

Design Thinking for Digital Transformation of Village Enterprises in Indonesia

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Abstract. This study developed a design thinking model to guide the digital transformation of village-owned enterprises in Indonesia. A survey of Sumbersekar village enterprise managers provided insights into current technology usage, challenges, and training needs. The proposed human-centered design thinking model provides a framework for developing digital capabilities tailored to village enterprise constraints. Findings underline the importance of collaborative participatory approaches in building enterprise digital literacy and online systems. This research delivers practical tools to support village enterprises in leveraging digital technologies for growth and financial sustainability.

Keywords: Village-owned Enterprises, Design Thinking, Human-centered Model, Digital Transformation

1. Introduction

Multiple villages in Indonesia continue to face numerous challenges with economic self-sufficiency (Arifin et al., 2020; Kania et al., 2021; Hutagalung et al., 2022). The government has endeavored to enhance the economic self-reliance of villages by implementing the Village Law and allocating Village Funds. Undoubtedly, the primary objective is to enhance the economy of the Village Community by augmenting the Village's Original Income. The establishment of Village-Owned Enterprises (VOEs) is one way to demonstrate the intention to enhance the village economy. Currently, VOEs operate in nearly every village in Indonesia, overseeing a range of enterprises like as water distribution management, sale of essential commodities, savings and lending, and other activities. According to Indonesian statistics, the projected number of VOEs for the year 2022 is 57,273. Out of the total number of 45,233 VOEs, 12,040 VOEs are now inactive. There are currently 45,233 active VOEs, which employ a total of 20,369,834 individuals. The business turnover for 2022 is projected to exceed IDR 4.6 trillion. By utilizing VOEs, communities have the opportunity to enhance their Village Original Income and tap into additional possible sources of revenue. However, VOEs in Indonesia face several challenges because of the villagers' lack of proficiency in contemporary advancements such as technology (Syahza et al., 2021; Prameka et al., 2021).

Each day, the field of information technology will continue to rapidly progress. Information technology enables the production of precise and current information (Tallon et al., 2019; Tao et al., 2019; Maddikunta et al., 2022). Information technology serves several purposes, including meeting individual, business, and government requirements. Essentially, technology has the potential to create fresh avenues for engaging with society and accelerate transactional processes (Johnson et al., 2020). Several governmental entities are increasingly adopting technology to enhance their operational efficiency. The rapid pace of technical advancements can facilitate the development of more efficient methods for information management. Technological advancements facilitate the expedited turnover of office activities, hence enhancing the quality of services offered to the community. Human Resources are motivated to innovate by the growing advancements in technology. Competent personnel have the ability to promote customized technological advancements that align with the operational requirements of an organization (Fitsilis et al., 2018; Hunt et al., 2020). Technology has become ubiquitous in daily life within the computer sector to facilitate work completion. One of the methods is using a website that is connected to the internet as a tool to facilitate work. Effective human resources can facilitate tailored technological adaptations to meet an agency's specific operational needs (Hussein, 2019). According to data from the Ministry of Village, there will be a total of 57,273 villages in Indonesia with VOEs by 2022. Out of these, 1,852 VOEs have already adopted technology to promote their products through e-commerce. The digital transformation of VOEs was prompted by the COVID-19 pandemic and is anticipated to inspire and promote digital transformation in additional VOEs. These findings indicate that a mere 3.62 percent of VOEs in Indonesia have implemented digital management systems.

Service is paramount in a company entity like VOEs. Employees will attain excellence in service when they are capable of delivering satisfaction to clients or the community. Enhanced public trust will be bolstered if the services rendered exhibit good quality. Consistently enhancing the quality of their work is vital for employees to ensure the production of high-quality products. The VOE business unit in Sumbersekar Village, Malang, Indonesia, engages in daily administrative data processing activities, including the distribution of clean water, named BUMDes Sekar Abadi. These activities involve managing various data and require innovative approaches to enhance administrative records and financial administration management. This can be achieved by utilizing computer technology and integrating it with appropriate equipment. Supports such as online platforms. This innovation enables business divisions to efficiently handle data by facilitating data management, data retrieval, and data storage (Akter et al., 2022). Thus, it is imperative for agencies to possess a robust administrative information system to ensure the precision of data, thereby facilitating efficient administration management.

Nevertheless, we discovered through interviews with the leader of the BUMDes clean water business unit that financial administration and record-keeping were still being done using traditional methods. Data recording was only conducted utilizing books, Microsoft Excel, and a calculator. The financial administration management is conducted using manual methods, namely by storing the data in a physical ledger. Subsequently, the officer is required to perform calculations for each unit of water consumed, by multiplying the volume in cubic meters with a predetermined rate. This gives rise to the potential for inaccuracies in computations, which can adversely affect the erosion of public confidence. Upon closer examination, this organization possesses amenities such as laptops, WiFi, and printers that are capable of facilitating the advancement of contemporary administrative information systems. The substandard human resources impede the administrative management process, necessitating additional effort and resulting in prolonged duration (Adamovic, 2018; Anwar & Abdullah, 2021).

Prior efforts have been made to create a website-based administrative information system, but these efforts were limited to handling financial administration data (Hikam et al., 2021; Dewi & Winarno 2021). The administrative information system built in this research serves to distribute information about BUMDes Sekar Abadi's clean water services and handle the financial administration of clean water service payment rates. The administrative information system is implemented as a website, facilitating convenient access to administrative services via cell phones, laptops, and computers.

This system exhibits an aesthetically pleasing design by accommodating the requirements of both the community and administrative personnel. It effectively delivers instructions pertaining to payment details, distributes information regarding repairs, and facilitates the submission of damage complaints. A cutting-edge administrative information system, devised by researchers, facilitates the efficient management of information and administration through the utilization of modern technologies. This article seeks to investigate the significance of cultivating human-centered business invention to provide innovative products that align with the societal demands of BUMDes, namely Sekar Abadi, located in Sumbersekar Malang, Indonesia. Additionally, the study intends to enhance the quality of public administrative services the BUMDes.

2. Literature Review

2.1. Design Thinking: The origin and development

Design thinking, initially written in lowercase, was described and researched by an international group of scholars as the cognitive process employed by designers two decades before it gained popularity as an innovative idea (Cross, et al., 1992; Eastman, et al., 2001). The aim of these studies was to get a further understanding of the significant characteristics of Design Creativity. In contrast to the previous trend of the 1970s that sought universal design approaches, contemporary research in design thinking focuses on discerning the fundamental cognitive strategies employed by designers during project work. The aim of this research was to enhance the cognitive abilities of designers in both individual and collaborative design processes, within the realms of education and professional practice.

In recent years, the concept of design thinking has undergone expansion and has transcended its previous boundaries. Today, Design Thinking (now capitalized) is recognized as a sophisticated cognitive process for generating novel concepts and integrating design principles and methodologies into domains like corporate innovation. Two influential authors and their respective books have played a significant role in reshaping the concept of design thinking. The first is "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" (2008) by Tim Brown, who serves as the CEO of IDEO, a highly influential design consultancy firm. The second is "The Design of Business: Why Design Thinking is the Next Competitive Advantage" (2009) by Roger Martin, who is the Dean of the Rotman School of Management in Toronto and has a background in management consulting. While the two have distinct definitions and descriptions of Design Thinking, they both examine its significance and promise in organizational contexts.

Design Thinking (DT) serves as a catalyst for innovation, driven by designers. It introduces novel

approaches and toolkits that enhance, expedite, and visualize creative processes. These methods are applicable not only to designers but also to multidisciplinary teams in any organizational context. The term DT, which combines "thinking" and "design", allows fields like Innovation Management to utilize design tools in problem-solving contexts that extend beyond the appearance and functionality of physical objects. Instead, these tools can be applied to the structure and operations of businesses, services, and processes. Design Thinking has evolved beyond being just a cognitive process or mentality, and is now a powerful toolkit for driving innovation. It bridges the gap between creative design methods and traditional business thinking, which emphasizes planning and logical problem-solving.

Scholars and professionals in the field of design thinking (Kimbell, 2011; Nussbaum, 2004; Plattner et al., 2015) have emphasized the importance of gaining a deeper comprehension and engaging in a thoughtful reassessment of design thinking. While there is a consensus that the core of design thinking involves understanding and prioritizing user demands, there is considerable ambiguity around the requirements for becoming a design thinker. Prerequisites for design thinkers typically include specific talents like pattern detection, visual communication, storytelling, and empathy (Noweski et al., 2012). Additionally, it is important to cultivate a design-thinking attitude (Luchs et al., 2015). Calabretta and Gemser (2015) discovered evidence suggesting that for design orientation to thrive within an organization, it must be deeply ingrained in a supportive organizational culture. However, they concluded that additional research is required to pinpoint the specific traits of such a 'design thinking culture'. Previous scholars have proposed many aspects of a culture that promote design thinking for innovation, such as a propensity for experimentation, acceptance of failure, and encouragement of widespread participation in innovation (Brown & Martin, 2016; Rosenberg et al., 2015). However, a comprehensive model is still absent.

2.2. Design Thinking in The Context of Business

2.2.1. Emphasize: Expanding and enhancing the viewpoint

A service-oriented enterprise necessitates a profound comprehension of consumers' demands. However, a common critique of marketing, as practiced in numerous organizations, is its emphasis on conventional market research methods, such as standardized questionnaires. An objection can be raised regarding the wide range of marketing research tools available in the market. These tools include qualitative methods such as focus groups and in-depth interviews, as well as monitoring processes, observations, and experiments conducted in both laboratory and field settings to analyze customer behavior. Standardized consumer surveys are currently devalued in marketing management, especially for the purpose of product creation, as they are no longer considered the primary instrument of choice. Design Thinking strongly prioritizes the act of observing over conducting surveys (Luchs et al., 2015).

The utilization of "personas" in this stage of Design Thinking, however, can foster a heightened sense of empathy in marketing. This technique compels all participants to adopt a human-centered approach, so amplifying the personal connection. It prioritizes the needs and experiences of actual individuals, rather than abstract "market segments," as a means of generating inspiration and understanding (Gobble, 2014). The use of personification enables a more focused examination of individual client requirements and facilitates more efficient team discussions compared to conventional market research reports. It protects the user from becoming disoriented in an anonymous analysis.

Storytelling enhances the process of combining information and results in a specific and tangible outcome that evokes stronger emotions compared to descriptions of customers or market segments. Considering that several future market research findings will rely on the analysis of "big data," it is evident that the expanding capacity of Design Thinking in terms of empathizing will significantly increase to maintain a harmonious equilibrium between intuition and reflection. Human discernment is essential for comprehending data accurately; Design Thinking can be regarded as a method to integrate intuition and creativity with analysis. Design Thinking helps mitigate the risk of developing a limited

viewpoint on customers and customer groups in marketing, thereby promoting a more expansive perspective. Design Thinking is described as a "human-centered approach to problem-solving" and a "human-centric point of view". This highlights that it should not solely focus on customer orientation or "customer centrality", but rather prioritize the broader concept of "human-centricity" (Lamberti & Paladino, 2013). The statement emphasizes the importance of recognizing a wider perspective on the human factor in both technologies and organizations ("empathy inaction").

2.2.2. Define: Seek inspiration and find practical solutions

Design Thinking is very motivating and enabling, encompassing two fundamental capabilities. By directing attention towards the creation of something entirely original, yet purposeful, it unleashes creative vitality and motivates all participants. Designing involves the creation of something novel and purposeful. It can improve the standard marketing planning process by employing a solution-based thinking approach that prioritizes achieving better future outcomes (Stickdorn, et al., 2018; Shafiee et al., 2021).

Design Thinking endeavors to specifically address "disruptive" objectives that necessitate entirely novel methodologies. This could perhaps result in a novel interpretation of the initial problem. Simultaneously, this necessitates that marketing embraces ambiguity, indicating that not only are the variable attributes uncertain, but the variables themselves are yet unidentified. Design Thinking can help redirect marketing efforts toward corporate strategy or the definition of a business model.

2.2.3. Ideate: Interdisciplinary and divergent thinking

The creative process of Design Thinking is inherently interdisciplinary. The contemporary definition of marketing states that "marketing concerns all" and is, thus, the culmination of all the tasks completed by the departments of marketing, communications, and advertising; engineers working in the R&D department also undoubtedly perform marketing-related tasks.

However, the application of multidisciplinary approaches in Design Thinking extends beyond functional boundaries and incorporates the many skill sets of team members. Genuine innovation and creativity necessitate a combination of profound expertise and the ability to make connections across several domains. Moreover, each individual utilizes their brain in a distinct manner, resulting in the acquisition of certain skills and inclinations. In Design Thinking innovation initiatives, teams are deliberately composed with a diverse range of skills and backgrounds in order to fully leverage the team's potential. This technique is primarily recognized in the fields of human resource science and organizational behavior within business administration. It is advisable to assess the efficacy of this technique for corporate innovation projects.

The term "ideation" is not commonly found in traditional business literature and practice. Marketing management, both in practice and education, continues to be primarily influenced by conventional marketing strategies, as exemplified by Kotler and Keller (2011). These marketing plans are developed using a linear analytical approach and follow a standard sequence of phases, such as conducting a SWOT analysis, identifying goals, devising strategies, determining the marketing mix, and implementing control measures. In management and marketing, the practice of "thinking in alternatives" is seldom observed. Practically, individuals rarely make a conscious effort to broaden their range of actions, nor do they produce many methods and courses of action to be systematically examined, merged, and assessed. In traditional product innovation projects, it is often the case that a large number of "mandatory" criteria are defined, which severely limits the range of possible solutions. Alternatively, traditional customer surveys might result in instances where customers feel overwhelmed due to their lack of understanding regarding the desired characteristics of a new product or service innovation. Consequently, the innovation space is prematurely limited, with customers and management establishing limits at an early stage in the innovation cycle.

By engaging in ideation and prototyping, marketing professionals can improve their cognitive

abilities to consider different options, tolerate ambiguity, and expand their range of choices. This, in turn, can result in making more informed and effective judgments (Heath and Heath, 2013). According to the Design Thinking principle of "Give questioning an equal or greater status than deciding", one might learn to avoid making initial conclusions and instead focus on exploring and evaluating numerous core versions.

2.2.4. Prototype: Creating a concrete approach

Prototyping is a crucial stage in the Design Thinking process and is commonly employed during the conclusive testing phase. Each product is specifically tailored to cater to a specific target demographic and is intended to address their concerns or issues in a particular manner (Cross, 2023). In order to evaluate the effectiveness of a product in addressing user issues, designers develop a prototype, which is an imperfect yet functional representation of the product, and subject it to testing with potential users and stakeholders. Prototyping enables designers to assess the feasibility of the existing design and maybe explore the perceptions and emotions of trial users towards the product. It facilitates thorough testing and exploration of design concepts prior to excessive resource utilization.

The core tenet of Design Thinking, known as the "Show, don't talk" or "make it tangible" guideline (Meinel and Leifer, 2020), is essentially rooted in the ideas of Visual Thinking. Designers typically employ product testing as the primary means to ascertain and comprehend the precise manner in which users engage with a product. Creating a finalized product for user testing would be imprudent and futile. Alternatively, designers might offer streamlined iterations of their products to facilitate the observation, documentation, evaluation, and quantification of user performance, either in relation to specific components or in terms of users' overall behavior, interactions, and responses to the entire design. The initial iterations of a product, referred to as prototypes, may not be created using the same materials or methods as the final version due to potential inefficiencies in terms of both time and cost.

2.2.5. Test: Testing for new insights

The testing process involves conducting comprehensive tests on the final product solution at a full scale. It aids in assessing the feasibility of a solution (Liedtka, 2018; Cross, 2023). The prototype that is deemed optimal based on the feedback received from customers and end-users is implemented. The Testing phase can yield either favorable or unfavorable outcomes, contingent upon the triumph or failure of the Prototype phase. Due to the non-linear nature of Design Thinking, testing may necessitate the repetition of the Design Thinking process if the end-user encounters usability problems with the offered solution (Glen et al., 2015). It offers useful insights that enable the designer to revise the problem definition and develop a new solution that can more effectively understand the needs of the end-user.

Design Thinking Model: a non linear process

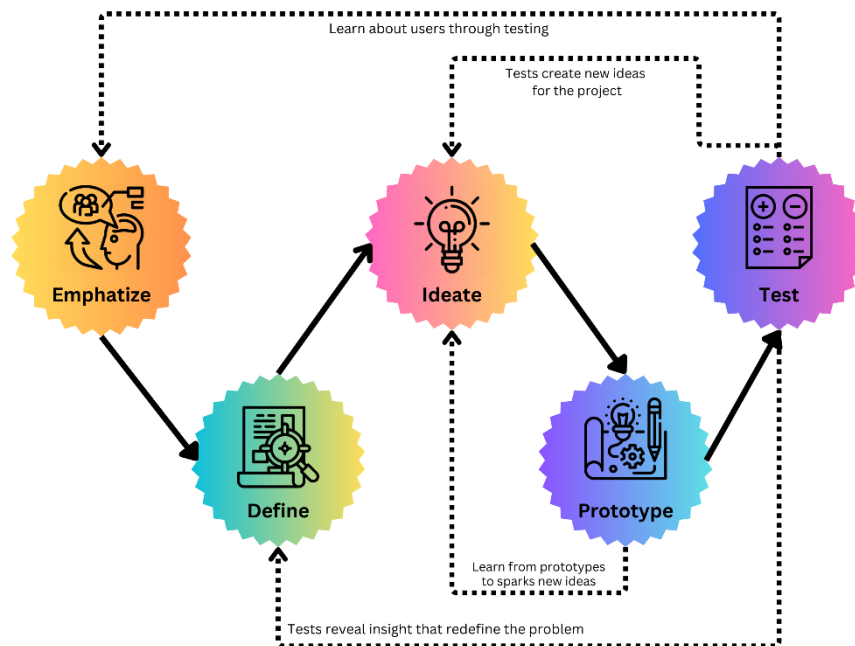


Fig 1: Design Thinking Process

Testing is an iterative process in which the prototype is regularly tested to refine the design. The Testing Phase exerts influence on all preceding stages of the Design Thinking Process as shown in Fig.1. Prior to the implementation of the Testing Stage, the envisioned product operates based on the designer's assumption. Although this proposed product may be well-researched and empathetic, there is a chance that important information could be missed or that the designer's bias could influence it. The Testing stage results in the repetition of a prototype. The prototype elicits user feedback that is specific to its design, which subsequently enhances the comprehension of end-users. Testing consolidates the prior processes and offers a full solution that may necessitate modifications or is prepared for extensive implementation (Liedtka, 2018).

3. Method

We employ a human-centered approach to ensure that the innovations we generate align precisely with the requirements of all stakeholders. We utilize the Design Thinking paradigm to tackle the difficulties faced by BUMDes Sekar Abadi in the administration of their clean water services as mentioned above. Design thinking is a process that utilizes a set of tools typically used by designers to develop innovation that focuses on the needs of people. It combines three essential components: comprehending people's requirements, investigating technology potentials, and delivering profitable commercial results.

We implement a five-stage design thinking process, which includes the steps of Emphasize, Define, Ideate, Prototype, and Testing. The study was carried out at Sumbersekar Village, Dau District, Malang Regency, East Java Province, Indonesia. This research utilized the snowball sampling approach to choose respondents. The participants were 5 individuals from the Village Government, 3 managers from BUMDes Sekar Abadi, 13 staff of BUMDes Sekar Abadi, and 34 customers of clean water under the management of BUMDes Sekar Abadi. In total, there were 55 participants involved in this study. The study employed many data collection techniques, including in-depth interviews, observation, documenting, and administering questionnaires. In order to have a deeper comprehension of the stakeholders' requirements and our tasks, we resided in Sumbersekar Village for a duration of 8 months. In addition, we extend invitations to other experts to assist in validating the innovative product we will develop.

4. Results and Discussion

4.1. Know Longer, Understand Better

During the empathizing stage, we conducted interviews with 55 individuals to identify issues and requirements for enhancing the services of BUMDes Sekar Abadi, as outlined in the preceding sub-chapter. We conducted semi-structured interviews to gain a comprehensive understanding of the problem while staying focused on our objectives. The 55 participants were divided into two distinct categories: the management group, which included Sumbersekar Village officials, managers, and workers of BUMDes Sekar Abadi, and the consumer group, comprising of Sumbersekar village residents who are clients of clean water services provided by BUMDes Sekar Abadi. The purpose of this grouping is to identify issues and requirements from two distinct perspectives: the manager as a producer and the inhabitants as consumers.

We accomplish this step not solely through deliberate interviews. Nevertheless, due to our extended stay in the area, we actively engaged in their cultural activities, so demonstrating empathy. Thus, we obtain a more comprehensive understanding of the issues and requirements they encounter. This aligns with the primary objective of the empathize stage (Luchs et al., 2015; Gobble, 2014). This activity demonstrates that the empathize process we conducted is designed to obtain a comprehensive understanding of the opinions held by the Sumbersekar community regarding the clean water services provided by BUMDes Sekar Abadi. This is also a planned triangulation technique derived from our earlier interview procedure. The empathize results are used to condense several sentences or keywords that reflect the respondents' opinions on the management of BUMDes Sekar Abadi water services. These condensed findings are presented in table 1.

Table 1. Findings in 'Emphatize'

No.	Keywords	BUMDes Management	Consumer
1	Usage Recording	- Usage recording uses manual methods from recording to calculating the costs - Manually recording is a time-consuming process. - Typing errors frequently occur when documenting and performing calculations manually.	- Uncertainty regarding the accuracy of data recording and water use
2	Payment	- Numerous clients are currently in default on their water payments. - Payment is remitted in physical currency. - There is a limited number of payment outlets available. - The money was not deposited promptly by the payment officer. - BUMDes administrators are required to compute payments with the Excel software. - Receipts sent to consumers as evidence of complete payment are frequently misplaced, hence complicating the process of verifying for potential errors.	- Consumers have a decreased level of confidence about payment computations. - The challenge lies in making payments exclusively at designated payment outlets as specified by the manager. - Lack confidence in payment officials. - The tangible evidence of payment provided is frequently overlooked or misplaced by consumers.
3	Digitalization	- The implementation of digitization plans is limited by financial constraints. - Digitalization is thought to enhance	- Hope there is a digital system in management - Consumers place greater trust in digital and

consumer confidence by promoting accountability. - The implementation of digitalization in management will result in a substantial reduction in the time required for recording and calculating invoices. - We anticipate support in developing internet-connected digital apps for water services.	automated calculations. - Consumers can make payments at any location and at any time, as long as there is a digital infrastructure in place. - Consumers exhibit greater confidence in digital systems.
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According to Table 1, there are three primary keywords frequently mentioned by research participants. The three essential terms are water usage recording, payment, and digitalization. Table 1 demonstrates a correlation between the viewpoints of the management and the consumers. Hence, digitalization is the primary concern in this process of Design Thinking.

4.2. Formulating and Executing the Idea

The outcomes of the 'emphasize' method indicate that the primary issues that need to be addressed are the first keyword, water usage recording, and the second keyword, payment, from two distinct perspectives. Concurrently, the third keyword (digitalization) pertains to the imperative of implementing solutions to address the aforementioned two issues. The crucial aspect of a service-based firm, such as BUMDes Sekar Abadi's clean water services, is the establishment of consumer confidence. In the present era of openness, the necessity for accountability and transparency is imperative (Sari, 2023). The process of digitalization can enhance accountability and transparency in management, hence fostering a rise in consumer trust (Rijal and Saranani, 2023). Enhanced trust will result in higher levels of adherence and improved precision in payments.

In order to address the current issues, we subsequently had multiple discussions with relevant parties involved. We conducted two sessions with the administration of BUMDes Sekar Abadi and the Sumber Sekar Village Government. During the initial meeting, we showcased the findings of our interview study, which focused on identifying current issues and proposing potential solutions for implementation. During the subsequent meeting, we presented a proposal to digitalize the management system for the clean water business. During this initial phase of the ideation, stakeholders unanimously approved the proposed plan for developing the clean water management system.

Previously, it has been elucidated that digitization serves as a remedy for resolving preexisting issues. Table 1 demonstrates the mutual consensus amongst both parties that digitization is the most rational and effective approach to address the challenges experienced by each party. Consequently, we created an online application called pamsekar.com to address the concerns experienced by both sides. Figure 2 provides a comprehensive perspective of the prototype for the digital management system.

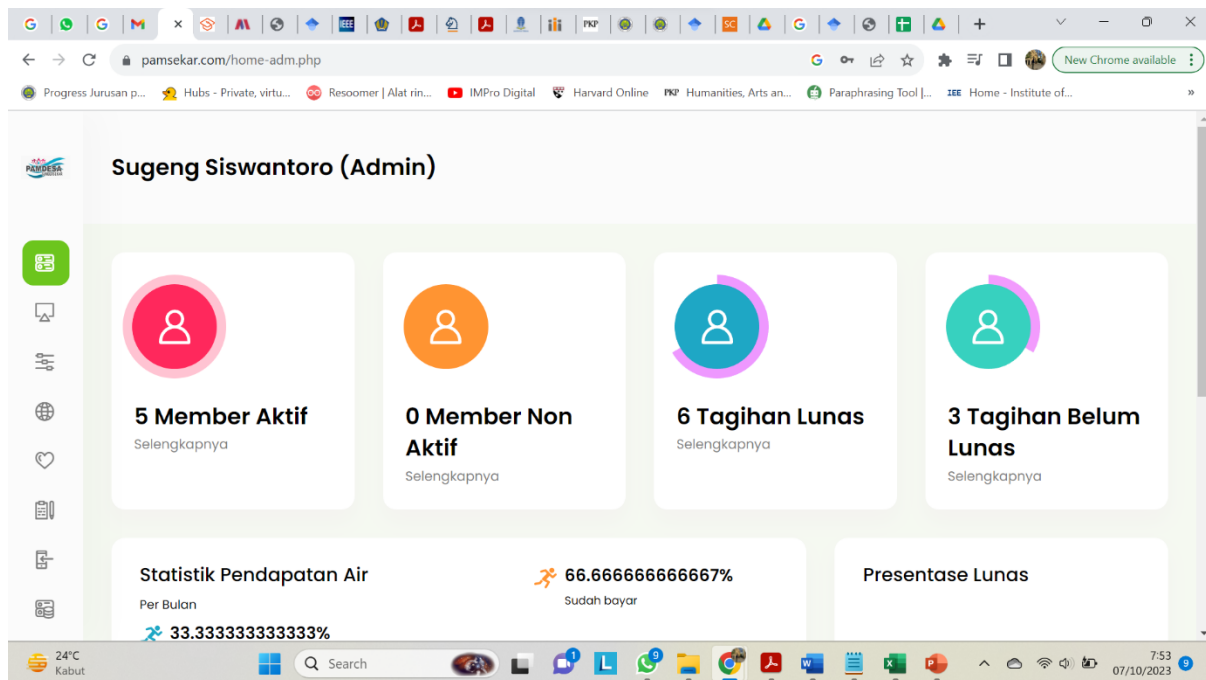


Fig 2. The Main Page (Dashboard) for Administrator

This program has four account classes: main admin, payment admin, registrar admin, and consumer. The customer data addition feature, the water usage recording feature, the water payment data feature, and the income reporting recap feature are the features available to the main admin. The ability to upload water usage statistics is a feature that the registrar admin possesses. Data on charges and fees that all customers are required to pay is a function available to the payment administrator. Consumer accounts, meanwhile, include fees that they are responsible for paying as well as information on water usage. It is possible to lessen asymmetric information by having distinct account classes. Asymmetric information makes it possible for a transaction to involve moral hazard and adverse selection (Owusu-Manu et al, 2021; Zheng et al, 2019). Both administrators and customers can view the amount of money that is received from them in a given period, as well as whether or not their payments have been officially recorded.

4.3. Testing to Get New Insights

Subsequently, the program undergoes a testing phase. Following the construction of the `pamsekar.com` service, our initial action was to submit data for all consumers who utilize pure water. Once all the data was entered, we proceeded to assemble a group of clients in order to promote and familiarize them with the program we had developed. We conducted a trial of `pamsekar.com` for a specific duration. After that, we invited back stakeholders including consumer representatives.

The objective of the meeting was to assess the efficacy of the program we had developed in resolving the preexisting issues. During the course of this process, novel concepts arise, resulting in a return to the stage of generating ideas. According to Glen et al. (2015), Design Thinking is a non-linear process. The testing phase does not signify the end, but instead has the capacity to produce novel insights for the product. For this particular situation, we received feedback from individuals with a vested interest, which we condensed and presented in Table 2.

Table 2. New Problems and Ideas from the Testing Phase

No.	Problems	New Idea
1	The counting officer is still required to search for the customer's identity within the application. There is a high number of consumers having the same name, resulting in bills being consistently confused.	We implement a distinctive barcode scanning functionality for every customer account. Officers simply need to scan the barcode affixed to each house.
2	While it is possible to make non-cash payments, it is necessary to send proof of payment to the designated officer via messaging applications such as WhatsApp.	We implement a functionality in the application that allows users to upload proof of payment.
3	There are still numerous users of clean water services that lack proficiency in technology.	We invite all consumers progressively to utilize the website to discuss the implementation of clean water management.

Table 2 represents the final outcome of a meeting that includes all the relevant parties participating in our Design Thinking process. The test results indicate that the primary contributors are the water usage data recording officers and consumers. Officers expressed difficulty in identifying the right user identity within the program due to the prevalence of consumers with almost identical names. Frequently, they erroneously input the customer's name, necessitating its repetition. Customers provide feedback primarily regarding payment-related matters. The payment system is primarily focused on collecting proof of online payments made by individuals. BUMDes managers have utilized fintech to facilitate payment processing. However, they are still required to submit the proof of payment through a social media application, like WhatsApp and etc, which is subsequently entered into the system by an officer. This is deemed to be less efficient for customers. In addition to the aforementioned issues, another significant concern is the presence of individuals with little technology literacy, which hinders the general awareness of digitalization.

To address these issues, we subsequently conducted the ideation and prototyping process once more. In order to address issues pertaining to user identification, we have implemented a distinct barcode functionality for every customer, enabling police to conveniently scan the barcode. Additionally, we implemented a functionality within our pamsekar.com application that enables users to upload evidence of payment. This allows consumers to conveniently conduct all their business transactions within a single platform. Ultimately, it is imperative to expand the scope of our efforts to educate consumers, particularly those with little technological proficiency, on the utilization of technology in the operation of clean water businesses.

5. Conclusion

The study results highlight the opportunities for design thinking-based approaches to facilitate progressive digital transformation of village enterprises in Indonesia. A localized, collaborative methodology is key to ensuring new technologies add value for rural enterprises. While limitations exist in the model validation, this research provides an important first step and foundation for future efforts to digitally empower village-owned businesses. Overall, developing context-specific digital management strategies through participatory design thinking can unlock the potential of Indonesia's village enterprises to thrive in the digital economy.

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