

Usability Evaluation of BMKG Pontianak Maritime Info Portal Using ISO 9126 Standard and USE Questionnaire

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Abstract: The high risk of fatalities from maritime accidents in West Kalimantan waters due to extreme weather conditions requires a reliable meteorological information dissemination system for coastal communities. The BMKG Maritime Meteorology Station Pontianak launched the Maritime Info Portal as a digital safety platform, but its usability for non-expert users has not yet been formally evaluated. This study aims to evaluate the usability of the portal based on the ISO 9126 standard, focusing on four characteristics: Understandability, Operability, Learnability, and Attractiveness, using the USE Questionnaire as the measurement instrument. This study employed a descriptive quantitative method with purposive sampling involving 30 valid respondents consisting of traditional fishermen, IT academics, and general users. Statistical testing using IBM SPSS showed that all 13 questionnaire items met the validity criteria, while the instrument demonstrated high internal consistency with a Cronbach's Alpha value of 0.924. The results showed that all four usability characteristics were rated Good, with Attractiveness obtaining the highest score at 80.44%, followed by Operability at 76.22%, Learnability at 75.78%, and Understandability at 70.00%. Field observations also indicated that some traditional fishermen experienced difficulties in interpreting formal meteorological terms, particularly wind speed units such as knots. Based on these findings, practical recommendations include the use of localized terminology for fishermen, automated unit conversion, and mobile web optimization for low-bandwidth coastal areas.

Keywords: BMKG Pontianak; ISO 9126; Software Quality; Usability; USE Questionnaire.

1. Introduction

Indonesia is an archipelagic country in which maritime activities play an important role in the livelihoods of coastal communities. Among these communities, traditional fishermen depend heavily on weather and marine conditions when planning fishing activities and deciding whether it is safe to operate at sea. In West Kalimantan, these activities are affected by extreme and unpredictable weather conditions that can increase risks during fishing operations (Ahmad *et al.*, 2025; Sugiarto, 2021). The seriousness of maritime safety conditions in the region was illustrated by an incident in July 2021, when 14 fishing vessels sank in West Kalimantan waters, resulting in 21 fatalities and 31 missing persons (Datu *et al.*, 2024; Ramadhani *et al.*, 2023). Such conditions indicate that access to timely meteorological information is important for supporting decisions made by fishermen before and during their activities at sea. Availability alone, however, does not

guarantee that users can understand and use the information appropriately, since the ability of fishermen to interpret weather symbols, numerical information, and warnings is equally important for an effective maritime information system.

To support the dissemination of meteorological information to coastal communities, the Meteorology, Climatology, and Geophysical Agency (BMKG) Maritime Meteorology Station Pontianak developed the Maritime Info Portal, which provides weather information, wave height estimates, wind-related information, and early warnings for coastal areas, particularly around Pontianak and Kubu Raya (Ikhsan & Samsudin, 2024; Purwandari *et al.*, 2022). BMKG has complemented this system with the Field School for Fishermen's Weather (SLCN), an educational initiative intended to improve fishermen's understanding of weather information. Together, these efforts indicate that the dissemination of meteorological information requires not only appropriate content but also an interface that can be understood and operated by its intended users. This need is reflected in preliminary findings: Makwa Nugraha (2025) reported that approximately 65% of traditional fishermen experienced difficulty understanding meteorological symbols and navigating the portal, a pattern that was also reflected in the authors' own field interviews conducted in June 2026 with traditional fishermen in the study area.

Usability is particularly important for a public safety information system because users may need to interpret information within a limited time, and difficulty in understanding weather warnings, symbols, or navigation features can directly hinder decisions made at sea. Previous studies have evaluated usability and software quality across different types of information systems; Jamil *et al.* (2021), for instance, evaluated the performance of a university academic information website using ISO/IEC 9126, while other studies have applied approaches such as Webqual 4.0 and the System Usability Scale to assess website and learning management system usability. These studies confirm the applicability of usability evaluation methods to information systems in general, yet their contexts differ considerably from a public maritime safety portal intended for users with varying levels of digital literacy. Studies of maritime information interfaces have likewise examined interactive map-based forecasts for professional maritime users, whose technical backgrounds and information needs differ from those of traditional fishermen (Jeuring *et al.*, 2024). The Maritime Info Portal therefore warrants evaluation from the perspective of its actual and potential users, particularly those with limited experience in digital systems and formal meteorological terminology, since such an evaluation can reveal whether the portal's content, navigation, learning process, and visual presentation are genuinely appropriate for this user group.

In this study, ISO 9126 is used as the software quality model, with the evaluation focused on the Usability characteristic and its four dimensions as reflected in the research instrument: Understandability, Operability, Learnability, and Attractiveness. The USE Questionnaire is incorporated as the measurement instrument to obtain users' responses regarding these aspects, allowing the study to assess not only whether users can access the portal but also whether they can understand its information, navigate its features, learn to operate the system, and perceive its interface positively.

Based on this problem, this study aims to evaluate the usability of the Maritime Info Portal using the ISO 9126 standard and the USE Questionnaire. The study specifically assesses the understandability of meteorological information, the operability of portal navigation, the learnability of the system for users with different levels of digital literacy, and the attractiveness of the user interface. It also identifies usability-related difficulties experienced by traditional fishermen and formulates practical recommendations based on the evaluation findings, with the results expected to provide an empirical basis for identifying usability aspects that require further attention in the development of maritime information services for coastal communities.

2. Related Work

2.1 State-of-the-Art Research

Software quality evaluation has been applied to various information systems using established quality models and usability evaluation methods. ISO 9126 is one of the software quality models that has been used to assess usability and other software quality characteristics in information systems (Andry *et al.*, 2023; Gunawan & Kusumastuti, 2023). The model has been applied in different contexts, including academic information systems and public-facing websites. Jamil *et al.* (2021), for example, evaluated the quality of a university academic information website using ISO/IEC 9126. Their study demonstrates the application of software quality characteristics to assess the performance and quality of information systems. Similarly, Rifqi Firdaus *et al.* (2025) evaluated the quality of an online media portal using ISO 9126, showing that the model can also be applied to public-facing websites. These studies indicate that software quality models can be used to identify usability-related aspects and assess whether an information system meets user requirements.

2.2 Comparison with Previous Studies

Previous usability studies have examined different types of information systems using various evaluation frameworks. Widodo *et al.* (2021) evaluated a service website using Webqual 4.0 and the Analytical Hierarchy Process, while Fatmawati (2021) and Kesuma (2021) used the System Usability Scale (SUS) to assess usability in learning management and online learning environments. These studies provide useful approaches for measuring users' perceptions of system usability, but their research contexts differ from a maritime safety information portal intended for coastal communities. Usability evaluation has also been applied to maritime information systems. Jeuring *et al.* (2024) examined an interactive map-based ensemble forecast system for maritime operations through decision scenarios. Their study focused on the usability of forecast information for maritime decision-making. Although this provides a relevant reference for evaluating maritime information interfaces, the user context differs from that of a public-facing portal for traditional fishermen. Traditional fishermen may have different levels of digital literacy and may interact with weather information under different operational conditions. Therefore, usability evaluation for this type of user requires attention to the understandability of meteorological information, navigation, ease of learning, and interface presentation.

2.3 Positioning of the Research

Based on the reviewed studies, previous research has addressed software quality and usability in academic information systems, online learning platforms, public websites, and maritime information interfaces. However, limited attention has been given to the usability of a regional maritime safety portal intended for heterogeneous users, particularly traditional fishermen. The BMKG Pontianak Maritime Info Portal has a different operational context because it provides meteorological information and early warnings that may be used by coastal communities when making decisions related to activities at sea. This study therefore evaluates the BMKG Pontianak Maritime Info Portal from the perspective of users with different levels of digital experience. The respondent group includes traditional fishermen, IT academics or students, and general users. This composition allows the evaluation to consider both the experiences of the portal's primary target users and the perspectives of users with greater familiarity with information systems. The study focuses on the usability aspects of the portal and examines whether its information, navigation, learning process, and visual presentation are appropriate for the intended users.

2.4 Evaluation Framework and Statistical Methods

This study uses the ISO 9126 software quality model, with the evaluation focused on the Usability characteristic. Four dimensions are considered in the evaluation instrument: Understandability, Operability, Learnability, and Attractiveness. Although ISO/IEC 25010 has subsequently replaced ISO 9126 as a software product quality standard, ISO 9126 was retained in this study because its usability-related characteristics are directly aligned with the dimensions used in the research instrument. The USE Questionnaire was used to collect users' responses regarding these usability aspects (Rizthy Shavna Azizah & Wafiah Murniati, 2024). The questionnaire data were processed using IBM SPSS Statistics. Pearson Product-Moment correlation was used to assess the validity of the questionnaire items, while Cronbach's Alpha was used to evaluate the internal consistency of the instrument. These statistical procedures provide the basis for determining whether the questionnaire items meet the required validity criteria and whether the instrument produces consistent responses across the respondents (Zayrin *et al.*, 2025). The relationship between the ISO 9126 dimensions and the questionnaire items is further operationalized in the research methodology to obtain usability index scores for the BMKG Pontianak Maritime Info Portal.

3. Methodology

This study employs a descriptive quantitative approach to evaluate the usability of the BMKG Pontianak Maritime Info Portal. The research procedure consists of the evaluation framework, respondent selection, data collection, questionnaire testing, and usability index calculation. Data collection was conducted from May to June 2026 using a guided survey approach to reduce potential misunderstanding of questionnaire items among respondents with different levels of digital experience.

3.1 Evaluation Framework

The evaluation framework is based on the ISO 9126 software quality standard, with the evaluation focused on the Usability characteristic. Four dimensions are assessed: Understandability, which refers to the ease of understanding texts, symbols, and information; Operability, which refers to the ease of navigating menus and using portal features; Learnability, which refers to the ease with which new users learn to use the system; and Attractiveness, which refers to the visual presentation and appeal of the interface. These four dimensions are operationalized through a 13-item questionnaire based on the USE Questionnaire structure.

Each item is measured using a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The evaluation framework is presented in Figure 1.

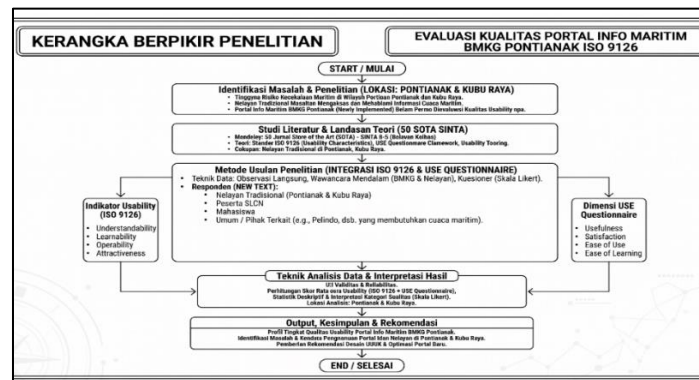


Figure 1. Research Framework Flowchart

ISO 9126 was selected because its usability characteristics are aligned with the dimensions assessed in this study and can be operationalized into questionnaire indicators for users with different levels of digital experience.

3.2 Respondents and Sampling

The primary data were collected from respondents in the West Kalimantan maritime operational area, particularly around Pontianak and Kubu Raya, with the field activities centered on the Sungai Kakap traditional port. A purposive sampling technique was used to select respondents who were considered relevant to the evaluation objectives. The study involved 30 valid respondents consisting of 15 traditional fishermen, 9 IT academics/students with familiarity with information systems, and 6 general users. Traditional fishermen represented the primary target users of the maritime information service, while IT academics/students and general users provided additional perspectives on the usability of the portal. The inclusion of these respondent groups was intended to obtain usability assessments from users with different levels of digital experience.

3.3 Research Instrument and Data Analysis

The primary research instrument was a structured questionnaire using a five-point Likert scale: 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, and 1 = Strongly Disagree. Data collection was conducted from May to June 2026 using a guided survey approach. For traditional fishermen, the researchers assisted respondents in understanding the questionnaire items by reading and explaining the questions using simplified contextual examples. This procedure was intended to reduce misunderstanding of the questionnaire items while allowing respondents to provide their own responses. IBM SPSS Statistics version 27 was used to analyze the questionnaire data. Pearson Product-Moment correlation was used to assess the validity of individual questionnaire items, while Cronbach's Alpha was used to evaluate the internal consistency of the instrument. The usability score was calculated by comparing the cumulative actual score obtained from respondents with the maximum possible score for each dimension. The percentage usability index was calculated using the following equation:

$$P = \frac{\sum X}{Y} \times 100\% \quad (1)$$

Where P represents the percentage usability index, X represents the cumulative actual score obtained from respondents, and Y represents the maximum possible score for the assessed dimension. The maximum score is determined by multiplying the highest Likert scale value (5), the number of respondents (30), and the number of questionnaire items included in the respective dimension. The resulting percentage was interpreted using the following usability categories: Very Poor (0.00–20.99%), Poor (21.00–40.99%), Fair (41.00–60.99%), Good (61.00–80.99%), and Very Good (81.00–100.00%).

4. Result and Discussion

4.1 Results

The BMKG Pontianak Maritime Info Portal was evaluated in its operational environment as a web-based platform for disseminating maritime meteorological information. The portal provides surface weather observations, wave height information, wind direction information, and extreme weather warnings for coastal areas. Its interface combines interactive maps with numerical meteorological information and other weather-related features. Field observations indicated that some traditional fishermen experienced difficulties when interacting directly with the portal. In some cases, weather information was shared among users through screenshots rather than by directly accessing the portal. This observation suggests that, although the portal provides the required meteorological information, some users may still experience difficulties in accessing or interpreting the information through the available interface. These observations provide additional context for the quantitative usability evaluation presented in the following sections.

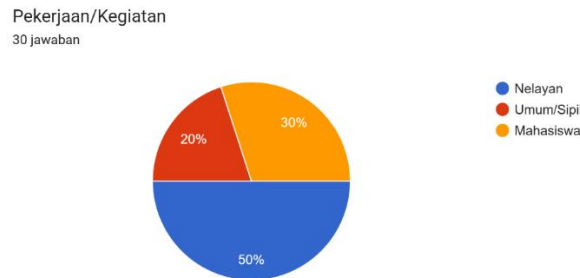


Figure 2. Respondent Demographics

The questionnaire was tested using IBM SPSS Statistics before the usability index was calculated. Pearson Product-Moment correlation was used to assess the validity of the 13 questionnaire items. With 30 respondents and a 5% significance level, the reference r -value was 0.361. All 13 items obtained calculated r -values greater than 0.361, ranging from 0.412 to 0.845. Therefore, all questionnaire items met the validity criterion used in this study.

Table 1. Validity Testing Results

No.	Variable	Statement/Question Indicator	Calculated r -value	r -table	Validity Status
1	U1	Helps to plan time at sea	0.584	0.361	Valid
2	U2	Provides wave and wind information	0.412	0.361	Valid
3	U3	Easy to understand the meaning of weather symbols (1)	0.595	0.361	Valid
4	U4	Easy to understand the meaning of weather symbols (2)	0.765	0.361	Valid
5	O1	Ease of use of the portal's menus and navigation	0.792	0.361	Valid
6	O2	Portal response speed when clicked	0.612	0.361	Valid
7	O3	Easy access to information about Pontianak/Ketapang	0.685	0.361	Valid
8	L1	Able to learn how to use the website quickly	0.692	0.361	Valid
9	L2	Easy to remember how to find information	0.688	0.361	Valid
10	L3	Steps to obtain simple information	0.845	0.361	Valid
11	A1	Attractive color scheme and layout	0.795	0.361	Valid
12	A2	Satisfied with using the website	0.754	0.361	Valid
13	A3	Willing to recommend the website to other colleagues	0.812	0.361	Valid

Table 2. Reliability Testing Results

Actual Cronbach's Alpha	Standard Threshold Value	Number of Statement Items	Reliability Status
0.924	0.60	13	Highly Reliable

The usability evaluation showed that the portal received generally positive assessments from the respondents. The highest dimension was Attractiveness, while Understandability obtained the lowest score among the four dimensions. Field observations also identified several usability issues that may affect users with limited

experience in using digital information systems. The portal's visual presentation was positively perceived, particularly in relation to its color scheme, layout, and graphical presentation of weather information. However, some traditional fishermen experienced difficulties when interpreting technical meteorological information, including terms such as *knots* and directional symbols. These observations are consistent with the lower score obtained for the Understandability dimension. Field observations also indicated that network conditions may affect users' experience when accessing the portal in coastal areas with limited connectivity. Users in such locations may experience slower access to information compared with users operating under more stable network conditions. If the 8–12 second loading time was obtained through a formal measurement procedure, the measurement method and results should be reported in the methodology or in a separate performance test. Otherwise, the specific loading-time figure should not be presented as a quantitative finding. These findings indicate that the portal's usability is generally good, while certain aspects of information interpretation and access conditions still require attention.

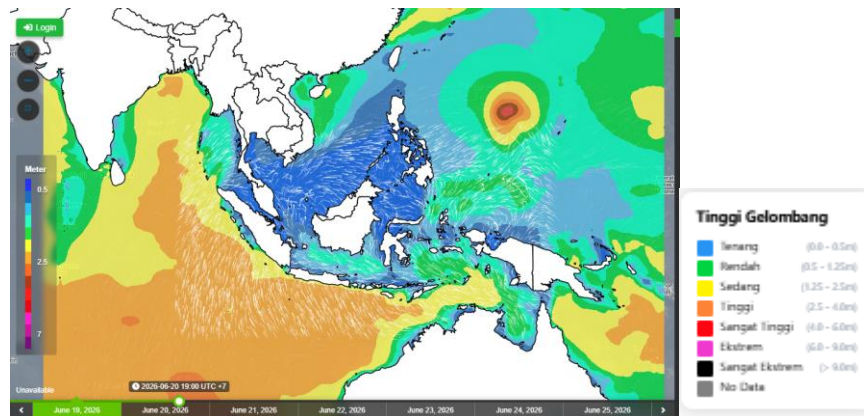


Figure 3. BMKG Portal Interface Evaluation

The usability scores were calculated using the percentage index described in the methodology. Attractiveness obtained the highest score at 80.44%, followed by Operability at 76.22%, Learnability at 75.78%, and Understandability at 70.00%. Based on the evaluation categories used in this study, all four dimensions were classified as Good. The difference between the highest score, Attractiveness (80.44%), and the lowest score, Understandability (70.00%), was 10.44 percentage points. This difference indicates that respondents gave a more positive assessment of the portal's visual presentation than of their ability to understand the information provided through the portal.

Table 3. Recapitulation of Usability Dimension Metrics

No.	ISO 9126 Usability Dimension	Total Actual Score (X)	Total Ideal Score (Y)	Index Value (P)	Quality Criteria
1	Understandability	420	600	70.00%	Good
2	Operability	343	450	76.22%	Good
3	Learnability	341	450	75.78%	Good
4	Attractiveness	362	450	80.44%	Good

4.2 Discussion

The usability evaluation indicates that the BMKG Pontianak Maritime Info Portal was generally perceived as usable by the respondents, as all four ISO 9126 usability dimensions were classified as Good. However, the difference between the highest and lowest dimensions shows that positive visual perception does not automatically ensure that users can interpret the information effectively. Attractiveness received the highest score at 80.44%, suggesting that the color scheme, layout, and visual presentation of the portal were relatively well accepted by users. In contrast, Understandability obtained the lowest score at 70.00%, indicating that the main usability concern lies in how users interpret meteorological information rather than in the visual appearance of the interface. The lower score for Understandability is important because the portal is intended to support maritime safety decisions, particularly among traditional fishermen. Field observations showed that several fishermen experienced difficulty interpreting formal meteorological terms, wind speed units such as knots, and directional symbols. This finding is consistent with Makwa Nugraha (2025), who reported usability-related difficulties among users of BMKG information services, particularly in understanding symbols and navigating information. It also aligns with Verawati et al. (2025), who emphasized that the use of information and communication technology among fishermen is influenced not only by technology availability but also by users' ability to access, understand, and apply the information in their daily activities. Therefore, the portal's

usefulness for traditional fishermen depends not only on the completeness of weather information but also on whether the information is presented in terms that are familiar and actionable for them.

The relatively high scores for Operability and Learnability suggest that respondents were generally able to navigate the portal and learn its basic functions. Nevertheless, these scores should be interpreted in relation to the respondent composition, which included IT academics or students and general users in addition to traditional fishermen. Users with higher digital familiarity may find the portal easier to operate than traditional fishermen who have more limited experience with web-based meteorological systems. This condition indicates the need to consider different user profiles in future interface development. In the context of maritime information systems, Jeuring *et al.* (2024) also showed that forecast interfaces need to be assessed through user-oriented decision scenarios because the same meteorological information may be interpreted differently depending on users' operational needs and technical background. The findings also have practical implications for the use of digital technology in supporting fishermen's safety and operational decisions. Muhammad Dani *et al.* (2025) showed that technological support can contribute to the safety and efficiency of traditional fishing activities when it is adapted to users' operational context. In relation to the BMKG Pontianak Maritime Info Portal, this suggests that interface improvements should prioritize features that reduce interpretation barriers, such as locally familiar terminology, short explanations of technical units, clearer visual labels, and automatic conversion of wind speed units into measurements more commonly understood by fishermen. These improvements should be treated as proposed usability enhancements that require further testing rather than as conclusions already proven by the present study.

Network accessibility is another issue that emerged from field observations. Some users in coastal areas may experience difficulty accessing web-based information when cellular connectivity is weak or unstable. Because this study did not conduct a formal performance or loading-time test, this issue should be interpreted as an observational finding rather than a quantified system performance result. Even so, it remains relevant for future development because maritime information is most useful when it can be accessed quickly under field conditions. Low-bandwidth optimization, lighter page components, optimized map displays, and mobile-friendly layouts may therefore be considered to improve accessibility for users in coastal areas with limited connectivity. These findings indicate that the BMKG Pontianak Maritime Info Portal already has a generally good usability level, particularly in terms of visual presentation, operation, and ease of learning. The main area that requires further attention is the understandability of technical meteorological information for traditional fishermen. Improving this aspect is important because public maritime information systems must not only provide accurate weather data but also present that data in a form that can be understood and used by the intended users when making safety-related decisions at sea.

5. Conclusion and Recommendations

This study evaluated the usability of the BMKG Pontianak Maritime Info Portal using the ISO 9126 standard and the USE Questionnaire. The validation test showed that all 13 questionnaire items were valid, and the reliability test produced a Cronbach's Alpha value of 0.924, indicating high internal consistency. The usability evaluation classified all four dimensions as Good, with Attractiveness obtaining the highest score at 80.44%, followed by Operability at 76.22%, Learnability at 75.78%, and Understandability at 70.00%. These results indicate that the portal was generally well received by respondents, particularly in terms of visual presentation, ease of operation, and ease of learning. The lowest score for Understandability shows that the main usability issue is related to users' ability to interpret meteorological information. Field observations indicated that some traditional fishermen still experienced difficulties in understanding formal meteorological terms, technical units such as knots, and certain weather symbols. Limited network conditions in several coastal areas were also observed as a potential access barrier, although this issue was not measured through a formal performance test. Therefore, the findings suggest that future improvements should focus on making maritime weather information easier to understand while maintaining portal accessibility under varying network conditions.

Based on these findings, BMKG Pontianak may consider providing more familiar terminology for traditional fishermen through a dedicated terminology mode, short explanations of technical terms, and automatic unit conversion for wind speed information. The portal may also be optimized for low-bandwidth environments by reducing heavy page components, improving image and map efficiency, and strengthening mobile web compatibility. Interface accessibility can be further supported through adjustable font sizes, appropriate contrast settings, and clearer visual labels, especially for users with different levels of digital experience.

The evaluation involved 30 respondents from the selected study area, which limits the generalizability of the findings to other coastal communities. The study also focused only on the Usability characteristic of ISO 9126 and did not evaluate other software quality characteristics. Future research should involve a larger and more diverse respondent group from different coastal regions, compare usability perceptions across user

categories, and examine additional software quality aspects such as efficiency, reliability, and security according to the intended evaluation framework.

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