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Knowledge Management System Development Using Tiwana Roadmap and Agile Scrum at HP Service Center Denpasar

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Abstract: *This study aimed to design and develop a Knowledge Management System (KMS) for HP Service Center Denpasar by integrating the Tiwana roadmap framework and the Agile Scrum development method. The study addressed the lack of structured documentation for technical and operational knowledge, which was previously stored individually by senior technicians, administrative staff, and logistics staff. The Tiwana Roadmap was used to guide the stages of KMS development, including infrastructure evaluation, knowledge asset identification, system design, implementation, and evaluation. Agile Scrum supported iterative system development based on user needs and feedback. The developed KMS includes role-based access, knowledge documentation, service data management, knowledge search, FAQs, discussion forums, and reporting features. Evaluation was conducted using blackbox testing, the User Experience Questionnaire (UEQ), and Concurrent Think Aloud (CTA). The results indicated that the system functions were implemented successfully, user experience was positive, and several usability improvement points were identified. The developed KMS supports structured knowledge documentation and knowledge access at HP Service Center Denpasar.*

Keywords: *Knowledge Management System, Tiwana Roadmap, Angile Scrum, UEQ, CTA.*

1. Introduction

In the increasingly advanced digital era, knowledge has become a highly valuable asset for companies[1]. Knowledge can be used to improve efficiency, effectiveness, and competitiveness within an organization. One way to manage knowledge is by using a Knowledge Management System (KMS). A KMS is a systematic process designed to help companies collect, store, manage, and distribute knowledge[2]. Hewlett-Packard, better known as HP, is one of the leading technology companies in the world, based in the United States. Since it was founded by Bill Hewlett and Dave Packard in 1939, HP has become a pioneer in various technological innovations, including in the field of computers. HP computer products include various types of devices, ranging from desktops, laptops, printers, servers, to data storage devices. With the various features and specifications offered, HP computer products have been used by millions of people worldwide for personal, business, and government purposes[3].

However, along with their widespread use, various technical problems often arise, ranging from hardware and software issues to problems related to updates and maintenance. To handle these issues, HP has a network of service centers located in various cities around the world. In Indonesia, several HP Service Centers are also spread across provinces. PT. HARRISMA DEWATA JAYA has been appointed as the partner or representative of the HP Service Center for the Bali region, located at Jl. Merdeka No. 47 Renon, Denpasar[4]. HP Service Center Denpasar is a service center that handles various technical problems related to HP products. In carrying out its duties, this service center relies on broad and in-depth technical knowledge about HP products. This knowledge does not only include knowledge of product specifications and features, but also knowledge of various problems that may arise and how to solve them.

The knowledge possessed by technicians differs depending on their work experience. Sometimes, experienced senior technicians or employees are reluctant to share their knowledge with new technicians or new employees because they feel that the knowledge was obtained through personal experience or self-learning [5].

This knowledge may take the form of implicit knowledge, known as tacit knowledge, and explicit knowledge. These two types of knowledge are interconnected. Explicit knowledge can be articulated, such as scientific facts or mathematical formulas, while tacit knowledge refers to intuition or skills that are more difficult to explain in words. Explicit knowledge often comes from tacit knowledge that has been refined or structured into a concept that can be explained and communicated. Tacit knowledge is knowledge that exists in a person's mind, formed from individual understanding and personal experience. This type of knowledge is usually difficult to express in words because it has a highly personal quality. This becomes a challenge for a company when such knowledge is not documented. Therefore, a KMS is needed to help improve the performance quality of technicians, administrative staff, and logistics staff, which can serve as a reference in the future[6], [7]. Currently, at HP Service Center Denpasar, much of the tacit knowledge possessed by senior staff has not yet been documented. As a result, when new staff join the company, they may experience difficulties in learning the technical problems commonly found in HP products. Not all problems related to HP products can be found through references on Google or YouTube. Certain knowledge is obtained from training conducted by HP headquarters in Jakarta, which was previously attended by senior staff. Therefore, documenting this knowledge is very important[8].

The undocumented tacit knowledge found at HP Service Center tends to fall under the category of procedural knowledge. This type of knowledge explains how to perform certain tasks. For example, senior staff possess knowledge about how to repair HP devices, which is obtained through experience and training. This includes how to diagnose device damage, replace components, and perform physical repairs on laptops or printers. Nonaka and Takeuchi (1995) stated that tacit knowledge can be articulated and transformed into explicit knowledge through a process known as the SECI spiral. This process involves four stages: Socialization, Externalization, Combination, and Internalization. By using the SECI model, tacit knowledge categorized as procedural knowledge in this study can be transformed into documented explicit knowledge and shared with new staff[9], [10].

The knowledge represented in the development of the Knowledge Management System (KMS) at HP Service Center Denpasar belongs to the category of procedural knowledge. This knowledge includes various work procedures carried out by technicians, administrative staff, and logistics staff in handling HP device repair services. The solution to this problem is to redocument the knowledge possessed by senior staff, including technicians, administrative staff, and logistics staff. This will make it easier to handle similar problems or obstacles in the future and serve as knowledge management for the company. If senior staff leave the company, the existence of this knowledge management system can serve as a reference for understanding and implementing the established Standard Operating Procedures (SOPs), thereby improving work efficiency and service quality at HP Service Center Denpasar[11]. This study will develop a KMS based on the knowledge possessed by senior staff. It is expected that this KMS will allow all knowledge owned by senior staff at HP Service Center Denpasar to be documented and will facilitate the knowledge-sharing process for new staff, thereby improving work efficiency. Based on the explanation above, the author will conduct research by developing a Knowledge Management System (KMS) using the Tiwana Roadmap and one of the Agile methods, namely Scrum, as the system development method. For system testing, the User Experience Questionnaire (UEQ) will be used to assess overall user satisfaction with the KMS. The UEQ measures various aspects such as attractiveness, clarity, efficiency, dependability, and user satisfaction in using the system for HP Service Center Denpasar staff. In addition, the KMS will also be tested using Concurrent Think Aloud (CTA) as a comparison to the UEQ testing method.

2. Literature Review

2.1 Knowledge Management and Knowledge Management Systems

Knowledge management refers to the systematic effort to identify, capture, organize, store, share, and apply organizational knowledge so that it can support decision making, problem solving, and organizational performance. In this context, a Knowledge Management System (KMS) is not merely an information repository, but a socio-technical system that integrates people, processes, organizational culture, and information technology to enable knowledge creation, retention, dissemination, and reuse.

2.2 Tacit Knowledge, Explicit Knowledge, and the SECI Model

In technical service organizations, much operational knowledge exists as tacit knowledge because it is formed through experience, troubleshooting practice, and direct interaction with device problems. Tacit knowledge is difficult to transfer when it remains in the minds of senior staff. In contrast, explicit knowledge can be documented in the form of troubleshooting procedures, service notes, frequently asked questions, technical guidelines, and repair histories. The SECI model explains knowledge creation through four processes: socialization, externalization, combination, and internalization.

2.3 Tiwana Roadmap as a KMS Development Framework

The Tiwana Roadmap provides structured guidance for developing and evaluating a KMS through four major phases: infrastructure evaluation; KM system analysis, design, and development; system deployment; and performance evaluation. These phases are suitable for the HP Service Center Denpasar case because the organization needs to identify existing infrastructure, map knowledge assets, design a KMS blueprint, develop the system, deploy it gradually, and evaluate its performance.

2.4 KMS in Technical Service and After-Sales Service Environments

Previous studies on KMS implementation in service center and after-sales service environments indicate that service organizations require accessible knowledge repositories to support troubleshooting, customer service, and repeated problem handling. In a service center, recurring problems should not depend solely on individual memory or informal consultation.

2.5 Research Gap

Based on several previous studies, it can be concluded that the implementation of a Knowledge Management System (KMS) using the Tiwana Roadmap and the Agile Scrum method has proven to be effective in supporting organizational knowledge management and information system development. The study conducted by Ida Ayu Widyantari Arnawa, I Gede Aris Gunadi, and D. G. H. Divayana showed that the Tiwana Roadmap can be used as a systematic framework for identifying, collecting, documenting, and managing both tacit and explicit knowledge within an organization[12]. Meanwhile, the use of Agile Scrum helps make the system development process more flexible, faster, and more responsive to user needs.

In addition, the studies conducted by Meta Amalya Dewi and Rafi Irham, as well as Yarpriransa, Darjat Saripurna, and Heri Santoso, showed that the Agile Scrum method is effective when applied to the development of online-based applications. Scrum is able to divide the development process into several sprints, allowing each development stage to be evaluated periodically through user feedback[13]. This contributes to development time efficiency, system quality improvement, and the system's ability to adapt to user requirements.

In general, previous studies indicate that the combination of the Tiwana Roadmap as a knowledge management framework and Agile Scrum as a system development method is highly relevant for building a structured, adaptive, and user-oriented system. However, most previous studies have focused on government institutions or academic applications, while the implementation of KMS in a technical service environment such as HP Service Center Denpasar remains a relevant research opportunity. Therefore, this study holds an important position in developing a KMS that focuses on procedural knowledge documentation, knowledge transfer among staff, and the prevention of knowledge loss in a service center environment.

3.Methods

This study employs a Research and Development (R&D) approach to design and develop a Knowledge Management System (KMS) at HP Service Center Denpasar [14], [15]., as shown in Figure 1. below

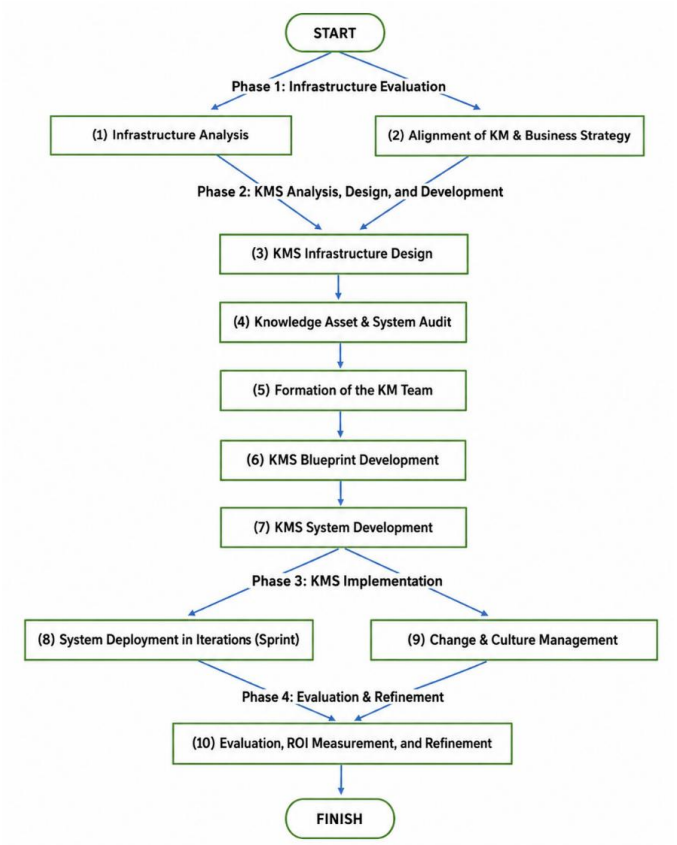

Figure 1. Reaserch Flow

3.1 KMS Development Stages Based on Tiwana Roadmap

The development of the KMS in this study refers to four main phases of the Tiwana Roadmap. Each phase consists of activities and outputs that serve as the basis for system development[16].

Table 1. KMS Development Stages Based on Tiwana Roadmap

Phase	Main Focus	Key Activities	Output
Phase 1: Infrastructure Evaluation	Evaluating organizational and technological readiness	Analyzing IT infrastructure and aligning KMS requirements with the business processes of HP Service Center Denpasar	Infrastructure readiness map and alignment of system requirements
Phase 2: KMS Analysis, Design, and Development	KMS analysis, design, and development	Designing the KMS infrastructure, auditing knowledge assets, forming the KM team, developing the blueprint, and building the system using Agile Scrum	KMS blueprint, KM team structure, knowledge asset list, and KMS prototype/application
Phase 3: KMS Implementation	System implementation and knowledge-sharing culture	Conducting gradual deployment and providing user training to encourage knowledge sharing	Usable KMS application and user adoption
Phase 4: Evaluation and Refinement	System evaluation and improvement	Evaluating user experience and refining the system based on evaluation results	System improvement recommendations

3.2 Data Collection Techniques

Data collection was conducted to obtain information related to system requirements, types of knowledge that need to be documented, and work processes at HP Service Center Denpasar. The data collection techniques include literature study, interviews, Focus Group Discussion (FGD), observation, and documentation.

3.3 System Development Using Agile Scrum

The system development process uses the Agile Scrum method so that the KMS can be developed iteratively, adaptively, and responsively according to user needs[17]. The Scrum stages used in this study include product backlog preparation, sprint planning, sprint backlog, feature development, testing, sprint review, and refinement [18], [19].

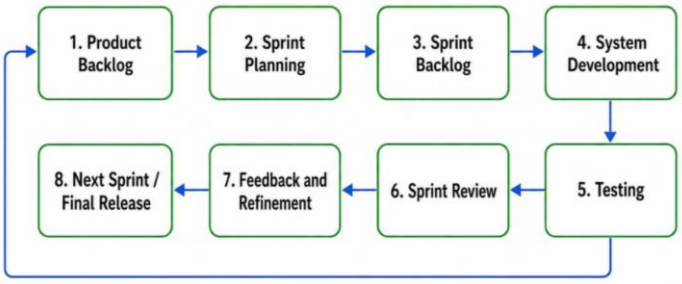

Figure 2. System Development Stages Using Agile Scrum

3.4 Knowledge Management System Features

The developed KMS consists of several main features that support the documentation, management, and dissemination of knowledge at HP Service Center Denpasar.

Table 2. Main Features of the Knowledge Management System

No.	Feature	User	Function
1	Login	Admin, technicians, logistics staff	Authenticates users based on email and password
2	Admin Dashboard	Admin	Displays service numbers, service progress, and documented knowledge data
3	Service Data Management	Admin	Manages incoming device data, technicians, service status, and repair actions
4	User Data Management	Admin	Adds, updates, and manages user access rights
5	Report	Admin	Displays service and knowledge reports based on selected periods
6	Staff Dashboard	Technicians and logistics staff	Displays knowledge being processed and work-related information
7	Service Knowledge Data Management	Admin and technicians	Adds, edits, deletes, and updates technical knowledge
8	Weekly Knowledge Update	Technicians	Documents weekly training results from HP Headquarters Jakarta

3.5 System Evaluation

User experience was evaluated using the (UEQ, while usability problems were identified using the CTA method. In addition, the knowledge search feature was evaluated through a query-based retrieval example using TF-IDF ranking. This study did not conduct a longitudinal operational performance evaluation; therefore, claims related to reduced dependence on senior staff, faster new staff adaptation, and improved operational efficiency are discussed as potential implications rather than CTA[20], [21].

Table 3. System Evaluation Methods

Evaluation Method	Evaluation Type	Respondents	Assessed Aspects	Output
User Experience Questionnaire	Quantitative	8 staff members of HP Service Center Denpasar	Attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty	User experience score
Concurrent Think Aloud	Qualitative	System users	Navigation ease, usage barriers, feature clarity, and task effectiveness	Usability findings and improvement recommendations
Blackbox Testing	Functional	Product owner and related users	Suitability of system input, process, and output	System function validation

3.6 Research Variables

The research variables consist of independent and dependent variables. The independent variable in this study is the implementation of the Knowledge Management System, while the dependent variable is the effectiveness of knowledge management and the improvement of operational support at HP Service Center Denpasar.

Table 4. Research Variables

Variable Type	Variable	Indicators	Measurement Technique
Independent Variable	Knowledge Management System Implementation	Implementation strategy, technology used, knowledge documentation, user training, and system features	Observation, interview, FGD, and blackbox testing
Dependent Variable	Effectiveness of Knowledge Management	Ease of knowledge access, efficiency of information retrieval, ease of documentation, and support for technician work	UEQ and CTA
Supporting Variable	Infrastructure Readiness	Availability of computers, servers, LAN, wireless LAN, and supporting devices	Infrastructure observation
Supporting Variable	User Acceptance	Satisfaction, ease of use, and user comfort	UEQ and CTA

4. Results and Discussion

4.1 Initial Data Collection Results

The initial data collection stage was conducted to understand the actual condition of knowledge management at HP Service Center Denpasar. The data were collected through direct observation, structured interviews, and Focus Group Discussion involving senior PC/laptop technicians, printer technicians, administrative staff, and logistics staff.

Table 5. Summary of Initial Data Collection Findings

Aspect	Main Finding	Implication for KMS
Knowledge form	Most knowledge is still tacit	Tacit knowledge needs to be externalized into explicit knowledge
Knowledge sources	Senior technicians, printer technicians, admin staff, and logistics staff	The KMS should support role-based knowledge documentation
Knowledge type	Procedural knowledge	The KMS should store diagnosis steps, hypotheses, technical reasons, and solutions
Knowledge-sharing pattern	Informal and dependent on direct communication	A centralized knowledge-sharing system is needed
Main risk	Knowledge loss due to staff turnover or rotation	The KMS should support organizational knowledge retention

4.2 Organizational Infrastructure Analysis

Infrastructure analysis was conducted using three main dimensions: people**,** process, and technology. The analysis shows that HP Service Center Denpasar has strong human resource potential, particularly due to the presence of experienced senior technicians. However, knowledge documentation has not yet been carried out systematically. From the technology perspective, the organization already has computers, internet access, LAN, wireless LAN, switches, access points, and a service administration system. Therefore, the existing infrastructure is considered sufficient to support the implementation of a web-based KMS.

Table 6. People, Process, and Technology Infrastructure Analysis

Component	Existing Condition	Problem Identified	System Requirement
People	PC/laptop technicians, printer technicians, admin staff, and logistics staff are available	Knowledge still depends heavily on senior individuals	Knowledge manager or senior validation role is needed
Process	Service activities follow SOPs from HP headquarters	Field-based procedural adjustments are not documented	A structured workflow for input, validation, and updating knowledge is needed
Technology	Computers, local servers, internet, LAN, WLAN, switches, and access points are available	No dedicated system for knowledge management	A web-based KMS is required for centralized access

4.3 KMS Development Using Agile Scrum

The KMS was developed using the Agile Scrum method because system requirements could change based on user feedback[22]. The development process began with product backlog preparation, followed by sprint planning, feature implementation, testing, and review with the product owner[23]. Agile Scrum allowed the development team to prioritize essential features and revise the system iteratively.

Table 7. Product Backlog of the KMS

ID	Backlog	Priority	Estimated Time	Purpose
B01	Product Category Management	90	2 days	Groups knowledge by device category
B02	Knowledge Input Module	95	4 days	Documents problems, hypotheses, and solutions
B03	Senior Technician Validation System	85	3 days	Ensures knowledge quality before publication

B04	Knowledge Search Feature	100	3 days	Speeds up solution retrieval based on cases
B05	File and Driver Repository	80	3 days	Stores supporting files such as drivers and firmware
B06	Troubleshooting Log	75	4 days	Captures practical field experience
B07	Logistics Module	70	3 days	Documents Macro, AWB, and spare-part issues
B08	Reporting and Analytics	60	3 days	Displays service and knowledge usage reports

4.4 Developed KMS Features

The developed system includes role-based login, admin dashboard, technician dashboard, knowledge base, knowledge search, FAQ, discussion forum, and reporting. In the technician dashboard, the system provides an input area for device problems, which are then analyzed using the TF-IDF method to display the most relevant solutions[24], [25].

Table 8. Main Features of the KMS

No.	Feature	User	Function
1	Role-based Login	Admin, technician, customer service, supervisor	Controls access based on user role
2	Admin Dashboard	Admin	Displays users, knowledge articles, FAQ, discussions, tickets, and service status
3	Technician Dashboard	Technician	Displays knowledge data, categories, tickets, and solution search area
4	Knowledge Base	Admin and technician	Manages repair solution articles
5	Knowledge Search	Technician	Displays solutions based on submitted problem queries
6	FAQ	Admin and technician	Stores frequently asked questions and official information links
7	Discussion Forum	Internal users	Supports case discussions and knowledge sharing
8	Reporting	Admin and supervisor	Displays service reports and knowledge usage data

4.5 TF-IDF-Based Knowledge Search Implementation

The knowledge search feature uses TF-IDF to calculate the relevance between technician queries and stored knowledge documents. An example query used in the system was “printer macet kertas nyangkut”. The calculation result showed that document D8: Error E4 Printer Printer Cannot Print obtained the highest score of 0.25481975 with 100% relevance, followed by document D15: Printer Cannot Pull Paper Properlywith a score of 0.20365406 and 79.92% relevance. This indicates that the system can display relevant solutions based on the problem entered by the technician.

Table 9. TF-IDF-Based Knowledge Search Result

Rank	Document ID	Document Title	Category	Raw Score	Relevance
1	D8	E4 Error: Printer Cannot Print	Printer	0.25481975	100.00%
2	D15	Printer Cannot Pull Paper Properly	Printer	0.20365406	79.92%

4.6 User Experience Questionnaire Evaluation

The user experience evaluation was conducted using the User Experience Questionnaire (UEQ), which assesses six dimensions: attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty. The UEQ result indicates that all evaluation dimensions obtained positive scores. Dependability, stimulation, and novelty were categorized as Excellent, while attractiveness, perspicuity, and efficiency were categorized as Good.

Table 10. UEQ Benchmark Result of the KMS

UEQ Dimension	Mean Score	Benchmark Category
Dependability	1.719	Excellent
Stimulation	1.750	Excellent
Novelty	1.750	Excellent
Attractiveness	1.666	Good
Perspicuity	1.719	Good
Efficiency	1.750	Good

4.7 Concurrent Think Aloud Usability Evaluation

The qualitative evaluation was conducted using the Concurrent Think Aloud method. Respondents were asked to use the system while verbally expressing their thoughts and experiences. This method helped identify usability issues and areas that required improvement, such as dashboard appearance, navigation buttons, search filtering, form validation, category clarity, and tag-based knowledge classification.

Table 11. CTA Findings and Improvement Recommendations

CTA Finding	Improvement Recommendation
The dashboard interface needs to be more attractive	Improve UI design to make it more modern and consistent
Navigation buttons need to be more visible	Use clearer button size, position, and visual emphasis
Search filters based on problem category are needed	Add filters for device type and damage category
The add-data button is not prominent enough	Move the add-data button to a more strategic position
Empty content validation is not yet available	Add form validation before saving data
Differences between knowledge categories are unclear	Add category descriptions or input guidelines
Tag or hashtag features are needed	Add tags to support classification and search
Timestamp is not easy to read	Improve date and time formatting

4.8 Discussion

The findings show that HP Service Center Denpasar still faces knowledge management problems because much technical knowledge remains tacit, individually stored, and shared informally. This creates a risk of knowledge loss when senior staff are unavailable or when staff turnover occurs. Using the Tiwana Roadmap, this study identified infrastructure readiness, mapped knowledge assets, designed the KMS blueprint, and developed the system iteratively through Agile Scrum. The developed KMS includes role-based access, a knowledge base, FAQ, discussion forum, reporting, and a TF-IDF-based knowledge search feature. The TF-IDF search feature was able to retrieve relevant knowledge documents based on a selected problem query, indicating that the system supports solution retrieval from documented knowledge. However, this result should be interpreted as feature-level evidence rather than direct evidence of improved operational efficiency. The UEQ evaluation showed positive user experience results, with all dimensions categorized as Good or Excellent. Meanwhile, CTA identified several usability improvements, including dashboard design, button visibility, search filters, form validation, category clarity, tagging, and timestamp readability. Overall, the KMS was successfully implemented and positively perceived by users. However, this study has not yet provided quantitative evidence that the system reduces dependence on senior staff, accelerates new staff adaptation, or improves operational efficiency. Future studies should include before-after measurements such as solution search time, frequency of repeated questions, knowledge reuse, and onboarding duration.

5. Conclusions

Based on the research results, HP Service Center Denpasar faces challenges in managing technical knowledge because much of the knowledge related to device repair, service procedures, and logistics activities is still tacit and individually stored by senior staff. This condition creates a risk of knowledge loss and makes the knowledge-sharing process dependent on informal communication. This study developed a Knowledge Management System using the Tiwana Roadmap as the knowledge management framework, the SECI model as the basis for transforming tacit knowledge into explicit knowledge, and Agile Scrum as the software development method. The developed system includes role-based login, dashboards, service data management, knowledge base management, FAQ, discussion forum, reporting, and TF-IDF-based solution search.

The system evaluation showed that the main functions worked according to the expected requirements, while the UEQ results indicated positive user experience across all evaluated dimensions. The CTA evaluation also identified several improvement needs, including interface enhancement, clearer navigation, search filters, form validation, category descriptions, tag-based classification, and better timestamp formatting. The TF-IDF search feature was able to display relevant solution documents for selected problem queries. Therefore, the developed KMS can support the documentation, storage, management, and retrieval of procedural knowledge at HP Service Center Denpasar. However, this study has not quantitatively proven that the system reduces dependence on senior staff, accelerates new staff adaptation, or improves overall operational efficiency. Future research should evaluate these impacts using before-after measurements, such as solution search time, frequency of repeated questions to senior staff, knowledge reuse rate, and new staff onboarding duration.

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