

The Impact of Information and Communication Technology on Performance of Logistics Service Providers in Vietnam

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Information and Communication Technology (ICT) has become an indispensable tool for logistics service providers (LSPs) to be competitive in the logistics market. LSPs increasingly relied upon ICT to create value for customers and other stakeholders. ICT benefits LSPs mainly for three reasons: cost reduction and better service to the customer. In Vietnam, ICT is being applied across domestic logistics industries, however, details on status and perception by LSPs towards ICT are not well-known. Therefore, the paper firstly attempts to clarify the status of ICT adoption among LSPs in Vietnam, such as foreign and local firms. The local firms are classified into large, medium and small firms. The technological gap between local and foreign LSPs in Vietnam are also analyzed. Besides, the motivators and barriers in ICT implementation are described. In general, ICT are introduced so that the performance of LSPs is improved. Thus, identification of the impact of ICT on firm performance are analyzed. The analysis were conducted for different ages, sizes and types of business since the current level of ICT adoption and impact on the revenue is likely to be different. It is also important to examine the implications of local government reform, and can help to make sure that the company can be able to learn new technologies quickly, adapt to changing trends in supply chain technology. Government is expected to present an industrial policy strategy for logistics and the transport of goods.

Key Words : *information and communication technology, logistics performance, Vietnam*

1. INTRODUCTION

Information and Communication Technology (ICT) has become an indispensable tool for logistics service providers (LSPs). LSPs have benefited from the use of ICT in their business processes mainly in: cost reduction and better service to customer. The purpose of this research is to clarify the status of ICT adoption among logistics service providers in Vietnam. Although ICT is being applied across Vietnamese logistics industry, details on status and perception towards ICT are not well-known. This paper describes the current status of the use of ICT in logistics within Vietnam, as well as the motivators and barriers of ICT implementation.

Vietnam lacks the presence of large domestic logistics service providers which have enough capacity and resources to undertake all stages of the logistics supply chain; thus, the large parts of logistics services are falling into the hands of foreign corporations.

According to The Saigon Times (2011)¹⁾, of approximately 900 logistics firms in the country, only 20% are joint ventures with foreign businesses, but they account for about 80% of the market share. Currently, more and more large logistic companies are coming and expanding operations in Vietnam, like Schenker - a joint venture between Gemadep and Lotte Sea, YCH-Protrade DistriPark, Mearsk, APL, Diethelm and Mapletree (Vietnam Business

Forum - VCCI, 2010²). Efficiency gap between local and foreign firms might be too large for domestic firms to benefit from the production activities of foreign firms.

At present, ICT system plays a key role in the process of logistics activities, and is considered as the third matter, standing behind the infrastructure and customs required to be settled to create conditions of development of such service. However, Vietnamese logistics companies are still young, with limited resources and technology specialists on staff.

The application of IT in data transmission in Vietnam is still limited. For example, at seaports in Vietnam which takes an important role in logistics administration, a few of port applies system of IT and EDI, others are able, however, not yet fully prepared, while several ASEAN countries have made substantial efforts to build up an inter-ministry, public-private EDI network to share the logistics information and to improve the industry's operations. The company should invest in modern technology to improve their information sharing ability as well as develop effective logistics pipeline integration. ICT adoption by large logistics service providers in developed country has been widely studied by Gunasekaran and Ngai. (2003)³, Piplani et al. (2004)⁴, Pokharel (2005)⁵, but ICT diffusion and its impact on the competitive capabilities of companies in developing nations has attracted little attention.

According to Pokharel (2005)⁵, ICT can be an enabler for both front-end and back-end processing in a supply chain. Access to information by each of the party in a supply chain can make logistics services more accurate, swift and less costly. The visibility of correct information can help the management to innovate operations for further improvements in service efficiency of a logistics company. The study also showed that the following classification of information technology applications were used to assess the status of technology implementation in LSPs.

According to the logistics survey compiled by SCM Consulting and Research Services (2008)⁶, top five logistics outsourcing activities are domestic transportation (100%), forwarding (77%), warehousing (73%), customs clearance (68%) and international transportation (59%). The survey was conducted on 300 companies among the top 500 largest companies in Vietnam, with the most respondents included operations manager, director of logistics and supply chain management. A wide range of participating companies, especially in consumer packaged goods sector, ranged from 250,000 USD to over 5 million USD of total annual revenues.

Here, three research questions arises; (1) What ICT practices are currently used by Vietnamese LSPs

and the differences between local and overseas multinational companies?, (2) What is the relationship between ICT adoption and the performance of firms? and (3) What are the major obstacles of ICT usage in Vietnamese LSPs and how to overcome them? In this study, corresponding to these research questions, major objectives are set up: (1) Analyse the status of ICT adoption and technological gap between local and foreign LSPs in Vietnam, (2) Identify the impact of ICT on firm performance in different ages, sizes and types of business and (3) Analyse the ICT adoption barriers and develop strategy for wide adoption among Vietnamese LSPs.

2. HYPOTHESIS AND DATA COLLECTION

(1) Hypothesis statement

In order to examine the relationship between ICT and firm size, a set of hypotheses in their own individual contexts have been defined. If ICT and firm size are complements, a positive correlation between them would be observed. Seven hypotheses are formulated as follow:

Hypothesis H1: Firm size is correlated to the number of ICT tools used

Hypothesis H2: The number of ICT tools used is correlated to firm types

Hypothesis H3: The number of ICT tools used is correlated to total floor area of all warehouses

Hypothesis H4: The number of ICT tools used is correlated to the number of branches, offices and subsidiaries

Hypothesis H5: The number of ICT tools used is correlated to the years of business

Hypothesis H6: The number of value added services supplied is correlated to the number of ICT tools used

Hypothesis H7: Firm's turnover is correlated to the number of ICT tools used

Hypothesis H1 and H2 explores the potential connection existing between the firm size or types and the adoption of ICT innovation (in the form of number of ICT tools) in LSPs. In hypothesis H3, H4 and H5, the correlation between number of ICT tools used and firms assets / network / age are identified. Hypothesis H6 addresses an interesting relationship between the level of ICT in place within the companies and the level of complexity in the value added services supplied, and finally hypothesis H7 explores the connection between ICT and firm's net sales as well as gross profit.

(2) Data collection

a) Research target

Vietnam now has approximately 900 logistics companies, covering the North, Central and South regions (The Saigon Times, 2011) as mentioned in chapter 1. The research target group is the companies consisting of logistics service providers operating in Vietnam. In general, logistics companies are divided into three types: (i) Freight Forwarder (FF), (ii) Shipping Liner (SHP) and (iii) Terminal Operator (TO). Those companies represent different sizes of business measured by number of employees. Large firms are those whose number of employees exceeds 200 and small firms are those whose number of employees does not exceed 50. In this study, the observed firm sizes are divided into 4 groups; (1) Small (less than 50 employees), (2) Medium (51-200 employees), (3) Large (over 200 employees) and (4) Foreign PSPs. Here, foreign LSPs do not belong to either of the above Small/Medium/Large categories.

b) Questionnaire survey

A questionnaire survey was conducted among Vietnamese logistics firms. The questionnaire was sent by email in December 2010 to logistics firms operating in Vietnam. In January 2011, the questionnaire was sent again by email to non-respondents. The survey was conducted on 258 companies, with the most respondents included operations manager, director of logistics and supply chain management.

The survey included ten questions and measured the following dimensions: the technologies currently used and planning to use in the future, the value added services supplied, the reasons of investing in ICT, the factors inhibiting ICT adoption and the respondent profile.

In order to collect the companies' data of all publicly listed firms on the stock exchange of Vietnam, the observation focused on the companies which responded to the questionnaire survey. Their financial statements are open to the public, as it is by law that public companies make their financial information available. Most of the information was obtained through the ventures' prospectus, a balance sheet or statement of financial.

3. RESULTS AND DISCUSSION

(1) Firm profile

The total number of questionnaires received was 39 at 2nd February 2011. 5 questionnaires were found unusable and excluded from the survey since they were incomplete. The final number of usable responses was 34, as shown in Table 1.

Table 1 Sampling results

Companies contacted	258
Questionnaires received (response rate =15.1%)	39
Questionnaires unusable	5
Total usable questionnaires	34

Among 34 samples, LSPs are divided into three types - Freight Forwarder (FF, 65%), Shipping Line (SHP, 23%) and Terminal Operator (TO, 12%). Regarding the firm sizes, most of those respondents are large firms (35%), small and medium firms (50%), while foreign firms are 15%. These foreign firms are from Japan, Italy and Kuwait. In regard to head office locations of LSPs, most of the respondents came from Ho Chi Minh City (62%), following Hanoi (21%), Hai Phong (10%) and Others (Southern Vietnam, 7%).

(2) Technological gap between local and foreign firms

Among various ICT tools, the use of Electronic data interchange (EDI) has been rapidly adopted for the enhancement of interactions and activities. Almost of foreign and large firms (100%), medium and small firms (66.7% and 75% respectively) use EDI to transfer electronic documents or business data from one trading partner to another trading partner without human intervention.

Fig.1 clearly indicates a significant increase of ICT tools used from small to large-sized and foreign companies.

Though the adoption of more complex technologies (such as RFID, ERP and CRM) is quite low in all firms, data shows that these technologies are more widely used by advanced logistics providers. Fig.2 shows the number of value added services offered by the surveyed companies. Moving from small firm to large and foreign logistics providers, the number of value added services offered increases dramatically. The technological gap between local and foreign firms might be too large for domestic firms to benefit fully from the production activities of foreign firms. As a result, the level of foreign enterprise on value added services tends to be much higher than that on the local ones. Providing value added services is one of the key factors to enhance competitiveness in logistics industry, but national firms have not made sincere efforts in this direction.

(2) Relationship between ICT investment and firm performance

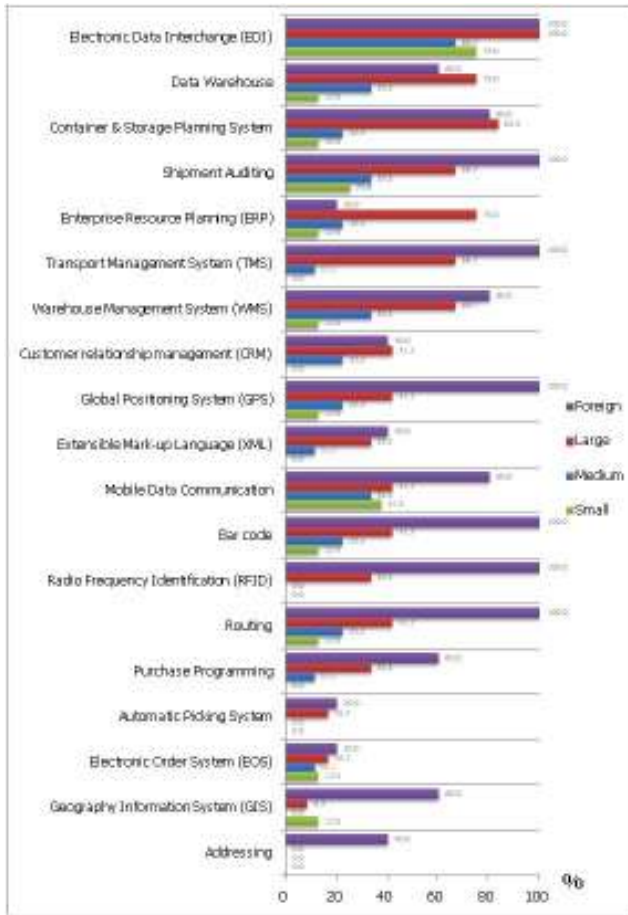


Fig. 1 Current ICT tools used by local and foreign firms

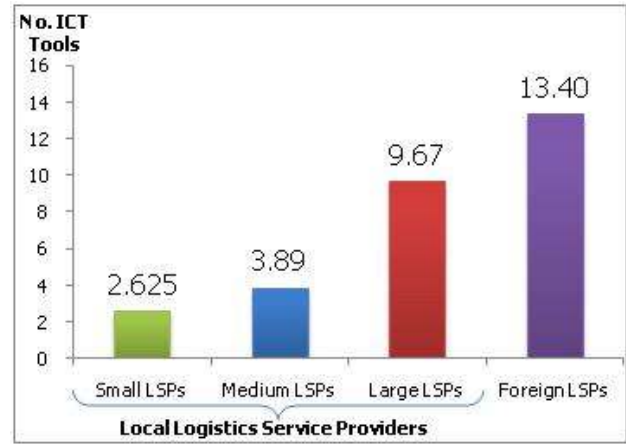


Fig. 3 The ICT adoption level of local and foreign enterprises

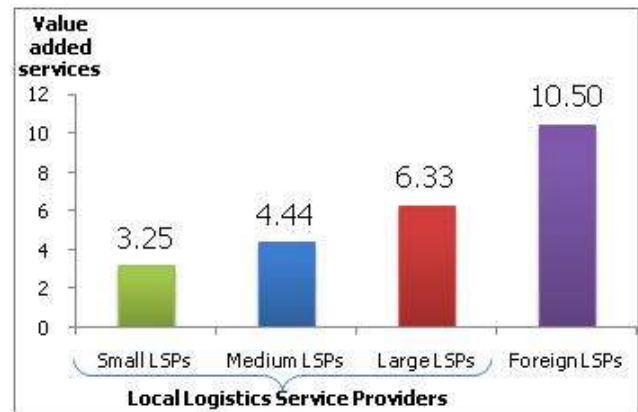


Fig. 4 Level of value added services supplied by local and foreign enterprises

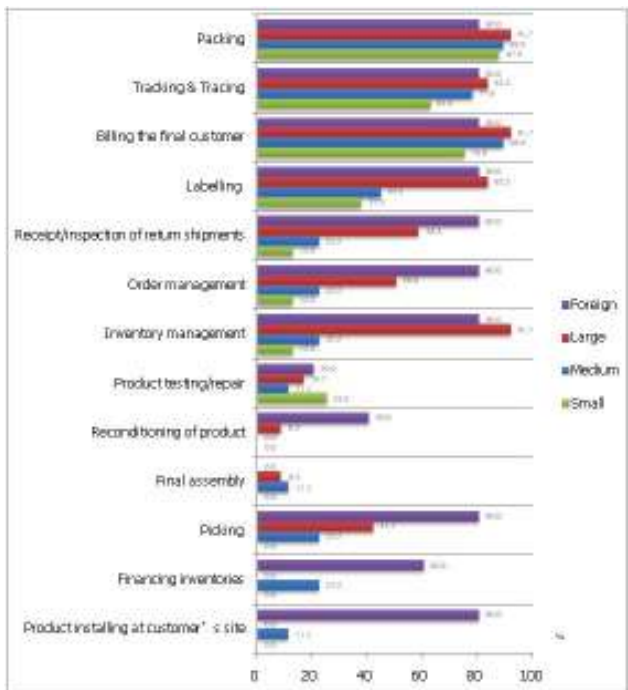


Fig. 2 Current value added services supplied by local LSPs

In this section, one-way ANOVA was performed in order to find the significant relation of development efficiency among each group.

Hypothesis H1: Firm size is correlated to the number of ICT tools used

The results show that a significant positive correlation was found between the number of ICT tools and firm sizes, including foreign firms. The number and the complexity of ICT tools adopted generally tend to increase with the enlargement of the company size.

Table 2 ANOVA test result (H1)

	Between Groups	Within Groups	Total
Sum of Squares	530.340	220.631	750.971
Degree of freedom	3	30	33
Mean Square	176.780	7.354	
F-value	24.037		
p-value	0.00000004		

This hypothesis was accepted with strong support ($p\text{-value} < 0.05$). The ICT tools used are significantly different across the companies in different sizes, and increase linearly with increasing number of employees. Even small firms forecast a wider impact of ICT on their business, they seem to be the most reluctant to spending to accelerate its pace towards

e-business integration, due to low budgets. The large businesses can afford to invest in expensive ICT infrastructure to improve the company's ability to sense and respond to customer demand. Further, with the technological advancement, more and more services could be offered which is essential to maintaining firm's presence within the competitive market.

Hypothesis H2: Firm types is correlated to the number of ICT tools used

With $p\text{-value} > 0.05$, the hypothesis is rejected. There was no significant association between the use of ICT and firm types.

Table 3 ANOVA test result (H2)

	Between Groups	Within Groups	Total
Sum of Squares	100.823	650.148	750.971
Degree of freedom	2	31	33
Mean Square	50.411	20.973	
F-value	2.404		
p-value	0.107		

Freight Forwarder, Shipping Line, as well as Terminal Operator play very important roles in the logistics industry, and integrated ICT systems (for example "tracking and tracing systems") also contribute to the successful integration of quality management systems. That's the reason why no significant differences in these ICT usage are noted between types of firms including both local and foreign enterprises.

Hypothesis H3: The number of ICT tools used is correlated to total floor area of all warehouses

This hypothesis was accepted with $p\text{-value} < 0.05$. For better control of warehouse operations, the companies need a flexible, integrated control system to provide visibility into their warehouse operations and supply chain. The firms whose large warehouse areas often have all of their warehouses completely automated with information technology for inventory control and robotics-based warehouse handling.

Table 4 Result of parameter estimation (H3)

	Coefficient	t-value	p-value
Warehouse Space	2.450E-5	3.564	0.003
Constant	6.574	7.703	0.000002
R square	0.476		
Adjusted R square	0.438		

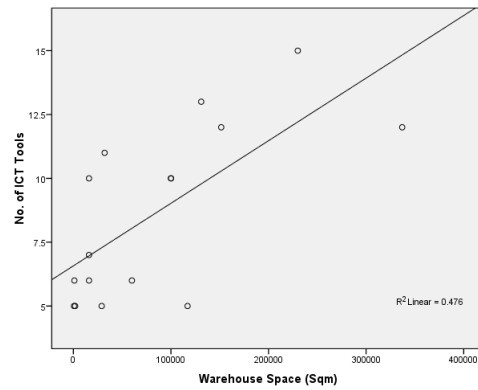


Fig.5 Means plots of ICT tools used and firm assets

Hypothesis H4: The number of ICT tools used is correlated to the number of branches, offices and subsidiaries

A highly significant correlation with a $p\text{-value}$ less than 0.05, was obtained, and this hypothesis was therefore accepted. The analyses presented here show that clear positive correlation between ICT usage and firm's network. This means surveyed companies tend to invest on ICT for better collaboration between disparate offices, shorter time to productivity for employees, and easier data sharing with subsidiaries or partners.

Table 5 Result of parameter estimation (H4)

	Coefficient	t-value	p-value
No. of Branches and Subsidiaries	0.553	5.823	0.000003
Constant	2.401	3.020	0.005
R square	0.557		
Adjusted R square	0.540		

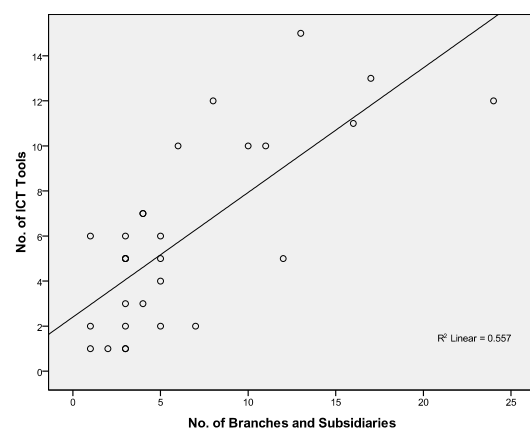


Fig.6 Means plots of ICT tools used and firm assets

Hypothesis H5: The number of ICT tools used is correlated to the years of business

The analyses presented here show the positive correlation between ICT usage and firm age ($p < 0.05$). This indicates that older firms tend to acquire ICT earlier than other categories of firms. This finding with regard to firm age are consistent with the need for ICT-complementing organizational changes. Moreover, experience gained from past process innovations helped those companies to make technology investments more productive.

Table 6 Result of parameter estimation (H5)

	Coefficient	t-value	p-value
Years of business	0.230	3.272	0.003
Constant	2.712	2.060	0.051
R square	0.318		
Adjusted R square	0.288		

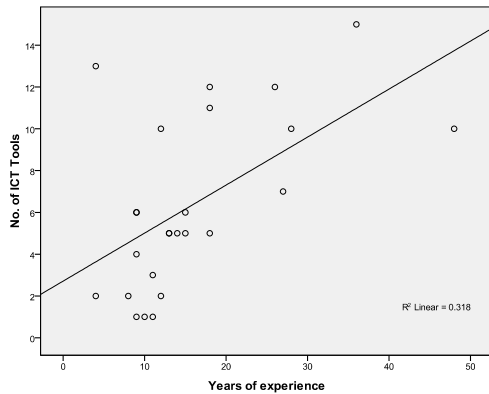


Fig.7 Means plots of ICT tools used and firm assets

Hypothesis H6: *The number of value added services supplied is correlated to the number of ICT tools used*

A Pearson correlation revealed a significant correlation between the two variables ($R=0.847$, $p < 0.05$), thus hypothesis H7 was accepted. In summary, it can be concluded that the value added services and ICT applications are relatively highly correlated, and they are considered key leverages to differentiate businesses and improve company competitive abilities.

Table 7 Result of parameter estimation (H6)

	Coefficient	t-value	p-value
No. of ICT Tools	0.484	8.865	0.000000001
Constant	2.202	4.779	0.00004
R square	0.717		
Adjusted R square	0.708		

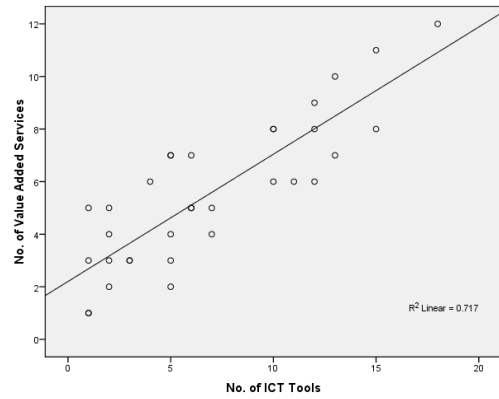


Fig.8 Number of ICT tools used and number value added services

Hypothesis H7: *Firm's turnover is correlated to the number of ICT tools used*

With p -values > 0.05 for both cases (Net Sales and Gross Profit), the hypothesis was rejected. There was no significant association between the use of ICT and firm's turnover. The gap between firms in different turnover status using these technologies has narrowed considerably. Furthermore, some of the shipping companies with high revenue do not usually have high levels of ICT adoption.

Table 8 Result of parameter estimation (H7, Net sales)

	Coefficient	t-value	p-value
Net sales	3.308	1.479	0.167
Constant	-6.265	-0.283	0.782
R square	0.166		
Adjusted R square	0.090		

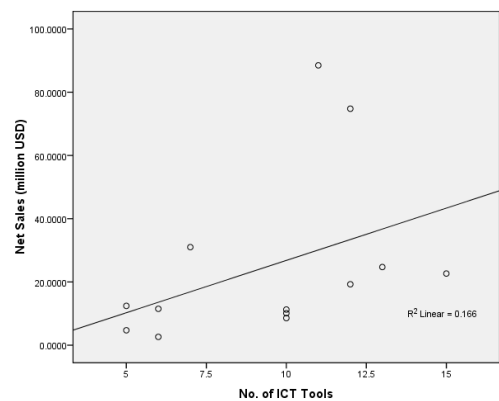


Fig.9 Means plots of ICT tools used and Net Sales

Table 9 Result of parameter estimation (H7, Net sales)

	Coefficient	t-value	p-value
Gross profit	0.596	0.524	0.066
Constant	-1.610	-0.556	0.589
R square	0.274		
Adjusted R square	0.208		

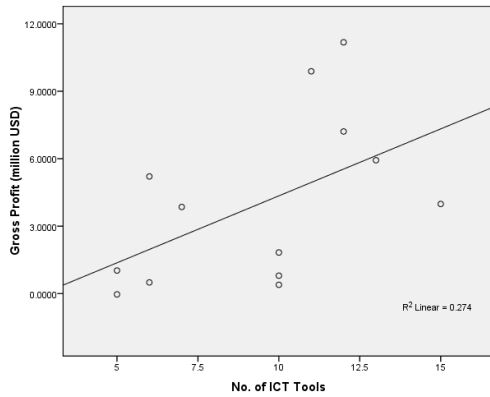
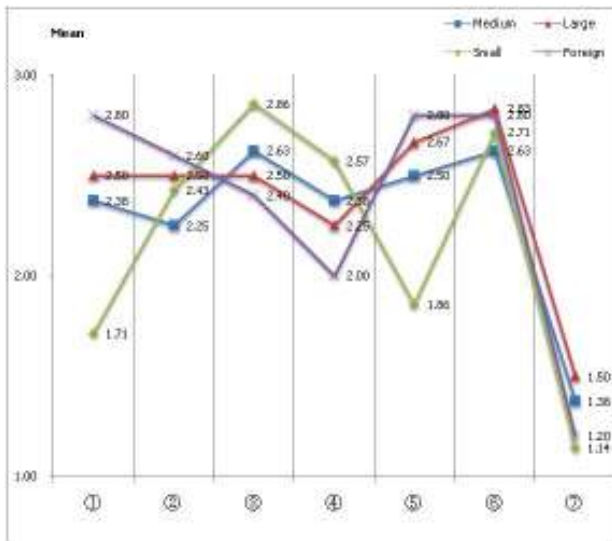


Fig.10 Means plots of ICT tools used and Gross Profit

(3) Impacts, motivators and barriers for ICT adoption

Fig. 11 reveals that most logistics firms surveyed in Vietnam considered the impact level of ICT as high impact. A point four scale was used to describe the impact from ICT use on logistics (0 = no impact, 1 = low impact, 2 = moderate impact, 3= high impact).



1. Cost reduction
2. Human Errors reduction
3. Improvement of effectiveness in control and planning
4. Integrating customers' logistics and production management systems
5. Improvement of flexibility towards customer's needs
6. Improvement of overall quality of customer service
7. Request from intermediaries

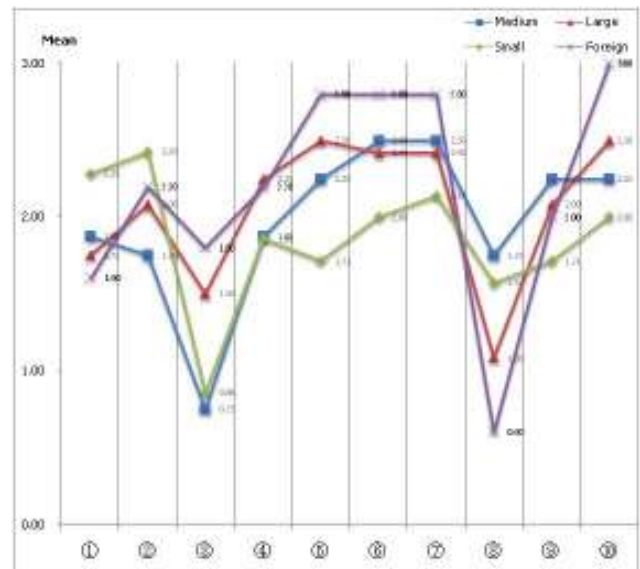
Fig.11 Impact level and motivators of ICT adoption among firms

The degree of impacts obtained from the survey mostly falls between large impact and moderate level as shown on the mean value of each variable on the impact of the use of ICT. The three biggest impacts of ICT use on logistics are “improvement of effectiveness in control and planning” (mean=2.6), “Improvement of overall quality of customer service”

(mean=2.7).

There are some significant differences on the level of “Cost reduction” and “Improvement of flexibility towards customer’s needs” impacts on ICT use between firm sizes. Small firms seem not to consider ICT as enabler for cost reduction (1.71) and flexibility (1.86), while large and foreign ones make best use of information and communication technology not only to reduce the cost of logistics enterprises, but also improve business service levels and operational efficiency, such as enhanced the consistency of strategic actions to improve customer responsiveness. This could be mainly because of long-term focus achieve higher performance and strategic or operational objective plays a moderator role in this relationship. Even small firms are highly aware of the benefit of ICT on their business, they seem to be the most reluctant to spending to accelerate its pace towards e-business integration, due to low budgets.

Fig.12 shows some of the main barriers to ICT adoption of logistics service providers in Vietnam.



1. High running costs
2. High investment and implementation costs
3. Unclear return on investment
4. Change management
5. Update of personal skills
6. Lack of technological skills
7. Data security
8. Difficulties in selecting ICT vendors
9. Difficulties in customers' SCM systems integration
10. Lack of technological standards

Fig.12 Barriers for ICT adoption among firms

The major barriers considered by the LSPs are: “Update of personal skills”, “Lack of technological skills”, “Data security” and “Lack of technological standards”. Among four group of companies, small firms face a number of constraints in adopting ICT. They chose their top two main barriers which are: “High investment and implementation (installing,

management, etc.) costs” (2.43), “Data security” (2.14) and “Lack of technological standards” (2.0).

The perception differs between foreign, large and small firms in terms of unclear return on investment, technological skills and standards, data security. There are also some differences on the level of cost obstacles on ICT investment between firm sizes. Large companies often use information technology to coordinate and communicate across different organizational levels and divisions, whereas small ones are cautious about wasting precious resources on unproven technologies, preferring to wait until innovative IT applications have become mature and are accepted in the world. In other words, small firms are already under extreme pressure to survive and struggling to maintain their business. The results also show that small and medium businesses are less likely to provide training and updating of personal skills for their employees than large and foreign firms.

(4) Analysis of every ICT tool currently used across firms of different size

The study characteristics was assessed by one-way ANOVA test to examine the correlation between every ICT tool and firm size (small, medium, large and foreign firms). We considered variables with a p-value of less than 0.05 to be significant. ANOVA test result with p-value < 0.05, shows that there was a significant association between each of the following 12 ICT tools (of total 19 tools) and firm size.

Table 10 ANOVA test result of every ICT tool and firm types

ICT tools	F	Sig.
Mobile Data Communication	1.042	.388
Data Warehouse	3.392	.031
Electronic Order System (EOS)	.081	.970
Electronic Data Interchange (EDI)	2.185	.110
Purchase Programming	2.864	.053
Container & Storage Planning System	7.357	.001
Shipment Auditing	3.736	.022
Routing	5.016	.006
Geography Information System (GIS)	4.255	.013
Global Positioning System (GPS)	5.016	.006
Bar code	5.016	.006
Radio Frequency Identification (RFID)	14.816	.000004
Extensible Mark-up Language (XML)	1.994	.136
Automatic Picking System	1.089	.369
Addressing	5.686	.003
Enterprise Resource Planning (ERP)	4.651	.009
Customer relationship management (CRM)	1.667	.195
Transport Management System (TMS)	13.162	.00001
Warehouse Management System (WMS)	3.357	.032

Fig.13 illustrates the distribution of these selected ICT tools by firms. The use of more complex technologies such as Transport Management System, Shipment Auditing, GPS, RFID, Routing are widely used by foreign firms operating in Vietnam, whereas local large firms focus on Container & Storage Planning System, Enterprise Resource Planning, Transport Management System and Warehouse Management System. Small and medium-sized firms lag behind large and foreign firms in almost all indicators of ICT and e-business use presented in this study.

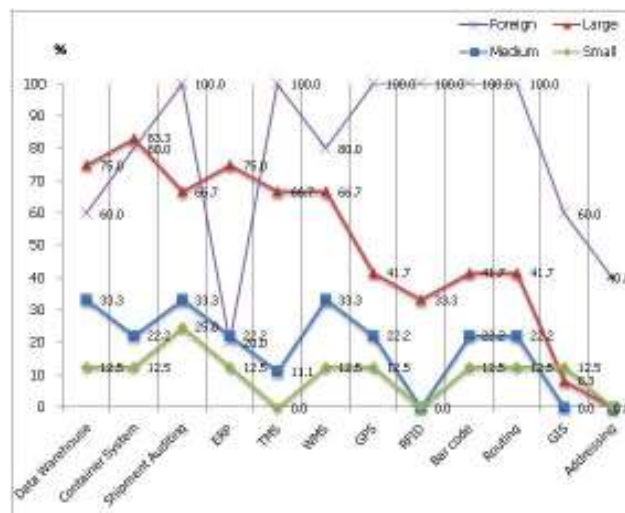


Fig.13 ANOVA test result of ICT tools and firm size

Compared to small and medium companies, large and foreign ones may be more aware and informed of the latest technological advances, and more able to handle the level of risk associated with ICT investment than smaller firms thank to their greater resources. Furthermore, larger firms may expect greater benefits from using technology than smaller ones. Based on above result, every ICT tool can be performed at different stages of investment. This not only suggests favorable strategy for ICT investment decision but also provides their corresponding option value to justify the decision.

6. CONCLUSION

Generally, the purpose of the study was to investigate the diffusion of technology that focus on the interaction of logistics industry, as well as its operation and management issues. The use of Electronic data interchange (EDI) has been rapidly adopted for the enhancement of interactions and activities, though the adoption of more complex technologies (such as RFID, ERP and CRM) is absolutely low in all firms. The technological gap between local and

foreign firms is too large for domestic firms to benefit from the production activities of foreign firms. Compared with local enterprises, foreign firms are large in scale, efficient in operation and level of services supplied.

The results show that significant positive correlations were found between the number of ICT tools and firm sizes, assets, network, age, and value added services. The number and the complexity of ICT tools adopted generally tend to increase with the enlargement of the firm performance. The biggest impacts of ICT use on logistics are improvement of effectiveness in control and planning, and improvement of overall quality of customer service. There are some broad key challenges to ensuring the optimal use of ICT by Vietnam's logistics firms. The major barriers considered by the LSPs are data security, technological skills and standards. Among four group of companies, small firms face a number of constraints in adopting ICT which are investment cost and technological standards. Problem on cost and financing in acquiring the ICT or high capital which indicates that most firms are lack of financial resources. Moreover, the use of ICT in logistics industry received a small attention and there is no constant monitoring and evaluation on how ICT will be fully utilized in freight logistics from the government side.

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