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# Factors Affecting the Performance of Small and Medium Enterprises Regarding the Sustainable Development Goals—The Case of Foreign Direct Investment Firms in Vietnam

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**Abstract:** The owners of SMEs in Vietnam mainly focus on business performance in the short term. In recent years, FDI firms have demonstrated interest in both business efficiency and sustainable development. These issues have attracted the attention of scientists and policy makers in Vietnam. Therefore, this study aimed to determine the factors affecting the performance of small and medium enterprises in Vietnam regarding the Sustainable Development Goals (SDGs). Using the latest published survey data up to March 2022 for food and beverage, wood and steel foreign direct investment enterprises, combined with a data envelope analysis model in step one and Tobit regression in step two, the results from this quantitative study are as follows: (1) the production efficiency index of Vietnamese FDI enterprises ranges from 82.5% to 89% depending on the industry (assuming variable output to scale); (2) the factors financial leverage, renewable consumption, scale and operating time are related to the performance of FDI enterprises, and have a positive effect on performance; and (3) financial leverage and renewable consumption can generally boost a firm's performance in the case of FDI SMEs in the food and beverage, wood and steel industries. This research also suggests some solutions to achieve the Sustainable Development Goads (SDGs) in the FDI SMEs of Vietnam.

**Keywords:** renewable consumptions (RC); small and medium enterprises (SMEs); foreign direct investment (FDI); scale (SC); operating time (OT); financial leverage (FL)



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## 1. Introduction

Foreign direct investment (FDI) enterprises play a significant role in the economy of Vietnam. Some of the key roles of FDI enterprises in Vietnam include:

- Job creation: FDI enterprises help create employment opportunities for the local population, contributing to the overall development of the country.
- Capital injection: FDI enterprises bring in large amounts of foreign capital into the country, which can be invested in various sectors, including infrastructure development and technology upgrades.
- Technology transfer: FDI enterprises often bring in advanced technology and management expertise, which can help modernize and improve the efficiency of Vietnamese industries.
- Boosting exports: FDI enterprises can also help increase exports by producing goods for export and by promoting Vietnamese products in international markets.
- Improved business environment: The presence of FDI enterprises can help to attract more investment, improve the business environment, and increase competition, leading to more innovation and growth.

In summary, FDI enterprises play a crucial role in the development of Vietnam's economy and have a positive impact on its growth and competitiveness.

Chen et al. examined the relationship between the night-time economy and the sustainable development of the economy and enterprises in South Korea (Chen et al. 2020). Fadly discussed the resource efficiency of SMEs in Vietnam, focusing on their environmental management standards in green industry (Fadly 2020). In addition, Fiori discussed SMEs with a view to enhancing economic sustainability in Vietnam (Fiori and Foroni 2019). In addition, FDI SMEs were shown to be successful in their business performance regarding the Sustainable Development Goals and the export of goods and services to foreign markets (Liao et al. 2022; Wang and Liu 2022). The study of the determinants of the business performance of FDI SMEs can help to provide experience and guidnacew to other Vietnamese SMEs to achieve sustainable development.

This study employs the concept of foreign direct investment (FDI). In general, FDI is an investment made by a company or individual in one country into a business or entity in another country with the intention of establishing a lasting interest. This can take the form of creating a subsidiary or associate company, acquiring a controlling stake in an existing company or building new operations from scratch. The main goal of FDI is to gain access to new markets, new technology, or to lower production costs by taking advantage of lower wages or tax incentives in the host country.

Flammini et al. investigated the sustainable production of coffee SMEs in Vietnam by reducing carbon dioxide emissions (Flammini et al. 2020). Giang et al. discussed the finance of institutions in relation to sustainability of SMEs in Vietnam (Giang et al. 2019). Joo et al. noted the interaction between FDI and economic growth in BRICS countries (Joo et al. 2022). Le et al. explored the influence of economic growth and environmental pollution on FDI in Vietnam (Le et al. 2022).

Compared with large-scale enterprises, SMEs bring more benefits to the economy in such areas as creating jobs, being dynamic and quick to respond to the urgent needs of the market and growing faster (Hall and Weiss 1967; Hallberg 1999). Schmitz argued that for developing countries, SMEs contribute to solving the problem of creating jobs for low-skilled workers. Resources are available but redundant in developing countries. According to the 2022 Statistical Yearbook of the General Statistics Office of Vietnam (GSO), the number of SMEs in Vietnam as of June 2022 was nearly 870,000, accounting for 98% of the total number of operating enterprises in Vietnam. In 2022, these enterprises contributed 50% of the GDP, approximately USD 196 billion, 33% of the state budget, creating of 31.5 million jobs (accounting for 62% of the total number of jobs) and adding USD 19.8 billion to the state budget (through taxes and other payments and fees).

Foreign direct investment (FDI) plays a significant role in the investment landscape of small and medium-sized enterprises (SMEs) in Vietnam. According to data from the Vietnamese government, FDI accounts for a significant portion of total investment in SMEs, with FDI capital making up a large proportion of the total investment capital for many SMEs in the country. However, the exact scale of FDI in relation to other investment in SMEs in Vietnam is subject to change and can vary depending on various factors such as economic conditions, government policies, and the overall investment environment in the country.

According to the data of the Vietnam General Office, it can be seen that the proportion of FDI enterprises with small-scale investment capital has increased, especially those with a total accumulated investment capital of less than USD 100,000, increasing at a relatively steady rate from 12.12% per year in 2008 to 14.68% in 2012 and 18.23% in 2019, 21.2% in 2022. For enterprises with a capital investment scale from USD 100,000 to USD 500,000, although there was a slight decrease in the proportion during the year 2012 compared to 2008, the proportion of this group of enterprises increased rapidly after this and reached 27.79%, and became the group occupying the highest proportion of FDI enterprises in 2022. FDI firms with a scale of investment from USD 500,000 to USD 1 million USD accounted for 17.12% of FDI enterprises in 2008, decreasing to 12.69% in 2022. In 2008, enterprises with foreign capital from USD 1 to 5 million accounted for nearly one third of all FDI enterprises, but this proportion decreased to 24.56% in 2022. The proportion of enterprises with a large

capital contribution of USD 5 million USD or more increased in the first period but then decreased after 2012 and accounted for 16.73% in the year 2022.

Despite their large contribution to the economy, SMEs always face great difficulties in sustainability and development due to their restricted access to resources (Hallberg 1999). Evaluating the efficiency of the sustainable production of this group of enterprises, as well as considering the factors affecting their production efficiency, is considered an important issue for policy makers and economic researchers. Several recent studies have investigated the efficiency of the sustainable operation and factors affecting the operational efficiency of enterprises in Vietnam (Chu and Kalirajan 2011; Le 2010; Minh and Vinh 2007; Pham et al. 2010). However, studies specifically relating to SMEs are still very limited; many case studies have not reflected the current situation of enterprises due to the use of old survey data.

The objective of this study is to determine the operational performance of SMEs, and determine the factors affecting the operational efficiency of the FDI group of enterprises. To achieve this goal, this study uses data envelopment analysis (DEA) in step one and Tobit regression in step two, and uses the latest data from the 2022 annual survey on SMEs.

This study consists of four sections. Section 1 provides an introduction to the topic, and Section 2 presents the theoretical basis and research methods. Section 3 provides data descriptions and details of the regression analysis. Section 4 provides conclusions and suggests policies based on the results.

## 2. Literature Review and Model Building

### *2.1. Literature Review*

Athanasoglou et al. argued that macroeconomics determines a sustainable firm's profit in certain industries (Athanasoglou et al. 2008). Blažková presented the determinants of the sustainable and profitable development of a firm based on each sector and industry (Blazkova and Dvoulety 2018). Capon et al. discussed other factors that could affect business performance (Capon et al. 1990).

Child examined the organizational structure of sustainable business firms, and how environmental issues can affect them. Cosh et al. noticed that innovation mostly affected sustainable business performance. Liem et al. recommended a reduction in greenhouse gas emissions in the Vietnam Mekong Delta region (Liem et al. 2022).

DeAngelo and Masulis showed that corporate and personal tax affected sustainable firms' performance (DeAngelo and Masulis 1980). Deloof investigated working capital management, which affected the profitability of sustainable firms in Belgium. Nguyen discussed the determinants of FDI location in Vietnam (Anh 2016).

Fareed et al. examined the determinants of business enterprises in the power and energy sector (Fareed et al. 2016; Farrell 1957). Gill et al. showed that working capital management can increase the sustainability and profitability of enterprises in the United States of America (Gill et al. 2010). Phan studied some constraints on Vietnamese SMEs (Phan 2022).

Goddard et al. noted that determinants affected the sustainability and profitability of European manufacturing and services enterprises (Goddard et al. 2005). Hall and Weiss showed that the larger the firm size, the greater the sustainability and profitability of the enterprise (Hall and Weiss 1967). Nickell and Nicolitsas showed that financial pressures decreased sustainable business performance (Nickell and Nicolitsas 1999; Nikaido 2004). Serrasqueiro and Nunes demonstrated the same in relation to Portuguese small and medium firms (Serrasqueiro and Nunes 2008). Phan discussed export and credit constraints of Vietnamese SMEs (Phan 2022).

Pattitoni et al. revealed the determinants of sustainable business enterprises of 15 EU countries (Pattitoni et al. 2014). Tsai et al. studied the impacts of environmental certificates on SMEs' operational performance in Vietnam (Tsai et al. 2021).

From the theoretical basis and the results of previous research, it can be seen that factors affecting the performance of an SME include two elements: subjective factors such

as solvency, firm size, growth rate, access to credit institutions, labor qualifications and duration of operating time of the business; and objective factors such as the international and regional environment, domestic environment and industry environment.

The concept of operation performance originates from the production process, which involves converting factors of production (inputs) into outputs. The sustainable economic efficiency (or total efficiency) can be divided into two components: (1) sustainable technical efficiency and (2) sustainable allocative efficiency (Coelli 1996).

The concept of sustainable technical efficiency has long existed in economics, along with the concept of production possibility frontiers, also known as production frontiers. In the production process, due to constraints on inputs, enterprises can only produce on (points B, C in Figure 1) or within the production possibility frontier (point A in Figure 1). Koopmans introduced the first formal concept of sustainable technical efficiency as follows: a firm achieves a sustainable technical efficiency score if and only if that efficiency score is feasible and no other better point exists than that point. Thus, a sustainably technically efficient firm can only increase output to a higher level if and only if it has to increase at least one input. Another widely accepted definition is that of Farell (Fareed et al. 2016; Farrell 1957): a firm is productive when it produces a maximum amount of output for a given amount of inputs. Farell's definition of sustainable technical efficiency is expressed in terms of an output-oriented approach, i.e., keeping inputs constant and maximizing outputs (Fareed et al. 2016; Farrell 1957). Meanwhile, Coelli et al. added a definition of sustainable technical efficiency according to the input-oriented approach (Coelli 1996; Coelli et al. 2005): a firm that achieves sustainable technical efficiency is one that produces a fixed amount of output with the minimum amount of input. Thus, with conceptual derivation from the production process, sustainable technical efficiency is often understood as production efficiency. This study also interchangeably uses the two terms production efficiency and sustainable technical efficiency to refer to the same concept of enterprise production efficiency.

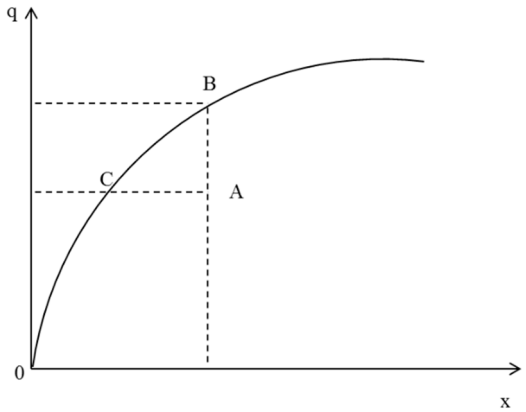


**Figure 1.** Production possibilities frontier and sustainable technical efficiency.

The concept of allocative efficiency helps to reflect a firm's cost control, so it can also be called cost efficiency. Allocative efficiency indicates a firm's ability to combine inputs to produce maximum output with the lowest budget. Thus, if the sustainable technical efficiency can be estimated from the production function, the allocative efficiency needs to be calculated through the cost function, revenue function or profit function.

### *2.2. Model Building*

Timmer, who is considered the first researcher to apply a two-step regression model to study the origin of production efficiency, has a famous thesis: "Determining the level of technical efficiency of an industry is important. Identifying the source of inefficiencies in that industry is doubly important" (Timmer 1971). Factors affecting the technical efficiency

of enterprises, in addition to the traditional factors of production factors such as labor and capital, also include other equally important factors.

One factor that has a strong impact on production efficiency, recognized by many theories and pre-researchers, is the enterprise's number of years of operation (operating time). From early studies such as those of Timmer, Patt and Lee (Le 2010; Pattitoni et al. 2014; Timmer 1971) to more recent studies such as those of Binam et al., Le and Harvie, Chu and Kalirajan, all show a strong relationship between uptime and the level of technical efficiency of firms (Banker and Thrall 1992; Binam et al. 2006; Chu and Kalirajan 2011; Le 2010). With the study of small and medium enterprises in Tanzania (Admassie and Matambalya 2002; Ahmad et al. 2015), Admassie and Matambalya demonstrated a relationship between age and technical efficiency on the basis of data from three industries: feed production, apparel and travel. These authors argued that a firm's uptime can positively affect firm productivity through the learning-by-doing theory. This theory shows that enterprises learn from experience to produce more and more efficiently over time, so the older enterprises are, the higher the level of production efficiency will be. This theory is consistent with the findings of Chu and Kalirajan in the case study of manufacturing enterprises in Vietnam in general (Chu and Kalirajan 2011). However, the study of Admassie and Matambalya also shows that the marginal impact of this learning process tends to decrease over time as firms mature enough in the field in which they produce. Admassie et al. studied the technical efficiency in SMEs in Tanzania. Ahmad et al. examined the relationship between the financial leverage and profit performance of SMEs in Pakistan (Admassie and Matambalya 2002; Ahmad et al. 2015). It is this that causes the efficiency of enterprises to be negatively affected by operating time, as younger businesses are more likely to absorb and apply new science and technology to production. A number of studies supporting this inverse relationship can be mentioned, such as those of Admassie and Matambalya and Binam et al. (Admassie and Matambalya 2002; Ahmad et al. 2015; Binam et al. 2006).

The second factor is enterprise size. In their study, Admassie and Matambalya also argued that enterprises that are too large or too small may encounter management obstacles, causing technical inefficiencies (Admassie and Matambalya 2002; Ahmad et al. 2015). In their study of SMEs, firm size was found to be positively related to firm performance. This result is also supported by many other empirical studies (Pitt and Lee 1981; Hallberg 1999; Rios and Shively 2005). Using the same DEA method and Tobit regression model as this study, Rios and Shively tested the data of farm households in Vietnam. The obtained results are similar to the above conclusions about the positive relationship between firm size and technical efficiency. However, there are also studies that show an inverse relationship between these two factors. With the same research object as SMEs, Nikaido showed a negative relationship between firm size and technical efficiency. In relation to the above result, Nikaido explained that, in many cases, SMEs often receive more substantial support from the government and organizations such as business associations; thus, inverse selection behavior occurred when businesses refused to scale up so they could continue to take advantage of incentives.

In addition to the two factors mentioned above, performance theory also shows that capital structure is an important factor to be considered. The agency cost theory (Jensen & Meckling) (Jensen 1986; Tjalling 1951) emphasizes the importance of debt in firm performance. This theory argues that firms with loans will be subject to the supervision and control of lenders; therefore, they will operate more efficiently than non-borrowing businesses. On the other hand, the pressure of loans and interest payments can cause liquidity issues for businesses. Nickell and Nicolitsas proved that the pressure from loans will limit enterprises in terms of labor policy and capital policy—two basic production factors that have a strong influence on a firm's operational efficiency (Nickell and Nicolitsas 1999; Nikaido 2004). Thus, although this theory shows a relatively strong relationship between capital structure and firm performance, there is still much debate about the multidimensional impact of financial leveraging on firm performance.

Mentel et al. noted the nexus of human capital, renewable energy and $CO_2$ emissions with evidence from 26 countries (Mentel et al. 2022). Liao et al. presented transferable domain-adversarial training for smart grid intrusion detection based on ensemble divergence metrics and spatiotemporal features (Liao et al. 2022). Wang et al. noted the relationship between FDI and technological innovation and carbon emission efficiency in China for development sustainability (Wang and Liu 2022).

This study examines the influence of the three important factors mentioned above on the performance of small and medium enterprises in Vietnam, thereby making appropriate policy recommendations to help improve the performance of SMEs in this business group.

### *2.3. Data Envelopment and Tobit Regression*

#### 2.3.1. Data Wrapping Method

Together with the method of one-weighted input quantity analysis to help the system provide unique solutions, we used a dual algorithm in equation linear programming (1)—that is, frontier stochastic analysis (SFA), a data envelopment analysis method that is widely applied in production efficiency analysis when the research object is enterprises (Coelli et al. 2005; Coelli 1996; Cosh et al. 2010). The basic idea of these two approaches comes from trying to construct a production frontier, which varies according to the nature of the industry. The DEA method will compare the input-to-output ratios to find the most efficient enterprise, corresponding to a relative technical efficiency level of 1. Less efficient firms will be included in the list.

#### 2.3.2. Tobit Regression Model

The results from the DEA method were used in the Tobit regression model to identify the factors affecting efficiency: the technical efficiency index of the enterprise, the technical efficiency of the enterprise industry and the type of data being blocked in such a range (Cameron and Trivedi 2010; Gujarati 2022). A number of production efficiency studies also apply DEA and Tobit regression techniques, such as Rios et al., Shively and Binam et al. (Banker and Thrall 1992; Binam et al. 2004, 2006; Rios and Shively 2005).

The Tobit Model in Equation (1) is as follows:

$$EI^*_i = a_i + b_i X_i + e_i \quad (1)$$

where EI* is the dependent variable for the Efficiency Index. If EI* < 0, the Efficiency Index is equal to zero; if EI* > 1, the Efficiency Index is equal to 1; if 0 < EI* < 1, the Efficiency Index EI = EI*.

$X_i$ represents independent variables such as size, operation time, renewable consumption and capital structure. The independent variables are as follows:

$a_i$ is the constant of the equation. It means that if $X_i = 0$ and $e_i = 0$, we calculate the EI of the FDI SMEs.

$X_1$ measures the size of the FDI enterprise. It quantifies the total labor force of the firm at the end of the fiscal year. We compared the average number of employees at the beginning of the year and at the end of the year, rounding up to the closest even number if odd.

$X_2$ measures the age of the FDI SMEs. It represents the operation time of FDI SMEs. We calculated the age by taking the year of establishment from 2021.

$X_3$ measures the renewable consumption. It represents the use of green energy, calculated as the percentage of the total energy consumption of FDI SMEs which involves green energy such as wind, water, and solar.

$X_4$ measures the debt equity ratio. It calculates the loan capital to equity ratio (data at the end of the fiscal year).

$e_i$ measures the other factors that can influence the Efficiency Index.

## 3. Data and Model Results

### *3.1. Data Description*

The data used in this study were taken from the 2021 small and medium-sized enterprise survey conducted by four organizations: the Institute of Management Central Economy (CIEM) under the Ministry of Planning and Investment (MPI); the Institute of Labor and Social Sciences (ILSSA) under the Ministry of Labour, Invalids and Social Affairs (MOLISA); the Faculty of Economics (DoE) of University of Copenhagen; and the Embassy of Denmark in Vietnam (Anbar and Alper 2011; CIEM 2022; Gill et al. 2010). This survey is the largest FDI SME survey conducted in 10 major cities and provinces in Vietnam. According to a survey report, the number of FDI SMEs in the 10 provinces accounted for 30% of the total number of SMEs in the country. At the same time, the sampling also followed strict rules to ensure that the sample best represented the FDI SME population in Vietnam. The study surveyed a total of 1500 enterprises; thus, the observations were large in scale in order to identify the factors affecting the business performance (Deloof 2003).

Table 1 below presents the concepts and methods of measuring variables in both steps. In step 1, three input variables (materials, labor and capital) and one output variable (output) were entered into the DEAP software and the operational efficiency indices were calculated (including the Efficiency Index technique based on two assumptions of constant output to scale and variable scale and the operation efficiency-to-scale index). In step 2, the sustainable technical efficiency variable based on the assumption that output varies with scale was obtained using Tobit regression with the independent variables (i) firm size, (ii) operating time and (iii) capital structure, from which we drew results on the relationship between these variables and the operational efficiency of enterprises.

**Table 1.** Concepts and measurement.

| Variable | Name Definition Unit | Measurement Method |
|---|---|---|
| *Step 1:* | *Input Variable* | |
| Labor | Value of labor contribution to the production process. Thousand VND | Total salary paid to employees in the fiscal year. |
| Capital | Value of physical assets contributed to production process. Thousand VND | Average value of land, factory and machinery at the beginning and end of the fiscal year. |
| Materials | Value of raw materials contributed to the production process. Thousand VND | Total value of materials used in the fiscal year. |
| | *Output Variable* | |
| Output | Value of product. Thousand VND | Value of products produced in fiscal year. |
| *Step 2:* | *Dependent variable* | |
| SDTE_VRS Sub-assumption Technical | Operation Efficiency Index | Changes with change in size variable by size, result of step 1. |
| | *Independent variable* | |
| Size | Size of business | Average number of employees at the beginning of the year and at the end of the year, rounded up to the closest even number if odd. |
| Age | Time in operation | Calculated by taking the year of establishment from 2021. |
| Renewable Consumption | Green Energy | Calculated as the percentage of the total energy consumption of FDI SMEs which involves green energy such as wind, water, and solar |
| Debt/Equity (DE) | Capital structure | Loan capital to equity ratio (data at the end of the fiscal year). |

Source: Compiled by authors.

### *3.2. Research Hypotheses*

Through analysis of the theoretical basis and pre-research mentioned above, this study proposed three research hypotheses as follows:

**Hypothesis H1.** *FDI firm size has a positive relationship with the business performance of FDI SMEs. This relationship is positive.*

**Hypothesis H2.** *The operating time of an FDI enterprise has a relationship with the business performance of the FDI enterprise. This relationship is positive.*

**Hypothesis H3.** *The renewable consumption of an FDI enterprise has a relationship with the business performance of the FDI enterprise. This relationship is positive.*

**Hypothesis H4.** *Loan capital has a positive relationship with the business performance of an FDI enterprise. Specifically, enterprises with a high capital structure will operate more efficiently than other enterprises.*

### *3.3. Research Results*

This section presents the experimental results, including the presentation and analysis of indicators measuring the operational performance of FDI SMEs in step one and the analysis of factors affecting the index number representing the performance level in step two.

#### 3.3.1. Step 1: Operation Performance of FDI SMEs in Vietnam

Table 2 below provides preliminary descriptive statistics of the data used in both steps.

**Table 2.** Descriptive statistics of variables.

| Variance | Observations | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Wage | 1500 | 3,350,982 | 7,105,330 | 250,000 | 90,000,000 |
| Capital | 1500 | 37,921,870 | 127,000,000 | 36,500 | 3,100,000,000 |
| Output | 1500 | 31,496,900 | 67,913,620 | 200,000 | 640,000,000 |
| Size | 1500 | 112.1 | 196.90 | 3 | 2390 |
| Age | 1500 | 26.8 | 22.5 | 2 | 80 |
| Green Energy | 1500 | 51.2 | 26.6 | 19.6 | 90.8 |
| D/E | 1500 | 0.11 | 0.24 | 0.00 | 2.70 |

Source: Authors' calculations.

Results from the data envelope analysis are shown in Table 3.

These indexes were calculated using Formula (1), representing the Efficiency Index. The results show that the level of operation technical efficiency among FDI SMEs in Vietnam is generally good. Based on the assumption of constant output to scale, the average operation efficiency index of firms in the food and beverage industry is 0.668, and that of firms in the steel industry is 0.691, while the wood industry has the highest, at 0.865. This index can be explained as follows: in the food and beverage industry, for example, the index being 0.668 shows that the operation technical efficiency in this industry is 66.8%, which means that the average turnover of FDI SMEs in this industry is 66.8% of the potential marginal level of production. In other words, this group of businesses can reduce input by 33.2% and still maintain the current level of output. This level of efficiency is higher in the other two industries, wood and steel, especially the wood industry, which has the highest, at 86.5%. The achievement of a relatively high efficiency in the timber industry may also contribute to explaining the increasing number of SMEs entering this industry in recent years (Charnes et al. 1978). Despite this, the direct comparison of performance indicators

across different industries is controversial, as the characteristics of different industries lead to different production levels in firms.

**Table 3.** Operational performance of the FDI SMEs surveyed.

| | **Food and Beverage** | | | **Wood** | | | **Steel** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **OTE_CRS** | **OTE_VRS** | **SE** | **OTE_CRS** | **OTE-VRS** | **SE** | **OTE_CRS** | **OTE_VRS** | **SE** |
| Mean | 0.668 | 0.825 | 0.900 | 0.865 | 0.890 | 0.696 | 0.691 | 0.839 | 0.908 |
| Standard Deviation | 0.548 | 0.217 | 0.141 | 0.107 | 0.122 | 0.061 | 0.192 | 0.201 | 0.111 |
| Minimum | 0.320 | 0.332 | 0.380 | 0.536 | 0.347 | 0.723 | 0.336 | 0.365 | 0.392 |
| Maximum | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Observations | 423 | | | 588 | | | 489 | | |

OTE_CRS: Operation technical efficiency index assuming constant output to scale. OTE_VRS: Operation technical efficiency index assuming variable output to scale. SE: Operation efficiency-to-scale index. Source: authors' calculations.

The operation efficiency index by scale of enterprises reached a high level, all above 90%. The presence of economies of scale leads to technical efficiency differences based on the assumption of variable output, and these indices differ based on the assumption of constant output to scale. In general, the OTE_VRS (operation technical efficiency index with the assumption of variable output to scale) always tends to be higher than the OTE_CRS (the operation technical efficiency index with the assumption of constant output to scale), fluctuating, depending on the industry, in the range of 82.5–89%.

The research results show that the operation performance of FDI SMEs in Vietnam is relatively good. This result is contrary to a number of studies on manufacturing enterprises in Vietnam, such as Minh and Vinh's study (OTE indices and efficiency-to-scale index fluctuate in the range of 42–48%, depending on industry; subjects are manufacturing enterprises in the period 2000–2003), Pham et al.'s study (OTE index of manufacturing enterprises reached 62% in 2003), and Chu and Kalirajan's study (OTE indices ranged from 55 to 64%, depending on the industry; subjects were manufacturing enterprises in the period 2000–2003). Thus, the results of this study somewhat disagree with a number of other studies in the context of FDI SMEs in Vietnam.

#### 3.3.2. Step 2: Factors Affecting the Operation Performance of SMEs in Vietnam

In the second step, the operation technical efficiency variable based on the assumption that output varies with scale is used in the Tobit regression model with the independent variables of (i) scale, (ii) operating time and (iii) loan structure. This study implements three corresponding models for the three industries. Tobit regression results are shown in Table 4. All three models for the three industries passed the likelihood ratio (LR) chi-squared test (testing for having at least one regression coefficient other than 0), showing that the built model is statistically significant.

**Table 4.** Table of correlation coefficients between independent variables in the model.

| | **Size** | **Age** | **Green Energy** | **D/A** |
|---|---|---|---|---|
| Size | 1 | | | |
| Age | 0.19 | 1 | | |
| Green Energy | 0.18 | 0.12 | 1 | |
| D/E | 0.13 | 0.16 | 0.11 | 1 |

Source: authors' calculations.

Table 4 presents the correlation coefficients of the independent variables in the model. The correlation coefficient between the variables is low, and the variance exaggeration factor (VIF) is low (all less than 5), indicating that there is no multicollinearity in the model.

The results for all three models, as shown in Table 5, show a strong correlation between the independent and dependent variables in the food and beverage, steel and wood industries. All three models show that scale has a strong relationship with the operation technical efficiency of FDI enterprises; moreover, this relationship is positive at the 1% significance level. For example, the regression coefficient of scale in the food and beverage industry is 0.00163, indicating that when increasing the size of the enterprise by one employee, the operation technical efficiency of the enterprise will increase by 0.00163 points, when other factors remain unchanged. The regression coefficient of scale in the wood industry is 0.00181, indicating that when increasing the size of the enterprise by one employee, the operation technical efficiency of the enterprise will increase by 0.00181 points, when other factors remain unchanged. The regression coefficient of scale in the steel industry is 0.00228, indicating that, when increasing the size of the enterprise by one employee, the operation technical efficiency of the enterprise will increase by 0.00228 points, when other factors remain unchanged. The positive sign of the regression coefficient is also observed for all three industries, which shows that a higher scale of FDI SMEs will be able to effectively support the research hypothesis H1, which has been confirmed to be higher.

**Table 5.** Results of the Tobit regression model.

| | **Food and Beverage** | | | **Wood** | | | **Steel** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Variable OTE_VRS** | | | | | | | | |
| | **Coefficient** | **SE** | **Sig. Level** | **Coefficient** | **SE** | **Sig. Level** | **Coefficient** | **SE** | **Sig. Level** |
| Size | 0.00163 | 0.0008 | *** | 0.00181 | 0.008 | *** | 0.00228 | 0.0005 | *** |
| Age | 0.00181 | 0.0008 | *** | 0.00176 | 0.001 | *** | 0.00179 | 0.0009 | *** |
| Green Energy | 0.18966 | 0.00621 | *** | 0.02861 | 0.002 | *** | 0.13636 | 0.0026 | *** |
| D/E | 0.25159 | 0.0510 | *** | 0.03920 | 0.0006 | *** | 0.16856 | 0.0386 | *** |
| Constant | 0.52194 | 0.0204 | | 0.8145 | 0.023 | | 0.6268 | 0.019 | |

*** represent 1% significance. Source: Compiled by the authors.

Table 5 shows the average number of years of operation. Regarding operating time, the theory has shown the diverse effects of this variable on the production efficiency of the firm. In the case of the food and beverage, wood and steel industries, the regression coefficients of age are significant at the 1% level and have positive signs, which indicate the effect of this variable on the production efficiency of the enterprise. The interpretation of the regression coefficient of age is also quite simple: this coefficient is equal to 0.00181 in the case of the food and beverage industry, given that enterprises with a large number of years of operation will operate more efficiently than businesses with fewer active years—that is, one year corresponds to an increase to 0.00181 effective points, in the event that other variables remain unchanged. This coefficient is equal to 0.00176 in the case of the wood industry, considering that enterprises with a large number of years of operation will operate more efficiently than businesses with fewer active years—that is, one year corresponds to an increase to 0.00176 effective points, in the event that other variables remain unchanged. This coefficient is equal to 0.00179 in the case of the steel industry, given that enterprises with a large number of years of operation will operate more efficiently than businesses with fewer active years—that is, one year corresponds to an increase to 0.00179 effective points, in the event that other variables remain unchanged.

Thus, the situation of FDI SMEs in Vietnam is contrary to the theory of diminishing marginal effects of operating time on performance as firms mature. Younger businesses have the disadvantage of not having been able to access and apply current technologies of FDI SMEs in Vietnam for more than 16 years, indicating the high operating age of FDI

SMEs in Vietnam in general. Thus, research hypothesis H2 has been proven correct in the case where the correlation between age and operation production efficiency is positive.

Regarding the renewable consumption variable, the regression coefficient of the renewable consumption variable has a high level of statistical significance (1%) in the case of the food and beverage, wood and steel industries. In statistically significant models, the positive signs of these coefficients are also consistent with the new theory of using renewable consumption to increase production efficiency. This is a new result that this paper identifies. The coefficient of 0.18966 of the food and beverage industry shows that if FDI SMEs in that industry increase the ratio of renewable consumptions to 1% (i.e., 0.01), the technical efficiency will increase by 0.18966 points, if all other variables remain unchanged. The coefficient of 0.02861 of the wood industry shows that if FDI SMEs in that industry increase the ratio of renewable consumptions to total energy consumptions to 1% (i.e., 0.01), the technical efficiency will increase by 0.02861 points, if all other variables remain unchanged. The coefficient of 0.13636 of the steel industry shows that if FDI SMEs in that industry increase the ratio of renewable consumptions to total energy consumptions to 1% (i.e., 0.01), the technical efficiency will increase by 0.13636 points, if all other variables remain unchanged. Thus, research hypothesis H3 has also been proven in the case of the food and beverage, wood and steel industries.

Regarding the capital structure variable, the regression coefficient of the capital structure variable has a high level of statistical significance (1%) in the case of the food and beverage, wood and steel industries. In statistically significant models, the positive signs of these coefficients are also consistent with the theory of using financial leverage to increase production efficiency. The coefficient of 0.25159 of the food and beverage industry shows that if FDI SMEs in that industry increase the ratio of loans to total assets to 1% (i.e., 0.01), the technical efficiency will increase by 0.25159 points, if all other variables remain unchanged. The coefficient of 0.0392 of the wood industry shows that if FDI SMEs in that industry increase the ratio of loans to total assets to 1% (i.e., 0.01), the operation technical efficiency will increase by 0.03592 points, if all other variables remain unchanged. The coefficient of 0.16856 of the steel industry shows that if FDI SMEs in that industry increase the ratio of loans to total assets to 1% (i.e., 0.01), the operation technical efficiency will increase by 0.16856 points, if all other variables remain unchanged.

Thus, research hypothesis H4 has also been proved in the case of the food and beverage, wood and steel industries.

Discussion of the empirical results in the research shows that the greater the size of an FDI enterprise, the better the business performance. The empirical results were checked in three industries: food and beverages, wood and steel. In addition, the research results show that the greater the age of the FDI SMEs, the better their business performance. The FDI SMEs with long-term operation have better business performance than younger FDI SMEs.

The new empirical results in this research show that the greater the green energy use of FDI SMEs, the better their business performance. These results suggest that FDI SMEs should use more the renewables and that the Vietnam government should invest more in green energy such as water, solar and wind power. In addition, these results show that the FDI SMEs in Vietnam care about the Sustainable Development Goals of the United Nations. These actions should be mirrored by domestic SMEs in Vietnam.

The results of an analysis of the sustainable development of FDI enterprises can vary depending on the criteria and methods used for the analysis. However, some common findings include:

Positive impact on economic growth: FDI can stimulate economic growth by increasing investment and creating jobs, leading to higher incomes and improved standard of living.

Transfer of technology and knowledge: FDI enterprises can bring new technologies and expertise to host countries, helping to improve local production processes and competitiveness.

Environmental and social challenges: FDI can also lead to environmental degradation and the exploitation of natural resources, and can sometimes result in negative social impacts, such as the displacement of local communities or the exploitation of workers.

Lack of transparency and accountability: Some FDI enterprises may not be transparent about their operations, particularly with regard to environmental and social impacts, leading to a lack of accountability.

Need for responsible business practices: To ensure sustainable development, FDI enterprises need to adopt responsible business practices, including environmental and social impact assessments, stakeholder engagement, and transparency and accountability mechanisms.

Overall, the sustainable development of FDI enterprises can have both positive and negative impacts, and depends on a number of factors, including the policies and regulations of host countries, the operations of individual FDI enterprises, and their engagement with local communities and stakeholders.

## 4. Conclusions and Recommendations for FDI SMEs

The purpose of this study was to determine the index showing the level of operation technical efficiency, as well as the factors affecting this index in the case of FDI SMEs in Vietnam. This study uses the latest data published in 2022 from the survey, "Business characteristics of SMEs in Vietnam" and the data envelope analysis technique in step one combined with Tobit regression in step two. We drew some conclusions from the study as follows. First, FDI SMEs play an important role in the economy, with the production efficiency of FDI SMEs in Vietnam reaching 82.5–89% (assuming that output varies with scale). Second, the factors scale, operating time, renewable consumptions and capital structure are related to the operation production efficiency of FDI enterprises in all three industries selected for this study. In addition, these factors are positively related to the operation technical performance index. While larger firms may be more productive, older FDI firms are likely to be more efficient because they can apply the latest technologies. Third, renewable consumption and financial leverage will mostly promote the production efficiency of FDI businesses. In the case of the food and beverage, wood and steel-manufacturing industries, this positive correlation is demonstrated in this study.

The results of this research contribute to policy recommendations for different management target groups. For policy makers, FDI SMEs play a particularly important role in the economy, especially in developing countries such as Vietnam. In addition, as the operation technical efficiency of this group of enterprises is still relatively good, policy makers should focus on developing appropriate policies to maintain the efficiency of these enterprises. The results of this study also support policies to encourage more loans and renewable consumption for FDI SMEs in Vietnam. Facilitating and promoting green energy and lending to FDI SMEs will promote the development of this group of businesses, which is a group with great motivation to improve the economic efficiency of the country.

For business managers, the increase in scale has the potential to help businesses operate more efficiently. This study shows a positive correlation between these three variables, so the efficient operation of the business is also sometimes a contributing factor to the success of an enterprise's basis for scaling up. On the other hand, the positive relationship between operating time and the operation production efficiency of enterprises also provides policies for managers who are over-reliant on the advantages they experience in terms of operating time. In many cases, the flexibility and innovations that come from past work experiences can promote business growth. Another recommendation for business managers is to consider using green energy and financial leverage to improve the production efficiency of an FDI business. This study shows that the increase in green energy and loan capital will help FDI small and medium enterprises to sharply increase their production efficiency index.

Foreign direct investment (FDI) enterprises can contribute to sustainable development by creating jobs, transferring technology and knowledge, and promoting economic growth.

However, they can also have negative impacts, such as environmental degradation and the exploitation of natural resources. To ensure sustainable development, FDI enterprises should integrate environmental, social, and governance (ESG) considerations into their operations and adopt responsible business practices. This can include reducing carbon emissions, promoting human rights and labor standards, and ensuring transparency and accountability. Additionally, governments can play a role by setting regulations and standards to encourage sustainable FDI and by providing incentives for companies to adopt sustainable practices.

This research work provides new contributions to the theory and empirical results in this field, such as the fact that the greater the renewable consumption of FDI SMEs, the better the business performance of these FDI SMEs. This new contribution helps to encourage policy makers and the Vietnamese government to produce more green energy for the Sustainable Development Goals (SDGs). The FDI SMEs should use more solar, water and wind energy for better business performance in Vietnam. Future studies should focus on the renewable consumption of other Vietnam SMEs.

This research has some limitations, such as the lack of information to check how the FDI SMEs in Vietnam are achieving the Sustainable Development Goals (SDGs) of United Nation. Future studies should research these issues.

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