Designing Inclusive Digital Platforms for Marginalized Communities: A Design Science Research Approach

Muhammad Rozahi Istambul[1] and Tarmin Abdulghani[2]
[1] Widyatama University, Bandung, Indoonesia
[2] Suryakancana University, Cianjur, Indonesia
rozahi.istambul@widyatama.ac.id
tarmin@artagani.com

Abstract. This research explores the development and implementation of a customized inclusive digital health platform for marginalized communities in three sub-districts in Bandung, Indonesia, Andir, Cibiru, and Bojongloa Kaler. The methodology used is Design Science Research (DSR), further integrating information system architecture and information technology (IT) governance to overcome barriers such as low digital literacy, limited access to technology, and economic constraints. The platform was designed with a personalization engine, data security measures, and enhanced accessibility features, and optimized according to local socio-economic conditions. The research showed significant improvements in user engagement and satisfaction across the three sub-districts, with key successes in personalizing content to users' needs, ensuring data protection, and providing offline functionality. Users in Cibiru and Bojongloa Kaler, who face lower technological limitations, reported improved ease of access and utilization of digital health services thanks to customized features such as data compression and simplified interfaces. DSR's iterative approach allows for continuous customization of the platform based on user feedback so that both technological and community needs can be effectively met. This research contributes to the literature on inclusive digital technologies and demonstrates the potential of flexible information system architecture and participatory IT governance in empowering marginalized populations. The findings suggest that this approach can be replicated in similar socio-economic settings to increase the adoption of digital health services and improve overall community health outcomes.

Keywords: Design Science Research, Digital Health, Information Systems, Personalization Engine, Accessibility

1. Introduction

Information technology has become the backbone in various sectors of life, including in community services in the digital era [1]. The implementation of an integrated information system architecture with good information technology governance is key in building a reliable digital platform. In this context, the use of digital platforms provides opportunities for the community, including marginalized communities, to gain wider access to public services and relevant information [2] [3]However, the utilisation of these technologies still faces various challenges, especially in areas with low levels of technological literacy [4] [5] . There are several sub-districts in Bandung City, such as Andir, Cibiru, and Bojongloa Kaler.

Marginalized communities in these areas have limitations in utilising digital platforms for their daily needs, both in terms of accessibility, security, and personalisation. A random survey of 100 community members in each subdistrict found that many of them still face challenges in optimally utilising digital platforms[6]. These challenges are closely related to the lack of technological knowledge, mistrust of data security systems, as well as the inability to customise available applications to their specific needs[7] This indicates an urgent need to build a system that can accommodate the needs of marginalized communities, which includes aspects of personalisation, data security, and ease of access.

In an effort to answer this problem, the Design Science Research (DSR) methodology is used as an approach to build a digital platform that is more inclusive and adaptive for marginalized communities[8] [9]DSR provides a structured framework for developing technological solutions by focusing on the iteration between theory and practice, enabling the creation of solutions that are not only theoretical but can also be directly implemented in the field [10]. In the context of developing digital platforms in Andir, Cibiru, and Bojongloa Kaler sub-districts, this methodology is highly relevant as it enables the creation of applications that not only fulfil functional needs but also fit the characteristics of the local community [11].

The personalization engine is one of the key features developed in this platform, which serves to customise the user experience based on individual preferences and needs[12]. In addition, data security systems are a major concern, given the high public concern regarding privacy and the potential leakage of personal data [13]. Accessibility is also considered by providing a user-friendly interface that is compatible with various devices [14] [15]. In addition, the platform also includes devices commonly used by marginalized communities in the

V. Mardiansyah and B. A. Prasetyo (eds.), *Proceedings of the Widyatama International Conference on Engineering 2024 (WICOENG 2024)*, Advances in Engineering Research 252,
https://doi.org/10.2991/978-94-6463-618-5_12

city of Bandung. Thus, this platform is expected to be able to make a real contribution in improving the quality of life of the community through technology that is more adaptive and safe.

In closing, the development of a digital platform designed using the DSR methodology is expected to be a model solution that can be replicated in other regions with similar conditions. Implementing robust information technology governance, combined with a resilient information system architecture, will create a platform that is not only functionally effective, but also inclusive and sustainable for marginalized communities [16] [17]. This research will make a significant contribution to the field of information technology development for marginalized communities, focusing on the aspects of personalisation, security, and accessibility.

2. Literature Review

This research draws on a wide range of literature that discusses the important role of digital technology in enhancing public participation and community empowerment in various contexts, particularly in areas with low levels of digital literacy[18]. Previous studies have shown that digitalisation can be an effective tool to promote citizen engagement in public decision-making processes [19]. In addition, digital literacy is also seen as an important component in improving the quality of public services in the digital era [20]. This opens up opportunities for people, including marginalized groups, to voice their needs and preferences more widely.

Information system architecture and information technology governance are fundamental elements in developing inclusive digital platforms, especially for marginalized communities. Information system architecture and information technology governance are fundamental elements in developing inclusive digital platforms, especially for marginalized communities [21] [22]. Information systems architecture ensures efficient technology integration and smooth functioning of the platform under limited infrastructure conditions, while information technology governance establishes policies and controls that ensure the safe, effective, and fit-for-purpose use of technology [23]. The novelty of this review lies in exploring the implementation of customized IT architecture and governance for marginalized communities in different regions, which has not previously been addressed in the literature.

This review highlights the adaptation of flexible information system architectures, such as those implemented in Kenya. This review highlights the adaptation of flexible information system architectures, such as those implemented in Kenya[24] [25], where digital platforms have enabled marginalized communities to access essential public services, despite limitations in infrastructure and digital literacy[14]. In addition, previous research has analysed the need to develop IT governance that is responsive to the local context for digital platforms to be adopted. This approach emphasises the importance of system design that is adaptive to local technological limitations, a novelty that demonstrates how architecture can support digital inclusion in conditions of limited infrastructure [26] [27]

From the perspective of IT governance, studies have shown that the implementation of transparent and community-based privacy policies can increase user trust by up to 40%, encouraging wider participation in the use of digital technologies. This review offers a new contribution by demonstrating how participatory IT governance can increase the engagement of marginalized users, adapting governance principles previously applied in corporate or government settings to the context of marginalized communities [28] [29].

In addition, machine personalization in the context of marginalized communities is also discussed in depth. Studies show that machine personalization based on local data significantly increases the engagement of marginalized users. The novelty of this review lies in the emphasis on adaptive personalisation, which adjusts algorithms based on local socioeconomic and cultural variables, thereby increasing the relevance and impact of technology in marginalized communities [30] [31].

The Design Science Research methodology is also discussed as an effective iterative approach in developing digital technology for marginalized communities [32]. Studies have revealed that the implementation of community-based DSR increases user participation through an iterative process that continuously involves user feedback. This review proposes a more micro and community-based DSR approach, which not only technically improves digital platforms, but also empowers marginalized communities [33].

Overall, this review adds a new contribution to the existing literature by emphasising the adaptation of information system architecture, participatory IT governance, and adaptive personalization relevant to marginalized communities. Through empirical examples from various countries such as Brazil, India, and Kenya, this review provides a new practical perspective on how digital technology can be adapted to enhance digital inclusion in environments with limited infrastructure [34] [35] [36].

3. Research Methodology

The Design Science study technique was chosen for this study project because to its ability to generate solutions that are both theoretically robust and can be directly implemented and refined through iterative procedures using real-world data[37][38]. The Design Science Research(DSR) technique is highly relevant in the domain of information technology development, as it enables the seamless integration of design, development, and ongoing assessment processes the citation for the source is Q. Deng, A.R.Hevner[39] [40]. Compared to other research methods like action research or case study research, which often focus on analyzing the context or testing theories, DSR offers a structured approach that is specifically designed to create new artifacts and provide practical solutions to real-world problems the reference[41].

Moreover, DSR strongly prioritizes the fusion of theory and practice, guaranteeing that the solutions it generates are not only academically relevant but also hold significant practical worth[42].When designing a digital health platform, it is crucial to consider the ability to effectively apply the resulting solutions in the field, especially in communities with restricted technological access. These solutions must include the limitations of infrastructure, financial resources, and digital literacy in underprivileged populations. Only by taking these factors into account can digital health services be modified and put into practice in a way that efficiently enhances accessibility and benefits for the population that requires them the most[43] [44]. This research will be carried out through a sequence of activities aimed at accomplishing the main goal of creating an adaptable and personalized digital health platform structure for the underprivileged community in Bandung City.

This study employs the Design Science Research (DSR) methodology, a structured approach that emphasizes the iterative development of artifacts to solve real-world problems while generating theoretical knowledge. DSR was chosen for its ability to facilitate continuous refinement of the digital health platform based on empirical feedback, making it particularly suited to the complex and evolving needs of marginalized communities in Andir, Cibiru, and Bojongloa Kaler. Key Stages of the DSR Process,

1) Problem Identification and Motivation: The first stage involved identifying the specific barriers faced by the target communities, such as low digital literacy, limited access to technology, and concerns over data security. These challenges were mapped through surveys and focus group discussions, building on insights from previous research on marginalized populations [45] [46].
2) Define Objectives of a Solution: Objectives were established to address the identified challenges, such as developing a personalization engine that adapts to varying literacy levels, implementing robust data security measures to build user trust, and ensuring the platform is accessible on low-end devices [47] [48].
3) Design and Development: The platform was designed iteratively, with multiple prototype versions developed and tested across the three sub-districts. Key components of the design included modular architecture for easy customization, security protocols such as end-to-end encryption, and offline functionality for regions with limited internet access [49].
4) Demonstration: The platform was deployed in real-world settings within the three sub-districts. Participants interacted with the system over several weeks, allowing the researchers to observe how effectively the platform addressed issues such as user engagement and data security.
5) Evaluation: The platform's effectiveness was evaluated using both quantitative and qualitative methods. Key performance indicators (KPIs) included user satisfaction, system usability, and security efficacy. Feedback was collected through post-implementation surveys and in-depth interviews, allowing for further refinements to the platform [25].
6) Communication: The final stage involved documenting the findings and sharing them with relevant stakeholders, including local government and health officials, to facilitate broader adoption of the platform in similar socio-economic settings.

Iterative Refinement

The iterative nature of DSR allowed for continuous improvement of the platform throughout the research process. After each deployment, user feedback was integrated into the next iteration, ensuring that the platform remained responsive to the evolving needs of the community. This iterative cycle was essential for refining features such as the personalization engine and improving the user interface based on real-world use.

By employing DSR, this study not only produced a functional digital health platform but also contributed theoretical insights into how IT solutions can be effectively adapted for marginalized communities. The methodology ensured that the platform evolved in tandem with user needs, leading to a more inclusive and practical solution.

4. Result and discussion

The digital health platform's implementation across the sub-districts of Andir, Cibiru, and Bojongloa Kaler generated a comprehensive set of data that provides valuable insights into its effectiveness in addressing key challenges in healthcare access, personalization, and data security for marginalized communities. The analysis presented here offers a detailed breakdown of the performance metrics and the implications of the platform's features across these three areas, informed by user feedback and system performance metrics.

4.1 Accessibility

In the first stage of Problem Identification and Motivation in the DSR methodology, the main challenge identified is the limited access to digital health services in three sub-districts. (Andir, Cibiru, dan Bojongloa Kaler). This is primarily due to limited infrastructure and limited digital literacy. In the Define Objectives of a Solution stage, the identified solution is the development of a platform that can function in low-connectivity environments. In the Design and Development stage, the platform is designed with offline capabilities that allow users to continue accessing healthcare services without an internet connection.

The results reflected in Table 1 show that Bojongloa Kaler achieved the highest accessibility level at 80%, followed by Andir at 78%, and Cibiru at 75%. Additionally, Bojongloa Kaler demonstrated a significant offline capability usage rate of 92%, underscoring the importance of this feature in areas with the most unstable connectivity. This achievement aligns with the literature that emphasizes the importance of flexible platforms capable of functioning offline to enhance service access in marginalized communities.

4.2 Personalization

At the Define Objectives of a Solution stage, one of the main objectives set is the development of services that can be personalized according to individual preferences and needs. This is realized in the Design and Development phase with the development of a personalization engine capable of adjusting health content, such as medication reminders and relevant health advice, according to the user's profile. The results, as shown in Table 1, indicate that the user engagement level in using the personalization feature is high, with Bojongloa Kaler reaching 85%, Andir 82%, and Cibiru 80%. This level of engagement demonstrates that the personalization engine successfully meets user needs, especially in areas with lower literacy rates.

Meanwhile, at the Evaluation stage, it was found that the system's response time in providing personalized recommendations was slower in Cibiru (50%) and Bojongloa Kaler (55%), compared to Andir which reached 85%. This indicates that at the Iterative Refinement stage, further improvements are needed to optimize the performance of the personalization engine, especially in areas with limited technological infrastructure. Estos retrasos pueden atribuirse a las limitaciones tecnológicas en estas regiones, donde el menor ancho de banda y la capacidad de procesamiento limitada en los dispositivos de los usuarios pueden ralentizar la capacidad del sistema para ofrecer contenido personalizado en tiempo real. Aunque Andir reportó tiempos de respuesta más rápidos (el 85% de los usuarios no experimentaron retrasos), es necesaria una mayor optimización del motor de personalización para garantizar un rendimiento consistente en todas las regiones.

.

4.3 Data Security

Data security becomes a primary concern at the Problem Identification and Motivation stage, considering the sensitivity of health information and user concerns regarding data breaches. To address this challenge, at the Design and Development stage, the platform implements strong encryption protocols, such as AES-256 in Andir and AES-128 in Cibiru and Bojongloa Kaler, to ensure user data protection. The evaluation results in Table 1 show a very high level of satisfaction with data security, with Bojongloa Kaler leading at 90%, followed by Andir at 85%, and Cibiru at 80%. This level of trust reflects the successful implementation of security protocols, which are a key element in the sustainability of platform usage.

Although the satisfaction level with data security is high, only 55% of users in Andir, and 45% in Cibiru and Bojongloa Kaler reported a clear understanding of the platform's privacy policy. This indicates that at the Communication stage, more educational efforts are needed to raise user awareness about how their data is managed and protected. These findings are consistent with several previous studies that show a relationship between high levels of encryption strength and user trust, especially among populations that have been concerned about their data privacy.

Table 1. Overall Performance Metrics Across Sub-Districts.

Performance Metric	Andir (%)	Cibiru (%)	Bojongloa Kaler (%)	Average (%)
User Accessibility	78	75	80	77.7
Engagement (Personalization)	82	80	85	82.3
Data Security Satisfaction	85	80	90	85.0
Ease of Access (Offline Capabilities)	75	70	92	79.0
Data Usage Efficiency	80	88	90	86.0
System Response Time (Personalization)	85 (fast)	50 (moderate)	55 (moderate)	-
Understanding of Privacy Policies	55	45	45	48.3
User Confidence in Data Security	85	80	90	85.0

In addition, this level of satisfaction is also influenced by how the platform handles data security threats, especially in areas like Bojongloa Kaler, where offline features are very important. This platform allows for local data storage with secure encryption features, which proves to be very beneficial for communities with unstable internet connectivity. The feature guarantees that users' health data remains protected even when not connected to the internet, and reduces the risk of data leaks that commonly occur in offline features. This success demonstrates how, through proper security protocols, user concerns in environments with limited connectivity can be effectively addressed. However, despite the high level of satisfaction with data security, Table 1 also shows a gap in users' understanding of the platform's privacy policy. Only 45% of users in Bojongloa Kaler and Cibiru, and 55% in Andir, reported that they clearly understand how their data is managed. This fact shows that although technical and infrastructural security measures are well implemented, there is an urgent need for more in-depth user education on this matter. This is very important because, after all, encryption technology can only provide effective security if its users truly understand how their data is processed and stored.

Overall, the data security performance, as seen in Table 1, shows a success rate in terms of the data protection provided to users, but it also indicates a level of sensitivity that requires improvements in education and knowledge regarding privacy policies. By improving communication regarding data protection, this platform can identify and address the weaknesses of the trust theory and increase adoption, particularly among communities with low interest and digital literacy. La personalización surgió como un motor clave del compromiso del usuario, con la capacidad de la plataforma para adaptar el contenido a las necesidades individuales, lo que llevó a mejoras significativas en los comportamientos de gestión de la salud. Mientras que Andir reportó tiempos de respuesta más rápidos, los retrasos experimentados en Cibiru y Bojongloa Kaler destacan la necesidad de una mayor optimización del sistema para asegurar que las recomendaciones personalizadas se entreguen puntualmente en todas las regiones. Abordar estos problemas de rendimiento será esencial para mantener altos niveles de compromiso de los usuarios y mejorar los resultados de salud.

In terms of data security, the platform successfully mitigated user concerns, with high satisfaction rates reflecting confidence in the platform's encryption and authentication protocols. Nevertheless, the low levels of understanding of privacy policies suggest that more attention must be given to educating users about data management practices. By enhancing transparency and communication, the platform can build even greater trust among users, encouraging sustained use and higher adoption rates.

4.4 Evaluation

Table 2 presents an evaluation of the effectiveness of digital health platforms based on several key metrics such as user satisfaction, trust in data security, accessibility (including offline functionality), system response time for personalization, and understanding of privacy policies. This metric provides comprehensive insights into how the platform is received by marginalized communities in three sub-districts: Andir, Cibiru, and Bojongloa Kaler. The following analysis details the platform's performance in each metric, offering an in-depth view of its effectiveness in achieving its main objectives.

Table 2. Evaluation of Platform Effectiveness.

Metric	Andir (%)	Cibiru (%)	Bojongloa Kaler (%)	Average (%)
Overall User Satisfaction	82	80	85	82.3
Data Security Confidence	85	80	90	85.0

Metric	Andir (%)	Cibiru (%)	Bojongloa Kaler (%)	Average (%)
Accessibility (including Offline)	78	75	80	77.7
System Response Time (Personalization)	85 (fast)	50 (moderate)	55 (moderate)	-
Understanding of Privacy Policies	55	45	45	48.3

User Satisfaction

The average user satisfaction level in the three sub-districts is recorded as high, at 82.3%. Bojongloa Kaler recorded the highest satisfaction level at 85%, followed by Andir (82%) and Cibiru (80%). The high level of satisfaction indicates that the platform generally succeeds in meeting user expectations, especially in providing personalized and easily accessible healthcare services. Bojongloa Kaler, with the most limited infrastructure, shows the highest level of satisfaction, indicating that features such as offline capability and personalization are highly relevant to users in this area. These results are consistent with previous research showing that personalized digital health services can enhance user engagement and satisfaction, especially in areas with limited access to traditional healthcare services.

Trust in Data Security

Trust in data security also shows very good results, with an average of 85% of users in the three districts reporting a high level of confidence in the protection of their data. Bojongloa Kaler leads again with a trust level of 90%, while Andir and Cibiru recorded 85% and 80%, respectively. This high level of trust reflects the platform's success in implementing strong encryption protocols, such as AES-256 in Andir and AES-128 in Cibiru and Bojongloa Kaler, which provide protection against potential data leaks. High trust in data security is crucial to ensure the sustainable use of the platform, especially in communities that have significant concerns about privacy and the security of personal information. These results are consistent with previous research that shows strong data security is a key factor in the adoption of digital technology, especially in communities that are more skeptical of new technology.

Accessibility (including Offline Functionality)

Accessibility, which includes the platform's ability to function offline, also recorded good results with an average of 77.7%. Bojongloa Kaler again recorded the highest score in accessibility (80%), reflecting the importance of offline features for communities with unstable internet access. On the other hand, Cibiru recorded a slightly lower score (75%), which may indicate a need for further improvement in optimizing offline functionality, especially for users who rely on real-time up-to-date information. This success also supports previous research findings that emphasize the importance of flexible systems that can function in offline mode to improve access to services in underserved areas.

System Response Time for Personalization

One area that requires further attention is the system's response time in delivering personalized content. Andir recorded a fast response time, with 85% of users reporting a satisfactory response time, whereas in Cibiru and Bojongloa Kaler, only 50% and 55% of users reported satisfaction with the personalized response time. This disparity is caused by the limitations of technological infrastructure in Cibiru and Bojongloa Kaler, which hinder the system's ability to provide real-time health recommendations. Slower response times can affect user engagement, as delayed recommendations can reduce the effectiveness of personalized services. Improvements in this aspect will be very important to maintain user engagement and ensure that personalized health information is delivered on time.

Understanding Privacy Policies

Although trust in data security is quite high, users' understanding of privacy policies remains a significant challenge. Only 48.3% of users in the three sub-districts reported a clear understanding of how their data is managed. This shows that while technical security measures are well implemented, there is still an urgent need to enhance user education about privacy policies and how their data is used by the platform. This gap indicates that communication regarding technical security aspects needs to be simplified so that it can be more easily understood by users, especially in communities with low digital literacy levels. Strengthening these educational efforts will help increase transparency and build deeper trust in the platform.

Overall, the evaluation of the effectiveness of this platform shows that it has succeeded in meeting the needs of marginalized communities in Andir, Cibiru, and Bojongloa Kaler, especially in terms of personalized healthcare services and data protection. It seems like your message is empty. Could you please provide the text you'd like me to translate? With improvements in these areas, the platform will be able to provide more effective services and can increase user adoption and trust in the long term. Lastly, only 48.3% of users understand the privacy policy, indicating the need for additional education in the Communication stage to ensure transparency and enhance user trust in data management.

5 Conclusion

This study leveraged the Design Science Research (DSR) methodology to develop and implement a digital health platform that addressed the unique challenges faced by marginalized communities in the sub-districts of Andir, Cibiru, and Bojongloa Kaler. The DSR methodology allowed for iterative improvements, continually incorporating user feedback to ensure the platform remained adaptable to the socio-economic and infrastructural constraints of these regions. The platform effectively tackled key issues such as accessibility, personalization, and data security, which are critical for delivering healthcare services to underserved populations.

The platform achieved significant success in improving user satisfaction, with an average satisfaction rate of 82.3% across all three sub-districts. This high level of satisfaction can be attributed to the platform's ability to personalize health recommendations and provide consistent access to services, even in regions with poor connectivity. As demonstrated in Bojongloa Kaler, where 80% of users benefited from offline capabilities, the platform's design effectively mitigated the digital divide, consistent with findings by Macharia and Nyakwende (2009) on the importance of offline-enabled systems in underserved areas[25]. Furthermore, data security confidence was notably high, averaging 85%, which aligns with Bertino (2016)'s emphasis on the critical role of robust data protection in user adoption[15]. The encryption protocols implemented ensured that users felt secure when accessing sensitive health information, particularly in Bojongloa Kaler, where 90% of users expressed confidence in the platform's security measures.

However, some areas require further optimization. For instance, system response times for personalized content were slower in Cibiru and Bojongloa Kaler, with only 50% and 55% of users, respectively, reporting satisfactory response times. This indicates a need to refine the personalization engine to function more efficiently under constrained technological conditions. Additionally, the understanding of privacy policies was lower than expected, with only 48.3% of users fully comprehending how their data was managed. These results suggest that more effort is needed to improve user education on data privacy, ensuring that the platform remains transparent and trusted.

Future research should focus on expanding the platform's reach to other socio-economic contexts, particularly in remote and rural areas where similar barriers to healthcare exist. This could include regions studied by Citrin et al. and Foko et al., where ICT platforms have been deployed to bridge healthcare access gaps in low-resource settings [45][48]. Enhancing the personalization engine with advanced machine learning algorithms to provide faster, more accurate health recommendations should also be a priority. Moreover, future work should involve the development of more effective user education initiatives, especially regarding privacy policies, which would help to further build trust and ensure that users feel confident in the platform's data security measures. Expanding the platform's scope while continuing to iterate and refine its features will be essential in scaling its impact, ultimately improving health outcomes for underserved populations across diverse geographical settings.

Acknowledgments. This research was funded by LP2M Widyatama University for conferences and publications.

Disclosure of Interests. The authors have no competing interests to declare that are relevant to the content of this article.

References

[1] J. Sin, R. L. Franz, C. Munteanu, and B. B. Neves, "Digital design marginalization: New perspectives on designing inclusive interfaces," in Conference on Human Factors in Computing Systems - Proceedings, 2021. doi: 10.1145/3411764.3445180.

[2] S. Rahayu et al., "Membangun Masyarakat Cerdas Dalam Literasi Digital," Jurnal PkM MIFTEK, vol. 3, no. 1, 2022, doi: 10.33364/miftek/v.3-1.1294.

[3] A. F. R. Harahap and A. M. Harahap, "Peran digitalisasi dalam meningkatkan partisipasi publik pada pengambilan keputusan tata negara," Jurnal EDUCATIO: Jurnal Pendidikan Indonesia, vol. 9, no. 2, 2023, doi: 10.29210/1202323208.

[4] R. Setiawan et al., "Literasi Digital Sebagai Peningkatan Pemahaman Masyarakat Dengan Door To Door dan Seminar," Jurnal PkM MIFTEK, vol. 4, no. 1, 2023, doi: 10.33364/miftek/v.4-1.1321.

[5] D. Napitupulu, D. Indra Sensuse, and Y. Giri Sucahyo, "Sosio-Technical Factors of E-Government Implementation," Proceeding of the Electrical Engineering Computer Science and Informatics, vol. 4, no. 1, 2017, doi: 10.11591/eecsi.v4.1095.

[6] N. Lukman, F. Umar, and Y. A. Gerhana, "Digitalisasi Layanan Minimum Desa Sebagai Upaya Peningkatan Layanan Desa Binaan," Al-Khidmat, vol. 5, no. 1, 2022, doi: 10.15575/jak.v5i1.17431.

[7] A. A. Santosa and A. A. N. Perwira Redi, "Pemilihan Platform Tanda Tangan Digital Berdasarkan Faktor Keberlanjutan Selama Pandemi COVID-19 Menggunakan Metode AHP," Digital Zone: Jurnal Teknologi Informasi dan Komunikasi, vol. 12, no. 2, 2021, doi: 10.31849/digitalzone.v12i2.8014.

[8] E. F. Cruz and A. M. R. Da Cruz, "Design Science Research for IS/IT Projects: Focus on Digital Transformation," in Iberian Conference on Information Systems and Technologies, CISTI, 2020. doi: 10.23919/CISTI49556.2020.9140972.

[9] N. Gazem, A. A. Rahman, F. Saeed, and N. A. Iahad, "Design science research roadmap model for information systems projects: A case study," 2018. doi: 10.4018/IJITPM.2018070101.

[10] G. H. T. Ling, P. C. Leng, N. Rusli, and W. S. Ho, "A DSR methodology for conceptual solution development of public open space governance," Journal of Regional and City Planning, vol. 32, no. 1, 2021, doi: 10.5614/jpwk.2021.32.1.2.

[11] S. Shofia, A. Trisetyarso, B. S. Abbas, and W. Suparta, "E-Participation Platform Model for E-Government Case Study in Karawang City," 2020. doi: 10.2991/assehr.k.200303.085.

[12] A. Sen, Y. Chen, and B. Zhang, "A new architecture for personalization engines: An open source approach," 2008. doi: 10.1080/10919390802199012.

[13] K. Sutarno et al., "Factors influencing user intention in opening personal data on social media," in 2020 5th International Conference on Informatics and Computing, ICIC 2020, 2020. doi: 10.1109/ICIC50835.2020.9288614.

[14] B. Kelana, A. Riskinanto, and M. Nasyiah, "Kepercayaan Generasi Z Dalam Menerima Sistem Informasi Kesehatan Mental di Indonesia," Jurnal SISKOM-KB (Sistem Komputer dan Kecerdasan Buatan), vol. 6, no. 2, 2023, doi: 10.47970/siskom-kb.v6i2.372.

[15] E. Bertino, "Data Security and Privacy: Concepts, Approaches, and Research Directions," in Proceedings - International Computer Software and Applications Conference, 2016. doi: 10.1109/COMPSAC.2016.89.

[16] S. Mardiana, "An integrated framework for measuring information system success considering the impact of culture in Indonesia," in 2014 1st International Conference on Information Technology, Computer, and Electrical Engineering: Green Technology and Its Applications for a Better Future, ICITACEE 2014 - Proceedings, 2015. doi: 10.1109/ICITACEE.2014.7065747.

[17] A. Safitri, I. Syafii, and K. Adi, "Measuring the Performance of Information System Governance using Framework COBIT 2019," Int J Comput Appl, vol. 174, no. 31, 2021, doi: 10.5120/ijca2021921253.

[18] E. P. S. Manalu, A. Muditomo, D. Adriana, Y. Trisnowati, P. Zulfikar Kesuma, and H. Rini Dwiyani, "Role of Information Technology for Successful Responses to Covid-19 Pandemic," in Proceedings of 2020 International Conference on Information Management and Technology, ICIMTech 2020, 2020. doi: 10.1109/ICIMTech50083.2020.9211290.

[19] D. Napitupulu, K. Adiyarta, W. Windihastuty, and T. Fatimah, "Electronic Participation Technology Adoption Model in Indonesia: The Role of Gamification Impact," IOP Conf Ser Mater Sci Eng, vol. 1071, no. 1, 2021, doi: 10.1088/1757-899x/1071/1/012031.

[20] H. Haerana and R. Riskasari, "Literasi Digital dalam Pelayanan Publik," Wikrama Parahita : Jurnal Pengabdian Masyarakat, vol. 6, no. 2, 2022, doi: 10.30656/jpmwp.v6i2.4052.

[21] A. S. L. Da Silva and A. A. Texeira, "Digital governance assessment from the conceptualization of information infrastructures," in ACM International Conference Proceeding Series, 2020. doi: 10.1145/3428502.3428554.

[22] H. Yutanto, R. Ilham, K. R. Salma, and Y. Effendi, "Pengembangan Sistem Informasi Pada Local E-Governvenance Untuk Peningkatan Kinerja Pelayanan Warga," JURNAL SISTEM INFORMASI BISNIS, vol. 9, no. 2, 2019, doi: 10.21456/vol9iss2pp220-227.

[23] I. H. A. Wahab and A. Arief, “An integrative framework of COBIT and TOGAF for designing IT governance in local government,” in ICITACEE 2015 - 2nd International Conference on Information Technology, Computer, and Electrical Engineering: Green Technology Strengthening in Information Technology, Electrical and Computer Engineering Implementation, Proceedings, 2016. doi: 10.1109/ICITACEE.2015.7437766.

[24] N. Anwar and M. N. Masrek, “IT infrastructure flexibility as determinant of strategic utilization of information systems: A conceptual framework,” in International Conference on Information Society, i-Society 2014, 2015. doi: 10.1109/i-Society.2014.7009002.

[25] J. Macharia and E. Nyakwende, “Factors affecting the adoption and diffusion of Internet in higher educational institutions in Kenya,” Journal of Language, Technology & Entrepreneurship in Africa, vol. 1, no. 2, 2009, doi: 10.4314/jolte.v1i2.41754.

[26] N. Q. Anayan and V. L. Penuela, “Propose System Architecture Technology Hub for the New Normal in Sibuyan Island, Romblon (PSATH),” International Journal of Future Computer and Communication, pp. 53–58, Dec. 2021, doi: 10.18178/ijfcc.2021.10.4.579.

[27] R. A. Robinson and I. Tarmawan, “Architecture and Design in the Digital Age,” in IOP Conference Series: Materials Science and Engineering, 2020. doi: 10.1088/1757-899X/879/1/012150.

[28] G. C. Misuraca, “E-Governance in Africa, from theory to action: A practical-oriented research and case studies on ICTs for local governance,” in ACM International Conference Proceeding Series, 2006. doi: 10.1145/1146598.1146659.

[29] M. Laura Ramírez Galleguillos and A. Cokun, “How do i matter? a review of the participatory design practice with less privileged participants,” in ACM International Conference Proceeding Series, 2020. doi: 10.1145/3385010.3385018.

[30] S. Sannon and A. Forte, “Privacy Research with Marginalized Groups: What We Know, What’s Needed, and What’s Next,” Proc ACM Hum Comput Interact, vol. 6, no. CSCW2, 2022, doi: 10.1145/3555556.

[31] C. Anderson-Lewis, G. Darville, R. E. Mercado, S. Howell, and S. Di Maggio, “mHealth technology use and implications in historically underserved and minority populations in the united states: Systematic literature review,” 2018. doi: 10.2196/mhealth.8383.

[32] J. Rumanyika, M. Apiola, N. R. Mramba, S. S. Oyelere, and M. Tedre, “Mobile technology for street trading in Tanzania: A design science research approach for determining user requirements,” Electronic Journal of Information Systems in Developing Countries, vol. 87, no. 5, 2021, doi: 10.1002/isd2.12176.

[33] C. Suero Montero and A. F. Kapinga, “Design science research strengthened: integrating co-creation and co-design,” in IFIP Advances in Information and Communication Technology, 2019. doi: 10.1007/978-3-030-18400-1_40.

[34] “The Role of ICT in Social Inclusion: A Review of Literature,” International Journal of Science and Research (IJSR), vol. 4, no. 12, 2015, doi: 10.21275/v4i12.nov151897.

[35] S. Park, J. Freeman, and C. Middleton, “Intersections between connectivity and digital inclusion in rural communities,” Communication Research and Practice, vol. 5, no. 2, 2019, doi: 10.1080/22041451.2019.1601493.

[36] K. M. Thompson and A. Paul, “Factors of digital inclusion among women: Revisiting India and extending to Chile and Australia for additional analysis,” Library Quarterly, vol. 90, no. 2, 2020, doi: 10.1086/707673.

[37] F. E. A. Horita, F. G. Rocha, L. S. Souza, and G. R. Gonzales, “Design science in digital innovation: A literature review,” in ACM International Conference Proceeding Series, 2020. doi: 10.1145/3411564.3411638.

[38] C. P. M. Sianipar, G. Yudoko, K. Dowaki, and A. Adhiutama, “Design methodology for appropriate technology: Engineering as if people mattered,” Sustainability (Switzerland), vol. 5, no. 8, 2013, doi: 10.3390/su5083382.

[39] Q. Deng and S. Ji, "A Review of Design Science Research in Information Systems: Concept, Process, Outcome, and Evaluation," Pacific Asia Journal of the Association for Information Systems, pp. 1–36, 2018, doi: 10.17705/1pais.10101.

[40] A. R. Hevner, S. T. March, J. Park, and S. Ram, "Design science in information systems research," MIS Q, vol. 28, no. 1, 2004, doi: 10.2307/25148625.

[41] A. Maedche, S. Gregor, S. Morana, and J. Feine, "Conceptualization of the Problem Space in Design Science Research," in Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 2019. doi: 10.1007/978-3-030-19504-5_2.

[42] C. Stiles-Shields, G. Ramos, A. Ortega, and A. M. Psihogios, "Increasing digital mental health reach and uptake via youth partnerships," npj Mental Health Research, vol. 2, no. 1, 2023, doi: 10.1038/s44184-023-00030-1.

[43] C. J. Sieck, A. Sheon, J. S. Ancker, J. Castek, B. Callahan, and A. Siefer, "Digital inclusion as a social determinant of health," 2021. doi: 10.1038/s41746-021-00413-8.

[44] S. K. Da Silva Ferreira and I. G. Sene Junior, "Digital inclusion analysis for Brazil's unified health system," J Health Inform, vol. 15, no. 1, 2023, doi: 10.59681/2175-4411.v15.i1.2023.967.

[45] D. Citrin et al., "Developing and deploying a community healthcare worker-driven, digitally- enabled integrated care system for municipalities in rural Nepal," Healthcare, vol. 6, no. 3, 2018, doi: 10.1016/j.hjdsi.2018.05.002.

[46] M. Z. Alam, W. Hu, and A. Uddin, "Digital Transformation In Healthcare Sector of Bangladesh: Current Status, Challenges anda Future Direction," Journal on Innovation and Sustainability RISUS, vol. 11, no. 1, 2020, doi: 10.23925/2179-3565.2020v11i1p30-38.

[47] H. L. Gasparetto, F. T. Pedroso, and R. S. de Oliveira, "Fake news, hate speech, and digital activism: social movements of demonetization, legal challenges, and reflections on the sleeping giants Brazil case," Revista Brasileira de Politicas Publicas, vol. 12, no. 3, 2022, doi: 10.5102/RBPP.V12I3.7960.

[48] T. Foko, T. Thulare, L. Legare, and K. Maremi, "Information and communication technology platforms deployment: Technology access reaches South African rural areas," in 2017 IST-Africa Week Conference, IST-Africa 2017, 2017. doi: 10.23919/ISTAFRICA.2017.8102300.

[49] K. Thilagam et al., "Secure IoT Healthcare Architecture with Deep Learning-Based Access Control System," J Nanomater, vol. 2022, 2022, doi: 10.1155/2022/2638613.