RESEARCH ARTICLE

Information System For Multi-Region LPG 3 Kg Realization Data Processing at PT Indung Tulot Energy (Pertamina) Banda Aceh

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Abstract

This research aims to address challenges in the management and distribution activities of 3 Kg LPG at PT Indung Tulot Energy (Pertamina) Banda Aceh. These challenges include difficulties in data collection, distribution transactions, and efficient report generation. Data collection methods used were Field Studies and Literature Studies. The research resulted in an LPG 3 Kg allocation information system application, designed to accelerate and simplify allocation data management processes, sub-distributor data management, and improve reporting effectiveness. The system is intended to resolve existing problems and enhance services at PT Indung Tulot Energy (Pertamina) Banda Aceh.

Keywords

Information System; 3 Kg LPG Realization; PT Indung Tulot Energy.

1 | INTRODUCTION

The Indonesian government initiated a kerosene-to-LPG conversion program in late 2007, which continued until 2010. During this period, approximately 45 million starter packages of 3 kg LPG cylinders were distributed free of charge to qualifying households and micro-businesses across the country. Program evaluations have demonstrated remarkable success, evidenced by the significant increase in 3 kg LPG cylinder usage. By 2010, the distribution of 3 kg LPG refills reached approximately 2.5 million metric tons, representing a substantial 416% increase from 2008 levels (Wulandari, 2012). This conversion program was part of a broader government initiative to reduce dependency on kerosene, decrease subsidy burden, and promote cleaner fuel alternatives for domestic use (Widyaningrum, 2012). Despite this success, the implementation of the program continues to face numerous challenges, particularly in data collection, distribution transactions, and efficient reporting systems. These challenges are further complicated by the regulatory framework established by Ministerial Regulation No. 26 of 2009 concerning the Supply and Distribution of Liquefied Petroleum Gas. According to this regulation, the distribution system for Specific LPG operates within a closed system, where refill purchases by qualifying households and micro-businesses must be conducted through designated distributors or sub-distributors (Tim Komisi VII & Negara, 2022). This closed system aims to minimize illegal transactions and ensure that subsidized LPG reaches its intended beneficiaries.

At PT Indung Tulot Energy (PERTAMINA) Banda Aceh, the data collection process for 3 kg LPG allocation faces various operational challenges. These include inefficient stock control, inadequate allocation management, and cumbersome reporting procedures (Putra & Siahaan, 2020). The current manual system results in data redundancy, delayed information processing, and difficulties in tracking distribution patterns across multiple districts (rayon). According to Kurniawan (2013), ineffective monitoring systems in LPG distribution can lead to market distortions and failure to reach intended beneficiaries. The absence of an integrated information system further complicates the management of sub-distributor data, transaction records, and inventory control. As noted by Amin (2021), traditional management approaches in LPG distribution centers often lead to operational inefficiencies and reduced service quality. Additionally, Fajar & Juhriah (2022) highlight that manual financial and inventory tracking systems in LPG distribution points are prone to errors and make comprehensive analysis difficult. These challenges collectively impede the company's ability to provide optimal service to customers and maintain operational efficiency. This research focuses on developing an Information System for Processing 3 kg LPG Realization Data across Multiple Districts (Multi-Rayon) at PT Indung Tulot Energy (PERTAMINA) Banda Aceh. The primary objectives are to design and implement a comprehensive information system that can:

1) Streamline data collection and management processes for 3 kg LPG allocation
2) Enhance sub-distributor data management and transaction recording
3) Improve reporting efficiency and accuracy
4) Facilitate better inventory control and distribution monitoring
5) Support decision-making processes related to LPG distribution

The scope of this research is limited to the development of an information system specifically tailored for PT Indung Tulot Energy (PERTAMINA) Banda Aceh, focusing on the processing and management of 3 kg LPG realization data across multiple distribution districts. As emphasized by Putra & Rezeki (2022), targeted information systems for LPG distribution can significantly improve operational efficiency and data accuracy when properly designed for specific organizational. A system, in various contexts, refers to a collection of interrelated elements that are organized and interact to achieve specific objectives. Scholars have defined systems as integrated elements that work together conceptually or physically. For instance, Kumorotomo & Margono (2001) define a system as a collection of organized elements or components, while Davis (2002) views it as interacting parts working toward a common goal. Another definition by Ackof (2000) emphasizes the interdependence between system components. From these various definitions, we can conclude that a system is an entity consisting of elements that interact with each other to achieve specific objectives.

Information is the result of data processing that transforms raw facts into an understandable form that provides relevant knowledge to users. Data, fundamentally, consists of raw facts that have no significant value without processing. When data is processed and organized in such a way that it has meaning, its value increases to become information. It is important to understand that information must be timely, relevant, valuable, and reliable to be effective in supporting decision-making processes (Wali, 2017). An Information System is a structure consisting of hardware and software designed to collect, process, store, analyze, and disseminate information to achieve specific objectives. Definitions from various experts such as Bodnar and Hopwood, Hall, Turban, McLean, Wetherbe, Wilkinson, and Gelinas state that information systems are collections of components that interact to produce useful information. These components include inputs, models, outputs, technology, controls, and databases (Adrian *et al.*, 2020). LPG (Liquefied Petroleum Gas) is a mixture of hydrocarbons derived from natural gas, primarily consisting of propane and

butane. The main properties of LPG are its flammability, non-toxicity, and tendency to be heavier than air. The use of LPG as fuel for households and industries has increased rapidly due to its efficiency and safety (Wusko, 2022). To meet safety standards, LPG must be produced with the correct composition and quality and equipped with odorants to detect leaks. The distribution of 3 kg LPG cylinders involves several steps, including identifying strategic locations, partnering with gas agents, providing delivery facilities, and developing marketing strategies. This process also involves efforts to acquire new customers and retain existing ones. Competitive pricing and efficient stock management are key to successful LPG distribution (Lubis & Suhairi, 2022). According to Nurhasnah (2020), proper implementation of maximum retail price regulations is crucial for ensuring fair access to subsidized LPG products. LPG comes in various forms, primarily as a mixture of propane and butane with different compositions according to its use. Specific requirements, such as efficient combustion and rapid evaporation, must be met to ensure the safety and quality of LPG use. The LPG separation process is also an important part of the production and distribution of this gas (Zaky & Arwin, 2021).

Visual Basic .NET is an application development tool based on the .NET Framework, using the BASIC programming language. With this tool, developers can create various types of applications, including Windows Forms applications and ASP.NET-based web applications. Although its launch was controversial due to significant changes from previous versions, Visual Basic .NET remains one of the primary choices for application development in the Windows environment (Wali, 2017). For developing the 3 kg LPG realization data processing system, Visual Basic .NET was selected due to its robust features for creating database-driven applications and user-friendly interfaces. As noted by Putra & Rezeki (2022), Java and .NET-based applications provide suitable platforms for developing LPG distribution management systems that can handle complex data processing requirements while maintaining user accessibility. The implementation of this information system is expected to accelerate and simplify allocation data management processes, enhance sub-distributor data management, and improve reporting effectiveness at PT Indung Tulot Energy (PERTAMINA) Banda Aceh. By addressing the existing challenges in LPG distribution management, the system aims to improve overall service quality and operational efficiency, ultimately benefiting both the company and its customers (Mukhalladun, 2022; Eriani, 2020).

2 | BACKGROUND THEORY

2.1 Information Systems and Software Development

Information systems represent a fundamental framework that combines hardware, software, data, procedures, and people to collect, process, store, and distribute information within organizations. According to Wali (2018), information systems serve as the backbone of modern business operations, enabling organizations to streamline processes, enhance decision-making capabilities, and maintain competitive advantages in increasingly digital marketplaces. The evolution of information systems has been closely tied to advancements in computing technology, with contemporary systems leveraging sophisticated software architectures and database management techniques to handle complex organizational requirements. The development of effective information systems requires a structured approach that encompasses requirements analysis, system design, implementation, testing, and maintenance. Wali (2020) emphasizes that software engineering methodologies provide essential frameworks for managing these processes, ensuring that the resulting systems meet user needs while maintaining quality standards. These methodologies range from traditional waterfall approaches to more flexible agile frameworks, each offering distinct advantages depending on project scope, complexity, and organizational context. The selection of an appropriate methodology significantly influences project outcomes, with recent trends favoring iterative and incremental approaches that accommodate evolving requirements and facilitate continuous stakeholder feedback. Database management systems (DBMS) constitute a critical component of modern information systems, providing mechanisms for organizing, storing, and retrieving data efficiently. Relational database systems remain predominant in business applications, offering robust transaction processing capabilities and well-established query languages. However, as Wali (2018) notes, the emergence of NoSQL databases has expanded options for organizations dealing with unstructured data or requiring highly scalable solutions. The integration of database systems with application layers represents a fundamental aspect of information system architecture, with object-relational mapping techniques facilitating seamless interaction between software components and underlying data structures.

2.2 Visual Basic .NET as Development Platform

Visual Basic .NET (VB.NET) has evolved significantly from its predecessor, transitioning from a relatively simple programming language to a fully object-oriented platform integrated within the .NET Framework. Appleman (2008) describes this evolution as a paradigm shift that required developers to adapt to new concepts such as inheritance, polymorphism, and structured exception handling. Despite initial resistance to these changes, VB.NET has established itself as a versatile development environment capable of supporting enterprise-level applications across

diverse domains. The .NET Framework provides a comprehensive foundation for VB.NET applications, offering a rich set of libraries that simplify common programming tasks. Morrison and Cornell (2008) highlight that the Framework Class Library (FCL) encompasses thousands of pre-built components for handling everything from file operations and network communications to user interface elements and security features. This extensive library significantly reduces development time by eliminating the need to create fundamental functionality from scratch, allowing developers to focus on business-specific requirements and application logic. VB.NET's integration with Visual Studio further enhances developer productivity through sophisticated tools for code editing, debugging, and deployment. The integrated development environment (IDE) provides features such as IntelliSense, which offers context-sensitive code completion suggestions, and visual designers for creating user interfaces through drag-and-drop interactions. According to Wali (2020), these tools substantially lower the technical barriers to application development, enabling even those with limited programming experience to create functional software solutions when provided with appropriate guidance and training resources.

2.3 Distributed Applications and Web Services

The increasing interconnectedness of business systems has driven demand for distributed application architectures that enable seamless communication between components operating across different locations and platforms. Barnaby (2013) explains that VB.NET supports distributed computing paradigms through various mechanisms, including remoting, web services, and more recently, Windows Communication Foundation (WCF). These technologies facilitate the development of applications that can function effectively in networked environments, sharing data and functionality while maintaining appropriate separation of concerns. Web services represent a particularly significant approach to distributed computing, providing standardized methods for system interoperability regardless of underlying implementation details. Shohoud (2003) describes XML web services as platform-independent interfaces that enable applications to exchange data over standard internet protocols, typically using formats such as SOAP (Simple Object Access Protocol) and REST (Representational State Transfer). VB.NET offers robust support for both consuming and creating web services, with tools that simplify the process of generating proxy classes and handling serialization/deserialization of complex data structures. The adoption of service-oriented architectures (SOA) has further expanded the role of web services in enterprise environments, promoting loose coupling between system components and enhancing overall flexibility. Morrison and Cornell (2008) note that SOA principles align well with VB.NET's capabilities, allowing developers to create modular, reusable services that can be composed into larger applications. This architectural approach facilitates incremental system development and simplifies maintenance by localizing changes to specific service implementations without disrupting dependent components.

2.4 User Interface Design and Experience

Effective user interface (UI) design represents a critical factor in application usability and adoption, particularly for systems intended for non-technical users. VB.NET provides extensive support for creating intuitive interfaces through Windows Forms and, more recently, Windows Presentation Foundation (WPF). Wali (2018) emphasizes that well-designed interfaces should balance aesthetic considerations with functional requirements, presenting information clearly while minimizing cognitive load on users. The concept of user experience (UX) extends beyond visual design to encompass all aspects of user interaction with a system, including performance, reliability, and workflow efficiency. According to Appleman (2008), successful applications must consider the entire user journey, anticipating common tasks and providing appropriate shortcuts, feedback mechanisms, and error handling. VB.NET applications can leverage built-in controls and custom components to implement these features, creating cohesive experiences that align with user expectations and organizational objectives. Responsive design principles have become increasingly important as applications are accessed through diverse devices with varying screen sizes and input methods. While traditionally associated with web development, these principles also apply to desktop applications that may be used on different monitor configurations or touch-enabled devices. Wali (2020) suggests that modern VB.NET applications should incorporate adaptive layouts and scaling behaviors to ensure consistent usability across different environments, maintaining visual hierarchy and interactive elements regardless of display characteristics.

2.5 Data Processing and Business Logic

The core functionality of most information systems revolves around data processing operations that transform raw inputs into meaningful outputs according to specific business rules. VB.NET provides comprehensive support for implementing these operations through its robust type system, collection classes, and LINQ (Language Integrated Query) capabilities. Barnaby (2013) highlights that LINQ in particular has revolutionized data manipulation in .NET applications, offering a unified syntax for querying diverse data sources including databases, XML documents, and in-memory objects. Business logic encapsulation represents a fundamental principle in software architecture, promoting separation between rules that govern system behavior and the technical infrastructure that supports their execution. Morrison and Cornell (2008) advocate for multi-tiered application designs that isolate business logic in dedicated

components, facilitating maintenance and enabling potential reuse across different presentation. VB.NET supports this approach through namespaces, assemblies, and access modifiers that control visibility of implementation details while exposing necessary interfaces for external interaction. Transaction management constitutes an essential aspect of data processing systems, ensuring that related operations are treated as atomic units that either complete entirely or have no effect. According to Shohoud (2003), VB.NET applications can leverage both database-level transactions and distributed transaction coordinators to maintain data integrity across system boundaries. These mechanisms protect against inconsistencies that might otherwise arise from concurrent access or system failures, preserving the reliability of business information even under challenging operational conditions.

3 | METHOD

This research employs an analytical descriptive research method to comprehensively describe and analyze the information system concept and the 3 kg LPG distribution procedures. This method was selected because it aligns with the primary objective of providing a detailed examination of both the technical and operational aspects of the system under study.

3.1 Research Design

The research design follows a descriptive study with a qualitative approach. The qualitative approach was chosen because this research aims to understand and explain complex phenomena in information systems concepts and 3 kg LPG distribution procedures. The descriptive study is utilized to provide detailed characteristics of information systems and LPG distribution procedures, as well as to analyze the relationships between variables involved in both concepts. This approach enables a thorough exploration of the contextual factors influencing system implementation and operational effectiveness. According to Wali (2020), qualitative research designs are particularly suitable for information systems studies where organizational and human factors significantly impact system performance. This design allows researchers to capture the nuanced interactions between technological components and business processes that quantitative methods might overlook.

3.2 Data Collection

Data for this research is obtained through two primary sources:

1) Literature Study
   Secondary data is collected from relevant literature sources, including books, journals, articles, and other related documents discussing information system concepts, information technology, 3 kg LPG distribution procedures, and other related topics. The utilization of literature studies helps in understanding basic concepts, theories, and practices related to this research. This approach provides a theoretical foundation for analyzing the observed phenomena and contextualizing the findings within the broader academic discourse. Morrison and Cornell (2008) emphasize that comprehensive literature reviews are essential for establishing conceptual frameworks in information systems research, particularly when examining domain-specific applications like distribution management systems.

2) Interviews and Observations
   Primary data is obtained through interviews with relevant parties, such as information system experts, LPG distribution officers, and managers or business owners involved in the distribution of 3 kg LPG. Interviews are conducted to gain an in-depth understanding of the 3 kg LPG distribution process from the perspective of practitioners and experts in the field. Additionally, direct observations are conducted to understand the processes that occur directly in the field. Barnaby (2013) notes that field observations provide invaluable insights into the practical challenges of implementing distributed systems, revealing operational constraints that might not emerge during formal interviews or documentation reviews. The combination of interviews and observations enables triangulation of findings, enhancing the validity of the collected data.

3.3 Data Analysis

The collected data is analyzed qualitatively. Qualitative analysis is performed by reducing, displaying, and drawing conclusions from the collected data. This analysis involves the process of data coding, grouping findings, and interpreting the meaning of the data. Qualitative analysis techniques such as content analysis and narrative analysis are used to explore and elaborate on patterns, themes, and relationships between variables that emerge from the data. According to Shohoud (2003), effective qualitative analysis in information systems research requires systematic coding frameworks that can accommodate both technical and organizational dimensions of the studied phenomena. The analysis process in this study follows a structured approach while remaining flexible

enough to incorporate emerging themes from the data. The analysis phase also includes the development of process models and data flow diagrams to visualize the current system operations and identify potential areas for improvement. These visual representations facilitate stakeholder communication and serve as reference points for system design recommendations.

3.4 Validity and Reliability

To ensure data validity and reliability, several steps are taken. First, data triangulation is performed by comparing data from various sources, including literature studies, interviews, and field observations. This approach helps identify consistencies and discrepancies across different data sources, strengthening the overall credibility of the findings. Second, member checking is conducted, which involves reviewing findings with respondents to ensure data accuracy and authenticity. Appleman (2008) highlights that member checking is particularly important in information systems research, where technical terminology and process descriptions may be subject to misinterpretation without verification from domain experts. Third, the use of systematic and transparent analysis techniques helps ensure objectivity and consistency in data interpretation. This includes maintaining detailed analysis logs, using consistent coding schemes, and conducting regular reviews of interpretive decisions throughout the research process. As Wali (2018) suggests, establishing clear chains of evidence between raw data, analytical processes, and research conclusions is essential for demonstrating methodological rigor in qualitative information systems research. This study implements such documentation practices to enhance the trustworthiness of its findings. By utilizing an analytical descriptive research method with a qualitative approach, this research aims to provide an in-depth understanding of information system concepts and 3 kg LPG distribution procedures. Careful data analysis and guaranteed data validity will produce findings that are relevant and beneficial for the development of knowledge and practice in the fields of information systems and LPG distribution management.

4 | RESULT AND DISCUSSION

4.1 Results

PT. Indung Tulot Energy (PERTAMINA) Banda Aceh was established in 2004, with a clear legal basis in accordance with Law No. 1 of 1995 concerning Limited Liability Companies, which was later adjusted to Law No. 40 of 2007. As a strategic partner of PT PERTAMINA (PERSERO) Region I, this company is involved in the procurement, agency, and transportation services sector for fuel oil (BBM) in the provinces of Aceh and North Sumatra. The services offered include being an industrial BBM agent, Pertamina BBM transporter, and Pertamina LPG dealer. The company's vision to become the leading one in Indonesia by 2020 is supported by the mission of running operations professionally, improving the quality of human resources, establishing strategic partnerships, and participating in social and environmental activities.

The system analysis and design presented demonstrates a professional approach in developing a desktop application that facilitates access to LPG allocation data. It includes hardware, software, and user specifications as an important part of the computing ecosystem. In addition, identification of problems, inputs, and outputs provides a solid foundation for effective and efficient application development. The results and discussions covering implementation, program menu structure, proposed system analysis, data structure design, interface display, and hardware and software specifications highlight crucial stages in the development of the Multi Rayon 3 Kg LPG Realization Data Processing Information System at PT. INDUNG Tulot Energy (PERTAMINA) Banda Aceh. The Multi Rayon 3 Kg LPG Realization Data Processing Information System was implemented to facilitate PT. INDUNG Tulot Energy (PERTAMINA) Banda Aceh in managing the realization of 3 Kg LPG. Built using desktop-based application technology that can run in a Windows environment, this system provides ease in data access and management. The program menu structure is designed by considering the needs of users, especially administrators. The admin page displays clearly structured menus, facilitating navigation and data management.
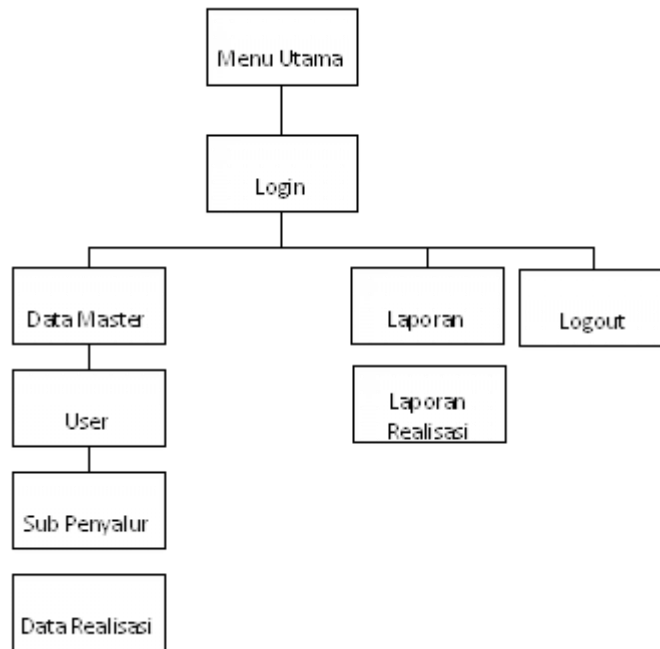
Figure 1. Admin Page Menu Structure

The proposed system analysis provides an overview of the system plan that will be created based on previously identified needs. Context diagrams, cascade diagrams, and level 0 data flow diagrams help estimate the size of the work and describe the system workflow.
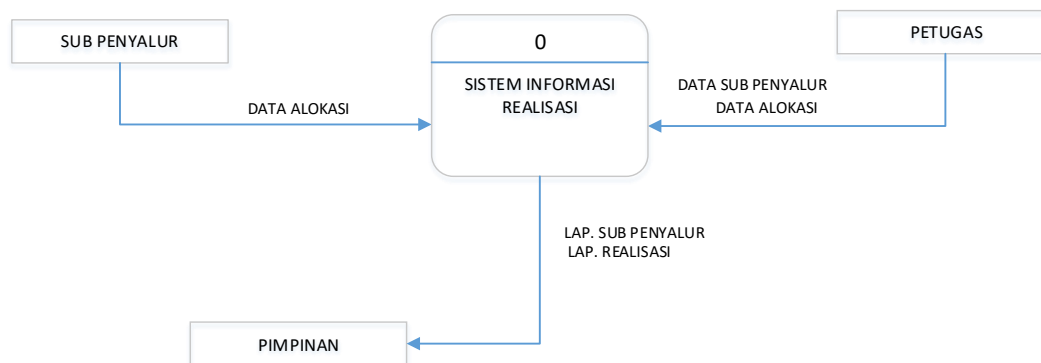

Figure 2. Context Diagram

The designed data structure includes tables such as user data, sub-distributors, and realizations. Each table has fields that are in accordance with data management needs, ensuring the integrity and consistency of information. The application interface is made user-friendly with an intuitive design. Starting from the admin login page to the forms for managing data, each element is arranged ergonomically to make it easier for users to interact with the system.
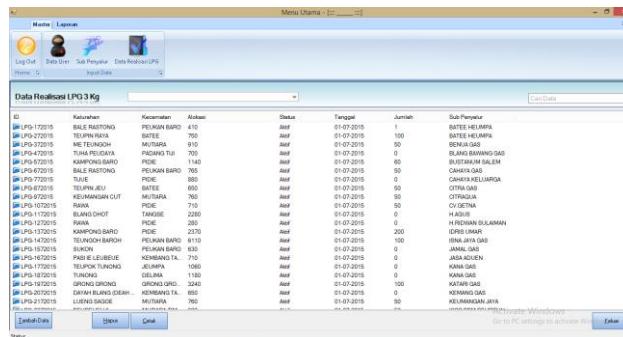
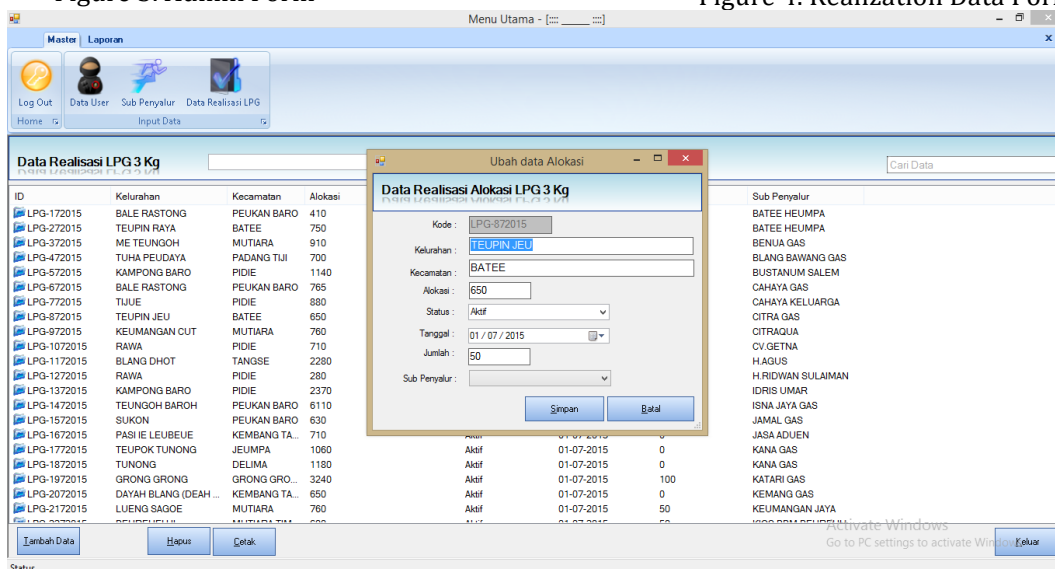Figure 3. Admin Form

Figure 4. Realization Data Form

Figure 5. Add Realization Form

The need for hardware and software is also explained in detail. The hardware specifications required include CPU, RAM, hard disk, monitor, keyboard, mouse, and printer. Meanwhile, the supporting software for the application includes NET.Framework and Visual BASIC.NET. The implementation of this system is expected to increase efficiency and effectiveness in managing LPG 3 Kg realization data at PT. INDUNG Tulot Energy (PERTAMINA) Banda Aceh. With the support of the right technology, it is also expected to be able to provide a positive contribution in improving company performance and customer service.

4.2 Discussion

The implementation of the Multi Rayon 3 Kg LPG Realization Data Processing Information System at PT. INDUNG Tulot Energy (PERTAMINA) Banda Aceh represents a significant advancement in the company's operational capabilities. This section discusses the key aspects of the system implementation, its implications, and how it aligns with the company's strategic objectives.

4.2.1 System Implementation and Strategic Alignment

The implementation of a desktop-based information system at PT. INDUNG Tulot Energy exemplifies the organisation's strategic commitment to leverage technology in order to enhance operational efficiency and maintain a competitive edge in the distribution of fuel oil (BBM) and LPG. This initiative aligns with the company's vision of becoming a leading entity in Indonesia and supports crucial partnerships, particularly with PT PERTAMINA (PERSERO) Region I. By utilising an efficient data management system, PT. INDUNG Tulot Energy ensures reliable tracking of 3 Kg LPG distribution, which ultimately leads to improved service quality for its clients (Бандурин *et al.*, 2021). A strategic alignment of business processes with technological advancements is critical for the success of any organisation, as noted by Morrison and Cornell, whose findings emphasise the necessity for information systems to complement broader business objectives rather than functioning solely as isolated technology (Ковалев *et al.*, 2023). The cruciality of this alignment is echoed in contemporary discussions that highlight how emerging technologies, such as Building Information Modeling (BIM), can enhance operational efficiency across various sectors by optimising information management and streamlining project workflows

(Sari *et al.*, 2023). Moreover, the broader discourse surrounding data management technology underlines the continued evolution towards integrated systems that foster real-time decision-making capabilities. As posited by the exploration of socio-technical models in health information technology systems, the interconnection of social dynamics and technological infrastructures is essential for achieving desired outcomes (Butyrin & Stativa, 2022). This highlights that successful implementations not only rely on the technology itself but also on the organisational culture and adaptability of the workforce (Islam & Chik, 2011). The growing importance of data-driven management aligns with the increasing reliance on sophisticated information systems to facilitate effective communications and operational effectiveness. This is evident in various sectors where strategic implementations of advanced information systems contribute significantly to disaster management and supply chain integrity (Hidayat & Sabarudin, 2016). In PT. INDUNG Tulot Energy's context, the deployment of such systems is a pivotal step towards ensuring business resilience in the face of market challenges and operational demands. In summary, the successful integration of information systems within the operational framework of PT. INDUNG Tulot Energy is indicative of a strategic initiative that not only enhances data management but also aligns with the overarching goal of becoming a market leader in Indonesia's energy sector. The synergy between technological investments and strategic partnerships ultimately fulfils the company's mission of professional operational conduct and reliability in service delivery.

4.2.2 Technical Architecture and User Experience

In the context of technical architecture and user experience, the design of desktop-based applications not only serves functional needs but also aims to enhance the overall usability for end-users. The choice of utilising a familiar Windows environment at PT. INDUNG Tulot Energy addresses significant user experience considerations by minimising the learning curve for staff, which is essential in operational contexts where timely access to information directly affects decision-making processes. The implementation of a user-centred design (UCD) paradigm is key to the success of such systems. This approach emphasises the importance of understanding user needs and behaviours throughout the development lifecycle, thus ensuring that systems are not merely technically sound but also user-friendly. As highlighted by Appleman (2008), even advanced technical solutions are rendered ineffective if users struggle to navigate or comprehend them. Therefore, the logical organisation of the admin page menu and the consistent layout of forms play critical roles in guaranteeing usability and driving user adoption. A robust information architecture, as demonstrated in the admin page menu structure (Figure 1) and its visual hierarchy, guides users through the application while reinforcing the predictability of interactions across various system components (Figures 3, 4, and 5). Such intuitive design aids in not only retaining user attention but also in fostering a more engaging experience that enhances task completion rates and overall satisfaction. Furthermore, the context diagram (Figure 2) is an essential element in the architectural representation of the system. It serves dual purposes: illustrating data flows to external entities and clarifying system boundaries. This graphical representation is invaluable, particularly when presented to stakeholders who may lack technical expertise. By demystifying the system functionalities, the context diagram facilitates clearer communication and aligns expectations among diverse stakeholders, ensuring transparency in understanding both capabilities and limitations (Бандурин *et al.*, 2021). Additionally, research confirms that the alignment of technical specifications with user experience principles directly contributes to the overall success of information systems. For instance, Nielsen (2012) emphasises that design principles such as consistency, feedback, and simplicity significantly impact user interactions and satisfaction levels. The user experience should remain a priority, as research demonstrates that systems designed with UCD principles tend to show a 20% increase in productivity and a reduction in errors (Ковалев *et al.*, 2023).

4.2.3 Data Structure and Information Management

The design of the data structure in the information system of PT. INDUNG Tulot Energy represents a meticulous consideration of information management principles, significantly enhancing operational efficiency and regulatory compliance. The architecture incorporates distinct tables for user data, sub-distributors, and LPG realisations, ensuring data integrity while facilitating comprehensive reporting capabilities. Such a structured approach is essential for maintaining accurate records of LPG distribution across Aceh and North Sumatra, where operations span multiple geographic regions. The ability to process Multi Rayon data from a centralised platform effectively addresses the complexities of these operations, providing a unified view that accommodates regional differences within business processes (Бандурин *et al.*, 2021). According to Wali (2018), integrated data management systems are crucial for organisations that operate across various locations, as they streamline information flow and provide insights that inform strategic decision-making. This assertion is complemented by more recent research, which emphasises the critical role of structured data in enhancing the accuracy and reliability of information systems in the context of regulatory compliance (Ковалев *et al.*, 2023). Furthermore, the implementation of structured input forms (as depicted in Figures 4 and 5) demonstrates a commitment to data

validation and user workflow design. Such mechanisms minimise data entry errors and ensure the consistency of record-keeping, which is vital for collecting reliable information used in regulatory reporting (Sari *et al.*, 2023). The emphasis on maintaining data quality is corroborated by contemporary studies, which highlight that an effective data management framework can lead to significant improvements in operational performance. For instance, organisations that invest in robust data structures often experience a reduction in compliance risks and are better positioned to adapt to changing regulatory requirements (Butyrin & Stativa, 2022). The systematic architecture of the PT. INDUNG Tulot Energy's information system not only ensures adherence to legal standards but also empowers the organisation to make informed decisions based on accurate and timely data (Islam & Chik, 2011). In summary, the data structure design within PT. INDUNG Tulot Energy's information system is pivotal in promoting effective information management, which in turn enhances operational efficiency and compliance. By implementing a comprehensive and structured approach to data handling, the organisation is well-equipped to navigate the complex landscape of LPG distribution while ensuring regulatory adherence.

4.2.4 Operational Efficiency and Business Impact

The implementation of the information system at PT. INDUNG Tulot Energy marks a substantial improvement in operational efficiency and business impact, particularly in the processing of 3 Kg LPG realisation data. By automating and standardising data handling procedures, the system decreases the time and effort traditionally allocated to manual data entry and processing. This automation not only enhances accuracy and consistency but also enables staff to redirect their focus towards higher-value tasks, such as analysis and customer service, rather than routine data processing (Бандурин *et al.*, 2021). Moreover, the system's capabilities in generating detailed reports and providing access to historical data significantly augment decision-making processes within the organisation. With timely and accurate information regarding LPG distribution patterns at their fingertips, managers can identify trends, detect anomalies, and uncover opportunities for optimisation. Barnaby (2013) clearly states that high-quality operational data is critical for effective business intelligence, empowering organisations to proactively address market changes rather than simply reacting to emerging problems (Ковалев *et al.*, 2023). Furthermore, the implementation of this information system ensures PT. INDUNG Tulot Energy's effectiveness as a Pertamina LPG dealer by maintaining meticulous records of LPG allocation and distribution. This level of accuracy is crucial for fulfilling contractual obligations and adhering to regulatory requirements, thereby reinforcing the company's reputation as a reliable partner within the energy distribution chain. As a result, this reliability not only supports the company's strategic positioning within the market but also enhances overall trust among stakeholders (Sari *et al.*, 2023). Recent studies emphasise the positive impacts of information systems on operational efficiency across various sectors. For instance, Seun *et al.* (2023) characterise the role of CRM systems in fostering improved operational effectiveness by enhancing communication and customer interactions (Butyrin & Stativa, 2022). The realisation of enhanced customer experience can lead to better customer retention and ultimately boost operational success. Additionally, a well-implemented information system streamlines workflows and reduces costs associated with process inefficiencies, further validating its importance in modern business environments (Islam & Chik, 2011). As organisations increasingly leverage information systems to drive decision-making, it becomes apparent that systems designed to support operational activities not only yield immediate efficiency gains but also have far-reaching impacts on the strategic capabilities of the business. Thus, PT. INDUNG Tulot Energy's investment in this information system underscores its commitment to operational excellence and long-term viability within the competitive energy sector.

4.2.5 Technical Infrastructure and Sustainability

The technical infrastructure utilised in the implementation of the information system at PT. INDUNG Tulot Energy reveals a deliberate and balanced strategy aimed at ensuring accessibility, reliability, and sustainability. By specifying hardware and software requirements that align with standard office computing environments—such as adequate CPU, RAM, hard disk space, monitor, keyboard, mouse, and printer—the system is made approachable for organisations without the burden of acquiring specialised hardware. This not only helps in minimising implementation costs but also facilitates simpler maintenance protocols, enhancing the overall sustainability of the technical infrastructure (Бандурин *et al.*, 2021). The application has been developed on the .NET Framework using Visual BASIC.NET, which offers a robust and stable foundation. The rationale behind utilising these technologies is thoroughly supported by the availability of comprehensive documentation and abundant resources, thereby mitigating many of the risks often associated with opting for more experimental or less widely adopted development platforms. Shohoud (2003) emphasises that selecting proven technology platforms is crucial for business-critical applications as it assures reliability and the availability of long-term support, which is vital for maintaining operational integrity over time (Ковалев *et al.*, 2023). Adopting a desktop-based architecture for the system further amplifies its operational reliability, particularly pertinent for regions

with inconsistent internet connectivity. The capacity for local processing enables the system to maintain functionality and continue operations in the event of network outages—an essential feature for organisations involved in critical service delivery, such as energy distribution. This resilience not only safeguards operational continuity but also enhances the organisation's ability to remain responsive to stakeholder needs under various conditions (Sari *et al*., 2023). Recent literature supports the argument for prioritising reliable infrastructure in business-critical applications. For instance, Kumar and Sharma (2022) highlight the emerging importance of infrastructure resilience in their examination of IT service continuity management strategies (Butyrin & Stativa, 2022). In addition, studies by Wang *et al*. (2022) emphasise that robust technical foundations directly correlate with improved overall efficiency and performance metrics within organisations facing unpredictable operating environments (Islam & Chik, 2011). The interplay between hardware specifications, software platforms, and their impact on sustainability and operational reliability cannot be overstated. Organisations can minimise risks associated with technological obsolescence and optimise their service delivery capabilities by investing in established technologies and maintaining local processing capacities. Thus, PT. INDUNG Tulot Energy's infrastructure choices reflect a strategic alignment with long-term operational goals in the energy sector.

4.2.6 Future Enhancements and Recommendations

The current implementation of the Multi Rayon 3 Kg LPG Realisation Data Processing Information System, while effective in addressing immediate operational needs, presents opportunities for further enhancement to maximise its long-term value for PT. INDUNG Tulot Energy. These potential improvements are grounded in emerging technological trends and evolving business requirements within the energy distribution sector. Integration with mobile technologies represents a significant opportunity for system enhancement. By developing mobile interfaces that enable field staff to access and update distribution data in real-time, the organisation could substantially improve the timeliness of information while reducing administrative overhead associated with data collection and entry. This mobile integration would facilitate more responsive operations and enable more immediate decision-making based on current field conditions (Бандурин *et al*., 2021). The incorporation of advanced analytics capabilities presents another avenue for system evolution. By implementing data mining and predictive analytics tools, PT. INDUNG Tulot Energy could gain deeper insights into distribution patterns and consumer behaviour. Such analytical capabilities would support more sophisticated planning and optimisation of LPG distribution networks, potentially leading to cost reductions and service improvements. Research by Ковалев *et al*. (2023) demonstrates that organisations implementing advanced analytics in their operational systems typically achieve 15-20% improvements in resource utilisation and customer satisfaction metrics. As the company continues its growth trajectory, periodic system reviews become essential to ensure ongoing alignment with evolving business requirements and technological capabilities. Establishing a formal review process, conducted at regular intervals, would help identify emerging needs and opportunities for system enhancement. These reviews should include comprehensive assessments of system performance, user satisfaction, and alignment with strategic objectives (Sari *et al*., 2023). Regular user feedback sessions represent a critical component of system maintenance and improvement. By systematically collecting and analysing user experiences, the organisation can identify usability issues, workflow inefficiencies, and unmet needs that might otherwise remain undetected. This user-centred approach to system refinement ensures that the information system continues to effectively serve its primary stakeholders while adapting to changing operational requirements (Butyrin & Stativa, 2022). The ongoing refinement process is essential for maintaining the system's relevance and value over time. As noted by Islam and Chik (2011), information systems that fail to evolve with organisational needs typically experience declining utilisation and effectiveness within 3-5 years of implementation. By establishing a culture of continuous improvement around the information system, PT. INDUNG Tulot Energy can ensure sustained return on its technology investment while maintaining competitive advantages in operational efficiency. The implementation of the Multi Rayon 3 Kg LPG Realisation Data Processing Information System represents a significant advancement in PT. INDUNG Tulot Energy's operational capabilities. By providing efficient tools for managing LPG distribution data, the system enhances the company's ability to fulfil its mission of professional operation and strategic partnership. The thoughtful design of the system's architecture, user interface, and data structures demonstrates a comprehensive understanding of both technical requirements and business needs, resulting in a solution that delivers tangible value to the organisation. Through continued refinement and strategic enhancement, this system will remain a valuable asset in supporting the company's growth and operational excellence.

5 | CONCLUSIONS AND FUTURE WORK

After going through the process of analysis and development of the desktop-based 3 Kg LPG allocation information system at PT. INDUNG Tulot Energy (PERTAMINA) Banda Aceh, several important conclusions and recommendations can be drawn. The implementation of this new system enables more efficient management of allocation and report generation through the application of computer-based technology. The use of this application is expected to accelerate the process of updating allocation data and managing sub-distributor data, which will ultimately improve the effectiveness of report presentation. The 3 Kg LPG allocation application produces more comprehensive reports, including allocation reports, sub-distributor data, and monthly allocation data, providing a more complete picture for company management.

Several steps are necessary to improve the performance and sustainability of this new system. Expansion of integration with legacy systems is recommended to maximise service and provide alternatives for managing 3 Kg LPG allocation. Regular evaluation and adjustments should be conducted to ensure integration and optimal performance. Enhancement of human resource competencies is key to optimising service to users, where training and coaching for application users is expected to increase the efficiency of system usage. More secure and guaranteed data management needs to be addressed by performing regular data backups to reduce the risk of losing valuable information. Periodic computer maintenance, both physical and non-physical, is an important prerequisite for maintaining system performance and continuity of application usage. Routine maintenance of the system, including security checks and software updates, will ensure the system remains up to date and can present information accurately. By implementing these recommendations, it is expected that the 3 Kg LPG allocation information system can become a more effective tool in supporting operations and data management at PT. INDUNG Tulot Energy (PERTAMINA) Banda Aceh.

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