number of computers	Sell online (%)	Buy online (%)	Export (%)	Average VA (billion VND)*
1. Education of owners / managers (With college/university degree?)								
Yes	79.8	49.2	21.1	3.7	16.7	12.7	14.9	3.9
No	21.1	8.4	2.3	0.7	2.8	1.5	3.3	0.6
2. Legal knowledge of owners / managers (Know at least one law?)								
Yes	40.2	21.3	7.9	1.6	7.1	4.8	7.1	1.6
No	6.1	0.5	0.3	0.07	0.3	0.3	0.3	0.2
3. Quality of the labor force (At least one worker with college/university degree?)								
Yes	82.4	49.3	20.8	3.8	16.8	11.7	16.2	3.9
No	15.2	5.1	0.9	0.4	1.6	1.0	1.8	0.3
4. Formality of the SMEs (Being enterprises other than household establishments?)								
Yes	78.6	45.9	18.2	3.4	15.6	10.8	14.2	3.4
No	11.3	2.9	0.6	0.3	0.9	0.5	1.6	0.3
5. Located in industrial/export processing zones/parks?								
Yes	89.3	69.4	30.6	6.1	26.4	19.8	21.5	4.3
No	32.3	15.6	5.6	1.2	5.1	3.4	5.3	1.3

** VA is value added*

Source: author's calculation from the SME survey

For the first three criteria, which are proxies for human capital endowed by the SMEs, data in Table 3 show clearly that the SMEs that have owners/managers who graduated from college/university and that have workers who also graduated from college/university used more internet, email, web, computers, selling products and selling materials through internet more than others. Additionally, the former export more and have larger operation size measured by value added. The differences in IT application and performance between the two groups are statistically significant. For the last two criteria, i.e. formality of the SMEs and locations of the SMEs, the same findings are also presented in Table 3.

A great body of literature shows that various factors affect adoption of information technology and/or e-commerce by enterprises in general and SMEs in particular.These factors can be broadly classified in two groups, decision-maker characteristics and environmental characteristics, as identified in Ching and Ellis (2004). As summarized in their study, Brancheau and Webtherbe (1990), Kimberly and Evanisko (1981), and Palvia et al. (1994) confirm that education of SME decision-makers has positive relationship with adoption of information technologies. They also point out that other studies by Brancheau and Webtherbe (1990), Ozanne and Churchill (1971), and Thong (1999) show that younger owners/managers tend to adopt more information technologies. Regarding environmental characteristics, competitive

intensity has positive effects on the adoption of information technologies as shown in Kimberly and Evanisko (1981), Thong (1999), and Thong and Yap (1995).Supplier incentives and customer's pressure are also indicated to positively affect the adoption of e-commerce in these studies. Furthermore, firm size and firm age are also found to affect the adoption of information technology. Das and Das (2012) reveal that while firm size has positive effects on the adoption, firm age has negative effects in micro, small and medium enterprises in North India.

Therefore, the following four hypotheses are advanced and to be tested in the following section:

H1: Owners/managers of the SMEs who are more educated and have better knowledge about legal issues in doing their business tend to apply information technology more and perform better than others.

H2: The SMEs that employ highly-educated workers are capable of apply more information technology in doing their businesses and perform better than others.

H3: The SMEs that decides to become formal tend to apply information technology in doing their businesses more and perform better than others.

H4: The SMEs that are located inside industrial/export processing zones/parks tend to apply information technology in doing their businesses more and perform better than others.

3. Regression results

The basic model in this study is as follows:

(1) where Y can be information technology application variables including use of internet, use of email, use of web, use of computer, selling products through internet, buying inputs through internet, or performance variables including exporting products and logarithm of value added of the SMEs, *X1* is a vector which measures owners/managers' characteristics such general education, knowledge about legal issues, age, gender, ethnicity group, *X2* is a vector which includes education of the workers, formality of the SMEs, location of the SMEs, firm age of the SMEs, P is a vector which includesnine regional dummiesfor locations of the SMEs, *S* is a vector which includes 13 sectors where the SMEs were in.[2]

Because the variables representing the usage of internet, email, web, selling products through internet, buying inputs through internet, exporting or not of the owners/managers of the SMEs take on the values of one and zeroa logit model is applied when estimating effects of explanatory variables on them. For the regression of the usage of computer, a tobit model is applied because there are many SMEs that have zero computer and, thus, the variable is censored at zero. For the regression ofvalue added, a normal OLS model is applied, which is corrected for heteroskedasticity. Ideally, the regression strategy should show that the characteristics of the owners/managers of the SMEs and the characteristics of the SMEs as presented earlier affect the application of information technology that, in turn, determines performance of the SMEs. In other words, for the regressions of performance of the SMEs, a 2SLS model should be applied. Nevertheless, such model requires the

[2] Enterprises where the employees work were located in 10 provinces: Hanoi, HCMC, HaiPhong, Ex-Ha Tay, Long An, PhuTho, Quang Nam, Nghe An, KhanhHoa, Lam Dong. Sectors include food, garment, leather, wood, paper, printing, chemical, rubber, mineral, electronic, machinery, vehicle, and furniture products.

availability of an instrumental variable (IV) that affects the application of information technology but does not affect performance directly. It is impossible given the dataset to find such an IV. It is, therefore, decided that first-stage regressions will be performed for all explained variables including performance ones on the same set of explanatory variables. If similar effects of the explanatory variables on different explained variables are observed, it might be possible to indirectly conclude that application of information technology is important for performance of the SMEs.

Table 4 presents the regression results. It is interesting to observe that the interested variables have quite similar effects on the application of information technology and performance of the SMEs. In columns from (1) to (8), owners/managers who have completed college/university apply more information technology and perform better than others since this variable has positive and highly significant effects on all of the seven regressions. Such finding supports Hypothesis H1. Except in the regressions in columns (3), (5), and (6) where variable of legal knowledge of the owners/managers have positive but insignificant effects, it has positive and highly significant effects on all other regressions, suggesting that legal knowledge is important for the application of information technology and performance of the SMEs. Thus, this finding supports Hypothesis H1.

As mentioned earlier, human capital of the SMEs is also represented by the quality of the labor force. All of the regressions show that the variable for formal education of the workers has positive and highly significant effects on the application of information technology and performance of the SMEs. The finding confirms Hypothesis H2 that quality of the labor force is not only important for the application of information technology but also for increased export and operation size of the SMEs.

The effects of formality of the SMEs and their locations on the application of information technology and performance of the SMEs are strikingly similar to those of the human capital of the owners/managers. The coefficients of the variable for formality of the SMEs are positive and statistically significant in all of the regressions in columns from (1) to (8), indicating that the SMEs other than household establishments tend to apply more information technology and perform better than others. Such finding supports Hypothesis H3. The application of information technology of the SMEs that are located in industrial/export processing zones/parks is also more than that of other SMEs as the variable of industrial zones/parks has positive and significant effects on all regressions in columns from (1) to (6). In columns (7) and (8), the coefficients of this variable are also positive and significant, suggesting that the SMEs located inside of industrial/export processing zones/parks perform better than others. This finding confirms Hypothesis H4. Variable of age of the owners/managers has negative in all regressions but only significant in some regressions, suggesting that younger owners/managers were more active in applying information technology, exported more, and performed better than the older ones.

Because the major interested variables have quite similar effects on both the application of information technology and performance of the SMEs as clearly shown in Table 4 and as mentioned earlier, it can be said that application of information technology and performance of

Table 4: Determinants of application of information technology and performance of SMEs

	Internet	Email	Web	Computer	E-sell	E-buy	Export	Ln (value added)
	Logit	Logit	Logit	Tobit	Logit	Logit	Logit	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Owners/managers with	1.077***	0.815***	0.709***	1.327***	0.565**	0.847***	0.481**	0.281***
college/university degree	(0.16)	(0.16)	(0.21)	(0.42)	(0.22)	(0.29)	(0.23)	(0.06)
Owners/managers with	0.672***	1.997***	0.657	3.578***	1.339	0.640	2.471**	0.500***
legal knowledge	(0.26)	(0.74)	(1.03)	(0.81)	(1.04)	(1.08)	(1.03)	(0.07)
Having at least one worker	0.719***	0.212***	0.113***	0.573***	0.071***	0.083***	0.112***	0.143***
who have college/ uni. Degree	(0.14)	(0.05)	(0.03)	(0.05)	(0.02)	(0.02)	(0.03)	(0.01)
Gender of owners/ managers	0.052	-0.104	-0.394*	-0.375	-0.007	-0.060	-0.157	0.038
	(0.13)	(0.15)	(0.20)	(0.37)	(0.20)	(0.24)	(0.21)	(0.04)
Age of owners/ managers	-0.018***	-0.016**	-0.013	-0.016	-0.019**	-0.028**	0.002	-0.005**
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	0.00
Kinh ethnicity of owners/managers	-0.426*	0.047	0.038	0.092	0.340	0.470	-0.108	0.026
	(0.24)	(0.33)	(0.39)	(0.67)	(0.59)	(0.78)	(0.40)	(0.08)
Being located in industrial zones	1.261***	1.262***	0.839***	3.679***	0.817***	0.820**	0.556*	0.418***
	(0.44)	(0.27)	(0.28)	(0.67)	(0.28)	(0.33)	(0.31)	(0.11)
Formality	1.811***	2.120***	2.369***	5.901***	2.048***	1.890***	1.739***	1.260***
	(0.16)	(0.21)	(0.40)	(0.45)	(0.34)	(0.45)	(0.27)	(0.06)
Firm age	-0.009	-0.011	0.001	-0.003	0.007	-0.016	0.005	-0.008***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	0.00
Constant	-1.277***	-4.905***	-4.761***	6.412***	-4.925***	-4.415**	-8.208***	11.934***
	(0.48)	(0.88)	(1.28)	(0.15)	(1.47)	(1.75)	(1.28)	(0.15)
Nine regional dummies are included								
Thirteensectoral dummies are included								
Number of SMEs	2506	2506	2506	2506	2506	2506	2506	2506

Figures in the brackets are absolute values of standard errors. Regressions are corrected for heteroskedasticity. * and ** indicate significant levels at 5% and 1%, respectively.

the SMEs are strongly correlated. As a result, the application of information technology is important not only for large enterprises but also for SMEs in Vietnam.

4. Conclusion

Findings thathuman capital, formality, and physical infrastructure determine the application of information technology and, consequently, performance of the SMEs have important policy implications. First of all, it should be noted that similar to large enterprises, the SMEs are also active in applying information technology in their businesses. Secondly, there are several implications for the public sector in promoting the development of the SMEs in Vietnam by supporting them to apply more information technology in all of the production processes. It is important that more education and knowledge should be provided to not only owners/managers but also workers of the SMEs. Physical infrastructure including but not limited to industrial/export processing zones or parks should be advanced for the SMEs. Additionally, administrative procedures for the SMEs to become formal from household businesses should be improved. Such public policies will ensure more application of information technology by the SMEs and, consequently leading to their better business performance.❑

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