Green Lean Concept for Measurement of Sustainable Performance Mediated by Organizational Culture in Oil & Gas and Petrochemical Industry

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ABSTRACT

This research explores the measurement of green lean concept in Oil and Gas and Petrochemical Industry in Indonesia to sustainable performance by examine organizational culture as a mediated. The green lean concept approach provides social benefits for industry, financial aspects, and environmental aspects that influence its performance so that it can be sustainable. A structured questionnaire was distributed among employees of the Oil and Gas and Petrochemical Industry in Indonesia. The sample consisted of 153 respondents consisting of 32 females and 121 males, and the composition consisted of Oil and Gas Companies 44 respondents; Oil Companies 87 respondents; and Petrochemical Companies 22 respondents was analyzed using the Structural Equation Modeling - Partial Least Square (SEM-PLS). The results indicate that the green lean concept is proxied by customer relationships, human resource practices, manufacturing planning and control, process and equipment, and supplier relationships have a positive and significant effect on organizational culture in the Oil and Gas and Petrochemical Industry in Indonesia. Organizational culture variable is "Fully Mediating" the sustainable performance variable in the Oil and Gas and Petrochemical Industry in Indonesia. The R-squared value is 65% that green lean concept able to explain, while the remaining 35% explained by other factors that were excluded in this research. The research outcomes contribute to the analysis of the research, broadening the writings on green lean concept and sustainable performance with a mediating of organizational culture. The research possibly will be used as a motivation for industries in Indonesia to implement green lean concept as companies that adopt green lean concept globally have the result of improving firms' endurable performance through green lean approaches.

Keywords: Customer Relationship, Green Lean Concept, Human Resource Practices, Organizational Culture, Sustainable Performance

1. INTRODUCTION

Every industry carries out its responsibility towards the environment, or every industry is obliged to have a good impact on the environment. ISO 14001 is an internationally agreed standard that establishes requirements for an environmental management systems. This helps organizations improve their environmental performance through more efficient use of resources and reduction of waste, gaining a competitive advantage and the trust of stakeholders. Stakeholders and regulatory agencies

putting pressure on manufacturing industries to be sustainable due to the warnings about global warming and social issues. The concept of "Green Lean" in this context refers to sustainability and environmental responsibility. Lean is a management philosophy that focuses on eliminating waste to obtain low production costs. Lean manufacturing is a methodology that focuses on minimizing waste in manufacturing systems while maximizing productivity (Daniel, 2023). Waste is seen as anything that customers do not believe will add value and are not willing to pay for. Kaizen is a Japanese concept that means "continuous improvement." Kaizen

targets human resources and processes so as to anchor an industry for long-term and successful operation.

This research explores the measurement of green lean concept in Oil and Gas and Petrochemical Industry in Indonesia towards sustainable performance while considering organizational culture as a mediated. Green lean concept is a concept related to increasing efficiency, sustainability and continuous improvement. Green refers to the sustainability of industry in Indonesia and the world as a whole. This means that every industry is obliged to carry out responsibility towards the environment (environmental management system). The definition of ISO 14001 is a standard regarding environmental management Systems that applies internationally. The connection with the lean system is that by running a green industry, a wedge occurs, namely an efficiency in the production process (use of electricity, water, human resources). The connection between green industry and kaizen, the intersection is related to energy saving, CO_2, and efficiency. The function of kaizen is to reduce energy, CO_2, and efficiency. Green lean concept is related to the lean system, namely how to costs reduction, quality improvement, reduce waste, and focus on customers.

Corporate culture is considered the primary motive for the failure of executing programs or systems to modify the organizational structure. Research have proposed that like the instruments, procedures, and change techniques may be present, failure appears if the institution's culture remains identical (Dorval et al., 2019; Wahab, 2022). Therefore, organizational values usually focus on assessing and measuring organizational culture (Rasheed, 2022). However, an essential fact of cultural studies is the role of an organization towards its primary matters and principles of management in diverting or developing the execution of organizational decisions and creations belongs to reengineering, total quality management, adaptable manufacturing technologies (Taherimashhadi and Ribas, 2018; Wahab, 2022; Rasheed, 2022).

As far as the stakeholders and regulative agencies are concerned, they pressure manufacturing industries to be more sustainable due to the warnings about global warming and social issues. Stakeholders instruct that companies are environmentally and socially accountable, and industries have become attentive to playing their strategic part in sustainable performance as a competitive advantage. In additional, numerous research have proposed that embracing green lean manufacturing can improve industries environmental, social, financial performance, and sustainable performance. Illustrating green lean can be an operationalazation activity that improves competitive functions (Khanchanapong et al., 2014), such as high quality, flexibility, integrity, expenditure, and delivery within organizations (Wahab, 2022). Natural Resources (SDA) are increasingly scarce, global warming is increasing, environmental pollution is increasing (Kurnia et al., 2022).

Lean Manufacturing Practices (LPM) are being adopted in this research due to empirical research conducted by several researchers, which proves that the implementation of lean manufacturing practices has a significant effect on overall business performance and sustainability. Burawat (2019) has also shown

in their studies that successful implementation of lean practices in the manufacturing industry of Thailand's Small and Medium Enterprises (SMEs) leads to better economic performance and sustainable competitiveness. Hussain et al. (2019) have found that the adoption of lean practices has a high impact on economic sustainability by improving efficiency and service quality. Henao et al. (2019) have shown that most previous work has focused on linking lean manufacturing with firm performance. Banihashemi et al. (2019) state that a large amount of previous research has mainly focused on performance. Martínez Leon and Calvo-Amodio (2017) concluded in their research that the majority of previous studies have limited their scope by only considering one direction without taking into account the economic, environmental, and social aspects.

A study by Ghobakhloo et al. (2018) and Henao et al. (2019) showed that most previous work linking lean manufacturing and company performance only focused on specific aspects, without considering sustainability performance using the green lean kaizen approach. For example, the implementation of lean manufacturing only measured operational or economic performance. The same can be said for the research by Banihashemi et al. (2019), as a significant amount of previous work primarily focused on performance by considering only economic and environmental factors. The studies by Leon and Amodio (2017) concluded that the majority of previous research was limited in scope, only considering one direction without taking into account the economic, environmental, and social aspects. Therefore, due to the limitations of previous studies, the aim of this research is to implement the green lean concept on sustainability performance, with the mediation of organizational culture, in order to fill these gaps.

The objective of this research to identify green lean concept configuration, to develop the prediction model and to validate the model. Previous research has developed several model for assessing the readiness model to implementing green lean, but in the case of Indonesia, appropriate indicators and assessment dimensions are required. In addition, differences in perceptions of assessment dimensions and indicators are also a major problem that need to be addressed immediately. Based on the background and there is still a research gap found in the previous studies mentioned above, the formulation of the problem in this research is about the Sustainable Performance (SPE) of Oil and Gas and Petrochemical Industry has decreased as mentioned, which are influenced by several implications. In this research green lean concept is proxied in Customer Relationship (CRE), Human Resource Practices (HRP), Manufacturing Planning and Control (MPC), Process and Equipment (PEQ), and Supplier Relationship (SRE), and Organizational Culture (OCU) as mediating variable.

The rest of the paper is organized as follow: In section 2, the literature review related to the research problem and solution are explored. In section 3, the research method and data analysis are delivered. In section 4, the result is discussed and proposed system solution. Finally, in section 5, the conclusion and recommendation are delivered.

2. LITERATURE REVIEW

2.1. Customer Relationship and Organizational Culture

Research on the influence of customer relationship and organizational culture has been carried out by many previous researchers, but from the results of these research there are gaps in their research, including research findings conducted by Xiang and Nor (2021), the findings showed that the Customer relationship insignificant effect on organizational culture. Ikasari et al. (2016), based on these results visible effect of the customer relationship implementation and organizational culture on performance improvement manufacturing company. According to Koetz (2019), customer satisfaction and engagement are becoming important elements for marketing to focus on as customers and the customer experience are more empowered than ever. According to Fung So et al. (2016) customer relationships are an important element that must be considered in order to establish long-term cooperation between producers and customers in transactions. According to Koetz, (2019); Xiang and Nor (2021), customer satisfaction and engagement become a importance element to be focus by marketing because customer and customer experience are more empowered than ever. Thus, be fathomedthat customer relationship have an influence on organizational culture in Oil and Gas and Petrochemical Industry. Based on the theory of this research, the researcher formulated the hypothesis in this research as follows:

H_1: Customer relationships influence organizational culture in Oil and Gas and Petrochemical Industry.

2.2. Human Resource Practices and Organizational Culture

The role of human resource practices is to strengthen and consolidate the employee commitment during times of uneasy time of change. Cultural change disrupts and modifies existing shared meanings within an organization to create new values (Abadilla et al., 2020). Nikolayevna (2021), the findings showed the impact of a volatile business environment and internal organizational factors can lead to change and the need to create and maintain a culture. The human resource practices approach can create a favourable psychological arrangement between employees and employers. In turn, this can increase organizational engagement, loyalty, trust, and a sense of truth (Shaheen, 2022; Baloch and Rashid, 2022). Human resource practices in research contribute to the development of distinctive cultures and organizational capabilities, such as the way innovation and learning management take place in organizations (Wahab, 2022).

Research on the influence of human resource practices and organizational culture has been carried out by many previous researchers, but from the results of these research there are gaps in their research, including research findings conducted by Xiang and Nor (2021), the findings showed that the human resource practices insignificant effect on organizational culture. Shaheen (2022), the findings found that the hypothesis was supported by narrating that quality management significantly and positively influences operational performance. Thus, be fathomedthat human resource practices have an influence on organizational culture in the Oil and Gas and Petrochemical Industry. Based on the theory of this research, the researcher formulated the hypothesis in this research as follows:

H_2: Human resource practices influence on organizational culture in Oil & Gas and Petrochemical Industry.

2.3. Manufacturing Planning and Control and Organizational Culture

Manufacturing industries account for a large quantity of resource consumption and of second-hand goods everywhere (Abdullah et al., 2016). Industries that follow sustainability as an execution goal for manufacturing operations need immediate changes to the manufacturing planning and control systems (Wahab, 2022). The system is frequently disrupted by fast-paced work, and production disruptions occur as unplanned activities, changeover, and set-up times (Strandhagen et al., 2017; Amjad, 2022).

Proper planning and control can improve transparency by paying attention to correction rather than prevention, resulting in more timely communication, material usage and avoid delays (Brady et al., 2018). According to Tambe and Kulkarni (2016) research and results shown planning and control practices can help to improve economic performance by reduce wastage of material in work process, reduce time, rework and improve the work conditions. Xiang and Nor (2021), results shown the manufacturing planning and control practices have direct effect toward economic, environmental, and social sustainability performance. Cherrafi et al. (2019) results by reduced water consumption, toxic air emission and pollution whereas kaizen improves economic and social sustainability performance through efficient on the continuous flow of production and well-being in all operation. Thus, be fathomedthat manufacturing planning and control have an influence on organizational culture in the Oil and Gas and Petrochemical Industry. Based on the theory of this research, the researcher formulated the hypothesis in this research as follows:

H_3: Manufacturing planning and control influence on organizational culture in Oil & Gas and Petrochemical Industry.

2.4. Process and Equipment and Organizational Culture

Process Equipment is the equipment in the process facility that is designed and operated for a specific processing function and identified by a unique number. The Process Equipment is incorporated in a finished manufacturing facility. Sustainability has become a top priority because of the important role of production activities in providing added value to the national economy and its consequences for the environment (Hunaid et al., 2022; Wahab, 2022). They adopted numerous initiatives and shifts to enhance the social and environmental performance of their processes, facilities, and products in the United States, Europe, and Japan (Rasheed, 2022).

Extra processing is recognized as one of the waste under the seven wastes (Brady et al., 2018; Xiang and Nor, 2021). By using process and equipment practices removing those extra-processing and unnecessary usage included energy and materials (Brady et al., 2018; Endri et al., 2021). The reduction impacts of environmental performance is expected contribute to enhance social performance which establish employees healthy work life without overwork

due to extra-processing or extra movement (Xiang and Nor, 2021). In fact, sustainability performance in aspect of economic and environmental can improved by using process and equipment practices. Thus, be fathomedthat process and equipment have an influence on organizational culture in the Oil & Gas and Petrochemical Industry. Based on the theory of this research, the researcher formulated the hypothesis in this research as follows:

H4: Process and equipment influence on organizational culture in Oil and Gas and Petrochemical Industry.

2.5. Supplier Relationship and Organizational Culture

Supplier relationship management has become an important business method due to the increasing off-shoring and outsourcing of administrative and production processes. This can have a major impact on achieving sustainability goals (Ali, 2022). In some cases, suppliers are found to be conducting business unethically (Wahab, 2022). In a comprehensive view, sustainable supplier connections has been recognized as a core of institutional competitiveness (Esfahbodi et al., 2016). Therefore, it is impossible for an organization today to be sustainable without considering suppliers for sustainable performance (Esfahbodi et al., 2016; Esfahbodi et al., 2016).

Research on the influence of supplier relationship and organizational culture has been carried out by many previous researchers, but from the results of these research there are gaps in their research, including research findings conducted by Tang and Hsu, (2015); Xiang and Nor (2021), Supplier relationships are seen as an important practice for industry to establish long-term business relationships due to changing environmental issues and diversity of customer behaviour in the marketplace. Thus, be fathomedthat supplier relationship have an influence on organizational culture in the Oil and Gas and Petrochemical Industry. Based on the theory of this research, the researcher formulated the hypothesis in this research as follows:

H5: Supplier relationship influence on organizational culture in Oil and Gas and Petrochemical Industry.

2.6. Organizational Culture and Sustainable Performance

Research on the influence of organizational culture and sustainable performance has been carried out by many previous researchers, but from the results of these research there are gaps in their research, including research findings conducted by Wahab (2022), the research results show this organizational culture has significant effect on sustainability performance. Basit (2022), the research results show that each cultural characteristic has a positive effect on overall company performance, sales growth and return on assets. Martinez et al. (2017) research concluded that the majority of previous studies limited their scope with expressed only in one direction without consider the economic, environmental, and social aspect. Zvidzayi (2021), that organisational culture is a major barrier in implementing lean in the industry. Thus, be fathomedthat organisational culture have an influence on sustainable performance in the Oil and Gas and Petrochemical Industry. Based on the theory of this research, the researcher formulated the hypothesis in this research as follows:

H6: Organisational culture influence sustainable performance in Oil and Gas and Petrochemical Industry.

2.7. Customer Relationship and Sustainable Performance

Research on the influence of customer relationship has been carried out by many previous researchers, but from the results of these research there are gaps in their research, including research findings conducted by Iranmanesh et al. (2019) the results indicate that customer relationships have a positive and significant effect on sustainable performance. Xiang and Nor (2021), the findings show that customer relationship has significant influence on sustainability performance. The finding of this research in line with Sajan et al. (2017) that customer relationship has significant on sustainability performance were particular element in social benefits. Bhamu and Sangwan (2014), customer relationship has significant influence on sustainability performance, that mean external issues like customer and environmental. Thus, be fathomedthat customer relationship have an influence on sustainable performance in the Oil & Gas and Petrochemical Industry. Based on the theory of this research, the researcher formulated the hypothesis in this research as follows:

H7: Customer relationship influence sustainable performance in Oil and Gas and Petrochemical Industry.

2.8. Human Resource Practices and Sustainable Performance

Human resource management (HRM) refers to the practices used to organize individuals and teams who perform work for an organization. Human resource practices to support its business strategy (Chong et al., 2020). Research on the influence of human resource practices and sustainable performance has been carried out by many previous researchers, but from the results of these research there are gaps in their research, including research findings conducted by Hao et al. (2020), the findings show the human resource practices has significant effect on sustainability performance, because of employees' tacit knowledge on create idea of environmental friendly products. The findings in line with Qi et al. (2020), the human resource practices has significant effect on sustainability performance. Thus, be fathomedthat human resource practices have an influence on sustainable performance in the Oil and Gas and Petrochemical Industry. Based on the theory of this research, the researcher formulated the hypothesis in this research as follows:

H8: Human resource practices influence sustainable performance in Oil and Gas and Petrochemical Industry.

2.9. Manufacturing Planning and Control and Sustainable Performance

Research on the influence of manufacturing planning and control and sustainable performance has been carried out by many previous researchers, but from the results of these research there are gaps in their research, including research findings conducted by Aljanadi and Alazzani (2023) the findings demonstrate that most OGCs in Qatar pay more attention to sustainable reporting indicators than the Oil and Gas Companies in other GCC countries. According to Hasan et al. (2023), results indicated a positive relationship between lean manufacturing practices and sustainability. These results are also in line with research by Iranmanesh et al. (2019) which found that lean manufacturing practices have a positive impact on sustainable performance. Thus,

be fathomedthat manufacturing planning and control significant impact on sustainable performance in the Oil and Gas and Petrochemical Industry. Based on the theory of this research, the researcher formulated the hypothesis in this research as follows:

H_9: Manufacturing planning and control has significant impact on sustainable performance in Oil and Gas and Petrochemical Industry.

2.10. Process and Equipment and Sustainable Performance

Research on the influence of process and equipment and sustainable performance has been carried out by many previous researchers, but from the results of these research there are gaps in their research, including research findings conducted by Iranmanesh et al. (2019) the results indicate that process and equipment have a positive and significant effect on sustainable performance. The significant impact of process and equipment on sustainable performance is in line with the findings of studies conducted by Xiang and Nor (2021). Azevedo and Sholiha (2015) the findings show, process and equipment has significant influence on sustainability performance, due to value stream mapping and value stream costing. Thus, be fathomedthat process and equipment have an influence on sustainable performance in the Oil and Gas and Petrochemical Industry. Based on the theory of this research, the researcher formulated the hypothesis in this research as follows:

H_{10}: Process and equipment influence sustainable performance in Oil and Gas and Petrochemical Industry.

2.11. Supplier Relationship and Sustainable Performance

Evaluating each aspect of sustainability as a specific variable raises practical problems when assessing the international sustainability of a company in different directions, just in case the variable develops in several directions. Research on the influence of supplier relationship and sustainable performance has been carried out by many previous researchers, but from the results of these research there are gaps in their research, including research findings conducted by Iranmanesh et al. (2019) the results indicate that supplier relationships have a positive and significant effect on sustainable performance. Wahab (2022); Mahmood et al. (2023), the research results show this supplier relationship has significant effect on sustainability performance. Reversely, the research by Xiang and Nor (2021), the findings showed supplier relationship insignificant effect on sustainability performance. Thus, be fathomedthat supplier relationships have an influence on sustainable performance in the Oil & Gas and Petrochemical Industry. Based on the theory of this research, the researcher formulated the hypothesis in this research as follows:

H_{11}: Supplier relationships influence sustainable performance in Oil and Gas and Petrochemical Industry.

3. RESEARCH METHOD

3.1. Data Collection

Primary data is data obtained directly from the object under research. According to Sugiyono (2019), primary sources are data sources that directly provide data to data collectors. Primary data is the first data obtained or sourced directly from individuals. Primary data was collected using a questionnaire distribution technique, namely a questionnaire is a data collection technique that is carried out by giving a set of questions or written statements to respondents to answer (Sugiyono, 2019). In this research, primary data was obtained through filling out questionnaires distributed to 283 Oil and Gas and Petrochemical Industry employees. According to (Hair et al., 2021) a good sample size is around 100-200 respondents.

This research uses the SEM-PLS method to model the relationship between complex latent variables. Also to know the relationship between dimensions' customer relationship, human resource practices, manufacturing planning and control, process and equipment, and supplier relationship, organizational culture on sustainable performance. The interaction between indicators with the aim of improving sustainable performance can be seen using qualitative and quantitative approaches (Nilsson et al., 2016; Pradhan et al., 2017).

3.2. Population and Samples

Population is a generalization area consisting of objects or subjects that have certain characteristics and quantities determined by the researcher to be studied and then a conclusion. According to Arikunto (2016), the population is the research subject as a whole. Meanwhile, Sugiyono (2019) defines population as a generalized area consisting of objects or subjects that have certain characteristics and qualities determined by the researcher to be studied and then a conclusion is drawn. Population is a generalization area consisting of objects or subjects that have certain characteristics and quantities determined by the researcher to be studied and then drawn conclusions (Yamin et al., 2023). The population in this research was 247 Companies.

The type of sampling technique in this research is Probability Sampling. Probability sampling is a sampling technique where each member of the population has the same chance of being selected as the sample. Probability sampling is any sampling scheme in which the probability of selecting each individual is the same or at least known, so that it can be readjusted mathematically. The probability sampling method in this research is Simple Random Sampling. In this technique, every member of the population has an equal chance of being selected as a subject. The sample consisted of 153 respondents consisting of 32 female and 121 male, and the composition consisted of Oil & Gas Companies 44 respondents; Oil Companies 87 respondents; and Petrochemical Companies 22 respondents. Figure 1 illustrates the research framework of this study.

3.3. Hypothesis

The hypothesis is a temporary answer, because the given is still based on what is relevant to the research question. The provisional answer is not based on empirical facts obtained through data collection. Based on the theoretical basis and empirical evidence from previous research results, and the researcher's framework, the research model hypotheses that can be developed and built can be formulated in this research as follows:

Figure 1: Research framework
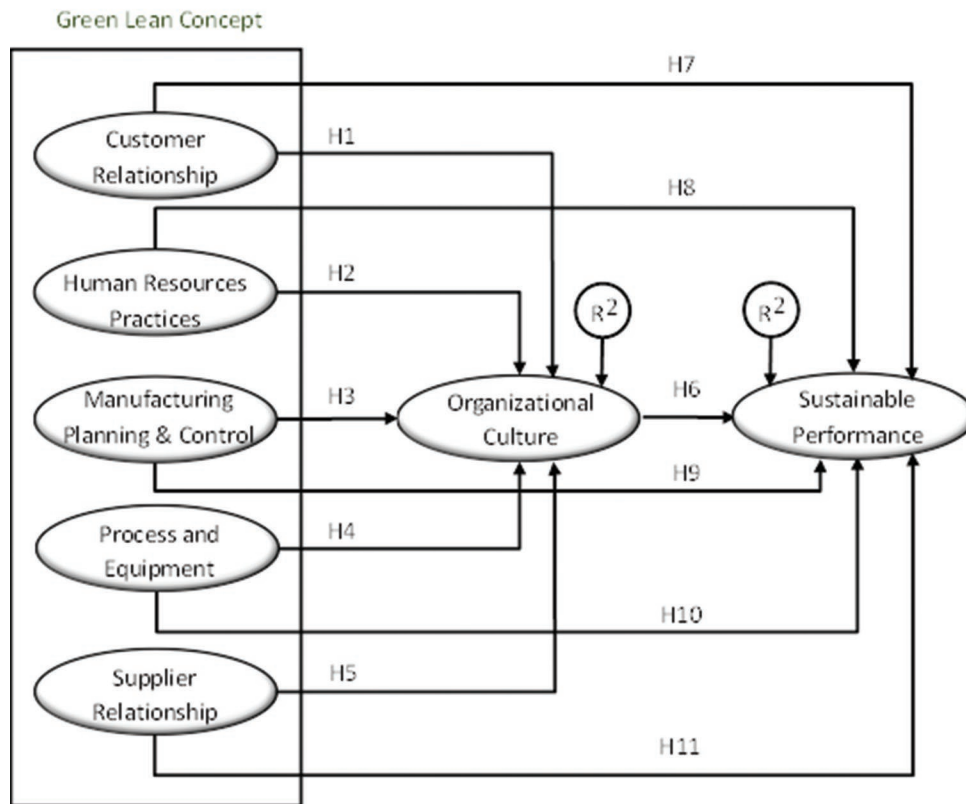
H$_1$: The customer relationship variable is thought to have a positive influence on organizational culture.

H$_2$: The human resource practices variable is thought to have a positive influence on organizational culture.

H$_3$: The manufacturing planning and control variable is thought to have a positive influence on organizational culture.

H$_4$: The process and equipment variable is thought to have a positive influence on organizational culture.

H$_5$: The supplier relationship variable is thought to have a positive influence on organizational culture.

H$_6$: The organizational culture is thought to have a positive influence on sustainable performance.

H$_7$: The customer relationship variable is thought to have a positive influence on sustainable performance.

H$_8$: The human resource practices variable is thought to have a positive influence on sustainable performance.

H$_9$: The manufacturing planning and control variable is thought to have a positive influence on sustainable performance.

H$_{10}$: The process and equipment variable is thought to have a positive influence on sustainable performance.

H$_{11}$: The supplier relationship variable is thought to have a positive influence on sustainable performance.

3.4. Structural Equation Modeling (SEM) Analysis

Structural Equation Modelling - Partial Least Square (SEM-PLS) has two models, namely the measurement model and the structural model. The measurement model is a model that connects the observed manifest variables with the latent variables. Meanwhile, the structural model describes the relationship between latent variables in the SEM-PLS model. Both measurement and structural models are evaluated based on the results of PLS-Algorthm, Bootstrapping and Blindfolding. PLS-Algorthm is a sequential regression procedure with the aim of estimating all unknown elements in the PLS path model.

This research method is quantitative research, data analysis used in this research is using the SEM-PLS method to model the relationship between complex latent variables. Based on the tabulated data from the questionnaire, latent variables were modeled using SmartPLS-4 software. Hair et al. (2021) provide an overview of the evaluation of the PLS SEM model. The following is a summary of the evaluation of the PLS SEM model, namely (Yamin, 2023): (1) Evaluation Measurement Model; (2) Structural Evaluation Model; (3) Evaluation Goodness and Fit Model; and (4) Robustness Check.

Structural Equation Modelling (SEM) is a multivariate analysis technique that was developed due to the limitations of previous analysis models such as regression analysis, path analysis and confirmatory factor analysis. According to Ferdinand (2014) SEM is a multilevel causal model that includes two main types of variables, namely latent variables and observation variables. Meanwhile, according to Santoso et al. (2020), it is a combination of factor analysis and path analysis, which was developed into a complete statistical methodology.

This research uses the variables Customer Relationship (CRE), Human Resource Practices (HRP), Manufacturing Planning and Control (MPC), Process and Equipment (PEQ), and Supplier Relationship (SRE) as exogenous variables and Organizational

Culture (OCU), and Sustainable Performance (SPE) as an endogenous variable. Latent variables are variables that cannot be measured directly, where there are two latent variables, namely endogenous (influenced) and exogenous (influence) variables. Each latent variable is explained by several manifest variables. Manifest variables are variables used to explain latent variables. Manifest variables are in the form of indicators that are reduced to question items in the questionnaire related to their respective latent variables.

The structural equation model in this research is as follows:

$$\eta_1 = \gamma_{11}\xi_1 + \gamma_{12}\xi_2 + \gamma_{13}\xi_3 + \gamma_{14}\xi_4 + \gamma_{15}\xi_5 + \zeta_1 \tag{1}$$

$$OCU = \gamma_{11}CRE + \gamma_{12}HRP + \gamma_{13}MPC + \gamma_{14}PEQ + \gamma_{15}SRE + \zeta_1$$

$$\eta_2 = \beta_{21}\eta_1 + \gamma_{21}\xi_1 + \gamma_{22}\xi_2 + \gamma_{23}\xi_3 + \gamma_{24}\xi_4 + \gamma_{25}\xi_5 + \zeta_2 \tag{2}$$

$$SPE = \beta_{21}OCU + \gamma_{21}CRE + \gamma_{22}HRP + \gamma_{23}MPC + \gamma_{24}PEQ + \gamma_{25}SRE + \zeta_2$$

Where:

CRE: Customer Relationship

HRP: Human Resource Practices

MPC: Manufacturing Planning and Control

PEQ: Process and Equipment

SRE: Supplier Relationship

OCU: Organizational Culture

SPE: Sustainable Performance

ξ_1: Exogenous Latent Variable Customer Relationship

ξ_2: Exogenous Latent Variable Human Resource Practices

ξ_3: Exogenous Latent Variable Manufacturing Planning and Control

ξ_4: Exogenous Latent Variable Process and Equipment

ξ_5: Exogenous Latent Variable Supplier Relationship

η_1: Endogenous Latent Variable Organizational Culture

η_2: Endogenous Latent Variable Sustainable Performance

γ: Path coefficient of exogenous to endogenous latent variables

β: Path coefficients between endogenous latent variables

ζ: Error

3.5. Evaluation Measurement Model (Outer Model Analysis)

The measurement model in this research consists of a reflective measurement model where the variables customer relationship, human resource practices, manufacturing planning and control, process and equipment, supplier relationship, organizational culture, and sustainable performance are measured reflectively. Hair et al. (2021); Yamin, (2023), evaluation of the reflective measurement model consists of a loading factor (outer loading) >0.70; composite reliability >0.70; Cronbach's alpha >0.70; average variance extracted (AVE) >0.70; and discriminant validity,

namely the Fornell and Lacker criteria and HTMT (Heterotrait Monotrait Ratio below 0.90).

3.5.1. Average variance extracted (AVE)
The level of Convergent Validity with AVE is where the recommended value is above 0.50, Hair et al. (2017). Average Variance Extracted (AVE) is a coefficient that explains the variance in an indicator that can be explained by common factors. Some experts see this coefficient as a variant of construct reliability estimates, this coefficient is a property that reveals discriminant validity. In this case the author supports the AVE coefficient as a property of discriminant validity because this coefficient describes internal intercorrelation, namely the correlation between indicators in the model. The minimum recommended AVE value is 0.5. If the AVE value is >0.5, then the indicators in the model being developed are proven to truly measure the targeted latent construct and do not measure other latent constructs.

3.5.2. Discriminant validity with Fornell and Lacker
Fornell and Lacker's criteria are an evaluation of discriminant validity at the variable level, namely a variable has good discriminant validity if the √AVE of the variable is greater than its correlation with other variables (Hair et al., 2021). A part from that, evaluating the measurement model also requires checking discriminant validity, namely checking that the variable is different from other variables and has been tested statistically. The statistical measure for discriminant validity is the Fornell and Lacker criteria. Evaluation of discriminant validity is accepted according to the Fornell and Lacker criteria if the √AVE of each variable is greater than the correlation between the variables.

3.5.3. Heterotrait monotrait ratio (HTMT) criteria
The HTMT (Heterotrait Monotrait Ratio) criteria is the ratio of the Heterotrait (average correlation between items measuring different variables) to the root of the geometric multiplication Monotrait (correlation between items measuring the same variable), Henseler et al. (2014). The HTMT value is below 0.90 which indicates that the discriminant validity evaluation is acceptable (Hair et al., 2017). Heterotrait-monotrait ratio (HTMT) is the ratio of the correlation between traits to the correlation within the trait, where HTMT is the average of all indicator correlations in all constructs that measure different constructs relative to the average of the average indicator correlations. that measures the same construct (Hair et al., 2017).

3.6. Structural Evaluation Model (Inner Model Analysis)
The structural evaluation model examination was carried out in 3 (three) stages, namely: (1) checking that there is no multicollinearity between variables and the Inner VIF (Variance Inflated Factor) measure. An Inner VIF value below 5 indicates that there is no multicollinearity between variables (Hair et al., 2021). (2) Hypothesis testing between variables by looking at the t statistic value or P-value. If the calculated t statistic is >1.96 (t_{table}) or the p-value of the test results is smaller than 0.05, then there is a significant influence between the variables. (3) The f square value is the influence of direct variables at the structural level with criteria (f square 0.02 is low, 0.15 is moderate, and

0.35 is high). Hair et al. (2021) and the f square mediation effect is called the upsilon v statistic which is obtained by squaring the mediation coefficient (Lachowicz et al., 2018) which is interpreted in Ogbeibu et al. (2022) is the low mediation effect (0.02), the mediation effect medium (0.075), and high mediation effect (0.175).

PLS is a variance-based SEM analysis with the aim of testing model theory which focuses on prediction studies. Therefore, several measures were developed to state that the proposed model was acceptable, such as R-square, Q-square, and Goodness of Fit Index (Hair et al., 2019; Yamin, 2023), as well as checking the robustness of the model by testing the linearity of the relationship between variables (Hair et al., 2019; Yamin, 2023).

4. RESULTS AND DISCUSSION

4.1. Demographic Profiles
Demographic rofiles descriptive of respondents are described in Table 1 for the sample size of 153 respondents; this provides percentage and the frequency of respondents. Gender is divided into two groups, female and male, demographic items of female respondents are 32 (21%), and male respondents are 121 (79%). The level of experience is divided into four groups, Demographic items of experience respectively are 1–6 years are 21 (14%), 7–10 years are 31(20%), 11–13 years are 45(29%), and 14 years and above are 56(37%).

4.2. Measurement Evaluation Model (Outer Model Analysis)
4.2.1. Composite reliability, convergent validity and average variance extracted (AVE)
The validity measure is described in the outer loading value or loading factor where the accepted loading factor (LF) value is LF ≥ 0.70. The level of reliability of the research variables from the Cronbach's Alpha, Rho A and Composite Reliability (CR) measures ≥ 0.70, and convergent validity is seen from the Average Variance Extracted (AVE) ≥ 0.50 (Table 2).

The level of reliability of all research variables shows acceptable results where the Cronbach's Alpha, Rho A, and Composite Reliability values are above (0.70), Hair et al. (2017). These results indicate that the internal consistency of each measurement item that measures all research variables is met (Reliable). Research variables have measurement items that are reliable and reliable in measuring these variables.

The interpretation of convergent validity can be said for the Customer Relationship (CRE) variable is that the size of the variation in the CRE1, CRE2, CRE3, CRE4 and CRE5 measurement items contained in the Customer Relationship (CRE) variable is 59.8%, exceeding the accepted convergent validity requirement of above 50%. Therefore, the convergent validity of Customer Relationship (CRE) is accepted. Likewise, the AVE of other variables with estimation results is above 0.50 so that the convergent validity of all research variables is accepted.

4.2.2. Discriminant validity with Fornell and Lacker
Fornell and Lacker's criteria are an evaluation of discriminant validity at the variable level, namely a variable has good discriminant validity if the √AVE of the variable is greater than its correlation with other variables.

The overall, the evaluation results show that the discriminant validity evaluation for the variable is acceptable. The diagonal value in the Fornell and Lacker table above is the √AVE while the other values are the correlation between variables. The √AVE for Customer Relationship (CRE) is 0.773 greater than the correlation with Human Resource Practices (HRP) 0.727, the correlation with Manufacturing Planning and Control (MPC) 0.406 and the correlation with Sustainable Performance (SPE) 0.520 (Table 3). These results indicate that the discriminant validity for the Customer Relationship Variable (CRE) is met. Likewise, with other variables where the entire √AVE of each variable is greater than the correlation with other variables,

Table 1: Respondent's demographic profile

No.	Demographic Items	Frequency	Percentage
	Gender		
1	Female	32	21
2	Male	121	79
	Total	153	100
	Experiences		
3	3–6 years	21	14
4	7–10 years	31	20
5	11–13 years	45	29
6	14 years and above	56	37
	Total	153	100

Table 2: Level of convergent validity and composite reliability

	Cronbach's Alpha	rho_A	Composite reliability	AVE
Customer Relationship (CRE)	0.831	0.832	0.881	0.598
Human Resource Practices (HRP)	0.809	0.815	0.867	0.566
Manufacturing Planning and Control (MPC)	0.795	0.800	0.859	0.549
Process and Equipment (PEQ	0.781	0.788	0.850	0.532
Supplier Relationship (SRE)	0.798	0.805	0.860	0.551
Organizational Culture (OCU)	0.876	0.877	0.904	0.574
Sustainable Performance (SPE)	0.874	0.881	0.903	0.571

Table 3: Fornell and Lacker

	CRE	HRP	MPC	PEQ	SRE	OCU	SPE
CRE	0.773						
HRP	0.727	0.753					
MPC	0.406	0.412	0.741				
PEQ	0.449	0.422	0.376	0.729			
SRE	0.520	0.463	0.314	0.438	0.742		
OCU	0.642	0.647	0.528	0.544	0.572	0.758	
SPE	0.672	0.656	0.439	0.476	0.624	0.719	0.756

the discriminant validity of the Fornell and Lacker criteria is accepted.

4.2.3. Heterotrait monotrait ratio (HTMT) criteria
The HTMT (Heterotrait Monotrait Ratio) criteria is the ratio of the Heterotrait (average correlation between items measuring different variables) to the root of the geometric multiplication Monotrait (correlation between items measuring the same variable).

The evaluation of discriminant validity at both variable levels is HTMT, where according to Hair et al. (2021) if HTMT is less than 0.90 then the discriminant validity evaluation is accepted. According to Hair et al. (2021), this measure has better sensitivity in detecting discriminant validity than the Fornell Lacker criteria. The estimation results show that all variable pairs have an HTMT of <0.90, so the discriminant validity evaluation is accepted. Variables distribute variance to the measurement items that measure each higher than dividing variance to items on other variables (Table 4).

4.3. Structural Evaluation Model (Inner Model Analysis)
4.3.1. Inner variance inflated factor (VIF)
Inner Variance Inflated Factor (VIF) measure where an Inner VIF value below 5 indicates there is no multicollinearity between variables. Data processing Independent variables that influence Organizational Culture (OCU) and Sustainable Performance (SPE) have an inner VIF value of <5, so the multicollinearity between these independent variables is low (can be ignored). These results indicate that the resulting parameter estimates are acceptable. The SEM-PLS model parameter estimates are unbiased and can be used to determine the influence between variables (Table 5).

4.3.2. R-square interpretation value (R²)
The statistical size R square describes the magnitude of variation in endogenous variables that can be explained by other exogenous or endogenous variables in the model. The qualitative R-square interpretation values are 0.19 (low influence), 0.33 (moderate influence), and 0.66 (high influence) (Table 6).

The results of the processing above are that in the first model it can be said that the joint influence of Customer Relationship, Human Resource Practices, Manufacturing Planning and Control, Process and Equipment, Supplier Relationship on Organizational Culture is 61.4%, including a moderate influence approaching high. The second model is the magnitude of the joint influence of Customer Relationship, Human Resource Practices, Manufacturing Planning and Control, Process and Equipment, Supplier Relationship and Organizational Culture on Sustainable Performance of 64.7% (moderate influence approaching high).

4.3.3. Predictive relevance (Q²)
Q square (Q²) measure describes a measure of prediction accuracy, namely how well each change in an exogenous or endogenous variable is able to predict the endogenous variable.

Q square value above 0 states that the model has predictive relevance, but Hair et al. (2019) qualitatively interpreted Q square values are 0 (low influence), 0.25 (moderate influence), and 0.50 (high influence). Based on the processing results above, the Q square variable Organizational Culture (OCU) value is 0.338 and Sustainable Performance (SRE) 0.357 above 0.25, indicating the model has a medium level of predictive relevance (Table 7).

4.4. Fitness Testing Model (Goodness of Fit Model)
The Goodness of Fit Index (GoF Index) is an evaluation of the overall model which is an evaluation of the measurement model and structural model. This GoF index is calculated from multiplying the geometric average communality by the average R square. The interpretation of the GoF index values is 0.1 (low GoF), 0.25 (medium GoF) and 0.36 (high GoF). The calculation results show that the GoF model value is 0.596 > 0.36, including the high GoF category. This means that the empirical data is able to explain the measurement model and the measurement model with a high degree of suitability (Table 8).

4.5. Hypothesis Results
Hypothesis testing of the model begins by looking at the path coefficient value of the relationship between the variables

Table 4: Heterotrait monotrait ratio (HTMT)

	CRE	HRP	MPC	PEQ	SRE	OCU	SPE
CRE							
HRP	0.880						
MPC	0.498	0.508					
PEQ	0.549	0.525	0.480				
SRE	0.638	0.561	0.388	0.554			
OCU	0.745	0.758	0.625	0.648	0.662		
SPE	0.780	0.763	0.521	0.563	0.718	0.816	

Table 5: Variance inflated factor (VIF) value

	OCU	SPE
CRE	2.414	2.495
HRP	2.252	2.418
MPC	1.305	1.425
PEQ	1.425	1.511
SRE	1.499	1.619
OCU		2.589

Table 6: R square value (R²)

	R-square	R-square adjusted
OCU	0.614	0.601
SPE	0.647	0.633

Table 7: Predictive relevance (Q²)

	SSO	SSE	Q² (=1-SSE or SSO)
OCU	1.071.000	708.676	0.338
SPE	1.071.000	689.179	0.357

Table 8: Goodness of Fit Index (GoF Index)

Communality	R-square	GoF Index
0.564	0.631	0.596

(constructs) that is built and then continues by looking at the t statistic value and p value of each hypothesis that was built at the beginning. In SmartPLS the bootstrapping process is the process of calculating the t-statistic value and p value. If the t statistic > t table 1.67 (α 5%) or P > sig α (0.05), it means the hypothesis is not rejected. If the t statistic value < t-table 1.67 (α 5%) or P < sig α (0.05), which means the hypothesis is rejected (Table 9).

The inner model evaluation is testing the hypothesis of direct influence between variables. The SEM-PLS model estimation results are as follows:

1. The first hypothesis (H_1) is that there is a significant positive influence of the Customer Relationship (CRE) variable on Organizational Culture (OCU) with a path coefficient of 0.177 and a t statistic of 2.236 > 1.96 and a P-value of 0.026 < 0.05. Every change in Customer Relationship (CRE) will increase Organizational Culture (OCU).
2. The second hypothesis (H_2) is that there is a significant positive influence of the Human Resource Practices (HRP) variable on Organizational Culture (OCU) variable with a path coefficient of 0.253 and a t statistic of 3.042 > 1.96 and a P-value of 0.002 < 0.05.
3. The third hypothesis (H_3) is that there is a significant positive influence of the Manufacturing Planning and Control (MPC) variable on Organizational Culture (OCU) variable with a path coefficient of 0.215 and a t statistic of 3.096 > 1.96 and a P-value of 0.002 < 0.05.
4. The fourth hypothesis (H_4) is that there is a significant positive influence of the Process and Equipment (PEQ) variable on Organizational Culture (OCU) variable with a path coefficient of 0.182 and a t statistic of 2.652 > 1.96 and a P-value of 0.008 < 0.05.
5. The fifth hypothesis (H_5) is that there is a significant positive influence of the Supplier Relationship (SRE) variable on Organizational Culture (OCU) variable with a path coefficient of 0.216 and a t statistic of 3.583 > 1.96 and a P-value of 0.000 < 0.05.
6. The sixth hypothesis (H_6) is that there is a significant positive influence of the Organizational Culture (OCU) variable on Sustainable Performance (SPE) with a path coefficient of 0.306 and a t statistic of 4.056 > 1.96 and a P-value of 0.000 < 0.05.
7. The seventh hypothesis (H_7) is that there is a significant positive influence of the Customer Relationship (CRE) variable on Sustainable Performance (SPE) with a path coefficient of 0.191 and a t statistic of 2.164 > 1.96 and a P-value of 0.031 < 0.05.
8. The eighth hypothesis (H_8) is that there is a significant positive influence of the Human Resource Practices (HRP) variable on Sustainable Performance (SPE) with a path coefficient of 0.179 and a t statistic of 2.187 > 1.96 and a P-value of 0.029 < 0.05.
9. The ninth hypothesis (H_9) is that there is insignificant influence of the Manufacturing Planning and Control (MPC) variable on Sustainable Performance (SPE) with a path coefficient of 0.040 and a t statistic of 0.609 < 1.96 and a P-value of 0.543 > 0.05.
10. The tenth hypothesis (H_{10}) is that there is insignificant influence of the Process and Equipment (PEQ) variable on Sustainable Performance (SPE) with a path coefficient of 0.026 and a t statistic of 0.364 < 1.96 and a P-value of 0.716 > 0.05.
11. The eleventh hypothesis (H_{11}) is that there is a significant positive influence of the Supplier Relationship (SRE) variable on Sustainable Performance (SPE) with a path coefficient of 0.242 and a t statistic of 3.736 > 1.96 and a P-value of 0.000 < 0.05.

4.6. Mediating Variable Test Results

A mediation test, namely testing the role of Organizational Culture as a mediating variable test results are presented in Table 10.

The results of the mediating variable test can be obtained as follows:

1. The twelfth hypothesis (H_{12}) is accepted where the Organizational Culture (OCU) variable plays a significant role as a mediating variable, namely the variable that mediated the indirect influence of the Customer Relationship (CRE) variable on Sustainable Performance (SPE) with a path coefficient of mediation of 0.054 and a t statistic of 1.997 > 1, 96 and P value 0.046 < 0.05.
2. The thirteenth hypothesis (H_{13}) is accepted where the Organizational Culture (OCU) variable plays a significant role as a mediating variable, namely the variable that mediated the indirect influence of the Human Resource Practices (HRP) variable on Sustainable Performance (SPE) with a path coefficient of mediation of 0.078 and a t statistic of 2.245 > 1.96 and P value 0.025 < 0.05.

Table 9: Hypothesis results

Hypothesis	Indicator	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O or STDEV|)	P-values	Remarks
H_1	CRE → OCU	0.177	0.165	0.079	2.236	0.026	Significant
H_2	HRP → OCU	0.253	0.252	0.083	3.042	0.002	Significant
H_3	MPC → OCU	0.215	0.222	0.069	3.096	0.002	Significant
H_4	PEQ → OCU	0.182	0.187	0.069	2.652	0.008	Significant
H_5	SRE → OCU	0.216	0.219	0.060	3.583	0.000	Significant
H_6	OCU → SPE	0.306	0.299	0.075	4.056	0.000	Significant
H_7	CRE → SPE	0.191	0.194	0.088	2.164	0.031	Significant
H_8	HRP → SPE	0.179	0.173	0.082	2.187	0.029	Significant
H_9	MPC → SPE	0.040	0.042	0.065	0.609	0.543	Insignificant
H_{10}	PEQ → SPE	0.026	0.028	0.072	0.364	0.716	Insignificant
H_{11}	SRE → SPE	0.242	0.252	0.065	3.736	0.000	Significant

Table 10: Mediating test results

Hypothesis	???	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T Statistics (|O or STDEV|)	P-values	Remarks
H_{12}	CRE → OCU → SPE	0.054	0.049	0.027	1.997	0.046	Significant
H_{13}	HRP → OCU → SPE	0.078	0.076	0.035	2.245	0.025	Significant
H_{14}	MPC → OCU → SPE	0.066	0.066	0.026	2.518	0.012	Significant
H_{15}	PEQ → OCU → SPE	0.056	0.056	0.025	2.249	0.025	Significant
H_{16}	SRE → OCU → SPE	0.066	0.066	0.026	2.590	0.010	Significant

3. The fourteenth hypothesis (H_{14}) is accepted where the Organizational Culture (OCU) variable plays a significant role as a mediating variable, namely the variable that mediated the indirect influence of the Manufacturing Planning and Control (MPC) variable on Sustainable Performance (SPE) with a path coefficient of mediation of 0.066 and t statistics. 2.518 > 1.96 and P value 0.012 < 0.05.

4. The fifteenth hypothesis (H_{15}) is accepted where the Organizational Culture (OCU) variable plays a significant role as a mediating variable, namely the variable that mediated the indirect influence of the Process and Equipment (PEQ) variable on Sustainable Performance (SPE) with a path coefficient of mediation of 0.056 and a t statistic of 2.249 > 1.96 and P value 0.025 < 0.05.

5. The sixteenth hypothesis (H_{16}) is accepted where the Organizational Culture (OCU) variable plays a significant role as a mediating variable, namely the variable that mediated the indirect influence of the Supplier Relationship (SRE) variable on Sustainable Performance (SPE) with a path coefficient of mediation of 0.066 and a t statistic of 2.590 > 1.96 and P value 0.010 < 0.05.

5. CONCLUSION

Based on the research questions, research objectives, research results, and discussions that have been carried out to answer questions and achieve the researcher's objectives, the conclusion of this research is that, the green lean concept is proxied by customer relationships, human resource practices, manufacturing planning and control, process and equipment, and supplier relationships have a positive and significant effect on organizational culture in the Oil & Gas and Petrochemical Industry in Indonesia.

Customer relationship, human resource practices, manufacturing planning and control, process and equipment, and supplier relationships can increase sustainable performance both directly and indirectly through organizational culture, but the indirect effect is more dominant. Thus, the effect on sustainable performance, the organizational culture variable is a mediating variable. Organizational culture variable is "Fully Mediating" the sustainable performance variable in the Oil and Gas and Petrochemical Industry in Indonesia.

Customer relationship, human resource practices, manufacturing planning and control, process and equipment, supplier relationships, and organizational culture have a positive and significant effect on sustainable performance in the Oil & Gas and Petrochemical Industry in Indonesia. The R-squared value is 65% that green lean concept able to explain, while the remaining 35% explained by other factors that were excluded in this research.

5.1. Managerial and Theoretical Implications
This research explores the positive effect of implementing green lean concept is proxied in customer relationship, human resource practices, manufacturing planning and control, process and equipment, and supplier relationship on organizational culture as mediating variable, its implication on sustainable performance in Oil and Gas and Petrochemical Industry. The findings can be helpful in exploring the literature for further research. The results of the research findings show that the green lean concept, has shown very good, but there are still several aspects of the customer relationship, human resource practices, manufacturing planning and control, process and equipment, and supplier relationship role dimensions according to improvements. It is recommended to improve the indicators through organizational culture to improve sustainability performance in the Oil and Gas and Petrochemical Industry.

The theoretical implication is that Sustainable Performance in the Oil and Gas and Petrochemical Industry as reflected by the green lean concept is by improving organizational culture, especially as reflected by organizations considering sustainability. Also, organizational culture will increase if the Oil and Gas and Petrochemical Industry is able to increase the role of customer relationship, especially the customer feedback dimension, which is supported by human resources practices, especially those reflected by contributing to improving the company, also supported by manufacturing planning and control. As well as supplier relationships, especially as reflected by direct involvement of suppliers with the new product development process.

6. RECOMMENDATIONS

Manufacturing planning and control and process and equipment variables has insignificant effect on sustainable performance in Oil and Gas and Petrochemical Industry in Indonesia, so manufacturing planning and control and process and equipment variables are recommended to be included in further research on different research objects. The results research show that the contribution of customer relationships, human resource practices, manufacturing planning and control, process and equipment, and supplier relationships to organizational culture in the Oil and Gas and Petrochemical Industry contributes 61%, so that there is still 39% which is influenced by other factors, so it is recommended that further research is needed.

6.1. Limitations

This research consists of 5 (five) independent variables consisting of customer relationship, human resource practices, manufacturing planning and control, process and equipment, and supplier relationship, 1 (one) intervening variable namely organizational culture, and the dependent variable is sustainable performance has several limitations are as follows: (1) research subjects were 153 employees who worked in the Oil & Gas and Petrochemical Industry; (2) the research object is the Oil and Gas and Petrochemical Industry in Indonesia; (3) when this research was carried out from September 2023 to March 2024.

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