Optimizing User Satisfaction: A Comprehensive Evaluation of the Info BMKG App Using UEQ+ and IPA Methods

Bima Tri Ariyanto
Faculty of Computer Science, Universitas Indonesia, Indonesia

Yova Ruldeviyani
Faculty of Computer Science, Universitas Indonesia, Indonesia

GS Budhi Dharmawan
Meteorology, Climatology, and Geophysical Agency, Indonesia

Maharani IF Bahar
Meteorology, Climatology, and Geophysical Agency, Indonesia

Abstract: An update to the appearance of the BMKG Info app in November 2022 led to a 0.26 drop in the monthly rating, suggesting that the change may not have met users' expectations. This study aims to identify the cause of the rating drop through a user experience (UX) assessment involving 1,237 app users. Using the User Experience Questionnaire Plus (UEQ+) and Importance Performance Analysis (IPA), this study collected and analyzed user feedback related to five aspects of UX: efficiency, novelty, usability, trust in content, and clarity. IPA results show that efficiency is a highly important but underperforming aspect, indicating that interface updates reduce efficiency and negatively impact user satisfaction. Recommendations include prioritizing efficiency improvements, usability evaluations, collecting additional feedback, and using IPA data to drive improvement priorities. The findings of this study contribute to the field of science by demonstrating the importance of a comprehensive UX analysis for updated apps. For future research, it is recommended to conduct longitudinal studies to monitor changes in user satisfaction over time and explore innovative methods to improve the overall user experience.

Keywords: Users Experience Questionnaire Plus, Importance Performance Analysis, Info BMKG Application, User Experience.

Correspondents Author:
Bima Tri Ariyanto, Faculty of Computer Science, Universitas Indonesia, Indonesia
Email : bimatriariyanto@gmail.com

Received March 30, 2024; Revised Juni 19, 2024; Accepted June 21, 2024; Published June 24, 2024

Introduction

User experience (UX) is the experience between the user and the system. To achieve the ideal UX, a system should follow the user's needs (Berni & Borgianni, 2021). Systems designed with UX in mind increase user satisfaction and keep users using the application in the long term (Hananto & Rahman, 2018). User engagement highlights the importance of maintaining user attention and interest during interaction with the app (Nakamura et al., 2022). A high-quality UX is critical to its success for an application like Info BMKG, which presents meteorological, climatological and geophysical data (Yu, 2023). An optimized UX can ensure that critical information can be delivered to users efficiently and effectively. Info BMKG is an application that provides weather information, early warnings, and geophysical data to the public (Alexander et al., 2018). With features such as current weather forecasts, long-term weather forecasts, tsunami warnings and earthquake warnings, Info BMKG is critical in maintaining the safety of many people (Ilham Fannani et al., 2023). Therefore, it is essential to ensure that the BMKG Info application provides a satisfactory user experience (UX) and guarantees the efficient and accurate presentation of critical information, supporting the need for reliable information in emergency situations (Maqbool & Herold, 2024).

Evaluating UX effectively is often challenging, especially for an app like Info BMKG that has just been updated. In November 2022, Info BMKG launched an updated version with a changed visual design and more advanced features than the previous version. Although the aim was to improve the look, the update lowered the app's November monthly rating by 0.26 (BMKG, 2022). These changes affect how users perceive and feel satisfied with the app. Therefore, it is essential to use objective and comprehensive UX evaluation and assessment. This involves collecting subjective feedback from users and conducting an in-depth analysis of that feedback to find aspects that need improvement. This way, any improvements made are genuinely based on the real needs of users, not just assumptions.

Saha, Nath, and Salehi-Sangari (Saha et al., 2012) surveyed electronic tax system users in Sweden to determine the system quality factors that most affect user satisfaction. The results showed that navigation and accessibility are the most critical factors affecting user satisfaction. Hinderks et al. (Hinderks et al., 2019)tested the User Experience Questionnaire (UEQ)+ and IPA analysis to evaluate user experience on information systems. The results showed that IPA can provide deep insight into the data from the user experience questionnaire results, helping to provide recommendations for steps to improve the quality of the system user experience. Othman and colleagues (Othman et al., 2024) used a combination of UEQ and IPA to evaluate Progressive Web Applications (PWAs). UEQ was used to evaluate user experience and then combined with IPA to assess the performance and importance of

attributes in the system. The results showed that the PWA performed well in some aspects of user experience but still had room for improvement in novelty and stimulation. The combination of UEQ and IPA successfully identified areas where the PWA performs well and areas that require improvement to optimize the user experience.

This research aims to conduct a user satisfaction survey of the BMKG Info application using the User Experience Questionnaire Plus (UEQ+) method and analyze the priorities for improving the application using the Importance Performance Analysis (IPA) method. By combining these two methods, the research aims to gain a more comprehensive understanding of the user experience of the BMKG Info application, identify areas that require improvement, and provide recommendations to improve the quality of the user experience.

Research Method

The stages of research in evaluating user satisfaction with the BMKG Info Application can be seen in Figure 1.

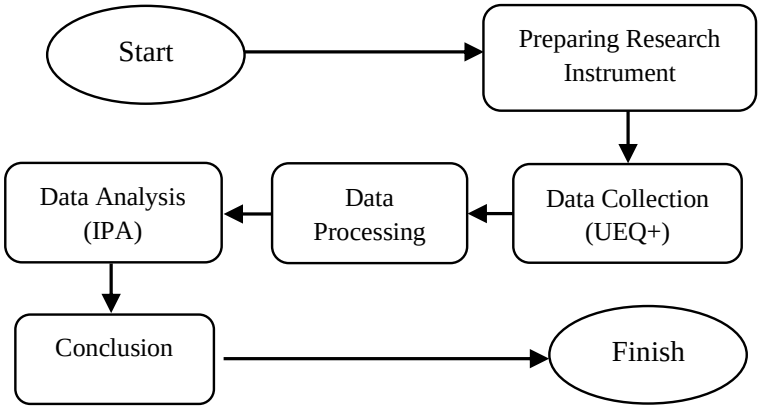

Figure 1 Research Stages of BMKG Info Application UX Evaluation

Figure 1 shows a flowchart summarizing the research process from start to finish. The process starts with the start point, followed by the preparation of the research instrument, which is the stage where research instruments, such as questionnaires or other measuring tools, are prepared. After that, at the Data Collection (UEQ+) stage, data is collected using the prepared instruments, with UEQ+ (User Experience Questionnaire Plus) possibly being the specific method used. The collected data then goes into the Data Processing stage, which is processed through cleaning, coding, and preparation for analysis. At this stage, validity and reliability tests are also conducted to ensure that the research instruments measure what they should measure (validity) and provide consistent results if used repeatedly under the same conditions

(reliability). After securing the data was valid and reliable, the data entered the Data Analysis (IPA) stage, where the data was analyzed using the Importance-Performance Analysis (IPA) method to evaluate the performance and importance of the various aspects measured. Based on the results of this analysis, researchers draw conclusions to answer research questions or test hypotheses. This research process ends with the Finish stage, signalling the completion of the entire process from preparation to a conclusion.

Research Object

The BMKG Info application is an innovation introduced by the Indonesian Agency for Meteorology, Climatology, and Geophysics, aimed at providing up-to-date information on weather conditions, early warnings, and earthquake data (Alexander et al., 2018). Users can obtain detailed information about the weather conditions for the next seven days for any location through the Weather Forecast feature.

The BMKG Info application also serves as a current source of information about earthquakes throughout Indonesia. Users can access real-time information through the earthquake feature, earthquakes with magnitudes greater than 5.0, as well as seismic events that are felt and occur in real time (Fajriyah, 2019). By providing relevant and detailed data, Info BMKG is beneficial in assisting the Indonesian community in managing risks and taking appropriate actions in response to weather changes and potential natural disasters. Additionally, the Voice Recognition feature introduces a new way to access information through voice, making it easier for users to receive weather updates, earthquake information, and air quality without typing

Preparing Research Instruments

The research instrument consisted of one questionnaire divided into two parts. The first part used the UEQ+ method to collect information about the respondents' identity and the operating system they use. UEQ+ is a technique for assessing and analyzing user interaction with systems (Meiners et al., 2021). One of the main advantages of UEQ+ is its ability to provide qualitative data through open-ended questions that allow users to share their views and experiences in detail (Heshmati et al., 2021). Overall, UEQ+ is a suitable method for developers and designers to understand and improve the user experience of the systems they develop (Meiners et al., 2021). Schrepp (Schrepp et al., 2023) compared several usability assessment methods, showing that SUS and UMUX-LITE assess mainly functional and practical usability, while UEQ-S assesses both functional aspects and user enjoyment in using the product.

In the context of the BMKG Info app, UEQ+ analysis can help identify areas that need to be improved or enhanced, as well as ensuring that the app provides users with a positive and intuitive experience in obtaining weather and earthquake information quickly and effectively. This research was conducted to examine the demographic and interaction attributes of potential participants for the BMKG Info app, evaluate the functionality of the app across multiple platforms, and measure user satisfaction with the system. This information will provide important context for further analysis of the research results.

The second part uses the UEQ+ questionnaire as the primary measurement tool. This study focused on five of the 20 UX aspects in UEQ+: efficiency, perspicuity, trustworthiness of content, usefullness, and novelty. In the second part, there are five questions for each aspect: four to measure user satisfaction and one to determine the importance of each component to the user. The data generated from UEQ+ can be interpreted to identify product or interface strengths and weaknesses, provide a basis for design improvements, and better understand user preferences and expectations (Santoso et al., 2022). Respondents are asked to rate each question within a range of one to seven, where a higher number indicates a more positive perception of the assessed aspect. Figure 2 shows an example of one of the questions given to respondents regarding the efficiency aspect.

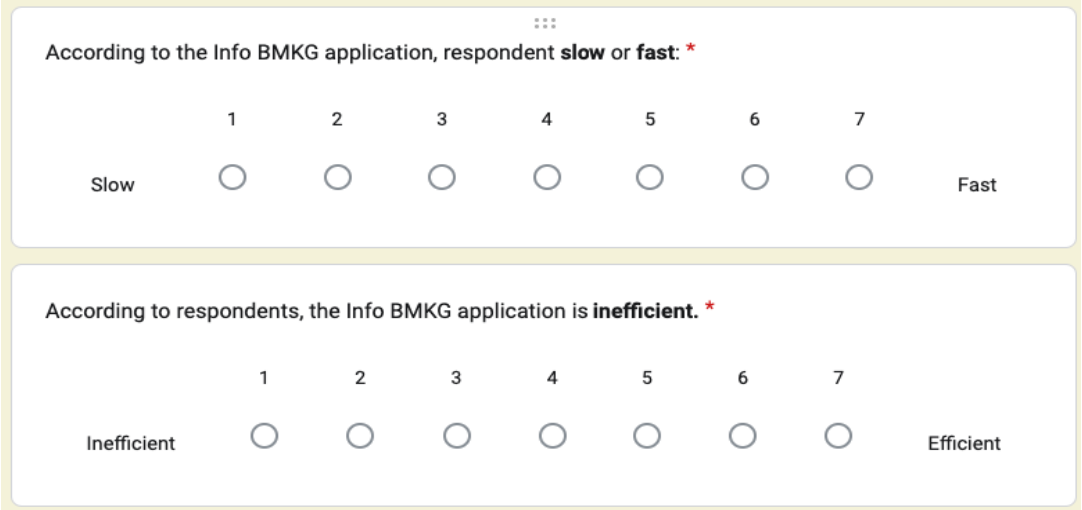

Figure 2 Example UEQ+ Question

Figure 2 shows that each dimension in the UEQ+ is measured through several questions rated by users on a Likert scale, typically from 1 to 7. To obtain an average score for each dimension, the values from all questions in that dimension are summed and then averaged.

$$Average\ Dimension\ Score = \frac{\sum(Individual\ scores\ on\ dimension)}{number\ of\ respondents} \quad (1)$$

Using this approach, the research can thoroughly evaluate the user experience of the BMKG Info app and identify areas that require improvement. The data obtained from this analysis will provide valuable insights for developers to improve the app and ensure higher user satisfaction.

Preparing Research Instruments

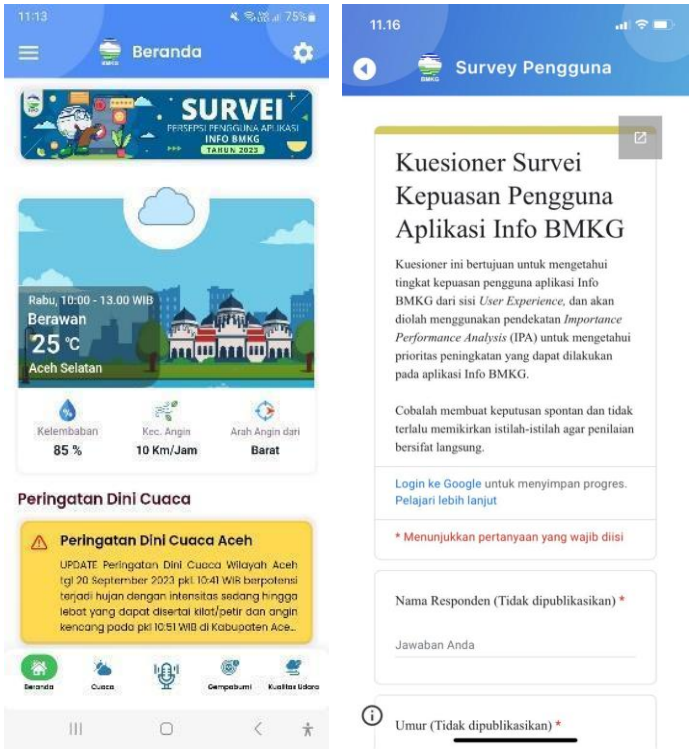

Figure 3 Example UEQ+ Question

This research uses a tool such as UEQ+, implemented online through Google Forms. The form was integrated on the main page of the BMKG Info application in the form of a banner to make it easier for users to access and complete the questionnaire. The program sent proactive messages to users to encourage their involvement in completing the survey. Research participants were recruited from active users of the BMKG Info application. They were asked to complete the questionnaire through notifications and banners that appeared when opening the application.

Data collection through this questionnaire took place over one week, from September 12 to 18, 2023, and successfully obtained the participation of 1,237 respondents. The initial target participants were active users of the BMKG Info application, who were expected to provide relevant and accurate feedback on their experience using the application.

This method ensures that the data obtained reflects authentic and up-to-date user experiences with the evaluated app. By involving active users and using easily accessible data collection

methods, this research gained a comprehensive picture of the user experience of the BMKG Info application.

Preparing Research Instruments

After the data is collected through the questionnaire, the data processing will be done using the UEQ+ Data Analysis Tool. This tool calculates average scores for each UX aspect and identifies areas that require special attention based on their ability scores to visualize the analysis results. The resulting visualizations are available in heatmaps that show how the user experience is evaluated in various aspects (Liapis et al., 2021).

Validity testing is conducted using SPSS application version 26 to confirm the accuracy and dependability of the data. The validity test aims to evaluate the extent to which the instrument can measure what should be measured (Adom et al., 2020). The reliability test results were assessed using the Cronbach's alpha (α) value on the UEQ+ Data Analysis Tool. The high Cronbach Alpha value indicates a good degree of consistency in retaining reasonable respondents to the questionnaire, ensuring that the data obtained is reliable and can be used for further analysis in this study (Govindasamy et al., 2024).

Data Analysis

After the data has been collected and passed the validity and reliability test phase, the next step in this study is to conduct an analysis using IPA. IPA analysis is a tool used to evaluate and understand how features or attributes influence user satisfaction with a product or service (Chen et al., 2022). IPA provides a clear and direct insight into how the comparison between expectations and reality can allocate resources efficiently (Putra & Imanuel, 2020). Through IPA analysis, organizations can design targeted and data-driven improvement strategies, enhance the quality of products or services, and respond to user needs and expectations more effectively (Bi et al., 2019). In the IPA analysis, the following formula is used to calculate the Level of Importance and Performance (Tki):

$$Tki = \frac{\sum Xi}{\sum Yi} x100\% \quad (2)$$

Where ∑Xi is the sum of the assessed attribute performances, ∑Yi is the sum of the attributes rated as important. This formula provides a percentage that describes the extent to which the attribute performance meets the user's importance expectations.

IPA typically involves two main dimensions: performance and importance (Markazi-Moghaddam et al., 2019). Performance of attributes measures the extent to which those attributes have been fulfilled or implemented in the product or service. By representing the

significance of performance on a 2D matrix, four quadrants can be identified: quadrant 1 (keep up the good work), quadrant 2 (potential overkill), quadrant 3 (low priority), and quadrant 4 (concentrate here) (Hinderks et al., 2020). An example of an IPA Cartesian diagram can be seen in Figure 4.

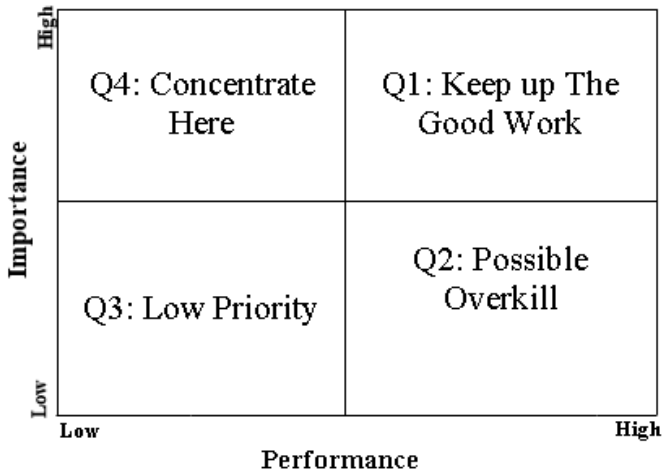

Figure 4 IPA Cartesian Diagram

The IPA method is used to understand the level of importance and performance of aspects assessed by respondents regarding the BMKG Info application. IPA enables a holistic evaluation of how specific features related to the application influence user satisfaction (Zulfahri et al., 2019). By analyzing the comparison between the level of interest and performance, this research can identify areas that require further attention. If there is a significant difference between the level of interest and the performance of an aspect, it can serve as a basis for development and improvement. The results of IPA analysis are expected to provide concrete and strategic recommendations for the developers of the BMKG Info application to enhance the quality of user experience while ensuring that features considered important by users are presented with optimal performance.

Result and Discussion

Result

Characteristic

Bulleted The survey conducted through the Info BMKG application from September 12-18, 2023, successfully collected data from 1.237 respondents. Based on the identity data of respondents, it was determined that users with varying age ranges, as shown in Figure 5.

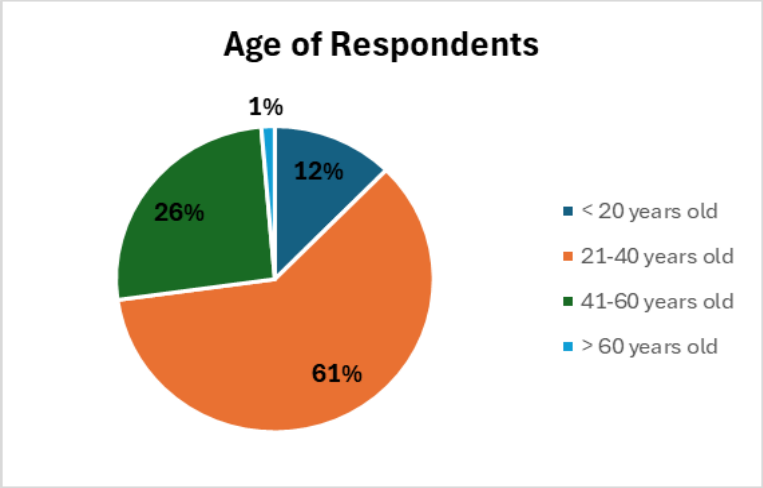

Figure 5 Respondent's Age Characteristics

In Figure 5, the age group of 21 to 40 years, the working age group, constitutes many of the total respondents, representing 61% of the population. The age group 41 to 60 years, individuals in the mature age range, also showed significant involvement, with a proportion of 26% of all respondents. The youth under 20 remained represented in the survey, although not as much as the other age groups, 12% of the overall respondent population. There were older age groups over 60 years old, and 1% of the respondents showed very low participation in this age group. The survey had the greatest responses from working-age individuals, with increased participation from younger and older groups.

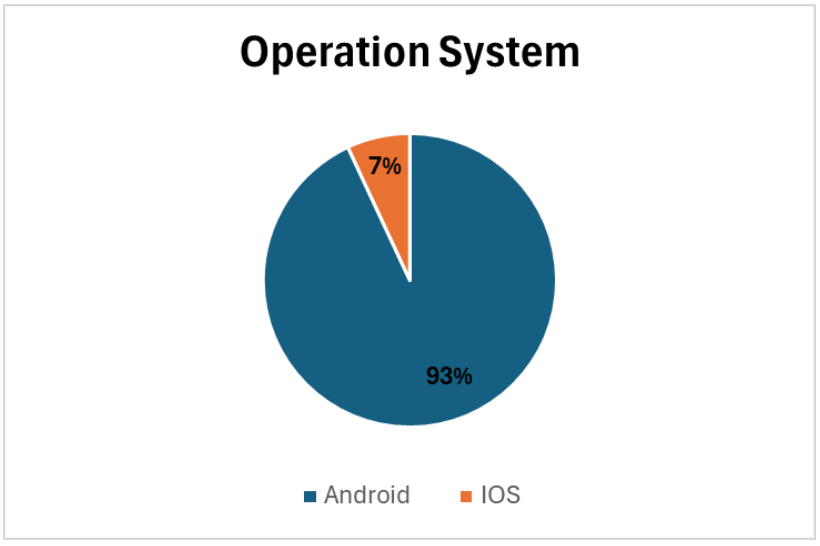

Figure 6 Characteristics of the respondent's operating system

Figure 6 displays the distribution of operating systems among respondents, with 93% being Android users and the remaining 7% being iOS users, it shows that the majority of BMKG Info application users are from the Android platform.

Validity Test Results

Table 1. Validity Test Results

Question	Validity Value	Description
According to the Info BMKG application, respondent slow or fast:	0.683	Valid
According to respondents, the Info BMKG application is inefficient:	0.751	Valid
According to respondents, the application Info BMKG is not practical:	0.786	Valid
According to the respondents of the unstructured Info BMKG application:	0.779	Valid
According to the respondents, the ideas and designs on the Info BMKG application are not creative.	0.739	Valid
According to the respondents, ideas, and designs for the conventional or original Info BMKG application are:	0.696	Valid
According to the respondents, ideas, and designs for the standard/excellent Info BMKG application are:	0.733	Valid
According to respondents, ideas and designs for conservative or innovative Info BMKG applications are:	0.747	Valid
According to the respondents, the Info BMKG application is useless:	0.758	Valid
According to the respondents, the Info BMKG application did not help:	0.797	Valid
According to the respondents, the Info BMKG application was unfavorable:	0.775	Valid
According to the respondents, the Info BMKG application is not applicable.	0.773	Valid
According to the respondents, the information and data on the Info BMKG application are useless.	0.796	Valid
According to the respondents, the information and data on the Info BMKG application make no sense:	0.777	Valid
According to the respondents, the information and data on the Info BMKG application are not trustworthy:	0.744	Valid
According to respondents, the information and data on the Info BMKG application are inaccurate:	0.754	Valid
According to the respondents, the use of this BMKG Info application is incomprehensible:	0.815	Valid
According to the respondents, how to use this Info BMKG application is challenging to learn or easy to learn:	0.781	Valid
According to the respondents, using this Info BMKG application is complicated or easy:	0.779	Valid
According to the respondents, using the Info BMKG application is confusing.	0.792	Valid

Table 1 shows the validity test results of the survey response data obtained. The validity test is performed to indicate the questionnaire's validity level. (0,0558).

Reliability Test Results

Table 2. Reliability Test Results

Scale	Corr						Average Corr.	Cronbach Alpha
	I1,I2	I1,I3	I1,I4	I2,I3	I2,I4	I3,I4		
Efficiency	0.63	0.59	0.58	0.69	0.65	0.71	0.64	0.88
Novelty	0.69	0.75	0.72	0.69	0.72	0.82	0.73	0.92
Usefulness	0.83	0.75	0.80	0.81	0.81	0.78	0.79	0.94
Trustworthiness of Content	0.79	0.69	0.64	0.74	0.67	0.77	0.72	0.91
Perspicuity	0.83	0.78	0.79	0.83	0.84	0.86	0.82	0.95

Table 2 shows the reliability test results of the survey response data obtained. Based on the table, it is accepted that all aspects measured have a Cronbach Alpha value > 0.6, which indicates that the measurement performed is reliable because it remains consistent after being repeatedly performed against the subject, in this case, the user in the same condition, according to the manual book of UEQ+.

Results of User Satisfaction Analysis

The results of the UEQ+ data analysis is shown in Table 3 and visualized in Figure 7.

Table 3. Average values and Info BMKG application confidence intervals

Scale	Mean	Variance	Std. dev.	N	Confidence	Confidence Interval	
Efficiency	1.78	1.80	1.34	1237	0.07	1.70	1.85
Novelty	1.36	2.30	1.52	1237	0.08	1.28	1.45
Usefulness	2.47	1.02	1.01	1237	0.06	2.41	2.52
Trustworthiness of Content	2.25	1.19	1.09	1237	0.06	2.19	2.31
Perspicuity	2.14	1.32	1.15	1237	0.06	2.07	2.20

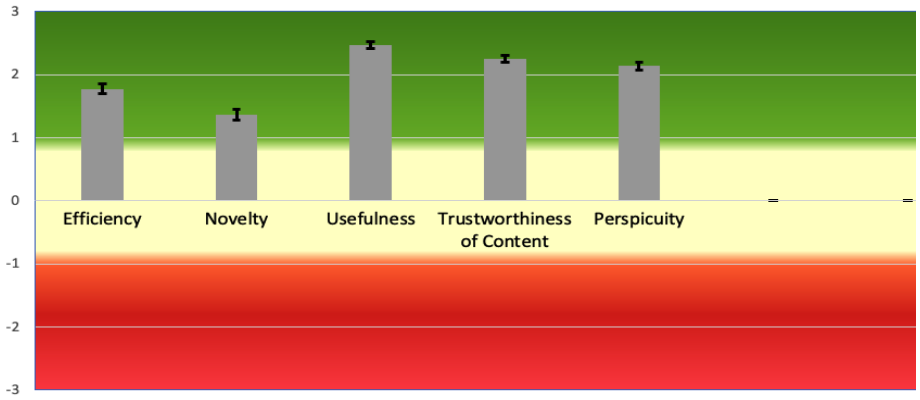

Figure 7 Visualization of average values and confidence intervals

Table 3 represents the average value and confidence interval for the Info BMKG application. Based on the data in the table above, it can be concluded that respondents have a positive impression of the application. The mean value of the 20 question items having a mean >0.8, which denotes a positive evaluation, demonstrates this.

1. The efficiency component had an average score of 1.72, indicating that users believe the Info BMKG program can be utilized swiftly, efficiently, practically, and in an ordered manner.
2. The novelty aspect achieved an average of 1.36, indicating that the Info BMKG application is creative, innovative, and always at the forefront of delivering up-to-date updates.
3. The usefulness aspect achieved an average score of 2.49, indicating that the Info BMKG application provides valuable information, helps, provides positive benefits, and a satisfactory user experience.
4. The Trustworthiness of Content aspect obtained an average score of 2.28, which indicates that the Info BMKG application presents information or content that is highly useful, reliable, and accurate, as well as providing reliable assurance.
5. The perspicuity aspect gains an average of 2.15, indicating that the information and display of the Info BMKG application are easy to understand, learn, and present.

Figure 7 provides a graphic visualization of the average value and confidence interval of the Info BMKG application. Based on the graph, it is evident that each aspect is in the green zone, which indicates that the user gives a positive impression related to the application experience. The line on each bar shows the confidence level of each aspect (error bar).

Aspect Interest Level Analysis

In addition to the mean values and confidence intervals of the Info BMKG application, data processing using the UEQ+ Data Analysis Tool can also produce an average value of the level of importance of the aspects in question, as shown in Table 4. Respondents assume that the overall aspect measured is essential; the mean value of each element shows this as a positive evaluation (>0.8). The average value is shown in Table 4 and visualized in graphical form in Figure 8.

Table 4. The Average Value of the Level of Interest of the Aspects Questioned.

Scale	Mean	Variance	Std. dev	N	Confidence	Confidence Interval	
Efficiency	2.43	1.01	1.00	1237	0.06	2.37	2.48
Novelty	2.13	1,63	1.28	1237	0.07	2.06	2.20
Usefulness	2.47	0.98	0.99	1237	0.06	2.41	2.52
Trustworthiness of Content	2.39	1.03	1.02	1237	0.06	2.34	2.45
Perspicuity	2.48	0.90	0.95	1237	0.05	2.43	2.54

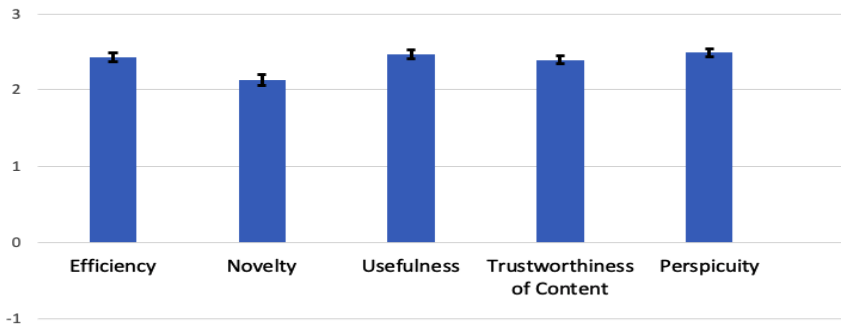

Figure 8 Visualization of the Average Value of the Level of Interest

Based on Table 4 above, it is obtained that of the five satisfaction aspects measured, the level of relevance of the perspicuity aspect is higher than the other aspects, with a mean value of 2.54, followed successively by the usefulness aspect with a medium value of 2.52, the efficiency aspect with an average value of 2.48, the trustworthiness aspect of content with a median value of 2.45, and the most recent aspect is the novelty aspect with a value of 2.20. Figure 7 is a graphic visualization of the average value of the level of importance of the aspects of satisfaction measured. Overall, the respondents considered the whole aspect important, as shown by any bar with a high value. In the IPA method, each aspect's performance level is compared to the expectations of each aspect and displayed as a quadrant analysis. The square is shown in Figure 9.

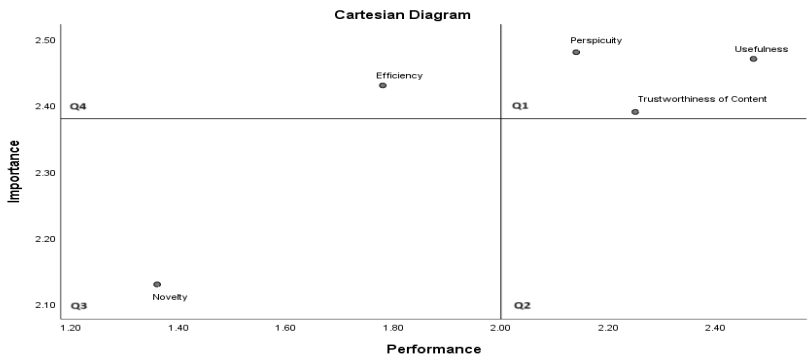

Figure 9 IPA Cartesius Diagram

Figure 9 shows an IPA cartesian diagram of user response results explaining that the usefulness, trustworthiness of content, and perspicuity aspects are in Quadrant I (Keep up the good work), which means that performance on these aspects is worthwhile and considered necessary. The efficiency aspect is in Quadrant IV (concentrate here), which signifies that the user thinks the aspects are required but has unsatisfactory performance. Thus, the efficiency aspect needs to be improved. The novelty aspect is in Quadrant III (low priority), which means that the application performance in that aspect is still low but that the element is considered not too crucial for improvement.

Discussion

The UEQ+ and IPA results indicate that the efficiency components of Quadrant IV require improvement, emphasizing the significance of concentrating on maximizing the user experience. By improving application efficiency, both in terms of speed and responsiveness, Info BMKG can deliver more satisfactory service and increase user engagement. The emphasis on the aspects of usefulness, trustworthiness of content, and perspicuity placed in Quadrant I (Keep up the good work) suggests that the Info BMKG application already has a strong foundation in presenting helpful, reliable, and understandable information. Therefore, continuous maintenance of content quality and improved clarity in the presentation of information will ensure the application remains relevant and dependable for users to obtain up-to-date weather and climate information. Furthermore, the finding that the novelty aspect is placed in Quadrant III (low priority) suggests that, although innovation is essential for long-term application growth, the current priority should remain improving the efficiency and quality of existing content. However, this does not mean that innovation should be ignored entirely. Developers can still consider upgrading new features or creating more exciting user experiences as strategic steps to enrich Info BMKG applications in the future. Info BMKG can continue growing and effectively meeting users' needs by balancing existing quality and integrating innovations.

Using UEQ+ has proven to be highly reliable in evaluating user experience on Info BMKG applications. Using UEQ+, researchers can quickly assess various aspects of user interaction with the application, including user satisfaction, usage efficiency, and the emotional elements involved. Researchers can comprehensively understand user interactions inside the app and identify areas that require enhancement. The UEQ+ reliability in the Info BMKG application also benefits developers and application designers. Using this evaluation tool, they can quickly identify areas that need to be fixed to improve the overall user experience. Thus, UEQ+ makes it easier for researchers to evaluate applications and provides valuable guidance for developers in developing and upgrading Info BMKG applications in the future. The outcome facilitates

enhanced user experiences and more efficient applications for distributing BMKG-related information to the public.

The IPA method has proven to be a handy tool in research related to user experience evaluation. Using IPA, researchers can effectively identify essential aspects of the Info BMKG application to the user and evaluate how well it meets their expectations. By analyzing the relationship between the importance of a feature or aspect and the actual performance of the application in terms of the features or aspects, they can identify areas that need to be improved to meet the needs and expectations of the user. In addition, IPA also makes it easier for researchers to formulate improvement and development strategies for Info BMKG applications. Developers can focus on better-targeted improvements by discovering which features or aspects are considered necessary by users but not optimally met. Thus, using IPA methods helps evaluate the user experience and guides further improvement and development steps to improve the overall Info BMKG application

Conclusions

User Experience (UX) evaluation is essential to improve quality and performance in application development. Research using UEQ+ and IPA methods on the BMKG Info app provides deep insights into user experience. Of the 1,237 respondents, the majority were aged 21 to 40, with 93% using Android and the rest using iOS. The validity and reliability test results show that the data collected is valid and reliable for interpretation, with all test aspects giving a positive impression, indicating that the BMKG Info app successfully provides a satisfactory user experience, especially regarding clarity and usability. IPA analysis shows that the aspects of usefulness, trustworthiness of content, and perspicuity, with mean scores of 2.47, 2.25 and 2.14, respectively, are already high and should be maintained. In contrast, the efficiency aspect, with an average score of 1.78, requires improvement. Although the novelty aspect has a low mean score and is considered less critical, it is possible that innovation can improve user experience in the future.

Developers should prioritize improving the BMKG Info application's efficiency based on this study's results. Aspects of efficiency that could be improved include access speed, responsiveness, performance optimization and effective navigation. Ensuring that the app can load information quickly without delay, improving responsiveness to user input, reducing resource usage so that the app runs smoothly on devices with lower specifications, and providing an intuitive navigation structure would be helpful. The UEQ+ and IPA methods have proven practical evaluation tools, providing valuable guidance for user-focused app development. These results emphasize the importance of understanding and meeting user needs to keep Info BMKG a reliable and enjoyable source of weather and geophysical

information for its users. Further research is recommended to combine other analysis methods to enrich the evaluation results and future development of the BMKG Info application.

References

Adom, D., Mensah, J. A., & Dake, D. A. (2020). Test, measurement, and evaluation: Understanding and use of the concepts in education. *International Journal of Evaluation and Research in Education*, *9*(1), 109–119.

Alexander, R., Prabawati, A. G., & Setyohadi, D. B. (2018). Comparison of Severity on Mobile Government Application Mobile. *2018 International Seminar on Application for Technology of Information and Communication*, 424–428. https://doi.org/10.1109/ISEMANTIC.2018.8549796

Berni, A., & Borgianni, Y. (2021). From The Definition of User Experience to A Framework to Classify its Applications in Design. *Proceedings of the Design Society*, *1*, 1627–1636. https://doi.org/10.1017/pds.2021.424

Bi, J.-W., Liu, Y., Fan, Z.-P., & Zhang, J. (2019). Wisdom of crowds: Conducting importance-performance analysis (IPA) through online reviews. *Tourism Management*, *70*, 460–478. https://doi.org/https://doi.org/10.1016/j.tourman.2018.09.010

BMKG. (2022). *Laporan Rating Google Play Store Aplikasi Info BMKG November 2022*.

Chen, Y., Zhong, Y., Yu, S., Xiao, Y., & Chen, S. (2022). Exploring bidirectional performance of hotel attributes through online reviews based on sentiment analysis and Kano-IPA model. *Applied Sciences*, *12*(2), 692.

Fajriyah, P. (2019). Pengaruh Penggunaan Aplikasi Info Bmkg Terhadap Sikap Tanggap Bencana Mahasiswa Universitas Mataram Pasca Gempa Bumi Lombok 2018. *JCommsci - Journal of Media and Communication Science*, *2*. https://doi.org/10.29303/jcommsci.v2i1.23

Govindasamy, P., Cumming, T. M., & Abdullah, N. (2024). Validity and reliability of a needs analysis questionnaire for the development of a creativity module. *Journal of Research in Special Educational Needs*.

Hananto, A. L., & Rahman, A. Y. (2018). User Experience Measurement On Go-Jek Mobile App In Malang City. *2018 Third International Conference on Informatics and Computing (ICIC)*, 1–6. https://doi.org/10.1109/IAC.2018.8780423

Heshmati, A., Moftian, N., Rezaei-Hachesu, P., & Samad-Soltani, T. (2021). Simple and Efficient Measurement of the User Experience in Health Information Systems: A Persian Version. *Iranian Journal of Public Health*, *50*(1), 217–218. https://doi.org/10.18502/ijph.v50i1.5097

Hinderks, A., Domínguez Mayo, F. J., Meiners, A.-L., & Thomaschewski, J. (2020). Applying Importance-Performance Analysis (IPA) to Interpret the Results of the User Experience Questionnaire (UEQ). *Journal of Web Engineering*. https://doi.org/10.13052/jwe1540-9589.1926

Hinderks, A., Meiners, A.-L., Mayo, F., & Thomaschewski, J. (2019). Interpreting the Results from the User Experience Questionnaire (UEQ) using Importance-Performance Analysis (IPA). *Proceedings of the 15th International Conference on Web Information Systems and Technologies*, 388–395. https://doi.org/10.5220/0008366503880395

Ilham Fannani, Enggar Novianto, & Alfin Syarifuddin Syahab. (2023). User Analysis of Info BMKG Application in The Perspective of Human Computer Interaction Using Support Vector Machine Algorithm. *Inspiration: Jurnal Teknologi Informasi Dan Komunikasi*, *13*(1 SE-Articles), 48–58. https://doi.org/10.35585/inspir.v13i1.42

Liapis, A., Katsanos, C., Karousos, N., Xenos, M., & Orphanoudakis, T. (2021). User experience evaluation: A validation study of a tool-based approach for automatic stress detection using physiological signals. *International Journal of Human–Computer Interaction*, *37*(5), 470–483.

Maqbool, B., & Herold, S. (2024). Potential effectiveness and efficiency issues in usability evaluation within digital health: A systematic literature review. *Journal of Systems and Software*, *208*, 111881. https://doi.org/https://doi.org/10.1016/j.jss.2023.111881

Markazi-Moghaddam, N., Kazemi, A., & Alimoradnori, M. (2019). Using the importance-performance analysis to improve hospital information system attributes based on nurses' perceptions. *Informatics in Medicine Unlocked*, *17*, 100251. https://doi.org/https://doi.org/10.1016/j.imu.2019.100251

Meiners, A.-L., Kollmorgen, J., Schrepp, M., & Thomaschewski, J. (2021). Which UX Aspects Are Important for a Software Product? Importance Ratings of UX Aspects for Software Products for Measurement with the UEQ+. *Proceedings of Mensch Und Computer 2021*, 136–139. https://doi.org/10.1145/3473856.3473997

Nakamura, W. T., de Oliveira, E. C., de Oliveira, E. H. T., Redmiles, D., & Conte, T. (2022). What factors affect the UX in mobile apps? A systematic mapping study on the analysis of app store reviews. *Journal of Systems and Software*, *193*, 111462. https://doi.org/https://doi.org/10.1016/j.jss.2022.111462

Othman, M. K., Norman Anuar, N., Barawi, M. H., Yahya, A. S. A.-H., & Abdul Manaf, A. A. (2024). A Comprehensive User Experience Analysis of Cultural Heritage Progressive Web App Using A Hybrid UEQ-IPA Approach. *J. Comput. Cult. Herit.* https://doi.org/10.1145/3647998

Putra, E. Y., & Imanuel, P. G. (2020). Evaluation of Service Quality of Manado City Government Website with E-GovQual Approach to Calculate Importance Performance Analysis. *2020 2nd International Conference on Cybernetics and Intelligent System (ICORIS)*, 1–5. https://doi.org/10.1109/ICORIS50180.2020.9320842

Saha, P., Nath, A. K., & Salehi-Sangari, E. (2012). Evaluation of government e-tax websites: an information quality and system quality approach. *Transforming Government: People, Process and Policy*, *6*(3), 300–321. https://doi.org/10.1108/17506161211251281

Santoso, H. B., Schrepp, M., Hasani, L. M., Fitriansyah, R., & Setyanto, A. (2022). The use of User Experience Questionnaire Plus (UEQ+) for cross-cultural UX research: evaluating Zoom and Learn Quran Tajwid as online learning tools. *Heliyon*, *8*(11), e11748. https://doi.org/https://doi.org/10.1016/j.heliyon.2022.e11748

Schrepp, M., Kollmorgen, J., & Thomaschewski, J. (2023). A Comparison of SUS, UMUX-LITE, and UEQ-S. In *Journal of User Experience* (Vol. 18, Issue 2).

Yu, M. (2023). The Rise of Super Apps: Insights and Opportunities from a UX Perspective. *2023 IEEE International Professional Communication Conference (ProComm)*, 128–133. https://doi.org/10.1109/ProComm57838.2023.00044

Zulfahri, A. F., Widodo, C. E., & Gernowo, R. (2019). Implementing Importance-Performance Analysis (IPA) for Measuring Students Satisfaction Levels. *2019 International Seminar on Research of Information Technology and Intelligent Systems (ISRITI)*, 363–367. https://doi.org/10.1109/ISRITI48646.2019.9034615