The Impact of Sustainability Learning On Sustainability Innovation

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ABSTRACT

Currently, palm oil industries are highly responsive to the improvement of global integration, innovation, the requirement of sustainable development and new technology. These raise challenges for a company's ability to survive. This paper's objective is to analyse the effect of formal and non-formal learning in palm oil business units. This has an impact on sustainability innovation practices and is complemented by the absorptive capacity to take up knowledge on sustainability requirements and policy. It is then implemented into sustainability innovation. This research model was empirically researched using a quantitative survey that incorporated cross-sectional data from 100 estate or mill managers who use palm oil sustainability certification. The data obtained was analysed with PLS Based SEM by using the Smart PLS 3.0 application. The result shows that the direct effect of variable formal sustainability organisational learning has a significant impact on sustainability-oriented innovation. However, non-formal sustainability organisational learning has no significant impact. Formal sustainable learning may be adopted to increase sustainability innovation practice by the partial mediation of absorptive capacity. Overall, this study clarifies the empirical findings and research in the field of formal and non-formal learning by investigating the relationships and effects of sustainable innovation.

Keywords

Formal, Non-formal, Sustainability Learning, Absorptive Capacity, Sustainability Innovation

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

Introduction

Currently, the oil palm industry is expanding toward the industrial era 4.0, in which the factors of innovation and sustainability play an important role. Changes in the business process of palm oil operations also led to a shift from manual to mechanics and digital (European Commission, 2017). It also has and will continue to influence plantation industry operations, including the use of smart sensing and monitoring systems to optimise the use of resources in operation fields (Aef, 2017). There are two factors that will determine the success of the palm oil industrial 4.0 era. The first factor is new management of the farming/plantation model. The second is sustainability. When palm oil companies are facing problems regarding sustainability, they have a choice to shift into sustainability practices to avoid their product's rejection in the market by joining sustainable certification such as RSPO, ISCC, or ISPO (Round Table on Sustainable Palm Oil, 2013)(Yaap & Paoli, 2014). It is necessary for an organisation to train its resources with sustainable practices and to develop knowledge to implement sustainability development and new technology through formal training or non-formal activities. Both improvements of digitalisation of new technology and sustainability becomes a significant objective in the implementation of sustainability innovation.

The main concern of this research is Sustainable Organisation Learning (SOL) by both formal and non-formal effect on sustainable innovation. This study attempts to demonstrate that formal and non-formal learning on sustainable organisations has an impact on Sustainable Oriented Innovation (SOI) by direct impact or mediating by Absorptive Capacity (ABP). The research in this paper consists of an empirical study to expand the limited knowledge and research in the field of SOL, SOI, and ABP.

Literature Review

Structured training involves a high number and frequency of well-planned instructions, conduction of practical training sessions, the teaching of well-tailored content, planned training schedules, targeted effective scope of audience, and establishment of systematic knowledge transfer of sustainability training (Brandi et al., 2013). Regular training sessions are conducted to improve employee knowledge of tasks regarding sustainability. Employees are encouraged to participate in training related functions outside of their organisation sustainability-related skills. On-job training is offered to increase the employee's ability to perform sustainability-related tasks. Procedural investigations are conducted to analyse the causes of failure and success of matters relating to sustainability and routine coordination meetings between various departments (Ching-Yii.Lin & Chiu-Chu.Chang, 2012).

Better practice in agronomy could be developed to adapt the requirement of sustainability, but it still needs a process to turn it into sustainability innovation. SOI involves making intentional changes to an organisation's philosophy and values, as well as to its products, processes, or practices to serve the specific purpose of creating and realising the social and environmental value in addition to economic returns (Adams, Jeanrenaud, Bessant, Denyer, & Overy, 2016). Sustainable innovation practice could be processed by assimilating knowledge of internal and external training to

handle sustainability issues required by sustainability certification and innovate through search, scan, and exploration of new opportunities as part of sustainable innovation practice. Formal Sustainability Organisation Learning (FSOL) could have a direct impact/influence on estate or mill managers, which they acquire through formal learning to implement the SOI. Based on that argument, the first hypothesis tested in this study is as follows:

H1: FSOL has a direct impact on SOI.

On the other hand, non-formal learning of sustainability could be adapted to exchange opinions in informal environment settings during working hours. For example, talking with colleagues about issues related to sustainability during social gatherings. Non-Formal Sustainability Organisation Learning (NFSOL) could have a direct impact/influence on estate or mill managers, in which their sharing of ideas in the informal event impacts their ability to perform SOI. Based on this argument, the hypothesis is as follows:

H2: NFSOL has a direct impact on SOI.

Wang and Ahmed (2007) identified three main component factors of dynamic capabilities: adaptive capability, absorptive capability, and innovative capability. Absorptive capacity (ABP) could be defined as the ability to recognise the value of new information. Assimilating and applying it to commercial use in the organisation's absorptive capacity will depend on the absorptive capabilities of its individual staff members(Wang & Ahmed, 2007). Formal and non-formal training could impact absorptive capacities for both individuals and organisations (W. Cohen & Levinthal, 1990). The absorptive capacity becomes valuable in knowledge-based competition. The company must develop an understanding of its internal and external knowledge before converting it into practices. Foundation of the absorption capability occurs by implying and assimilating the current practices with learning through the pooling and interpretation of the knowledge of sustainability requirements, and adapting the changes demanded by sustainable practices. Based on this information, it is hypothesised that absorptive capacity plays a role in mediating sustainable organisational learning for FSOL and SIO,

H3: ABP is a mediator between FSOL and SOI.

Beside FSOL, absorptive capacity could plays a role in mediating sustainable organizational learning for NFSOL and SOI. Based on this, the hypotheses are:

H4: ABP is a mediator between NFSOL and SOI.

Research Methodology

Operational Variable

For measuring the construct of FSOL and NFSOL, researchers used an adapted questionnaire from formal and non-formal organisational learning from the article entitled "Organisational Learning, Environmental Dynamism and Dynamic Capabilities" (Ching-Yii.Lin & Chiu-Chu.Chang, 2012) The questionnaire consists of five indicators for FSOL and five indicators for NFSOL. For measuring the construct of absorptive capacity, the researcher adapted the questionnaire from Chen, Lin, and Chang (Chen, Lin, & Chang, 2009), which consists of four indicators for absorptive capacity. For measuring the construct of sustainability-oriented innovation, researchers developed nine indicators from the criteria requirements of RSPO, Triple Bottom Line concept, and sustainability innovation principal.

Data Collection and Sampling Technique

The target group of this research consisted of estate and mill management staff, who had training and implemented sustainability certification in their units in private companies in Indonesia. This research used a descriptive survey method on 132 estates and mill managers, who participated in a Plantation Conference using simple random distribution with cross-sectional data representative of the population. However, only 116 participants who received the questionnaire filled out them out completely. The survey consisted of questions using a 1-5 Likert scale to analyse the impact of sustainable organisational learning on their sustainability innovation practice. The number of participants fulfilled the requirement of sample size determination. Using Cochran's sample size formula for continuous data, with t = value for a selected alpha with a level of =1.96, s = estimate of standard deviation in the population with a 5 point scale divided by 4 = 1.25, d = acceptable margin of error being estimated – 0.0625 (number of points on primary scale x acceptable margin of error = 0.05 = 5 x 0.05= 0.25). $n_o = (t)^2 (s)^2/ (d)^2 = (1.96)^2(1.25)^2/(0.25)^2 =$ 96,04 (Bartlett, Kotrlik, & Higgins, 2001).

Table 1. Respondent Profile

	Sample Distribution of Respondent Profile			
The Respondent Profile	Description	Qty	%	Explanation
Age of Respondent	30- 40	2	2	
	40- 50	65	65	
	>50	32	32	
Certification in Estate/Mill	RSPO	70	70	Mill/Estate could have more than one certification
	ISCC	74	74	
	ISPO	48	48	
Business Unit	Estate	79	79	
	Mill	21	21	

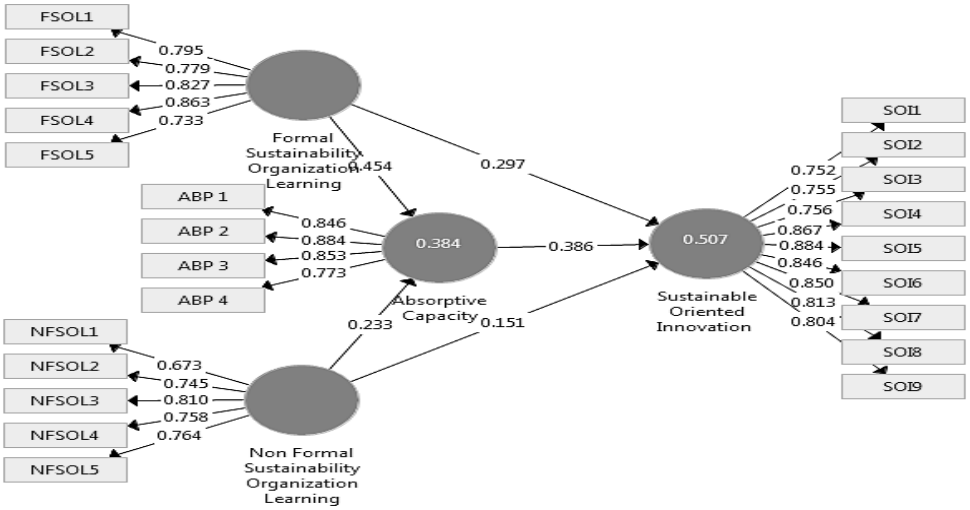
Reference: Questionnaire Survey

Measurement and Procedures

The data obtained were analysed using Smart PLS 3.0, a Partial Least Squares (PLS) Structural Equation Modelling (SEM) approach that simultaneously assessed the psychometric properties of the measurement model and estimated the parameters of the structural model (J. F. J. Hair, Hult, Ringle, & Sarstedt, 2014). Smart PLS 3.0 applied the principles of variance based or partial least square based sequential modelling. SEM-PLS was chosen because of the variance-based SEM that focused on the construct's prediction. Exploration of the theory supported the small sample (100 sample) with construct type support. Both

reflective and formative constructs became the preferred methods because they used available data to estimate the path relationships in the model with the objective of minimising the error terms of the endogenous constructs. The sample size of this research fulfilled the recommended sample size model for absorptive capacity. The construct has two arrows pointing at a construct with 0.25 R^2 are 52 sample, and SOI construct has three arrows pointing at a construct with 0.25 R^2 are 59 sample with 0.05 significance level (J. Cohen, 1998).

Figure 1. Relationship of Model



Reference: Data Processing Using SEM-PLS

Results And Discussions

The research model indicator shows that the measurement is reliable and valid to use. Outer loading above 0.600 is acceptable for Exploratory Research (Chin, 1998). Validity measurement used in this paper are convergent and discriminant validity, as shown in Table 2. Average Variance Extracted (AVE) is used for the construct validity when it is more than 0.5 with FSOL 0.641, NFSOL 0.564, ABP 0.705 and SOI 0.665. This value exceeds the recommended threshold value of 0.5 (Fornell & Larcker, 1981). This means the entire measurement model has good convergent validity and reliability. The model has composite reliabilities of each variable in the model range from 0.866 to 0.947, which exceed the recommended threshold value of 0.70 (Nunnally, 1978). This means the model has good composite reliability. The Cronbach's alpha results ranged from 0.815 to 0.937 and was used to measure internal consistency. When Cronbach's alpha is higher than 0.7, it implies that the scores of all the variables indicated have high internal consistency (Cronbach, 1987). The threshold value is 0.7 for indicator reliability at a significance level of $p < 0.05$, but lower item loading is acceptable in exploratory research (Chin, 1998).

Table 2. Construct Reliability and Validity of Testing

Variable	Cronbach's Alpha	Rho_A	Composite Reliability	Average Variance Extracted (AVE)
FSOL	0.860	0.873	0.899	0.641
NFSOL	0.815	0.846	0.866	0.564
ABP	0.860	0.867	0.905	0.705
SOI	0.937	0.937	0.947	0.665

Reference: Data Processing Using SEM-PL.

Table 3. Discriminant Validity

Variable	ABP	FSOL	NFSOL	SOI
ABP	**0.840**			
FSOL	0.590	**0.801**		
NFSOL	0.499	0.586	**0.751**	
SOI	0.637	0.614	0.581	**0.816**

Reference: Data Processing Using SEM-PLS

Table 3 shows bold diagonal numbers that are higher than other listed numbers. This means that the measurement model's discriminant validity is acceptable. By test parameters of the convergence validity, all measurement indicators proved to have a high correlation and are valid to represent its latent variables. Processing Smart-PLS using bootstrapping with a 10,000 sample, with one tail, with significance $\alpha = 0.05$ and using individual sign changes as recommended by Hair (J. F. Hair, Sarstedt, Ringle, & Mena, 2012) model. The bootstrapping results are as follows:

1. VIF value for FSOL and NFSOL → ABP is 1.522, FSOL → SOI is 1.857, NFSOL → SOI is 1.610, and ABP →

SOI is 1.623. All of the VIF values less than five indicate there is no co-linearity problem in both exogenous constructs of the structural model.

2. The model construct of absorptive capacity R^2 is 0.384 with a t-statistic of 5.135, and p-value =0.000, which means that FSOL and NFSOL contribute 38.4% on ABP as an endogenous construct. This structural model and relationship is low because of R^2 < 0.5. The model construct of SOI R^2 is 0.507 with a t-statistic 6.778 and p-value =0.000. This suggests that ABP, FSOL, NFSOL contribute 50.7% to SOI as an endogenous construct. The structural model is a moderate model because of R^2 being between 0.5 and 0.75.

3. To analyse effect size F^2, FSOL→ ABP has f^2 = 0.220 and ABP → SOI f^2 = 0.186. Both have f^2 in range of 0.15 to 0.25. This means FSOL gives moderate impact to ABP and ABP gives moderate impact to SOI. But FSOL → SOI has f^2 =0.096, NFSOL → ABP has f^2 = 0.058, and NFSOL → SOI has f^2 = 0.029. This means FSOL gives low impact to SOI, and NFSOL gives low impact to ABP and SOI because of their f^2 < 0.15.

4. Goodness of Fit (GoF) index is defined as the geometric mean of the average communality and average R^2 for all endogenous constructs (Tenenhaus, Vinzi, Chatelin, & Lauro, 2005) GoF for ABP = (0.5 x 0.384) 0.5=0.4382 and GoF for SOI = (0.5 x0.507) 0.5 = 0.5035. Both GoF variables are higher than 0.36 and means the model has better prediction power in comparison to GoF criteria.

5. To calculate the effect of mediation of ABP, excluding ABP from the model, R^2 excluded of SOI = 0.420, R^2 < 0.5, the relationship is low. To calculate f^2 effect size of ABP to SOI = (R^2 included – R^2 excluded) / (1-R^2 included). f^2 (ABP → SOI) = (0.507-0.420)/(1-0.507) = 0.1765 f^2 in range of 0.15 to 0.25. This means ABP gives moderate impact to SOI as an intervening variable. It is better than the model without ABP, and it means the effect of mediating exists.

6. Blindfolding Routine Analysis predicts the value of the predictive relevance. The predictive power of relevance of this research model was calculated using Q^2 predictive relevance analysis (Akter, Ambra, & Ray, 2011). To calculate cross-validated redundancy estimates from SEM PLS with absorptive capacity, the result in the first case blindfolding Q^2 = 0.367 and the model without absorptive capacity the result Q^2 = 0.309, and the seven-case blindfolding Q^2 = 0.259 and the model without absorptive capacity Q^2 = 0.186. Q^2 case 1 effect size ABP → SOI = (Q^2 Included – Q^2 Excluded)/(1-Q^2 Included) = (0.367 – 0.309)/(1-0.367) = 0.0916 Q^2 case 7 effect size ABP → SOI = (0.259-0.186)/(1-0.259) = 0.0985. The effect of prediction is close to the original value, meaning the model has high predictive value. All of Q^2 value (Chin, 1998) larger than 0 suggests that the model has predictive relevance for a certain endogenous construct. The research has a highly predictive model (J. F. J. Hair et al., 2014).

7. Outer loading and t-statistic of all indicator constructs have T-Statistics > 1.96. This means all indicators are valid and reliable.

Table 4. Constructs Relationship Direct Effect

Direct Effect	Path Coefficient	T - Statistics	P Value	Result
FSOL → ABP	0.454	4.549	0.000	Significant
NFSOL → ABP	0.233	2.245	0.012	Significant
FSOL → SOI	0.297	2.383	0.009	Significant
NFSOL → SOI	0.151	1,681	0.046	Not Significant
ABP → SOI	0.386	3.709	0.000	Significant

Reference: Data Processing Using SEM-PLS

8. Table 4 shows the construct relationship and direct effect of FSOL → SOI, t = 1.96, path coefficient = 0.297, t-statistics = 2.383 and p=0.000. It means that H_0 was rejected and H_1 was accepted. It suggests that FSOL has a significant impact on SOI. However, the direct effect of NFSOL, with path coefficient 0.151, t-statistics = 1.681 and p =0.059. This means that H_0 was accepted and H_2 was rejected. It suggests that NFSOL has no significant impact on SOI. There are no mediating effects of ABP on NFSOL (Baron & Kenny, 1986). This means H_4 was rejected.

Table 5. Constructs Relationship of Indirect Effect

Indirect Effect	Path Coefficient	T -Statistics	P Value	Result
FSOL → SOI	0.176	2.787	0.0	Significant
NFSOL → SOI	0.090	1.850	0.0	Not Significant

Reference: Data Processing Using SEM-PLS

Table 6. Constructs Relationship of Total Effect

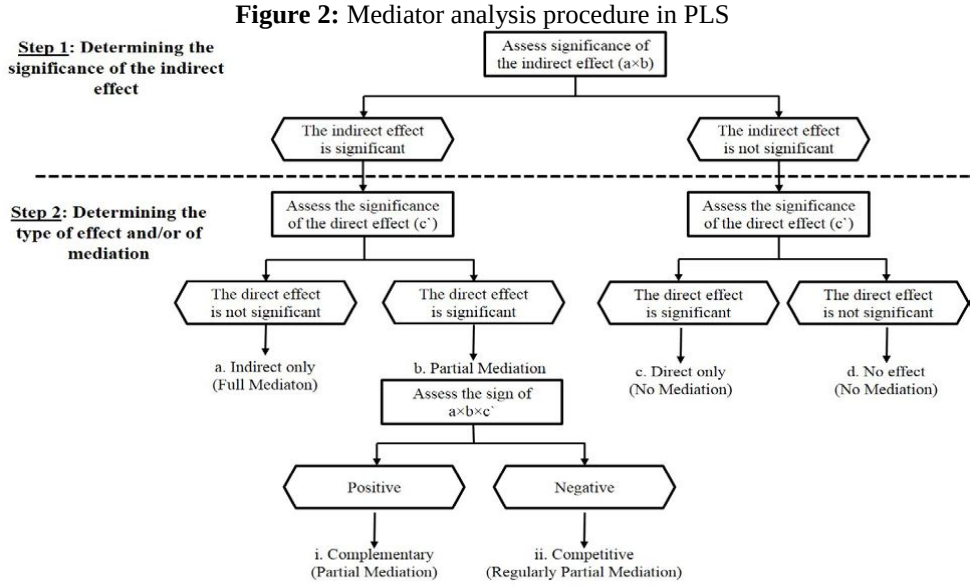
Total Effect	Path Coefficient	T-Statistics	P Value	Result
FSOL→ ABP	0.454	4.549	0.000	Significant
FSOL → SOI	0.473	4.362	0.000	Significant
NFSOL → ABP	0.233	2.245	0.015	Significant
NFSOL → SOI	0.241	2.370	0.008	Significant
ABP → SOI	0.386	3.709	0.000	Significant

Reference: Data Processing Using SEM-PLS

9. Table 5 shows the construct relationship of indirect effect FSOL → SOI, with path coefficient of 0.176, t-statistic = 2.833, and p-value = 0.002. This means the indirect effect was significant. Variance accounted for (VAF) could determine the size of the indirect effect of the total effect (J. F. J. Hair et al., 2014). The VAF equal to the direct effect divided by the total effect has a value of 0.297/0.473 = 63% of FSOL effect on SOI is explained via ABP as a mediating. Since the VAF is larger than 20% but smaller than 80%, there was partial mediation. This means that H_3 is accepted. It suggests that absorptive capacity is a mediator between FSOL and SOI with partial mediation.

10. Testing the mediation effect of ABP using advanced procedures for mediation analysis in PLS (Zhao, Lynch, & Chen, 2010), FSOL → ABOP as a = 0.454, ABP → SOI as b = 0.386, FSOL→ SOI as c = 0.297 and c' = 0.176, indirect effect (a x b) = total effect (c) - direct effect (c'). Table 5 shows an indirect effect: FSOL→ SOI is significant. Table 4 shows the direct effect FSOL → SOI (c') is significant. Both a, b, and c are positive. This means ABP has complementary partial mediation of FSOL → SOI. The indirect effect NFSOL → SOI is not significant, and the direct effect NFSOL → SOI is not significant and means ABP has no mediation of NFSOL → SOI. See Figure 2 for an illustration.

Figure 2: Mediator analysis procedure in PLS



Reference: (Zhao et al., 2010)& (Nitzl, Roldan, & Cepeda, 2016)

The results of this research suggest that FSOL has a supported impact on SOI, but NFSOL does not. ABP was a mediator between FSOL and SOI, which have partial mediation. The novelty of this research shows the relationship of FSOL and NFSOL to SOI, and the effect of mediation ABP on FSOL and NFSOL to SOI in the sustainability area. This study had managerial implications that elaborate on the relationship between SOL and SOI. This reveals only formal learning fosters the development of SOI. Absorptive capacity influence partial mediating role to connect FSOL to SOI. Theoretical implications of the research are consistent with the research theory of Cohen and Levinthal (1990); absorptive capacity is beneficial in the implementation of innovation. However, the absorptive capacity changes continuously, and absorptive capacity impinges at different times on different capabilities and routines (Zahra & George, 2002). The results of this research expand on the research of Andrea Fosfuri, who demonstrated the important role played by external linkages in the process of learning that drives the accumulation of absorptive capacity into innovation performance (Fosfuri & Tribó, 2008).

The managerial implications of this research suggest that FSOL plays a vital factor in supporting SOI. In our study, the results suggest that, in sustainability areas, FSOL plays a more important role in the development of SOI rather than NFSOL. This is due to the requirements of sustainability certification that already has standard rules to be followed. To implement this better, SOI need proper FSOL training to achieve a better result.

Conclusions

Novelty of this study developed a framework to examine the relationship among Sustainability Organisational Learning, Absorptive Capacity, and Sustainable Oriented Innovation to address the main question of this research, which was:

"Did Formal and Non-Formal Sustainability Organisational Learning affect participants' performance of sustainable innovation practice?" The results show that FSOL had a significant impact on SOI, but NFSOL had no supported impact on SOI. Partial mediation exists in absorptive capacity, which suggests that only in FSOL does absorptive capacity have an impact in mediating. This research is consistent with other research from Dicle & Kose (2014) which suggested that the strong relationship found between organisational learning and environmental orientation indicates that organisational learning affects the environmental stance from awareness of individuals to the degree of consciousness of managers toward the interests of environmental stakeholders. (Dicle & Köse, 2014)

Thus, they could improvise their knowledge from formal learning to better perform SOI in their field. In company practices, it can be concluded that companies will initiate and carry out sustainability-oriented learning processes when sustainability-related requirements are anchored in the personal and cultural attributes of a company. Qualifications and training of personnel seem to be most helpful for enabling organisations to learn and change.(Siebenhüner & Arnold, 2007)

Further studies could examine the factors of adaptive capability and innovative capability to sustainability-oriented innovation. This study had certain limitations that must be considered when valuing the conclusions set out above. There was a limitation of the number of surveys completed in the research at the plantation conference to represent the population. Future research should collect more samples to represent the population and combine relevant cases to carry out analysis and research. The other limitations are empirical designs using cross-sectional data, which may lead to other causal interpretations. In the process of transforming external knowledge flows into innovation outcomes, the role played by absorptive capacity changes continuously, and absorptive capacity impinges at different times on different capabilities and routines (Fosfuri & Tribó, 2008). It will be more efficient to carry out a longitudinal time series study of absorptive capacity mediating learning to sustainability innovation.

Acknowledgments

Thanks go to the organisers and participants of Sinarmas Plantation Conference 2017 for their help and filling out the questionnaires of this research.

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Outer Loading & T-Statistic Indicator

Indicator	Questionnaire	Outer Loading	T - Statistics	P - Value
FSOL1	Regular training sessions are conducted to improve knowledge related to employee tasks regarding sustainability,	0.795	20.840	0.000
FSOL2	Employees are encouraged to participate in training related tasks outside their organization to improve related skills of sustainability,	0.779	14.436	0.000
FSOL3	On-job training is offered to improve employee's ability to perform Sustainability related tasks	0.827	21.516	0.000
FSOL4	Procedures Investigations are conducted to analyze the causes of failure and success of matters relating to Sustainability	0.863	34.883	0.000
FSOL5	Coordination meetings and regular discussions are held between various departments for Sustainability	0.733	10.220	0.000
NFSOL1	We exchange opinions regarding Sustainability in informal settings during working hours.	0.673	5.077	0.0000
NFSOL2	We talked with colleagues about issues related to sustainability during social gatherings	0.745	6.452	0.000
NFSOL3	Free expression and exchange of ideas on Sustainability are encouraged within the organization	0.810	25.430	0.000
NFSOL4	We are willing to offer Sustainability related information to co-workers if needed.	0.758	8.582	0.000
NFSOL5	When working on sustainability, the Unit learns the implementation of the sustainable implementation of other units/companies	0.764	13.647	0.000
ABP1	My unit / organization is able to gain the necessary external knowledge	0.846	19.051	0.000
ABP2	My unit/organization can understand and analyze information from the environment	0.884	23.431	0.000
ABP3	My unit/organization can combine external knowledge information with internal knowledge	0.853	21.107	0.000
ABP4	My unit/organization regularly organizes special meetings with external partners to acquire new skills/technologies	0.773	14.679	0.000
SOI1	We could adapt to the changing sustainable development 's government regulations to gain new access to improve performance	0.752	14.540	0.000
SOI2	We use the latest technology as a media in working	0.755	16.151	0.000
SOI3	We made observations of impact before launching an innovation	0.756	13.830	0.000
SOI4	The innovations that we are trying to develop a need to consider the economic factor	0.867	26.629	0.000
SOI5	The innovations that we are trying to develop a need to consider the social factors	0.884	44.604	0.000

SOI6	The innovations that we are trying to develop a need to consider the environmental factors	0.846	33.476	0.000
SOI7	The innovations that I am trying to develop a need to prioritize certification requirements in sustainability	0.850	27.503	0.000
SOI8	We need to update the latest information on sustainability requirement when developing innovation in the field	0.813	21.699	0.000
SOI9	We get support from tops management and organizations in developing sustainability-based innovations	0.804	20.165	0.000