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The moderating of portfolio sustainability impact on oil and gas corporate management resilience in Indonesia

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Abstract: In recent volatility, uncertainty, complexity, and ambiguity (VUCA) environments, significant challenges are posed to the business world. Sustainable portfolio governance (SPG) plays a crucial role in enhancing the resilience of project portfolio management offices (PPMOs) to navigate these challenges. However, its application, particularly within the oil and gas (OG) industry, remains underexplored in existing literature. This study aims to address this gap by examining how SPG influences PPMO resilience, with VUCA as a moderating factor. A mixed-methods approach was used, combining a literature review to develop a conceptual framework and a survey to test an empirical model. Data were collected from 112 project management team members in OG companies and analyzed using structural equation modeling (SEM). The results show that SPG significantly enhances PPMO resilience, but VUCA conditions weaken the relationship. These findings underscore the need to formulate strategies to effectively manage VUCA, enabling organizations to quickly adapt to disruptive changes and improve project portfolio outcomes. By addressing these dynamics, this study highlights the critical role of SPG in fostering organizational resilience, particularly in industries that are highly impacted by unpredictable and complex environments such as oil and gas.

Keywords: *Oil and gas, Organizational; VUCA, Project management, Resilience, Sustainability.*

1. Introduction

The oil and gas (OG) industry faces several challenges and pressures to build a sustainable portfolio that adapts and thrives in a dynamic environment [1]. In an era marked by volatility, uncertainty, complexity, and ambiguity (VUCA), these conditions are difficult to predict but often arise and can influence the business environment, including the OG industry. High level of dependence on petroleum [2] impact of OG infrastructure development [3] various risks that spread across upstream and downstream sectors [4] and unsustainable use of resources [1] demands attention to developing sustainable project governance [5].

The need to integrate principles of sustainability project portfolio governance (SPG) while enhancing the resilience of the project portfolio management office (PPMO) is critical for long-term planning and decision-making [6]. This is because SPG emphasizes sustainability in various decisions regarding projects in the OG sector by considering their impact on the environment, economy, and society. On the other hand, organizations in PPMO must be able to manage projects in a company to run well, including adequate resource allocation on time and according to budget. The problems that arise in OG projects can be seen in facing challenges in making difficult strategic decisions and building a sustainable portfolio for the long term. This is important due to the need to align the project portfolio with sustainability goals and manage resources and risks effectively. The various issues that arise require proactive action and strategic decisions to balance economic growth with environmental and

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social responsibility in the OG industry [7]. Developing a sustainable project governance model to enhance PPMO resilience can address issues and promote sustainable practices in the sector [8].

Indonesia as a developing country, with abundant natural resources, is still very dependent on the OG sector for state revenue and energy resilience. The impact of oil prices on the profits of the OG sector in Indonesia varies and shows a complex relationship [9]. On the other hand, Indonesia is also taking steps to reduce dependence on oil by switching to gas and developing renewable energy sources [10]. According to Simanjuntak and Mahendrawan [11] the reduction in production and decreasing income requires awareness of sustainable management.

Based on this, a sustainable project management model is needed in the development and management of project portfolios, especially in companies in the OG sector in the VUCA era [12]. Although various studies have examined aspects of sustainable development and project management [13-18]. A research gap exists in developing a comprehensive sustainable project governance system that explicitly targets resilience in the OG industry. This study aims to address the research gap by investigating and proposing a new model that integrates sustainability principles into project governance practices and enhances the resilience of project portfolio management in the OG industry, particularly in Indonesia.

2. Literature Review

2.1. Oil and Gas Industry in Indonesia

The OG industry is renowned for its complex and large-scale projects that require efficient management practices to ensure successful delivery. The OG sector in Indonesia, in terms of state revenue and energy resilience, is described by the difference between demand projections and domestic supply capacity, where the country's dependence on imports for oil supplies is increasing. The OG industry is essential in driving the Indonesian economy, especially as a source of budgeting, revenue, and energy for various sectors. However, Indonesia is also taking steps to reduce its reliance on oil by switching to gas and renewable energy sources [10]. The impact of oil prices on the profits of the OG sector in Indonesia varies and shows a complex relationship [9, 19]. This condition emphasizes the need for a national energy policy to assess domestic potential by setting goals to achieve higher, economically viable and environmentally sound production levels. Therefore, the OG sector requires strategic planning to ensure sustainability and resilience in an ever-changing global landscape.

The need for fuel consumption in Indonesia continues to increase yearly, even though the government has attempted to control and diversify fuel into other fuel types. Around 30-40% of domestically produced crude oil is exported abroad because Indonesian oil is of good quality (sweet crude oil) and has a higher selling value. In addition, most domestic oil refineries can only process sour crude oil, so the government has implemented an import policy to meet the needs of these refineries. Crude oil from domestic mining (lifting) that is not exported and imported crude oil is then supplied to oil refineries throughout Indonesia to produce Fuel Oil (BBM) and Non-BBM products.

Projects supporting OG infrastructure are of primary importance, as projects and project management are crucial components of an organization to respond to change and maintain competitive advantage. Some essential reasons for developing OG infrastructure in Indonesia, namely the first is the increase in energy demand along with population growth and industrial expansion [20]. Second, the development of OG infrastructure is significant for achieving energy sovereignty and encouraging economic growth through infrastructure development and improvement, thus supporting the utilization of domestic OG resources [21]. This involves optimizing the extraction, processing, and distribution of resources, resulting in more significant domestic benefits and reduced dependence on imports [22]. Another reason is the availability of accessibility and an adequate delivery transportation system to supply refined fuel and liquefied petroleum gas to all Indonesian people [23]. Overall, developing OG infrastructure in Indonesia is vital to meeting energy needs, encouraging economic growth, ensuring energy resilience, optimizing domestic utilization, and improving accessibility and delivery systems.

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However, the development of OG infrastructure also has negative impacts, including environmental pollution, including air, water and land pollution [3, 24, 25]. This was also confirmed by Ismukurnianto [25] that the extraction, refining and burning of fossil fuels contribute to greenhouse gas emissions and exacerbate climate change. Spills, leaks and improper disposal of waste during OG operations can contaminate land and water resources, negatively impacting local communities and ecosystems [3, 24, 25] and disruption to local communities due to displacement, disruption of livelihoods, and conflict over land rights and resources [3].

In general, using petroleum as an energy source is driven by industrialization. The more industries there are, the more energy resources are needed. In this context, economic growth will also increase the oil demand. More than half of the global market for energy resources is currently met by oil and natural gas, and according to forecasts, it will grow 1.5 – 2 times more significantly over the next 30–50 years [2]. The high dependence on petroleum shows that energy in the form of petroleum is vital, so improving petroleum governance is an urgent matter to be carried out to realize national energy sovereignty [5]. Indonesia has significant OG reserves, and by exploring and exploiting these resources, the country can increase its energy resilience, generate state revenues, and drive economic development [26] while considering sustainable practices to minimize negative impacts.

2.2. Sustainable Portfolio Governance (SPG)

Portfolio governance is the decision-making and oversight process to ensure projects are running according to company objectives. Sustainability in portfolio governance (SPG) is intended to control and balance the company's financial benefits and protect the environment. In this case, SPG is a practice that supports long-term environmental, social, and economic sustainability. According to Aghajani, et al. [13]; Derakhshan, et al. [27] and Schipper and Silvius [17] achieving sustainability involves corporate organizations overseeing or monitoring projects using a strategic and integrated approach to managing a portfolio of projects that are oriented toward not only financial gain but also value creation through decision-making and policy implementation that is aligned with sustainability goals. The study by Klimenko and Apenko [6] also supports this. In the research, they investigated how to integrate sustainability strategies into project portfolios. Their case study highlights that to implement sustainability in a project portfolio, it is essential to establish a sustainability team within an organization that manages the sustainability strategy and controls it in KPIs to measure the success of projects in terms of sustainability goals. On the other hand, Tuominen and Martinsuo [28] emphasized that project governance practices can differ in each company depending on the type or characteristics of the company in the industry. There are three different approaches formulated, including *delegated portfolio governance*, *consultative portfolio governance* and *regulated portfolio governance* – where these three frameworks have the same goal, that is to support the strategic goals of the organization and the company's long-term strategy.

Study of Biesenthal and Wilden [29] divides governance into different levels that are believed to provide opportunities for applying existing governance theories, namely organizational level, portfolio level and project level. The organizational level emphasizes strategic performance targets, the long-term impact and competitiveness of the organization, its impact on society, benefits for external stakeholders or shareholders, and the sustainability of the projects being implemented. At the portfolio level, the emphasis is on intermediary organizational structures in a project-based environment whose purpose is to align projects, programs, and portfolios with strategic objectives at the corporate level. In short, this is a project liaison with organizations (such as PPMO). Lastly is the project level, where the primary objectives and performance measures are short-term and goal-oriented to align with the nature of the particular project [29].

SPG is also not free from various obstacles and challenges when adopting its practices, especially in the OG industry. Some of these obstacles and challenges include the lack of maturity in implementing value-added management practices Zhan, et al. [30] the increasing need to align with sustainable

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development goals [14] the challenge of reducing carbon emissions through initiatives such as the clean development mechanism [31] and lack of resources in applying artificial intelligence to promote sustainable development [32].

2.3. Project Portfolio Management Office (PPMO) Resilience

Project Portfolio Management Office (PPMO) is a team appointed to manage the project portfolio. A resilient PPMO emphasizes the organization's ability to adapt and recover from disruptions. According to Leontieva and Makarova [33] a resilient PPMO is critical for organizations to effectively navigate a dynamic and uncertain business environment to ensure long-term competitiveness, sustainability and success. Varajão, et al. [34] stated that resilient project portfolio management addresses volatility and uncertainty, such as market fluctuations, regulatory changes, and progress. This is because resilient portfolio management is supported by the flexible nature of the organization, making it possible to address various challenges and opportunities simultaneously [35]. According to Rahi [36] by integrating the concept of resilience, projects can be supported to maintain their performance through a flexible, systemic and specific approach when facing disruptive events.

Integrating project portfolio management into strategic planning systems is critical for OG companies. Effective project portfolio management aligns project selection and prioritization with the organization's overall strategic objectives, ensuring optimal resource utilization and better project outcomes Song [12] this also simultaneously helps prioritize and select projects that contribute to realizing the vision and mission of the organization [37]. By managing a project portfolio effectively, organizations can optimize resource allocation across projects to minimize their negative impacts [38].

Effective project portfolio management benefits organizations by gaining a competitive advantage in the marketplace [21]. On the other hand, project portfolio management plays an essential role in achieving the goals of state entities and companies in the OG sector [33] has a direct impact on the organization's business model [39] shaping and aligning the organization's processes, operations, and value propositions with strategic objectives through project selection and prioritization [40] and provide a platform for effective governance, ensuring that projects are governed and managed by established best practices, thereby facilitating the implementation of the project governance framework, efficient decision-making and oversight [41].

Several critical factors of project portfolio management resilience have been identified in previous studies as crucial factors. These factors include creative and innovative [34, 37]. Trust, focus, commitment, management, skill and behaviour [34] effective communication [6] quality and agility of decision-making [36] value management [10] project organization [42, 43] role of PPMO and portfolio balance [18] risk and vulnerability management [36] interdependencies between projects [42] as well as knowledge and learning aspects [15]. Understanding and managing these critical factors effectively can contribute to the success and resilience of project portfolio management.

2.4. Volatility, Uncertainty, Complexity and Ambiguity (VUCA)

VUCA is an abbreviation for volatility, uncertainty, complexity, and ambiguity. Several studies provide an understanding of the definition of VUCA, such as in the study Fridgeirsson, et al. [44] which states, Volatility refers to the level of variation and uncertainty in factors related to a project such as scope, requirements, resources, and external influences, where these events experience rapid and unpredictable changes that can affect project outcomes. In the research of Taskan, et al. [45] also stated that volatility is a disruptive, unstable and unexpected change but can provide an opportunity to gain profit. On the other hand, volatility challenges project management approaches because it makes it difficult to create adaptive and flexible strategies to effectively respond to unexpected developments and changes[46].

Uncertainty is defined as the inability to evaluate the objectives and characteristics of a project and the consequences of actions and decisions on the overall project environment [36]. There is a lack of

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knowledge about whether an event will have a significant impact; causes and effects are understood, but it is unknown whether an event will create significant change [46]. In other words, Uncertainty relates to events that cannot be predicted or events that are unknown due to lack of knowledge (Shet, 2024). Often the level of uncertainty will tend to be high at the beginning of a project and is expected to decrease as the project approaches closure.

Complexity can be defined in terms of differentiation and interdependence, managed through integration. According to Fridgeirsson, et al. [46] Complexity consists of many interconnected parts, forming an information network with complex procedures; often diverse and convoluted but not necessarily related to change. The same definition is also mentioned in the research of Taskan, et al. [45] that Complexity is related to the chaos that arises and is interconnected, often encountered every day and is the cause of uncertainty. Complexity is not only limited to technical aspects but also includes social aspects including the diverse goals, interests, and needs of various stakeholders. In this case, Complexity is not only about managing work but also about managing human resources to deliver results, with an emphasis on the social aspects of the project. In addition, Complexity is often associated with interaction complexity, which reflects the dynamic and diverse relationships between project components and stakeholders. Therefore, it is necessary to create a framework for managing complex projects by highlighting the importance of understanding and addressing the nature of project Complexity from various aspects [46].

Lastly, Ambiguity relates to unclear circumstances due to individual behavior, lack of data, lack of detail, lack of structure for considering the problem, working assumptions and frameworks used to consider the problem, known and unknown sources of bias, and ignorance about how much effort needs to be expended to clarify the situation [36]. Ambiguity is defined as the lack of clarity regarding who, how, and why an event occurred. In this case, there is an inability to understand the occurrence of the event, either from experience or using logic – which can trigger multiple interpretations [47]. According to [46] Ambiguity is often caused by cultural differences and the level of optimism of stakeholders, increasing the likelihood of project failure. Cause and effect are not understood and there is no precedent for making predictions about what is expected to happen. In short, the term VUCA become popular because of its characteristics that affect projects based on the project manager's decision to allocate resources effectively [46].

The OG industry operates in a VUCA environment with various challenges and risks, such as geopolitical changes Shet [48] changes in world OG prices, especially during the pandemic Chandranegara and Hoesein [5] which resulted in the OG industry experiencing a decline in demand [49] including various policies that are starting to require a switch to using renewable energy [2]. On the other hand, these various challenges also encourage the implementation of technological innovation [2] enhance the organization's ability to be more resilient [5] and encourage active participation of stakeholder to find solutions and make decisions quickly [14, 48]. Therefore, VUCA can be said to have negative or positive threats for companies [16]. Organizations across the industry have adopted a sustainable project governance model to address this. This model aims to enhance conventional risk assessment procedures by incorporating the VUCA framework [46]. A fast and collaborative approach is required for leaders to navigate VUCA situations effectively and develop productive projects.

Overall, the VUCA issues highlight the need for an adaptable and comprehensive approach to project governance to address the challenges. The VUCA framework provides a thorough understanding of the types and severity of challenges present in any project. It helps project leaders and organizations identify and assess the risks associated with VUCA in the OG industry.

2.5. Hypotheses Development

Sustainable practices in industrial practices involve balancing social, environmental, and economic aspects of project implementation [50]. Ensuring project sustainability is essential which can be achieved with the right organizational structure [51]. Integrating sustainability into the project

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portfolio process can have a positive impact on the resilience of project portfolio management. According to Aghajani, et al. [13] by considering sustainability factors, such as environmental and social impacts, in the project selection and management process, organizations can improve their ability to adapt to change and mitigate risks. The integration of sustainability assessments as well as the integration of actors in the project portfolio management process can support long-term scalability and sustainability [52]. In addition, integrating renewable energy sources, implementing energy efficiency, and applying new technologies, especially in the oil and gas industry, can reduce emissions and contribute to a more sustainable future. Overall, adopting a sustainability-focused approach in project portfolio management can help organizations in the oil and gas industry achieve their strategic goals while addressing sustainability and resilience challenges [12]. Therefore, the following hypothesis is proposed:

H_1: Sustainable portfolio governance has a positive influence on the resilience of the project portfolio management office.

Understanding and adapting to volatile and uncertain industry dynamics is critical to project success and maximizing value in this complex environment. VUCA requires proficient skills and methodologies in project governance. For example, employees must be proficient in Results-Based Monitoring and Evaluation, Strategic Planning, Program and Project Management Methodologies, and Change Management Methodologies to deliver good service in a VUCA environment Bredillet [53]. Fridgeirsson, et al. [44] stated that the VUCA framework provides a new approach to assessing complex project risks. It emphasizes that organizations have the ability to consider the volatile and uncertain nature of markets in risk assessment. Haouel and Nemeslaki [54] show that VUCA can encourage organizations to adopt innovation and technology. Organizations in the oil and gas industry can benefit from the use of innovative technologies, including the application of digital technologies that have a positive and significant impact on increasing hydrocarbon recovery, ensuring safety, and improving operational reliability in the industry. It also highlights the potential for long-term success and profitability through digital transformation in the oil and gas sector. By utilizing technological advances, project performance and efficiency can be improved. Next, the following hypothesis is proposed:

H_2: VUCA has a positive influence on the resilience of the project portfolio management office

H_3: VUCA moderates the influence between sustainable portfolio governance and resilience of the project portfolio management office

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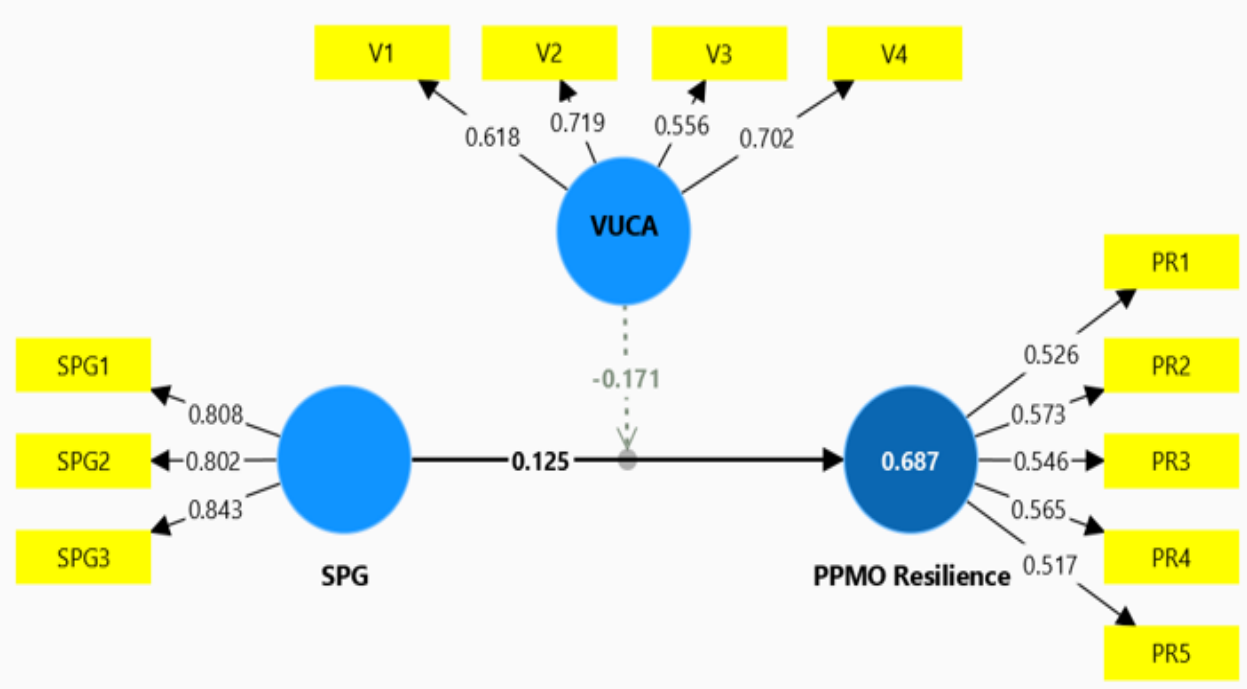

Figure 1.
Conceptual model of research.

Figure 1 presents a conceptual model of the relationship between sustainable portfolio governance and increasing PPMO resilience moderated by VUCA. The sustainable portfolio governance variable has three indicators: organizational-level governance, PPMO-level governance and project-level governance. The PPMO resilience variable has five indicators: trust, adaptability, transformability, flexibility and commitment. The moderating variables include volatility, uncertainty, complexity and ambiguity (VUCA).

3. Method

3.1. Procedure

This study uses a combination of qualitative and quantitative approaches. Qualitative research through literature review is used to collect relevant articles on sustainable project governance and its application in dealing with VUCA in the OG industry. Furthermore, a quantitative approach is used to empirically confirm the theoretical model found based on the results of the literature review.

Before the primary survey, a preliminary survey was conducted involving experts, namely three practitioners and two academics, to provide suggestions for the initial questionnaire. The trial conducted on expert respondents in the industry serves as an initial step to evaluate the questionnaire questions so that they can be well understood by respondents in the main survey, including whether the questions represent what is to be achieved in the research objectives.

Furthermore, the primary survey was limited to the DKI Jakarta area because this city is considered the largest city in Indonesia, and companies in this area handle many OG projects in Indonesia. Using purposive sampling techniques, data was collected using electronic surveys via email and social media messages to related companies. The advantage of using electronic surveys compared to paper-based surveys is the speed of data collection so that it is more time-efficient [55] minimize costs, flexible for respondents to be able to fill out the questionnaire anywhere and anytime [56] and increase the response rate more quickly if there are invalid questionnaire results.

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The questionnaire survey consists of two parts. The first part requires respondents to fill in their identity in the form of work experience, position, and type of company organization. The second part contains the respondents' perspectives on the statement of SPG, PPMO resilience, and VUCA factors that are drivers and obstacles to the successful implementation of PPMO resilience. Data collection through a questionnaire survey was carried out on project managers and executives. The survey was distributed for six months, from January to July 2024. Finally, 112 valid questionnaires were obtained from the project management team with approximately ten years of experience in Indonesia's OG industry:

3.2. Measurement and Analysis Testing

The use of the SEM model in this study is to test the non-hierarchical hypothesis model, namely the influence of independent variables on dependent variables and their changes through the presence of moderating variables that can strengthen or weaken the relationship between the two variables. A 5-point Likert scale was used to assess the level of respondent agreement, where the value 1 = disagree to a scale of 5 = strongly agree. Confirmatory data analysis through structural equation modeling (SEM) using SmartPLS (partial least square). Some of the reasons for using PLS-SEM in this study include the data collection that does not require a large sample, although it should be underlined that it can cause sampling errors due to the small sample size; Data sets that do not need a multivariate normal distribution; and the SEM model developed is not in the form of a causal loop [57].

In testing the SEM model, two criteria are assessed: validity testing through convergent validity and discriminant validity and reliability testing using internal consistency reliability. Convergent validity is used to measure the extent to which constructs are interrelated. To assess convergent validity using the average variance extracted (AVE) with a minimum value of 0.5 [58] and or can use composite reliability (CR). Discriminant validity functions to measure each construct in a different model and is not correlated or overlapping with each other. The use of cross-loading and the Fornell-Larcker criteria are used in evaluating discriminant validity [59]. Furthermore, internal consistency reliability is used to measure the consistency of the results of the indicators on the latent variables. The assessment uses composite reliability (CR) with a threshold value of >0.70 [59]. If the value is lower, it can be removed, but some researchers also maintain a threshold value of 0.40 [60, 61].

4. Result

4.1. Respondent Characteristics

Respondent characteristics are presented to help researchers understand the background of respondents used as research samples. The characteristics displayed describe respondents related to position, educational qualifications, and work experience. The results are shown in Table 1.

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Table 1.
Respondent demographics.

Respondent demographics	Frequency	Percentage (%)
Position		
Junior Staff	36	32.1
Senior Staff	60	53.5
Manager	16	14.2
Educational qualifications		
Bachelor's degree	56	50
Master's degree	48	42.9
Doctor degree	8	7.1
Work experience		
< 5 years	31	27.7
5-10 years	44	39.2
10-15 years	20	17.9
> 15 years	17	15.1

The respondents' involvement in the study was mostly as senior staff, with a percentage of 54% having educational qualifications as bachelor graduates and having experience working in OG companies for 5-10 years (39%). This shows that respondents have sufficient knowledge about project portfolio governance, so this study appropriately targets informants to reduce research bias.

4.2. Model measurement

The following shows the measurement of the model using PLS. The results of the model evaluation are shown in Table 2. To assess the level of significance of the structural model can be seen the value of R^2. This study describes that PPMO resilience is positively influenced by SPG through VUCA moderation. The value of R^2 for PPMO resilience is 0.687, which indicates that 68.7% of the variance of PPMO resilience can be explained by SPG and VUCA. Furthermore, based on the results of the convergent validity test through loadings factor, average variance extracted (AVE), and composite reliability (CR), the loading of all constructs has a value that exceeds the recommended value of >0.6 [62]. AVE, which shows the total variance of the indicators in the construct, is also at a value of 0.6, where this value is within the range recommended by Hair, et al. [59] of 0.50, which indicates that the model has adequate convergent validity.

Table 2.
Validity and reliability model evaluation measurements.

Construct	Indicator	Factor loading	Cronbach's alpha	CR	AVE
Sustainable portfolio governance	SPG1	0.808	0.757	0.817	0.669
	SPG2	0.802			
	SPG3	0.843			
PPMO resilience	PR1	0.526	0.610	0.835	0.698
	PR2	0.573			
	PR3	0.546			
	PR4	0.565			
	PR5	0.517			
VUCA	V1	0.618	0.744	0.790	0.625
	V2	0.719			
	V3	0.556			
	V4	0.702			
R^2 = 68.7%					

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Table 3.
Fornell-Lacker criteria.

	PPMO Resilience	SPG	VUCA
PPMO Resilience	0.835		
SPG	0.053	0.817	
VUCA	0.103	0.135	0.790

Table 3 shows the discriminant validity test of the indicator using the Fornell-Larcker criteria calculated based on the square root value of AVE. The test results show values in the range of 0.817 (SPG), 0.835 (PPMO resilience), and 0.790 (VUCA), where these values are more significant than the correlation values between other constructs. The last is the internal consistency reliability test, which looks at the composite reliability (CR) and Cronbach's alpha values. The results of the model evaluation show CR and Cronbach's alpha values >0.6, where this value exceeds the required threshold and is acceptable. Thus, the construct has good internal consistency reliability.

4.3. Structural Model Testing

The results of the structural model testing are shown in Figure 2 and Table 4. This study uses three constructs, SPG, PPMO resilience and VUCA, as moderating variables. The results of the path analysis show that SPG has a direct positive influence on PPMO resilience (β= 0.125, t-value= 2.213) and is significant at 0.05, while VUCA has a negative influence (β= -0.171, t-value= 2.586) and significant at p-value <0.05. These results show that SPG positively impacts PPMO resilience practices through full support. However, the VUCA factor that moderates the relationship between factors has a negative impact on the relationship between SPG and PPMO resilience. These results confirm that the presence of VUCA can weaken SPG practices, thereby reducing PPMO resilience performance.

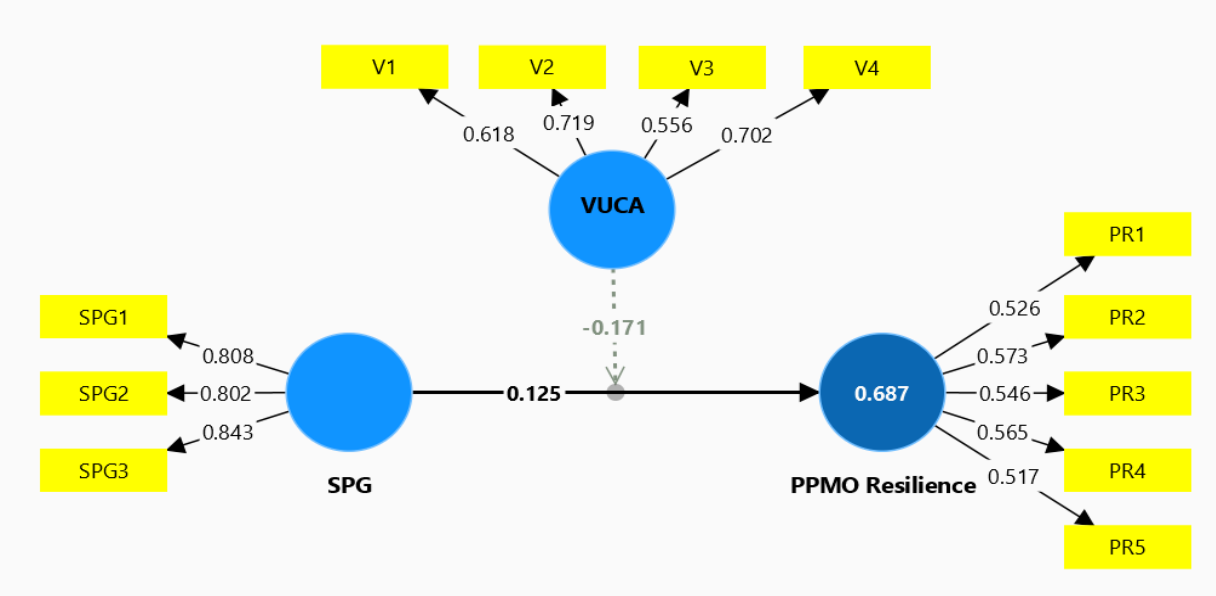

Figure 2.
Path model.

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Table 4.
Result evaluation path model.

Relationship construct	Coefficient	t-value	p-value	Result
SPG -> PPMO Resilience	0.125	2.213	0.026	Supported
VUCA -> PPMO Resilience	0.210	2.205	0.017	Supported
VUCA x SPG -> PPMO Resilience	-0.171	2.586	0.013	Supported

5. Discussion

5.1. Theoretical Implications

The OG industry faces increasingly complex challenges and often experiences unexpected conditions. Studying the resilience of PPMO is essential to understanding how sustainable governance organizations can be successfully implemented in the VUCA era. This study provides important theoretical contributions to the body of knowledge, especially in the field of project management. At the same time, this study contributes to improving the understanding of the correlation between sustainable governance and PPMO resilience when VUCA events occur in OG projects.

Sustainability goals in the OG industry have become important because they provide valuable impacts for the long term. The challenge currently faced is the fragmentation of sustainability governance with company project management. In this case, integration between stakeholders by including sustainability goals is still neglected due to the complexity of the project which requires various tools and strategies for successful implementation. Based on the analysis of the empirical model of this study, it was found that there is a positive relationship between SPG and PPMO resilience. These results confirm the research of Aghajani, et al. [13] found that by including sustainability values, company profitability could be increased, including cost recovery, minimizing project risk and timely project completion. On the other hand, by including sustainability as a long-term goal, the selection of project portfolios is not only financially beneficial but also in terms of environmental aspects such as minimizing carbon emissions, efficient use of natural resources, better waste management; and in terms of social aspects that include improving community welfare, attention to worker safety and health and more organized stakeholder relations [17]. In short, success in sustainable projects creates value for society, the organization and the environment [27].

VUCA as a moderating variable has a negative effect on the relationship between SPG and PPMO resilience in Indonesia's OG industry. These results underline several reasons, namely, first, the rapid decision-making process becomes a critical point if there is a disruption to the project. In Indonesia, bureaucratic and structural complexity (central government, regional government, local communities, foreign investors) can slow the decision-making process because it requires lengthy approvals and permits from these various stakeholders. Second, there is the problem of determining national strategic objectives for priority projects, such as focusing on renewable energy but still using coal and oil, or prioritizing infrastructure development. This causes PPMO to experience a decline in performance in the face of major changes. Third, not all human resources in the organization have technical and digital skills, thus hampering the implementation of innovation as part of accelerating sustainability.

When project management faces VUCA it means they must be able to understand and manage uncertainty quickly through different actions or responses [44]. Support through commitment, continuous interaction and joint with appropriate decision-making between stakeholders are critical factors in adjusting to unexpected external changes or disturbances. However, the problem highlighted is when the parties involved during the project do not have sufficient knowledge, experience and ability to predict emerging problems, which impacts the implementation of SPG and ultimately reduces PPMO performance. The results of this study also underline the study Norouzi [49] that the OG industry is faced with various challenges and must remain competitive, especially in changes related to policies in the use of renewable energy in order to maintain a competitive company business. The complexity of

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projects in the OG industry requires high attention and the right strategy because it is included in the industry that influences global economic growth.

This study highlights the results that it is very important to build an effective strategy in the PPMO team in formulating sustainability in the VUCA era. As emphasized in the study Song [12] that companies must clarify the role of project portfolio management through adequate training to encourage awareness of sustainability aspects, improve the monitoring system for project quality including identifying potential problems that arise, build a knowledge management system in the organization through collaboration and open communication, risk management [45] and evaluation systems and an organizational culture that does not blame but supports in providing solutions to problems.

5.2. Managerial Implications

The study results have highlighted managerial implications that are relevant in project management organizations and provide empirical evidence to focus more on social aspects in promoting PPMO resilience as highlighted by other authors [18, 27, 34]. A resilient PPMO means having the ability to recover and adapt to change. Therefore, to encourage a resilient PPMO, organizations need to improve the capabilities of project team members so that they can directly affect the overall performance of the PPMO Rahi [36]. Varajão, et al. [34] highlighted that the resilience of PPMO requires team skills and competencies where every decision-making can be accounted for according to their knowledge, can control risks, and solutions to problems can be accepted by all parties. Derakhshan, et al. [27] emphasized that internal relationships within the organization also play an important role in governance practices and portfolio management. Building relationships through communication, trust and commitment between project managers, top managers, general managers and field managers supports the success and efficiency of the project.

Research by Unger, et al. [18] highlights the division of roles that can increase the resilience of PPMO, including the role of coordination which is tasked with directing the entire portfolio and resources; as a control that functions in providing information and providing input before decision making; and a supporting role that helps in providing various needs of leaders/members during project activities. The occurrence of VUCA presents its own challenges for companies, and at the same time also increases the risk. Therefore, stakeholders in the PPMO organization are required to have management capabilities to minimize various negative impacts, and/or change them to maximize opportunities for the company [63].

6. Conclusion

OG projects have challenges for companies, and this industry must include sustainability in long-term strategies. On the other hand, it also emphasizes the improvement of PPMO in overseeing projects according to the company's business goals and strategy. This study seeks to analyze the relationship between SPG and PPMO resilience and the moderating effect of VUCA. This study focuses on the OG industry, where data was collected through a questionnaire survey and analyzed using SEM to test the research hypothesis. The findings show that SPG positively influences PPMO resilience, but VUCA can hinder the practice of implementing SPG and PPMO resilience. Thus, the implementation of OG projects, especially in Indonesia, must make strategic plans that can be used to avoid or manage VUCA problems that arise and have implications for project failure.

This study has limitations regarding the use of survey methods and limited sample sizes, so it is susceptible to bias and error. Therefore, further research can consider conducting case studies and in-depth interviews with other stakeholders to support the results of this study. In addition, future research can also expand the scope and involve OG companies in different countries to compare results and obtain more complete information.

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Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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