



## Analysis of Generative AI Chatbot in Improving Public Services: A Case Study on Program Indonesia Pintar (PIP) for Primary and Secondary Education

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### ABSTRACT

The Smart Indonesia Program (PIP), as a supporter of educational access, faces challenges in disseminating information that still relies on conventional methods such as email and telephone, thus requiring the implementation of Generative AI-based chatbot technology as a potential solution to improve the effectiveness of communication and public service delivery. This study aims to analyze the influence of the readiness, design, and implementation of Generative AI chatbots on the effectiveness of information delivery to PIP service users. This study uses a descriptive quantitative approach by distributing questionnaires to 407 respondents. The instrument was tested for validity and reliability. Regression testing and t-tests were conducted to assess the influence between variables. The results show that the design variable ( $X_2$ ) has a strong effect on service effectiveness, with a t-value of 14.757 (significance level of 0.000). The regression coefficient of 0.683 indicates that each unit increase in chatbot design quality contributes significantly to an increase in perceived service effectiveness. The implementation variable ( $X_3$ ) also has a significant effect with a t-value of 7.489 and a regression coefficient of 0.217. The design and implementation variables influence service effectiveness with a model contribution of 77.8%. However, the readiness variable ( $X_1$ ) did not show a significant effect ( $p = 0.077$ ). The R-squared value of 0.778 indicates that 77.8% of the variation in public service effectiveness can be explained by readiness, design, and implementation variables. The remaining 22.2% is influenced by other factors, such as external policies, user digital literacy, or organizational issues. These findings provide a strong foundation for further development of AI technology in the digital transformation of public services, particularly in the education sector.

**Keywords:** Chatbot, Generative AI, Public Service, Program Indonesia Pintar

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### INTRODUCTION

Digital transformation has driven significant changes in the delivery of public services. Today's society demands fast, accurate, and responsive access to information to address increasingly complex needs. In this context, Generative AI-based chatbot technology emerges as a promising innovation to enhance communication effectiveness between the government and the public (Abdenebaoui dkk., 2025; Branda dkk., 2025; Damar dkk., 2024). With its ability to understand natural language and generate contextual responses, this type of chatbot offers a solution to various limitations of manual service systems that are still widely used (Chopra, D dkk., 2013). One public service facing communication challenges is the Program Indonesia Pintar (PIP), a strategic government initiative aimed at supporting educational access for students from underprivileged families (Diyoga dkk., 2026; Ninghardjanti dkk., 2023). Despite

its wide national coverage, the dissemination of information related to PIP still relies on conventional channels such as email, social media, and telephone. These methods not only place a burden on limited human resources but also lead to delayed responses to public inquiries and complaints (Berry dkk., 2024). The gap between the public's high demand for information and the limited responsiveness of current systems highlights the urgent need for technological innovation in service delivery (Fadilah, S & Ramdani, I, 2019).

As artificial intelligence technology advances, the use of chatbots in public services has evolved significantly, particularly with the emergence of Large Language Models (LLMs) such as GPT, which enable greater flexibility and contextual understanding in conversations (Annepaka & Pakray, 2025; Goodfellow, I dkk., 2016; Hao Qin & Zhi Li, 2024). The application of Generative AI chatbots has expanded beyond administrative services and is increasingly adopted in the education and government sectors (Akpan dkk., 2025; Androniceanu, A, 2024; Chen, T. dkk., 2024). A recent study by Haroud and Saqri (2025), found that both educators and students recognize the benefits of Generative AI chatbots in supporting academic tasks, especially in simplifying access to information and accelerating response time. However, they also emphasized the importance of digital literacy to ensure the technology is used effectively. Similarly, McGrath dkk. (2025) conducted a systematic review showing that chatbot integration in higher education improves communication efficiency and provides personalized information services for users. Moreover, through a meta-analysis, concluded that the adoption of AI chatbots in public services consistently contributes to improved operational efficiency, faster response times, and increased user satisfaction—provided that the implementation follows a user-centered approach and is supported by institutional readiness (Ma'rup dkk., 2024). Despite this potential, chatbot implementation in Indonesia has largely been dominated by rule-based systems with static and limited response patterns. In contrast, current technology allows for the development of more intelligent chatbots through the application of Natural Language Processing (NLP) and architectures such as Transformer and Recurrent Neural Network (RNN), enabling systems to learn from data and generate human-like interactions (Rahmawati & Sudrajat, 2025).

Prior studies in Indonesia have demonstrated chatbot effectiveness, such as (Chandra & Suyanto, 2019) in a university admissions system, and (Sugiono, 2021) who utilized chatbots to disseminate information during the COVID-19 pandemic as part of Society 5.0 implementation (Kartika, E & Sembiring, J, 2019). Furthermore, research by Ma'rup dkk. (2024) examined chatbots as a significant application in improving response times and government services through a meta-analysis. In a specific study, Vallejo Blanxart and Nicolas Sans (2025) highlighted the use of Generative AI, which offers adaptive interactions rather than rule-based models. However, the majority of the literature still focuses on general technical aspects of performance without integrating important aspects such as organizational readiness and specific design, which are more extensive and sensitive.

This study fills this gap by offering a comprehensive approach that analyzes the simultaneous influence of readiness, design, and implementation strategy for Generative AI-based chatbots on the effectiveness of public services, particularly in the context of national education policies such as the Smart Indonesia Program. Unlike previous research, which is general in nature, this study examines the structural design process of generative AI-based chatbots in mitigating bureaucratic bottlenecks in the distribution of educational assistance. The main novelty of this research lies in the use of an evaluation model that links the readiness of the government's digital infrastructure with the quality of generative AI responses as an affirmative policy. This research not only contributes theoretically to the e-government literature but also serves as a practical guide for policymakers optimizing generative AI to improve the inclusiveness and accuracy of public services in developing countries. Therefore, this study aims to address this gap by examining how these three variables contribute to the successful delivery of digital and adaptive information to PIP service users.

This study focuses on analyzing the implementation of Generative AI-based chatbots to improve the quality of public services in the context of the Program Indonesia Pintar (PIP) for primary and secondary education levels. In the domain of public information services,

especially in the education sector, a system is required that can respond quickly, accurately, and contextually to accommodate the high volume of public inquiries.

Specifically, this research aims to examine the influence of three main variables – readiness, design, and implementation of Generative AI chatbots – on the effectiveness of public information services within the Program Indonesia Pintar (PIP). This three-variable model refers to prior studies that have shown the significant impact of chatbot design and implementation on the success of digital public services (Plonsey & Barr, 2007). Furthermore, this study seeks to identify the extent to which Generative AI chatbots can overcome the limitations of conventional service systems and enhance public satisfaction, particularly in terms of information access, ease of use, and relevance of responses generated by the system.

The outcomes of this research are expected to provide academic contributions in the form of mapping the relationships among variables within the research model, as well as practical insights to support the development of more adaptive and responsive public service technologies, especially in the field of education.

## METHOD

This study employs a quantitative approach aimed at analyzing the extent to which the implementation of Generative AI-based chatbots can improve the effectiveness of public services within the Program Indonesia Pintar (PIP) at the primary and secondary education levels. This approach was chosen because it enables the collection of objective and measurable data, and allows the researcher to examine relationships between variables through statistical analysis (Plonsey & Barr, 2007).

The conceptual framework of this study consists of three independent variables: Readiness ( $X_1$ ), Design ( $X_2$ ), and Implementation ( $X_3$ ), which are assumed to influence the dependent variable, namely Effectiveness of Public Services (Y). Each variable was constructed based on several indicators, which were then developed into questionnaire items. The relationship between these variables is illustrated in the research model below:

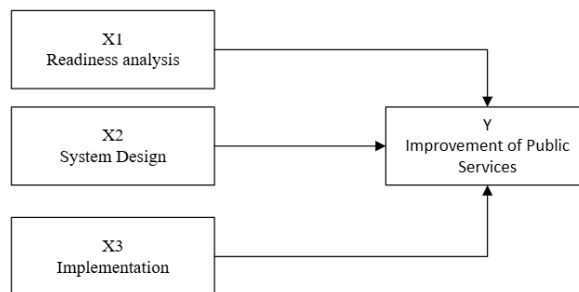


Figure 1. Research Model

The population of this study comprises users of the Program Indonesia Pintar (PIP) public information service, totaling 221,162 active user accounts. The sample was selected using a simple random sampling technique, which ensures that every member of the population has an equal chance of being selected. The sample size was determined using the Taro Yamane formula with a margin of error of 10%, resulting in a final sample of 400 respondents. Data were collected using a closed-ended questionnaire based on a five-point Likert scale, consisting of 24 items derived from the indicators of the four research variables. These indicators are presented in the following table:

Table 1. Variables and Question Items

Variabel	Question Items
(X1) Readiness	<ol style="list-style-type: none"> <li>1. Users have the technological infrastructure to support chatbot usage.</li> <li>2. Users already have stable and adequate internet access.</li> <li>3. There is institutional support for adopting chatbot technology in PIP services.</li> <li>4. Human resources possess basic competencies in utilizing information technology.</li> <li>5. Users are willing to learn how to use the chatbot.</li> </ol>

(X2) Design	6. Regulations and policies support the use of chatbot technology in public services.
	7. The chatbot conversation flow is designed to be easily understood by users.
	8. The chatbot's language and interface are designed with consideration of user characteristics.
	9. The chatbot is integrated with the PIP system, including student data validation.
	10. The chatbot can automatically display beneficiary status data.
(X3) Implementation	11. The chatbot system includes data security and user privacy features.
	12. The technical design of the chatbot allows for future feature development.
	13. The chatbot has been trialed on a limited scale in school environments.
	14. An evaluation has been conducted to identify the chatbot's strengths and weaknesses.
	15. AI model training has been conducted using data related to PIP.
(Y) Effectiveness of Public Services	16. Users have received training or guidance in using the chatbot.
	17. Information about the chatbot and how to use it has been disseminated to users.
	18. The results of the chatbot implementation are documented for policy evaluation purposes.
	19. The chatbot helps accelerate the process of retrieving information related to PIP.
	20. The chatbot is able to respond to user inquiries directly and accurately.
	21. Using the chatbot reduces the workload of administrators/operators.
	22. The chatbot makes PIP services more accessible anytime and anywhere.
	23. The chatbot enhances user satisfaction in accessing PIP service information.
	24. The chatbot contributes to improving public services in the education sector

Before conducting the main analysis, the questionnaire items were tested through validity and reliability procedures to ensure that the instrument accurately measures the intended constructs and yields consistent results. Validity testing was performed using the Pearson Product Moment correlation, which measures the correlation between each item score and the total score within its respective variable. An item is considered valid if the significance value (p-value) is less than 0.05. Meanwhile, reliability testing used the Cronbach's Alpha method (Bonett & Wright, 2015; Jarupunphol dkk., 2025), with a threshold of 0.70 to indicate good internal consistency among items within the same variable.

Once the instrument was confirmed to be valid and reliable, the collected data were analyzed using multiple linear regression to examine both the simultaneous and partial effects of the independent variables on the dependent variable. To assess the individual contribution of each independent variable, a t-test (partial test) was conducted. Additionally, the coefficient of determination ( $R^2$ ) was used to determine the proportion of variance in the dependent variable that can be explained by the three independent variables collectively (Saunders dkk., 2012). All statistical analyses were conducted using the SPSS software, which supports accurate and comprehensive regression analysis and hypothesis testing.

Through this methodological approach, the study aims to provide a comprehensive empirical overview of how the readiness, design, and implementation of Generative AI-based chatbots can contribute to enhancing the quality of public information services in the education sector, particularly within the context of the Program Indonesia Pintar (PIP).

## RESULT AND DISCUSSION

This study aimed to examine the influence of the variables of readiness, design, and implementation of Generative AI-based chatbots on the effectiveness of public services within the Program Indonesia Pintar (PIP). The analysis was conducted based on quantitative data obtained from 407 respondents and processed through multiple linear regression testing. This section presents the results of instrument validity and reliability tests, t-tests (partial significance), and the coefficient of determination to evaluate the model's contribution.

### Instrument Validity and Reliability

Before conducting regression analysis, instrument validation and reliability testing were carried out to ensure that the questionnaire accurately measured the intended constructs. The results of the validity test, using Pearson Product Moment, showed that all questionnaire items under the variables  $X_1$  (Readiness),  $X_2$  (Design),  $X_3$  (Implementation), and  $Y$  (Effectiveness of Public Services) had correlation values higher than the critical  $r$ -value at the 5% significance level. Therefore, all items were declared valid.

Table 2. Instrument Validity Test Results

Variable	Items	Description
Chatbot Readiness ( $X_1$ )	6 item	Valid
Chatbot Design ( $X_2$ )	6 item	Valid
Chatbot Implementation ( $X_3$ )	6 item	Valid
Public Services ( $Y$ )	6 item	Valid

In parallel, the reliability test revealed a Cronbach's Alpha value of 0.975, indicating a very high level of internal consistency. This confirms that the instrument is both trustworthy and consistent in measuring respondents' perceptions regarding the use of chatbots in PIP services

Table 3. Reliability Test Results

Variabel	Cronbach's Alpha	Description
$X_1, X_2, X_3, Y$	0,975	Reliabel

#### t-Test Results: Partial Influence of Independent Variables

The t-test was employed to evaluate the individual influence of each independent variable on the dependent variable. The results are presented in the following table:

Table 4. t-Test Results

Variabel	t-value	Significance	Description
$X_1$ (Chatbot Readiness)	1.771	0.077	Not Significant
$X_2$ (Chatbot Design)	14.757	0.000	Significant
$X_3$ (Chatbot Implementation)	7.489	0,000	Significant

The results show that the design variable ( $X_2$ ) has the strongest influence on service effectiveness, with a t-value of 14.757 and a significance level of 0.000. The regression coefficient of 0.683 indicates that every unit increase in chatbot design quality—covering conversational flow, user interface, system integration, security, and scalability—contributes significantly to improving the perceived effectiveness of the service. Similarly, the implementation variable ( $X_3$ ) also shows a statistically significant effect, with a t-value of 7.489 and a regression coefficient of 0.217. This demonstrates that successful implementation—through pilot testing, user training, socialization, and documentation—plays a critical role in realizing an effective chatbot-based public service. Conversely, the readiness variable ( $X_1$ ), which includes infrastructure, human resource capacity, and policy support, does not show a significant effect ( $p = 0.077$ ). This finding implies that initial readiness, while important, is insufficient to improve service effectiveness without being followed by well-structured design and execution strategies.

#### Coefficient of Determination ( $R^2$ )

To assess the extent to which the three independent variables collectively explain variations in service effectiveness, the coefficient of determination was used. The analysis produced an R Square value of 0.778, indicating that 77.8% of the variation in the effectiveness

of public services can be explained by the variables of readiness, design, and implementation. The remaining 22.2% is influenced by factors outside the research model, such as external policies, users' digital literacy, or organizational issues

Additionally, the Adjusted R Square of 0.776 further confirms the stability of the model, even after accounting for the number of predictors. The Standard Error of the Estimate (2.244) also shows an acceptable prediction error, reinforcing the model's adequacy in explaining the dependent variable.

Table 5 Determination Test Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,882	0.778	0.776	2.244

### Synthesis of Empirical Findings

Overall, the findings confirm that the success of Generative AI-based chatbot implementation in public services is not determined solely by readiness, but is primarily influenced by the quality of chatbot design and implementation strategies. A well-designed chatbot—featuring responsive dialogue, intuitive user experience, relevant data integration, and secure architecture—significantly enhances the quality-of-service delivery. Moreover, its implementation, when supported by adequate testing, user education, and communication, strengthens user trust and satisfaction. Conversely, institutional and technological readiness without being followed by optimal design and implementation will not have a significant impact on service effectiveness. This finding reinforces the urgency of developing chatbots not only from a technological standpoint, but also from the perspective of user experience, as well as the supporting digital ecosystem and accompanying policy framework.

## DISCUSSION

This study contributes to a deeper understanding of how Generative AI-based chatbots can enhance the effectiveness of public services, particularly in the context of the Program Indonesia Pintar (PIP). Based on the results of multiple linear regression analysis, two of the three independent variables—design and implementation—were found to have a statistically significant influence on service effectiveness, while the readiness variable did not show a meaningful effect. These findings reinforce the argument that the success of AI-based systems in the public sector is not merely determined by infrastructure availability or institutional support, but strongly relies on the quality of system design and implementation strategy.

Among the variables, chatbot design emerged as the most dominant factor, with the highest regression coefficient (0.683) and a significance level of 0.000. This result affirms that system design is not just a technical consideration, but a critical foundation in shaping effective interactions between users and public service platforms. When a chatbot is developed with clear conversational flow, user-friendly language, intuitive interface, and solid system integration, the overall user satisfaction and trust in the system significantly improve. In this regard, the user-centered design (UCD) approach becomes highly relevant. UCD emphasizes that digital systems, including chatbots, should be developed based on a deep understanding of users' needs, preferences, and capabilities in order to create more effective and meaningful interactions (Haroud & Saqri, 2025; Virvou, 2023; Zhou dkk., 2026). Further state that chatbots designed with UCD principles are more likely to be adopted and deliver real value in government service contexts (Kartika, E & Sembiring, J, 2019; Moylan & Doherty, 2025; Senadheera dkk., 2025). A well-designed chatbot also ensures that it can deliver timely and contextual responses, provide automated access to PIP recipient information, and adapt to the characteristics of different user groups. These findings are in line with Gunawan and Putri (2021), who emphasize that successful digital services are often those that align system design with user expectations.

In addition to design, implementation plays a key role in determining system success. In this study, the implementation variable had a regression coefficient of 0.217 and a significance value of 0.000, indicating that service effectiveness increases when chatbot deployment follows

a structured process, including pilot testing, user training, and broad public socialization. The human-centered implementation approach supports this view by arguing that technology adoption success is not solely determined by its features, but also by the extent to which users are involved and adequately equipped to use the system (Ma'rup dkk., 2024; Van Velsen dkk., 2022). In the context of public services, training and outreach serve not only as technical education, but also as mechanisms to build public trust in new systems. This is echoed by Chaves and Gerosa (2019), who found that chatbots implemented through participatory approaches tend to be better received and are more effective in delivering services. Gunawan, A and Putri, L (2021), also observed that proper training and communication enhance user perceptions of ease of use and system usefulness.

In contrast to the other two variables, readiness—which includes technological infrastructure, human resource capacity, and regulatory support—did not show a significant influence on service effectiveness, with a p-value of 0.077. This suggests that although readiness is an important prerequisite for digital transformation, it is not sufficient on its own to ensure success unless it is complemented by effective system design and strategic implementation. These findings are consistent with Di Giulio and Vecchi (2023), who argues that many public digitalization programs fail not due to a lack of readiness, but because of weak design and implementation strategies. In other words, while readiness provides the foundation, its impact is conditional on how it is translated into user-centric systems and processes. The regression model developed in this study produced an  $R^2$  value of 0.778, indicating that 77.8% of the variation in service effectiveness can be explained by the three independent variables studied. This is a relatively high figure for social and technology studies and suggests that well-designed and properly implemented systems account for a large portion of chatbot success in public service. These findings support Ferrucci dkk. (2010) argument in the Watson AI project, which emphasized that the effectiveness of AI systems depends more on cognitive design and real-world execution than on technical sophistication alone.

Theoretically, this study enriches the literature on AI adoption in public service by highlighting the importance of user-centered design and implementation strategies as key determinants of service effectiveness. A chatbot must not only be technically functional but also strategically developed and deployed to meet users' real needs and behavioral contexts. Practically, the findings suggest that public service institutions such as Puslapdik should place greater emphasis on optimizing chatbot design, developing ongoing training programs, and implementing inclusive outreach strategies. Rather than relying solely on infrastructure readiness, the success of digital public services depends on a holistic approach that integrates technology, process, and people into a coherent, user-driven system.

This research makes a significant contribution to the development of digital transformation studies in public services, particularly on the use of generative AI chatbots in government social assistance-based education services. The research's novelty lies in its empirical analysis of the effectiveness of generative AI-based chatbots in the context of the Smart Indonesia Program (PIP) services, a topic that has been relatively limited in the Indonesian public service literature. Most previous research focuses on the use of chatbots in the business sector, commercial customer service, or public administration in general, while studies specifically investigating the determinants of generative chatbot success in government education assistance services are rare. This research expands on these studies by examining the influence of design, implementation, and readiness on the effectiveness of AI chatbot-based public services in the context of primary and secondary education services.

Furthermore, this research provides a new perspective that the successful implementation of generative AI chatbots in public services is not solely determined by the readiness of technological infrastructure or institutional support, but rather by the quality of system design and user-oriented implementation strategies. The finding that design variables are the most dominant factor demonstrates the importance of a user-centered design approach in the development of government digital services. This strengthens the argument that successful public sector digital transformation requires the integration of technological innovation and user experience, not just organizational technical readiness. Thus, this research

contributes to the development of knowledge regarding the strategic factors influencing the effectiveness of artificial intelligence-based digital public services.

Practically, the results of this study can serve as a reference for managers of the Smart Indonesia Program (PIP) and other government institutions in designing chatbot services that are more effective, adaptive, and responsive to public needs. The research findings indicate that chatbot development requires prioritizing conversational flow quality, user interface ease, service data integration, and a systematic implementation strategy through outreach, user training, and ongoing evaluation. Therefore, the use of generative AI chatbots has the potential to improve information accessibility, accelerate service response, reduce administrative burdens, and increase public satisfaction with public education services.

Academically, this research enriches the literature on the adoption of artificial intelligence in public services, particularly in the context of developing countries and the education sector. It also strengthens the theoretical study of public digital transformation by demonstrating that the effectiveness of AI-based services is influenced by a combination of technological and socio-organizational aspects. From a policy perspective, the research findings can be used by the government to develop a digitalization strategy for public services that is more focused on user experience and the sustainability of AI technology implementation in the education sector.

This research has limitations, as it was conducted within the context of the Smart Indonesia Program (PIP) program. Therefore, generalization of the results to other public service sectors requires caution. Therefore, further research is recommended to expand the study to other public service sectors, such as healthcare, population administration, or digital social assistance. Future research could also examine other variables, such as the public's digital literacy level, user trust in AI, data security, and the quality of human-computer interaction, to gain a more comprehensive understanding of the implementation of generative AI chatbots in public services.

## CONCLUSION

This study aimed to examine the influence of Generative AI-based chatbot implementation on improving the effectiveness of public services, with a case study focused on the Program Indonesia Pintar (PIP) in primary and secondary education. In the increasingly digitized landscape of public services, systems that are capable of delivering information quickly, accurately, and in an accessible manner have become essential. Chatbots, as a form of artificial intelligence application, are regarded as a potential solution to overcome the limitations of conventional communication methods that still rely heavily on manual channels such as email and phone calls. By involving 400 respondents who are users of PIP information services and employing multiple linear regression analysis, this research provides empirical insight into how the variables of readiness, design, and implementation contribute to the effectiveness of chatbots as instruments of digital public service delivery.

The results reveal that, collectively, the three independent variables explain 77.8% of the variation in public service effectiveness, with design and implementation showing statistically significant individual effects. Design emerged as the most dominant factor, indicating that the quality of the system's architecture—including conversational flow, user interface, and integration with the PIP information system—is critical in ensuring that the chatbot meets user needs. A user-oriented design allows for more intuitive and efficient interaction, while also enhancing public perception of the system's ease of use and reliability. Meanwhile, a systematic implementation process—comprising pilot testing, user training, outreach, and evaluative documentation—also contributes significantly to the acceptance and success of chatbot use among the public. This highlights that system success is determined not only by the technology itself, but by adaptive and inclusive execution strategies. Conversely, the readiness variable, which includes technological infrastructure, human resource capacity, and institutional or regulatory support, did not show a significant effect on service effectiveness within the context of this study. This finding implies that while readiness forms an important foundation for information technology development, it does not automatically lead to service success unless

accompanied by relevant system design and a well-structured implementation process. Readiness, therefore, should be seen as a supporting prerequisite rather than a primary determinant of digital service quality.

Overall, this research concludes that Generative AI-based chatbot implementation holds strong potential in supporting the digital transformation of public services, particularly in providing more effective and efficient information access for beneficiaries of the Program Indonesia Pintar. The practical implications of these findings point to the need for technology development strategies – by institutions such as Puslapdik – to go beyond system readiness and place serious emphasis on service design quality and comprehensive implementation strategies. A user-centered approach, supported by continuous training and effective communication, can accelerate technology adoption and strengthen public trust in AI-driven services. Through such an approach, chatbots become not merely technical tools, but a reflection of the government's commitment to delivering modern, inclusive, and citizen-responsive public services.

## REFERENCES

- Abdenebaoui, L., Aljuneidi, S., Horstmannshoff, F., Meyer, J., & Boll, S. (2025). Value-Driven Design for Public Administration: Insights from a Generative Chatbot in a Housing Application Case Study. *Proceedings of the 2025 ACM Conference on Fairness, Accountability, and Transparency*, 1554–1564. <https://doi.org/10.1145/3715275.3732103>
- Akpan, I. J., Kobara, Y. M., Owolabi, J., Akpan, A. A., & Offodile, O. F. (2025). Conversational and generative artificial intelligence and human–chatbot interaction in education and research. *International Transactions in Operational Research*, 32(3), 1251–1281. <https://doi.org/10.1111/itor.13522>
- Androniceanu, A. (2024). Generative artificial intelligence, present and perspectives in public administration.«(RAMP). Dalam *Revista» Administratie si Management Public* (43 ed.).
- Annepaka, Y., & Pakray, P. (2025). Large language models: A survey of their development, capabilities, and applications. *Knowledge and Information Systems*, 67(3), 2967–3022. <https://doi.org/10.1007/s10115-024-02310-4>
- Berry, S., Trochmann, M. B., & Millesen, J. L. (2024). Putting the Humanity Back Into Public Human Resources Management: A Narrative Inquiry Analysis of Public Service in the Time of COVID-19. *Review of Public Personnel Administration*, 44(1), 8–31. <https://doi.org/10.1177/0734371X211069656>
- Bonett, D. G., & Wright, T. A. (2015). Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior*, 36(1), 3–15. <https://doi.org/10.1002/job.1960>
- Branda, F., Stella, M., Ceccarelli, C., Cabitza, F., Ceccarelli, G., Maruotti, A., Ciccozzi, M., & Scarpa, F. (2025). The Role of AI-Based Chatbots in Public Health Emergencies: A Narrative Review. *Future Internet*, 17(4), 145. <https://doi.org/10.3390/fi17040145>
- Chandra, Y. W., & Suyanto, S. (2019). Indonesian Chatbot of University Admission Using a Question Answering System Based on Sequence-to-Sequence Model. *Procedia Computer Science*, 157, 367–374. <https://doi.org/10.1016/j.procs.2019.08.179>
- Chaves, A. P., & Gerosa, M. A. (2019). *How should my chatbot interact? A survey on human-chatbot interaction design*. <https://doi.org/10.48550/ARXIV.1904.02743>
- Chen, T., ascó-Hernandez, M., & Esteve, M. (2024). *The adoption and implementation of artificial intelligence chatbots in public organizations: Evidence from US state governments*. *The American Review of Public Administration*. 54(3). <https://doi.org/10.1177/027507402312005>
- Chopra, D, Prashar, A, & ain, M. (2013). *Natural Language Processing* (Bag. 42–45). 82(7).
- Damar, M., Özen, A., Çakmak, Ü. E., Özoğuz, E., & Erenay, F. S. (2024). Super AI, Generative AI, Narrow AI and Chatbots: An Assessment of Artificial Intelligence Technologies for The Public Sector and Public Administration. *Journal of AI*, 8(1), 83–106. <https://doi.org/10.61969/jai.1512906>
- Di Giulio, M., & Vecchi, G. (2023). Implementing digitalization in the public sector. Technologies, agency, and governance. *Public Policy and Administration*, 38(2), 133–158. <https://doi.org/10.1177/09520767211023283>

- Diyoga, I. K., Setyowati, E., Khannanah, S. F., Juniati, L., & Syukron, A. (2026). Evaluation of the Effectiveness of the Smart Indonesia Program in Supporting the Sustainability of Education for Underprivileged Junior High School Students in Malang City. *International Journal of Research in Social Science and Humanities*, 07(01), 447–453. <https://doi.org/10.47505/IJRSS.2026.1.40>
- Fadilah, S., & Ramdani, I. (2019). *Implementasi Kecerdasan Buatan pada Layanan Publik: Studi Kasus di Sektor Pendidikan* (Bag. 210-220). 10(3).
- Ferrucci, D., Brown, E., Chu-Carroll, J., Fan, J., Gondek, D., Kalyanpur, A. A., Lally, A., Murdock, J. W., Nyberg, E., Prager, J., Schlaefel, N., & Welty, C. (2010). Building Watson: An Overview of the DeepQA Project. *AI Magazine*, 31(3), 59–79. <https://doi.org/10.1609/aimag.v31i3.2303>
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. MIT Press.
- Gunawan, A., & Putri, L. (2021). *Penggunaan Teknologi Chatbot untuk Meningkatkan Efisiensi Layanan Publik* (Bag. 233-242). 15(4).
- Hao Qin, & Zhi Li. (2024). *A Study on Enhancing Government Efficiency and Public Trust: The Transformative Role of Artificial Intelligence and Large Language Models*. <https://doi.org/10.5281/ZENODO.12619360>
- Haroud, S., & Saqri, N. (2025). Generative AI in Higher Education: Teachers' and Students' Perspectives on Support, Replacement, and Digital Literacy. *Education Sciences*, 15(4), 396. <https://doi.org/10.3390/educsci15040396>
- Jarupunphol, P., Ikonnikov, O., Roncevic, I., Kapustina, S., Kataeva, A., Parfjonovs, M., & Tsarev, R. (2025). Applying Cronbach's Alpha to Ensure Reliable Online Testing in E-Learning Environments. Dalam R. Silhavy & P. Silhavy (Ed.), *Artificial Intelligence and System Engineering* (Vol. 1490, hlm. 120–139). Springer Nature Switzerland. [https://doi.org/10.1007/978-3-031-96759-7\\_8](https://doi.org/10.1007/978-3-031-96759-7_8)
- Kartika, E., & Sembiring, J. (2019). *Studi Implementasi Chatbot dalam Meningkatkan Layanan Pemerintah*. 8(1), 65–75.
- Ma'rup, M., Tobirin, & Ali Rokhman. (2024). Utilization of Artificial Intelligence (AI) Chatbots in Improving Public Services: A Meta-Analysis Study. *Open Access Indonesia Journal of Social Sciences*, 7(4), 1610–1618. <https://doi.org/10.37275/oaajss.v7i4.255>
- McGrath, C., Farazouli, A., & Cerratto-Pargman, T. (2025). Generative AI chatbots in higher education: A review of an emerging research area. *Higher Education*, 89(6), 1533–1549. <https://doi.org/10.1007/s10734-024-01288-w>
- Moylan, K., & Doherty, K. (2025). Expert and Interdisciplinary Analysis of AI-Driven Chatbots for Mental Health Support: Mixed Methods Study. *Journal of Medical Internet Research*, 27, e67114. <https://doi.org/10.2196/67114>
- Ninghardjanti, P., Murtini, W., Hindrayani, A., & Sangka, K. B. (2023). Evaluation of the Smart Indonesia Program as a Policy to Improve Equality in Education. *Sustainability*, 15(6), 5114. <https://doi.org/10.3390/su15065114>
- Plonsey, R., & Barr, R. C. (Ed.). (2007). *Bioelectricity: A Quantitative Approach* (Third Edition). Springer Science+Business Media, LLC. <https://doi.org/10.1007/978-0-387-48865-3>
- Rahmawati, H., & Sudrajat, A. (2025). Implementasi Chatbot pada Penerimaan Mahasiswa Baru di Politeknik Tedc Bandung Menggunakan Natural Language Processing. *Jurnal Informatika dan Teknik Elektro Terapan*, 13(1). <https://doi.org/10.23960/jitet.v13i1.5456>
- Saunders, L. J., Russell, R. A., & Crabb, D. P. (2012). The Coefficient of Determination: What Determines a Useful  $R^2$  Statistic? *Investigative Ophthalmology & Visual Science*, 53(11), 6830. <https://doi.org/10.1167/iovs.12-10598>
- Senadheera, S., Yigitcanlar, T., Desouza, K. C., Mossberger, K., Corchado, J., Mehmood, R., Li, R. Y. M., & Cheong, P. H. (2025). Understanding Chatbot Adoption in Local Governments: A Review and Framework. *Journal of Urban Technology*, 32(3), 35–69. <https://doi.org/10.1080/10630732.2023.2297665>
- Sugiono, S. (2021). *Pemanfaatan Chatbot Pada Masa Pandemi Covid-19: Kajian Fenomena Society 5.0 Chatbot Utilization During The Covid-19 Pandemic: Revisiting The Concept Of Society 5.0*. 22(2).
- Vallejo Blanxart, A., & Nicolas Sans, R. (2025). The role of generative AI chatbots in higher education: A student-centric conceptual analysis of benefits, ethics, and privacy concerns. *Journal of Technology and Science Education*, 15(3), 810. <https://doi.org/10.3926/jotse.3643>

- Van Velsen, L., Ludden, G., & Grünloh, C. (2022). The Limitations of User-and Human-Centered Design in an eHealth Context and How to Move Beyond Them. *Journal of Medical Internet Research*, 24(10), e37341. <https://doi.org/10.2196/37341>
- Virvou, M. (2023). Artificial Intelligence and User Experience in reciprocity: Contributions and state of the art. *Intelligent Decision Technologies*, 17(1), 73–125. <https://doi.org/10.3233/IDT-230092>
- Zhou, T., Liu, Y., Kumar, M., & Wang, S. (2026). Generative AI-enabled chatbots for user-centred design: A state-of-the-art review. *Journal of Engineering Design*, 1–28. <https://doi.org/10.1080/09544828.2026.2633488>