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Survival through Strategic Performance Measurement System in Coal Mines

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ABSTRACT

The research is about performance measurement system (PMS) in coal mine organizations. The purpose of this research is to test the strategic performance measurement system (SPMS) framework through a quantitative approach and to assess the level of importance of variables in the SPMS framework by examining the effect of variables of organizational culture (OCL) on SPMS mediated by activity-based costing system (ABCS) and flexibility strategy (FLS), the effect of OCL on SPMS, the effect of ABCS on organizational performance (OPF), the effect of FLS on OPF and finally the effect of ABCS on OPF. The novelty of this research is to put the ABCS and FLS as mediating variables instead of independent variables as previous researches. The framework is hypothetic-deductive research. Primary data was collected through questionnaires. A number of 150 samples of the 250 questionnaires disseminated to both coal mine companies and mining contractors were collected and processed using SEM Lisrel version 8.7. The sample population was fairly distributed to coal mine organizations as unit of analysis. The results, using SEM Lisrel, OCL as an exogenous variable is positively related to both ABCS and FLS but does not affect SPMS directly. OCL is fully mediated by both ABCS and FLS. ABCS is positively related to both SPMS and OPF. FLS is positively related to SPMS but does not affect OPF directly. The SPMS is positively related to OPF.

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INTRODUCTION

Low demand of coal since 2012 due to oversupply and continued depressed price of coal has made coal mine organizations difficult to improve financial performance (PwC Report, 2015). Due to the significant drop in the financial performance, Indonesian coal mine organizations are struggling to survive in a low commodity price. Owing to poor financial performance, in 2014, many small and medium organizations particularly local companies had collapsed caused mainly by low commodity prices and poor operational performance. The purpose of this research is to propose a strategic performance measurement system (SPMS) as strategic initiatives as an alternative solution and early warning system for improving the economic viability of coal mining companies which are now critical, to remain positive in a low commodity price or at least can sustain survival.

According to Wentzel (2012) there are some significant factors affecting the performance of coal mine organizations such as operational factors focusing on improving productivity as a basis for improving financial performance. Therefore, performance drivers of both operational and cost factors have been as variables to be investigated in this research. This research combines these factors of both operational and cost factors with organizational culture predicted as a determinant of the effectiveness of SPMS. With regard to operational factor, this research uses the term flexibility strategy as a variable which is used in the mining industry to optimize a mine plan considering the cost of an activity. With regard to cost factors known as life-cycle cost management as explained by Wentzel, this research uses more specific term called as activity-based costing system (ABCS) which is a costing methodology identifying activities in an organization. The purpose of this research is to assess the level of importance of variables in the SPMS framework by examining the effect of variables of organizational culture (OCL) on SPMS mediated by activity-based costing system (ABCS) and flexibility strategy (FLS), the effect of OCL on SPMS, the effect of ABCS on organizational performance (OPF), the effect of FLS on OPF and finally the effect of ABCS on OPF.

LITERATURE REVIEW

This literature review clarifies the associated theories of organizational performance, strategic performance measurement system, activity-based costing, flexibility strategy and organizational culture.

Organizational Performance

According to Richard and Devinney (2009) organizational performance encompasses three specific areas of outcomes; financial performance, market performance and shareholder return. According to Venkatraman and Ramanujam (1986), indicators to measure organizational performance is derived from perspective of financial performance, operational performance, and organizational effectiveness. Financial performance is narrowest conceptualization of business performance which centers

on the use of simple outcome-based financial indicators which are assumed to reflect the fulfillment of the economic goals. Operational performance, which is non-financial performance, a broader domain of performance construct in recent strategy research, is indicated by market share covering; innovation, quality of product and results of process (productivity and work satisfactory). Organizational effectiveness, which is a domain reflecting strategic management, covers the overall measurements compared to competitors and also compared to the organizational objectives.

Strategic Performance Measurement System (SPMS)

Neely and Najjar (2006) defined a performance measurement as the process of quantifying the efficiency and effectiveness of action. Performance measurement is a topic which often discussed and a complex issue which normally incorporates at least three different disciplines: economics, management and accounting (Tangen, 2004). According to Teh et al. (2015), the term "strategic performance measurement system" in manufacturing companies is related to the sustainable process with minimum impacts on environment as well as minimum energy, cost and resources used. Interest in performance measures has grown, as evidenced by the large portion of literature investigating some aspects such as "benchmarking", "total quality" measures and "balanced scorecards" as new performance measurement systems. This trend has forced organizations to improve their performance to survive in their environment and industries. Furthermore, Folan and Browne (2005) suggested that recommendations concerning performance measurement could be divided into two core areas, namely performance measures, and performance measurement framework and system design.

Ideally, a well-developed, broad-based performance measurement system could be used to improve the organizations strategic focus (Kaplan & Norton, 2000). Prior researches have approached on the possible factors from the narrower perspective to the wider perspective. In the narrower perspective studies, performance has been tested to a single or few factors, for example, Siu (2000) found that there was a relationship between marketing practices and company performance, while Lee et al. (2001) found that close business relationships positively affected business performance. On the contrary, in the wider perspective studies, the researchers tested a combination of factors to business performance.

Activity-Based Costing (ABC) System

According to Dixon et al. (1990), the problems with existing performance measurement system are still based on traditional cost accounting principles. Previous studies have examined ABC implementation from the perspectives of organizational structure, contextual and process factors, and cultural influences (Major & Hopper, 2005). These studies provide the reasons why companies adopted

ABC, and most of the results reveal that decision usefulness, organization support, and links to performance measurement influenced the adoption and implementation of ABC. Activity-based costing (ABC) is a costing methodology which identifies activities and assigns the cost of each activity with resources to all products and services. ABC assigns more indirect costs (overhead) into direct cost. According to Turney (1992), ABC is defined as a method of measuring the cost and performance of activities and cost objects.

Flexibility Strategy

The nature of mining industry is high risk in addition to very large capital is required upfront for the construction of facilities including processing plant, development of mine and transport infrastructure. Recently many mathematical techniques have been applied to optimize mine plan including mining sequence, volume to be mined, and quality or cut of grade using deterministic commodity prices (Caccetta & Hill, 2003).

An approach to mining project evaluation is the flexibility approach which emulates a strategy that a real operating mine would undertake over its mine life by modifying the mine plan in each new period in response to the latest information on commodity price. Also, the flexibility approach can estimate the mine project value more accurately by recognizing additional value. This flexibility strategy is to improve operational performance continuously in facing rapidly changing environment causing uncertainties of commodity prices.

Flexibility strategy is basically defined as an optionality of a decision-making process of both reactive and proactive to determine the quantity, the quality of reserves to be mined and what the costs incurred for extracting the quantity.

Organizational Culture

Organizational culture has been recognized as an important essential influential factor in analyzing organizations to establish competitive advantages (Cameron & Quinn, 2005) and its impact on organizational performance (Marcaulides & Hech, 1993). Cameron and Quinn (2005) emphasized that the success of organizations was not only determined by specific external conditions but also with company values. According to Daft (2010), culture can play an important role in creating an organizational climate which enables learning and innovative response to challenges, competitive threats, or new opportunities. Culture is a major determinant of an organization's ability. Any organization has a set of values which characterize how people behave and how the organization carries out day-to-day business. Thus, according to Daft (2010) corporate values as the central dimension of an organizational culture and have been recognized as powerful influences differentiating one firm from another. In this research, the organizational culture is defined as a driving force of the engine which moves people to action and is as a powerful lever which drives and controls organizational behavior and promote specific patterns of behavior (Soltani et al., 2011).

MATERIALS AND METHODS

Research Design

Research design is quantitative research based on a framework of strategic performance measurement (SPMS). A structured questionnaire survey was developed to collect quantitative data. The purposes of the research are to test the strategic performance measurement framework through a quantitative approach, and to assess the level of importance of the variables in the SPMS framework by examining variables of organizational culture (OCL), activity-based costing system (ABCS), flexibility strategy (FLS), strategic performance measurement system (SPMS), and organizational performance (OPF) which are based on the framework in Figure 1. The framework is hypothetic-deductive research. Primary data was collected through questionnaires. A number of 150 samples of the 250 questionnaires disseminated to both coal mine companies and mining contractors were collected and processed using SEM Lisrel version 8.7. Therefore, the response rate is 60%. The sample population was fairly distributed to coal mine organizations as unit of analysis with unit of observation consisting of senior positions.

The framework for this research is developed by synthesizing from previous literatures and researches derived from the relationships among the variables and how the variables relate to each other. This hypothetic-deductive research that starts with a general theory and then apply this theory to a specific case (Sekaran & Bougie, 2011). All hypotheses development deducted from previous literatures are presented in the framework in Figure 1.

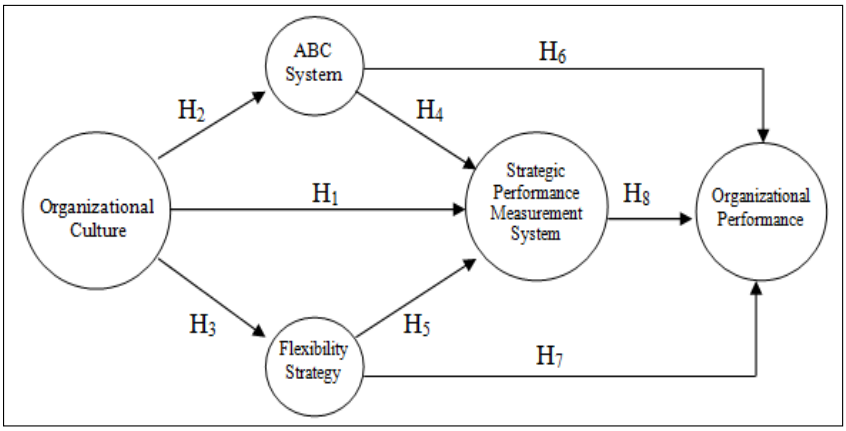


Figure 1. Framework of strategic performance measurement system

RESULTS AND DISCUSSIONS

Validity and Reliability Test

The validity tests are indicated with the correlation (r) of each indicator and were calculated and compared with the r-value from the table. For the sample size of 150 respondents, the r-value from the table is 0.16. An item was valid if the calculated r-value was higher than standard r-value from the table. All of the items in the questionnaire met this requirement as shown in Table 1.

Table 1

Validity test of all indicators of latent variables

No. of Indicator	Item-Total Correlation	r table Value	Variable
OCL1	0.812	0.16	Organizational Culture
OCL2	0.844	0.16	
OCL3	0.850	0.16	
OCL4	0.840	0.16	
OCL5	0.799	0.16	
ABC1	0.948	0.16	Activity-Based Costing System
ABC2	0.933	0.16	
FLS1	0.867	0.16	Flexibility Strategy
FLS2	0.858	0.16	
FLS3	0.867	0.16	
FLS4	0.874	0.16	
SPMS1	0.833	0.16	Strategic Performance Measurement System
SPMS2	0.862	0.16	
SPMS3	0.883	0.16	
SPMS4	0.819	0.16	
SPMS5	0.914	0.16	
OPF1	0.807	0.16	Organizational Performance
OPF2	0.829	0.16	
OPF3	0.856	0.16	
OPF4	0.862	0.16	

To test the reliability of multiple-item scale for each variable is conducted by calculating the Cronbach Alpha. The Cronbach Alpha was used to test the internal consistency of the data. The Cronbach Alpha of each variable should be higher than 0.60 (Sekaran & Bougie, 2011) to indicate that the instruments of this research model are reliable. All variables used in this research are reliable as shown in Table 2.

Table 2

Reliability test of each variable

Variable	Cronbach Alpha	Reliability
Organizational Culture (OCL)	0.884	Reliable
Activity-Based Costing System (ABCS)	0.866	Reliable
Flexibility Strategy (FLS)	0.887	Reliable
Strategic Performance Measurement System (SPMS)	0.911	Reliable
Organizational Performance (OPF)	0.858	Reliable

Quantitative Analysis Using Structural Equation Modeling

A number of 150 samples was processed using Lisrel Version 8.7. In this research there are five latent variables those were Organizational Culture (OCL), Activity-Based Costing System (ABCS), Strategic Performance Measurement System (SPMS), Flexibility Strategy (FLS) and Organizational Performance (OPF).

SEM analysis consists of Model Fitness Testing, Measurement Model Testing and Confirmatory Factor Analysis (CFA), and Structural Model Testing or Hypotheses Testing.

Model Fitness Testing

The result of the model fitness testing can be seen in the GOFI in Table 3.

Table 3

Goodness of Fit Index (GOFI) of model fitness test

GOFI Indicators	GOFI Indicators Explanation	Standard of Fitness	Calculation Result	Conclusion
RMSEA	Root Mean Square Error of Approximation	≤ 0.08	0.037	Fit is Good
NFI	Normed Fit Index	≥ 0.90	0.98	Fit is Good

Table 3 *(Continued)*

GOFI Indicators	GOFI Indicators Explanation	Standard of Fitness	Calculation Result	Conclusion
NNFI	Non-Normed Fit Index	≥ 0.90	1.00	Fit is Good
CFI	Comparative Fit Index	≥ 0.90	1.00	Fit is Good
IFI	Incremental Fit Index	≥ 0.90	1.00	Fit is Good
RFI	Relative Fit Index	≥ 0.90	0.98	Fit is Good
Std RMR	Standardized Root Mean Square Residual	≤ 0.05	0.036	Fit is Good
RMR	Root Mean Square Residual	≤ 0.05	0.019	Fit is Good
GFI	Goodness of Fit Index	≥ 0.90	0.90	Fit is Good
AGFI	Adjusted Goodnes of Fit Index	≥ 0.85	0.85	Fit is Good

As shown in Table 3, all the GOFI indicators reflected good fitness so it could be concluded that the data for the measurement and structural model testing had appropriately supported the research model.

Measurement Model Testing

The result of measurement model testing of first order latent variable *Organizational Culture* as exogenous variable is reflected by five observed variables *OCL1-OCL5*; first order latent variable *Activity-Based Costing System* as endogenous variable is reflected by two observed variables ABCS1-ABCS2; first order latent variable *Flexibility Strategy* as endogenous variable is reflected by four observed variables FLS1-FLS4; first order latent variable *Strategic Performance Measurement System* as endogenous variable is reflected by five observed variables SPMS1-SPMS5; first order latent variable *Organizational Performance* as endogenous is reflected by four observed variables OPF1-OPF4. The result of measurement model testing and confirmatory factor analysis of first order of five latent variables can be seen in the following Figure 2.

As shown in Figure 2, all the loading factor of each indicators shows *Standardized Loading Factor (SLV)* above 0.7 and the Error Value below the SLV. It could be concluded that the five latent variables could be processed simultaneously into the structural model testing.

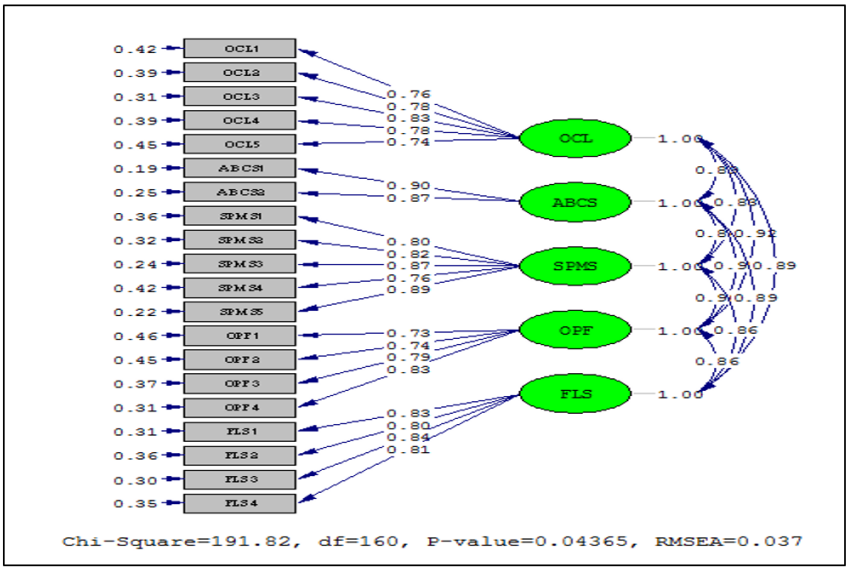


Figure 2. Path diagram of first order latent variables

Structural Model Testing or Hypotheses Testing

The result of structural model testing can be seen in the Table 4 below.

Table 4

Result of hypotheses significance testing based on structural research model testing

Hypotheses	t-value	Standard Coefficient	Conclusion
H1: Organizational culture will positively affect strategic performance measurement system	-0.32	-0.11	H1 is not accepted, t- value -1.96 < t < 1.96; there is no significant effect
H2: Organizational culture will positively affect activity-based costing system	12.34	0.94	H2 is accepted, t-value > 1.96; there is significant positive effect
H3: Organizational culture will positively affect flexibility strategy	10.84	0.92	H3 is accepted, t-value > 1.96; there is significant positive effect
H4: Activity-based costing system will positively affect strategic performance measurement system.	2.18	0.57	H4 is accepted, t-value > 1.96; there is significant positive effect
H5: Flexibility strategy will positively affect strategic performance measurement system	2.41	0.47	H5 is accepted, t-value > 1.96; there is significant positive effect

Table 4 *(Continued)*

Hypotheses	t-value	Standard Coefficient	Conclusion
H6: ABC system will positively affect organizational performance.	4.65	0.73	H6 is accepted, t-value > 1.96; there is significant positive effect
H7: Flexibility strategy will positively affect organizational performance.	-0.09	-0.01	H7 is not accepted, t-value -1.96 < t < 1.96; there is no significant effect
H8: Strategic performance measurement system will positively affect organizational performance.	2.20	0.28	H8 is accepted, t-value > 1.96; there is significant positive effect

Result of structural model testing is drawn in the Figure 3 and 4 showing the diagram of standardized solution structural model and t-value.

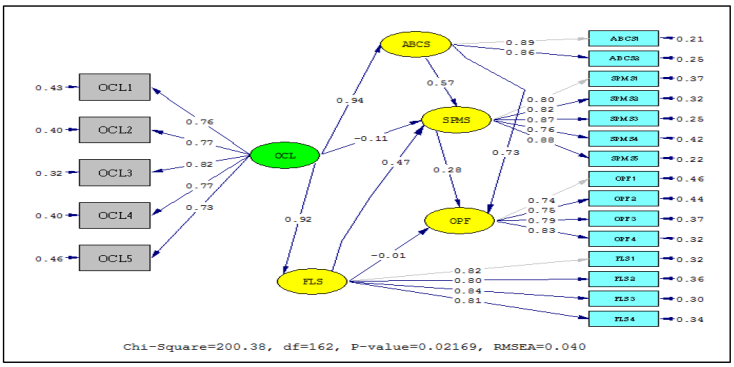


Figure 3. Diagram of structural model with standardized solution

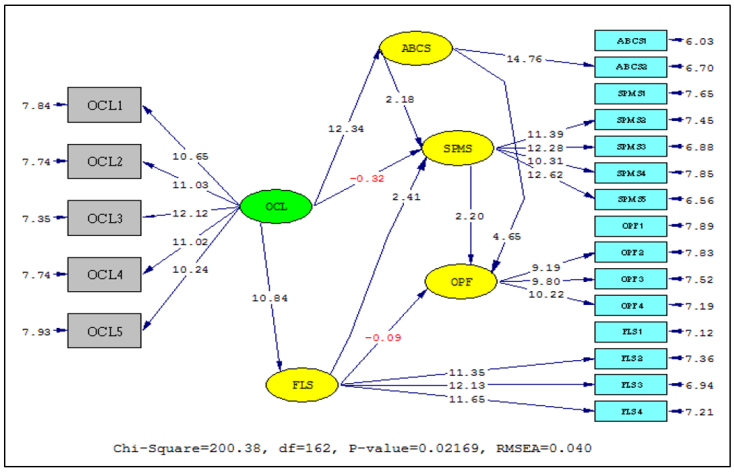


Figure 4. Diagram of structural model with t-value

Structural equation obtained from the model in Figure 1 can be summarized as follows:

$M_1 = \beta_0 + \beta_2 X_1 + \varepsilon$

$M_2 = \beta_0 + \beta_3 X_1 + \varepsilon$

$Y_1 = \beta_0 + \beta_1 X_1 + \beta_4 M_1 + \beta_5 M_2 + \varepsilon$

$Y_2 = \beta_0 + \beta_8 Y_1 + \beta_6 M_1 + \beta_7 M_2 + \varepsilon$

where,

Y : Dependent variable; Y_1 = SPMS, Y_2 = OPF

SPMS : Strategic Performance Measurement System

OPF : Organizational Performance

β_0 : Axis intercept

β_n : Regression coefficient; n = 1, 2, 3, 4, 5, 6, 7, 8

X : Independent variable ; X_1 = OCL

OCL : Organizational Culture

M : Mediating variables; M_1 = ABCS, M_2 = FLS

ABCS : Activity-Based Costing System

FLS : Flexibility Strategy

ε : error

Coefficient value of direct effect resulted from SEM Lisrel is as follows:

OCL ---> SPMS $\beta_1 = -0.11$

OCL ---> ABCS $\beta_2 = 0.94$

OCL ---> FLS $\beta_3 = 0.92$

ABCS ---> SPMS $\beta_4 = 0.57$

FLS ---> SPMS $\beta_5 = 0.47$

ABCS ---> OPF $\beta_6 = 0.73$

FLS ---> OPF $\beta_7 = -0.01$

SPMS ---> OPF $\beta_8 = 0.28$

Indirect effect of latent variable SPMS:

OCL ---> ABCS ---> SPMS = 0.94*0.57 = 0.54

OCL ---> FLS ---> SPMS = 0.92*0.47 = 0.43

Indirect effect of latent variable OPF :

OCL ---> ABCS ---> OPF = 0.94*0.73 = 0.69

OCL ---> FLS ---> OPF = 0.92*-0.01= -0.009

Total effect of latent variable SPMS = Direct effect + Indirect effect
= -0.11 + 0.54 + 0.43 = 0.86

Total effect of latent variable OPF = Direct effect + Indirect effect
= (0.28*0.86) + 0.69 -0.009 = 0.92

Refering to Table 4, Figure 3 and 4, based on the result of structural model testing regarding the direct effect of OCL on ABCS, the OCL significantly affects the ABCS with coefficient value of 0.94 and t-value of 12.34 respectively. Direct effect of ABCS on SPMS has indicated the ABCS significantly affect the SPMS with coefficient value of 0.57 and t-value of 2.18. Total effect of OCL on SPMS mediated by ABCS is 0.54 resulted from 0.94 times 0.57.

The positive direct effect of OCL on ABCS is supported by numerous research findings such as Lana and Fei (2007) that ABC could result in more accurate costing information if factors influencing ABC success such as factors of organizational culture, outcome orientation and attention to detail, were significantly associated with the implementation of ABC.

Based on the result of structural model testing regarding the direct effect of OCL on FLS in this research has indicated the

OCL significantly affect the FLS with coefficient value of 0.92 and t-value of 10.84 respectively. Direct effect of FLS on SPMS has indicated the FLS significantly affect the SPMS with coefficient value of 0.47 and t-value of 2.41. Total effect of OCL on SPMS mediated by FLS is 0.43 resulted from 0.92 times 0.47. This result shows the total effect of SPMS through FLS is lower than total effect of SPMS through ABCS. This means that mediating variable of ABCS is more significant to affect the SPMS.

Regarding the effect of SPMS on OPF in this research has indicated the SPMS significantly affect the OPF with coefficient value of 0.28 and t-value of 2.20. These research findings are supported by many researchers that have still controversy regarding the importance of the performance measurement system found in previous literatures. According to Bititci et al. (2006), some businesses perform better if they use integrated performance measures, while others argue that the use of performance measurement systems, such as balanced scorecard does not make any difference to business performance. More contemporary studies suggest that the impact of performance measurement systems is contingent (Braam & Nijssen, 2004).

The effect of both ABCS and SPMS is still positively relate to OPF. It is concluded that the SPMS is effective for coal mine organizations; however, some coal mine organizations particularly small to medium companies tend to use the SPMS just as a tool for the purpose of controlling, comparing and analyzing if the performance is not achieved, not yet as an active and effective tool aligning strategies to improve operational performance. Small to medium coal mine companies argue that organizational performance so far is sufficient and measured on indicators of variable ABCS, this means that the variable of flexibility strategy is considered as not so important factor contributing to the organizational performance.

The direct effect of FLS on OPF has indicated the FLS does not significantly affect the OPF with coefficient value of -0.01 and t-value of -0.09. These research findings is supported by Micheli and Manzoni (2010) mentioning that strategy formulation and implementation should be linked to the SPMS to effectively achieve the goals of organizational performance. Therefore, the direct effect of FLS on OPF is negative but can be positive and significant through SPMS.

Theoretical Contribution of the Research

This research theoretically can contribute to performance measurement in building a robust model of an integrated and strategic performance measurement system for the sake of improving organizational performance of coal mine organizations. Also by identifying the features and requirements of performance measurement system in coal mine organizations combined with critical success factors influencing the SPMS, these can be a basis for finding what the most effective theoretical approaches to designing PM framework for coal mine

organizations by examining the strengths and weaknesses of each of the theoretical approaches based on PM features.

This SPMS is a various holistic PMS which is developed to overcome the shortcomings of traditional measurement system in coal mine organizations. This SPMS theoretically has been provided by looking at different perspectives and strive for the best approach for the use in coal mine organizations. Also theoretical contribution of this research has answered the gap between what are wanted to be measured and what can be measured (Meyer, 2002). What are wanted to be measured and what can be measured in coal mine organizations is different and also depends on what the critical issues to be measured and what improvements to be achieved. This research has also contributed about controversy regarding the importance of the performance measurement system. In addition to internal improvement focusing on costing system and flexibility strategy, organizational effectiveness is also considered by setting the most appropriate behavior patterns of culture which enabling strong alignment of strategies towards goal achievement, to shape employee behavior patterns at work, enabling the organization to be more efficient, and to create operational skills-based culture and flexibility-driven culture. According to Dubey et al. (2017), organizational culture particularly flexible orientation and control orientation can be very important employee factors that can generate motivated employees and appropriate behavior patterns. Another theoretical contribution of this research has proven that more contemporary studies suggest that the impact of performance measurement systems is contingent (Braam & Nijssen, 2004).

Managerial Implication of the Research

Managerial implication of this research is to develop a new SPMS framework which is appropriate and able to measure performance of coal mine organizations effectively to improve short-term profitability and long-term growth, at least to sustain survival in facing uncertainties, complexities and risks specific to the coal mining industry.

Managerial benefits of this research in general can be summarized as follows:

We will know what the critical factors and which one will be prioritized for designing an effective SPMS dedicated for coal mine organizations. This will be a basis for an effective decision-making process taken by top management of the companies. The critical factors of each variable of organizational culture, ABC system and flexibility strategy are of paramount importance to be analyzed. By examining the relationship among the variables, top management as a decision maker will have a guidance how to operate the mine and what strategies and what a good system of control taken in order to manage mining organizations effectively and efficiently.

For the sake of survival, improving the financial performance especially free cashflow, by adopting the indicators of flexibility strategy, both volume strategy and

cost strategy or both of them in parallel to mitigate the risks of collapsing due to high cost compared to revenue. Volume strategy implementation is basically adjusted to combination of high grade and low grade; or high overburden removal and low overburden removal; or high Calorific Value (CV) of coal and low CV of coal. The purpose of this volume strategy is basically what the volume must be achieved but still meet both the economies of scale and economies of scope so that the targeted costs of both mining and processing can be achieved, and also can be absorbed by market.

In parallel with the strategy adoption, the cost management system using ABC system will also be adopted to track the costs incurred in every activity to make sure the costs are relevant and achieve standardized costs of each activity. When the strategy and ABC system to be implemented is consistent, it will be effective to carry out mine operation efficiently. However, the use of strategy and ABC system will be effective and efficiently when organizational culture of the companies can support.

Appropriate organizational culture and SPMS dedicated for coal mine organizations can align the strategies taken with goals of organization so that top management will have a good understanding about what the values and how to set pattern of behaviors of organization in order to support the strategies and ABC system implemented to influence the SPMS effectively.

CONCLUSION

The result of structural model testing regarding the direct effect of OCL on ABCS has indicated the OCL significantly affect the ABCS. The direct effect of ABCS on SPMS has indicated the ABCS significantly affect the SPMS. Total effect of OCL on SPMS mediated by ABCS is 0.54 resulted from 0.94 times 0.57.

The direct effect of OCL on FLS has indicated the OCL significantly affects the FLS. Direct effect of FLS on SPMS has indicated the FLS significantly affect the SPMS. Total effect of OCL on SPMS mediated by FLS is 0.43 resulted from 0.92 times 0.47. This result shows the total effect of SPMS through FLS is lower than total effect of SPMS through ABCS. This means that mediating variable of ABCS is more significant to affect the SPMS; however, the effectiveness of the SPMS has to be mediated by both ABCS and FLS which is also the novelty of this research by putting the both ABCS and FLS as mediating varibles instead of independent variables as previous researches. The SPMS is positively related to OPF. This means that the SPMS is effective to improve the organizational performance (OPF).

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