

# Low-carbon FDI in the Manufacturing Sector in Vietnam:

## A Stable Trend or Only a Temporary Phenomenon

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### Abstract

Climate change requires the world turning toward green/low-carbon economic development. Likewise, it brings about a new generation of FDI policies at both the international and national levels. As a result, inward Low-carbon FDI (LCF) is encouraged by many host countries.

Vietnam received a large amount of FDI in 1988-Aug. 2014, with over 50% of the total registered projects and capital flows in the manufacturing sector. Though some research shows that there is a footprint of LCF flow in this sector, still it is the major source of CO<sub>2</sub> emissions in Vietnam. This paper is based on the theoretical framework of Low-carbon FDI developed in the World Investment Report 2010 (UNCTAD) to examine the trend of LCF in Vietnam's manufacturing sector. The result of a survey on FDI enterprises' awareness of and motivation for their Low-carbon Performance (LCP) in Vietnam reveals that LCF may enter the country. However, this trend is not stable as most foreign affiliates consider "production cost saving" and "Air/water pollution treatment" as the major locational determinants and there are not yet stringent LCP requirements by Vietnam government. Those foreign affiliates are aware of LCP, and spontaneously apply Low-carbon technology (LCT) in their core production process, require/support LCT implemented by their input suppliers or industrial customers, and are possibly participating in certain LCP value/supply chains. In switching to the new generation of "quality" inward FDI promotion policy, LCF locational determinants in Vietnam should be taken thoroughly into consideration.

**Key words: Low-carbon FDI (LCF), LCF determinants and drivers**

### 1. Introduction

In this millennium, the world is coping with climate change as well as energy and food security. Natural

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The authors would like to express deep thanks to Prof. Craig Parsons, Faculty of Economics, Yokohama National University for his precious comments.

disasters are increasing, and the earthquake and tsunami in March 2011 in Japan and the prolonged flood in Thailand in 2012 revealed the negative impacts of climate change. The disadvantage of nuclear energy and the political uncertainty in the oil-rich region showed the instability caused by human's dependence on fossil fuels. This situation requires countries to save fossil fuel use that can not only mitigate the risk of energy security but also reduce CO<sub>2</sub> emissions intensity and other greenhouse gases (GHGs) to curb the earth's warming. However, in the process of economic and social development, the faster the economy grows, the more energy is to be consumed, ultimately resulting in increasing volume of GHGs emitted to the atmosphere. Climate change has become the central issue in the international political area, and seriously debated at Conferences of the Parties to UNFCCC for over two decades and drawn concern by not only developed but also developing countries.

However, Hanni et al. (2011, p. 29) suggests: *“though awareness of climate change continues to grow and significant policies and regulations have been implemented at the national level, it is ascertained that private sector investment plays a critical role in supplementing government GHGs mitigation efforts. Transnational corporations engaging in foreign direct investment (FDI) is considered as the major players in developing a low-carbon economy in both home and host countries”*.

FDI is considered as a dynamic factor contributing to Vietnam's economic growth over last two decades. By August 2014, in Vietnam there were 16,910 FDI projects in effect with registered capital of US\$ 243,038 billion and creating over 2 million direct jobs. In 2013, FDI shared about 30% in total capital formation and contributed 18% of GDP. However, after 26 years of FDI attraction, it is said that: “Vietnam has succeeded in attracting FDI in terms of volume but not in quality”. Though the number of FDI projects in manufacturing industry, which is the largest CO<sub>2</sub> emitter in Vietnam's economy by 2013, accounts for about 50% of total FDI projects in Vietnam, Ministry of Planning and Investment of Vietnam in 2013 (MPIVN) reported that in comparison with the world's average technology level, over 80% of inward FDI projects attracted in 25 year (1988–2012) used technology at the same level, 14% at lower level, and only about 5–6 % at higher level. Are Vietnam's inward FDI enterprises aware of Low-Carbon performance (LCP) in this country? The World Investment Report 2010: Investing in a Low-Carbon Economy (WIR 2010) provides a comprehensive theoretical framework on concept of LCF, its drivers and determinants. This paper based on WIR 2010's arguments and references to hypothesis of “Pollution havens” and “Pollution Halo” to investigate foreign investors' awareness and their actual Low-carbon performance when investing in Vietnam.

The paper uses primary data from the survey conducted in 2013 by a researcher group at the University of Economics and Business (UEB) of Vietnam National University Hanoi (VNU Hanoi). The survey was carried out by sending questionnaires to domestic and FDI enterprises in manufacturing industry in Hanoi and neighboring area. In addition, interviews were held with some key persons of Canon's, Panasonic's foreign affiliates in Hanoi, VIJACHIP in Da Nang, Cai Lan Vegetable Oil Joint-Stock Company in Quang Ninh province for further understanding of enterprises' awareness on Low-carbon economic growth and their responses to Vietnam's environment/energy relating policies.

The paper is designed as follows: the next section reviews the theoretical framework of Low-Carbon FDI (LCF) and raises the hypothesis for survey FDI's awareness, motivation and obstacles of Low-Carbon Performance (LCP); the third section introduces the survey sample and organization; the fourth section summaries the findings and explanation; the last section ends up by providing some conclusions and discussion

on FDI policy implications for Vietnam.

## 2. Reviewing theoretical framework for Low-carbon FDI analysis

*“Low-carbon foreign investment is the transfer of technology, practices or products by TNCs to host countries –through equity investment (FDI) and non-equity forms of participation–such that their own and related operations as well as use of their products and services, generates significantly lower GHG emissions than would otherwise prevail in the industry under business-as-usual (BAU) circumstances” and “such that Low-carbon FDI is FDI undertaken to access low-carbon technologies, processes and products” (WIR 2010, p. 103).*

Based on the OLI paradigm and various empirical research, locational determinants of FDI developed in World Investment Report 1998 (p. 91) consist of three groups: FDI relating policies and regulations of the host economies, economic factors (market-seeking, resource seeking and efficiency seeking), and business facilitations.

Then drivers and locational determinants of FDI in some specific sectors/issues such as FDI in Services, in R&D, FDI from developing and transition economies, FDI in Extractive industries and in Infrastructure sector are set up and analyzed respectively in WIR 2004 (pp. 115–118), WIR 2005 (pp. 157–178), WIR 2006 (pp. 155–168), WIR 2007 (pp. 122–126) and WIR 2008 (pp. 116–123).

The World Investment Report 2010 (pp. 115–119) provides a comprehensive theoretical framework of climate change-specific drivers and determinants of FDI, particularly of LCF with comparison to the general decisive factors of FDI (WIR 1998). The locational determinants of LCF consist of general policy, economic factors and facilitations relating to Low-carbon product market improvement, low production/transaction cost in reducing CO<sub>2</sub> emission, incentives to transfer LCT, to save and consume energy effectively, to shift to cleaner energy and reduce fossil fuel dependence as well as recycle waste to generate electricity.

The WIR 2010 also gives references to TNCs’ participation in Low-Carbon Performance (LCP). On managing the value/supply chain with low-carbon performance, TNCs apply Low-carbon technology to their core production process, use LC inputs from LC suppliers and provide LC products and services to industrial customers and end-users, provides technology solutions to input suppliers and industrial customers along the supply chain/ value chain. TNCs’ LCP is required not only by host/home climate change-specific policies/ measures but also by international market conditions. If TNCs provide LC products to the international market, all stages along their value chain are required to carry out LCP. In that case, even though no low-carbon standards and regulations are required, foreign affiliates in some host countries spontaneously use LC technology in their production process, and likewise do their local input suppliers. Therefore, transfer of LC technology to the host countries is an important factor to support foreign affiliates themselves as well as their local input suppliers, reduce CO<sub>2</sub> emissions accordingly.

## 3. Hypothesis for the survey of LCF trend in manufacturing industry in Vietnam

### *Overview of FDI in Vietnam*

Vietnam has enjoyed a constant average rate of economic growth at 7% annually in 1986–2012 since “Doimoi” (Reform” in 1986). Industry sector sharing 38.63% of GDP in 2012 grows at the highest average annual rate of 8.83%, out of which Manufacturing industry grows at an average annual rate of 9.13% and accounting for

**Table 1 Effective FDI by Sector, 1988-Aug. 2014**

	Industry	Projects		Registered capital		Legal capital	
		Number of Projects	Share in total (%)	Capital (mill. US\$)	Share in total (%)	Capital (mill. US\$)	Share in total (%)
1	Industry:	10,408	61.55	145,762.77	59.98	53,402.03	64.80
	- Manufacturing	9,207	54.45	131,645.68	54.17	46,761.47	56.74
	- Construction	1,119	6.62	10,843.48	4.46	4,034.13	4.90
	- Mining	82	0.48	3,273.61	1.35	2,606.42	3.16
2	Agriculture	512	3.03	3,430.25	1.41	1,783.17	2.16
3	Service	5,990	35.42	93,845.18	38.61	27,223.87	33.04
	Total	16,910	100	243,038.20	100	82,409.07	100

Source: Ministry of Planning and Investment, Sept. 2014. [Http://www.mpi.org.vn](http://www.mpi.org.vn) accessed in Nov. 2014

**Table 2 Effective FDI by Forms, 1988-Aug. 2014**

	Form of Investment	Projects		Registered capital		Legal capital		Average size
		Number of Projects	Share in total (%)	(mill. US\$)	Share in total (%)	(mill. US\$)	Share in total (%)	mill.US\$/project
1	100% FOE	13,614	80.51	165,528.28	68.11	53,649.30	65.10	12.16
2	JVE	2,875	17.00	59,371.28	24.43	21,235.04	25.77	20.65
3	Others	421	2.49	18,138.64	7.46	7,524.73	9.13	43.08
	Total	16,910	100	243,038.20	100	82,409.07	100	14.37

Source: Ministry of Planning and Investment. <http://www.mpi.org.vn> accessed in Nov. 2014.

17.39% of GDP in 2012. By August 2014, Vietnam still has 16,910 FDI projects in effect with total registered capital of US\$ 243,038 million of which largest amount of FDI in terms of number of projects and registered capital respectively of 54.45% and 54.17% of total effective FDI flows to manufacturing industry (Table 1).

According to Vietnam's Investment Law 2005, FDI may be taken in the forms of Joint-venture enterprise (JVE), 100% foreign owned enterprise (100% FOE), Holding Company, Joint-stock company, or other contractual forms like Business Cooperation Contract (BCC), Build-Operation-Transfer (BOT), Build-Transfer-Operation (BTO) or Build-Transfer (BT). However, FDI in the form of JVE and 100% FOE are the two main forms accounting for 97.5% of total projects and 90.87% of total registered capital in 1988-Aug. 2014. Though the government expects to attract FDI in the form of JVE, in fact, 100% FOEs has a larger share of 80.51% in the number of projects and 65.1% in total registered capital, while that ratio of JVEs are 17% and 25.77% respectively. The average size of JVEs in terms of registered capital is larger than of 100% FOEs as most JVEs are in priority/strategic sectors and participated by State-Owned-Enterprises (SOEs) (Table 2).

**Table 3 Effective FDI of 5 Largest Home Economies, 1988-Aug. 2014**

	Home economy	Project		Registered capital		Legal capital		Average Size of Project mill.US\$/project (b/a)
		Number of projects (a)	Share in total (%)	mill.US\$ (b)	Share in total (%)	mill. US\$	Share in total (%)	
1	Japan	2,381	14.08	36,201.51	14.90	11,727.62	14.23	15.20
2	Korea	3,930	23.24	32,845.31	13.51	10,235.17	12.42	8.36
3	Singapore	1,300	7.69	30,804.95	12.67	7,921.08	9.61	23.70
4	Taiwan	2,325	13.75	27,907.43	11.48	11,717.93	14.22	12.00
5	China	1,056	6.24	7,884.11	3.24	3,109.36	3.77	7.47
6	Others	5,918	35	107,395	44	3,698	46	18.15
	Total	16,910	100	243,038.2	100	82,409.07	100	14.37

Source: Ministry of Planning and Investment. <http://www.mpi.org.vn> accessed in Nov. 2014.

By August 2014, Vietnam has hosted FDI from 101 countries/territories. Korea, Japan, Taiwan, Singapore, and China are the five largest home economies sharing 23.24%, 14.08%, 13.75%, 7.69% and 6.24% of total effective projects, respectively (Table 3).

Vietnam already has Law on Environmental Protection (1993, replaced by the new Law 2005 enforcing since 2006), Law on Technology Transfer 80/2006/QH11, Law of Intellectual Property 50/2005/QH11 passed in 12/2005 providing legal framework to encourage foreign investors to transfer environmentally friendly technology (EFT), policy encouraging Clean Development Mechanism Projects (CDM projects) and FDI incentives in renewable energy generation and technology transfer (Investment Law 2005).

In addition, Vietnam has promoted energy saving and efficient consumption through promulgating Law on Energy Efficiency and Conservation (approved in 2010) together with Degree No. 21/2011/ND-CP stipulating detailed requirements and measures to carry out this Law, Degree 134/2013/ND-CP on sanctioning of administrative violation in the power sector, dam security, and energy efficiency and conservation (EE&C), Circular 39/2011/TT-BCT on training and awarding certificates on energy management and energy auditor, Circular 09/2012/TT-BCT planning and reporting the implementation of EE&C Plans, Circular 02/2014/TT-BCT stipulating EE&C measures in industrial sector, Circular 07/2012/TT-BCT on energy labeling for energy consuming devices and equipment, Decision 51/2011/QD-TTg announcing List of devices and equipment that must have energy labels, Decision 03/2013/QD-TTg amending and supplementing some articles of Decision 51/2011/QD-TTg, Decision 3276/QD-BCT informing labels applicable to electronic ballasts, fluorescent tubes and washing machines, and Decision 68/2011/QD-TTg declaring List of energy saving devices that may be purchased by agencies funded by state budget. Nevertheless, there are not yet low-carbon products markets, and some other locational determinants pulling LCF except those in the LC value chain.

According to the report of MPI VN, by 2013 there are only 5% of transferred technology deal at high

level, the rest are at low and medium levels. Nguyen (2010) examines 1677 FDI projects in Manufacturing industry with references to disaggregation of Manufacturing Sector of Li et al. (1990) and based on some characteristics of LCF, found that about 25% of FDI projects in Strategic-low energy intensity manufacturing subgroup (S-LEI), 19% of Projects in Strategic-high energy intensity manufacturing subgroup (S-HEI), and the rest is in non-strategic high/low energy intensity manufacturing subgroup, and concluded that 25% of FDI Projects in S-LEI shows the sign of LCF. This raises the question whether foreign investors are concerned about LCP? Have they implemented their core production process relating to LCP? What are their motives and barriers in carrying LCP in Vietnam?

### ***Hypothesis for survey***

In order to find the answers to those questions, such hypotheses for survey were raised:

- (1) FDI enterprise is not concerned about LCP because Vietnam does not have enough stringent regulations on that.
- (2) FDI enterprise selects technology transferred/applied in their production process based on general locational determinants rather than climate change-specific determinants.
- (3) There may be some motives for as well as obstacles in carrying out LCP in Vietnam.

## **4. General information of survey**

### ***The survey purpose:***

It is shown that there is a footprint of LCF in Vietnam, for example, Vietnam registered 110 CDM projects by 2012, a number of projects in strategic energy-saving manufacturing sub-group, some projects in agriculture directing clean product supply and consumption, some energy saving projects in service (Nguyen, 2012). It is argued that a large number of FDI from Japan seems to be LCF, while FDI from Korea, China and Taiwan seems to be energy-intensity and polluted ones (Nguyen, 2013). In addition, there are few FDI projects from developed countries like EU countries, the US, where green growth has been strictly implemented for decades. There are many FDI in the form of 100% foreign owned enterprise (100% FOE) in polluted and energy-intensity manufacturing sub-group. In order to provide the answers for the questions mentioned above, the researcher group conducted a survey on LCP awareness and motivation of foreign affiliates in 2013. The purpose of the survey is to re-examine some above findings based on the secondary data which focuses on production process rather than input and output stages of a value chain. The survey object was manufacturing enterprises in Hanoi and some FDI concentrated areas like Ho Chi Minh City, Binh Duong, Hai Phong provinces.

### ***The survey method:***

The primary data is gathered from responses to a questionnaire and in-depth interviews with experts. The in-depth interview focuses on issues which are not raised in the questionnaire.

The questionnaire is designed with 34 questions into three parts:

- (1) Part I. General information includes 14 questions on the survey objects such as: the company's name, address/location, business size (investment capital and employees), and form of business under Vietnam's investment law, business sector, and position of the respondent in his company, and his/her ranking of the

importance of Vietnam's investment climate.

(2) Part II. Information about the company's production process during 2007–2012 includes 20 questions. The questions are set to get information through which the survey can reveal 6 issues as: (i) the company's business performance, (ii) energy consumption, (iii) main production technology and disposal/waste water treatment technology/system, (iv) company's awareness of necessity of Low-carbon production (LCP) implementation, (v) how the company has actually implement LCP, and (vi) how the impacts of Vietnam's environment related FDI policy on LCP. Thus, 20 questions are about the company's average annual revenue, expenditure on/volume and form of consumed energy, change in energy consumption, disposal waste and water treatment system, current technology used by the company, reasons and motivations to use the current technology in production process, awareness of low-carbon investment, motivations and obstacles in implementing low-carbon production process.

(3) Part III. Investigators and supervisors. Investigators conducted the survey by directly interviewing or sending questionnaires in both English and Vietnamese by email or mail to domestic/FDI manufacturing enterprises in Hanoi and neighboring areas.

The quality, reliability and precision of the received questionnaires are cross-checked randomly at 10% probability. Furthermore, data is coded, inputted and examined to find outliers through which investigators can examine and confirm the valid questionnaire.

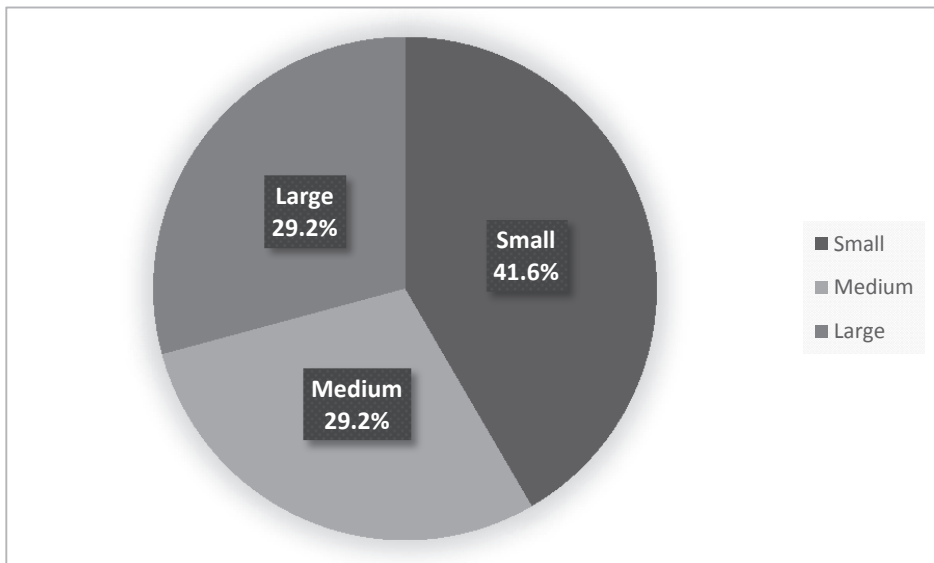
### *Analysis of the sample*

From the list of 1677 FDI companies in manufacturing industry registering and capital expanding in 2006–2008 provided by Ministry of Planning and Investment and the directory of domestic companies in this sector, 200 questionnaires were distributed in the survey. However, the LCF story is relatively new in Vietnam, only 72 valid questionnaires were received, just at response rate of 36%. This sample includes 80.6% of companies in Hanoi and neighboring provinces (VinhPhuc, Nam Dinh and Hai Phong) in the North; and the rest in the Middle (Nghe An, Quang Ngai, Ha Tinh provinces) and in the South (Binh Duong, Dong Nai, Tay Ninh provinces). In the survey manufacturing industry is divided into two sub-groups: competitive and priority. Although this classification is different from Li et al. (1990)'s one based on 4 sub-groups, it is suitable for the goal of this survey since the research group is only concerned with how FDI responds to environment related policies.

*Enterprise size:* The company size (small, medium and large size) is classified based on Degree no. 56/2009/ND-CP dated 30 June 2009 of Vietnam's government with their shares at 41.6%, 29.2% and 31.2% respectively (Figure 1).

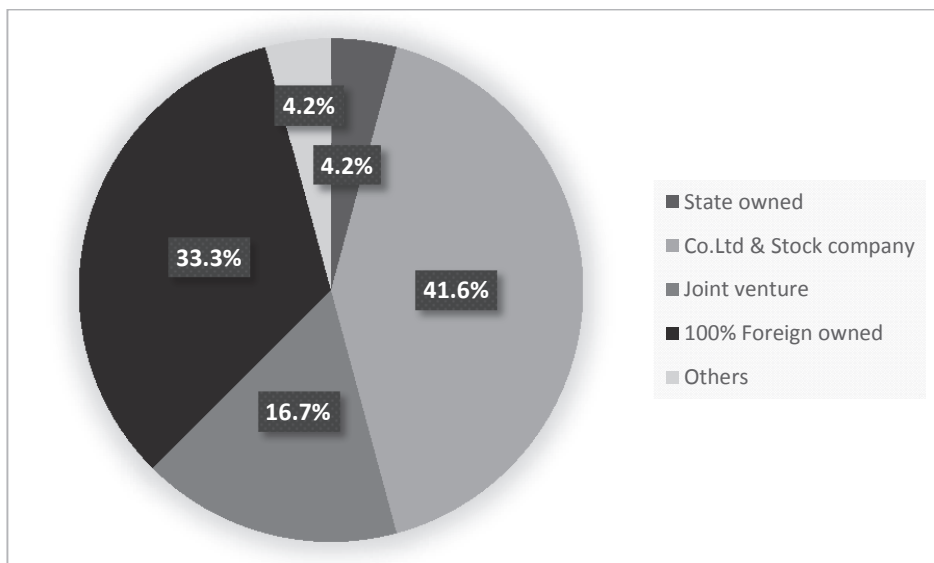
*Ownership distribution:* FDI companies make up 50% of sample out of which Joint-venture enterprises (JVEs) account for 16.7% and 100% Foreign-Owned-Enterprises (100% FOEs) account for 33.3% while domestic companies in the forms of joint-stock or limited enterprises and State-owned-enterprises (SOEs) account for 41.6% and a small share of 4.2% respectively (Figure 2). This sounds reasonable since the government has promoted the equalization of small and medium sized companies throughout the country. Yet, shortage of SOEs in the sample may cause drawback to the survey result as it may impact on the analysis or making comparison of low-carbon production implementation by SOEs in Joint-venture and pure SOEs.

The sample includes 30 FDI enterprises accounting for 41.7% of surveyed firms in Hanoi. This may be



Source: Result of survey conducted by UEB's researchers in 2013

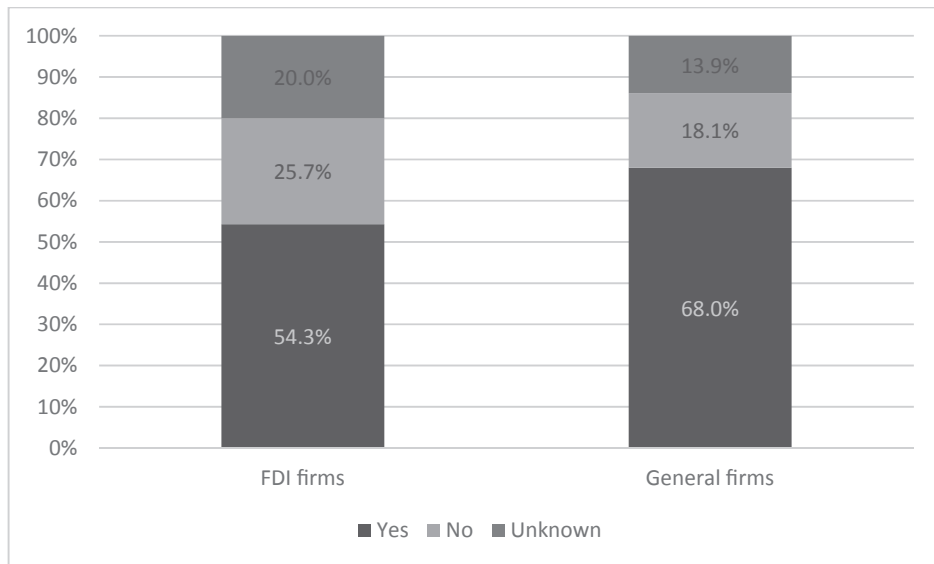
**Figure 1 Enterprise Size**



Source: Result of survey conducted by UEB's researchers in 2013

**Figure 2 Ownership Distribution**





Source: Result of survey conducted by UEB's researchers in 2013

**Figure 3 LCP Awareness of Hanoi's FDI and General Firms**

reasonable to compare the LCP implementation by FDI firms and domestic ones.

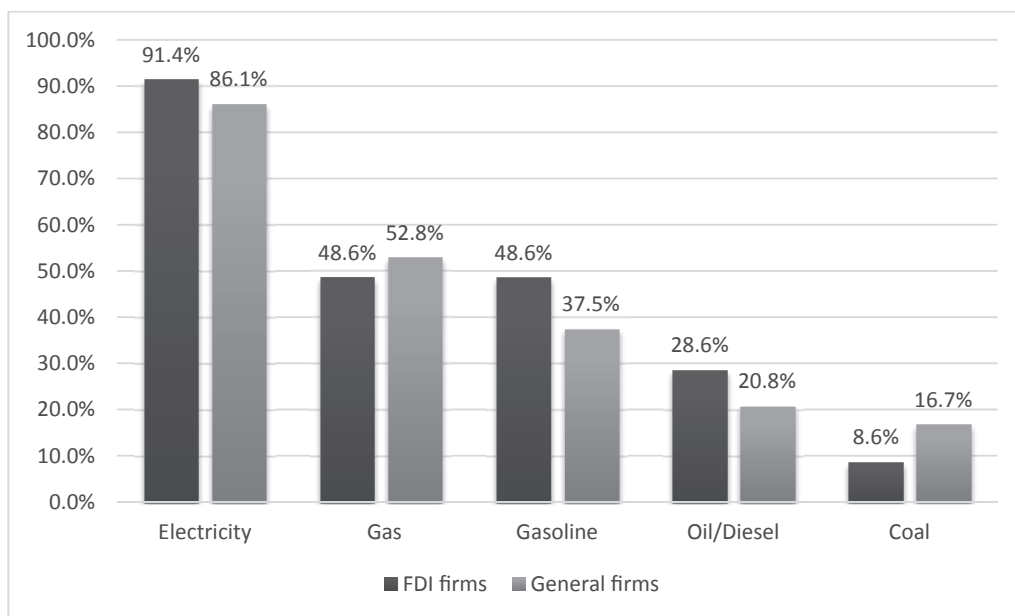
### 5. Main findings and analysis

*FDI does not necessarily lead to LCP implementation in Vietnam's manufacturing industry.* The survey shows that there is a considerable part of FDI enterprises that have less understanding about LCP. The proportion of 45.7% of Hanoi's FDI enterprises does not know or are unclear of this LCP is higher than one of 32.0% of total surveyed enterprises. As for LCP implementation, about 18.2% of total surveyed FDI enterprises and 16.7% of Hanoi's survey FDI enterprises do not carry out any measures to reduce CO2 emission and these ratios are significantly higher than domestic enterprises at 9.4%. This fact reveals that though some home economies are committed to reduce CO2 emission, their FDI enterprises do not care about LCP when they invest in Vietnam and are even less concerned than domestic enterprises

This finding is also supported by the contrary between 100% FOE and JV (Note: 100% FOE and JVE are two main forms of FDI in Vietnam, by Aug. 2014 these forms share 97.51% of total effective registered FDI projects in Vietnam). JV has a share of LCP awareness and implementation at 58.3% and 100% respectively, larger than that of 100% FOEs at 45.8% and 66.7%. This implies the important role of domestic partner in JV in dealing with LCP. Actually, the domestic partners are mainly state-owned-enterprises (SOEs), thus SOEs might have positive impacts on LCP implementation by JVs.

*LCP implementation is primitive at FDI enterprises.* The survey based on criteria for CO2 emission such as: consumed energy source, energy consumption plan toward emission reduction, waste and water treatment system, and solutions relating to inputs, production process (technology) and output.

Regarding consumed energy source, electricity is the most important energy source at 86.1% for



Source: Result of survey conducted by UEB's researchers in 2013

**Figure 4** Types of Consumed Energy of Hanoi's FDI and General Firms

enterprises as well as FDI enterprises at 91.4% (Figure 4). Electricity consumption during production process helps FDI enterprises to reduce CO<sub>2</sub> emission. However, CO<sub>2</sub> emission is not the foremost priority factors being taken into consideration by FDI enterprises since most of enterprises increased volume of consumed energy for production capacity expansion in 2007–2012.

The survey does not provide enough information to reason comprehensively the increase in energy consumption by form, but their 100% increase in the coal use and 70% increase in the oil use (two types of CO<sub>2</sub> intensity energy) is an adverse sign of CO<sub>2</sub> emission reduction by enterprises. In an interview with managers of CaiLan Oil JV company in Quang Ninh in June 2013, the surveyor team understands that, the company was conscious of environmental protection, so the waste water treatment systems was built at the time of the factory construction before the government declared regulations on this issue; however, because the price of electricity and fuel increased, the company turned to the use of cheaper energy such as coal, firewood in order to save energy, and reduce costs. Thus, it may be true that FDI enterprises are only interested in air pollution treatment and energy costs saving rather than pay due attention to the LCP orientation.

Regarding waste and water treatment system, the sample shows that 100% of enterprises have sewage and waste treatment systems, but only 41.7% of the systems meet standards of Vietnam's environmental protection; 11.1% meet those of their home countries/territory; 8.3% of the systems are capable of generating renewable energy. The rates of Hanoi's FDI enterprise are very similar to these results at 42.9%, 11.4% and 8.6%, respectively.

In terms of the reasons for choosing production technology, "generating less pollution" and "low-cost" are the two main causes of FDI enterprises with 55.6% and 72.2% respectively (Figure 5).

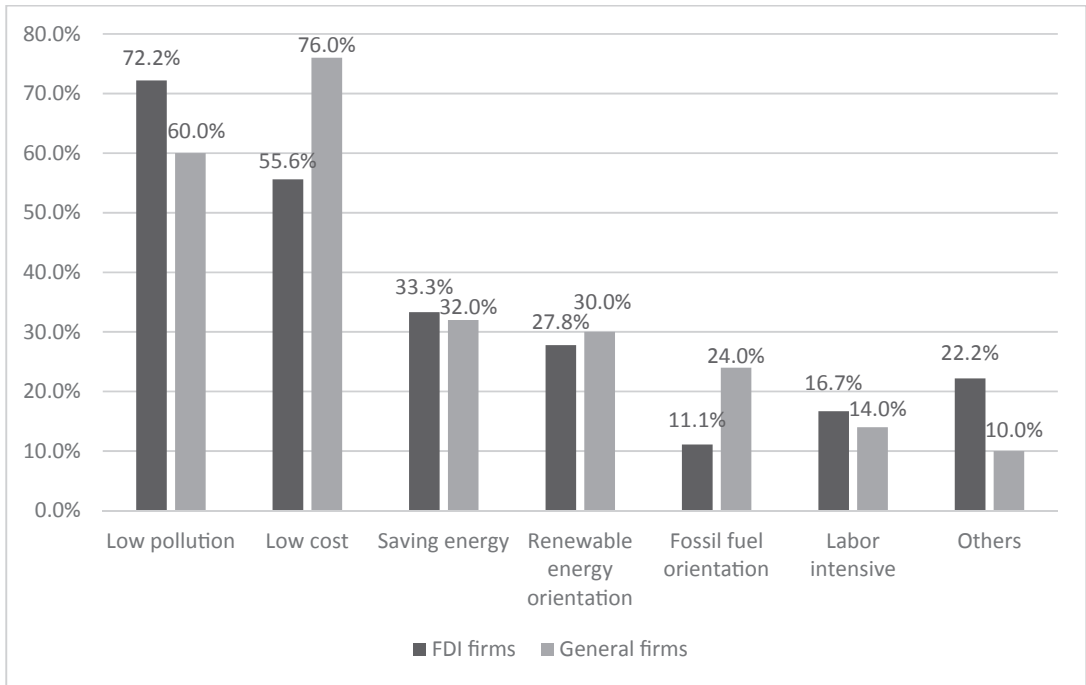
In fact, “low-cost” and “less polluting technologies” are substitutes rather than complements. Hence, the choices might be different between FDI forms. Figure 6 shows the difference in the choice of technology by JVEs and 100% FOEs, all JVEs using fossil energy intensity technology, while 100% FOEs pay attention to technologies less polluting (69.2%), labor-intensive (66.7%) and low-cost (60%). This again demonstrates that 100% FOEs give first priority to cope with the environmental pollution and seek for efficiency (efficiency seeking) through the use of low-cost and labor intensive technology rather than focusing on seeking for strategic assets (strategic asset seeking), and bringing in Vietnam LCP technologies so as to reduce CO2 emissions to mitigate the effects of climate change.

On the other hand, Figure 7 shows that there are fewer differences between priority/incentive FDI enterprises and competitive ones. Although these two sub-groups are concerned with low-cost technology at the same level of 25%, interestingly priority sub-group is interested in choosing less-polluting technology at 37.5%, less fossil consumption and energy saving (12.5%), which is a bit better than competitive sub-group at 25%, 8.3% and 8.3% respectively. This implies the competitive subgroup compete by reducing costs rather than improving quality, while the incentive sub-group is initially concerned with issues of environmental protection, energy saving, reducing the use of fossil energy, and reduce CO2 emissions.

Regarding CO2 emission reduction, applying solutions in the production process by FDI enterprises is the largest choice at 54.2 %, and applying solutions relating to output is at the lowest ratio of 29.2%. The result is different from the domestic ones since their highest choice is “solutions relating to input” at 65.6 % and the lowest is “solutions relating to output”, only at 12.5% (Figure 8). This may be reasoned that domestic firms are more active for the local supply of inputs while FDI enterprises have a comparative advantage over LCP technology. In addition, enterprises generally pay less attention on LC output since the regulations and policies on environmental protection relating to corporate responsibility for consumer products are relatively limited and enterprises’ awareness of LCP is still low as previously analyzed. The lowest choice relating to LC output of FDI enterprises is still higher than one of domestic firms since the FDI, having exported products to developed countries or supplied inputs being part of segment along value chain of products provided to developed countries, often apply LC technology along the entire value chain to meet the standards for energy consumption and CO2 emissions of developed countries’ markets.

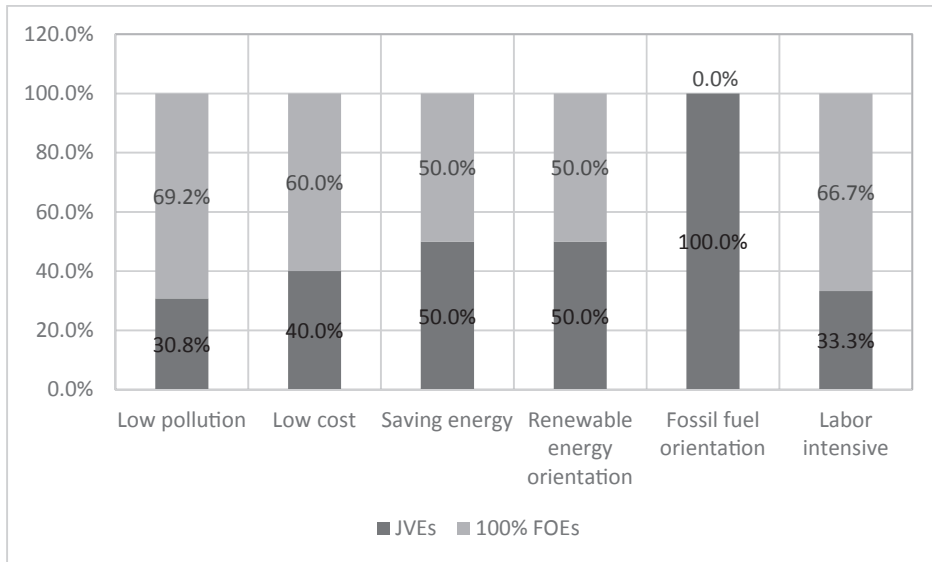
*Requirements of regulations or policies are the most important reasons for doing LCP while factors such as “high cost” and “non-requirement” are the main motivations for LCP implementation.* About 58.8% of Hanoi’s FDI enterprises do LCP because of regulations/policies, the following rates are for self-fulfilling, and CDM at 32.4% and 29.4% correspondently (Figure 9). The lower is “international commitment” at 26.5%, which implies that even though the home countries are committed to reduce CO2 emission, their investors do not necessarily comply with this commitment to reduce CO2 emissions when they invest abroad, particularly in developing and least developed countries which have not committed to reduce emissions and also have less stringent regulations on this issue. On the other hand, reasons like “not required” and “high cost” play important roles for non-LCP with the rates of 68.6% and 60% respectively (Figure 10).

The survey shows that there are statistical differences in the reasons for implementing non-LCP among type of business fields. Enterprises in competitive field consider “high cost” a more important cause than enterprises in priority fields; while those in priority field put “no incentive” as the most important reason to decide non-LC performance (Table 4). This sounds reasonable as the enterprises in competitive field tend to



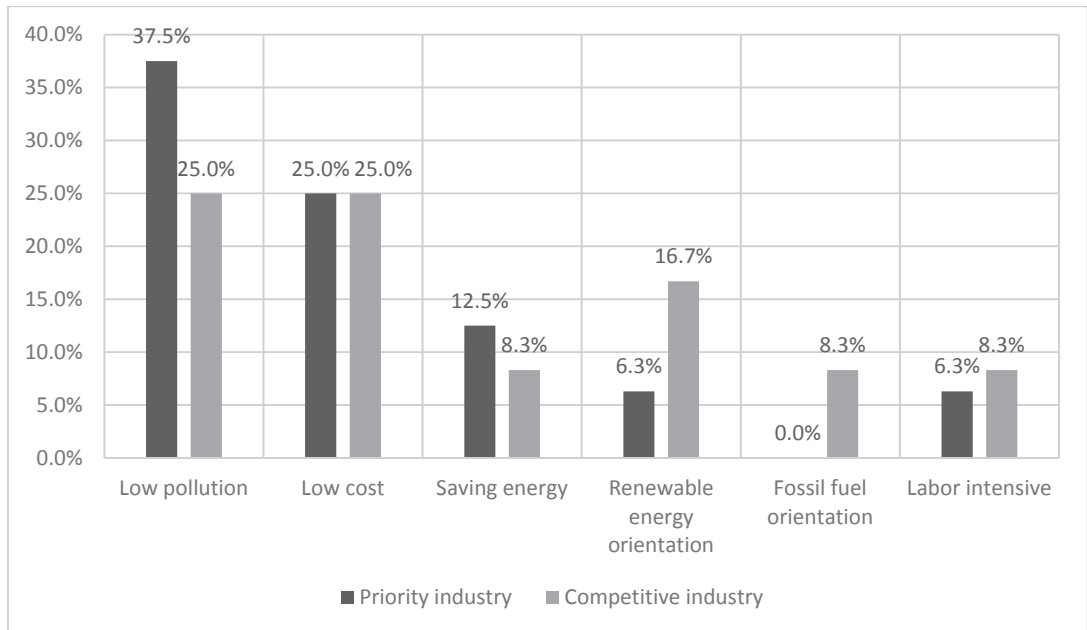
Source: Result of survey conducted by UEB's researchers in 2013

**Figure 5 Reasons of Technology Choice of Hanoi's FDI and General Firms**



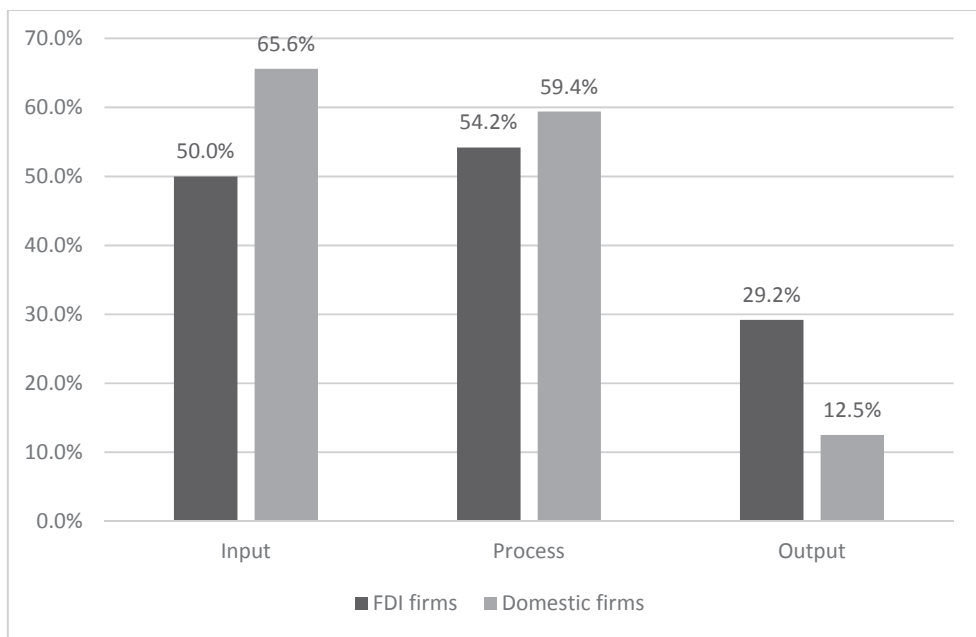
Source: Result of survey conducted by UEB's researchers in 2013

**Figure 6 Technology Selection by JVEs and 100% FOEs**



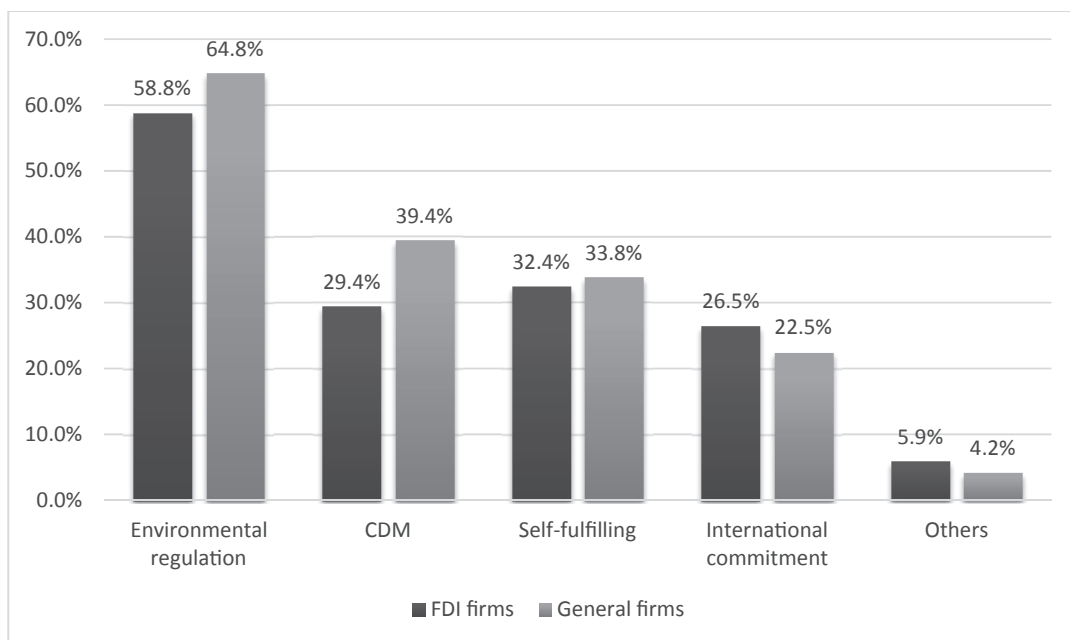
Source: Result of survey conducted by UEB's researchers in 2013

**Figure 7 Technology Selection by Priority and Competitive Sub-groups**



Source: Result of survey conducted by UEB's researchers in 2013

**Figure 8 Types of Solutions on CO2 Emission Reduction**



Source: Result of survey conducted by UEB's researchers in 2013

**Figure 9 Motives for LC Performance by Hanoi's FDI Firms and General Enterprises**



Source: Result of survey conducted by UEB's researchers in 2013

**Figure 10 Motives for Non-LC Performance by Hanoi's FDI Firms and General Enterprises**

**Table 4** Rankings of Reasons for Non-LCP of Hanoi's FDI Firms

Reason	Priority Group		Competitive Group	
	Percentage	Ranking	Percentage	Ranking
<i>No incentive</i>	<b>72.7%</b>	<b>1</b>	<b>15.4%</b>	<b>5</b>
<i>High cost</i>	<b>45.4%</b>	<b>4</b>	<b>53.8%</b>	<b>3</b>
<i>No required</i>	<b>54.5%</b>	<b>2</b>	<b>76.9%</b>	<b>1</b>
<i>Low support</i>	<b>36.4%</b>	<b>5</b>	<b>61.5%</b>	<b>2</b>
<i>Low benefit</i>	<b>54.5%</b>	<b>2</b>	<b>38.5%</b>	<b>4</b>

Source: Result of survey conducted by UEB's researchers in 2013

**Table 5** Rankings of Barriers for Non-LCP of Hanoi's FDI Firms

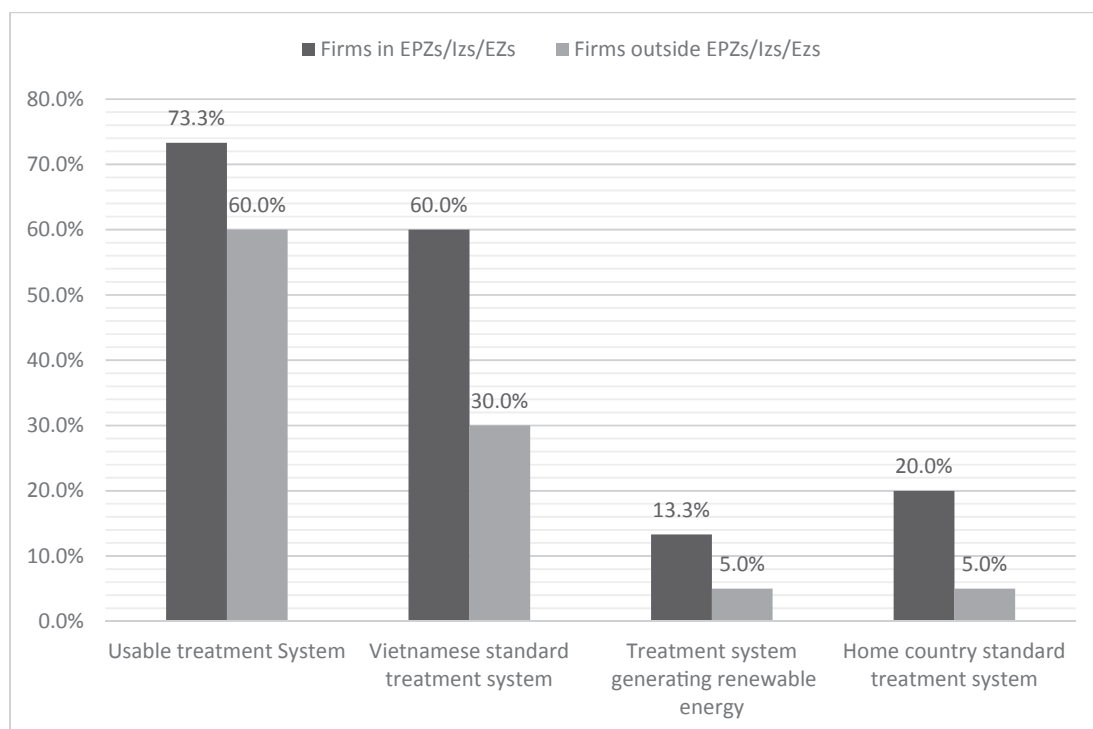
Barriers	Domestic enterprises		Hanoi's FDI enterprises	
	Mean	SE of mean	Mean	SE of mean
High cost	<b>3.43</b>	<i>0.504</i>	<b>4.13</b>	<i>0.973</i>
Conflicts in environmental regulations	<b>3.64</b>	<i>0.621</i>	<b>3.10</b>	<i>1.155</i>
Inadequacy of energy price policy	<b>3.35</b>	<i>0.775</i>	<b>2.96</b>	<i>0.980</i>
Lack of synchronized cognition in company	<b>3.29</b>	<i>0.976</i>	<b>2.83</b>	<i>1.315</i>
Competitive pressure in terms of production cost	<b>3.50</b>	<i>0.694</i>	<b>3.93</b>	<i>1.081</i>
Difficulty in controlling and monitoring input supplier	<b>3.42</b>	<i>0.945</i>	<b>2.54</b>	<i>1.240</i>
Shortcomings in technology	<b>3.33</b>	<i>0.702</i>	<b>3.38</b>	<i>0.805</i>
Consumption habits in Vietnamese market	<b>3.64</b>	<i>0.860</i>	<b>3.24</b>	<i>0.970</i>

Source: Result of survey conducted by UEB's researchers in 2013

focus on cost reduction, and prioritized enterprises often make decisions based on the preferential policies of the host government.

The reasons for non-LCP performance can also be studied from the barriers of LCP implementation side. The biggest obstacle to Hanoi's FDI enterprises is still "high cost" with a mean of 4.13 and subsequently "competitive pressure on costs" with a mean of 3.93 while the lowest one is unsurprisingly "difficult to control the input suppliers" with a mean of 2.54 because FDI firms have advantages over diversity of suppliers (Table 5).

*Drawbacks in regulation and low efficient implementation.* The regulations regard Vietnam's policies on industries, energy and FDI attraction, Law on Environment and EPZs' and IZs' LCF related regulations. As mentioned above, the policy factor has the most important role for LCP implementation. Under the absence of regulation or policy, there could be 68.6% of Hanoi's FDI firms which do not implement LCP, and only over



Source: Result of survey conducted by UEB's researchers in 2013

**Figure 11 Waste Treatment System of Enterprises in and outside EPZs, IZs and EZs**

31 % of them performing LC activities. However, efficiency of regulation and policy is limited and depends on transparency or detail of policy. In other words, regulations or policies on FDI firms in IZs, EPZs, and EZs (Economic Zones) are more effective than general regulation for LCP implementation. The sample reveals that 72.7% of non-LCP's FDI enterprises located outside IZs, EPZs, and EZ. Regarding waste management system, enterprises in IZs, EPZs, and EZs also have higher level than enterprises outside these areas, for example, the ratio of enterprises in these zones having waste treatment system at Vietnam's environmental protection standard reaches 60% of total businesses while that ratio of enterprises outside these Zones is at 30%; the ratio of having energy renewable waste water treatment system reaches 13.3% while that ratio of enterprises outside the EPZs, IZs and EZs is at 5%; the ratio of having waste treatment systems at home country's environmental protection standard reaches 20%, and that ratio of enterprises outside the Zones is just at 5% (Figure 11).

On the other hand, the survey also provides evaluations of important level of factors affecting LC performance at FDI enterprises. Environmental protection policy and the provisions of Board of Management of EPZs, IZs and EZs are considered as the most important factors with the means of 4.12 and 3.8 respectively while environmental protection of Non-Governmental Organizations, efficiency of implementing environment regulations and policy in the host country; and tax incentives for LC performance are the least important factors with the means of 2.76, 2.68 and 2.68 correspondently (Table 6). This does not sound like a positive signal for the LC implementation once enterprises take LC performance into consideration as a way of responding



**Table 6** Rankings of Reasons for LCP of Hanoi's FDI Firms

Reason	Domestic enterprises		Hanoi's FDI enterprises	
	Mean	SE of mean	Mean	SE of mean
Environmental protection policies of Vietnam	<b>3.61</b>	<i>0.665</i>	<b>4.12</b>	<i>0.666</i>
Environmental regulations of Management Board of EPZ, IZs, EZs, High-Tech Zone.	<b>3.79</b>	<i>0.738</i>	<b>3.80</b>	<i>0.913</i>
Environmental protection non-government organizations	<b>3.11</b>	<i>0.832</i>	<b>2.76</b>	<i>0.879</i>
Pressures from home country's international commitment	<b>3.32</b>	<i>0.723</i>	<b>3.48</b>	<i>0.918</i>
The effectiveness of authorization's environmental policy implementation	<b>3.29</b>	<i>0.976</i>	<b>2.68</b>	<i>1.069</i>
Tax incentives for implementing low carbon intensity	<b>3.29</b>	<i>0.713</i>	<b>2.68</b>	<i>0.988</i>
Energy price policies	<b>3.43</b>	<i>0.573</i>	<b>3.44</b>	<i>1.193</i>
Technology	<b>3.39</b>	<i>0.737</i>	<b>3.28</b>	<i>0.792</i>

Source: Result of survey conducted by UEB's researchers in 2013

to policy rather than being aware of the value of CO<sub>2</sub> emission reduction from individual perspective of long-term individual company's, the economies' and society's interests and voluntarily implement by individual company. The business is highly motivated to perform non-LC when the regulations are not available and the cost of the implementation is still high. This poses challenges for policy makers as well as environmental protection regulations promulgated by IPs and EPZs to persuade more companies to draw every effort in the LC implementation.

## 6. Conclusion and discussion

Based on theoretical framework of Low-carbon FDI's determinants developed in World Investment Report 2010 and used both secondary and primary data of FDI in Manufacturing sector in Vietnam, the paper revealed the answers to the research questions as follows:

There is a trend of inward LCF in Vietnam; however, it is not stable as it has not yet been commanded by the government of Vietnam. Actually, Vietnam has promulgated some Laws and regulations in regards to environmental protection, energy efficiency and conservation, encouraging environmental friendly technology transfer, yet those policies mainly focus on pollution prevention, energy saving rather than regulating on low-carbon performance. In addition, Vietnam's environment and energy relating standards are low, which do not enhance foreign investors to transfer LC technology.

Those foreign affiliates are concerned with LCP because they engage in LC value chain/supply chain managed by TNCs who are supplying LC products and services for customers in developed countries.

In their production process, foreign affiliates are interested in "cost-saving" and "less polluting" under the pressures of competition and the government's requirements. Waste treatment system of enterprises aims at

lowering water and air pollution, does not make a good use of sewage and waste to create renewable energy, and to reduce CO<sub>2</sub> emissions.

100% FOEs select technology based on criteria of “low-cost”, “less polluting” and “labor-intensive”. So this kind of businesses is only interested in efficiency seeking and environmental pollution protection.

A number of FDI projects in priority investment sectors pay more attention to the choice of technology “less polluting”, “less fossil energy intensity”, “energy saving”. Thus FDI in incentive investment sector create more positive impacts on LC performance than FDI in the competitive sector.

The ratio of FDI enterprises being aware of LCP necessity for society and their competitiveness improvement and product value is high; however, the ratio of non-LC solution performance by FDI enterprises in Hanoi is higher than by domestic enterprises. Nevertheless, if only take FDI enterprises in Hanoi into consideration, the percentage of LC solution by FDI enterprises in priority sector is higher than in competitive sector.

The government policy and regulations imposed by BOM of EPZs, IZs and EZs are the most important motivation for LC performance by FDI enterprises in Hanoi. Thus, FDI enterprises will not perform LCP if the host countries do not have stringent regulations and LC criteria, even though the home country has pledged to reduce CO<sub>2</sub> emissions under any international agreement. This confirms the challenges of policy making to attract FDI orienting low carbon economic growth in the host developing countries as a whole and in Vietnam in particular.

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