Research article

How innovation and ownership concentration affect the financial sustainability of energy enterprises: evidence from a transition economy

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\section*{ABSTRACT}

The energy sector in Vietnam has developed rapidly as the country is transitioning to renewable energy. Moreover, the Vietnamese government also motivates the engagement of private investors in the energy sector to enhance the competitiveness of the energy market. Therefore, this paper investigates how innovation investments and ownership concentration affect the financial sustainability of energy companies in Vietnam. We employ the Fixed Effect Model and Generalized Method of Moments estimations to analyze the sample, including 600 firm-year observations of 103 energy companies from January 2007 to December 2020. The empirical findings show that innovations and block-holders support firms to grow sustainably. The positive relationship between innovation investments and financial sustainability is robust even when we employ alternative proxies of innovation investments. Our study indicates that block-ownership affects sustainable developments of smaller energy firms, while innovation investments significantly improve the sustainability of larger energy firms. Finally, our study reports that the Covid-19 pandemic adversely affects the financial sustainability of energy firms. Our findings align with agency theory, resource-based theory, and prior literature. Our findings recommend that energy firms motivate innovation investments such as training and R&D activities to grow sustainably. In addition, the Vietnamese government should encourage small energy firms to attract blockholders to improve financial sustainability.

\section*{1. Introduction}

Financial sustainability has recently attracted significant attention from the literature globe due to its importance in the survival of institutions. Rodriguez Bolívar et al. (2016) define financial sustainability as the ability to meet service delivery and financial commitments, applying current policies and maintaining them in the future without causing the debt to rise continuously. Agency theory and Resource-based theory help explain the sustainable developments of listed firms. Agency theory suggests that blockholders can address the monitoring problems and have more voting power over the board of directors’ decisions, leading to increased performance and financial sustainability for the company.

Recent literature reports mixed impacts of innovation on the sustainable growth of energy firms. Qiao et al. (2021) indicate that higher innovation efficiency can reduce resource consumption and pollutant emissions per unit output value, helping firms to improve profitability and gain a competitive advantage. Similarly, Shen et al. (2017) and Vanderpal (2015) argue the positive relationship between innovation investments and financial sustainability, a critical aspect in increasing business efficiency and profitability. Meanwhile, Xu et al. (2020) report that innovation has a significantly negative influence on financial sustainability, implying that the economic advantages of R&D spending require a time lag. While prior studies examine the innovation effect in developed and emerging markets (Qiao et al., 2021; Shen et al., 2017; Xu et al., 2020), there is no study investigating the impact of innovation investments on financial sustainability in frontier countries such as Vietnam. Therefore, the literature gap motivates us to conduct this topic in Vietnam.

We examine the impact of innovations on financial sustainability in the Vietnamese energy sector since it is amongst the most active in

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Southeast Asia, offering significant investment opportunities. Vietnam is also transitioning from conventional energy to renewable energy. The Vietnamese energy sector has been growing significantly over decades with the implementation of coal, natural gas, and hydropower (Wanniechi, 2016). Secondly, the Vietnamese government has encouraged market liberalization and competition in the energy sector since 2004 to improve the market efficiency of gas and power (Gerner et al., 2018). For instance, the government regulates competitive regulations to ensure the long-term sustainability of the energy sector. The Vietnamese government has issued decision number 37/2011/QĐ-TTg to attract domestic and foreign private investors to invest in energy companies. The participation of institutional investors encourages environmental protection and maintains sustainable development through innovation strategies. Therefore, it is worth testing the impacts of innovations and ownership concentration on the financial sustainability of energy firms, especially after the enactment of renewable energy regulations.

Recent studies generate the mixed impacts of ownership concentration and financial sustainability because they employ Standard Least Squares estimations. Lepore et al. (2017) employ the Ordinary Least Squares (OLS) regression and conclude that concentrated ownership increases business performance, especially in nations with weak legal systems. Ahmad et al. (2020) employ the Two-stage Least Squares (TSLS) estimation, and the results suggest that excessively concentrated ownership could reduce the firm’s long-term sustainability. However, Greene (2005) and Wooldridge (2001) indicate that the Generalized Method of Moments (GMM) method is more efficient than OLS and TSLS. Thus, it is worth testing the impacts of innovation investments and ownership concentration on financial sustainability in the energy industry in Vietnam by employing a two-step system GMM method.

We perform the following research methodology to close the research gaps. Firstly, we compare the two standard estimation methods of testing OLS and the Fixed Effects Model (FEM) by applying the Hausman Test and Redundant Test. However, Greene (2005) argues that OLS and FEM generate bias estimations because of violating the hypothesis and are related to the incidental parameters problem. Therefore, we employ the two-step system GMM regressions to overcome endogenous issues. After that, we perform the first robustness test in INI and firm size subsamples. We further test whether our main findings are persistent even after employing two alternative proxies of INI.

The closest research to our study is Xu et al. (2020). Their study mentions the impact of innovation and executive incentives on financial sustainability and only adds ownership concentration as a control variable. Ang et al. (2000) imply that principal-agent agency conflicts are less frequent in firms with blockholders since concentrated ownership improves corporate governance’s monitoring and thus leads to firm sustainability. Our study deviates from Xu et al. (2020) since we mainly focus on how innovation investments and ownership concentration affect financial sustainability.

Our results also extend the findings of Xu et al. (2020) in the following ways. Firstly, we examine whether the Covid-19 pandemic affects the financial sustainability of energy firms. In addition, we take further steps to divide our sample into subsamples based on firm size and R&D investment intensity to test whether our primary findings are robust. Finally, we employ various innovation proxies to complement Xu et al. (2020) and test the robustness of our findings. Therefore, our empirical findings have fewer biases than Xu et al. (2020), Lepore et al. (2017), and Ahmad et al. (2020).

This study contributes to the literature in the following ways. Our striking findings suggest a positive and significant relationship between innovation investments and financial sustainability, consistent with resource-based view theory and Qiao et al. (2021). We figure out that block-holders improve the financial sustainability of energy firms. In addition, the result demonstrates that ownership concentration contributes to a more positive relationship between innovation investments and financial sustainability. Our findings align with Connelly and Hirschey (2005) and the agency theory. Our study figures out that the Covid-19 pandemic negatively erodes the financial sustainability of energy firms. Finally, our robustness tests indicate persistent impacts of innovation on financial sustainability in larger energy firms, while block-ownership solely affects sustainable developments of smaller energy firms.

Our study also suggests the following policy implications for the energy sector in emerging countries. This study includes data from all energy firms in HOSE, HNX, and UPCOM exchanges, which gives an in-depth overview of the energy sector in Vietnam since 40% of energy enterprises are listed on the UPCOM market. Our research confirms the importance of innovations and corporate governance on sustainable growth in Vietnam before and during the pandemic. Large energy enterprises should enhance their innovation investments like R&D and training activities to boost their value. Meanwhile, small energy firms should develop their ownership concentration to reach financial sustainability. The government could provide support by subsidizing renewable energy prices, protecting the intellectual properties, and corporate tax reduction policies could motivate the managers to expand the investments in R&D to archive sustainable development for energy firms. Aside from developing R&D programs, tax and credit policies are also necessary to improve innovation efficiency. Finally, we suggest that energy companies increase the holdings of blockholders to optimize financial sustainability.

The remainder of the study is presented as follows. Section 2 is the literature review; Section 3 is Data and Methodology; Section 4 is empirical results; Section 5 is the conclusion; the final is the Appendix.

2. Literature review

2.1. Financial sustainability

Existing literature in finance has reported several financial sustainability measures because it has no universal definition. Commonly, financial sustainability relies on short- and long-term financial success factors that might contribute to operations stability (Cull et al., 2007; Hermes et al., 2011; Quayes, 2012). Operational self-sufficiency (OSS), profit margin, return to equity (ROE), and return on assets (ROA) are often used as financial sustainability measures in the previous research. Osasfua (2020) evaluates financial sustainability by analyzing all three indicators at the same time, return on asset (ROA), sustainable growth rate (SGR), and financial distress. Rodríguez Bolívar et al. (2016) consider net debt and adjusted income to measure financial sustainability. Financial sustainability encompasses more than just liquidity or the profit of an enterprise. This paper follows Xu et al. (2020) to employ the sustainable growth rate because it might reflect the difficulties that financial reasons are limiting business growth.

2.2. The impact of innovations on financial sustainability

The resource-based theory helps explain the impact of innovation investments on financial sustainability. R&D, which belongs to intangible assets, is an essential component from a strategic point of view. It often brings together the requirement needed to be the core of competitive advantage: to be valuable, scarce, and hard to imitate substitute by competitors. Lukovszki et al. (2020) indicate that innovation is the method through which organizations gain a competitive advantage by depending on R&D activities, and it is the assurance of long-term added value. As a result, R&D has been considered a vital competitive advantage that allows the enterprise to generate significant earnings over time, allowing the company to achieve financial sustainability.

Existing literature documents the controversial impacts of innovations on financial sustainability (Liu et al. 2021a, b and Qiao et al. 2021).
Qiao et al. (2021) suggest that innovation efficiency has a positive and significant relationship with sustainable development. The authors explain that higher innovation efficiency can lower energy or resource consumption and pollutant emissions per unit output value of businesses, allowing them to grow profitably and compete more effectively. Shen et al. (2017) show that R&D expenses increase semiconductor businesses' financial and corporate sustainability. Vanderpal (2015) reports that R&D has a favorable impact on corporate value. In various industries, a high level of R&D spending strengthens financial performance. In considerations of the corporate life cycle, Liang et al. (2010) discover that the INI of growth businesses significantly affects present period corporate performance and will have a long-term cumulative effect.

Meanwhile, Xu et al. (2020) indicate that innovation investments reduce financial sustainability. The authors suggest that the economic advantages generated by R&D investments have a temporal lag, which leads to a negative relationship between current innovation investments and financial sustainability. However, Xu et al. (2020) figured out that the lag innovation investments positively impact subsequent financial sustainability. Trachuk and Linder (2018) report a nonlinear relationship between innovation investments and performance. This relationship only becomes positive after heavy spending on R&D. Prior studies show the INI effect in developed and emerging markets (Qiao et al., 2021; Shen et al., 2017; Xu et al., 2020). Therefore, it is worth investigating the impact of innovation investments and financial sustainability in a transition economy. Moreover, Xu et al. (2020) mainly focus on the impact of innovation and executive incentives on financial sustainability and only add ownership concentration as a control variable. Ang et al. (2000) imply that agency costs are minor in firms with blockholders since concentrated ownership improves corporate governance and thus leads to higher financial sustainability.

**Hypothesis 1.** Innovation investments positively affect financial sustainability.

### 2.3. The impact of ownership concentration on financial sustainability

Agency theory can explain the impact of ownership concentration on financial sustainability. The agency theory implies that managers do not have a solid motivation to maintain low expenses. Accordingly, the managers might follow strategies and practices that personally profit them, leading to a higher expense for shareholders. Therefore, the role of blockholders is more critical since they can monitor managers’ behavior. Blockholders have better monitors than more minor stockholders since they internalize a more significant portion of the monitoring costs and have more substantial voting power to affect the business decision, leading firms to more extraordinary performance and financial sustainability. As a result, we expected to find out that ownership concentration is positively related to financial sustainability.

There has already been a broad entirety of theory and observational research on the relationship between ownership concentration and financial sustainability. Ownership concentration represents the blockholders, who acquire more than 5% of outstanding shares. Claessens et al. (1997) discovered that concentrated ownership is positively related to firm value and profitability in market economies. Similarly, Lepore et al. (2017) investigated the positive effect of concentrated ownership on the firm for 565 non-financial listed companies in France, Germany, Italy, and Spain. The authors suggest that concentrated ownership improves corporate performance, particularly in countries with a weak legal system. Ahsan et al. (2020) find a robust positive relationship between ownership concentration and sustainable growth, implying that concentrated ownership adds to sustainable Chinese enterprises. Large shareholders typically have more business expertise and skills, positively impacting management decisions and sustainable growth.

However, few studies show the reverse results. Ahmad et al. (2020) regress the TSLS approach and demonstrate the significantly negative relation between ownership concentration and firm sustainability. Ahmad et al. (2020) suggest that excessively concentrated ownership could lead to policies not at the most significant advantage of all key shareholders, reducing the firm’s long-term sustainability. Feng et al. (2018) show that the concentration of ownership has no impact on short- or long-term performance in Chinese listed energy companies. The reason given is that a significantly higher concentration of ownership may benefit larger shareholder self-interests at the expense of smaller shareholders and other stakeholders. However, Greene (2005) and Wooldridge (2001) indicate that GMM estimators are often more efficient than OLS and TSLS. To close this gap, by employing GMM estimations, we are the first to test the impact of innovation investments and ownership concentration on financial sustainability in the energy industry in Vietnam. This estimation helps us generate less biased results than Lepore et al. (2017) and Ahmad et al. (2020).

**Hypothesis 2.** Ownership concentration positively affects financial sustainability.

### 3. Research method

#### 3.1. Data

We collected accounting data from FisinPro and the financial statement of 103 listed energy businesses on HOSE, HNX, and UPCOM markets from January 2007 to December 2020. Our sample includes observations traded on the UPCOM exchange, which differs from previous studies because more than 40% of energy enterprises are listed on the UPCOM market. Based on the data accessibility that listed firms have disclosure, this paper chooses the listed firms in the energy industry with R&D investments of more than zero. To deal with the influence of outliers, we follow Zhang et al. (2015) to winsorize all of the variables at 0.5% and 99.5% levels. Finally, our final data sample contains 600 firm-year observations of 11.

#### 3.2. Model construction

This paper analyzes the effect of innovation investments and ownership concentration on financial sustainability. Since previous research has found mixed effects of innovation investments on financial sustainability, we first create a baseline model to examine the linearity of INI and SGR. SGR stands for financial sustainability (FS); INI measures innovation investments. Following Bae and Noh (2001), we compute INI by dividing the net sales of a product or service by the company’s R&D spending. Xu et al. (2020) suggest that innovation investments are a performance indicator used to assess the success of a company’s product or service investments. Following Xu et al. (2020), Model 1 includes the following variables as the executive incentive (EXI) and firm size (SIZE). We also follow Lassala et al. (2017) and Tehulu (2013) to add return on equity (ROE) and firm ages (AGE) into Model 1. Following Lassala et al. (2017), we define ROE as the ratio between net income and shareholders’ equity. Lassala et al. (2017) indicate that while accounting fundamentals are better indicators than market measures, they are easily manipulated. Furthermore, while market indicators help explain a company’s behavior, accounting data show what is happening inside the organization. Model 1 is specified as follows.

\[
SGR_{it} = \alpha_0 + \beta_1INI_{it} + \beta_2EXI_{it} + \beta_3AGE_{it} + \beta_4ROE_{it} + \beta_5SIZE_{it} + \epsilon_{it}
\]  

(1)

In model 2, following Xu et al. (2020), we include OWN to see whether it impacts the relationship between INI and SGR. OWN is measured for the largest shareholder in shareholding ratio. The authors suggest that concentrated ownership improves corporate performance, particularly in countries with a weak legal system. Ahsan et al. (2020) find a robust positive relationship between ownership concentration and sustainable growth, implying that concentrated ownership adds to sustainable Chinese enterprises. Large shareholders typically have more business expertise and skills, positively impacting management decisions and sustainable growth.

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\]  

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regression. We mark COVID as one if the time is from 2020 and equals zero otherwise.

\[
SGR_{i,t} = \alpha + \beta_1INI_{i,t} + \beta_2EXI_{i,t} + \beta_3AGE_{i,t} + \beta_4OWN_{i,t} + \beta_5ROE_{i,t} + \beta_6SIZE_{i,t} + \beta_7COVID_{i,t} + \epsilon_{i,t} \tag{3}
\]

Where SGR represents the corporate financial sustainability; INI denotes innovation investment; EXI denotes the executives’ salaries; AGE denotes firm ages; OWN denotes ownership concentration; ROE denotes return on equity; SIZE denotes firm size; COVID denotes COVID dummy variable. All the variable definitions are explicitly displayed in Appendix A.

4. Empirical result

4.1. Descriptive statistics

The summary statistics are shown in Table 1. The mean of financial sustainability is 0.024, and the median is 0.004. The statistics indicate that the mean of INI is 0.057. The mean of the highest ownership is about 42.7 percent, and the mean age of energy companies is about 5.520 years. The average value of our main variables, such as INI and OWN, is pretty similar to Xu et al. (2020).

4.2. Pearson correlation matrix

Table 2 presents the correlation matrix of the research data sample. All the coefficient correlations are acceptable with no perfect relationships because all the correlation coefficients are less than 0.5. Noticeably, the highest correlation coefficient between SIZE and EXI is approximately 0.486. Therefore, our study does not have a multicollinearity problem (Salihu et al., 2019).

### Table 1. Descriptive statistics.

|       | Mean | Median | 10th Pct | 90th Pct | Std. Dev. | Obs |
|-------|------|--------|----------|----------|-----------|-----|
| SGR   | 0.024| 0.004  | 0.000    | 0.095    | 0.042     | 600 |
| INI   | 0.057| 0.020  | 0.000    | 0.188    | 0.084     | 600 |
| EXI   | 2.062| 1.573  | 0.368    | 4.697    | 1.693     | 600 |
| AGE   | 5.520| 5.000  | 2.000    | 10.000   | 3.004     | 600 |
| OWN   | 0.427| 0.504  | 0.137    | 0.668    | 0.198     | 584 |
| ROE   | 0.124| 0.108  | 0.013    | 0.256    | 0.091     | 600 |
| SIZE  | 11.996|12.015 |11.255    |12.826    |0.543  |600 |
| COVID | 0.307| 0.000  | 0.000    | 1.000    | 0.461     | 600 |

This table displays the descriptive statistics for the main variables of the research. The sample includes 103 listed energy businesses in Vietnam from 2007 to 2020. Financial sustainability (SGR) is a dependent variable. The independent variables are innovation investments (INI) and ownership concentration (OWN). Executives’ salaries (EXI), firm characteristics (AGE and SIZE), firm performance (ROE), and COVID dummy are employed as control variables. All variables are winsorized at 0.5% and 99.5% levels.

### Table 2. Pearson Correlation Matrix.

|      | INI | EXI | AGE | OWN | ROE | SIZE | COVID |
|------|-----|-----|-----|-----|-----|------|-------|
| INI  | 1   |     |     |     |     |      |       |
| EXI  | -0.040 | 1   |     |     |     |      |       |
| AGE  | 0.095 | 0.167 | 1   |     |     |      |       |
| OWN  | -0.088 | -0.019 | 0.029 | 1   |     |      |       |
| ROE  | 0.056 | 0.166 | -0.054 | 0.013 | 1   |      |       |
| SIZE | -0.029 | 0.486 | 0.082 | 0.067 | 0.032 | 1    |       |
| COVID| -0.178 | 0.096 | 0.202 | 0.061 | -0.108 | 0.025 | 1    |

Table 2 reports the Pearson correlation coefficients of all independent variables. The correlation coefficients are less than 0.5, so our data sample has no multicollinearity issue.

4.3. The results of the Fixed Effects Model (FEM) regression

We employ Hausman’s (1978) and redundant tests to determine whether we should apply the OLS, fixed-effects, or random-effects Models in our study. These test results indicate that the FEM is preferable to our sample data. Therefore, we regress three models using the FEM estimation to test the impact of independent variables on financial sustainability. Table 3 reports that INI has negative efficiency with financial sustainability, but the relationship is statistically insignificant. Most of the independent variables are insignificant with financial sustainability, except for ROE. This result is consistent with Lassala et al. (2017) since accounting measurements are better indicators to perform the productivity of enterprises.

4.4. The regression results from generalized Least Squares (GMM) estimations

Table 4 presents the GMM estimation results from 2007 to 2020. Greene (2005) showed that typical panel regression methods like OLS, FEM, and REM have asymptotic efficiency and heterogeneity, generating biased results. Therefore, we mitigate endogeneity and unobserved heterogeneity by using the GMM estimations. Furthermore, GMM can overcome omitted bias issues and remove autocorrelation problems. Therefore, we implement the GMM estimation to investigate the impact of innovation investments and ownership concentration on financial sustainability. Our findings report that innovation has a positive and significant effect on financial sustainability. The coefficient of INI increases from 0.07 in model 1 to 0.072 in model 2 after we include OWN into the regression. The result shows that ownership concentration helps increase the positive relationship between innovation investments and financial sustainability. After considering the COVID factor in our regression, the coefficient of INI in model 3 declined to 0.067, indicating that if the INI increases by 1 percent, then the SGR is predicted to increase by 0.067%. The Covid-19 pandemic reduces the impacts of innovations on financial sustainability, consistent with Shen et al. (2020). Shen et al. (2020) report that the pandemic causes companies to reduce corporate investments and profitability. This finding implies that increasing R&D spending develops financial sustainability, consistent with the resource-based view theory and Qiao et al. (2021), suggesting that R&D is an efficient innovation to achieve corporate sustainability without resource overconsumption. Our findings also align with Shen et al. (2017), Vanderpal (2015), and Liang et al. (2010). Our results support hypothesis 1 that innovation investments enhance the financial sustainability of energy firms. Unfortunately, our findings are inconsistent with Xu et al. (2020) and Trachuk and Linder (2018).

This table also indicates a positive and significant relationship between OWN and financial sustainability, suggesting that ownership concentration enhances financial sustainability. Blockholders or institutional shareholders have monitoring experiences that positively impact management decisions and sustainable growth. Especially after concluding COVID in model 3, the coefficient of OWN from 0.017 to 0.03, implying that one more percent of ownership concentration ratio will increase 0.03 percent of financial sustainability after controlling for the pandemic. Our findings imply that blockholders empower financial sustainability during the COVID pandemic because they typically have more business knowledge and skills, which monitor management decisions promptly, especially during the pandemic. While our findings align with agency theory and Ahsan et al. (2020), they are inconsistent with Ahmad et al. (2020) and Feng et al. (2018). Our findings also support hypothesis 2, indicating a positively impacting ownership concentration and financial sustainability.

The results in Table 4 report a significant and positive relation between ROE and financial sustainability, indicating that firms with higher profitability achieve financial sustainability. The profitable firms have extra retained earnings for reinvestments. They also have fewer financial constraints for external financing. Therefore, higher profitability
enhances financial sustainability. While our findings align with Lassala et al. (2017); Alcock and Steiner (2017), they are inconsistent with Baciu and Petre (2018). The coefficient of EXI is significantly negative, which aligns with the agency theory and Hossain (2020). Due to inefficient corporate governance, board members' higher compensation and remuneration cause companies to underperform.

Table 4 also reports the negative relationship between SIZE financial sustainability. Orazalin et al. (2019) report that larger businesses are riskier and less financially stable than smaller businesses. The larger firms also encounter higher agency costs, which erode corporate sustainability. While our findings align with Orazalin et al. (2019), they are inconsistent with Tehulu (2013).

The results from Table 4 reveal a negative and significant impact of firm age on financial sustainability. In other words, older firms have less financial sustainability than younger firms. Loderer and Waelchli (2010) explain that older firms are inflexible and transform slowly to new competition contexts. The older firms also have higher agency costs due to the entrenchment of rent-seeking behavior. While our findings are consistent with Loderer and Waelchli (2010), they are inconsistent with Tehulu (2013), Orazalin et al. (2019), Njiku and Nyamsogoro (2019).

Finally, our findings indicate that the Covid-19 reduces the impact of INI on financial sustainability. The pandemic causes an economic slowdown, reducing energy demand and eroding the energy sector's performance. The pandemic also causes companies to reduce corporate investments and profitability, increasing financial constraints for businesses. Our findings are consistent with Shen et al. (2020).

### 4.5. Empirical results from subsamples

By employing GMM regression, we put two scenarios on our sample to consider the impact of INI and OWN on financial sustainability. Table 5 represents the separation of the entire sample into two subsamples based on the intensity of innovation investments of the firms. Some companies invest more in R&D than others due to differences in production technologies. To see whether the R&D intensity impacted our main findings, we follow Mishra (2007) to divide our sample into two subsamples based

| Table 3. The regression results from the Fixed Effects Model (FEM). |
|-----------------------------|-----------------------------|-----------------------------|
|                            | Coefficient | Prob.  | Coefficient | Prob.  | Coefficient | Prob.  |
| C                           | 0.089        | 0.3846 | 0.094       | 0.4485 | 0.098       | 0.4305 |
| INI                         | -0.010       | 0.6578 | -0.010      | 0.6507 | -0.009      | 0.6926 |
| EXI                         | -0.001       | 0.5483 | -0.001      | 0.5573 | -0.001      | 0.4571 |
| AGE                         | 0.0001       | 0.8365 | 0.0001      | 0.7977 | 0.0001      | 0.7071 |
| OWN                         | 0.012        | 0.1977 | 0.012       | 0.1977 | 0.012       | 0.1969 |
| ROE                         | 0.126**      | <0.0001| 0.126**     | <0.0001| 0.125***    | <0.0001|
| SIZE                        | -0.006       | 0.4509 | -0.007      | 0.4833 | -0.008      | 0.4629 |
| COVID                       |              |        |            |        | -0.003      | 0.2767 |
| R²                          | 0.7376       |        | 0.7369      |        | 0.7375      |        |
| Adj R²                      | 0.6805       |        | 0.6777      |        | 0.6778      |        |
| F-statistic                 | 12.9258      |        | 12.4572     |        | 12.3577     |        |
| Prob (F-statistic)          | <0.0001      |        | <0.0001     |        | <0.0001     |        |
| N                           | 600          |        | 584         |        | 584         |        |

This table represents the regression results between innovation investments (INI) and financial sustainability (SGR). The sample includes 103 listed energy businesses in Vietnam from 2007 to 2020. Financial sustainability (SGR) is the explained variable. The explanatory variables are innovation investments (INI) and ownership concentration (OWN). The control variables are executives’ salaries (EXI), firm characteristics (AGE and SIZE), firm performance (ROE), and the COVID dummy variable. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| Table 4. The regression results from the GMM estimations. |
|-----------------------------|-----------------------------|-----------------------------|
|                            | Coefficient | Prob.  | Coefficient | Prob.  | Coefficient | Prob.  |
| SGR (-1)                    | 0.101***     | <0.0001| 0.123***    | <0.0001| 0.102***    | <0.0001|
| INI                         | 0.070***     | <0.0001| 0.072***    | <0.0001| 0.067***    | <0.0001|
| EXI                         | -0.015***    | <0.0001| -0.008***   | <0.0001| -0.007***   | <0.0001|
| AGE                         | -0.002***    | <0.0001| -0.002***   | <0.0001| -0.001***   | <0.0001|
| OWN                         | 0.017***     | <0.0001| 0.020***    | <0.0001| 0.030***    | <0.0001|
| ROE                         | 0.120***     | <0.0001| 0.110***    | <0.0001| 0.099***    | <0.0001|
| SIZE                        | -0.010***    | <0.0001| -0.020***   | <0.0001| -0.027***   | <0.0001|
| COVID                       |              |        |            |        | -0.014***   | <0.0001|
| J-statistic                 | 41.358       |        | 45.006     |        | 35.952      |        |
| Prob (J-statistic)          | 0.6668       |        | 0.3879     |        | 0.7682      |        |
| N                           | 400          |        | 386        |        | 386         |        |

Financial sustainability (SGR) is the dependent variable. This table shows the regression coefficients between innovation investments (INI) and financial sustainability (SGR). The sample includes 103 listed energy businesses in Vietnam from 2007 to 2020. The explanatory variables are INI and ownership concentration (OWN). The control variables include executives’ salaries (EXI), firm characteristics (AGE and SIZE), firm performance (ROE), and the COVID dummy variable. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.
This table represents the GMM regression results between innovation investments (INI) and financial sustainability (SGR) for high and low innovation investment intensity. The sample is divided into two subsamples by INI. Firms have high innovation investment intensity, whether INI is higher or equal to the median of INI in the whole sample, and have low innovation investment intensity otherwise.

This table represents the GMM regression results between alternative innovation investment indicators and financial sustainability (SGR) determinants. The sample consists of 103 listed energy firms in Vietnam from 2007 to 2020. Financial sustainability (SGR) is the explained variable. The independent variables are innovation investments (INI_TA and INI_MV) and ownership concentration (OWN). The control variables are executives' salaries (EXI), firm characteristics (AGE and SIZE), firm performance (ROE), and the COVID dummy variable. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

This table represents the GMM regression results between innovation investments (INI) and financial sustainability (SGR) for small firms and large firms. The sample is divided into three groups based on firm size. Large firms are the largest group, and small firms belong to the smallest group.

Table 6. The regression results in subsamples by size.

|                | Smaller firms |                | Larger firms |                |
|----------------|---------------|----------------|--------------|----------------|
|                | Coefficient   | Prob.          | Coefficient  | Prob.          |
| SGR (-1)       | 0.027***      | <0.0001        | -0.092***    | <0.0001        |
| INI            | -0.027*       | 0.0956         | 0.207***     | <0.0001        |
| EXI            | -0.015***     | <0.0001        | -0.003***    | 0.0013         |
| AGE            | 0.003***      | <0.0001        | -0.001      | 0.1287         |
| OWN            | 0.018**       | 0.0495         | -0.004      | 0.5293         |
| ROE            | 0.048***      | <0.0001        | 0.097***     | <0.0001        |
| SIZE           | 0.019**       | 0.0304         | 0.023**     | 0.0121         |
| COVID          | -0.012**      | 0.0350         | -0.003**    | 0.0247         |
| J-statistic    | 14.828        | 18.426         |              |                |
| Prob (J-statistic) | 0.3900    | 0.1420         |              |                |
| N              | 122           | 103            |              |                |

This table represents the GMM regression results between alternative innovation investments and financial sustainability. In this section, we test whether the positive impact of innovation on financial sustainability is robust after employing alternative proxies of innovation. We follow Li (2011) to calculate the ratio of R&D investments on total assets (INI_TA) and the ratio of R&D investments on market value (INI_MV) for each firm. Table 7 reports that the coefficients of INI_MV and INI_TA are positive and significant, supporting our prior finding that firms with high innovation investments are more financially sustainable than firms with low innovation investments. Therefore, Table 7 documents the persistent impacts of innovation investments on financial sustainability, even after employing various proxies of innovation investments. In other words, innovations robustly develop the financial sustainability of the Vietnamese energy sector.

4.6. The regression results by employing alternative proxies of innovation

In this section, we test whether the positive impact of innovation on financial sustainability is robust after employing alternative proxies of innovation. We follow Li (2011) to calculate the ratio of R&D investments on total assets (INI_TA) and the ratio of R&D investments on market value (INI_MV) for each firm. Table 7 reports that the coefficients of INI_MV and INI_TA are positive and significant, supporting our prior finding that firms with high innovation investments are more financially sustainable than firms with low innovation investments. Therefore, Table 7 documents the persistent impacts of innovation investments on financial sustainability, even after employing various proxies of innovation investments. In other words, innovations robustly develop the financial sustainability of the Vietnamese energy sector.

5. Conclusion

This paper examines how innovation investments and ownership concentration affect the financial sustainability of listed energy enterprises in Vietnam from 2007 to 2020. We are inspired by the significant development of the energy sector in the last decades. Moreover, the Vietnamese energy sector is transitioning into renewable energy with the higher competition due to the privatization trend in the energy sector. We follow Xu et al. (2020) and Bae and Noh (2001) to compute innovation investments and blockholders. We employ FEM models and two-step system GMM regressions to examine whether innovation investments and ownership concentration increase the financial sustainability of energy firms in Vietnam, a transition country in Asia.

Our empirical results show that increasing R&D investments enhances energy firms' financial sustainability in Vietnam. This finding is consistent with resource-based view theory and Qiao et al. (2021). We...
also figure out that ownership concentration also increases the financial sustainability of energy companies. Our findings are consistent with agency theory and Ahsan et al. (2020) because the blockholders and institutional shareholders with expertise and experience improve sustainable performance. The profitability also strengthens the financial sustainability of energy firms. However, our findings report that executive salaries, size, and firm age reduce financial sustainability. In addition, our findings indicate that the positive impact of innovations on financial sustainability is slightly reduced after controlling the pandemic. 

Our findings indicate that the positive impacts of innovation efficiency on financial sustainability solely exist in larger energy firms, while ownership concentration improves sustainability in smaller energy companies. Furthermore, the positive impacts of innovations on financial sustainability remain robust in different innovation intensity subsamples. Finally, our main findings remain robust after employing alternative proxies of innovation investments.

Our findings are relevant to managers and policymakers to enhance the sustainable development of the energy sector. Our study recommends that larger energy companies increase their innovation investments, such as R&D and internal training programs, to grow their businesses more sustainably. Meantime, smaller energy firms might attract blockholders to improve their long-term performance. As a result, firms in the energy industry should promote innovations as a strategy for survival and future developments. Besides, policymakers should design various incentives to improve innovation efficiency. Tax and credit preferential policies are necessary to improve the efficiency of innovation promotions. Our findings indicate that blockholders empower financial sustainability, especially during the pandemic. Hence, energy companies should consider more about the combination of ownership concentration and innovation. Blockholders and institutional shareholders play an essential role in monitoring enterprise strategy and financial sustainability.

Although our study has a marginal contribution, it has data limitations because we only focus on the data from Vietnam, a frontier country in Asia. Therefore, our findings may be different from emerging and developed markets. Despite the limitation, our findings are robust so that future studies may complement our study by performing cross-country analysis.

### Appendix A: Variable definitions

| Variable | Definition |
|----------|------------|
| SGR | Following Xu et al. (2020), we calculate SGR as:

\[
SGR = \frac{R}{P \times T \times E}
\]

Where SGR, R, P, T, and E are present for financial sustainability, sales margin, total asset turnover, payout ratio, and equity multiplier, respectively. |

| INI | Following Bae and Noh (2001), we measure innovation investments as:

\[
INI = \frac{R}{D \times \text{expenditure}}
\]

where R is R&D expenditure, and D is Net sales. |

| INI_MV | Following Li (2011), we measure INI_MV as:

\[
INI_{MV} = \frac{R}{D \times \text{expenditure/Market value of the firm}}
\] |

| INI_TA | Following Li (2011), we measure INI_TA as:

\[
INI_{TA} = \frac{R}{D \times \text{expenditure/Total assets}}
\] |

| EXI | Following Xu et al. (2020), we calculate executives’ salaries by adding salary of the CEO, Board of Directors, and Board of Supervisory together. |

| OWN | Following Xu et al. (2020), we define ownership concentration as the percentage holding of the largest shareholder. |

| AGE | We follow Lam and Wei (2011) to define firm ages as the number of years stock has appeared on the stock exchange to 2020 |

| ROE | Following Liasala et al. (2017), we calculate return on equity as earnings after tax divided by the average total equity. |

| SIZE | We follow Orazalin et al. (2019) to define firm size as the natural logarithm of total assets. |

| COVID | We follow Duong et al. (2022) to employ the COVID dummy variable with a value equal to one if the year is from 2020 and equals 0 otherwise. |

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