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UTILIZATION OF EXTREME PROGRAMMING IN VILLAGE ADMINITRATION SYSTEMS TO REALIZE VILLAGE INDEPENDENCE

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ABSTRACT
In the age of digital transformation, rural communities are increasingly exploring innovative methods to improve their administrative systems, strengthen governance, and achieve self-sufficiency. This paper examines the use of Extreme Programming (XP) techniques in developing and implementing Village Administration Systems (VAS) to promote village independence. XP, which focuses on iterative development, continuous feedback, and collaborative design, provides a flexible approach to tackle the unique challenges faced by village administrations, such as limited resources, diverse user needs, and varying digital literacy levels. By applying XP principles—such as continuous integration, collective ownership of code, and customer collaboration—this method enables the creation of adaptive, user-focused systems that can evolve according to community needs. Through real-time stakeholder feedback, the system can be refined to improve local governance, increase transparency, and ensure efficient resource management. The paper also explores how XP practices, including pair programming and frequent releases, help develop scalable and reliable solutions for rural areas. By fostering collaboration among local leaders, developers, and citizens, the system can empower village administrations to independently manage resources, reduce reliance on external support, and strengthen local capabilities. Ultimately, this paper aims to show how applying Extreme Programming to Village Administration Systems can enhance ownership, self-reliance, and contribute to sustainable rural development and village independence.

I. INTRODUCTION

In the modern digital era, rural communities face significant challenges in managing resources, delivering public services, and ensuring effective governance. While technology rapidly advances in urban areas, rural regions often lack access to digital tools, reliable infrastructure, and skilled personnel. These barriers prevent self-sufficiency and independence [1][2], resulting in villages being heavily reliant on external authorities for decision-making and resource management. Despite these challenges, technological advancements present a valuable opportunity for rural areas to overcome these limitations and build systems that promote self-governance, transparency, and efficiency. One promising approach is the application of Extreme Programming (XP), a flexible software development methodology focused on collaboration, continuous feedback, and iterative development. By adopting XP principles in the creation of Village Administration Systems (VAS) [3], rural communities can develop systems that are responsive, sustainable, and tailored to their specific needs, thereby improving local governance and fostering independence. XP is simpler and more direct in addressing core issues, such as continuous testing, regular integration, and developing software based on immediate user needs. A simpler XP system allows smaller teams with limited HR to focus on developing and delivering only the most essential features. On the other hand, Scrum-XP combines two methodologies, which, although offering flexibility, can make the process more complex with several stages like sprint planning, review, and retrospectives, along with role division. This can be harder to implement effectively in teams with limited HR.

XP emphasizes regular communication between developers and stakeholders, facilitating the development of user-focused systems that evolve with the community's needs. In rural settings, where resources are often scarce, XP offers an affordable, scalable solution to design and maintain systems that adapt to changing demands [4]. XP techniques such as pair programming, collective code ownership, and frequent releases ensure that the system is

continuously updated, incorporating valuable feedback from local leaders and residents at each stage of development [5]. This paper investigates how Extreme Programming can transform village administration systems by enabling the creation of flexible solutions that empower rural communities. Through XP, village administrations can optimize resource management, streamline administrative functions, and engage the community more effectively. Ultimately, the goal is to show how integrating XP into Village Administration Systems can help reduce dependence on outside support, promote greater autonomy, and contribute to achieving long-term village independence. The subsequent sections will explore the key principles of Extreme Programming [6], the challenges faced by rural administrations, and how these principles can be applied to develop systems that foster self-reliance, transparency, and sustainable development in rural areas.

The Smart Village program aims to leverage technology to improve the quality of life in villages, focusing on developing digital infrastructure and empowering local communities. Through synchronization with this program, decision-making becomes easier, and the community can more easily access various services available in the village. This aligns with the objectives of the SDGs Desa program, which aims to ensure that villages contribute to the achievement of the Sustainable Development Goals (SDGs), such as improving access to education, healthcare, and economic opportunities for village communities.

As references and support for this study, the author includes previous research along with its differences from the current study, as follows: 1. Research conducted Amirullah, I., Sari, L. P., Syafaruddin, S., Rasyid, M. F. F., Lira, H. A., Mallappiang, N., ... & Natsir, N. (2023). Development of Village Information System to Enhance Village Administration Transparency through E-Government. This community service initiative in Biring Ere Village aimed to implement e-government to improve administrative transparency, enhance public understanding of the Village Information System (SID), and promote its development in other villages within Pangkep Regency. This study focuses on the application of the Extreme Programming (XP) methodology to develop an adaptive and flexible village administration system aimed at enhancing village independence, while the previous research emphasized the development of the Village Information System (SID) to improve village administration transparency through e-government, without explicitly referencing XP [7]; 2. Research conducted Romadhon, A. L., & Maryam, M. (2023). Design and development of a web-based village administration service information system in Dukuh Village. Dukuh Village faces problems in the process of requesting letter creation, which is still done manually, resulting in a lengthy process, inefficiency, and susceptibility to errors. This study aims to develop an information system for village administration services to simplify the letter handling process [8]. The system is developed using the waterfall method with PHP, Laravel, MySQL, and CSS Bootstrap technologies, and tested using black box testing and the System Usability Scale (SUS), with a score of 77.17, indicating that the system is suitable for use [9]. This study uses the Extreme Programming (XP) methodology, which focuses on developing adaptive and flexible systems through rapid iterations, intensive collaboration, and continuous feedback with mobile technology, while the previous study used the waterfall method, which is more structured and linear [10].

3. Research conducted Baskoro, D. A., Maipita, I., Fitrawaty, F., & Dongoran, F. R. (2023). Digitalisasi sistem informasi dan administrasi desa sebagai upaya menuju desa cerdas di desa kolam, percut sei tuan, deli serdang, sumatera utara. Pengabdian ini bertujuan mewujudkan desa cerdas di Desa Kolam melalui pengembangan aplikasi dan website untuk sistem informasi dan administrasi desa, serta pelatihan kepada masyarakat dan aparatur desa, yang meningkatkan efisiensi administrasi, mempermudah akses informasi, dan mewujudkan transparansi pemerintahan. This study emphasizes the development of adaptive and flexible software through rapid iterations, intensive team collaboration, and continuous feedback to support village independence, while the previous study focused more on the digitalization of village information and administration systems to enhance efficiency and transparency in creating smart villages[11]. 4. Research conducted Rinova, D., Fajri, R. C., Irsandi, I., Satria, I., & Oktaviannur, M. (2023). Optimization of Village-Owned Enterprises (BUMDes) Management to Achieve an Independent Village. BUMDes is an alternative to improving the economy and welfare of village communities; however, many village governments are still unable to manage it optimally due to limited resources and managerial capabilities. Utilization of Extreme Programming in Village Administration Systems focuses on applying software development methodology to improve the efficiency of village administration systems, while Optimization of BUMDes Management emphasizes managing Village-Owned Enterprises (BUMDes) to strengthen the economic independence of the village [12] [13].

This research is of high urgency in the context of improving village administration to be more efficient, transparent, and independent. In the current digital era, many villages still rely on traditional methods for administration, leading to low efficiency, lack of transparency, and dependency on external parties. By utilizing the Extreme Programming (XP) methodology in the development of village administration systems, this study aims

to address these challenges by creating a more adaptive and flexible system that can evolve with the village's needs.

The tendency of previous studies using Waterfall, which has shortcomings, can be translated as: Waterfall does not facilitate continuous interaction with users until the final testing or implementation phase. In village administration, user feedback (from the village community and local officials) is crucial to ensure that the system being developed truly meets their needs. Post-pandemic, many villages face the need to quickly adjust their systems and processes. With Waterfall, the chances of obtaining timely feedback from stakeholders are limited, meaning urgent needs or changes may not be reflected in the developed system.

After the development of the system, many villages face significant challenges in terms of infrastructure and human resources to support long-term sustainability. Although XP (Extreme Programming) is designed to support ongoing development and improvement of systems throughout their lifecycle, in villages, especially those with limited resources, it is difficult to maintain active involvement from development teams or ensure sufficient technical support. Existing research tends to not explore adequately how XP-based village administration systems can sustain themselves in the long term in these resource-constrained environments after the development phase is completed. Systems developed with XP are dynamic and flexible, with rapid iterations and frequent adjustments. However, in the long run, managing and updating a continuously evolving system can become a major challenge, especially if there is no clear mechanism to ensure that system development remains sustainable and can address the ever-changing needs. Without proper planning for system maintenance and updates after development, the system is at risk of becoming outdated or irrelevant over time.

Extreme Programming (XP) places a strong emphasis on the importance of quick feedback and continuous iteration, making it highly relevant for applications intended for use in village contexts. However, without the active involvement of the village community, the feedback provided may be misdirected or not reflect the actual local needs. Community participation is crucial, not only to maintain the relevance of the system but also to ensure that the developed system truly fits the local context and can adapt to changing needs.

One of the core principles of XP is close collaboration between developers and stakeholders. However, in many existing studies, attention to the direct involvement of the village community in the software development process remains limited. In the context of villages, where the sustainability of the system heavily relies on local understanding and acceptance, active community participation is essential. Local ownership becomes much easier to achieve if the village community is involved from the outset in the planning, design, and testing of the system.

II. METHOD

To support the development of an adaptive and sustainable village administration system, this study employs the Extreme Programming (XP) methodology. This methodology was chosen due to its flexible approach, emphasis on intensive team collaboration [14], and its ability to enable continuous feedback from stakeholders. XP is designed to create software systems that can evolve over time and be adjusted to changing needs, which is highly relevant in the context of dynamic and diverse village governance. The Extreme Programming (XP) methodology As can be seen in Figure 1 applied in this study is as follows:

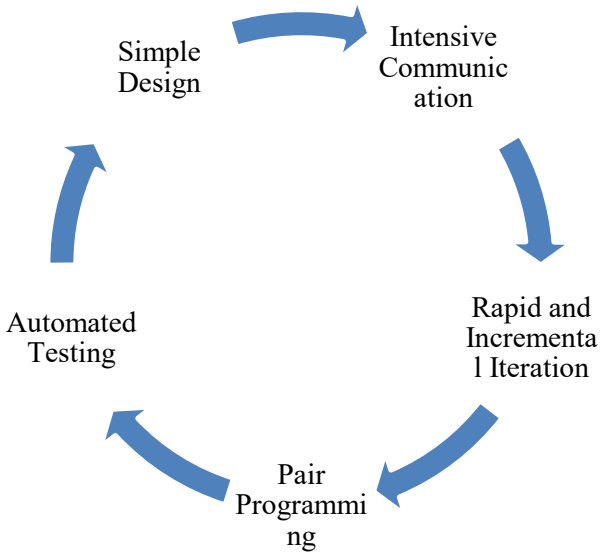


Figure 1. Extreme Programming Method [15]

The explanation of these stages is as follows:

1. Intensive Communication

   The stages of intensive communication in village administration management to support village independence include several steps, namely: identifying the parties involved in village administration, such as the village government, the community, system developers, and other stakeholders. Next, developing a clear communication strategy and plan is essential to ensure that important information is conveyed in a timely and efficient manner. Lastly, the implementation of a technology-based village administration system aims to streamline the flow of information and reduce communication barriers [16].

2. Rapid and Incremental Iteration

   The stages of Rapid and Incremental Iteration in village administration to support village independence include several important steps: first, conducting an initial analysis to identify the main needs in village administration and setting priorities for features or services required by the community and village government. Next, developing the initial version of the village administration system with the most essential basic features, which are ready for immediate use. This development process is carried out quickly and iteratively, involving direct feedback from village users. After the first version of the system is completed, a trial is conducted at the village level to gather input from users. This feedback is used to evaluate the system's performance and identify areas that need improvement. Based on the evaluation results, the system is refined and further developed with the addition of more complex features. This process occurs in several iterative cycles, where each cycle results in an increasingly improved version of the village administration system.

3. Pair Programming

   Pair Programming in village administration to support village independence can be implemented through several steps, including: Pair programming involves two software developers working together, with one acting as the code writer (driver) and the other as the reviewer (observer). In the context of village administration, this means collaboration between system developers and relevant stakeholders in the village government to ensure that the system being developed meets local needs and characteristics. Through the pair programming approach, both parties can discuss and design a more efficient village administration system. The developers focus on creating technological solutions, while the village government provides input and understanding of the specific administrative needs of the village.

4. Automated Testing

   UAT (User Acceptance Testing) is a testing phase in software development conducted by end users to ensure that the developed system or application meets their needs and expectations before being fully implemented. During this phase, users will test the system's functionality based on predefined scenarios to ensure that the system operates properly in real-world conditions and environments [17] [18].

   Blackbox refers to a system or device where its internal processes do not need to be known or understood by the user, who can only observe the input provided and the output produced by the system [19]. In the context of technology and software, the blackbox approach is used to test the functionality of a system without needing to know how the system operates internally [20].

5. Simple Design

   The system design must be created with a simple principle. The main focus is to create a user interface that is easy to understand and use. Avoid features or elements that are overly complex and irrelevant to the primary needs. A modular system design allows for updates or changes in the future without disrupting the entire system [21].

III. Results And Discussion

A. Results

1. Intensive Communication

   The stages of intensive communication in village administration management to support village independence include several key steps, such as: identifying the parties involved in village administration, such as the village government, the community, system developers, and other relevant stakeholders. The next step is to develop a clear communication strategy and plan to ensure that necessary information can be conveyed in a timely and efficient manner. Additionally, the implementation of a technology-based village

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administration system is required to facilitate the flow of information and reduce communication barriers. In this process, creating a use case is also essential to illustrate how the village administration system can be explained and implemented in this context. Intensive communication As can be seen in Figure 2 and 3.

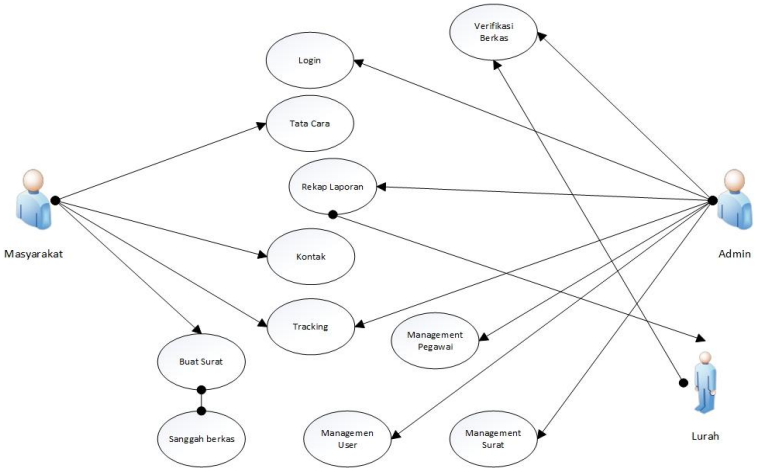


Figure 2. Use Case of Utilization of Extreme Programming in Village Administration Systems to Realize Village Independence

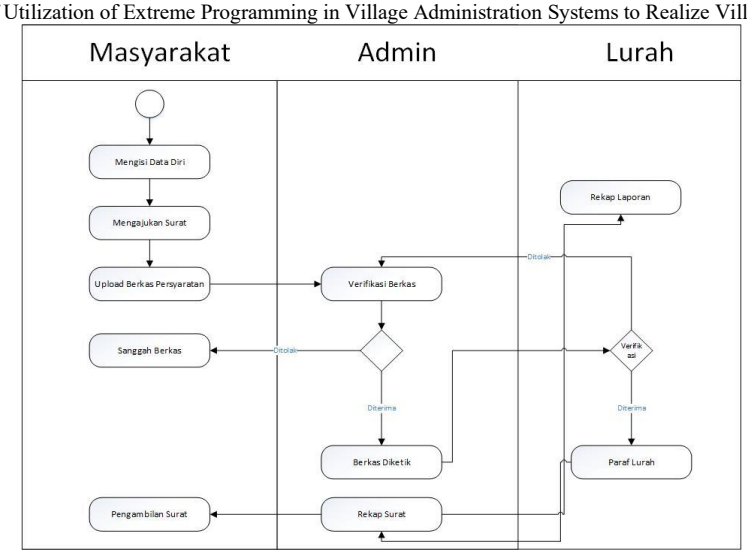


Figure 3. Activity Diagram of Utilization of Extreme Programming in Village Administration Systems to Realize Village Independence

2. Pair Programming

In the context of village administration, this means collaboration between system developers and relevant stakeholders in the village government to ensure that the system being developed meets local needs and characteristics. Through the pair programming approach, both parties can discuss and design a more efficient village administration system. API coding and Android studio coding As can be seen in Figure 4 and Figure 5.

.well-known	02/02/2024 13:38	File folder	
application	02/02/2024 13:38	File folder	
assets	02/02/2024 13:38	File folder	
cgi-bin	02/02/2024 13:38	File folder	
database	02/02/2024 13:38	File folder	
system	02/02/2024 13:38	File folder	
uploads	02/02/2024 13:38	File folder	
.htaccess	05/01/2024 7:21	HTACCESS File	1 KB
buatsuratmasuk	05/01/2024 7:21	PHP Source File	3 KB
cekpenduduk	05/01/2024 7:21	PHP Source File	1 KB
composer	05/01/2024 7:21	JSON Source File	1 KB
contributing	05/01/2024 7:21	Markdown Source ...	7 KB
error_log	05/01/2024 7:21	File	1 KB
index	05/01/2024 7:21	PHP Source File	11 KB
konek	05/01/2024 7:21	PHP Source File	1 KB
license	05/01/2024 7:21	Text Document	2 KB
README	05/01/2024 7:21	Markdown Source ...	1 KB
tracking	04/01/2024 18:59	PHP Source File	2 KB

Figure 4. API Coding

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model	File folder					21/01/2023 12:54
network	File folder					24/01/2023 23:07
BuatSurat.kt	KT File	1 KB	No	3 KB	70%	08/01/2023 5:58
ContactUs.kt	KT File	1 KB	No	2 KB	62%	24/01/2023 20:00
IntroSlider.kt	KT File	1 KB	No	1 KB	26%	26/12/2022 4:04
IntroSliderAdapter.kt	KT File	1 KB	No	2 KB	66%	26/12/2022 4:04
LoginSurat.kt	KT File	1 KB	No	2 KB	57%	06/01/2023 1:29
MainActivity.kt	KT File	2 KB	No	4 KB	73%	26/12/2022 8:01
MenuActivity.kt	KT File	1 KB	No	2 KB	69%	24/01/2023 18:30
ProfilDesa.kt	KT File	1 KB	No	2 KB	57%	11/01/2023 3:20
SplashScreen.kt	KT File	1 KB	No	1 KB	50%	11/01/2023 2:59
SuratActivity.kt	KT File	3 KB	No	9 KB	73%	21/01/2023 14:32
TataCara.kt	KT File	1 KB	No	2 KB	62%	24/01/2023 18:14
TrackingSurat.kt	KT File	2 KB	No	11 KB	85%	21/01/2023 13:56
Utility.kt	KT File	1 KB	No	1 KB	48%	06/01/2023 1:29

Figure 5. Android Studio Coding

3. Simple Design

When the user accesses the Sadbro application by clicking its icon, the system will display several initial pages, as shown in the following image. User Interface of the First Village Administration Program As can be seen in Figure 6.



Figure 6. User Interface of the First Village Administration Program

On the homepage, several menus will be displayed, including the guide menu, create letter menu, search/tracking menu, and contact menu. The display after the user enters the tracking code sent by the system to the applicant's WhatsApp number as the code. Once the tracking code is entered by the user, the system will display information Online Tracking. User Interface Display Information for Online Tracking As can be seen in Figure 7.

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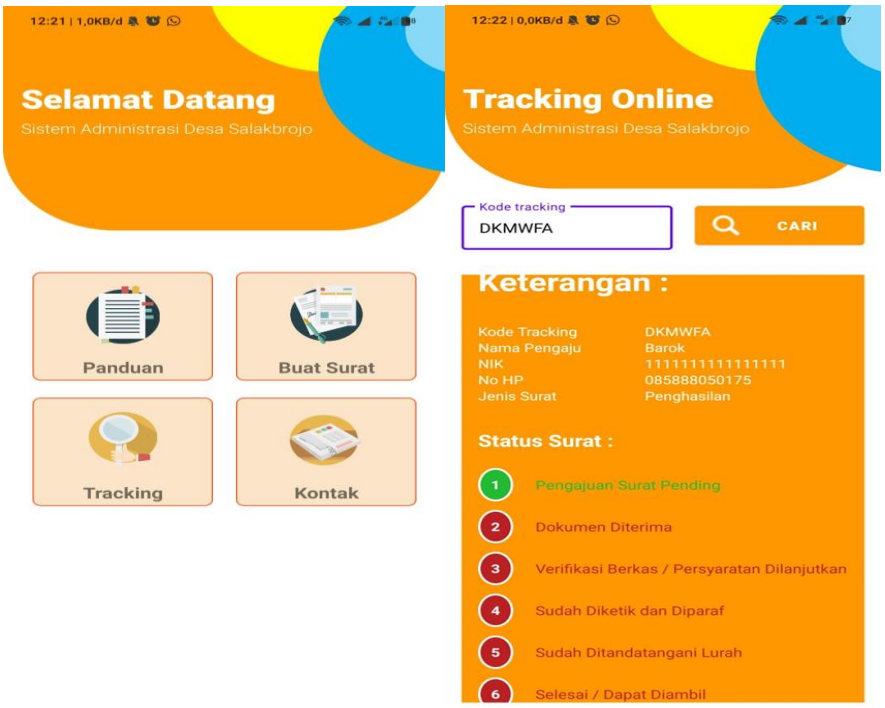


Figure 7. User Interface Display Information for Online Tracking

B. *Discussion*

1. Automated Testing

Each task in the testing is equipped with success and failure indicators. Users who successfully complete the task scenario will be given the code "S" (success), while users who fail or give up in completing the task will be given the code "G" (failure). Table 1 shows the success rate indicators.

TABLE I.
USABILITY TESTING SUCCESS INDICATORS

code	Success Rate	Description
S	Success	Complete the task according to the scenario
G	Incomplete	Did not complete the task according to the scenario

Table 2 shows the data of the overall task completion rate by user respondents for the scenario tasks as follows:

TABLE II. OVERALL RESPONDENT COMPLETION RATE

Task	Overall Completion Rate			
	Responden	Percentage (S) = (Number of Successes / Total Respond-ents) × 100%	Respondents (G)	Percentage (G) = (Number of Failures / Total Respondents) × 100%
T-1	19	96%	1	5%
T-2	18	84%	2	10%
T-3	17	87%	4	25%
T-4	19	90%	2	5%
T-5	18	95%	3	10%
T-6	18	84%	2	25%
T-7	17	87%	1	5%
T-8	17	90%	3	25%
T-9	17	95%	4	5%
T-10	18	90%	2	20%
T-11	17	95%	1	5%
T-12	19	84%	3	25%
T-13	18	90%	1	5%
T-14	18	95%	2	10%
T-15	18	90%	4	35%
T-16	17	95%	1	5%
T-17	19	86%	1	5%
T-18	18	87%	1	5%

Table 3. Calculation Process for Determining the Completion Rate Result:

TABLE III.
CALCULATION OF THE AVERAGE COMPLETION RATE

Number of User Respondents (S)	Number of Tasks Assigned	Total Number of User Respondents
340	18	20

$$\frac{Number\ of\ Respondents\ (S)}{\text{Total Tasks} \times \text{Total Respondents}} \text{ x } 100\ \%$$

$$\frac{\mathbf{340}}{\mathbf{18}x\mathbf{20}}x\mathbf{100}\% = \mathbf{94}\%$$

The results of the usability testing on the duration aspect showed that the average completion rate of 85% is considered a good standard. In contrast, values below this number indicate an inadequate task completion rate. The task success rate in completing the utilization of extreme programming in village administration systems to realize village independence, conducted by 20 respondents, achieved a 94% success rate in task completion, which indicates a good outcome. Of the 18 prototype design scenarios tested by the user respondents, despite some respondents experiencing failures in some of the tasks assigned, the overall results were satisfactory.

The challenges in collaboration between developers and village stakeholders often involve factors that are not visible from success metrics, such as the digital skills gap among village stakeholders, especially the elderly or those less familiar with technology, as well as the limitations of village infrastructure, such as internet access and adequate devices. Without proper support, the use of developed technology can become suboptimal.

The imbalance in participation in system development, especially in involving vulnerable groups such as the elderly or women, can lead to unequal access and benefits from technology, as development is often more influenced by the needs of dominant groups such as youth or men. In the development of this village, only 2% of the village population participates. This is mostly due to vulnerable groups who have less understanding of technology.

The limitations of implementation in areas with unstable internet connectivity can hinder the use of technology, even when the UI is designed simply. The main issue is the reliance on a stable connection, which can limit access and performance of the application. The impacts include difficulty accessing the application consistently, system performance issues, and user frustration, which can lower adoption rates and satisfaction.

The village may have certain customs or social structures that facilitate technology adoption, such as a higher level of education or a community more open to change. On the other hand, other villages with more conservative traditions or lower education levels might face resistance to new technology. The ability to manage and maintain the system may depend on the skill level of the human resources in the village. If the research village has individuals with technological expertise or support from people with digital skills, replication in other areas might face difficulties if similar human resources are not available.

The comparison between the results of previous research and the current study is as follows: The research conducted by Yoraeni, A., Basri, H., & Puspasari, A. (2022) on the implementation of village service information systems to improve public service quality and realize a smart village shows that the results achieved in this PKM activity include an 85% improvement in partners' ability to manage archives systematically, about 85% improvement in village staff's skills in using information technology, which in turn can improve the quality of public services by approximately 90% [22]. With these results, the current research is higher compared to the previous one. The research conducted by Mayadi, M., & Kustanto, P. (2022) on the training of the Village Service Information System for Letter of Recommendation Staff in Mangunjaya Village, Tambun Selatan District, Bekasi Regency, shows that, in this activity held in Mangunjaya Village, out of a total of 30 participants, 57% expressed being very satisfied, 30% were satisfied, and 13% said they were quite satisfied with the presentation delivered by the speaker [23]. With these results, the current research is higher compared to the previous one. The research conducted by Khaerunnisa, N., & Nofiyati, N. (2020) on the Web-based Population Administration Service Information System, with a case study in Sidakangen Village, Purbalingga, used Blackbox testing and MOS (Mean Opinion Score) methods. The results demonstrated that 80% of the system functioned according to the needs defined by the users [24]. With these results, the current research is higher compared to the previous one.

IV. CONCLUSION

the conclusion of "utilization of extreme programming in village administration systems to realize village independence" can be explained as follows:

1. The implementation of extreme programming (xp) in village administration systems can improve performance in terms of efficiency, transparency, and accountability in managing administrative tasks at the village level. the xp approach, which emphasizes collaboration between developers and village stakeholders, as well as continuous testing, results in a system that is more responsive to the needs of the village community.
2. furthermore, xp supports the application of principles such as decentralization and active participation, which in turn play an important role in achieving village independence. with a more organized administration system and the use of more reliable technology, villages are better able to manage resources, provide public services, and make decisions more effectively and independently.
3. The success rate of the task in completing utilization of extreme programming in village administration systems to realize village independence, conducted by 20 respondents, was 94%.

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