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Digital Transformation in Subsidized Fertilizer Distribution Governance: The Effectiveness of I PUBERS Application Implementation at Retailer and Agricultural Supply Store Levels in Coppo Urban Village, Barru Regency.

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ABSTRACT

This study examines the implementation of the Integrated Subsidized Fertilizer Application (I-PUBERS) in supporting the effectiveness of subsidized fertilizer distribution in Barru Regency, Indonesia. It focuses on digital transaction management, stakeholder coordination, institutional capacity, technological infrastructure, transparency, and administrative accountability. A qualitative approach was employed to explore the implementation of I-PUBERS based on interview data. The data were analyzed thematically using NVivo, producing coding structures and word-cloud visualizations to identify recurring concepts and relationships among research themes. The findings reveal several important dimensions, including digital fertilizer transactions, communication between retailers and farmers, coordination among farmer group leaders and distribution stakeholders, stock administration, and beneficiary verification. The analysis also identifies supporting and inhibiting factors, particularly human resource capacity, internet connectivity, technological facilities, stakeholder commitment, and consistency in following established procedures. The NVivo visualizations highlight the importance of digital administration, transparency, accountability, and institutional coordination in managing subsidized fertilizer distribution. These findings suggest that I-PUBERS provides an important digital mechanism for improving transaction documentation, facilitating administrative monitoring, and supporting the verification of eligible fertilizer beneficiaries. However, the effectiveness of its implementation depends on adequate technological infrastructure, accurate beneficiary data, user competencies, and continuous institutional supervision. The study concludes that optimizing I-PUBERS requires an integrated approach combining digital technology, organizational commitment, stakeholder participation, and administrative accountability. It recommends improving internet connectivity, strengthening user training, enhancing coordination among distribution actors, and conducting regular monitoring and evaluation to support more transparent, accountable, and effective subsidized fertilizer distribution in Barru Regency.

Keywords: I-PUBERS; Subsidized Fertilizer Distribution; Digital Governance; Administrative Accountability

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A.INTRODUCTION

Agriculture remains a strategic sector in supporting food security, rural livelihoods, and national economic development. The availability of agricultural inputs, particularly fertilizers, plays an important role in maintaining soil fertility and improving crop productivity. For smallholder farmers, fertilizer prices and accessibility can directly affect production costs and farming decisions. Therefore, government intervention through fertilizer subsidies is intended to reduce farmers' financial burden and support sustainable agricultural production. However, the success of this policy depends not only on the amount of subsidy allocated but also on the effectiveness of its distribution system. Previous studies have highlighted that fertilizer subsidy policies require improvements in technical management, institutional coordination, and regulatory implementation (Rachman, 2009; Hendrawan et al., 2011). Consequently, strengthening distribution governance is essential to ensure that subsidized fertilizers reach eligible farmers in accordance with established regulations.

At the global level, digital transformation has increasingly influenced the governance of public services and agricultural supply chains. Digital applications can support more systematic data management, improve transaction records, and facilitate the monitoring of goods from suppliers to end users. In agricultural distribution, these technologies provide opportunities to reduce information gaps, improve inventory visibility, and strengthen accountability among distribution actors. Digitalization can also support more accurate identification of beneficiaries and provide a basis for evaluating the performance of agricultural assistance programs. Nevertheless, the adoption of digital technology does not automatically guarantee effective governance, since its success depends on users' digital capabilities, infrastructure availability, institutional readiness, and the quality of supporting data. Therefore, digital systems should be understood not merely as technological tools but also as instruments for improving transparency, coordination, and accountability in public policy implementation. This perspective is relevant to the distribution of subsidized fertilizers, where accurate information and reliable transactions are important for ensuring that public resources are properly utilized.

In Indonesia, subsidized fertilizer is a government policy instrument designed to support agricultural production and protect farmers' purchasing power. The distribution system involves

several actors, including the central government, fertilizer producers, distributors, authorized retailers, and eligible farmers. However, previous research has identified persistent challenges, including inaccurate demand planning, uneven fertilizer availability, distribution irregularities, and weak supervision (Rachman & Sudaryanto, 2010; Suryana et al., 2022). The government has consequently introduced regulatory and administrative reforms to strengthen the management of subsidized fertilizer distribution. Presidential Regulation No. 6 of 2025, as amended by Presidential Regulation No. 113 of 2025, establishes the governance framework for subsidized fertilizer procurement and distribution, emphasizing the principles of appropriate quantity, price, location, timing, quality, and beneficiaries (Republic of Indonesia, 2025a, 2025b). In addition, Minister of Agriculture Regulation No. 15 of 2025 provides further operational provisions concerning allocation, distribution, supervision, evaluation, and administrative sanctions (Ministry of Agriculture of the Republic of Indonesia, 2025). These regulations demonstrate the importance of effective implementation at the local distribution level.

One of the digital instruments introduced to support subsidized fertilizer distribution in Indonesia is the Integrated Subsidized Fertilizer Application, known as I-PUBERS. The application was developed through cooperation between the Ministry of Agriculture and PT Pupuk Indonesia to facilitate the recording of subsidized fertilizer transactions and improve the monitoring of stock and allocation at authorized retail outlets. Its features include transaction administration, sales documentation, and the recording of customer and product information (Ministry of Agriculture of the Republic of Indonesia, 2024a; Ministry of Agriculture of the Republic of Indonesia & PT Pupuk Indonesia, n.d.). The application also uses geotagging and timestamps to support transaction traceability and real-time monitoring of fertilizer distribution at retailer level (Ministry of Agriculture of the Republic of Indonesia, 2024b). Despite these intended benefits, the effectiveness of I-PUBERS depends on how consistently retailers and agricultural supply stores operate the system in their daily activities. Potential implementation challenges may involve internet connectivity, user competence, data accuracy, transaction procedures, and the consistency of administrative reporting. These aspects require examination to determine whether the application functions effectively as a digital governance instrument.

At the local level, Coppo Urban Village in Barru Regency provides a relevant setting for examining the implementation of I-PUBERS at the retailer and agricultural supply store levels.

These outlets occupy an important position in the final stage of subsidized fertilizer distribution because they interact directly with eligible farmers and are responsible for administering fertilizer transactions. Their ability to use the application correctly may influence the accuracy of transaction records, the availability of stock information, and the accountability of fertilizer distribution. Previous studies on fertilizer distribution in Indonesia have emphasized the importance of retailer supervision, coordination among distribution actors, and the reliability of distribution mechanisms (Sudjono, 2011; Jamil, 2022). However, the implementation of a digital application at the local level needs to be examined in relation to the actual operational conditions of its users. In this context, the study of I-PUBERS in Coppo Urban Village is important for understanding how digital distribution procedures are carried out by retailers and how the application supports their administrative responsibilities. The local context also provides an opportunity to identify factors that may facilitate or constrain the implementation of digital fertilizer distribution.

The implementation of I-PUBERS raises several research problems that deserve systematic investigation. First, it is necessary to examine whether retailers and agricultural supply stores understand the application's functions and are able to operate its features in accordance with established procedures. Second, the study needs to assess whether transaction recording, stock administration, and beneficiary verification are conducted accurately and consistently. Third, the availability of supporting facilities, particularly internet access and appropriate digital devices, may influence the continuity of application use. Fourth, the competence and readiness of application users are important because digital systems require both technical skills and compliance with administrative procedures. These concerns are consistent with earlier findings that fertilizer subsidy distribution may be affected by weaknesses in supervision, coordination, and management (Rachman, 2009; Rozci & Rizkiyah, 2024). Furthermore, research has identified problems relating to beneficiary targeting, data consistency, and distribution accountability in the implementation of fertilizer subsidy programs (Fatika et al., 2025). Accordingly, the central research problem is whether I-PUBERS has been implemented effectively at the retailer and agricultural supply store levels in Coppo Urban Village.

Previous studies have examined subsidized fertilizer distribution from various policy, management, and institutional perspectives. Rachman (2009) emphasized the need to improve technical, managerial, and regulatory aspects of fertilizer subsidy policies. Hendrawan et al. (2011)

examined alternative subsidy mechanisms and distribution systems, identifying supervision as an important factor in determining distribution effectiveness. Rachman and Sudaryanto (2010) also highlighted problems concerning fertilizer availability, demand planning, and the effectiveness of distribution supervision. More recent research by Rozci and Rizkiyah (2024) discussed the implementation and improvement of fertilizer subsidy policies, particularly the need to strengthen monitoring and coordination. Similarly, Fatika et al. (2025) evaluated fertilizer distribution effectiveness using the principles of appropriate beneficiaries, type, quantity, price, timing, location, and quality. These studies provide a substantial foundation for understanding the challenges of subsidized fertilizer governance. Nevertheless, their primary emphasis is on general distribution policies, institutional management, and program effectiveness rather than the practical use of I-PUBERS by retailers at the local level.

Based on the literature reviewed, a research gap can be identified concerning the relationship between digital application implementation and the operational responsibilities of subsidized fertilizer retailers. Previous studies have primarily discussed distribution systems, subsidy policies, supervision, and general program effectiveness (Hendrawan et al., 2011; Suryana et al., 2022; Rozci & Rizkiyah, 2024). Meanwhile, the development of I-PUBERS introduces a more specific dimension of digital governance involving electronic transaction recording, stock monitoring, beneficiary information, and distribution traceability. The novelty of this study lies in its focus on the effectiveness of I-PUBERS implementation at the retailer and agricultural supply store levels in Coppo Urban Village, Barru Regency. Rather than examining subsidized fertilizer distribution only as a policy outcome, this study focuses on the application as an operational instrument used by frontline distribution actors. It examines the implementation process through user understanding, application operation, administrative accuracy, supporting infrastructure, and accountability. This focus is expected to provide a more detailed understanding of how digital technology is translated into daily distribution practices at the local level.

This study is therefore directed at analyzing the effectiveness of I-PUBERS implementation in supporting the governance of subsidized fertilizer distribution at the retailer and agricultural supply store levels in Coppo Urban Village, Barru Regency. Specifically, it examines how retailers use the application to record fertilizer transactions, manage stock information, and administer distribution to eligible farmers. It also identifies the supporting and inhibiting factors

affecting application implementation, including human resource capacity, technological infrastructure, data management, and institutional support. In addition, the study considers whether the application contributes to the principles of transparency, accuracy, efficiency, and accountability in subsidized fertilizer distribution. The findings are expected to contribute to the development of public administration studies, particularly in the areas of digital governance and public policy implementation. Practically, the results may provide recommendations for improving retailer capacity, strengthening technical assistance, and enhancing the monitoring of subsidized fertilizer distribution. Ultimately, the study seeks to explain how digital transformation through I-PUBERS can support more effective and accountable fertilizer distribution governance at the local level.

B.RESEARCH METHOD

This study employed a qualitative descriptive approach to examine the effectiveness of the Integrated Subsidized Fertilizer Application (I-PUBERS) in supporting subsidized fertilizer distribution governance at the retailer and agricultural supply store levels in Coppo Urban Village, Barru Regency. A qualitative approach was selected because the study focuses on understanding the implementation process, the experiences of application users, and the factors influencing the effectiveness of digital technology in local fertilizer distribution. The research was conducted using a case study design to obtain an in-depth understanding of I-PUBERS implementation within its actual operational context. The analysis focused on five aspects: user understanding and competence, application utilization, transaction and stock administration, supporting infrastructure, and accountability in fertilizer distribution (Creswell & Poth, 2018).

Data were collected through interviews, direct observation, and documentation. Informants were selected purposively based on their involvement and knowledge of I-PUBERS implementation, including subsidized fertilizer retailers, agricultural supply store operators, relevant agricultural officers, and other stakeholders involved in the distribution process. Interviews were conducted to explore users' experiences, understanding, operational challenges, and perceptions of the application's benefits. Direct observation was used to examine how the application was utilized in recording transactions, managing fertilizer stock, and administering sales to eligible farmers. Meanwhile, documentation involved reviewing relevant regulations,

distribution records, application-related documents, and other supporting materials. Data triangulation was applied by comparing information obtained from different sources and data collection techniques to strengthen the credibility of the research findings.

Data analysis followed the interactive model developed by Miles, Huberman, and Saldaña (2014), which consists of three interconnected activities: data condensation, data display, and conclusion drawing and verification. Data condensation involved selecting, organizing, and focusing the information obtained from interviews, observations, and documents according to the research objectives. The condensed data were then presented in descriptive and thematic forms to identify patterns relating to application utilization, administrative effectiveness, user capacity, infrastructure availability, and distribution accountability. Finally, conclusions were drawn and continuously verified by examining the consistency of evidence across different data sources. Through this analytical process, the study sought to identify the extent to which I-PUBERS supports effective, transparent, and accountable subsidized fertilizer distribution in Coppo Urban Village, Barru Regency.

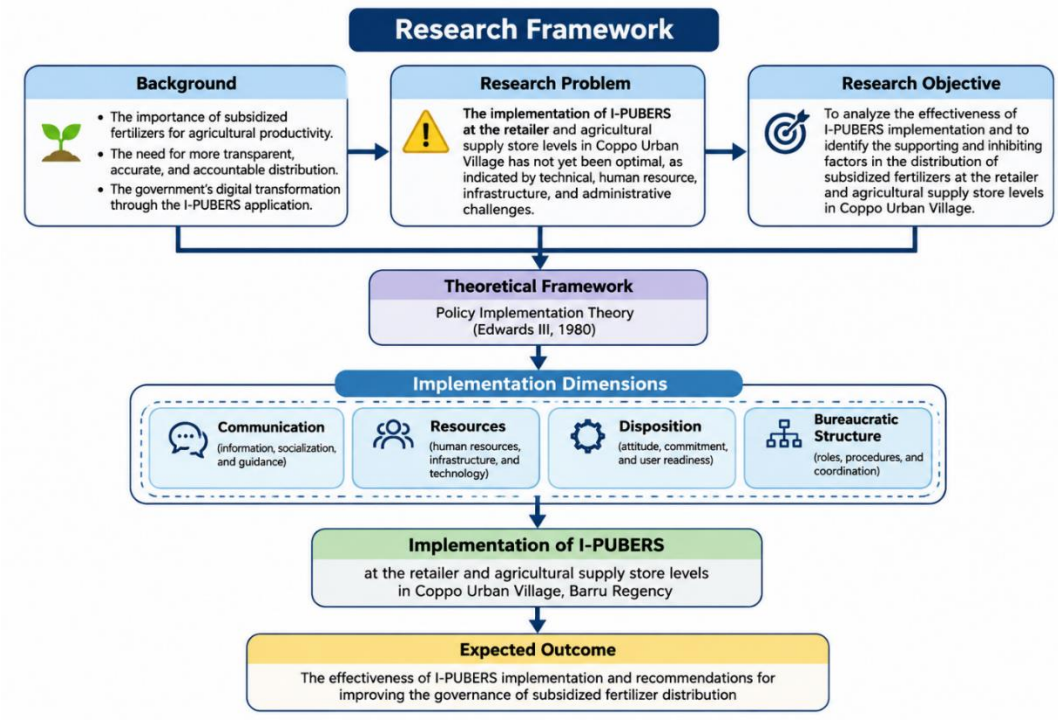


Figure 1 Research Framework for the Effectiveness of I-PUBERS Application Implementation in Subsidized Fertilizer Distribution Governance in Coppo Urban Village, Barru Regency.

The figure illustrates the research framework for analyzing the effectiveness of the Integrated Subsidized Fertilizer Application (I-PUBERS) in supporting subsidized fertilizer distribution governance at the retailer and agricultural supply store levels in Coppo Urban Village, Barru Regency. The analysis begins with the background of subsidized fertilizer distribution and the challenges associated with digital transformation, followed by the identification of research problems and objectives. The study adopts George C. Edwards III's policy implementation theory (1980), which consists of four dimensions: communication, resources, disposition, and bureaucratic structure. These dimensions provide the analytical basis for examining how I-PUBERS is implemented in daily distribution activities. The analysis ultimately aims to assess the effectiveness of the application, identify supporting and inhibiting factors, and formulate recommendations to improve transparency, efficiency, and accountability in subsidized fertilizer distribution governance.

C.RESEARCH RESULTS AND DISCUSSION

- Results

The implementation of the Integrated Subsidized Fertilizer Application (I-PUBERS) in Coppo Urban Village, Barru Regency, represents an effort to improve the administration and monitoring of subsidized fertilizer distribution through digital technology. The application is intended to facilitate the recording of fertilizer transactions, monitor stock availability, and improve the accuracy of distribution information. In this study, the implementation process is examined from the perspectives of retailers, agricultural group representatives, and farmers. The research involves seven informants, consisting of H. Basir Naming as the owner of UD Tani Mulya and I-PUBERS administrator, Ahmad AZ as the chairman of the Samaturu Farmers' Group, and five farmers: Jamal, Suriadi, Sale, Musliadi, and Side'. Their different positions provide perspectives on the relationship between digital administration at the retailer level and fertilizer distribution at the farmer level. The analysis focuses on how the application supports distribution activities and the extent to which its implementation contributes to effective fertilizer governance.

Understanding the functions and procedures of I-PUBERS is an important factor in determining the effectiveness of its implementation. As the owner of UD Tani Mulya and the application administrator, H. Basir Naming occupies a central position in the operational use of

the system at the retailer level. The administrator is responsible for understanding the application procedures and ensuring that fertilizer transactions are recorded according to the applicable requirements. Meanwhile, farmers interact with the distribution system as the final beneficiaries of subsidized fertilizer. Their understanding of the application may influence their ability to access fertilizer through the established procedures. Ahmad AZ, as chairman of the Samaturu Farmers' Group, also represents an important link between farmers and the retailer. Therefore, differences in knowledge and understanding between administrators, farmer group representatives, and individual farmers need to be considered when assessing the effectiveness of I-PUBERS implementation.

The recording of subsidized fertilizer transactions is one of the main functions of I-PUBERS. Through the application, retailers are expected to document fertilizer sales electronically and maintain more systematic administrative records. This digital recording mechanism is intended to reduce dependence on manual documentation and improve the availability of transaction information. At UD Tani Mulya, the administrator's ability to operate the application is particularly important because the retailer serves as the point of interaction between the distribution system and eligible farmers. Transaction accuracy also depends on the correctness of farmer identification, fertilizer allocation information, and the consistency of data entered into the application. From the perspective of public administration, the digital recording process can strengthen accountability because distribution activities become more systematically documented. Nevertheless, its effectiveness must be assessed through actual transaction records and observations of daily application use.

Communication is a significant dimension in the implementation of I-PUBERS because the distribution of subsidized fertilizer involves several actors with different responsibilities. Retailers need to communicate information regarding fertilizer availability, distribution procedures, and administrative requirements to farmers. Farmer group representatives also play an important role in conveying information and facilitating coordination between farmers and distribution outlets. In this context, Ahmad AZ, as chairman of the Samaturu Farmers' Group, represents an important institutional connection between the retailer and the farming community. The five farmer informants—Jamal, Suriadi, Sale, Musliadi, and Side'—provide perspectives that can help assess whether information about fertilizer distribution reaches beneficiaries effectively.

Effective communication is expected to minimize misunderstandings regarding allocation, purchasing procedures, and fertilizer availability. Consequently, the quality of communication among these actors is an important indicator of successful I-PUBERS implementation.

The effectiveness of I-PUBERS should also be examined from the perspective of farmers who directly receive subsidized fertilizer. The application is expected to support a more orderly distribution process by improving transaction administration and beneficiary verification at the retailer level. For farmers, however, the most important considerations include the accessibility of fertilizer, clarity of purchasing procedures, and certainty regarding their eligibility. The experiences of Jamal, Suriadi, Sale, Musliadi, and Side' are relevant to understanding how the distribution system operates from the beneficiaries' perspective. Their experiences can provide information about whether the administrative procedures are understandable and whether the application supports the process of obtaining fertilizer. In addition, the role of the retailer remains important in assisting farmers who may have limited familiarity with digital administrative systems. Thus, the effectiveness of I-PUBERS should not be measured solely by the successful operation of the application but also by its contribution to accessible fertilizer services.

The availability of adequate human resources and technological infrastructure is another important factor affecting I-PUBERS implementation. The application requires administrators who possess sufficient technical knowledge to operate the system and manage transaction information accurately. H. Basir Naming, as the administrator at UD Tani Mulya, has a central responsibility in this process. Supporting facilities, including smartphones or computers, internet connectivity, and access to the application, are also necessary to ensure that digital transactions can be recorded consistently. Limitations in these facilities may affect the speed and continuity of administrative activities. Furthermore, the ability of users to adapt to application updates and technical procedures may influence implementation quality. From the perspective of policy implementation, adequate resources are essential because even a well-designed digital system may not achieve its objectives if the implementing actors lack the necessary skills and facilities.

Disposition refers to the attitudes, commitment, and willingness of policy implementers to carry out their assigned responsibilities. In the implementation of I-PUBERS, the commitment of retailers is important because they are directly responsible for using the application in fertilizer

distribution activities. The willingness of H. Basir Naming to operate the system, maintain transaction records, and follow established procedures represents an important aspect to be investigated. Positive attitudes among implementing actors can support the consistency of digital administration and improve the quality of services provided to farmers. At the same time, the participation of farmer group representatives and individual farmers is relevant to ensuring that distribution procedures are followed appropriately. Ahmad AZ and the five farmer informants provide an opportunity to examine how the policy is received by its beneficiaries. Therefore, the disposition dimension encompasses not only the commitment of the retailer but also the cooperation and acceptance of the actors involved in the

The bureaucratic structure concerns the division of responsibilities, administrative procedures, and coordination mechanisms involved in policy implementation. In the subsidized fertilizer distribution system, retailers must follow the established procedures governing the sale and recording of fertilizer transactions. These procedures are intended to ensure that subsidized fertilizer is distributed to eligible beneficiaries in accordance with the applicable allocation and regulatory requirements. The position of UD Tani Mulya as a retailer makes its administrative practices an important component of the local distribution process. Coordination with farmer groups and relevant agricultural institutions is also necessary to support accurate beneficiary information and orderly distribution. Ahmad AZ, as chairman of the Samaturu Farmers' Group, represents an important actor in this coordination process. The effectiveness of the bureaucratic structure can therefore be assessed through the clarity of procedures, consistency of implementation, and coordination between the retailer, farmer groups, and relevant government institutions.

The implementation of I-PUBERS may be influenced by several supporting and inhibiting factors. Supporting factors potentially include the availability of digital application facilities, the commitment of the retailer administrator, the involvement of farmer group representatives, and the existence of procedures governing subsidized fertilizer distribution. These factors can encourage more systematic transaction recording and improve administrative accountability. However, potential inhibiting factors may include limited digital literacy, unstable internet connectivity, technical difficulties, insufficient user assistance, and differences in farmers' understanding of distribution procedures. The perspectives of H. Basir Naming, Ahmad AZ, Jamal, Suriadi, Sale,

Musliadi, and Side' are important for identifying which factors are actually experienced in the research location. The relationship between these factors should be examined to understand whether the application operates effectively in everyday distribution activities. Identifying these conditions is essential for formulating recommendations that address the practical needs of retailers and farmers.

Overall, the implementation of I-PUBERS in Coppo Urban Village can be analyzed through four dimensions of George C. Edwards III's policy implementation theory: communication, resources, disposition, and bureaucratic structure. Communication concerns the delivery of information and coordination among retailers, farmer groups, and farmers. Resources relate to the availability of competent administrators, technological facilities, and internet connectivity. Disposition concerns the commitment and willingness of implementing actors to use the application in accordance with established procedures. Meanwhile, bureaucratic structure examines the clarity of responsibilities, administrative procedures, and coordination mechanisms in subsidized fertilizer distribution. The seven informants provide different perspectives for evaluating these dimensions, particularly the relationship between retailer-level administration and farmers' access to subsidized fertilizer. The final assessment of effectiveness should be based on the consistency of interview findings, direct observations, and supporting documentation. The results are expected to provide a basis for recommendations to strengthen digital governance, improve distribution transparency, and enhance accountability in subsidized fertilizer distribution in Coppo Urban Village, Barru Regency.

- Data Analysis Using NVivo

Data analysis in this study was conducted using a qualitative approach supported by NVivo 12 Pro software. The utilization of NVivo was intended to assist the researcher in managing, organizing, coding, and systematically analyzing qualitative data concerning the effectiveness of the Integrated Subsidized Fertilizer Application (I-PUBERS) in supporting subsidized fertilizer distribution governance at retailer and agricultural supply store levels in Coppo Urban Village, Barru Regency. The primary data were obtained through in-depth interviews with seven informants, consisting of H. Basir Naming, the owner of UD Tani Mulya and I-PUBERS administrator; Ahmad AZ, Chairman of the Samaturu Farmers' Group and a farmer; and five

farmers, namely Jamal, Suriadi, Sale, Musliadi, and Side'. These informants were selected because of their involvement in or experience with subsidized fertilizer distribution and the implementation of I-PUBERS at the local level. To strengthen the credibility of the findings, interview data were complemented by field observations and documentary evidence, including subsidized fertilizer distribution regulations, retailer administrative records, transaction documentation, farmer group records, and relevant policy documents concerning fertilizer subsidy governance. The application of NVivo enabled the researcher to systematically organize qualitative data, identify recurring patterns, and explore relationships among emerging concepts. Through this process, themes associated with digital application implementation, fertilizer distribution procedures, transaction recording, stock administration, communication among distribution actors, user competence, technological infrastructure, and distribution accountability were identified and analyzed comprehensively.

Through NVivo, the analysis was organized using three coding stages: open coding, axial coding, and selective coding. During the open coding stage, the researcher identified initial concepts emerging from interview transcripts, field observations, and supporting documents. Several preliminary codes were developed, including understanding of the I-PUBERS application, digital transaction recording, subsidized fertilizer stock management, farmer beneficiary verification, fertilizer distribution procedures, retailer administrative responsibilities, communication between retailers and farmers, farmer group coordination, digital literacy, internet connectivity, technological facilities, and distribution transparency. These initial codes reflected the technological, administrative, and institutional dimensions of I-PUBERS implementation. The coding process also enabled the researcher to capture different perspectives between the retailer administrator, the farmer group representative, and individual farmers concerning the use of digital technology in subsidized fertilizer distribution. By organizing interview statements into relevant coding categories, the researcher could identify similarities and differences in informants' experiences, perceptions, and assessments of the application, particularly regarding its operational functions and contribution to the distribution process.

The second stage involved axial coding, in which related concepts were connected and grouped into broader thematic categories based on George C. Edwards III's policy implementation theory (1980). The identified categories included communication, resources, disposition, and bureaucratic structure. The communication category examined information dissemination, coordination between retailers and farmers, and the clarity of fertilizer distribution procedures. The resources category focused on human resource capacity, digital skills, internet connectivity, and the availability of technological facilities supporting I-PUBERS operations. The disposition category explored the commitment, attitudes, and willingness of retailers and other implementing actors to use the application consistently. Meanwhile, the bureaucratic structure category examined administrative responsibilities, transaction procedures, coordination mechanisms, and compliance with subsidized fertilizer distribution regulations. Finally, selective coding was employed to identify the central theme integrating all major categories, namely the effectiveness of digital transformation through I-PUBERS in strengthening subsidized fertilizer distribution governance at the retailer and agricultural supply store levels. The analytical framework was designed to examine the relationship between digital application utilization, institutional implementation capacity, and farmers' access to subsidized fertilizer. The findings were interpreted by comparing information from the seven informants and examining its consistency with observational and documentary evidence. Therefore, the use of NVivo not only facilitated the systematic organization and interpretation of qualitative data but also supported analytical transparency, methodological rigor, and the development of an evidence-based understanding of I-PUBERS implementation in Coppo Urban Village, Barru Regency.

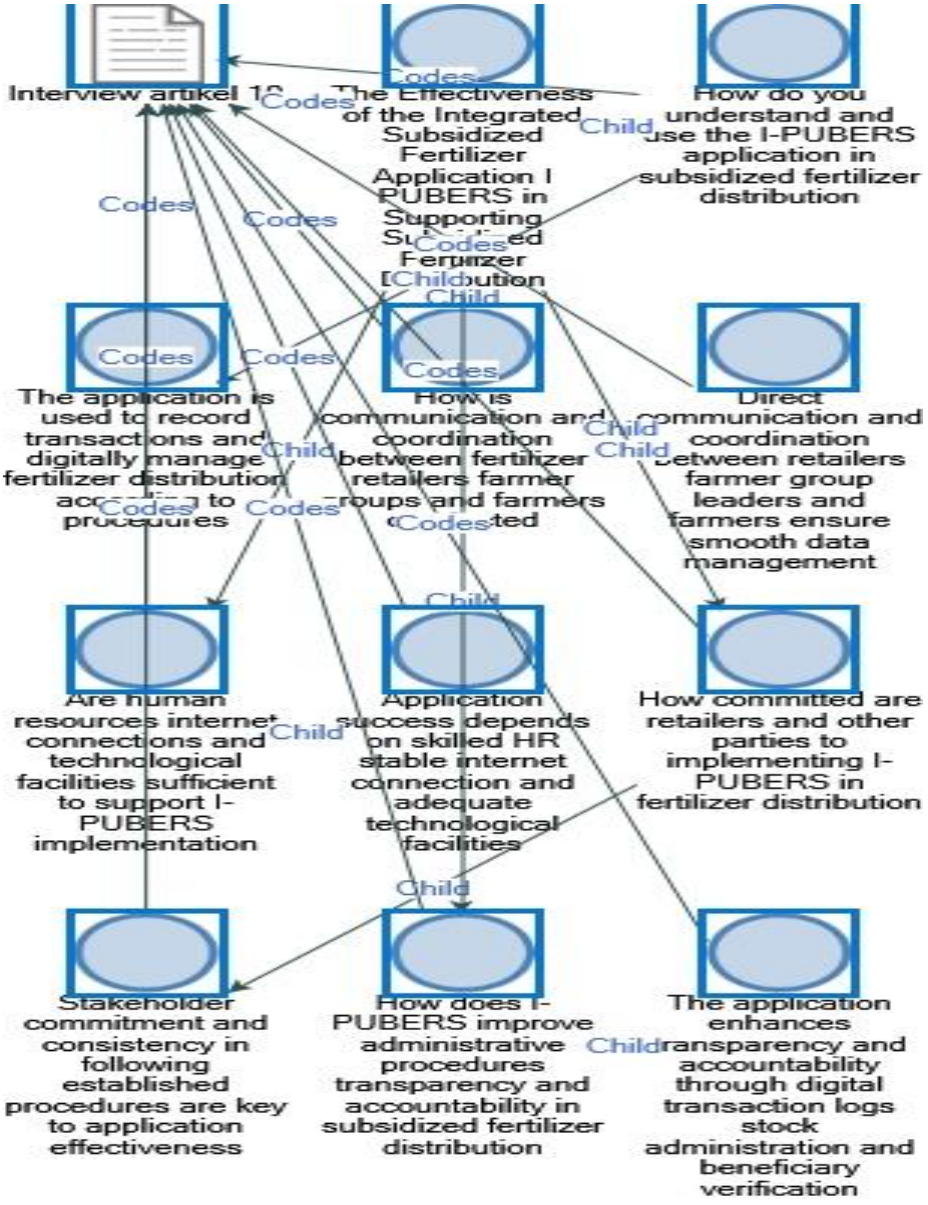


Figure 2 NVivo Coding Structure of the Effectiveness of the Integrated Subsidized Fertilizer Application (I-PUBERS) in Supporting Fertilizer Distribution in Barru Regency

Figure 2 illustrates the NVivo coding structure developed to analyze the effectiveness of the Integrated Subsidized Fertilizer Application (I-PUBERS) in supporting subsidized fertilizer distribution. The diagram presents several research dimensions, including the application of I-PUBERS in digital fertilizer transactions, communication and coordination among retailers, farmer groups, and farmers, as well as the effectiveness of the application in supporting fertilizer distribution. It also identifies the importance of human resources, internet connectivity, and

technological facilities as supporting factors for application implementation. These dimensions are connected to the central interview document, showing how interview information was organized into research questions and thematic categories. The coding structure demonstrates that the implementation of I-PUBERS involves not only digital technology but also administrative processes and coordination among distribution stakeholders.

Furthermore, the diagram highlights several factors influencing the effectiveness of I-PUBERS, including stakeholder commitment, consistency in following established procedures, stable internet connections, adequate technological facilities, and the capacity of application users. Other important themes include administrative transparency, accountability, stock administration, transaction records, and beneficiary verification. These themes indicate that the application is intended to improve the accuracy, transparency, and accountability of subsidized fertilizer distribution. The relationships labeled Child and Codes represent the hierarchical connections between research questions, thematic categories, and coded interview data. Overall, this NVivo visualization provides an analytical framework for understanding how digital application utilization, institutional coordination, human resource capacity, and technological infrastructure influence the implementation of subsidized fertilizer distribution through I-PUBERS.



Figure 3 NVivo Word Cloud of Interview Data on the Effectiveness of the Integrated Subsidized Fertilizer Application (I-PUBERS) in Supporting Fertilizer Distribution

Figure 3 presents a word cloud generated through NVivo analysis of interview data concerning the effectiveness of the Integrated Subsidized Fertilizer Application (I-PUBERS) in supporting subsidized fertilizer distribution. The visualization displays frequently occurring words and concepts, with larger words representing terms that appear more frequently in the analyzed data. The most prominent terms include distribution, fertilizer, application, subsidized, retailers, farmers, coordination, and effectiveness. These terms reflect the central focus of the research, particularly the implementation of digital technology in managing subsidized fertilizer distribution and facilitating transactions between fertilizer retailers and farmers. The prominence of these concepts indicates that I-PUBERS is closely associated with distribution processes, administrative management, and coordination among stakeholders.

Furthermore, the word cloud highlights several supporting themes, including transparency, accountability, verification, communication, internet connectivity, technological facilities, human resources, and commitment. These concepts suggest that the effectiveness of I-PUBERS depends not only on the availability of the digital application but also on adequate technological infrastructure, user competencies, and consistent implementation of established procedures. The appearance of terms related to stock management, transaction records, and beneficiary verification also emphasizes the importance of accurate administrative information in strengthening fertilizer distribution governance. Overall, this visualization provides an overview of the dominant vocabulary emerging from the interviews and supports further thematic interpretation of digital transformation, institutional coordination, and accountability in subsidized fertilizer distribution in Barru Regency. However, word frequency alone does not establish the effectiveness or causal impact of the application.

- Discussion

The findings demonstrate that the Integrated Subsidized Fertilizer Application (I-PUBERS) plays an important role in supporting the digital transformation of subsidized fertilizer distribution in Barru Regency. The NVivo coding structure in Figure 2 identifies several interconnected dimensions, including digital fertilizer transactions, administrative procedures, communication and coordination among retailers and farmers, and the transparency of distribution activities. Figure 3 further highlights prominent concepts such as distribution, fertilizer,

application, subsidized, retailers, farmers, and coordination. These themes indicate that I-PUBERS is not merely a technological instrument but also an administrative mechanism for improving the management and supervision of subsidized fertilizer distribution. Through digital transaction recording, the application can support more systematic documentation of fertilizer redemption, stock administration, and beneficiary verification. This interpretation is consistent with Amanda and Sasmita (2024), who explain that I-PUBERS represents an e-government innovation intended to optimize subsidized fertilizer distribution through digital administrative processes.

Therefore, the implementation of I-PUBERS in Barru Regency should be understood as part of broader efforts to improve the quality of public services in the agricultural sector, particularly in terms of distribution efficiency, administrative transparency, and accountability.The effectiveness of I-PUBERS also depends on communication and coordination among fertilizer retailers, farmer group leaders, and farmers. The NVivo analysis identifies direct communication, stakeholder coordination, and the commitment of retailers and farmer groups as important themes in supporting application implementation. These relationships are essential because digital distribution requires accurate information exchange concerning farmer eligibility, fertilizer allocations, stock availability, and transaction procedures. Coordination between retailers and farmers can reduce misunderstandings and facilitate the implementation of fertilizer redemption in accordance with established requirements. However, the availability of an application does not automatically guarantee effective communication or consistent implementation. The study by Lestari et al. (2025), which examines retailers' and farmers' perceptions of I-PUBERS in Makarti Jaya, highlights the role of the application in facilitating communication and fertilizer distribution while also identifying technological limitations and difficulties experienced by some users.

This suggests that strengthening I-PUBERS implementation in Barru Regency requires not only application availability but also continuous communication, user assistance, and coordination among all distribution actors.The implementation of I-PUBERS is also influenced by the availability of technological infrastructure and the capacity of human resources. Figure 2 identifies internet connectivity, technological facilities, application users' skills, and stakeholder commitment as important factors affecting the effectiveness of the system. These findings suggest that digital transformation in subsidized fertilizer distribution requires more than the introduction of an application; it must be accompanied by adequate infrastructure and continuous capacity

development. Unstable internet connections, limited digital literacy, and insufficient technical assistance may disrupt transaction recording and administrative procedures. Apriadi et al. (2026) similarly found that I-PUBERS implementation in Sungai Rotan Village improved transaction transparency and distribution monitoring but remained constrained by inaccurate farmer identification data, internet connectivity problems, technical application issues, and limited digital literacy.This comparison indicates that the effectiveness of I-PUBERS in Barru Regency should be supported by regular training for retailers and farmers, technical assistance, improved internet access, and accurate beneficiary data. Strengthening these components is essential to ensure that digital systems can operate consistently and provide reliable information for fertilizer distribution management.

Furthermore, I-PUBERS has the potential to strengthen transparency and accountability through digital transaction records, stock administration, and beneficiary verification. The prominence of these themes in Figure 3 indicates that administrative accountability is an important aspect of the application's implementation. Digital records can facilitate the monitoring of fertilizer transactions, provide information about stock availability, and support the verification of eligible farmers. Nevertheless, the existence of digital records does not automatically guarantee that subsidized fertilizer reaches the right beneficiaries in the appropriate quantity, price, time, and location. Effective supervision, accurate data management, compliance with distribution procedures, and coordination among stakeholders remain necessary. In this regard, the effectiveness of I-PUBERS in Barru Regency should be evaluated not only through application utilization but also through improvements in distribution accuracy, administrative transparency, service accessibility, and accountability. Overall, the findings suggest that optimizing I-PUBERS requires an integrated approach combining digital technology, institutional commitment, human resource capacity, infrastructure readiness, and stakeholder collaboration. Such an approach can strengthen the governance of subsidized fertilizer distribution and support more reliable agricultural public services.

D. CONCLUSION AND RECOMMENDATIONS

- Conclusion

This study concludes that the Integrated Subsidized Fertilizer Application (I-PUBERS) has an important role in supporting the digital transformation of subsidized fertilizer distribution in Barru Regency. The NVivo analysis identifies several key dimensions, including digital fertilizer transactions, administrative procedures, communication and coordination among retailers and farmers, stock administration, and beneficiary verification. These findings indicate that I-PUBERS provides a digital mechanism for supporting more systematic fertilizer distribution management through transaction recording, information accessibility, and administrative monitoring. The application also has the potential to strengthen transparency and accountability in the distribution process, particularly by improving the documentation of fertilizer transactions and the verification of eligible beneficiaries.

Furthermore, the effectiveness of I-PUBERS depends on several supporting factors, including human resource capacity, internet connectivity, technological facilities, stakeholder commitment, and compliance with established procedures. Communication and coordination among retailers, farmer group leaders, and farmers are also essential to ensuring the smooth implementation of the application. However, the availability of digital technology alone does not guarantee optimal distribution outcomes without adequate infrastructure, technical assistance, accurate beneficiary data, and continuous institutional supervision. Therefore, optimizing I-PUBERS requires an integrated approach that combines technological readiness, organizational commitment, administrative accountability, and active stakeholder participation to strengthen subsidized fertilizer distribution governance.

- Recommendations

The local government of Barru Regency, particularly the relevant agricultural agencies, should strengthen the implementation of I-PUBERS by improving internet connectivity, providing adequate technological facilities, and conducting regular training for fertilizer retailers, farmer group leaders, and farmers. Technical assistance should be made continuously available to address application-related problems and improve users' digital competencies. Furthermore, coordination

among retailers, farmer groups, village governments, and agricultural institutions should be strengthened to ensure accurate beneficiary data, transparent transaction recording, and effective stock monitoring. Regular supervision and evaluation should also be conducted to assess distribution accuracy, administrative accountability, and compliance with established procedures. Future research should examine the effectiveness of I-PUBERS using transaction records, fertilizer distribution data, and direct assessments of farmers' experiences.

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