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Transformation of Public Policy Evaluation: Multi-Stakeholder Approach in Food Security in South Papua

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ABSTRACT

Background: Food security is a critical issue in South Papua, where socio-cultural and environmental factors demand locally tailored policies. This study explores the transformation of food security policy evaluation through a multi-stakeholder approach involving indigenous communities, local governments, the private sector, and Non-Governmental Organizations (NGOs). The approach integrates diverse perspectives and innovative strategies to enhance policy relevance, sustainability, and effectiveness. **Methods**: This research employs a qualitative case study method, using data from in-depth interviews, focus group discussions (FGDs), participatory observations, and document analysis. Stakeholders provided insights into local challenges and policy implementation. Participatory mapping and data analytics further enhanced evaluation accuracy and depth, ensuring a comprehensive understanding of diverse perspectives on food security policies. **Results**: Stakeholder collaboration improves policy relevance by integrating indigenous knowledge into resource management, promoting accountability, transparency, and responsiveness. Technology tools like participatory mapping enhanced evaluation accuracy. However, challenges such as coordination inefficiencies and limited access to technology hinder optimal policy implementation. **Conclusion**: The multi-stakeholder approach effectively transforms food security policy evaluation in South Papua, making it more relevant and sustainable. Addressing coordination challenges and investing in infrastructure are crucial for overcoming persistent barriers.

Introduction

Food security is a crucial issue that affects people's welfare and socio-economic stability (Chegini *et al.*, 2021). South Papua, as one of the regions facing unique challenges in terms of food security, faces various problems such as limited access to food resources, climate change, and market uncertainty. Effective public policy evaluation is needed to ensure that the policies implemented can respond to these challenges appropriately (Mazzucato *et al.*, 2020). A multi-stakeholder approach is considered important because it involves various stakeholders, including local governments, local communities, non-governmental organizations, and the private sector (Eikelenboom and Long, 2023).

The problem of food security in South Papua is

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very complex and diverse. One of the main issues is limited access to quality food resources, caused by poor transportation infrastructure and logistical challenges in remote areas (Kaiser and Barstow, 2022). This condition results in uneven food distribution and is often inadequate to meet the needs of local communities. In addition, the impacts of extreme climate change such as irregular rainfall and increasing temperatures worsen food security by disrupting local agricultural production (Farooq *et al.*, 2022). Another problem is the lack of support and coordination between the various parties involved in food policy, including local governments, farmers, and local communities. This often results in policies being implemented that are not in accordance with local conditions and the specific needs of the community. Lack of training and capacity in modern agricultural management also contributes to low productivity and dependence on imported food (Hemathilake and Gunathilake, 2022). Given these challenging circumstances, it is important to identify and understand these challenges in depth so that the solutions designed can be effective and sustainable.

Previous research on food security in South Papua shows the various challenges faced and the approaches that have been implemented to overcome them. Existing policies often do not take into account the local context and the specific needs of local communities, resulting in an inability to effectively improve food security (Clapp *et al.*, 2022). Furthermore, involving various parties in policy planning and implementation can increase the relevance and effectiveness of policies (Verweij *et al.*, 2021). This approach has proven to be helpful in creating more sustainable and responsive solutions to local needs. Adaptation to climate change through agricultural technologies and risk management strategies is critical to improving food security in the region (Diallo *et al.*, 2020).

The research gap that exists in studies on food security in South Papua lies in the lack of in-depth understanding of how multi-stakeholder approaches can be effectively integrated into public policy evaluations to improve food security. Although previous studies, such as those conducted has identified various challenges and the importance of multi-stakeholder engagement, there is a lack of concrete application of this approach in the context of South Papua (Mutahara *et al.*, 2020). This research has not adequately explored how collaboration between government, local communities, and the private sector can be optimized to design and implement more responsive and sustainable policies. Furthermore, the lack of specific research regarding the impact of climate change adaptation on food security in South Papua highlights the need forin-depth analysis of effective and measurable adaptation strategies. Research by Hurlimann *et al.* underlines the importance of climate change adaptation, but there are gaps in how policies can be tailored to address changing climate conditions locally (Hurlimann *et al.*, 2021). Focused research on applying a multi-stakeholder approach to policy evaluation and integrating climate change adaptation strategies specific to South Papua is needed to fill gaps and support more effective, sustainable policies.

This study introduces a novel, inclusive, and collaborative approach to public policy evaluation in South Papua, involving local governments, indigenous communities, the private sector, and Non-Governmental Organizations (NGOs). Unlike previous top-down evaluations, the study emphasizes adapting food security policies to the region's unique challenges, such as geographical remoteness and cultural diversity, while focusing on sustainability and food independence. It also incorporates advanced technologies like data analytics and participatory mapping to enhance transparency, accuracy, and accountability, strengthening the responsiveness of food security policies in a region often overlooked by national policies. This study aims to analyze the transformation of food security policy evaluation in South Papua through a multi-stakeholder approach involving various local stakeholders, as well as identifying innovative strategies to improve the sustainability and effectiveness of policies in the region.

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Materials and Methods

This study employs a qualitative case study method, which is appropriate for understanding complex phenomena within a specific context, such as food security policy evaluation in South Papua. The method allows for in-depth exploration of local dynamics, policy processes, and stakeholder interactions. A participatory approach was integrated into all stages of the research from planning and data collection to analysis, ensuring that the voices and experiences of key stakeholders were not only captured but also meaningfully incorporated into the study. These stakeholders include indigenous communities, who possess deep traditional knowledge and manage natural resources; local governments, which design and implement public policies; private sector actors, who play roles in supply chains and distribution; and NGOs, which act as facilitators and watchdogs in community development and environmental advocacy. By engaging these four groups directly, the research is grounded in local realities and aligned with participatory research ethics.

The research took place in Tanah Miring District, South Papua, selected due to its strategic mix of inland, coastal, and agricultural villages, each presenting unique food security profiles. This geographical diversity allowed for a more representative understanding of the challenges and potential within different environmental and socio-economic contexts. The roles of each stakeholder group were clearly identified and integrated into the research framework. Indigenous peoples are custodians of traditional land and food systems, relying on cultural practices to manage forests, rivers, and agricultural lands. Local government officials are the main actors in formulating food-related policies and overseeing their implementation at the district and village levels. The private sector contributes to the food supply chain, including transportation, marketing, and storage. Meanwhile, NGOs provide technical support, capacity building, and promote sustainable food practices rooted in community empowerment. Understanding these diverse roles was essential for assessing how food security policies are evaluated and transformed in practice.

Data collection employed three main qualitative techniques in in-depth interviews, focus group discussions (FGDs), and participatory observation to allow for triangulation and comprehensive analysis. A critical aspect of the methodology was the use of consistent stakeholder groups across all data collection methods. This ensured coherence in perspective comparison and strengthened the reliability of the findings. Using the same target groups in both interviews and FGDs namely indigenous representatives, local government officials, private sector actors, and NGOs staff enabled the researchers to capture both individual and collective viewpoints. This approach facilitated cross-validation of insights and revealed both shared understandings and divergent opinions across the stakeholder spectrum.

In-depth interviews were designed to extract rich, experiential data from each stakeholder group. The researchers used a semi-structured interview format, which provided flexibility to probe deeper into specific topics while following a consistent thematic guide. Key topics included the degree of stakeholder involvement in policy evaluation, perceptions of policy effectiveness, obstacles to effective multi-stakeholder collaboration, and recommendations for policy refinement. This was while the initial methodological plan aimed for two interview sessions per informant, practical limitations-such as time constraints and participants' availability required adjustments. As a result, each informant was interviewed at least once, and follow-up interviews were conducted selectively for clarification or expansion of key points. Interviews were conducted in person, usually at local offices, community halls, or other neutral locations. Each session lasted 60 to 90 minutes, with data captured via audio recordings and detailed field notes to ensure accuracy and completeness.

FGDs provided a platform for interactive discussions among stakeholders, encouraging dialogue, debate, and collaborative problem-solving. These sessions were held in local community spaces that were easily accessible,

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minimizing logistical barriers to participation. A trained moderator facilitated the discussions, beginning with a brief explanation of the session's objectives and ground rules to foster mutual respect and equal voice. FGDs centered on two major themes: (1) challenges in evaluating food security policies, such as limited local data, inadequate feedback mechanisms, and coordination issues; and (2) opportunities for stakeholder collaboration, including the integration of traditional knowledge, public-private partnerships, and community-led monitoring. The discussion process was divided into two 90-minute sessions, each focused on one theme. The research team recorded, transcribed, and later analyzed all discussions. The moderator ensured that all participants, regardless of institutional affiliation or social status, were encouraged to speak and contribute insights.

To complement interview and FGD data, the researchers conducted participatory observation, attending real-time policy evaluation activities such as coordination meetings, food distribution events, and local community discussions. This allowed the researchers to witness interactions, observe decision-making processes, and identify power dynamics in a natural setting. Observations were conducted non-intrusively, and findings were documented through field notes, photos, and informal reflections. Furthermore, participatory mapping exercises were conducted with community members to visualize local food systems, challenges, and resources. These visual tools not only enriched the data but also empowered communities to express their views spatially. Finally, official documents-including regional policies, implementation reports, and food security statistics-were analyzed to assess the alignment between what is planned on paper and what occurs in the field. All qualitative data were analyzed using thematic analysis, and triangulation across methods ensured the credibility, transferability, and dependability of the research findings.

Thematic analysis of the triangulated data revealed several key dimensions of food security policy evaluation in South Papua. Among the most prominent themes were inclusiveness, referring to how well different groups are integrated into the policy process; multi-stakeholder participation, indicating the level of cooperation and communication among actors; and policy adaptability, showing how policies respond to local feedback and contextual changes. These findings provide a nuanced and evidence-based understanding of how food security policies are currently functioning, where the gaps lie, and what improvements are needed. More importantly, the participatory nature of the research ensures that these findings are grounded in lived experiences and co-produced knowledge, offering practical and locally legitimate recommendations for policy transformation in South Papua.

Results

In-depth interviews with government officials, indigenous leaders, the private sector, and NGOs revealed challenges in achieving effective inclusivity and participation in food security policy evaluation. The results highlighted the need for better communication between stakeholders and more community involvement in policy formulation. Stakeholders recommended strengthening coordination and creating platforms for collaborative decision-making to improve policy effectiveness.

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Table 1. Stakeholder perspectives and recommendations for enhancing policy implementation.

Stakeholders	Views and findings	Recommendation
Government officials	Stating that better communication with communities is needed to identify local needs	Encouraging the use of digital platforms for two-way communication between government and the public
Traditional community representatives	Considering that the role of indigenous communities has not been optimally accommodated in the policy process, even though they have valuable local knowledge.	Establish regular consultation forums involving indigenous community leaders in policy formulation.
Private sector	Conveying that collaboration between the private sector and government needs to be improved to maximize resources in food security	Developing strategic partnerships between the private sector and government to support food security programs
NGO representative	Emphasizing the importance of transparency in the decision-making process so that all parties feel involved and have a voice	Preparing regular reports on policy progress and challenges that are accessible to all stakeholders

The research findings highlight key insights from various stakeholders on improving food security policy implementation (**Table 1**). Government officials call for better communication with local communities through digital platforms, while indigenous leaders stress the need for more active involvement in the policy-making process through regular consultation forums. The private sector advocates for stronger collaboration with the government to optimize resources, and NGOs emphasize transparency in decision-making, recommending accessible reports for all stakeholders. The study's interviews explored stakeholder involvement, perceptions of policy success, challenges in multi-stakeholder participation, and recommendations for future improvements. These results are summarized in the **Table 2**.

Table 2. Key policy evaluation findings and recommendations.

Indicator	Findings	Recommendation
Involvement in the policy evaluation process	Many stakeholders feel that their involvement in policy evaluation is still limited, especially local communities.	Enhancing training and outreach programs to increase community awareness and involvement
Perception of policy success	Perceptions of the policy's success varied, with some stakeholders feeling the policy had not achieved its objectives	Conducting periodic evaluations to measure the impact of policies and ensure that objectives are achieved
Multi-stakeholder participation challenges	Key challenges identified included lack of communication between stakeholders, resource constraints, and differing interests.	Establishing a regular communication forum between all stakeholders to discuss issues and solutions
Recommendations for policy Improvement	Stakeholders recommended increasing transparency and accountability in the decision-making process.	Developing effective feedback mechanisms so that all parties can provide input and suggestions

The findings highlight key issues in the policy evaluation process, including limited involvement of local communities, varying perceptions of policy success, and challenges in multi-stakeholder participation due to communication gaps, resource constraints, and conflicting interests. To address these, the study recommends enhancing training and outreach programs, conducting periodic evaluations, and establishing regular forums for dialogue. Stakeholders also call for greater transparency and accountability, with the development of feedback mechanisms to improve decision-making. Active participation from all stakeholders is essential for effective food security

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programs, with each contributing unique insights and resources.

Table 3. Stakeholder participation and contributions in food security programs.

Stakeholders	Participation percentage	Main contributions
Government	25	Provision of policies and regulations that support food security and facilitate coordination between stakeholders
Indigenous peoples	30	Local knowledge and in-depth understanding of the social and environmental conditions that influence food security in the local area
Private sector	20	Resources and innovation in agricultural technology and partnerships for the implementation of food security programs
NGO	25	Oversight of transparency of policy processes and advocacy for the inclusion of vulnerable communities in the formulation of food security policies

The participation of various stakeholders in the food security program is distributed as follows (**Table 3**): Government contributes 25% by providing policies, regulations, and facilitating coordination among stakeholders. Indigenous peoples, with 30% participation, offer valuable local knowledge and a deep understanding of social and environmental factors affecting food security. The private sector, contributing 20%, brings resources, innovation in agricultural technology, and partnerships for implementing food security programs. NGOs, also with 25% participation, ensure transparency in policy processes and advocate for the inclusion of vulnerable communities in policy formulation. Collaboration among stakeholders is crucial for the effective development and improvement of food security policies. The following table summarizes the participation percentages and descriptions of key contributions made by stakeholders in this process.

Table 4. Stakeholder contributions to food security policy development.

Category	Participation percentage	Description
Mutual agreement	35	Stakeholders reach agreement on common goals and basic principles in food security policy.
Collaborative recommendations	40	Recommendations are generated through collaboration between stakeholders to improve food security policies.
Policy improvements	25	Identifying specific corrective steps which are needed to improve existing policies.

The participation of stakeholders in food security policy is categorized into three key areas (**Table 4**). Mutual agreement, representing 35%, indicates that stakeholders collectively reach consensus on common goals and fundamental principles guiding food security policy. Collaborative recommendations, accounting for 40%, highlight the importance of joint efforts among stakeholders to develop strategies aimed at enhancing food security policies. Ultimately, policy improvements, comprising 25%, focus on identifying specific corrective measures necessary for refining and strengthening existing policies to better address food security challenges.

The **figure 1** illustrates the collaborative framework among key stakeholders in food policy evaluation, including the community, local government, NGOs, and the private sector. Arrows connecting these entities show the flow of communication and decision-making, emphasizing

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the importance of cooperation in developing effective food policies. This research on food security policies in South Papua highlights key aspects such as increased stakeholder participation, policy adaptation to local contexts, the use of technology for accurate evaluation, and the focus on sustainability and community food independence. It also identifies challenges and provides recommendations for improvement, summarized in the **Table 5**.

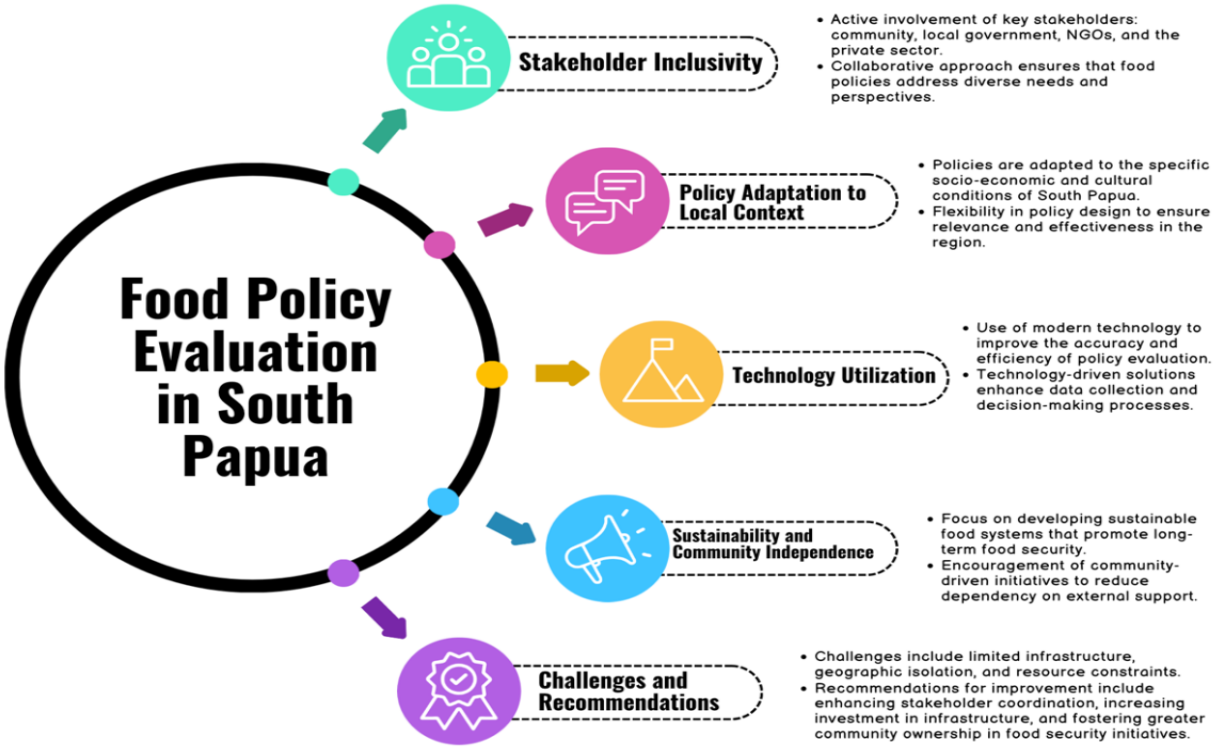

Figure 1. Collaborative framework for food policy**.**

Table 5. Key findings on food security policy evaluation in south papua.

Research aspects	Findings
Policy adaptation to local context	Food security policies become more relevant and effective after being adjusted to local geographic, social, and cultural conditions. Policies that take into account the unique characteristics of South Papua tend to be more successful in achieving food security goals.
Leveraging technology for more accurate evaluation	The use of technologies such as data analytics and participatory mapping increases the accuracy and transparency of evaluations. Technology helps identify specific challenges faced by communities and measure the impact of policies more effectively.
Leveraging Technology for More Accurate Evaluation	Policies involving local stakeholders contribute to increasing sustainability and food independence in South Papua. This approach strengthens local capacity in natural resource management and sustainable food production.
Identification of challenges and recommendations for improvement	Identification of challenges such as lack of coordination between stakeholders and limited access to technology in remote areas. Recommendations include increasing synergy between stakeholders and strengthening technology infrastructure to support more effective policy evaluation in the future.

The research highlights the importance of adapting food security policies to the unique geographic, social, and cultural contexts of South Papua for greater effectiveness. Leveraging

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technology, such as data analytics and participatory mapping, enhances evaluation accuracy and transparency, helping to identify community challenges and measure policy impacts. Involving local stakeholders in policy formulation fosters food sustainability and strengthens capacities for resource management and food production. However, challenges such as stakeholder coordination and limited access to technology in remote areas require improved synergy and better technology infrastructure to support more effective future policy evaluations.

Discussion

A multi-stakeholder approach to food security policy evaluation plays a crucial role in increasing inclusivity and representation of local interests (Thorpe *et al.*, 2022). This approach fosters collaboration by involving diverse stakeholders, including indigenous peoples, local governments, the private sector, and NGOs, in policy evaluation. Indigenous peoples play a crucial role in food security policy evaluation because they bring deep knowledge of the environment and local agricultural practices that cannot be obtained from other sources (Babatunde, 2020). Their presence bridges the gap between policies made at the central level and the reality on the ground. The traditional knowledge they possess includes an understanding of local weather patterns, soil types, and time-tested farming methods. By involving indigenous peoples in the evaluation process, policies can be designed with more consideration of local wisdom and the specific needs of communities, which are often overlooked in policy formulation by policymakers at the center (Brondízio *et al.*, 2021). Active participation of indigenous communities ensures that the resulting food security policies are not only relevant and appropriate to local conditions but are also more easily accepted and implemented by the community (Tsuji *et al.*, 2020). In this way, the diversity of approaches and solutions proposed can reflect the reality on the ground, increasing the effectiveness of policy implementation and the sustainability of food security programs (Siebrecht, 2020).

Local governments play a vital role in bridging national policies and their implementation at the regional level (Retnandari, 2022). They serve as a direct link between policies formulated at the central level and the reality on the ground. The participation of local governments in the policy evaluation process allows for more appropriate adjustments to the specific conditions and needs of the South Papua region (Dutta and Fischer, 2021). Through their involvement, policy evaluations can more accurately reflect local challenges and opportunities, such as changing environmental conditions or social dynamics that may not be visible at the national level. Local governments also accelerate policy adaptation, ensuring that needed changes can be implemented quickly and effectively, responding directly to issues that arise in the community (Dale *et al.*, 2020). Thus, local government involvement not only increases policy relevance but also increases policy effectiveness and responsiveness to community needs (Lihua *et al.*, 2020).

The private sector, especially those engaged in agriculture and food distribution, plays a crucial role in evaluating food security policies (Moragues-Faus *et al.*, 2020). Companies in this sector provide an important business perspective by providing data and practical experience related to the impact of policies on food production and distribution. Through their contributions, policy evaluations become more comprehensive and based on operational realities on the ground. The involvement of the private sector allows evaluations to cover a range of economic aspects that are often critical to the sustainability of policies (Cheng *et al.*, 2021). Data provided by this sector includes information on production costs, distribution efficiency, and challenges and opportunities faced in the food supply chain. With input from the private sector, policies can be adjusted to be more responsive to market needs and real conditions, thereby increasing the effectiveness and sustainability of food security policies. NGOs play an important role in policy evaluation by emphasizing the social and

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ecological impacts of the policies being analyzed (Partelow *et al.*, 2020). NGOs evaluate policies with a focus on social justice and environmental sustainability, ensuring equitable societal benefits and minimal environmental harm alongside economic goals. NGOs can evaluate how a policy affects vulnerable groups or marginalized communities, as well as assess the long-term impacts on ecosystems and the sustainability of natural resources (King-Okumu *et al.*, 2020). In doing so, they contribute to the development of more inclusive and responsible policies, ensuring that the policies implemented are not only economically effective but also socially just and ecologically sustainable.

Synergy between various stakeholders enriches the evaluation process by providing a wider range of perspectives, creating a more comprehensive picture of the situation in South Papua (Coletta *et al.*, 2021). By involving various parties, such as government, local communities, academics, and the private sector, the evaluation process not only reflects the interests of certain groups, but also includes the various needs and priorities that exist in the region. This makes the evaluation results more comprehensive and relevant to the real conditions faced. In addition, the involvement of various stakeholders increases accountability and transparency in the evaluation process (Ortega-Rodríguez *et al.*, 2020). Stakeholder collaboration ensures accurate evaluations, builds trust, and enhances policy implementation effectiveness.

Food security policies in South Papua are more effective when tailored to the region's diverse topography, which includes mountains, forests, and coasts, posing challenges in food distribution and access. Therefore, policies that accommodate these geographical constraints are very important. For example, policies that involve transportation solutions suited to difficult terrain conditions can ensure that food can be distributed more efficiently to remote areas (Paciarotti and Torregiani, 2021). In addition, the adaptation of local plants to suit the local climate and soil types helps reduce the risk of crop failure and increase agricultural yields (Martinez-Feria and Basso, 2020). Food security policies that involve local communities in planning and implementation are more successful, especially in South Papua's unique social structure. The involvement of local communities in decision-making ensures that the policies implemented are relevant to their needs and expectations (Wheeler and Root-Bernstein, 2020). Training programs for farmers on more efficient farming techniques and support for improving social infrastructure, such as local markets and food distribution systems, strengthen food security (Sekaran *et al.*, 2021). By taking these social factors into account, policies can create a greater and more sustainable impact on society.

Food security policies in South Papua are more effective when tailored to local cultural conditions, valuing traditional agricultural practices and local plants. Integrating these cultural practices with modern agricultural techniques can create more sustainable solutions that are in line with the needs of the community (Patel *et al.*, 2020). Education and outreach programs that take into account language and communication methods appropriate to local culture also contribute to the understanding and acceptance of food security policies by the community. Policy evaluation and adjustment are important aspects in ensuring the success of food security policies (Diallo *et al.*, 2020). The evaluation results show that flexible and adaptable policies according to community feedback and changing field conditions tend to be more effective. Regular monitoring of policy implementation allows for identification of problems and necessary adjustments to improve effectiveness. In addition, increased participation from various stakeholders, including local governments, non-governmental organizations, and local communities, contributes to the creation of policies that are more comprehensive and responsive to local needs (Vitálišová *et al.*, 2021). With this approach, food security policies can achieve better goals and provide greater positive impacts on food security in South Papua. The use of data analytics and participatory mapping

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technologies significantly increases the accuracy and transparency of the policy evaluation process. Data analytics enables real-time data collection and analysis, providing deep insights into patterns, trends, and relationships between variables (Ikegwu *et al.*, 2022). In South Papua, technology simplifies the mapping of areas which need attention and identifies factors influencing policy effectiveness. Participatory mapping, involving local communities in data collection, enhances transparency by reflecting their direct perspectives and addressing overlooked geographic locations and issues.

Data analytics technology and participatory mapping help in identifying specific challenges faced by communities in South Papua (Fagerholm *et al.*, 2021). With data analytics, researchers can unearth local issues that might go undetected through conventional data collection methods, such as limited access to basic services, poor infrastructure, or economic problems. Participatory mapping, on the other hand, allows communities to mark their issues and needs on maps directly, providing more accurate and relevant data on areas in need of intervention (Colloredo-Mansfeld *et al.*, 2020). For example, data from participatory mapping may show that certain areas are lacking in education or health facilities, allowing policymakers to focus more on those areas. Data analytics technology facilitates the measurement of policy impact in a more precise and evidence-based manner. The data collected and analyzed can show how effective the implemented policy is in achieving its goals. If the policy is designed to increase access to education, data analytics can show whether there is an increase in student participation rates in areas affected by the policy (Tsai *et al.*, 2020). In addition, technology allows for more detailed and continuous evaluation, allowing policymakers to make necessary adjustments and develop new strategies based on the results of the analysis. This supports a process of continuous policy improvement that is responsive to community needs.

Technologies such as participatory mapping play a vital role in increasing stakeholder engagement and community participation. By involving communities in data collection and map-making, these technologies increase ownership and support for the policies being implemented. Community involvement in this process not only provides more comprehensive data but also creates a direct feedback channel that allows policymakers to understand the impact of policies on the community's daily lives (Leino and Puumala, 2021). This feedback is invaluable in assessing and adapting policies to better meet community needs and expectations. Research shows that data analytics and participatory mapping technologies have great potential to improve policy evaluation processes by providing more accurate and transparent data, and by actively engaging communities. In conclusion, these technologies can improve decision-making and policy effectiveness by providing a better understanding of specific challenges and policy impacts. To maximize the benefits of technology, it is recommended that technical capacity be enhanced, more stakeholders be involved in the data collection process, and the data collected be used to make evidence-based decisions that are responsive to community needs. This approach supports more informed and inclusive policymaking, and increases the effectiveness of policy interventions on the ground.

Policy evaluation shows that the involvement of local stakeholders in the process of formulating and implementing food policies has a very positive impact on food sustainability and independence in South Papua. By involving local communities, such as farmers, farmer groups, and civil society organizations, the policies implemented become more relevant and in accordance with local needs and conditions (Ogunyiola *et al.*, 2022). This involvement not only increases the acceptability of policies but also ensures that the proposed solutions are more targeted and well-received by the communities involved. Policies that prioritize local stakeholder participation directly contribute to increased natural resource management capacity. Through

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training and education provided to communities, they gain knowledge and skills in soil management techniques, water conservation, and sustainable agricultural practices. Thus, local communities are able to manage natural resources more efficiently and sustainably, which in turn reduces the risk of environmental degradation and increases agricultural yields. Policy approaches that involve communities in decision-making also support sustainable food production (Hoek *et al.*, 2021). Policies designed with local conditions in mind can facilitate the adoption of environmentally friendly farming techniques, organic pest management, and sustainable farming systems. This contributes to increased food production that not only meets local needs but also reduces dependence on food supplies from outside the region, thereby supporting food self-sufficiency.

Direct involvement of local stakeholders in food policy plays an important role in increasing food independence in South Papua. By strengthening local production capacity and reducing dependence on supplies from outside the region, communities can better face challenges related to food security (Barrett, 2021). Policies that support the development of local markets and distribution of agricultural products also play a crucial role in strengthening food independence, so that these regions can be more independent in meeting their own food needs (Enthoven and Van den Broeck, 2021). While there are many benefits from local stakeholder engagement, there are a number of challenges that need to be addressed. Key challenges include resistance to change, limited access to new technologies, and limited funding. Addressing these challenges requires increased financial support, adequate infrastructure development, and ongoing outreach to improve community knowledge and skills. With right solutions, these challenges can be addressed to ensure policy success and the achievement of sustainable food security goals (Barrett, 2021). This study identified several key challenges that affect the effectiveness of policy implementation. One significant challenge is the lack of coordination among stakeholders. The study found that ineffective communication and overlapping roles between different parties often hamper policy implementation. This results in a lack of shared understanding of policy objectives, which can lead to wasted resources and reduced program effectiveness. Poor coordination also negatively impacts the integration of strategies and initiatives implemented, reducing the expected positive impacts of the policy (Bazzan *et al.*, 2023).

Limited access to technology in remote areas, including inadequate Internet, hardware, and software, hinders effective policy monitoring, evaluation, and reporting. Lack of access to technology also hinders the implementation of technology-based solutions that can improve policy efficiency and outcomes (Ediriweera and Wiewiora, 2021). To address coordination challenges and reduce inequalities in access to information and resources, this study recommends establishing better communication mechanisms through regular forums, coordination meetings, and digital platforms for collaborative problem-solving. This step aims to clarify the roles and responsibilities of each party, and ensure a transparent communication flow. The implementation of clear policies and procedures in managing cooperation is also highly recommended to optimize synergy between the parties involved (Brown *et al.*, 2021). The study recommends strengthening technology infrastructure in remote areas through investments in Internet networks, technology devices, user training, and collaboration with service providers and government agencies. Utilizing local resources to support infrastructure development and maintenance is also proposed as a strategic step to increase access and effectiveness of technology (ElMassah and Mohieldin, 2020). Increasing synergy between related parties and improving technological infrastructure have significant implications for future policy evaluation (Secundo *et al.*, 2020). Better communication and technology access enhance the accuracy of evaluations through improved data collection, analysis, and reporting. This strengthens decision-

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making and ensures policies achieve their intended outcomes effectively.

This study has several strengths, including the use of a multi-stakeholder approach that integrates perspectives from government officials, indigenous communities, the private sector, and NGOs, providing a comprehensive understanding of food security policy evaluation in South Papua. The study also captures context-specific challenges and opportunities and employs qualitative methods that yield rich, nuanced insights into stakeholder experiences. However, the findings are contextually limited to South Papua, which may affect generalizability, and some relevant stakeholder groups may have been underrepresented. Additionally, reliance on self-reported perceptions introduces the potential for subjective bias. Future research could expand the geographic scope and combine qualitative and quantitative methods to enhance the robustness of policy evaluation outcomes.

Conclusion

A multi-stakeholder approach significantly improved the evaluation of food security policies in South Papua. Indigenous communities provided invaluable local knowledge, ensuring policies were relevant to the environment and agricultural practices. Local governments acted as intermediaries, aligning national policies with regional needs, while the private sector introduced market insights. NGOs emphasized equity and ecological considerations, enriching the process with diverse perspectives and enhancing accountability. Tailored policies addressed local geographic, social, and cultural challenges, leading to better outcomes and sustainability. The use of data analytics and participatory mapping improved the accuracy and transparency of evaluations, helping identify specific issues and measure policy impacts effectively. This adaptive approach demonstrated the importance of aligning policies with local realities. However, challenges such as limited stakeholder coordination and access to technology remain. Addressing these through improved communication mechanisms and investments in technology infrastructure can further strengthen food security policies. This collaborative approach paves the way for sustainable food independence in South Papua.

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Authors' contribution

Phuk Tjilen A and Dharmawan B involved in methodology and validation. Tambaip B and Sembiring J participated in data analysis. All authors involved in writing the manuscript and approved the final version of it.

Conflict of interest

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