



Structural Relationship of Factors Affecting the Performance of Oil & Gas Company: Case Study of Adnoc

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Abstract: This paper presents the development and analysis of Structural Equation Model (SEM) on factors affecting the performance oil & gas company. The model was constructed based on the model framework where it involved 5 groups of independent factors affecting the performance of oil & gas company and one group of dependent of the performance. Data collected from the 100 respondents of questionnaire survey among employees of the company were used in the model development. Assessments at measurement level of the model found that for the 5 most important groups of factors affecting oil & gas company are effective support system (J-group), empowerment (L-group), supporting employees (M-group), creativity and innovation (C-group), and training regularly (T-group). Assessment at structural level involved omitting one group for each iteration to evaluate the effect size and also involved bootstrapping process. It was found the model has achieved the overall model of fit known as *GoF* with the value of 0.436 indicating large validating power. Hopefully the study contributed either directly or indirectly to the academic and practitioners related to oil & gas industry.

Keywords: Structural Equation Model (SEM), affect factors, oil & gas company

1. Introduction

UAE Vision 2030 is to improve on oil & gas industry performance and simultaneously expand the economy from the industry. Investments and new ventures were intended to increase the skill and expertise of the industry workforces. Oil & gas employees face continuous insecurity at the workplace in term of safety, hazards jobs, heavy production loads and constantly shifting technologies. This makes it difficult to recruit and retain employees particularly the experienced employees for the industry (Harhara *et al.*, 2015; Harun *et al.*, 2014). For organization to survive and sustain in a competitive market it needs to increase the performance continuously (Arslan & Staub, 2013). There many factors contributed to the organization performance from previous literature and classified into five domains namely leadership, training, motivation, organisation's culture and job satisfaction.

According to previous studies, the role of *leadership* is seriously vital for achieving better organizational performance (Peterson *et al.*, 2003; Boal & Hooijberg, 2000). Nevertheless, there are findings indicated that the role of leadership in organization performance varied (Peterson *et al.*, 2003; Meindl, 2004). Particularly, Wang *et al.* (2011)

proposed that there is a need to examine the influence of leadership in organizational performance due to inconsistent outcomes from previous studies. Additional, most of previous study concentrated on the role of leadership in the different contexts such as restaurants, and education institutes (Weinberg & McDermott, 2002; Youngs & King 2002).

Quartey (2012) indicated that employee **training** scheme has significance improvement to the productivity in achieving competitive advantage. The employees’ training development has direct benefits to organizations by the demonstrations of superior performance. Also, it is predicted that the organizational performance increased through training (Niazi, 2011). In the context of the oil & gas industry, training of human capital is an investment to the industry which used advanced technologies and to stay competitive.

Several researchers found that **motivation** is an essential factor to encourage employees to execute job seriously according to the required organisation performance (Dobre, 2013; Asim, 2013). There is a relationship between motivation and employee efficiency, where employee motivation influences on organizational effectiveness/performance (Matthew *et al.*, 2009; Muhammad *et al.* 2011; Agburu, 2012).

Many studies had highlighted influence of **organisational culture** to organization performance (Dasanayake & Mahakalanda, 2008; Varelas, 2009). Furthermore, researchers investigated the relationships of organisational culture and the behaviour of employees which in turn affecting the organizational performance. The role of organisational culture is important to support business performance. Additionally, the significance of organisational culture in work place is influenced by factors of globalization and multiple workplace locations (Varelas, 2009; Huang *et al.*, 2010). Many past researches investigated the effect of organisational culture on performance however lack of study in developing countries especially UAE.

Although the significance of **job satisfaction** has been investigated on the influence of organizational performance by many scholars but not many studies are conducted in the Middle East countries. Also previous studies indicated that job satisfaction factors vary through different cultures. The literature search also found it is necessary to investigate effect of training and also on employees’ job satisfaction toward organizational performance especially in the oil & gas sectors and also to the region of Abu Dhabi, UAE situation (Ameen *et al.*, 2018; Yee, 2018).

Most of the mentioned studies are not integrated, hence this study intended to incorporate these factors from the five domains namely leadership, training, motivation, organization’s culture and job satisfaction with the organizations performance in the context of oil & gas sectors in UAE. This novel study was intended to uncover the structural relationship of all the factors that affecting Abu Dhabi oil & gas company/organisations.

2. Methodology

This study adopted quantitative approach where the data was collected through questionnaire survey a sample of employees of Abu Dhabi oil & gas industry. A total of 100 respondents were involved in giving their judgements in the questionnaire. The collected data was analysed descriptively to ensure it is reliable and valid to be used in the model development. The model was developed based on the hypotheses that five groups of contributing factors which are leadership, training, motivation, organizational culture and job satisfaction has significantly affecting the O&G company of Abu Dhabi. The framework of the model with the dependent variable and independent variables are as Figure 1.

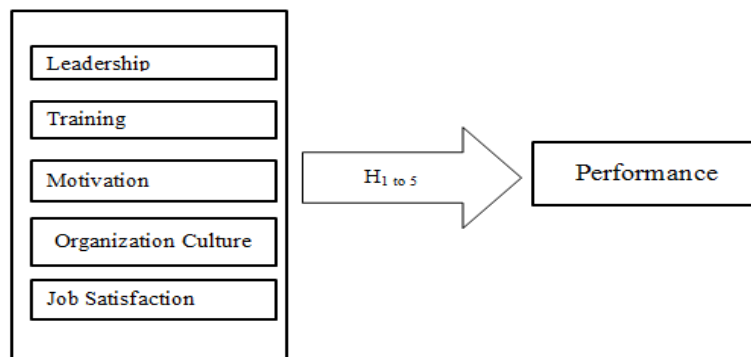


Figure 1 - Model framework

The hypothesis that generated from this model framework is as follow;

- H₁: Leadership has significant affecting the oil & gas company performance
- H₂: Training has significant affecting the oil & gas company performance
- H₃: Motivation has significant affecting the oil & gas company performance
- H₄: Organization culture has significant affecting the oil & gas company performance

H₅: Job satisfaction has significant affecting the oil & gas company performance

3. Measurement model assessment

A model was constructed in SmartPLS software using the collected data from the questionnaire survey and based on the model framework. The constructed PLS model comprised of 25 affect factors in 5 groups that act as exogenous variables and connected to single group of performance which act as endogenous variable having two measured criteria as Figure 2.

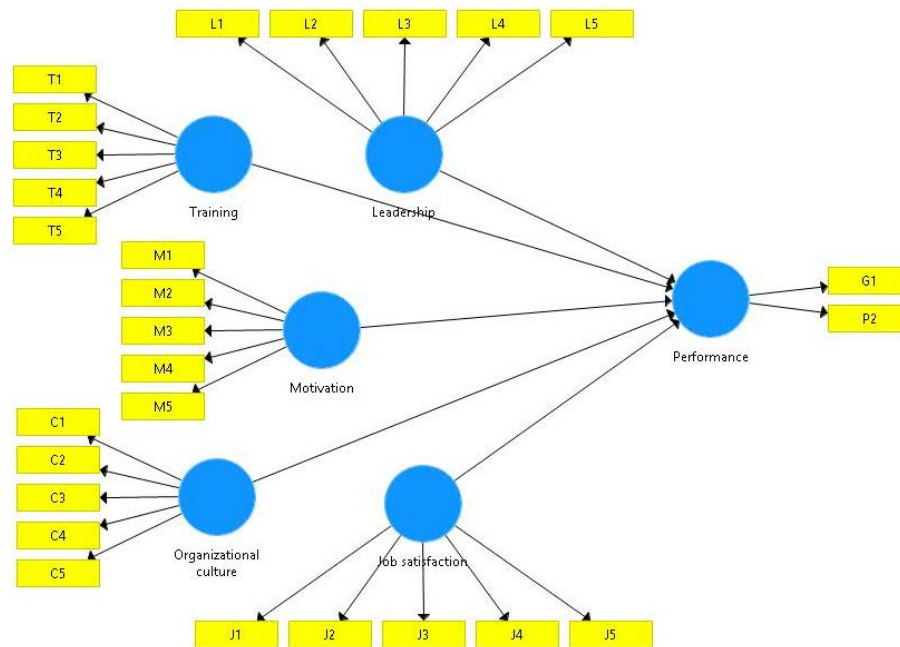


Figure 2 - Constructed mod

This model consisted of the measurement model (outer component) and structural model (inner component). Assessment at measurement model involves three criteria which are indicator reliability, convergent validity and discriminant validity. While assessment at structural model involves five criteria which are Structural model path Coefficients (β), Coefficient of determination (R^2), Effect size (f^2), Predictive relevance (q^2) and Goodness-of-fit (GoF).

3.1 Reliability and convergent validity

Assessment of individual item reliability is the correlations of the items with their respective latent variables for the purpose to evaluate the extent to which an indicator known as factor loading is consistent with what it intends to measure (Urbach & Ahlemann, 2010; Rahman *et al.*, 2016). Factor loading denotes the proportion of the indicator variance in its latent variable and indicator with loadings of less than 0.4 should be dropped if it does not increase value to composite reliability. Also, indicators/items with loading of 0.7 or above are considered significant (Ramayah *et al.*, 2016; Hair *et al.*, 2017).

Hence to conduct the assessments, the model needs to regenerate several iterations until it achieved the specified criteria either at measurement and structural levels. In iteration process it used PLS algorithm function with the criteria for indicator reliability and convergent validity and the final model is as Figure 3.

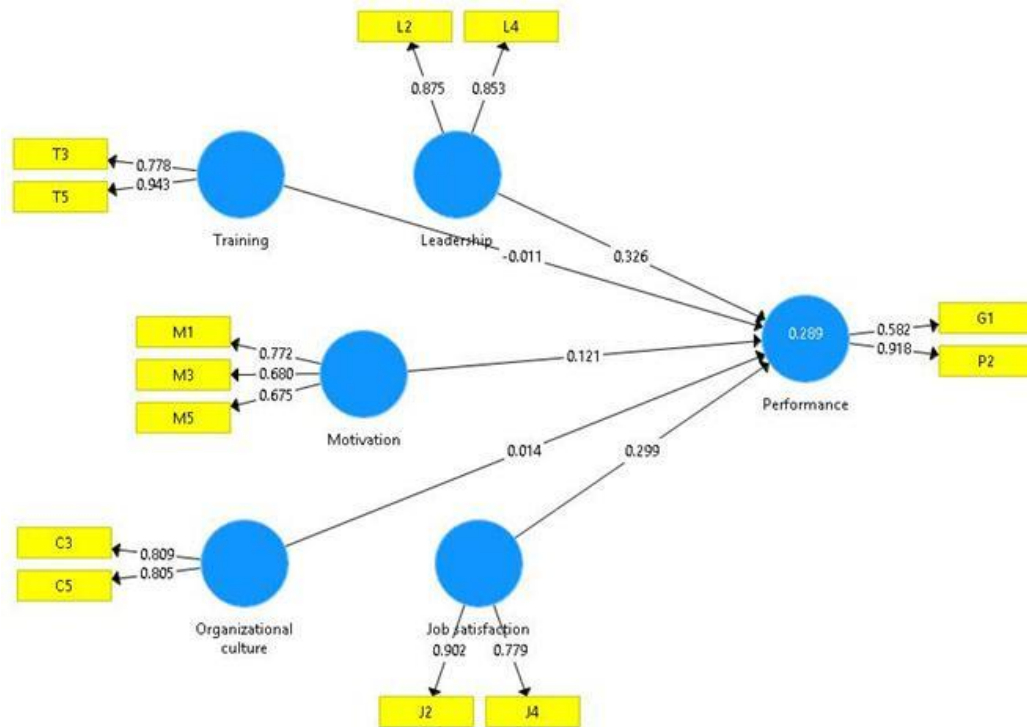


Figure 3 - Final model of factors affecting the performance oil & gas company

After 3 iterations, the model had achieved the two criteria which are item reliability and convergent validity however still need to conform with discriminant validity criteria. A total of 14 weak indicators were removed while creation and construction of PLS model.

3.2 Discriminant validity using Fornell-Lacker

This assessment can be conducted by two methods which are analysis of cross loadings and analysis of Average Variance Extracted (AVE) using Fornell-Lacker criterion. However for this study, it adopted Fornell-Lacker approach. This approach compares the square root of the average variance extracted (AVE) with the correlation of latent constructs (Hair *et al.*, 2017). The square roots of AVE coefficients are presented in the correlation matrix along the diagonal. Furthermore, the square root of each construct’s AVE should have a greater value than the correlations with other latent constructs (Hair *et al.*, 2014). This result for Fornell-Lacker approach of this study is as in Table 1.

Table 1 - Fornell-Lacker criterion

Construct/ Group	J	L	M	C	P	T
Job satisfaction (J)	0.842					
Leadership (L)	0.343	0.864				
Motivation (M)	-0.067	0.195	0.711			
Organizational culture (C)	0.462	0.378	-0.084	0.807		
Performance (P)	0.405	0.453	0.162	0.261	0.768	
Training (T)	0.433	0.448	0.103	0.398	0.283	0.864

Table 1 shows the generated discriminant validity using Fornell-Lacker. In Fornell-Lacker approach, when weak indicators are deleted in stages it will improvise the errors of Average Variance Extracted (AVE) of latent (exogenous and endogenous) constructs to an acceptable level. Finally, the square root of AVE value of each latent construct at the diagonal matrix should be larger than its correlation values in corresponding with other latent constructs as in Table 1 which indicate the model reached the adequacy of discriminant validity criterion. At this level, three criteria of the measurement model assessment were tested which included indicator reliability, convergent validity and discriminant validity. The results indicate that each of assessment criteria has achieved with the stipulated guidelines for PLS model assessment. Thus it can be concluded that the measurement model is validated statistically. Based on the figure of the final model, it was found that for the 5 most important factors affecting oil & gas company are effective support system (J-group), empowerment (L-group), supporting employees (M-group), creativity and innovation (C-group), and training regularly (T-group).

4. Structural model assessment

Structural model assessments involves five criteria which are Structural model path Coefficients (β), Coefficient of determination (R^2), Effect size (f^2), Predictive relevance (q^2) and Goodness-of-fit (GoF).

4.1 Path coefficients evaluation (β)

According to Hair *et al.* (2017) and Aibinu & Al-Lawati (2010) that the higher the path coefficient value indicates the stronger the effect of predictor exogenous variables on the endogenous variable. Path coefficients values generated from the PLS algorithm function in SmartPLS software for all constructs of structural model are as in Figure 4.

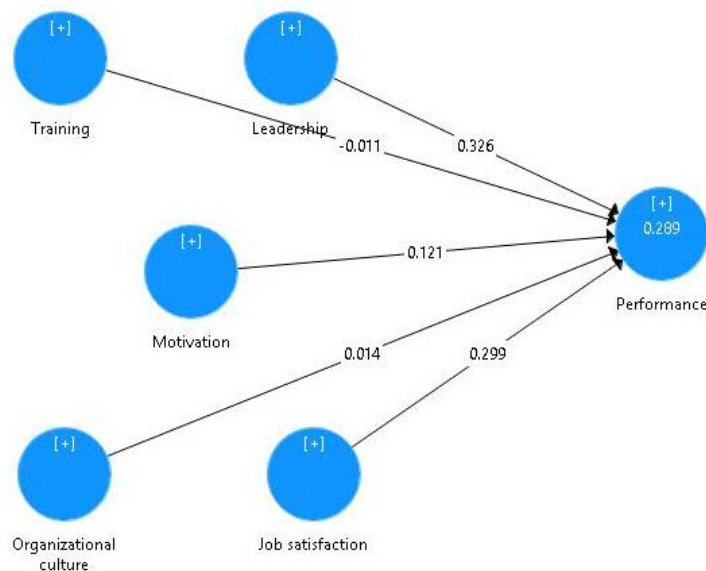


Figure 4 - Path coefficient (β value)

Based on the path coefficients values in Figure 4, it indicate that Leadership group has the highest β value of 0.326 (above 0.1). This indicates that the group has the strongest influence or impact on performance. Then, it’s followed by *Job satisfaction* group with β value of 0.299. However others groups seem not having much influence on performance of the company.

To test whether the each relationship is significant or otherwise, it needs to conduct bootstrapping process. The process estimates the spread and shape of the sampling distribution (Hesterberg, 2015; Hair *et al.*, 2017). Bootstrapping is also considered as hypothesis testing for the model to check whether the constructs relationships are significant or otherwise (Banerjee *et al.*, 2009). In this study the bootstrapping procedure involved 5000 resamples and two-tailed tests of 1.96 (significance level, $p=0.05$) to generate and interpret t-values (Hair *et al.*, 2017) and the results of this procedure are as in Table 2.

Table 2.0: Results of bootstrapping

Hypothesis	Relationship	Generated t-values	Inference
H ₁	Leadership has a significant effect on performance	2.358	Significant
H ₂	Training has a significant effect on performance	0.090	Not significant
H ₃	Motivation has a significant effect on performance	1.006	Not significant
H ₄	Organizational culture has a significant effect on performance	0.113	Not significant
H ₅	Job satisfaction has a significant effect on performance	2.680	Significant

Based on Table 2, it means that *Leadership* and *Job satisfaction* groups have significant relationship with *performance*. In contrast, other groups having t-values less than the cut-off value are considered having non-significant with performance. The overall conclusion from this path coefficient evaluation process is that *Leadership* and *Job satisfaction* groups have the strongest and statistically significant relationship with the performance. This proven by Bakotic (2016) that job satisfaction had a positive or strong impact on performance such as reducing moral stress, create new thinking and innovation.

4.2 Coefficient of determination (R²)

Coefficient of determination is to evaluate the model’s predictive explanatory power (accuracy) where the value closer to 1 representing complete predictive accuracy (Hair *et al.*, 2017). Based on Figure 4.0, the R² value for the structural model is 0.289 which according Cohen (1988) specification the developed model can be classified as having substantial explaining power in representing the impact of the 5 groups of factors that affecting oil & gas company to performance.

4.2.1 Effect size (f²) approach

Effect size is to evaluate whether the omitted exogenous construct has a substantive impact on the endogenous construct (Hair *et al.*, 2017). It is conducted by evaluating the effect size referred (f²) as is measured using the following formula (Hair *et al.*, 2017):

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}} \tag{1.0}$$

where;

f² = effect size

R² included = R² value of the endogenous variable when all the exogenous variables are included in the model

R²excluded = R² value of the endogenous variable when the selected exogenous variable is excluded from the model

According to Cohen (1988) effect size having values of 0.02, 0.15 and 0.35 are representing for small, medium and large effects of the respective omitted exogenous variable to the model. Since there are 5 exogenous constructs then it required 5 iterations process using PLS algorithm to determine 5 effects size value for the model. In each iteration process it generated R²_{excluded} value which is used together with R²_{included} for calculating model effect size. The iteration process was repeated to other exogenous constructs and the effect sizes (f²) calculated for this model is as Table 3.

Table 3 - Effect size (f²)

Iteration	Omitted exogenous construct	R ² included	R ² excluded	f ²	Effect size
1	Leadership	0.289	0.221	0.096	Small effect size to the model
2	Training	0.289	0.289	0	No effect size to the model
3	Motivation	0.289	0.282	0.009	No effect size to the model
4	Organizational culture	0.289	0.289	0.009	No effect size to the model
5	Job satisfaction	0.289	0.245	0.062	Small effect size to the model

Table 3 indicates that *Leadership* and *Job satisfaction* constructs are having small effect size of 0.096 and 0.062 respectively to the structural model. However other exogenous constructs are having an effect size less than cut-off value of 0.02 as specified by Cohen (1998) which mean that when these constructs are omitted individually and simulated it found that the constructs are having no effect size to the model. These mean that *Leadership* and *Job satisfaction* constructs have substantive small impact of effect size toward endogenous construct or the model.

4.2.2 Predictive relevance (q²) approach

Predictive relevance is the ability to predict the data points of indicators in reflective measurement models of endogenous constructs and endogenous single-item constructs. It is based on Q² values which measures the differences between the omitted data points and the predicated ones and are generated from blindfolding iteration process. Hence, predictive relevance of the model is calculated using the following formula (Hair *et al.*, 2017):

$$q^2 = \frac{Q^2_{included} - Q^2_{excluded}}{1 - Q^2_{included}} \tag{2.0}$$

where;

q^2 = predictive relevance

$Q^2_{included}$ = Q^2 value of at endogenous variable where all the exogenous variables are included in the model

$Q^2_{excluded}$ = Q^2 value of at endogenous variable where the selected exogenous variable is excluded from the model

According to Cohen (1988), if the q^2 value is 0.02, 0.15, 0.35 then it indicates that the respective exogenous construct is having small, medium, large predictive relevance to the model respectively. To conduct the predictive relevance analysis, blindfolding technique was applied. Blindfolding technique is built on a sample reuse technique that omits every d^{th} (d = omission distance) data point in the endogenous construct’s indicators and estimates the parameters with the remaining data points (Chin, 1998; Tenenhaus *et al.*, 2005; Hair *et al.*, 2017). Hair *et al.*, (2012) suggested to use 7th omission distance as the default of the software. Blindfolding process generates two different types of Q^2 values that are cross-validated communality (CVC) and cross-validated redundancy (CVR). However, the study model only used cross-validated redundancy value as suggested by Hair *et al.* (2017) that CVR has already includes the key element of the path model, the structural model, to predict eliminated data points. Since the model has five exogenous variables then it involved five blindfolding processes where in each process one of the variable is deleted. Hence the following iteration processes were repeated for other exogenous constructs and the overall predictive relevance q^2 were calculated for this model is as Table 4.

Table 4 - Predictive relevance (q^2)

Iteration with blindfolding	Omitted exogenous construct	$Q^2_{included}$	$Q^2_{excluded}$	q^2	Predictive relevance
1	Leadership	0.108	0.057	0.057	Small predictive effect
2	Training	0.108	0.123	-0.017	No predictive effect
3	Motivation	0.108	0.114	-0.007	No predictive effect
4	Organizational culture	0.108	0.113	-0.006	No predictive effect
5	Job satisfaction	0.108	0.086	0.025	Small predictive effect

Table 4 indicates that only *Leadership* and *Job satisfaction* constructs q^2 value is having small predictive relevance because the values are in the range between $0.02 \leq q^2 < 0.15$ (Hair *et al.*, 2017). However, other constructs which are *Training*, *Motivation* and *Organizational culture* are not having predictive relevance and no effect to the endogenous construct. The strength of each relationship of exogenous and endogenous is based on statistical computational probability of the input data of the questionnaire survey. If the data provided by the respondents of poor quality then the established relationship will be reflected as not significant and not relevant (Koban *et al.*, 2012; Ishiyaku, Kasim, Harir, 2017). Since in this study’s questionnaire the endogenous construct is in section B while exogenous construct is in section C and this may cause unawareness to the respondents on the relationship between these two constructs. Thus, input data provided by the respondents may seem reliable however it does not having enough power/strength to the established relationship of exogenous and endogenous constructs.

4.3 Goodness-of-fit (GoF)

Goodness-of-Fit (GoF) is an index use to define a geometric mean of the average communality (AVE) and the average of Coefficient of determination (R^2) (for endogenous constructs) (Tenenhaus *et al.*, 2005). GoF index serves as baseline value for validating the PLS model globally (Wetzels *et al.*, 2009) with the value bounded between 0 and 1 (Akter *et al.*, 2011). GoF index can be categorised into 3 criteria which are small, medium and large validating power for the values of 0.1, 0.25, and 0.36 respectively (Wetzels *et al.*, 2009). Hence, GoF index of a model can be calculated using the following formula (Wetzels *et al.*, 2009):

$$GoF = \sqrt{AVE \times \bar{R}^2} \tag{3.0}$$

where;

GoF = goodness-of-Fit

AVE = average communality

R^2 = coefficient of determination

Table 5 - Calculation of goodness-of-fit

Construct	Square root of AVE [from Table 5.5]	R² value [from Figure 5.5]
Job satisfaction [exogenous]	0.710	0.289
Leadership [exogenous]	0.746	
Motivation [exogenous]	0.505	
Organizational culture [exogenous]	0.651	
Training [exogenous]	0.590	
Performance [exogenous]	0.747	
Average	0.658	0.289

Table 5 of this model, the average of AVE for endogenous variable is 0.658 and the average R² for all dependent variables is 0.289.

Thus, $GoF = \sqrt{0.658 \times 0.289} = 0.436$

With this calculated value of GoF, it exceeds the cut-off value of 0.25 and this indicates that the model is having large validating criteria. Finally even though that some of the results are not as the expected as the hypotheses but it can be concluded that the structural model has been validated statistically.

5. Conclusion

This paper has presented the development and assessment of PLS-SEM model of relationship between the 25 factors affecting the performance oil & gas company in the UAE. The model comprises of 5 groups of factors affecting the performance oil & gas company. Assessments processes involved on this model are at measurement and structural levels. In measurement level, 3 iterations were carried out before the model achieved the assessment criteria adequacy. Results from this iteration process found that for the 5 most important groups of factors affecting oil & gas company are effective support system (J-group), empowerment (L-group), supporting employees (Motivation group), creativity and innovation (C-group), and training regularly (T-group). At structural level assessment processes it involved omitting one group for each iteration to evaluate the effect size and also involved bootstrapping process. It was found the model has achieved the overall model of fit known as GoF with the value of 0.436 indicating large validating power.

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