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Exploring the Impact of Female Participation on Innovation Within Indonesian SOEs

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ABSTRACT
State-owned enterprise (SOEs) in Indonesia increasingly recognize the importance of innovation for competitiveness. Gender diversity is a key driver, with research highlighting the positive impact of women on creativity and problem-solving. This study explores how female participation in innovation initiatives within Indonesian SOEs. We examine data from 133 innovation competition records, focusing on team composition (female presence vs no female) and innovation characteristics (orientation, benefit, type, deliverable and area of focus). Chi-square tests assess overal and individual associations, while Benjamin-Hochberg (BH) correction accounts for multiple comparisons. Our findings reveal a statistically significant association between female-led teams and the specific area of focus chosen for innovation projects. This suggests women might prioritize or excel in certain innovation areas within Indonesian SOEs. Further research can explore the reason behind this association and its implication for fostering a more diverse and innovation environment in SOEs.

1. INTRODUCTION

State-Owned Enterprises (SOEs) in Indonesia are encountering dynamic shifts and must adjust to swift environmental changes and significant complexities (Jamil & Inayah, 2023). Therefore, like similar enterprises in other countries, SOEs in Indonesia are increasingly acknowledging the critical role of innovation in maintaining competitiveness within a dynamic market (Global Innovation Index, 2023). Research increasingly recognizes workforce diversity, particularly gender diversity, as a crucial factor driving innovation due to its positive impact on creativity (Hemmert,

2024). Diverse teams, including those with strong female participation, can foster a more collaborative and inclusive environment. This leads to a wider range of perspectives and approaches to problem-solving, ultimately enhancing the generation of creative ideas. Additionally, the presence of more female directors significantly enhances critical board processes such as analysis and decision-making. (Hemmert et al., 2024).

Innovation has become a cornerstone for the strategic growth and competitiveness of enterprises worldwide (Schwab, 2023). In Indonesia, state-owned enterprises (SOEs) have recognized the importance of fostering an innovative culture to drive efficiency, productivity, and growth. In their study, Indrayanti & Ulfia (2022) highlighted the critical role of innovation culture for the performance of Indonesian SOEs. As part of the effort to foster an innovative culture, management of an Indonesia SOE in digital security business has initiated innovation competitions program to harness the creative potential of their employees. These competitions not only encourage employees to generate novel ideas but also aim to cultivate an environment where continuous improvement and innovative thinking are ingrained in the organizational culture. Several outcomes from the innovation competition, which has been running since 2021, have been implemented, providing benefits for state-owned companies in terms of improving the performance and welfare of their employees.

The role of gender diversity, particularly the participation of female in innovation processes, has gained considerable attention in recent years. Research has indicated that diverse teams, including those with a higher presence of female, often outperform less diverse ones in generating creative solutions and achieving higher innovation outcomes. For example, a study by Hemmert et al., (2024) found that gender diversity positively impacts radical innovation in organizations. Similarly, research by Jones et al., (2020) suggests that gender diversity enhances innovation performance, especially in high-tech industries.

While numerous studies have explored the general impact of gender diversity on innovation, there is a scarcity of research focusing on the specific context of Indonesian SOEs. Moreover, existing literature often does not disaggregate innovation characteristics to identify where female contributions are most impactful. Studies such as those by Jones et al., (2020) has highlighted the benefits of gender diversity in management and innovation, yet few have specifically examined the Indonesian context or the distinct innovation characteristics influenced by female participation. Studies on gender diversity and innovation have primarily focused on developed economies, leaving a gap in understanding how these dynamics play out in different institutional environments. Research by Ritter-Hayashi et al., (2019) focus gender diversity in a firm's ownership on innovation in the developing countries in Africa, the Middle East and South Asia not covering South East Asia region. This gap in the literature necessitates a more granular analysis to understand the association between female presence and various innovation characteristics, such as innovation orientation, benefit, type, deliverable, and area of focus. By addressing this gap, the

current research aims to provide a nuanced understanding of the role of women in driving innovation within Indonesian SOEs. Since 2013, the Ministry of SOEs the Republic of Indonesia has held an innovation competition among state-owned companies. While various kinds of innovation arose from the event, only a small number of SOEs participated. This shows that not all SOEs can foster a culture of innovation in their corporate environment. Innovation culture can grow positively when subjected to reliable innovation management. By understanding how women influence the types of innovations proposed and the areas they focus on, this study can provide valuable insights for fostering a more inclusive and effective innovation culture within Indonesian SOEs.

This research is significant for several reasons. Firstly, it addresses the broader discourse on gender diversity in the workplace, contributing to the understanding of how female employees can impact innovation within organizations. Secondly, given the strategic importance of innovation for SOEs in Indonesia, insights from this study could inform policies and practices that enhance the effectiveness of innovation programs. By analyzing the specific characteristics of innovations proposed by female participants, this research can help identify areas where women make the most significant contributions and highlight opportunities for further leveraging their potential. For example, research suggests tailoring diversity and inclusion initiatives to specific organizational contexts can lead to improved outcomes (Saqib & Khan, 2022). This tailored approach could be particularly valuable for SOEs in Indonesia, as they navigate fostering innovation within a unique institutional environment.

The purpose of this research is to examine the association between female presence and various innovation characteristics within Indonesian State-Owned Enterprises (SOEs), specifically focusing on an innovation competition held by one such enterprise. By analyzing the innovation proposals submitted by women, the study aims to understand how women contribute to innovation in this context. This research addresses the gap in existing literature, which often neglects the impact of gender diversity on innovation in developing economies and tends to view innovation as a uniform concept. By examining the association between female participation and various innovation characteristics (such as orientation, benefit, deliverable, type, and area of focus), this research will identify which aspects are most strongly influenced by female presence within the SOE environment. Ultimately, the findings will help shape policies and practices to promote female-driven innovation, fostering a more inclusive and innovative organizational culture in these organizations.

2. LITERATURE REVIEW

2.1. Innovation in State-Owned Enterprises

State-Owned Enterprises (SOEs) are integral to the economic frameworks of many countries, especially in developing nations like Indonesia. These enterprises operate in crucial sectors such as energy, transportation, and finance, with their performance directly influencing national economic stability and growth (OECD, 2020). Innovation within SOEs is essential for maintaining competitiveness,

improving operational efficiency, and delivering superior public services (Zhan & Zhu, 2020). While innovation is crucial for SOEs to remain competitive and adapt to changing market demands, fostering a culture of innovation within these organizations can be challenging. SOEs often face difficulties due to bureaucratic processes and hierarchical decision-making, which can stifle creativity and hinder the implementation of innovative ideas (Apriliyanti et al., 2023). Research has underlined the importance of strategic leadership, investment in R&D, and supportive policies to foster a culture of innovation within SOEs (Christensen, 2019).

Innovation plays a critical role in the success and competitiveness of SOEs worldwide. In an increasingly dynamic business landscape, SOEs need to embrace innovation to develop new products and services, improve efficiency, and respond to changing customer demands. Studies by Zhan & Zhu (2020) highlight the importance of fostering a strong innovation culture within SOEs for achieving positive performance outcomes. This culture encourages experimentation, risk-taking, and collaboration, all of which are crucial for successful innovation.

Furthermore, research by Iqbal et al. (2022) emphasizes that innovation significantly impacts business strategies within Indonesian SOEs. Implementation of business strategies relies heavily on innovation processes in product/service development, marketing, and technology. Structural factors, an innovation-driven culture, and resource availability play key roles in SOEs' business strategy success. The study also reveals that 52.3% of business strategy variations within SOEs can be explained by innovation, contributing to global competitiveness and business sustainability.

Research by Azizah et al. (2023) further emphasizes that innovation culture plays a significant role in improving innovation performance. A proactive innovation strategy and a growth-oriented approach contribute to a stronger culture of innovation, making organizations more adaptable to market changes and customer needs. Additionally, the presence of innovation culture within SOEs is crucial to fostering an inclusive and dynamic environment where employees, regardless of gender, can contribute effectively to innovation efforts.

Additionally, Castelnovo (2022) finds that SOEs often outperform Private-Owned Enterprises in innovation within specific industries, such as medium-high-tech manufacturing (e.g., chemicals and automotive sectors) and energy. The research highlights that SOEs with managerial autonomy and strong external coordination with government policies tend to be more innovative. Institutional quality also plays a role, as countries with strong regulations and governance structures enhance the innovation capacity of SOEs.

2.2. Female Impact on Innovation

The inclusion of women in innovation processes is increasingly recognized as a key driver of creativity and diverse thinking. Gender diversity in teams enhances problem-solving abilities and leads to more innovative outcomes (Hemmert et al., 2024). Women bring unique perspectives and approaches to innovation, often focusing on inclusivity and user-centric design (Asteria et al., 2020). Research has shown that the relationship between a company’s

capability for knowledge combination and innovation performance is positively moderated by gender diversity (Adam et al., 2023).

According to the Global Entrepreneurship Monitor (2022), the proportion of women owning innovative business offerings is higher than that of men. Therefore, in general, women exhibit higher engagement than men in high-growth businesses that emphasize innovation and have a strong focus on international markets. Syukri (2023) argues that strengthening governance and promoting gender diversity can enhance the effectiveness of Indonesian SOEs in achieving broader social impacts.

2.3. Innovation Orientation

Innovation orientation refers to an organization's propensity to innovate and its strategic emphasis on innovation activities (Norris & Ciesielska, 2019). Innovation activities produce innovative products that are implemented either internally or externally. Innovation orientation can be categorized based on the intended beneficiary of the innovation. Companies can focus on developing products, processes, or services that either enhance internal operations or deliver value to customers.

Internal innovation orientation focuses on streamlining processes and boosting efficiency. Examples include new software for project management, automated workflows, or innovative training programs (Tidd et al., 2021). External innovation orientation focuses on developing products and services that directly benefit customers. Market orientation is crucial, as companies need to understand customer needs and preferences (Chesbrough, 2022).

2.4. Innovation Benefit

Innovation benefits encompass positive outcomes such as enhanced efficiency, improved customer satisfaction, and increased market competitiveness (Nguyen et al., 2024). Innovation is widely recognized as a critical driver of both effectiveness and efficiency in organizational operations Osintsev & Khalilian (2023). Rew et al., (2021) argue that innovation enhances organizational performance by improving the quality of products and services, which in turn boosts effectiveness. This is supported by the work of Tidd et al., (2021), who argue that innovative practices streamline processes, reduce waste, and optimize resource utilization.

2.5. Innovation Deliverables

Innovation deliverables emphasize that innovation outcomes should be concrete and implementable. While some innovations might be groundbreaking in concept, their translation into tangible or intangible solutions ultimately drives progress. Innovation deliverables can be categorized into tangible and intangible outputs, including new products, services, processes, and business models. Tangible innovations are readily perceivable objects or devices and are labeled as hardware innovations (Chen & Nagasawa, 2021). This includes new hardware products, improved manufacturing processes, or advancements in materials science.

Intangible innovations, on the other hand, lack physical embodiment and are labeled as software innovations (Chesbrough, 2022). Examples include new software applications, innovative business models, or novel marketing strategies. Recent studies highlight the

increasing importance of intangible innovation in a knowledge-based economy. Intellectual property, such as patents for new drugs or software, can provide firms with a significant competitive advantage (Robertson et al., 2023).

2.6. Innovation Type

Process innovation and product innovation are pivotal drivers of organizational success. Process innovation involves implementing new or improved methods, techniques, or procedures to enhance efficiency, reduce costs, and improve quality (Tidd et al., 2021). This type of innovation often targets internal processes and workflows, optimizing resource utilization.

Product innovation, in contrast, refers to developing new or improved goods or services that offer enhanced features, functionalities, or value propositions to customers (Tidd et al., 2021). Organizations leveraging both process and product innovation create synergies that enhance overall performance and market position.

In addition, incremental innovation and radical innovation shape organizational strategies. Incremental innovation involves gradual improvements to existing products, services, or processes, while radical innovation involves developing entirely new products, processes, or business models (Rosch et al., 2023).

2.7. Innovation Area of Focus

The area of focus for innovation varies across industries. Recent studies emphasize area focus for innovation on technological advancements, process improvements, customer experience, and sustainability initiatives (Khan et al., 2023). In production, Industry 4.0 technologies such as automation and IoT enhance operational efficiencies (Soori et al., 2023). Marketing innovations increasingly rely on AI-driven analytics and digital platforms (Ozturk, 2023). In management, digital transformation strategies and agile methodologies improve organizational adaptability and performance (Al Nuami et.al, 2022).

3. METHOD

This study employs a quantitative research design to investigate the impact of female participation in innovation teams on innovation initiatives within Indonesian state-owned enterprises (SOEs). Data from 133 innovation competition documents were analyzed using R software to understand how gender diversity relates to innovation outcomes.
The data included team composition and various innovation characteristics: orientation - external or internal, benefits - effectiveness or efficiency, type - product or process, deliverables - software or hardware, and areas of focus - production, marketing, management support. Female presence in innovation teams was the independent variable, categorized as presence or absence, while innovation characteristics served as dependent variables.

Statistical analyses focused on identifying associations between female presence and innovation characteristics using Chi-square tests, with the Benjamini-Hochberg correction method applied to control the false discovery rate. Results highlighted significant associations between female presence and specific innovation characteristics.

4. RESULT AND DISCUSSION

Descriptive statistics of this research reveal that out of the total 133 record documents, 82 documents (62%) have no female presence, while 51 documents (38%) include female presence. The research analysis revealed a statistically significant association between female presence in innovation teams and the combined characteristics of the innovation initiatives (χ^2 (10) = 45.34) as presented on Table 1. This indicates a strong connection between the gender composition of innovation teams and innovation characteristics pursued within Indonesian SOEs. A significance level of $p < 0.05$ suggests a very low probability that this observed association occurred by chance.

Table 1. Test of Independence (Chi-square)

	Innovation Characteristics					
	Overall	**Area of Focus**	**Deliver-able**	**Orien-tation**	**Type**	**Benefit**
Alpha	0.05	0.05	0.05	0.05	0.05	0.05
df	10	2	1	1	1	1
P-value	0.0000019	0.0000022	0.000059	0.149456	0.300648	0.9144431
Test statis-tic	45.34	26.05	16.13	2.08	1.07	0.01
Critical value	18.31	5.99	3.84	3.84	3.84	3.84

Table 2. Benjamini-Hochberg (BH) Correction

	Innovation Characteristics				
	Area of Focus	**Deliver-able**	**Orientation**	**Type**	**Benefit**
P-value	0.00000220	0.0000592	0.14945606	0.3006408	0.91444312
BH critical value	0.01	0.02	0.03	0.04	0.05
Adjusted p-value	0.00001102	0.0001479	0.24909343	0.3758010	0.91444312
Significant	Yes	Yes	No	No	No

The BH correction as presented on Table 2., revealed the strongest association between female presence and the Area of Focus ($p'_{\_1} = 0.0000022$). This suggests a strong connection between female-led teams and the specific domains they target for innovation proposals within Indonesian SOEs. Based on our findings women might prioritize innovation in certain areas of focus innovation such as production, marketing or management support compared to their male counterparts. A significant association was also found for Deliverables ($p'_{\_2} = 0.000059$). indicating a potential link between female-led teams and the types of deliverables proposed, such as focusing on intangible solutions – software or tangible prototypes – harware.

Orientation, Type and Benefit did not exhibit statistically significant associations with female presence after BH correction ($p'_{\_3} > 0.05$; $p'_{\_4} > 0.05$; $p'_{\_5} > 0.05$). This suggests that female participation in innovation teams may not have a significant influence on whether the innovation is internally focused on improving processes or externally focused on market opportunities, the specific type of innovation (product or process) or the targeted benefit (effectiveness or efficiency). This findings align with study of Kuntadi et al., (2020), which found that gender did not influence the relationship between decision-makers' behavioral preferences and innovations adoption.

This research focused on exploring the association between female presence in innovation teams and the characteristics of innovation initiatives within Indonesian State-Owned Enterprises (SOEs). We conducted a chi-square test of independence to analyze this relationship, revealing significant findings that are elaborated below.

The research found a statistically significant association between the presence of females in innovation teams and the combined characteristics of the

innovation initiatives (χ^2 (10) = 45.34, $p < 0.0000019$). This result, presented in Table 1, indicates a strong connection between the gender composition of innovation teams and the nature of the innovation projects they pursue. Given the critical value of 18.31 for 10 degrees of freedom at an alpha level of 0.05, the test statistic far exceeds this threshold, reinforcing the robustness of our finding and suggesting that the likelihood of this association occurring by chance is extremely low ($p < 0.05$).

The findings of this study revealing a significant association between female presence in innovation teams and the characteristics of innovation initiatives align with previous research emphasizing the positive impact of gender diversity on innovation such as research by Jones et al., (2020) that found gender diversity in Researh and Development teams leads to improved innovation efficiency by broadening the knowledge base and enhancing knowledge integration among team members. This study also has strengthen evidences that diverse teams bring varied perspectives and problem-solving approaches, enhancing creativity and innovation outcomes.

The analysis of the chi-square test results across different innovation characteristics, as presented in Table 1, reveals particular areas where the presence of women is correlated with innovation characteristics. The strongest association was observed in the area of focus (χ^2 (2) = 26.05, $p = 0.0000022$), significantly surpassing the critical value of 5.99. This suggests that female-led teams tend to prioritize specific domains for innovation, potentially focusing on production, marketing, or management support, differing from their male counterparts. This finding aligns with research indicating that gender diversity can enhance team creativity and the breadth of perspectives considered in decision-making (Hemmert et al., 2024). Interestingly, the research doesn't find a significant connection between female participation and the innovation's orientation (internal vs. external focus), type (product vs. process), or targeted benefit (effectiveness vs. efficiency). This suggests that while women may influence the specific areas and deliverables of innovation proposals, their presence might not have a bearing on the broader strategic objectives or goals.

Another significant association was found with the type of deliverables (χ^2 (1) = 16.13, $p = 0.000059$), exceeding the critical value of 3.84. This indicates that female-led teams are more likely to propose deliverables such as software solutions or tangible prototypes, pointing to a distinct approach in the types of innovation outputs they pursue. Research by Rosch et al., (2023) supports this, showing that women in technology fields often drive innovation towards practical and user-centric solutions. Female presence might be linked to the types of deliverables proposed, with a potential preference for intangible solutions (software) or tangible prototypes (hardware) over other forms. There is no statistically significant evidence to suggest a link between female participation and innovation orientation (internal vs. external focus), type (product vs. process), or targeted benefit (effectiveness vs. efficiency).

To control for multiple testing and reduce the likelihood of false positives, we applied the Benjamini-Hochberg (BH) correction to our p-values, as shown in

Table 2. The adjusted p-values confirmed the significance of associations in specific areas. The adjusted p-value for the area of focus (p'_1 = 0.00001102) remained significant, reinforcing the strong link between female presence and targeted innovation domains. This supports the idea that gender-diverse teams may focus on more comprehensive and diverse innovation areas (Yang et al., 2022). Similarly, the adjusted p-value for deliverables (p'_2 = 0.0001479) also remained significant, indicating that female-led teams have a notable impact on the type of deliverables proposed. Previous studies suggest that diverse teams often produce a wider range of innovative outputs (Jones et al., 2020).

However, after the BH correction, other characteristics such as orientation, type, and benefit did not show significant associations ($p'_3 > 0.05$, $p'_4 > 0.05$, $p'_5 > 0.05$). This suggests that female participation in innovation teams does not significantly influence whether the innovation is internally or externally focused, the specific type of innovation (product or process), or the targeted benefit (effectiveness or efficiency). These findings are consistent with some studies which indicate that while gender diversity impacts certain areas of innovation, it does not uniformly affect all aspects of innovation processes (Xie et al., 2020)

5. CONCLUSION AND POLICY IMPLICATION

In conclusion, this research contributes to the growing body of evidence supporting the positive role of gender diversity in enhancing innovation within organizations. By fostering inclusive innovation teams, Indonesian SOEs can leverage the unique strengths and perspectives of female leaders to drive more effective and targeted innovation efforts.

These findings offer valuable insights into the dynamics of gender composition within innovation teams in Indonesian SOEs. The strong associations found in specific areas indicate that female presence may steer innovation efforts towards particular focuses and deliverable types. This could imply that women in these teams bring unique perspectives or preferences that shape the innovation landscape in meaningful ways.

The lack of significant association in other areas suggests that while gender diversity may influence certain aspects of innovation, it does not uniformly affect all characteristics. This nuanced understanding can help policymakers and organizational leaders in Indonesian SOEs to foster gender-diverse teams that leverage these unique contributions effectively.

Overall, our research underscores the importance of considering gender diversity in innovation teams and highlights specific areas where female presence can make a substantial difference. Further research could delve deeper into understanding the underlying reasons for these patterns and how they can be harnessed to drive more effective and inclusive innovation strategies.

These findings offer a springboard for further exploration. Future research could investigate the reasons behind these associations. Are there cultural or social factors within Indonesian SOEs that influence how women approach innovation? Additionally, qualitative studies could delve into the experiences and perspectives of women within these teams, providing richer insights into their

decision-making processes and priorities. Ultimately, understanding the link between female presence and innovation characteristics can inform efforts to promote diversity within innovation teams and potentially lead to a wider range of impactful innovation initiatives within Indonesian SOEs.

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