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EVALUATING THE TECHNICAL EFFICIENCY OF CONSTRUCTION ENTERPRISES IN VIETNAM WITH STOCHASTIC FRONTIER ANALYSIS (SFA) APPROACH

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ABSTRACT

This article analyzes the actual operation of construction enterprises in Vietnam and evaluates the technical efficiency of this business sector in the period 2012-2017. To achieve the research's objective, the author has used a number of Vietnam Enterprise Survey data in the period 2012-2017 which is implemented by General Statistics Office of Vietnam. Research's results show that technical efficiency of construction enterprises in Vietnam during this period accounted for approximately 47%, which means potential of improving the added value of enterprises. Moreover, the research also proposes some solutions to enhance the technical efficiency of construction enterprises.

Keywords: Technical efficiency, construction enterprise, Stochastic Frontier Analysis production function.

1. INTRODUCTION

In Vietnam, construction enterprises is a sector that make important contributions to socio-economic development, such as infrastructure construction, job creation and income for workers, state budget contribution, etc. According to the General Statistics Office[1], in 2016, the construction industry saw a good growth rate of 10.1% and contributed 0.6 percentage points to the national economic growth. It takes the position of an industry that has been growing in recent years with the third highest growth rate in Asia and has been continuing to grow in the current period. This is reflected in the increasing number of construction enterprises and operation results.

Table 1 shows that, between 2012-2017, State-owned, private, and foreign invested construction enterprises have been increasing not only in terms of quantity, but also their scale, namely: In 2012, the number of active construction enterprises was 44,884, however, it has increased 3,906 enterprises within only one year to reach 48,790 enterprises, corresponding to an increase of 8.7% compared to 2012. As of 2017, the number of enterprises developed to 65,371. On average,

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during 2012-2017, the number of enterprises has increased by nearly 1.5 times compared to 2012, the average annual growth rate obtained 7.91%. However, the development trend of 3 types enterprises was a lot different. Private enterprises accounted for the largest proportion with 97%. The remaining proportion belonged to the construction enterprises of State-owned and foreign invested. In the period 2012-2017, private enterprises increased 1.47 times, equivalent to an average increase of 8.11%. Besides, foreign invested enterprises also increased significantly, reaching an average annual rate of 7.28%. In the opposite direction, the number of construction enterprises of State own decreased over the years, accounting for a so small proportion, at 1.0% in 2017. The cause of this situation was due to Vietnam policy implement of equitizing state-owned enterprises, or divesting state capital.

2. ACTUAL OPERATION OF CONSTRUCTION ENTERPRISES IN VIETNAM IN THE PERIOD 2012-2017

In general, the number of enterprises in the private and FDI sectors accounted for the largest proportion, however, in terms of scale, these enterprises were still small and micro-scale, accounting for 77-83% of the total enterprises

Table 1: Number and scale of construction enterprises in Vietnam, 2012-2017

Ownership	Scale	Year						Total
		2012	2013	2014	2015	2016	2017	
State	Microenterprise	266	234	259	243	236	241	**1.479**
	Small Enterprises	390	378	349	360	342	305	**2.124**
	Medium Enterprises	55	44	51	44	33	28	**255**
	Large Enterprises	144	132	125	117	98	89	**705**
Total		**855**	**788**	**784**	**764**	**709**	**663**	**4.563**
Private	Microenterprise	21.067	25.475	28.521	32.807	36.620	38.945	**183.435**
	Small Enterprises	21.363	20.787	20.738	21.035	22.443	23.875	**130.241**
	Medium Enterprises	594	603	544	545	550	541	**3.377**
	Large Enterprises	626	676	615	605	648	633	**3.803**
Total		**43.650**	**47.541**	**50.418**	**54.992**	**60.261**	**63.994**	**320.856**
FDI	Microenterprise	293	240	262	315	335	354	**1.799**
	Small Enterprises	224	218	241	267	272	329	**1.551**

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	Medium Enterprises	12	10	15	11	20	14	**82**
	Large Enterprises	11	7	13	17	14	18	**80**
Total		**540**	**475**	**531**	**610**	**641**	**715**	**3.512**

(Source: General Statistics Office of Vietnam)

In terms construction enterprises' revenue, figure 1 shows that the revenue of construction enterprises has improved significantly over time and between 2012-2017, the revenue increase reached 10.72% on average. If in 2012, the average revenue of construction enterprises only was about VND 14,972 million, this figure increased to VND 17,710 million in 2017.

Unit: Billion dong *Unit: Million dong*

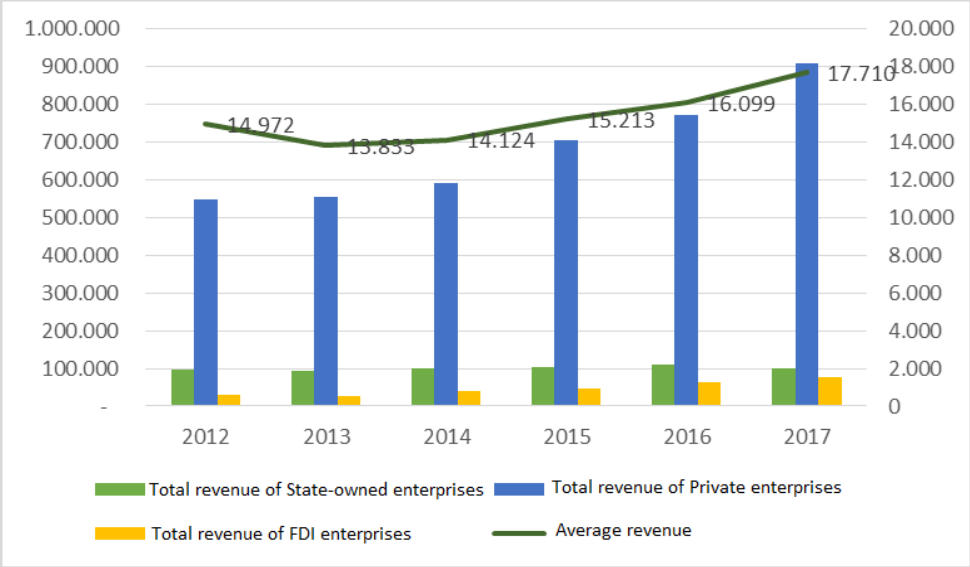

Figure 1: Revenue of construction enterprises in Vietnam, 2012-2017

(Source: General Statistics Office of Vietnam)

Although the revenue of construction enterprises increased steadily over the years, but the profit before tax of construction enterprises increased unevenly, especially in 2013, the profit before tax decreased by VND 2,591 billion compared to 2012. However, this situation has shown signs of significant improvement from 2014 up to now, but in terms of scale, this improvement is still limited. It can be seen that the profit before tax of enterprises tends to increase and the profit before tax of private enterprises was higher than State-owned enterprises and FDI enterprises. Contributing to the profit of the entire construction industry, the profit of private enterprises accounted for a large proportion, often accounting for about 60% of the industry's profit.

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Unit: Billion dong *Unit: Million dong*

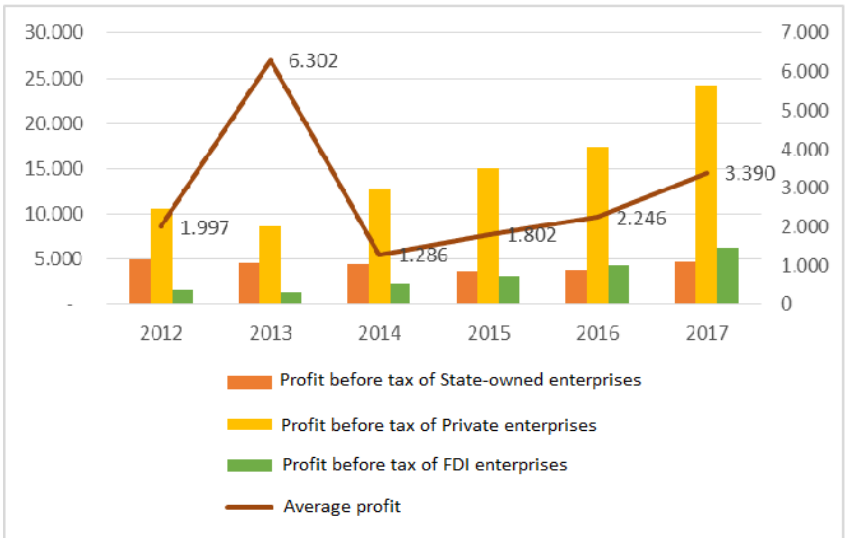

Figure 2: Profit before tax by type of business and average profit of construction enterprises in the period of 2012-2017

Source: Author's calculations

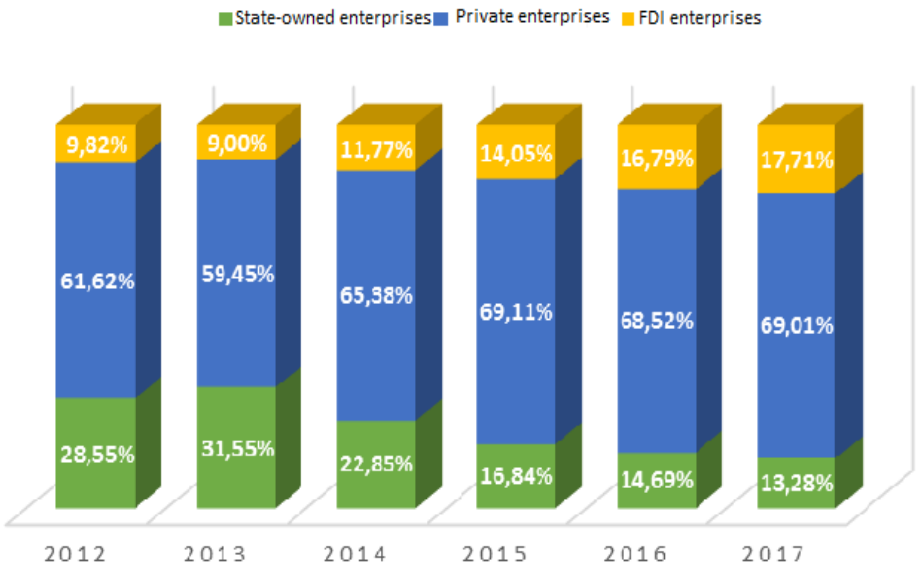

Figure 3: Profit structure of construction enterprises by type of enterprises in the period 2012-2017

Source: Author's calculations

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However, in this period, there is a fact that the number of enterprises with huge loss in operation results often accounts for over 30% of the number of enterprises in the whole industry; Particularly, in 2017, enterprises with negative profit accounted for 40.36%. The reason is that enterprises tend to adjust their profits lower than actual one to avoid paying taxes to the state budget.

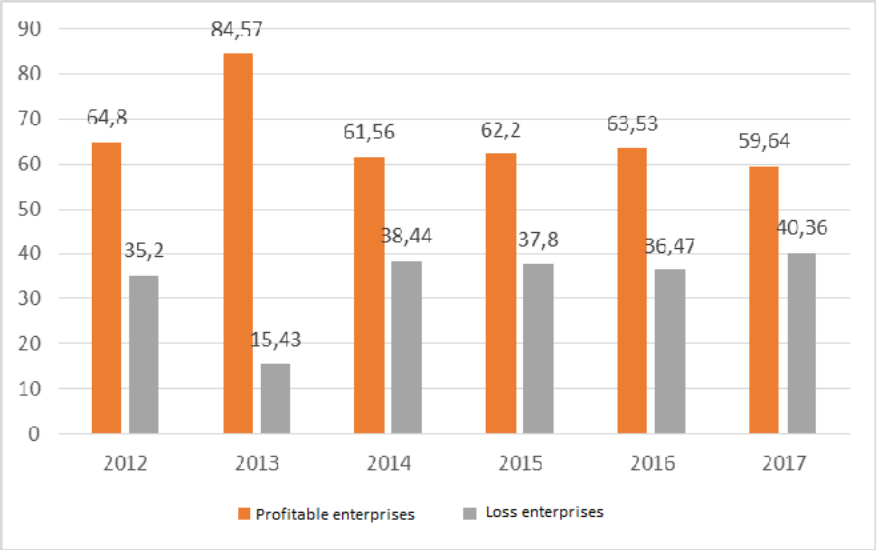

Figure 4: Profit situation of construction enterprises in the period of 2012-2017

Source: Author's calculations

3. TECHNICAL EFFICIENCY OF CONSTRUCTION ENTERPRISES IN VIETNAM

To clarify the technical efficiency of construction enterprises in Vietnam, the article used the annual enterprise survey data of General Statistics Office of Vietnam in the period of 2012-2017, with the research sample including data of 65,371 construction enterprises in Vietnam from 2012 to 2017 and 328,479 observations.

In terms of output, the target which is added value has been used as the output of enterprises, reflecting business operation results of the enterprise. In which, the added value of the business is calculated according to income method, which is caculated by this formula: the income of the employee + income of the enterprise + depreciation of assets + Total taxes and fees payable to the State - VAT on domestic sales - Special consumption tax.

In terms of inputs, include: (1) the average number of employees (L), which is the average number of employees in the year, calculated by the average of the number of employees at the beginning of the year and the number of employees at the end of the year; (2) capital source (K), calculated as the average of total assets at the beginning and ending of the year. Assets include

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receivables, inventory, fixed assets. This variable shows how the level of business expansion or narrowing affects the labor demand in the enterprise.

Table 2: Technical efficiency of construction enterprises in the period 2012-2017

Year	Average	Standard deviation
2012	0,3359	(0,267)
2013	0,5941	(0,204)
2014	0,5710	(0,219)
2015	0,5005	(0,237)
2016	0,4833	(0,221)
2017	0,3217	(0,232)
Average	**0,4647**	

Note: Standard deviations are reported in parentheses

Source: Author's calculations

Estimates of technical efficiency of construction enterprises by Stochastic Frontier Analysis are presented in Table 3. Estimated results show that the average technical efficiency of construction enterprises is expected at 46.47 %. In 2012, the technical efficiency of construction enterprises was 33.59%, this index jumped to 59.41% in 2013. It is noteworthy that the technical efficiency has decreased by 27 percentage points during 2013-2017, which was a reduction from 59.41% in 2013 to only 32.17% in 2017. The average technical efficiency reached the highest level of 59.41% with a standard deviation of 26.7% in 2013. This level continuously decreased from 2013 to 2017 with the lowest effeciency level of 32.17%. The average technical efficiency of the construction industry during this period may be due to a boom of new established enterprises. This is clearly shown in Table 1, the average growth rate of new established enterprises in the period 2013-2017 was 8%, with more than 3,300 new established enterprises each year. Because it takes a certain amount of time for new established enterprises to catch up with the technical efficiency of enterprises that have been operating longer before in the industry. Therefore, new entrants to the industry may reduce the overall technical efficiency of the industry.

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Table 3: Technical efficiency of construction enterprises by region in the period 2012-2017

Region	Year					
	2012	2013	2014	2015	2016	2017
Red river delta	0,3797	0,6051	0,5893	0,4342	0,4826	0,3309
Northern mountainous region	0,3992	0,5476	0,5295	0,4941	0,5512	0,3942
Central Vietnam	0,3542	0,5561	0,5446	0,5214	0,4994	0,3486
Western Highlands	0,3655	0,5776	0,5643	0,5178	0,5703	0,3606
South East	0,2744	0,6346	0,5917	0,5505	0,4467	0,2719
Mekong Delta	0,3176	0,5370	0,5231	0,4973	0,5137	0,3584
General	**0,3359**	**0,5941**	**0,5710**	**0,5005**	**0,4833**	**0,3217**

Source: Author's calculations

In general, state-owned enterprises are the ones obtained the highest technical efficiency with 48.16% of the potential, the lowest was FDI enterprises which occupied 36.32%. However, in the northern mountainous region and the Mekong River Delta, private ownership is more effective than the other two forms of ownership. In all regions, FDI ownership was still the sector with the lowest efficiency, typically in the northern mountainous region, FDI enterprises have only exploited 17.76% of the inherent potential for production development. For state ownership, the Southeast region took the highest technical efficiency of 57.91%, followed by the Red River Delta with 55.37%. However, if looking at the whole country, the lowest effective place is the Southeast. Another special thing is that the Western Highlands region did not attract any foreign enterprises.

Table 4: Technical efficiency of construction enterprises by type of enterprises and regions in the period 2012-2017

Region	Type of enterprises		
	State-owned	Private	FDI
Red river delta	0,5537	0,4671	0,3633
Northern mountainous	0,3894	0,4903	0,1776

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region			
Central Vietnam	0,4973	0,4692	0,2495
Western Highlands	0,4963	0,4901	
South East	0,5791	0,4565	0,3767
Mekong Delta	0,4328	0,4560	0,2296
General	**0,4816**	**0,4655**	**0,3632**

Source: Author's calculations

The results of measuring the technical efficiency of construction enterprises according to scale are shown in Table 5 and Table 6 below:

Table 5: Technical efficiency of construction enterprises according to the scale of enterprises in the period 2012-2017

Enterprise's scale	Year					
	2012	**2013**	**2014**	**2015**	**2016**	**2017**
Microenterprise	0,2436	0,5898	0,5572	0,4769	0,4292	0,2606
Small Enterprise	0,4170	0,5980	0,5883	0,5330	0,5670	0,4150
Medium Enterprise	0,4787	0,6138	0,5891	0,5600	0,5453	0,4170
Large Enterprise	0,4828	0,6154	0,5990	0,5669	0,5515	0,4148
General	**0,3359**	**0,5941**	**0,5710**	**0,5005**	**0,4833**	**0,3217**

Source: Author's calculations

As can be seen from the above result, in the period of 2012-2013, technical efficiency of most of enterprises increased, especially the sudden increase of micro enterprises from 24.36% in 2012 to 58.98% in 2013. However, the period from 2014 to 2017, technical efficiency tended to decrease in all enterprises. During 2012-2017, large enterprises have higher technical efficiency than micro enterprises, small and medium enterprises in most of years, but this efficiency level is still low, not yet reached 62% of the potential. This shows that the use of labor resources and use of capital in production and business activities of construction enterprises was not really effective and tends to decrease in recent years.

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Table 6: Technical efficiency of construction enterprises by type and scale of enterprises in the period 2012-2017

Type of enterprise	Scale of enterprise			
	Microenterprise	Small enterprise	Medium enterprise	Large enteprise
State ownership	0,3500	0,5286	0,5821	0,5842
Private ownership	0,4256	0,5180	0,5334	0,5323
Foreign ownership	0,2566	0,4709	0,4676	0,4909
General	**0,4236**	**0,5177**	**0,5351**	**0,5395**

N Source: Author's calculations

The study used stochastic frontier analysis caculation function to estimate the technical efficiency index for enterprises of construction industry. The estimated results show that the level of technical efficiency differs according to ownership and scale of enterprises. Large enterprises achieved 53.95% efficiency level while medium enterprises were 53.51%, small enterprises took 51.77%, and micro enterprises only reached 42.36% efficiency level. The reason is that large enterprises are more and more suitable to the current conditions of the market, and because the products manufactued have gradually met the market demand. However, the production level of Vietnamese enterprises in general is still limited (especially small and micro enterprises), the infrastructure is poor, not yet creating a brand in the market, ability to access to credit capital and investment attraction still has some drawbacks. Therefore, policies and mechanisms to support small and micro enterprises in accessing credit for production investment and scaling up should continue to be completed.

4. CONCLUSION

The above analysis results show that the technical efficiency of construction enterprises has been declining in recent years, reflecting that these enterprises have not made good use of resources to growth. On the other hand, state-owned enterprises seem to have higher technical efficiency than private enterprises and foreign-invested ones.

Among 3 types of enterprises, foreign invested enterprises achieved the lowest technical efficiency. These results show that policies to attract FDI should consider the factors of capital, technology, as well as equality between business regions.

On the other hand, Vietnam needs to focus on developing infrastructure in the Central Vietnam, the Southeast and the Mekong River Delta to develop trade, technical infrastructure to improve

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the construction industry in these regions. Besides, there is a need for construction enterprises to have labor training policies, skills enhancement towards applying advanced technology to improve labor productivity.

Last but not least, the State should continue to have support for construction enterprises, especially small and medium enterprises, and investment must be synchronized between regions to promote investment efficiency.

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