Factors Affecting the Application the Balanced Scorecard to Improve Organizational Performance in Vietnamese Coal-Fired Thermal Power Plants

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ABSTRACT

Facing the demand from the Vietnamese Government to transition to more environmentally friendly fuels, coal-fired thermal power plants are encountering many challenges. However, this also presents a significant opportunity for them to aim for higher goals, namely green and sustainable development. In this study, we utilized the Contingency Theory, Resource-based View, and previous studies to identify factors that significantly influenced the application of the balanced scorecard **(**BSC). We used both qualitative and quantitative research methods, conducting direct surveys at 18 coal-fired thermal power plants and obtaining 198 valid questionnaires. We then aggregated the data in Microsoft Excel and used Smart PLS software to analyze the results. The research results showed that culture and strategy did not have much influence. In contrast, top management support, technology, structure, and human resources had significant impacts on the application of BSC. Furthermore, BSC had a substantial effect on enhancing organizational performance in Vietnamese coal-fired thermal power plants.

Keywords: Balanced Scorecard (BSC), Coal-fired, Thermal Power Plant, Organizational Performance, Resource-based View

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INTRODUCTION

Coal-fired power plants contribute numerous electricity in the word. According to IEA (2022), it generated 36% of global electricity. In the effort to achieve Net zero by 2050, nations consider to cease construction and change the other power resources that are better than for environment. The Vietnamese Government issued the National Power Development Plan (Power Plan VIII) for the period 2021-2030, with a vision extending to 2050 that prohibits the licensing of new coal-fired power projects. This will encourage plants operating for over 20 years to convert to ammonia or biomass fuels, if economically feasible. Non-converters with over 40 years in operation must close. Consequently, coal-fired thermal power plants must transition to more environmentally friendly alternatives, necessitating a significant allocation of resources for this phase. To facilitate this, we proposed the adoption of the balanced scorecard (BSC) method to enhance organizational performance in Vietnamese coal-fired thermal power plants. We anticipated that this approach will expedite the transition period and enhance efficiency throughout the process (Vietnam, 2023).

In business operations, providing information to support senior leaders in decision-making is crucial. The Management Accounting Control System (MACS) offers senior leaders the necessary information to make timely and accurate decisions (Abu-Allan et al., 2021). As a component of MACS, a Performance Management System (PMS) helps address challenges arising from change (Kloviene, 2013). One of the most widely used PMS for evaluating organizational performance today is the BSC. In practice, Jordanian manufacturing companies frequently apply the BSC as a traditional performance measurement system (Abu-Allan, 2024). Implementing the BSC can help businesses improve and enhance organizational performance.

In a market economy, it is essential for businesses to assess their organizational performance accurately and comprehensively (Moghaddam et al., 2015). We can evaluate organizational performance using criteria like product cost, profit, and subjective performance measures (Mehralian et al., 2016). The BSC provides managers with a swift yet comprehensive view of organizational performance, enabling them to focus on critical areas that support the execution of business strategies and goals.

The remainder of this research paper is structured as follows: After the introduction section, the second section comprises the literature review and hypotheses, followed by the research methodology in section three. The fourth section presents the empirical results. Section five presents the conclusions, implications, and a brief discussion.

LITERATURE REVIEW AND HYPOTHESES

Balanced Scorecard and Affected Factors

Scholars, consultants, and businesses have shown significant interest in the Balanced Scorecard (BSC) since its introduction by Kaplan and Norton in 1992 (Kaplan & Norton, 1992). Research on BSC has primarily focused on the factors influencing its implementation. Kaplan and Norton (1996) assert that successful BSC implementation requires addressing several key issues: (1) The support of senior management is essential; (2) Businesses need to promote and encourage employee participation; (3) The initial implementation period is often too lengthy; and (4) The primary purpose of BSC is not well understood (Kaplan & Norton, 1996a, 1996b).

In the study "Conceptual Foundations of the Balanced Scorecard," Kaplan emphasized that successful BSC implementation hinges on senior management's commitment and participation. This includes clearly defining the necessity of applying BSC, articulating vision and strategy, understanding new management methods, and establishing a strategic management department (Kaplan, 2010). Furthermore, Kaplan suggested that businesses should transform strategy into specific tasks, link the entire organization to the strategy, encourage employees to integrate the strategy into their daily work, and ensure the continuous execution of the strategy.

Based on these insights, we proposed the following hypothesis:

H1: Top management support (MS) has a positive impact on the implementation of BSC.

Based on the Institution Theory and the Contingency Theory, Quesado et al. (2014) analyzed data from questionnaires sent to 591

public organizations and 549 private organizations in Portugal, with an overall response rate of 31.3%, using SPSS for data processing. The authors identified seven factors influencing the implementation of BSC in public and private organizations in Portugal, including: (1) Form of capital ownership; (2) Technology; (3) Structure; (4) Standardization; (5) Culture; (6) Managerial expertise; and (7) Employees (Quesado et al., 2014). The following hypotheses were then proposed:

H2: Technology (TE) has a positive impact on the implementation of BSC.
H3: Structure (ST) has a positive impact on the implementation of BSC.
H4: Culture (CT) has a positive impact on the implementation of BSC.

Nanang et al. (2023) demonstrated through a survey of 131 individuals in public organizations in Indonesia that organizational strategy significantly affects the implementation of the BSC and optimizes organizational assets (Nanang et al., 2023). For healthcare organizations, Khan et al. (2023) suggested that implementing the BSC strategy can improve healthcare-related processes (Khan et al., 2023). Yang and Tang (2023) emphasized that human resources are crucial for businesses in developing strategies and enhancing competitive capabilities (Yang & Tang, 2023). In their study, the authors explored the use of BSC to build an effective performance evaluation system, highlighting the model's superior advantages and its applicability in human resource management. Based on their findings, the authors proposed the fifth and sixth hypotheses:

H5: Strategy (SG) has a positive impact on the implementation of BSC.
H6: Human resources (HR) has a positive impact on the implementation of BSC.

Balanced Scorecard and Organizational Performance

According to Ronny (2016), the BSC influences decision-making and organizational performance (Ronny, 2016). Similarly, Sorooshian et al. (2016) argued that applying the BSC helps improve a company's organizational performance (Sorooshian et al., 2016). In line with the insights provided by Anca and Rainer (2015), BSC implementation is believed to have a significant impact on organizational performance (Anca & Rainer, 2015). Reviewing the literature on BSC, most studies link its implementation

with enhanced organizational performance (Al-Naser et al., 2017; Anca & Rainer, 2015; Bastian & Muchlish, 2012; Harlez & Malagueño, 2016; Hendricks et al., 2011). Therefore, it is crucial to determine whether BSC implementation indeed improves organizational performance (Quesado et al., 2018). Abu-Allan (2024) conducted a survey of manufacturing companies in Jordan, receiving 312 responses (Abu-Allan, 2024). This empirical study demonstrated that BSC provides relevant information for decision-making and contributes to improving organizational performance within the enterprise.

Ratnaningrum et al. (2020) showed that a large number of scholars doubt the relationship between the BSC and an organization's performance outcomes (Ratnaningrum et al., 2020). However, BSC remains widely used, and practitioner-oriented literature indicates that it has significant utility, particularly in improving organizational performance and achieving strategic goals. Another study by Suárez-Gargallo and Zaragoza-Sáez (2023) explored the relationship between BSC and performance (Suárez-Gargallo & Zaragoza-Sáez, 2023). The authors conducted a keyword co-citation analysis, revealing that BSC and performance were the two most prominent items and had a direct relationship with each other. The authors proposed the following final hypothesis based on these insights:

H7: BSC application enhances organizational performance (OP).

METHODOLOGY RESEARCH

Research Model

The authors employed the Contingency Theory and the Resource-based View, drawing from research on factors that influenced the application of the BSC to enhance organizational performance.

Researchers developed the Contingency Theory, which has been known since the 1960s, to explain related factors. Islam and Hu (2012) suggested that organizational performance depended on the alignment or combination of technology, environmental dynamics, scale, organizational structure characteristics, and organizational information systems (Islam &

Hu, 2012). Technological and human resources influenced the application of the BSC method and organizational performance in this study. Meanwhile, Barney introduced the Resource-based View in 1991, and since then, studies on the relationship between management systems and organizational performance have widely developed and applied this Theory (Barney, 1991). The Resource-based View posits that organizational resources are crucial for innovation activities and long-term competitive advantage. Technology and human resources, considered technically in this study, influence the application of the BSC method and organizational performance.

Based on the theoretical foundation presented, we proposed a research model comprising 6 independent variables, and 2 dependent variables. Specifically: Top management support (MS), technology (TE), structure (ST), culture (CT), strategy (SG), and human resources (HR) were independent variables; Balanced scorecard (BSC), and organizational performance (OP) were dependent variables.

We measured these variables using scales, as shown in Table 1 below:

Table 1: Scale of Variables

Code	Variables and scales	Sources
MS	***Top management support***	
MS1	Top management sets criteria for achieving goals	(Lan, 2019; Rundora & Selesho, 2014).
MS2	Top management actively participates in the communication process during innovation	
MS3	Top management supports the adoption of new tools	
MS4	Top management is willing to provide adequate resources to implement new tools	
MS5	Top management actively seeks and presents innovative ideas	
TE	***Technology***	
TE1	Information technology systems meet job requirements	(Ahmad, 2012; Mat, 2010; Nương, 2020).
TE2	Technology is the foundation for BSC implementation techniques	
TE3	Accountants get support from software systems	

Code	Variables and scales	Sources
ST	***Structure***	
ST1	The company organizes management according to responsibility centers	(Mat, 2010; Ojra, 2014).
ST2	Delegation of authority and assessment of impact responsibilities are made clear	
ST3	Timeliness of information and ability to update the system help improve decision-making	
ST4	Indirect costs account for a larger proportion of total costs	
ST5	The company needs to accurately calculate overhead costs and identify areas where they are high	
SG	***Strategy***	
SG1	Businesses have specific annual development goals	(Alsoboa, 2015; Ojra, 2014)
SG2	Policy adjustments and resource allocation to business goals are made regularly	
SG3	Periodically, we adjust the norms of resource consumption for production	
SG4	Cost-saving solutions are evaluated and implemented	
CT	***Culture***	
CT1	Employees receive encouragement and support from managers	(Hùng, 2016; Nương, 2020).
CT2	Departments in the business support each other in work	
CT3	All employees strive to achieve the set goals	
CT4	The company has a strong connection between management at all levels and employees	
HR	***Human resource***	
HR1	Workers have the capacity to match the assigned work	(Foroughi et al., 2017; Nương, 2020).
HR2	The company conducts regular and irregular training for employees	
HR3	The company has a policy of encouraging employees to participate in finding and developing new solutions	
BSC	***Balanced scorecard***	
BSC1	BSC helps ensure business goals and strategies	(Al-Najjar & Kalaf, 2012).
BSC2	BSC helps positively change employee behavior in the enterprise	
BSC3	BSC contributes to improving customer satisfaction	
BSC4	BSC helps to positively change financial goals in businesses	

Code	Variables and scales	Sources
OP	***Organizational performance***	
OP1	Return on equity (ROE) is better than without applying BSC	(Kalkhouran et al., 2017; Nương, 2020; Turner et al., 2017) and adjustments
OP2	Return on assets (ROA) is better than without applying BSC	
OP3	Customer and supplier satisfaction are better than without applying BSC	
OP4	Employee productivity is better than without applying BSC	
OP5	Sustainable development and innovation are better than without applying BSC	

Sources: Authors' compilation

Sample Size

To evaluate the hypothesis model, we collected data from 18 coal-fired thermal power plants across Vietnam. These plants were managed by Vietnam Electricity (EVN), Vietnam National Coal and Mineral Industries Group (TKV), and Vietnam Oil and Gas Group (PVN), among others. The survey targeted senior managers (Board of Directors, Executive Board), middle managers (Department Heads, Deputy Heads, Chief Accountants, General Accountants), and employees directly involved in accounting work (Accountants). These individuals possesed extensive knowledge of production processes, cost calculation processes, and business performance determination at the enterprises. The survey was conducted using printed questionnaires directly at the coal-fired thermal power plants from November 15, 2023, to May 15, 2024. The chosen subjects, methods, and survey timeframe were deemed appropriate for the article's content. A total of 217 completed survey responses were collected. However, upon review and data entry, 19 responses were excluded due to incomplete information. Consequently, 198 valid responses were used for data analysis in the subsequent steps. Table 1 presents the demographic profile of the survey respondents.

Evaluate Survey Results

Tho (2012) argued that quantitative research requires a large sample size, and non-probability sampling methods are also commonly used (Thọ, 2012). If the data verification process meets the conditions during testing, it still contributes to theory evaluation. This study also indicated that the

minimum sample size in multiple linear regression models is determined by the formula: $n \geq 50 + 8p$ (where: n is the minimum sample size and pp is the number of independent variables). In contrast, Hair et al. (2017) suggested that the minimum sample size should be ten times the number of hypotheses in the research model (Hair et al., 2017). This served as a basis for determining the appropriate sample size when conducting surveys and data collection. The minimum sample sizes according to Tho (2012) and Hair et al. (2017) were 98 and 70, respectively. Meanwhile, Bowman et al. (1997) argued that learning about a company's strategy through the Board of Directors or Directorates alone is not enough (Bowman & Ambrosini, 1997). Therefore, in this study, fourteen (14) respondents who were senior, middle, and low-level managers or accountants were selected to get the most comprehensive view of the research content. This limitation was to ensure that the collected data is representative and to avoid collecting too much from a few factories. The respondents all had certain knowledge about corporate governance in coal-fired thermal power plants. The maximum number of survey questionnaires collected was two hundred and fifty-two (252). The questionnaires were sent to all eighteen (18) coal-fired thermal power plants nationwide, and the author also sent three more reminder letters to those who did not respond. As a result, two hundred and thirty-four (234) questionnaires were obtained, of which one hundred and ninety-eight (198) were valid responses to continue the analysis in the next step (reaching 78.57% of the expected data). Next, PLS-SEM analysis was performed using SmartPLS version 4.0.9.8 software to evaluate the measurement model and test hypotheses (Ringle et al., 2022).

After data cleaning, a descriptive statistics analysis was conducted, yielding specific results on the demographic information of survey respondents and their respective factories, as shown in the details in Table 2:

Table 2: Demographic Profile of Respondents

Area	Description	Number of respondents	Percentage
Job title	Board of Directors	15	7.58%
	Directorates	6	3.03%
	Head/Deputy Head of Department, Chief Accountant, General Accountant	52	26.26%
	Accountants	82	41.41%
	Other	43	21.72%
Job experience	5-10 years	82	41.41%
	10-20 years	82	41.41%
	Above 20 years	34	17.17%
Age	22 - 30	55	27.78%
	31 - 40	60	30.30%
	41 - 50	64	32.32%
	Above 50	19	9.60%
Number of factory workers	Below 500	68	34.34%
	500 - 800	44	22.22%
	800 - 1000	9	4.55%
	Above 1000	77	38.89%
Factory capacity	Below 200 MW	32	16.16%
	200 - 500 MW	53	26.77%
	500 - 1000 MW	42	21.21%
	Above 1000 MW	71	35.86%

Sources: Author's own calculations

Based on the demographic information of the survey respondents, the sample could be considered representative of Vietnamese coal-fired thermal power plants. Specifically, the highest response rate came from accountants (82 responses, 41.41%), followed by middle-level managers (52 responses, 26.26%). Responses from board members and directors were limited, with only 15 responses (7.09%) from board members and 6 responses (3.03%) from directors.

Regarding job experience, respondents with 5 to 10 years and 10 to 20 years of experience were equally represented (82 responses each, 41.41%). The largest age group was 41 to 50 years old (64 responses, 32.32%), followed by 31 to 40 years old (60 responses, 30.30%), 22 to 30 years old (55 responses, 27.78%), and those over 50 years old (19 responses, 9.60%).

In terms of the number of factory workers, the largest proportion of responses came from factories with over 1000 workers (77 responses, 38.89%), followed by those with fewer than 500 workers (68 responses, 34.34%), 500 to 800 workers (44 responses, 22.22%), and 800 to 1000 workers (9 responses, 4.55%). Similarly, regarding factory capacity, plants with over 1000 MW had the highest number of responses (71 responses, 35.86%), followed by those with capacities from 200 to 500 MW (53 responses, 26.77%), 500 to 1000 MW (42 responses, 21.21%), and less than 200 MW with the lowest response rate (32 responses, 16.16%).

RESEARCH RESULT

Measurement Model

The author conducted PLS-SEM analysis using SmartPLS software to evaluate the measurement model. The outer loading coefficients are depicted in Figure 1. The Cronbach's α, CR, and AVE coefficients are presented in Table 3.

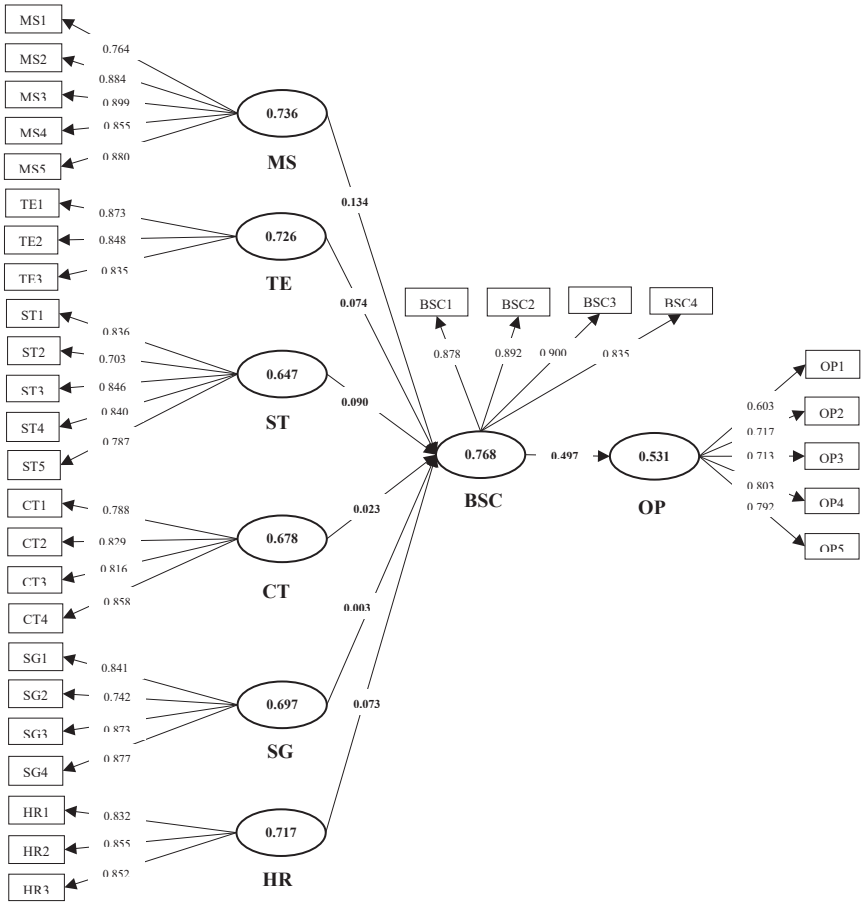

Figure 1: Research Model Results
Sources: Authors calculated on SmartPLS software

Table 3: Scale Reliability and Convergence

	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
BSC	0.900	0.930	0.768
CT	0.841	0.894	0.678
HR	0.802	0.884	0.717
MS	0.910	0.933	0.736
OP	0.783	0.849	0.531
SG	0.854	0.902	0.697

	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
ST	0.863	0.901	0.647
TE	0.812	0.888	0.726

Sources: Authors calculated on SmartPLS software

As proposed in Hair et al. (2017), the data analysis results in Figure 1 showed no outer loading < 0.4; the observed variables OP1 = 0.603 and AVE = 0.531 met the requirements, with all other observed variables > 0.7. The observed variables MS3 and BSC 3 had the highest outer loading coefficients, 0.900 and 0.899, respectively. Therefore, these observed variables were retained for further analysis. The Cronbach's α and CR coefficients of MS variables were the highest (0.910 and 0.933), while those of OP variables were the lowest (0.783 and 0.849), all > 0.7 indicating their usability (Trọng & Ngọc, 2008). Meanwhile, the highest AVE coefficient belonged to the BSC variable (0.768) and the lowest to the OP variable (0.531), all > 0.5 (Höck & Ringle, 2010). These results satisfied the requirements for evaluating the measurement model.

The HTMT coefficient between SG and ST was the highest (0.863), confirming discriminant validity. Additionally, we conducted an assessment using the Fornell-Larcker criterion to ensure conclusions about the discriminant validity of the scale (Henseler et al., 2015).

Table 4: Heterotrait-monotrait Ratio (HTMT)

	BSC	CT	HR	MS	OP	SG	ST	TE
BSC								
CT	0.471							
HR	0.705	0.386						
MS	0.674	0.388	0.487					
OP	0.641	0.599	0.735	0.541				
SG	0.700	0.391	0.611	0.551	0.622			
ST	0.752	0.360	0.588	0.606	0.636	0.863		
TE	0.642	0.368	0.592	0.373	0.503	0.613	0.514	

Sources: Authors calculated on SmartPLS software

Table 5: Fornell-Larcker Coefficient

	BSC	CT	HR	MS	OP	SG	ST	TE
BSC	0.877							
CT	0.415	**0.823**						
HR	0.604	0.320	0.847					
MS	0.623	0.344	0.425	**0.858**				
OP	0.576	0.481	0.600	0.473	**0.729**			
SG	0.622	0.329	0.511	0.490	0.520	**0.835**		
ST	0.673	0.305	0.500	0.535	0.533	0.743	**0.804**	
TE	0.559	0.307	0.484	0.332	0.417	0.516	0.438	0.852

(Note: The square root of AVE is shown in bold)
Sources: Authors calculated on SmartPLS software

The computed results of the Fornell-Larcker criterion are presented in Table 5. The square root of AVE (bolded) was greater than the correlations between other latent variables. As suggested in Henseler et al. (2015), this demonstrated that discriminant validity among the variables was ensured (Henseler et al., 2015).

Structural Model

We conducted a structural model evaluation by: (1) Assessing multicollinearity using VIF; (2) Evaluating model explanatory power R^2; (3) Hypothesis testing with P values; (4) Assessing effect size f^2; and (5) Evaluating model predictive ability Q^2. The analysis was performed using the bootstrapping method, and the results are presented in Table 6 and Table 7.

Table 6: Results of Bootstrapping Analysis

	VIF	f^2	Original sample (O)	P values	Result
H1: MS -> BSC	1.538	0.134	0.267	0.000	Significant
H2: TE -> BSC	1.520	0.074	0.197	0.003	Significant
H3: ST -> BSC	2.497	0.090	0.279	0.001	Significant
H4: CT -> BSC	1.221	0.023	0.098	0.056	Insignificant
H5: SG -> BSC	2.575	0.003	0.048	0.584	Insignificant
H6: HR -> BSC	1.603	0.073	0.200	0.004	Significant
H7: BSC -> OP	1.000	0.497	0.576	0.000	Significant

Sources: Authors calculated on SmartPLS software

Table 7: The Model's Level of Explanation

	R^2	R^2 adjusted
BSC	0.655	0.645
OP	0.332	0.329

Sources: Authors calculated on SmartPLS software

Firstly, regarding the assessment of multicollinearity, we evaluated VIF coefficients. If VIF ≥ 5, there is a high risk of multicollinearity; if 3 ≤ VIF ≤ 5, multicollinearity is likely; and if VIF ≤ 3, there is no multicollinearity (Hair et al., 2019). In Table 6, the highest VIF coefficients were for hypotheses H5 (2.575) and H3 (2.497), with all VIF coefficients < 3 indicating no multicollinearity among the independent variables.

Secondly, the model explanatory results are shown through R^2 coefficients in Table 7. We observed that the factors in the model explained 65.5% of the variance in BSC (or 64.5% for R^2 adjusted), while for OP it was 33.2% (or 32.9% for R^2 adjusted). This indicated a high-quality model with good explanatory power over the variance of dependent variables.

Thirdly, we conducted hypothesis testing as outlined in Section 2, with results presented in Table 6. Specifically, hypothesis H7 had the highest standardized effect coefficient ($\beta = 0.576$), demonstrating a clear impact of BSC on OP. Conversely, hypotheses H4 and H5 had the smallest standardized effect coefficients ($\beta = 0.098$ and $\beta = 0.048$), indicating unclear impacts of CT and SG on OP. At a significance level of 5%, the P values for hypotheses H4 and H5 were 0.056 and 0.584, respectively, both > 0.05, indicating these hypotheses were not statistically significant and were rejected. Meanwhile, the remaining hypotheses had P values < 0.05, indicating statistical significance and acceptance.

Fourthly, we evaluated effect size f^2. According to Hair et al. (2021), $f^2 < 0.02$ indicated no effect, $0.02 \leq f^2 < 0.15$ indicated a small effect, $0.15 \leq f^2 < 0.35$ indicated a medium effect, and $f^2 > 0.35$ indicated a large effect. In Table 6, we present the computed f^2 effect size results. Hypothesis H7 has the largest effect size $f^2 = 0.497 > 0.35$, demonstrating a large effect of BSC on OP. Hypotheses H1, H3, H2, H6, H4 had decreasing f^2 effect sizes of 0.134, 0.090, 0.074, 0.073, and 0.023 respectively, indicating small effects of these hypotheses. Hypothesis H5 had an $f^2 = 0.003 < 0.02$, indicating a negligible effect.

Finally, we assessed the model's predictive ability using the Stone-Geisser Q^2 index (Geisser, 1974; Stone, 1974). We observed a Q^2 value of 0.486 for BSC, indicating moderate predictive accuracy (Hair et al.,2019).

DISCUSSION, IMPLICATIONS, AND CONCLUSIONS

In this study, several key findings were identified: Firstly, culture and strategy did not significantly influence the adoption of the BSC in Vietnamese coal-fired thermal power plants. This finding contrasts with previous research by (Hendricks et al., 2004; Quesado et al., 2014; Tanyi, 2011), which highlighted the significant impact of culture and strategy on BSC adoption. However, our quantitative analysis challenged this view, especially in the context of developing countries like Vietnam. Vietnam's market is considered emerging and highly dynamic in Asia (Duong, 2022; Nguyen, Le, & Do, 2022; Nguyen, Le, Pham, et al., 2022), making the adoption of modern management tools like BSC crucial for industries undergoing transformation, such as coal-fired thermal power plants. The result is relevant to the context and characteristics of Vietnamese coal-fired thermal power plants. They had a high percentage of State ownership, so they were directed and monitored by state agencies. In the energy industry, strategies of Vietnamese coal-fired thermal power plants' conformed to those of superior companies or corporations. The culture of EVN or energy corporations was communicated from the top to bottom and it was implemented in coal-fired thermal power plants to recognize the general culture of EVN or energy corporations.

Secondly, aside from the non-influential factors, the remaining factors significantly affected BSC adoption. Notably, top management support, technology, organizational structure, and human resources played critical roles (Hendricks et al., 2004; Quesado et al., 2014; Tanyi, 2011). In the Fourth Industrial Revolution era, technology is essential for every enterprise's survival. It impacts production processes and the management and innovation of enterprise management tools. Organizational structure also affects BSC adoption. Complex structures with multiple units and departments face greater management challenges, necessitating BSC adoption to streamline operations and enhance performance. Furthermore, human resources are pivotal. Skilled employees facilitate the rapid and

effective implementation of new knowledge into business operations. However, top management support remained as the most crucial factor for BSC adoption. Previous studies by Barkdoll and Kamensky (2005), Kaplan and Norton (1996b), and Niven (2006) had consistently validated this assertion, and our research reaffirmed the pivotal role of top management support, particularly for Vietnamese coal-fired thermal power plants.

Thirdly, a significant conclusion of our study was that applying BSC can substantially enhance organizational performance. This conclusion is supported by numerous prior studies, including Kaplan and Norton (1996a, 1996b), Cobbold and Lawrie (2002), Jusoh et al. (2008), Khan and Halabi (2009), and Duong (2017). Empirical evidence showed that various methods can improve organizational performance, but BSC stands out due to its comprehensive approach. BSC push organizational performance comprehensively through change the managers and employees' behavior (BSC2), meet goals and strategies of organizations (BSC1). Scales of BSC in this study presented the connection in strategic control to all activities of plants. BSC is also a powerful tool for decision-making, especially for businesses operating in the energy sector. From there, we believe that BSC is a suitable performance assessment tool for Vietnamese coal-fired thermal power plants. Given the unique context of the coal-fired power sector in Vietnam, and with the recent issuance of Power Plan VIII, which emphasizes a shift towards more environmentally friendly fuels, BSC's role in achieving green and sustainable development is particularly relevant.

Implications

Theoretical Implications

We utilized the Contingency Theory and the Resource-based View to identify factors influencing the application of the BSC. This study systematically organized the theoretical framework and proposed novel metrics tailored to the context of Vietnamese coal-fired thermal power plants. Our study revealed that not all factors affect BSC adoption equally—some had a significant impact, others have minimal influence, and some have no impact at all. Nevertheless, BSC had a profound effect on organizational performance in Vietnamese coal-fired thermal power plants.

Additionally, we conducted a comprehensive survey at coal-fired thermal power plants and used the survey results for quantitative analysis employing the PLS-SEM model. Although the PLS-SEM model is well-established and widely used for its practicality, we validated both the measurement and structural models through this approach. While some hypotheses proposed in this study were supported, notably hypotheses H4 and H5 were rejected due to lack of statistical significance. Conversely, hypotheses H1, H2, H3, H6, and H7 were accepted and found to be statistically significant. However, the research model did not demonstrate significant predictive value.

Management Implications

Previous research and this study both underscored the pivotal role of top management support in facilitating change initiatives. For enterprises seeking to implement modern management tools like the BSC, robust support from top management is essential. Active involvement from top management not only accelerates the BSC implementation process but also reduces the likelihood of encountering obstacles. Furthermore, if top management receives comprehensive training on the benefits of BSC, the implementation process tends to proceed more smoothly.

In the context of the Fourth Industrial Revolution, which profoundly influences all sectors of the economy, coal-fired thermal power plants must embrace these advancements. Utilizing technological innovations to apply modern management tools is critical for enhancing labor productivity and improving organizational performance. Enhancing labor productivity begins with the optimization of processes, which can be achieved more effectively and swiftly with the aid of technology.

Ongoing improvement in human resource quality is also crucial for organizational survival. To enhance organizational performance, coal-fired thermal power plants should prioritize aspects of learning and growth. High-quality human resources contribute to reduced task completion times and improved decision-making efficiency.

Limitations And Future Research Directions

Despite the new findings and contributions both theoretically and in management practice, this study has its limitations. To address these

shortcomings, we propose several directions for future research. In Vietnam, the electricity sector is monopolized by EVN. EVN exclusively purchases electricity from power generation companies, which may include hydroelectric, wind, solar, or coal-fired thermal power plants. EVN then transmits and distributes this electricity to retail companies, which in turn sell it to businesses and households. As a result, power generation companies can only produce electricity up to the amount prescribed by EVN; any excess is either not purchased or bought back at a price of 0 VND. Additionally, the issuance of Power Plan VIII requires Vietnamese coal-fired thermal power plants to further enhance their organizational performance.

In this study, we suggested that enterprises adopt the BSC to improve operational efficiency. However, many plants remain hesitant to implement BSC in practice. Future research could focus on applying BSC to a specific coal-fired power plant or its affiliated unit to demonstrate its effectiveness as a management tool for enhancing organizational performance. Furthermore, while this study concentrated on Vietnamese coal-fired thermal power plants, other enterprises or organizations could also benefit from adopting BSC criteria across its four perspectives. Lastly, our survey was limited to 18 coal-fired thermal power plants, and we may not have reached all intended respondents at these plants. Future research should employ more comprehensive data collection methods to enhance sample representativeness. Despite surveying on a large scale with a diverse range of subjects, the results were overwhelmingly positive. However, these surveys were conducted based on the personal views and perceptions of the respondents. It is completely independent of the fluctuations in organizational performance. Future studies should measure organizational performance more carefully rather than relying on the subjective assessment of the survey subjects.

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