International Journal of Information Science and Management
Vol. 24, No. 2, 2026, 53-83
DOI / DOR:

Original Research

Analysis of the Database Knowledge Management System for MSMEs in Reog Ponorogo Handcrafts

Ghulam Asrofi Buntoro
Associate Prof., Computer Science and Information Technology, Department of Informatics Engineering, Faculty of Engineering, Universitas Muhammadiyah Ponorogo, Indonesia.
Corresponding Author: ghulam@umpo.ac.id
ORCID iD: https://orcid.org/0000-0001-5936-0359

Indah Puji Astuti
Assistant Prof., Software Engineering, Department of Informatics Engineering, Faculty of Engineering, Universitas Muhammadiyah Ponorogo, Indonesia.
indahpujiastuti@umpo.ac.id
ORCID iD: https://orcid.org/0000-0003-0281-4799

Wahna Widhianingrum
Assistant Prof., Human Resource Management, Department of Management, Faculty of Economics, Universitas Muhammadiyah Ponorogo, Indonesia.
wahnawidhia@umpo.ac.id
ORCID iD: https://orcid.org/0009-0007-0205-3842

Rizal Arifin
Associate Prof., Computational and Simulations, Faculty of Engineering, Universitas Muhammadiyah Ponorogo, Indonesia.
rarifin@umpo.ac.id
ORCID iD: https://orcid.org/0000-0002-3917-9963

Kuntang Winangun
Assistant Prof., Energy Conversion, Department of Mechanical Engineering, Faculty of Engineering, Universitas Muhammadiyah Ponorogo, Indonesia.
kuntang@umpo.ac.id
ORCID iD: https://orcid.org/0000-0001-7128-0028

Ali Selamat
Professor, Software Engineering, Malaysia-Japan International Institute of Technology, Universiti Teknologi Malaysia, Malaysia.
aselamat@utm.my
ORCID iD: https://orcid.org/0000-0001-9746-8459

Received: 24 January 2024
Reviewed: 20 February 2024
Accepted: 14 February 2026

Abstract

This research aims to develop and analyze the web-based database of the Knowledge Management System (KMS) in small, micro, and medium-sized handicrafts. The research flow comprised nine steps: Identification of Research Objectives, Literature Review, Identification of Data Requirements, Database Scheme Design, Database Implementation, KMS Application Development, Integration and Customization, Testing and Evaluation, and Analysis and Interpretation. The research begins with a literature review and visits MSME locations to conduct interviews, observations, and surveys to collect data for the KMS database. In the development phase, the web-based KMS also facilitates easier access to information and the management of a company's operations, thereby overcoming challenges posed by access constraints and physical distance. The contribution of this research is the provision of a web-based database for the knowledge management system of MSMEs Reog Ponorogo, including product, order, customer, staff, and report management, which can support better decision-making.

Keywords: Knowledge Management, Knowledge Management System, Databases, MSMEs, Reog Ponorogo Handcraft.

Introduction

Reog Ponorogo Handicrafts is an MSME based in Ponorogo, East Java, known for its reog handicrafts (Kristianto, 2019). They produce masks, sculptures, wall decorations, and accessories (Buntoro, Astuti & Widhianingrum, 2023). Reog Ponorogo's crafts are a cultural and tourism emblem, attracting demand in the region and abroad. These MSMEs play a crucial role in maintaining the region's culture and providing employment opportunities (Kristiyana & Rapini, 2017).

MSMEs, such as Reog Ponorogo Handcrafts, face challenges in selling their products online due to limited access to digital technologies and internet marketing (Wijayanto, Sugianto & Vidyastari, 2021). This hinders their ability to reach larger markets and maintain product quality. Factors such as resource scarcity, market trends, and competition from other producers contribute to these challenges (Atayde, Garduño, Robles & Zúñiga, 2021).

MSMEs such as Reog Ponorogo Handcrafts can improve their efficiency by implementing a knowledge management system (KMS) (Miftahurrohman & Wafiroh, 2022). KMS can enhance production, marketing, and business networks, maximizing internal resources. Advantages include leveraging extensive expertise, enhancing product quality, promoting products online, and improving interactions with clients and business partners. KMS also allows for tailored digital platforms for product promotion (Entas, 2017).

A knowledge management system (KMS) is a tool for managing information within an organization (Safriadi, Salam & Hazriani, 2015). Reog Ponorogo Handicrafts, a Micro, Small, and Medium Enterprise (MSME), can benefit from KMS in managing manufacturing processes, design, marketing, and management (Buntoro, Astuti, Widhianingrum, Arifin, Winangun & Selamat, 2023). KMS can enhance production, efficiency, and competitiveness; help MSMEs improve product quality; expand into new markets; and strengthen relationships. It also reduces operating expenses and time spent on redundant tasks (Humairoh & Budi, 2019).

This study focuses on developing a knowledge management system (KMS) for Reog Ponorogo Handcrafts, a micro, small, and medium enterprise (MSME) that lacks operational capabilities in technology, management, marketing, and finance (Khaliq, 2016). The KMS will assist in leveraging information technology and online marketing management for Reog Ponorogo's handcrafted goods, enabling them to adapt and thrive over the long term (Handayani, 2010). Both MSMEs and governments need to establish their own knowledge management frameworks to enhance quality and promote MSMEs (Rijanto & Dewintari, 2020).

Research on Knowledge Management System (KMS) database architecture focuses on developing innovative systems for micro, small, and medium enterprises (MSMEs) (Retnoningsih & Khasanah, 2019; Buntoro, Astuti & Widhianingrum, 2023). The article suggests that Indonesian MSMEs explore the benefits of digitalization and adopt better digital business practices and knowledge management (Jordão & Novas, 2022). Most KMS studies focus on adoption, diffusion, use, and implementation, with process approaches being rare. The author provides a critical overview of current approaches and suggests appropriate approaches for studying KMS in organizations (Santoso & Abdillah Karim, 2019). This study (Mohiuddin, Matei, Al-Azad & Su, 2022) shows how systematic and organized knowledge management can help organizations offer continuing education services effectively and improve performance in

a competitive market. This research aims to design and analyze a Knowledge Management System (KMS) database for the Ponorogo Reog Craft business, a micro, small, and medium enterprise (MSME) in Ponorogo.

Existing research on KMS in MSMEs often highlights the importance of knowledge sharing and digital tools but provides limited detail on how KM processes are embedded in the system's technical design, particularly at the database and feature levels. This gap is especially visible in cultural and handicraft-based MSMEs, where knowledge is highly experiential and rarely formalized.

This study addresses that gap by developing a database-driven KMS prototype explicitly structured around KM processes. Each key mechanism, knowledge capture, storage, organization, sharing, and retrieval is mapped to specific entities, relationships, and system functionalities. By demonstrating how KM theory can guide concrete system architecture in a real MSME context, this research contributes a process-informed design reference rather than only reporting adoption factors or perceived benefits.

How can a relational database-supported Knowledge Management System be designed and implemented to support knowledge capture, organization, and retrieval in handicraft MSMEs? This study follows a Design Science Research (DSR) paradigm, where the artifact is a web-based KMS prototype supported by a relational database schema.

Literature Review

A knowledge management system (KMS) enables an organization or corporation to efficiently manage, store, share, and optimize the use of its information and knowledge. Here are some literature reviews about the Knowledge Management System:

The research by Idrees, Xu, Haider and Tehseen (2023) explores the concepts of knowledge management and systems, their implementation challenges and opportunities, and the various technologies and methods for effective KMS. (Gao, Chai & Liu, 2018) Provide further details on KMS research, methodologies, results, reasons for implementation, advantages, and success factors.

The study explores knowledge management from various theoretical and practical perspectives, discussing fundamental ideas, strategies, processes, and technology used in organizations (Bennet & Bennet, 2014). It also discusses factors that affect workers' use of knowledge management systems. The research also discusses theories and models for examining knowledge management systems and their success, as well as the factors influencing their use (Nguyen, Truong, Nguyen, Nguyen & Tran, 2023).

Research on knowledge management systems (KMS) in MSMEs has shown that it can improve performance, competitiveness, and address challenges like a lack of qualified human resources and limited access to information (Bolisani, Scarso, Ceccato & Zieba, 2023). A case study in Malaysia's handicraft sector found that KMS can help address skills shortages and financial constraints. This article provides a comprehensive analysis of KMS evolution, considering cultural, technical, and managerial issues (Poh Choo Cheak, Wei Chong, Yen Yuen & Yoke Chu Leong, 2022).

Research on knowledge management systems (KMS) database architecture examines the development of innovative systems for micro, small, and medium-sized enterprises (MSMEs) (Retnoningsih & Khasanah, 2019; Sijabat, 2022). The article suggests that Indonesian MSMEs

should explore the benefits of digitization and adopt better business and digital knowledge management practices (Jordão & Novas, 2022). Most KMS studies focus on adoption, diffusion, use, and implementation, with process approaches being rare. The author provides a critical overview of current approaches and suggests appropriate approaches for studying KMS in organizations (Santoso & Abdillah Karim, 2019). This study (Mohiuddin et al., 2022) shows how systematic and organized knowledge management can help an organization offer continuing education services effectively and improve performance in a competitive marketplace.

Knowledge management (KM) may be described as the strategic process of optimizing the use of knowledge resources. While KM may be used at the individual level, it has recently attracted the attention of companies. Knowledge Management (KM) is regarded as a progressively significant field that facilitates the generation, dissemination, and use of an organization's knowledge (Becerra-Fernandez & Sabherwal, 2014).

Knowledge is a comprehensive and abstract concept that has shaped discussions about how humans understand and acquire knowledge in Western philosophy since ancient Greece. Recently, there has been an increasing focus on seeing knowledge as a valuable asset inside organizations (Alavi & Leidner, 1999). Researchers have begun advocating for knowledge management systems (KMS) that align with the focus on organizational knowledge and knowledge management (KM) (Hafeez, Shahzad, Helo & Mubarak, 2025).

The primary goal of Knowledge Management Systems (KMS) is to facilitate the generation, dissemination, and use of information inside businesses. Knowledge and knowledge management are intricate and multifaceted topics. Hence, the successful establishment and execution of KMS needs a strong grounding in several extensive bodies of knowledge (Alavi & Leidner, 2001). To establish credibility, KMS research and development must maintain and expand the substantial body of literature across several interconnected domains (Cerchione & Esposito, 2017).

Knowledge management mechanisms are organizational or structural methods used to promote knowledge management. The use of advanced information technologies, such as Web-based conferencing, facilitates knowledge management in ways previously unattainable. The term "knowledge management systems" refers to applications arising from the combination of advanced technology and social and structural forces (Becerra-Fernandez & Sabherwal, 2010). Knowledge management systems use a range of KM procedures and technology to facilitate knowledge management activities.

To demonstrate how KM concepts are translated into a working system, Table 1 maps key KM mechanisms identified in the literature to specific database entities and application features in the proposed KMS.

Table 1
Mapping of KM mechanisms to KMS implementation

KM Mechanism (Literature)	Conceptual Meaning	Database Components	System Features / Functions
Knowledge Capture	Converting tacit or scattered knowledge into a structured, storable form	knowledge, categories, users, knowledge_resources	Forms for adding new knowledge entries, upload of images, documents, and videos, and assignment of categories and tags

KM Mechanism (Literature)	Conceptual Meaning	Database Components	System Features / Functions
Knowledge Storage	Systematic preservation of knowledge for long-term access	knowledge, knowledge resources, products, relational links	Centralized database storage; structured categorization; file path storage for multimedia resources
Knowledge Organization	Structuring knowledge so it can be easily located and understood	categories, linking tables (e.g., knowledge_product)	Category-based menus; hierarchical classification; tagging and metadata fields
Knowledge Sharing	Enabling access and dissemination of knowledge among users	users, role attributes, access control rules	Web-based interface accessible to MSMEs; role-based access; viewing and browsing knowledge entries
Knowledge Retrieval	Searching and accessing relevant knowledge when needed	Indexed fields in knowledge, categories	Keyword search; category filtering; sorting by date/title
Knowledge Reuse	Applying existing knowledge to new products or activities	knowledge_product linking table	Knowledge linked to specific products; users can reference previous techniques or marketing practices
Knowledge Preservation	Safeguarding cultural and experiential knowledge from loss	knowledge, knowledge_resources	Documentation of cultural background, production steps, and visual materials in digital form

Knowledge management is significant despite the evolving technical infrastructure in businesses. Emerging technologies enable firms to deepen their knowledge of asset management through more innovative and efficient approaches. Studies (Hussein, Akhavan & Mohammadi Fateh, 2023) knowledge management have generated an awareness that small- and medium-sized enterprises (SMEs) need to be able to exploit sources of knowledge outside the firm using external relationships, but this understanding has not been followed up by an adequate theoretical and empirical research effort to analyze the role of relationships in an SME's knowledge management processes (Polas, Tabash, Bhattacharjee & Dávila, 2023).

Relational databases are essential components of knowledge management systems, enabling businesses to perform various knowledge management tasks, such as capturing, storing, transferring, and applying information (Zhang, 2017). Designing, developing, and implementing a relational database-based system to streamline these procedures is difficult and burdensome due to their complexity. The conclusion of the study (Iskandar, Jambak, Kosala & Prabowo, 2017) emphasized big data as the most contemporary topic for future research, alongside the growing need for Knowledge Management System (KMS) capabilities and feature development.

To provide a coherent theoretical basis, this study adopts a knowledge management process perspective as its primary conceptual framework. KM literature commonly describes

organizational knowledge activities as a set of interrelated processes, including knowledge creation or capture, storage, organization, sharing, and reuse. These processes are particularly relevant for MSMEs, where knowledge is often tacit, fragmented, and weakly documented.

In this research, the KM process model serves as a design-oriented framework that guides the translation of abstract KM concepts into system components. Rather than focusing solely on behavioral or organizational success factors, the study emphasizes how each KM process can be operationalized through database structures and application features.

For system evaluation, the study draws loosely on perspectives on KMS success that consider system quality and perceived usefulness. However, the evaluation remains exploratory and centered on feasibility and initial user perception rather than formal success modeling.

While many studies discuss Knowledge Management Systems in terms of technological adoption, system success factors, or general benefits, fewer works explicitly adopt a process-oriented approach. In this study, a process approach refers to designing a KMS by starting from core knowledge management processes such as knowledge capture, storage, organization, sharing, and retrieval, and then systematically translating these processes into data structures, system modules, and user interactions.

Rather than focusing only on the presence of a KMS or user attitudes toward it, a process approach emphasizes how each KM process is operationalized within the system architecture. This includes identifying what data must be captured, how it is structured in relational tables, how users contribute and access knowledge, and how different types of knowledge are linked.

Materials and Methods

The research on the Knowledge Management System (KMS) Database for MSMEs in Reog Ponorogo Handcrafts follows a standard research flow, comprising the following steps (Figure 1).

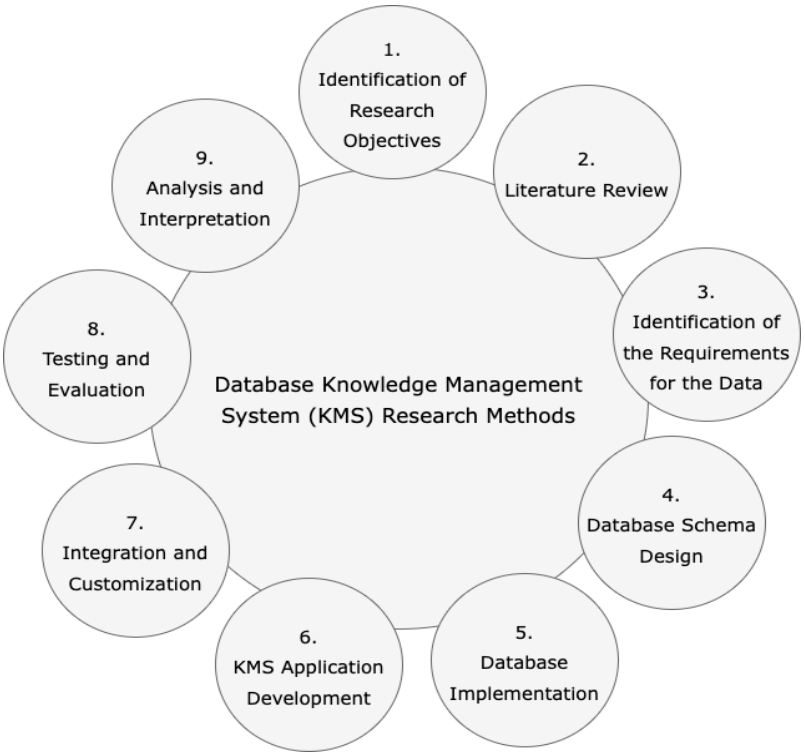

Figure 1: Database Knowledge Management System *(KMS) research methods*

1. Identification of Research Objectives The research focuses on identifying issues faced by MSMEs through interviews, observations, and surveys conducted with artisans and sellers regarding handcrafted products (Buntoro Astuti, Widhianingrum, Arifin, Winangun & Selamat, 2023).

2. Literature review: This research examines the core concepts, database use, and KMS framework in MSMEs, highlighting the paucity of research on its application among Reog Ponorogo craftsmen and sellers (Grandinetti, 2016).

3. Identification of the data requirements for this study informs data collection for the KMS database, using sources such as the literature (Iskandar et al., 2017), interviews, observations, and surveys, including documents, articles, images, and videos, thereby aiding database schema design.

4. Database Scheme Design. This research focuses on designing the structure and scheme of a KMS database (Becerra-Fernandez & Sabherwal, 2014), including primary entities, relationships, attributes, index schemes, and performance factors.

5. This research focuses on implementing a database schema using MySQL within a database management system (Zhang, 2017), creating tables for various stakeholders: users, craftsmen, sellers, buyers, products, distributors, suppliers, and stores.

6. KMS Application Development. The study focuses on developing a user interface for a KMS connected to a database, ensuring an intuitive and user-friendly design for operations such as adding, deleting, and searching for knowledge (Becerra-Fernandez & Sabherwal, 2014).

7. Integration and Customization in a KMS application must integrate with existing business systems and processes to adapt to user needs and feedback, ensuring seamless interaction and efficient organization (An & Wang, 2010).

8. Testing and Evaluation: The system undergoes rigorous testing to ensure reliability, security, and performance, with user evaluation conducted using black-box testing (Lee & Xia, 2010). Black Box Testing Techniques using Decision Table Testing: Uses tables to test combinations of inputs and expected outputs (Barraood, Mohd, Baharom & Almogahed, 2023).

9. Analysis and Interpretation, the analysis phase involves evaluating the data from testing and evaluation, identifying the benefits, drawbacks, and challenges of KMS, and providing interpretations and suggestions for improvement (Lee & Xia, 2010).

Stakeholder data collection

To identify system requirements and understand knowledge practices in Reog Ponorogo handicraft MSMEs, data were collected through interviews, field observations, and questionnaires involving artisans and sellers.

- **Interviews**: Semi-structured interviews were conducted with 10 MSME actors (artisans and business owners). Participants were selected through purposive sampling, targeting individuals directly involved in the production or sale of Reog Ponorogo handicrafts and with practical knowledge of daily business operations. Interview questions focused on current knowledge-sharing practices, challenges in documenting production techniques, information needed for marketing, and difficulties in retrieving past experience or documentation.
- **Observations**: Field observations were carried out at JOGLO REYOG GALERY MSME workshops or business locations. The observation protocol focused on how knowledge

was stored (e.g., in notebooks, through verbal transmission, or in digital files), how production steps were documented (if at all), and how product and marketing information was managed in practice.

- **Questionnaires**: A structured questionnaire was distributed to 20 respondents, consisting of artisans and sellers. The questionnaire included closed- and open-ended items on the types of knowledge considered important, preferred forms of documentation (text, images, video), and perceived difficulties in accessing business-related information.

Data Analysis

The collected data were analyzed using a combination of descriptive and qualitative approaches:

- Questionnaire responses were summarized using descriptive statistics (e.g., frequency of preferred knowledge types and documentation formats).
- Interview and observation notes were analyzed through thematic grouping, where recurring themes such as cultural knowledge, production techniques, product variations, and marketing practices were identified and used to inform the system's knowledge categories and feature design.

The purpose of this analysis was not to test hypotheses, but to derive contextual system requirements and structure the initial knowledge taxonomy for the KMS prototype. The KMS manages unstructured resources such as documents, images, and videos using a file-reference approach rather than storing large binary objects directly in database tables.

Storage strategy

Multimedia files are stored in the server's file system (or external storage directory), while the database stores only metadata records and file paths. Each resource record includes attributes such as resource_id (primary key), file name, file type (image, document, video), file path or URL, upload date, and a short description. This approach reduces database size, improves backup efficiency, and avoids performance degradation associated with large BLOB storage.

Linkage to knowledge and other entities

Unstructured resources are linked to other entities through foreign key relationships:

- Each resource is associated with a specific knowledge item via knowledge_id (knowledge: many resources).
- The uploading user is recorded through user_id, enabling traceability of contributions.
- When relevant, resources can also be indirectly associated with products through the knowledge-product relationship, as some knowledge items linked to products include supporting multimedia documentation (e.g., production-step photos).

This design allows multimedia materials to function as supporting evidence or illustrations for structured knowledge entries, while maintaining a clear relational structure and manageable database performance. In the KMS data model, knowledge is the primary conceptual entity, denoting structured information entries such as descriptions of cultural background, production techniques, design variations, or marketing practices. A knowledge item can exist independently as general knowledge (e.g., the history or symbolism of Reog Ponorogo) and

does not necessarily require a direct link to a specific product.

Knowledge resources refer to supporting materials associated with a knowledge item, such as images, documents, or videos. The relationship between knowledge and knowledge resources is one-to-many: a single knowledge entry may have multiple related multimedia resources that illustrate or complement its textual explanation.

The product entity represents tangible handicraft items produced by MSMEs, such as specific mask types or costume components. The relationship between knowledge and products is optional and many-to-many. Some knowledge items are directly linked to products (e.g., a tutorial describing how to produce a specific mask type), while others are broader and not product-bound (e.g., cultural history, symbolism, or general marketing strategies). A linking table is used to associate knowledge entries with relevant products when such a relationship exists.

Thus, the phrase "knowledge tables cannot stand alone" in the earlier version was misleading. More precisely, knowledge forms the core entity, while links to resources and products are contextual enrichments rather than mandatory dependencies.

The KMS prototype uses a MySQL relational database designed to balance data consistency, flexibility, and performance.

Normalization approach

The database schema was designed to approximately satisfy Third Normal Form (3NF). Core entities such as knowledge items, categories, users, and multimedia resources are stored in separate tables to minimize redundancy and ensure data integrity. For example, category information is decoupled from knowledge records via foreign keys, enabling changes to the taxonomy without duplicating category names. A moderate level of normalization was chosen to maintain structured data relationships while avoiding excessive table fragmentation that could complicate query performance in a small-scale deployment.

Indexing strategy

Indexes were created on frequently queried attributes, including primary keys, foreign keys linking knowledge items to categories and users, and selected text fields used in keyword search (e.g., titles and tags). These indexes improve retrieval speed for common operations, such as category filtering and date-based sorting. Because the current search mechanism relies on SQL-based keyword matching rather than full-text indexing, indexing focuses on structural fields rather than deep text optimization. Future versions may adopt MySQL full-text indexing or external search engines for larger datasets.

Scalability considerations

To support future growth, multimedia files (images and documents) are stored as file references rather than large binary objects directly in database tables. This reduces database size and improves backup and query performance. The schema design also allows incremental addition of new knowledge categories and records without structural changes. However, the current system has been tested only in small-scale settings; large-scale deployment would require additional measures, including database optimization, content delivery strategies for media files, and potentially distributed storage solutions.

Overall, the present design prioritizes data integrity and moderate performance for a pilot-scale KMS, while leaving room for more advanced optimization and scalability enhancements in future implementations.

Results

The results from the compiled research stream on Database Knowledge Management System (KMS) research methods are presented.

1. Identification of research objectives

The study investigates the challenges faced by MSMEs in Reog Ponorogo during the COVID-19 pandemic, revealing a decline in sales and instances of individuals resorting to risky practices.

2. Literature review

The study aims to explore the application of Knowledge Management System (KMS) concepts and databases in MSMEs, with a specific focus on Reog Ponorogo artisans and perpetrators, a gap that has not been addressed in previous research.

3. Identification of the requirements for the data

The data collection phase determines the format for the KMS database, including papers, articles, photographs, and videos, sourced from literature studies, interviews, observations, and surveys. This simplifies and improves the schema-building process, ensuring accurate data entry.

4. Database scheme design

The study plans to organize and navigate a Knowledge Management System (KMS) database using Entity-Relationship Diagrams (ERDs) and Unified Modeling Language (UML) class diagrams. The KMS system includes tables for users, products, knowledge, shops, craftsmen, REOG, showing, and MSMEs.

The KM process framework directly informed the database design and system functionality:

- Knowledge Capture is supported by input forms and database tables for structured entries of knowledge, categories, and associated multimedia resources.
- Knowledge Storage is implemented using a relational schema that separates knowledge items, categories, products, and resources to ensure organized, persistent data storage.
- Knowledge Organization is implemented through category hierarchies, tagging fields, and relational links between knowledge and products.
- Knowledge Sharing is enabled by the web-based interface and role-based access, which allow MSME users to view and contribute knowledge.
- Knowledge Retrieval and Reuse are supported by keyword search, category filtering, and the linkage of knowledge to specific products and practices.

Thus, the KM process model functions as a conceptual bridge between theory and technical design: each process corresponds to specific entities, relationships, and user interactions within the KMS. In the conceptual UML class diagram, Admin, MSME users, and Government Tourism Office users are depicted as specialized user types to highlight their distinct

responsibilities within the system. However, in the actual database implementation, these actors are stored in a single Users table with a role attribute indicating their access level (e.g., admin, msme, government). Thus, the subclass distinction is primarily conceptual, whereas the physical data model employs a unified structure to enhance maintainability and simplicity.

Role-Based Access Control (RBAC) is enforced at the application level using this role attribute. Each authenticated user is assigned permissions based on their role:

- Admin users have full privileges, including creating, editing, deleting, and categorizing knowledge; managing users; and maintaining system configuration.
- MSME users can create and edit their own knowledge entries, upload related resources, and manage information related to their products, but cannot modify system-wide taxonomies or other users' data.
- Government Tourism Office users (as currently modeled) have read access to most knowledge content and may contribute selected cultural or promotional information, but do not have authority to alter or delete MSME-generated data.

Access rules are enforced through server-side authorization checks that verify user roles before permitting create, update, or delete operations. Therefore, while the design is presented in the UML diagram using subclass terminology for clarity of roles, the implementation follows a single-user-table model with role-based permission control, which improves scalability and simplifies future role additions.

To clarify the data model, key entities in the KMS database include Users, MSMEs, Knowledge, Categories, Knowledge_Resources, Products, and associative tables linking these entities.

Primary and foreign keys

Each main entity has a unique primary key:

- user_id in Users
- msme_id in MSMEs
- knowledge_id in Knowledge
- category_id in Categories
- resource_id in Knowledge_Resources
- product_id in Products

Foreign keys define relationships between entities. For example:

- msme_id in Products links each product to its producing MSME.
- user_id in Knowledge identifies the contributor or author of the knowledge entry.
- category_id in Knowledge links knowledge to its classification.
- knowledge_id in Knowledge Resources associates multimedia materials with a knowledge item.
- A linking table (e.g., Knowledge_Product) contains knowledge_id and product_id as foreign keys to represent associations between knowledge and products.

Cardinalities between entities

- One MSME can have many Products (1: N).
- One User can contribute many Knowledge entries (1: N).

- One Category can contain many Knowledge items (1: N).
- One Knowledge item can have many Knowledge_Resources (1: N).
- Knowledge and Products have a many-to-many (M: N) relationship via the linking table, since a knowledge entry may describe multiple products and a product may be associated with multiple knowledge items.

Versioning and update history

In the current prototype, knowledge updates are managed using timestamp fields (e.g., created_at, updated_at) within the Knowledge table. The system maintains only the latest version of each knowledge entry, and previous versions are not automatically preserved in a separate history table. Therefore, version control is limited to tracking when a record was last modified, rather than maintaining a full revision history.

Comprehensive versioning,g such as storing historical revisions, tracking change authorship, or enabling rollback, has been identified as a future enhancement to better support knowledge evolution and accountability.

The four main knowledge categories, Reog cultural knowledge, Production Technology, Craft Products, and Marketing,g were not arbitrarily defined. They were derived through an iterative requirement elicitation process combining (1) literature on knowledge domains relevant to handicraft MSMEs and cultural industries, and (2) field data from interviews and questionnaires with Reog Ponorogo MSME actors. Respondents frequently grouped their knowledge needs around (a) cultural background and symbolism, (b) production techniques and materials, (c) finished craft products, and (d) marketing and sales practices. These recurring themes informed the initial design of the taxonomy.

Figure 2 presents the Unified Modeling Language (UML) Class Diagram of the Database Knowledge Management System (KMS), which comprises the classes or tables admin, MSMEs, and the Government Tourism Office. For a class or table, users can create, read, update, and delete knowledge. Class or knowledge tables cannot stand alone; they require class or knowledge resources and products.

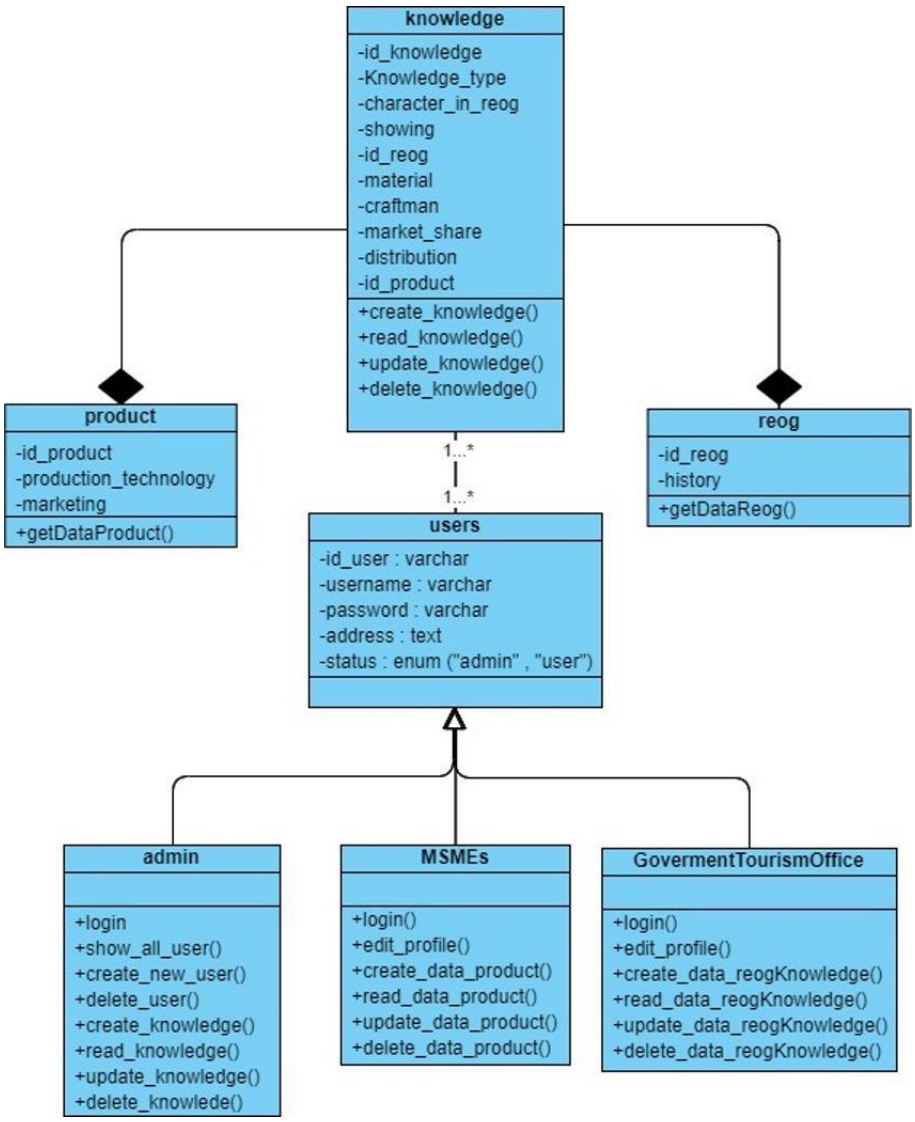

Figure 2: Unified modeling language (UML) Class diagrams database knowledge management system (KMS)

Figure 3 is the Entity Relationship Diagram (ERD) Database Knowledge Management System (KMS) car that describes entities (such as user, product, knowledge, shop, craftman, reog, showing, and MSMEs), with attributes (such as id_user, first_name, last_name, address, telephone number, type_user, id_product, production_technology, marketing, id_knowledge, knowledge_type, id _reog, character_in_reog, showing, material, craftmann, market_share, distribution, id-shop, shope_name, product_craftman, name, history, id-show name, place_show, time, id_MSMEs, name_MSMEs, and address), as well as relationships.

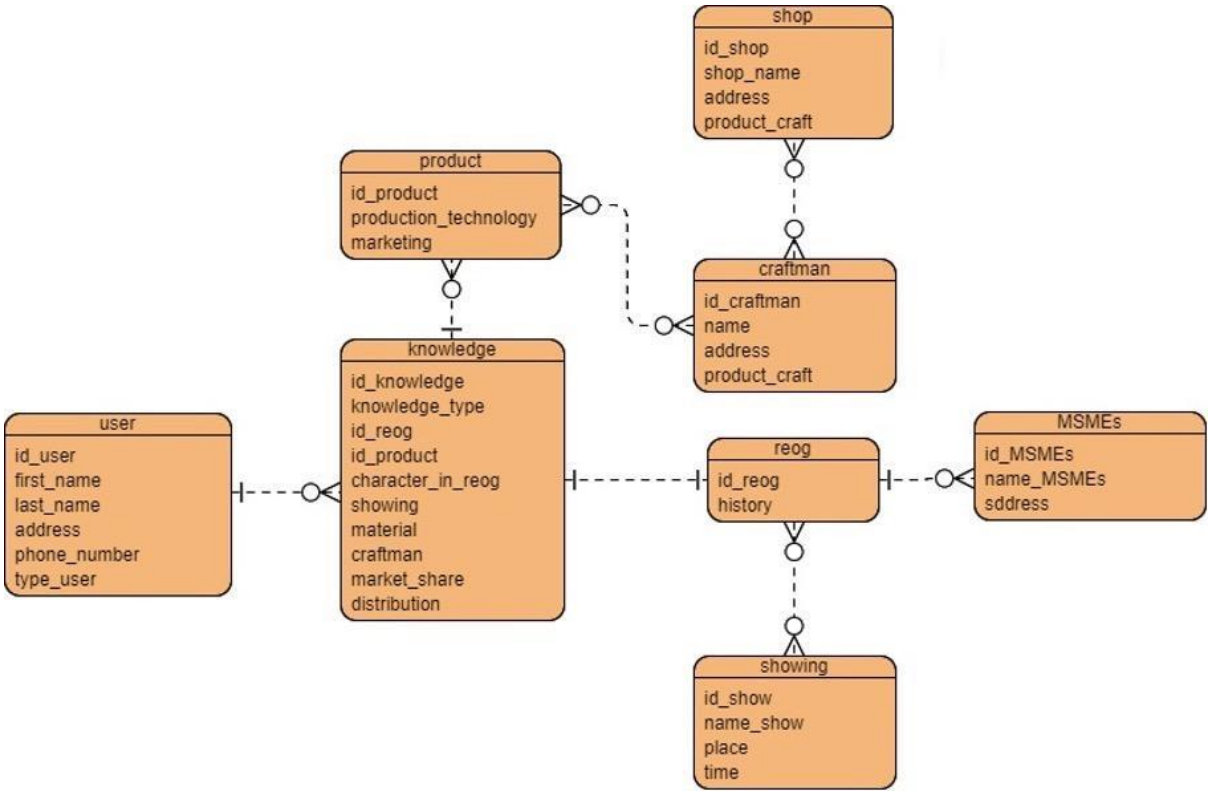

Figure 3: Entity relationship diagram (ERD) Database knowledge management system (KMS)

5. Database implementation

After designing a KMS database schema, the next step is to determine whether to implement it in a database management system (DBMS). This is the next stage of this research. In implementing the KMS database design, this research creates tables for users, products, knowledge, shops, craftsmen, REOG, showing, and MSMEs (Figure 4).

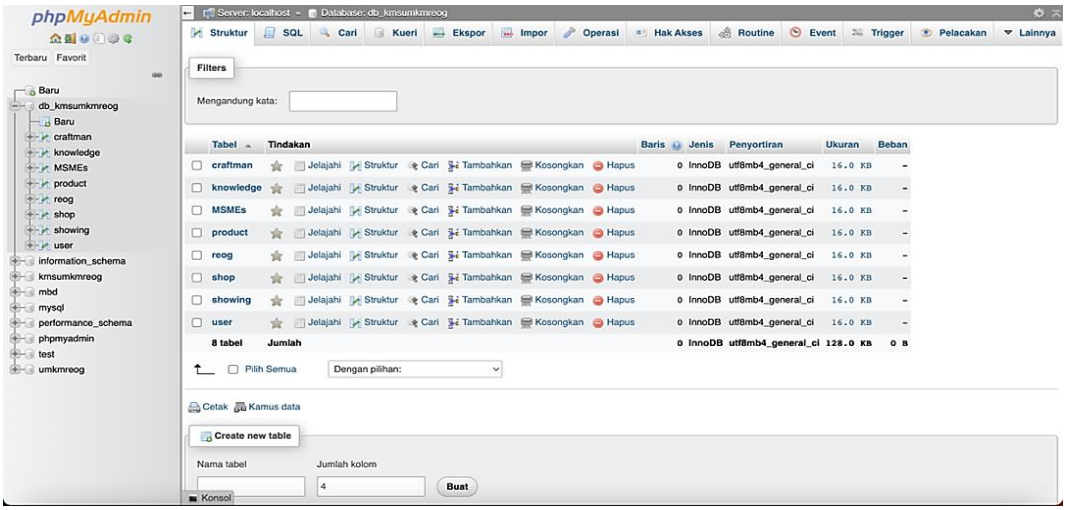

Figure 4: Implementation of database knowledge management system (KMS) research methods

6. Web-based MSMEs Reog Ponorogo KMS application development

The next step is to develop a user interface for KMS that is connected to the database. The web-based MSME Reog Ponorogo KMS application supports operations such as adding,

deleting, and searching for knowledge. Moreover, the built-in display design should be intuitive and user-friendly, making it easy for users to operate, which is a key consideration in this study.

According to the KMS database schema, for web-class or user tables, the KMS MSME Reog Ponorogo comprises the Admin, MSMEs, and the Government Tourism Office. This stage involves building a web-based KMS Reog Ponorogo application with an intuitive, user-friendly interface. In addition, the login page must support login for the admin, MSMEs, and the government tourism office.

6.1. Admin login page

Figure 5 is the Display Login Page of the Admin Web Knowledge Management System (KMS) for MSMEs Reog Ponorogo. For login, you can use a username, email address, or password (Figure 5).

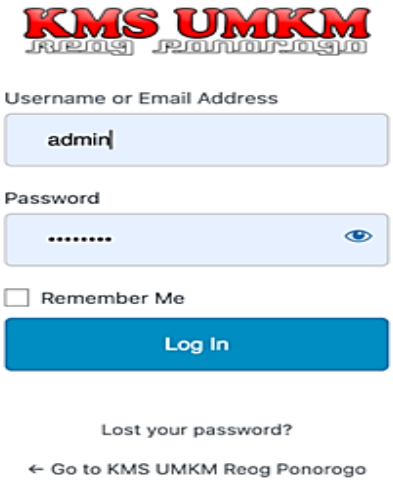

Figure 5: Login page admin knowledge management system (KMS) MSMEs Reog Ponorogo web-based

6.2. MSMEs login page

Figure 6 is the display of the MSMEs login page for the web Knowledge Management System (KMS) at MSMEs Reog Ponorogo. To log in, you can use your username, email address, and password.

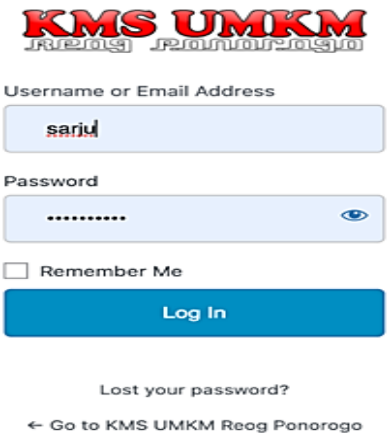

Figure 6: MSMEs login page knowledge management system (KMS) MSMEs Reog Ponorogo web-based

6.3. The login page of the Government Tourism Office

Figure 7 shows the login page of the government tourism office web knowledge management system (KMS) for MSMEs in Regency Ponorogo. To log in, you can use your username, email address, and password.

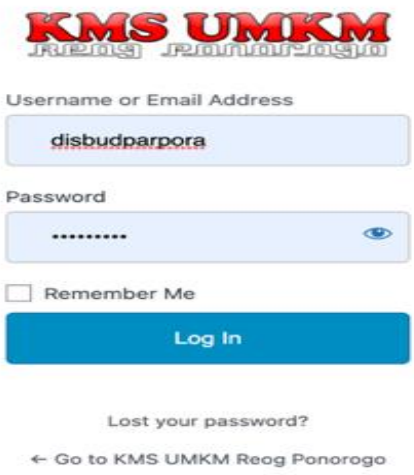

Figure 7: Login page, government tourism office, knowledge management system (KMS), MSMEs, Reog Ponorogo, web-based

6.4. Main page of the web-based KMS MSMEs Reog Ponorogo application

Figure 8. This is the Web-based Knowledge Management System (KMS) Application Main Page of MSMEs Reog Ponorogo. On this page, there is a login menu in the top right and a KMS Reog Ponorogo menu in the top left, which contains Reog menus, production technology, Reog craft results, and marketing.

On the main page, there is a search feature to find knowledge on MSMEs Reog Ponorogo that has been entered into the KMS MSMEs Reog Ponorogo database. On the main page, the title "Knowledge about MSMEs Reog Ponorogo" is accompanied by features. sorted knowledge, that is, to display the most recently entered or disordered knowledge, sorted from the oldest entered into the database. The aim is to make it easier for us to find knowledge on the KMS website.

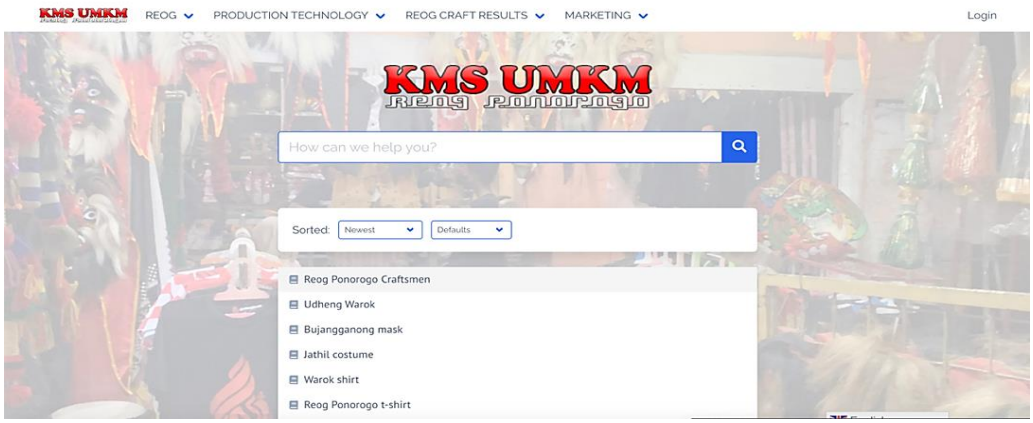

Figure 8: Main page of MSMEs Reog Ponorogo web-based knowledge management system (KMS) applications

6.5. The knowledge pages of MSMEs Reog Ponorogo

All knowledge about Reog and the MSMEs Reog Ponorogo that has been collected is then entered into the KMS MSMEs Reog Ponorogo database, and the knowledge is subsequently displayed on the web, organized into four menus and pages.

The Reog menu

The Reog Menu is used to access the page and obtain comprehensive information about Reog Ponorogo. On this page, there is a search function for knowledge, with results sorted by the most recent database insertions or the oldest in the KMS MSMEs Reog Ponorogo.

In Figure 9, we observe knowledge rooted in the history of the Reog Ponorogo and its figures, namely the Curious Dadak, the Klonosewandono, the Warok, the Bujangganong, and the Jathil. Knowledge of the performance of Reog Ponorogo begins with the largest event of Ponorogo, the National Festival of Reog Ponorogo (FNRP), which is part of the series of Grebegsuro Ponorogo events.

Besides, there is a regular ponorogo performance every month at the main stage of the aloon-aloon ponorogo, called the full moon reog performance. There are also Ponorogo regong performances at the village clean-up event in Ponorogo. Regarding the schedule of dates, there is no one, but every year there must be a village clean-up festival in Ponorogo, usually in Muharram or Suro.

Reog Ponorogo shows are usually held at the Krempyeng market, which is held by the village government every 35 days. Unscheduled rego performances are rego performances in social devotions, such as marriage, birth, and chitanan.

Menu production technology

On the menu and this page, you will find information from MSME Reog Ponorogo on the technology of producing Ponorogo reog handicrafts, from raw materials to suppliers and craftsmen.

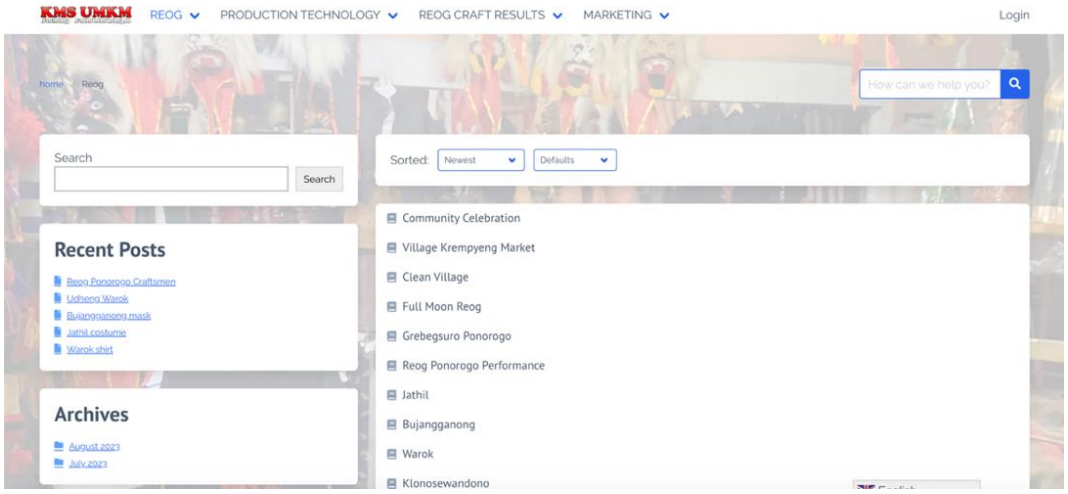

Figure 9: Knowledge Reog page in the knowledge management system (KMS) MSMEs Reog Ponorogo web-based

In Figure 10, It is shown that the searching features and sorted knowledge of MSMEs Reog Ponorogo on the technology of production of Reog Ponorogo crafts, one of which is the raw

material of the manufacture of leopard and head of lion barong, are: bamboo (bamboo apus), fur fur, leopard's skin (now the cow's skin is painted the motif of the skin of the lion), bludru fabric, monte, wooden paint, yarn of bed, and nails.

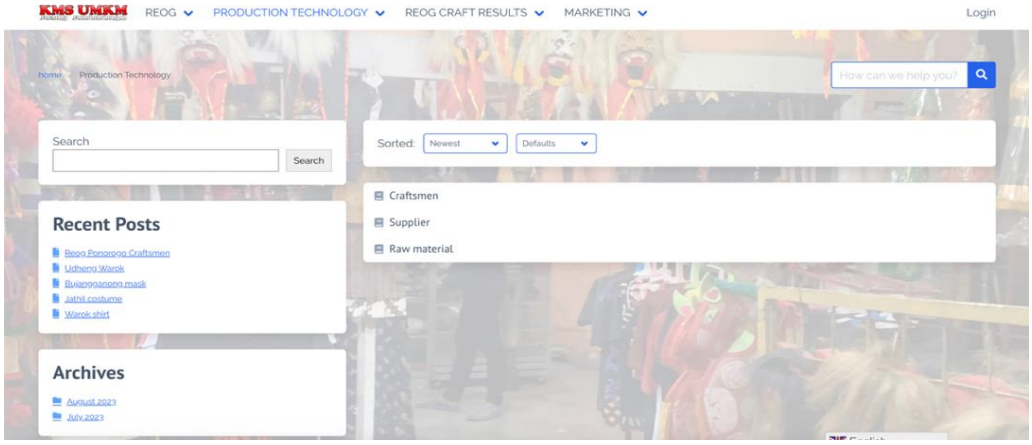

Figure 10: Knowledge page production technology in knowledge management system (KMS) MSMEs Reog Ponorogo web-based

Menu Reog craft results

Knowledge MSMEs Reog Ponorogo Next is displayed in the menu results of Reog Knowledge; on this page, you can see the result of the craft or cinderamata Reog Ponorogo, among other things: klonosewandono masks, miniature sudden peacock and singo barong, key chains of sudden peacock and singo barong, reog ponorogo shirts, complete clothes with udheng ponorogo warok, complete jathil costumes, eblek or jaranan jathil, complete bujangganong costumes, bujangganong masks, drums, ketipung, trumpets, angklung, and others.

Figure 11 is a knowledge page of Reog Crafting Results, or cinderamata, by craftsmen and MSMEs of Reog Ponorogo. On this page, users can search for knowledge using the search feature or by sorting by the latest or longest knowledge entered in the KMS MSMEs Reog Ponorogo database.

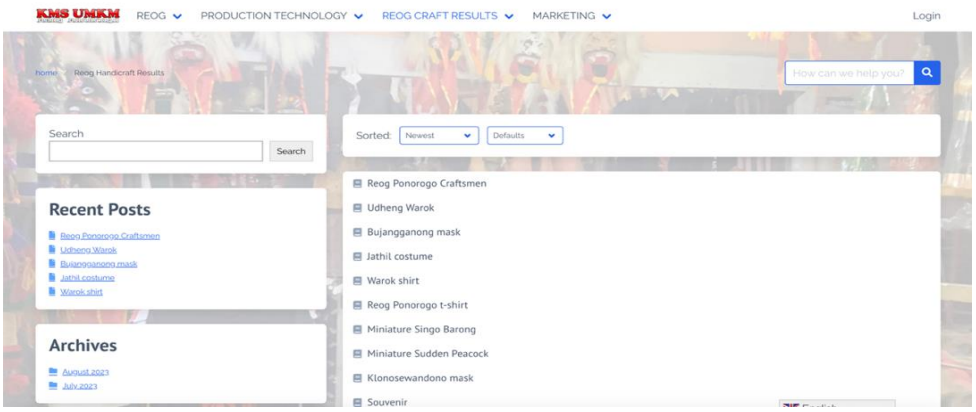

Figure 11: Reog knowledge results in the knowledge management system (KMS) at MSMES Reog Ponorogo web-based

The marketing menu

The next knowledge page in the web KMS MSMEs Reog Ponorogo that has been built is the marketing page. This page also includes a search and sorting feature that enables users to find the knowledge they seek. As shown in Figure 12, the market share for the marketing of reog ponorogo handicrafts has continued to this day. For the marketing of local-level Reog Ponorogo Handicraft products, there are cinderamata stores and MSMES. For market share and product distribution, Reog Podorogo not only covers local domestic markets such as Medan, Solo, Yogyakarta, Surabaya, Jakarta, Jember, and other cities in Indonesia. Even some craftsmen are already able to export because they have networks or communities abroad.

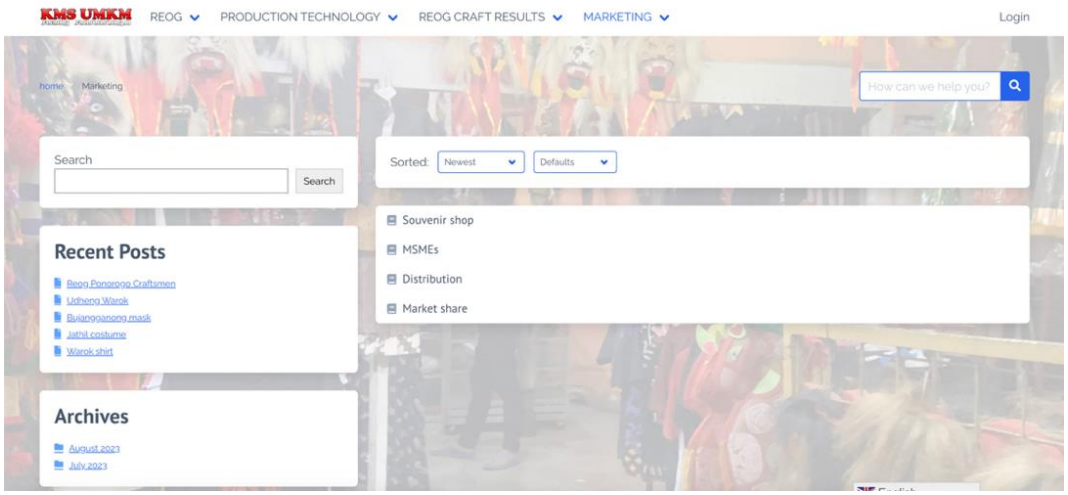

Figure 12: Marketing knowledge page in the knowledge management system (KMS) MSMEs Reog Ponorogo web-based

7. Integration and adjustment

After building a web-based KMS MSMEs Reog Ponorogo application, the next step is to integrate it with the existing business system or process. The existing business process, which has been carried out for many years, is conventional marketing, i.e., selling directly to the craftsman or MSMEs in Regency Ponorogo (Figure 13).

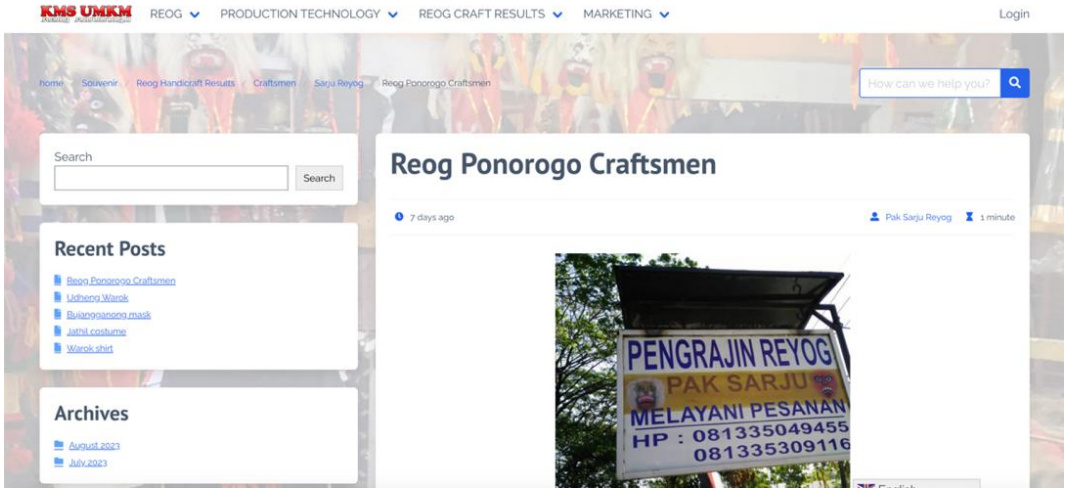

Figure 13. Page posting of MSMEs, Reog Ponorogo craftsmen and perpetrators in the knowledge

8. Testing and evaluation

The current study delivers a fully implemented Knowledge Management (KM) module and partially implemented business-support modules (Table 2). Product, customer, and staff data structures are implemented at the database level, while order management and reporting remain conceptual extensions prepared in the schema but not yet operational in the user interface.

Table 2
Implementation status of claimed KMS modules

Module	Database Schema	Interface	Evaluation
Knowledge Management	√	Partial	Functional testing
Product Management	√	Partial	CRUD tested
Customer Management	√	Partial	CRUD tested
Staff Management	√	Partial (user roles)	Login/role test
Order Management	√ (conceptual tables)	x	Not evaluated
Reporting	Conceptual	x	Not evaluated

Next, it performs system testing to ensure good performance. User evaluation in this study is conducted using black-box testing techniques (Table 3).

Table 3
Test results using blackbox testing

Test ID	Input	Output	Test Results
T01	The user opens the KMS application web address.	The system redirects to the web KMS application landing page.	Succeeded
T02	User logged in	If the username and password combination is correct, the system will redirect to the dashboard page; if they are incorrect, a warning will appear.	Succeeded
T04	Users can use the password reset feature by entering their email addresses.	The system will send a password reset link to the email address provided by the user, and, upon clicking it, the user will be directed to the new password form.	Succeeded
T05	User pressing home menu	The system will redirect the user to the KMS dashboard home page of the user's web application.	Succeeded
T06	The user presses the posts menu.	The system will redirect to the knowledge page already inserted in the web KMS application.	Succeeded
T07	The user presses the Add New submenu on the Posts menu to add new knowledge.	The system will open the posting form to enter knowledge, and after the user presses publish, the knowledge will appear on the KMS web application page.	Succeeded

Test ID	Input	Output	Test Results
T08	Users can press the category submenu on the post menu to view the knowledge categories.	The system will redirect the page to the knowledge categories available in the KMS web application.	Succeeded
T09	The user presses "Add new category" to create a new knowledge category.	The system will redirect to the knowledge category page in the web application KMS after entering the name of the new knowledge category and pressing Add New.	Succeeded
T10	The user presses the media menu.	The system will redirect to the media library page of the web KMS application.	Succeeded
T11	The user clicks the Add New Media submenu on the media menu to add a new media item.	The system will redirect to the page for uploading a new media photo or video to the KMS web application.	Succeeded
T12	User pressing menu pages	The system will redirect to the knowledge pages within the KMS web application.	Succeeded
T13	The user selects the Add New submenu in the Pages menu to add new page knowledge.	The system will redirect to the Add New Pages page for adding new pages to the web KMS application.	Succeeded
T14	The user presses the user menu	The system will redirect to the user page that exists in the KMS web	Succeeded
T15	The user clicks Add New Submenu in their menu.	The system will redirect to the Add New User page to add new users to the KMS web application.	Succeeded
T16	The user clicks the profile submenu on the user menu.	The system will redirect the user to the KMS web application's user profile page for editing.	Succeeded
T17	The user presses menu settings.	The system will redirect to the general settings page to edit the title, URL, and email for the KMS web application.	Succeeded

Table 1 shows that most menus in the web-based Reog Ponorogo MSMEs KMS application already show valid functionality. In addition to black-box functional testing, a limited user-centered evaluation was conducted during the pilot deployment. A small group of MSME users interacted with the system to enter and retrieve knowledge items, and subsequently provided feedback via short questionnaires and informal interviews. The evaluation focused on perceived ease of use, menu clarity, and the usefulness of the knowledge organization, rather than on controlled usability experiments.

No formal usability testing protocol, such as measuring task completion time, analyzing error rates, or using standardized instruments like the System Usability Scale (SUS), was employed. Therefore, conclusions regarding usability are based on qualitative feedback and general user impressions rather than on quantitative performance metrics.

Users generally reported that the menu structure and categorization facilitated the

identification of relevant knowledge more easily than informal document storage. However, these perceptions should be interpreted as initial indications of usability, and not as verified evidence of efficiency improvement.

The black-box testing (T01–T17) evaluated whether each system function operated in accordance with its specified input–process–output behavior. A test case was considered successful when all of the following conditions were met:

1. The system accepted valid input without error,
2. The intended database operation (insert, update, delete, or retrieve) was executed correctly,
3. The resulting data were stored and could be retrieved accurately, and
4. The interface displayed confirmation or output consistent with the expected system behavior.

Thus, "success" referred not only to screen display but also to the correct processing and storage of data at the database level. During testing and pilot use, several minor issues were identified, including inconsistent input validation messages for empty fields and occasional delays when uploading large image files. These issues were corrected during system refinement and did not result in data loss. No critical functional failures were observed in the tested features.

Regarding performance and security, testing was limited to small-scale pilot conditions. The system remained responsive under typical use by a small number of users, but no formal load testing was conducted. Basic access control, implemented through user authentication and role-based permissions, was in place; however, no penetration testing or formal security assessment was conducted. Therefore, conclusions about system robustness under heavy load or against advanced security threats are beyond the scope of this study.

In addition to functional testing, limited attention was given to basic non-functional aspects during system deployment. Reliability was assessed informally by repeatedly using the system during the pilot phase; no critical system crashes or data loss events were observed. Basic security measures were implemented at the application level, including user authentication, role-based access control, and password-protected logins, but no formal penetration testing or security audits were conducted. Performance was observed in terms of responsiveness under normal usage conditions with a small number of concurrent users; no load or stress testing was performed.

Therefore, the non-functional evaluation in this study should be understood as preliminary and operational, intended to ensure that the prototype functions adequately in a limited pilot context. Comprehensive testing of scalability, security robustness, and system resilience, such as load testing, vulnerability assessment, and backup–recovery validation, remains an important direction for future development and research.

The study did not include formal load testing, penetration testing, or disaster recovery evaluation; thus, conclusions regarding system reliability, security, and scalability are limited to small-scale pilot conditions.

9. Analysis and interpretation

Data analysis from testing and evaluation is crucial for designing a web-based Knowledge Management System (KMS). It involves identifying the advantages, disadvantages, and challenges of KMS, interpreting the research results, and offering suggestions for improvement.

The design should account for user requirements, knowledge management capabilities, and the potential for future adjustments. MSMEs such as Ponorogo Reog Crafts can optimize their knowledge management and decision-making processes by using an integrated web-based KMS, thereby increasing efficiency and productivity. The results of KMS implementation should account for the advantages, implementation success, limitations, and potential for future enhancements. Reog Ponorogo Crafts can utilize KMS to its full potential to manage knowledge and enhance organizational efficiency.

Discussion

This study designs and analyzes the Knowledge Management System (KMS) database for Reog Ponorogo Craft, a micro, small, and medium enterprise (MSME) in Ponorogo. The findings from this study can be applied to micro, small, and medium-sized enterprises (MSMEs), particularly in the Ponorogo Regency craft sector. The findings of this study are a KMS MSMEs reog ponorogo web application that can guide craftsmen and the general public to find complete knowledge about reog ponorogo. His knowledge encompasses the history of Ponorogo reog, its figures, performance schedules, production technology, from raw materials to their origins, and the market share and marketing of Ponorogo reog SME craft products. Based on the results of black-box testing, the design of the Knowledge Management System (KMS) database for Reog Ponorogo MSMEs has been successfully implemented in a web-based KMS application, with test instructions executed successfully.

The system currently presents separate login interfaces for administrators, MSME users, and the Government Tourism Office. This separation is primarily at the interface and routing level, intended to provide role-specific entry points and reduce confusion for users with different responsibilities. However, authentication itself is handled through a shared user database with role attributes that determine access permissions after login.

Thus, the separation does not constitute three independent authentication endpoints but rather multiple role-oriented login pages that share the same underlying access control mechanism. Once authenticated, users are directed to dashboards and menus appropriate to their assigned roles. From a usability perspective, the role-specific login pages were considered helpful during early deployment, as many MSME users are not accustomed to multi-role systems and may find role selection after login confusing. From a maintainability perspective, however, a unified login page with role-based redirection would be more efficient, reducing duplication in interface management and simplifying future expansion. Therefore, the current design reflects a pragmatic approach to early-stage usability, whereas future system refinement may consolidate authentication into a single entry point with automatic role detection and redirection, thereby improving scalability and maintainability.

In addition to knowledge-related entities, the database schema includes tables for orders, customers, and staff. These components were designed to facilitate integration between knowledge management and core business operations. However, in the current prototype, their implementations differ in maturity. The customer management component is implemented at a basic level, allowing administrators to store and update customer identity and contact information associated with product or order records. The staff management component supports role definition (e.g., administrator, contributor) and user account management for system access control. These functions are operational but were not the primary focus of user

testing. The order management component is currently limited to structural support within the database schema and to simple record-entry forms. Advanced operational features, such as order status tracking, transaction history visualization, and automated reporting, were not yet fully developed in the interface and were therefore not evaluated during the pilot phase.

Consequently, the present study focuses on the system's knowledge management functionalities, whereas the order, customer, and staff modules should be understood as foundational extensions for future integration rather than as fully realized enterprise management features. The study explored users' information needs through questionnaires and interviews, which included background variables such as education level, employment status, type of work, and primary business interests. These variables were analyzed using descriptive statistics and simple cross-tabulation, complemented by qualitative interpretation of interview responses. No inferential statistical tests or predictive models were applied; therefore, the findings should be understood as indicative patterns rather than statistically validated relationships.

Descriptively, several tendencies were observed. Respondents directly involved in craft production more frequently expressed interest in knowledge of raw materials, production techniques, and tool use. In contrast, MSME actors involved in sales and distribution reported greater interest in marketing strategies, market coverage information, and product presentation. Participants with higher levels of formal education tended to emphasize structured documentation and written guides, whereas those relying more on experiential learning highlighted the value of visual materials, such as photographs and videos. These patterns suggest that different user groups may prioritize different types of knowledge within the KMS, although further research with larger samples and statistical analysis would be required to confirm these relationships.

From all test scenarios using the black box method, the results show that all features in the website is functioning as planned. The findings of research conducted by (Grandinetti, 2016) are that the existence of a knowledge management system has raised awareness that small and medium enterprises (SMEs) must be able to utilize knowledge sources outside the company by using external relationships, but the findings of this research have not been followed up on implementation, so this research implements KMS into Reog Ponorogo MSMEs. Research on knowledge management systems (KMS) in MSMEs indicates that they can enhance performance and competitiveness and overcome challenges such as a shortage of qualified human resources and limited access to information (Bolisani, Scarso, Ceccato & Zieba, 2023).

A case study in the Malaysian handicrafts sector found that KMS can help overcome skills and financial shortages (Hassan, 2020). Research on Knowledge Management System (KMS) database architecture focuses on developing innovative systems for micro, small, and medium enterprises (MSMEs) (Retnoningsih & Khasanah, 2019; Buntoro, Astuti & Widhianingrum, 2023). The article suggests that Indonesian MSMEs explore the benefits of digitalization and adopt better digital business practices and knowledge management (Jordão & Novas, 2022). Most KMS studies focus on adoption, diffusion, use, and implementation, with process approaches being rare. The author provides a critical overview of current approaches and suggests appropriate approaches for studying KMS in organizations (Santoso & Abdillah Karim, 2019).

This study (Mohiuddin et al., 2022) shows how systematic and organized knowledge management can help organizations offer continuing education services effectively and

improve performance in a competitive market. To explain the relationship previously mentioned with that carried out in this research, the web-based knowledge management system (KMS) of Reog Ponorogo crafts, a Reog Ponorogo micro, small, and medium enterprise (MSMEs), it can be said that Reog Ponorogo MSMEs carry out various activities whose main objective is to improve the performance, efficiency, and effectiveness of MSMEs in facilitating appropriate decision-making and obtaining user satisfaction. The results of this research include an introduction to Reog Ponorogo MSMEs and sources of Reog Ponorogo crafts, the latest web-based MSME services, market share information, and marketing, which collectively generate knowledge for users and customers.

The results of the analysis of KMS application users for Reog Ponorogo Craft MSMEs indicate that education, employment status, type of work, and interests influence the information they seek from the KMS web application. Finally, analyze users' and customers' perceptions of the KMS MSMEs Reog Ponorogo Crafts web application, as well as the data sources derived from user and customer knowledge in the KMS database. The KMS database contains basic knowledge about Ponorogo reog, reog figures, performance schedules, production technology, and the origins of raw materials, ranging from raw materials to the production of Ponorogo reog crafts such as miniature reog, Klonosewandono masks, bujangganong, etc., and marketing to the present day.

Although these four categories are presented as main menus in the current interface, they are implemented in the database as configurable category records, rather than as fixed program code. System administrators can add, rename, or reorganize categories and subcategories through the category management interface. This allows the knowledge taxonomy to evolve as new knowledge domains emerge or as the system is adapted to other MSME contexts.

However, in the present study, the right to modify taxonomy was limited to administrators to maintain consistency during the pilot phase. Ordinary end-users (contributors) could add knowledge entries within existing categories, but could not independently create new top-level categories. Future development may include controlled, user-driven taxonomy expansion, such as proposing new categories for administrative approval, to support scalability while preserving structure. The search functionality in the current KMS prototype is implemented using keyword-based matching on selected text fields (such as knowledge title, short description, and tags) stored in the relational database. The system does not yet implement advanced full-text indexing or semantic search; instead, it relies on SQL-based string matching to retrieve relevant records.

In addition to keyword search, users can apply category-based filtering to narrow results by knowledge domain (e.g., cultural knowledge, production techniques, marketing). Basic sorting features, such as by date of entry or title, are also available. Currently, filters are applied alongside keyword searches, allowing users to refine results by both text queries and selected categories. However, more advanced multi-parameter filtering (e.g., by product type, contributor, or geographic origin) has not yet been fully implemented and remains an area for future enhancement.

Regarding language handling, the system currently stores content primarily in Indonesian, reflecting the local MSME user context. The database design supports standard Unicode text storage, allowing multilingual entries; however, no dedicated multilingual interface, translation support, or language-based filtering is yet provided. As a result, search operates only at the

literal keyword level and does not account for cross-language equivalence. Future development could integrate multilingual metadata and language-aware search features to broaden accessibility.

Further research needs to address the shortcomings of the KMS database for Ponorogo reog craft MSMEs, including the completeness of historical data on Ponorogo reog and the availability of comprehensive data on craftsmen and Ponorogo reog craft MSMEs. The findings of this research indicate that the storage and management of knowledge from both users and customers can improve the service quality of Reog Ponorogo craft MSMEs. In addition, creating, storing, and managing customer knowledge, when implemented with effective technology and information management, can further improve the quality of service that Reog Ponorogo crafts for MSMEs provide to users.

Although the system was developed within the specific context of MSMEs producing Reog Ponorogo handicrafts, its design contains both domain-specific and generic, transferable components.

The domain-specific elements primarily relate to the cultural and product taxonomy embedded in the knowledge structure. These include categories such as Reog performance history, specific character figures, traditional costume components, and locally distinctive production materials. Entity attributes describing Reog-related events, cultural terminology, and region-specific market information also reflect the unique characteristics of the Reog Ponorogo craft ecosystem. These components would require adaptation when applying the system to other handicraft domains.

In contrast, the system's generic components are transferable to other MSMEs, particularly those in craft and cultural industries. These include the overall database architecture, the separation between knowledge items and multimedia resources, role-based user management, categorization mechanisms, search and retrieval functions, and the linkage between knowledge records and product information. The underlying support for key KM processes-knowledge capture, storage, sharing, and reuse-is not specific to Reog Ponorogo and can be reconfigured with different taxonomies and content types.

Although the KMS design includes several stakeholder categories at the system level, not all of them were equally involved in the empirical phases of this study. Stakeholders can be distinguished into actively engaged participants and conceptually modeled users.

The actively engaged stakeholders in this research were primarily:

- Reog Ponorogo craftsmen and MSME owners, who participated in interviews, observations, and questionnaires during the requirement elicitation phase, and
- A subset of these MSME actors participated in the limited pilot of the system, contributing knowledge entries and testing system features.

These participants directly influenced the identification of knowledge categories, system requirements, and initial data population.

In contrast, the Government Tourism Office was included in the system design as a potential institutional user who could, in the future, contribute cultural information, event schedules, or promotional content. However, representatives from this office were not formally involved in system development, data entry, or evaluation during the study period. Their role in the current research is therefore limited to a conceptual and architectural consideration,

intended to reflect possible future integration with public-sector stakeholders.

Accordingly, the empirical findings regarding system use, usability, and perceived usefulness are based solely on the experiences of MSME actors and should not be interpreted as reflecting the perspectives of government or other external institutions.

It is important to note that this study did not measure changes in productivity, product quality, sales performance, or other quantitative business indicators before and after KMS adoption. User feedback collected during the pilot phase was limited to perceptions of ease of use and usefulness in accessing knowledge. Consequently, any claims regarding efficiency or performance enhancement should be understood as anticipated benefits grounded in KM theory rather than empirically verified outcomes in this study.

A key limitation of this study is the incompleteness of the current KMS database. At the time of evaluation, the system lacked comprehensive historical documentation of Reog Ponorogo crafts, nor did it fully cover all craftsmen and MSMEs operating in the region. This partial coverage may introduce several forms of bias.

First, usage patterns observed during the pilot may reflect the distribution of currently available content rather than actual user information needs. Knowledge categories with more entries may appear more frequently accessed simply because they are better represented in the system. Second, the perceived usefulness of the KMS may be underestimated or uneven across user groups if certain craft techniques, product types, or local practices relevant to them are not yet documented. Third, statements about market coverage based on the stored data should be interpreted with caution, as the absence of certain MSMEs or product lines may yield an incomplete picture of the regional handicraft ecosystem.

Therefore, the current findings primarily demonstrate the feasibility and initial usability of the KMS rather than providing a comprehensive representation of the Reog Ponorogo craft sector. Future system deployment should prioritize broader data population and stakeholder participation to reduce these biases and improve the representativeness of the knowledge base.

Conclusion

This study presented the design and demonstration of a web-based Knowledge Management System (KMS) supported by a relational database to address knowledge organization needs in MSMEs (UMKM) producing Reog Ponorogo handicrafts. Using a Design Science Research approach with an embedded case study, the research produced two main artifacts: (1) a structured KMS database schema and (2) a functional web-based prototype implementing core knowledge management processes. The developed system supports key KM activities, including knowledge capture, storage, organization, and retrieval, covering domains such as Reog Ponorogo cultural knowledge, production technologies, craft products, and marketing practices. Functional testing indicates that the main system features operate as intended, and limited pilot use suggests that users find the system helpful for documenting and accessing structured knowledge. These findings demonstrate the technical feasibility and contextual relevance of implementing a KMS tailored to handicraft MSMEs. However, this study does not provide longitudinal or quantitative evidence of improvements in business performance, productivity, or financial outcomes. Therefore, the contribution of this research should be understood primarily as a design and implementation study demonstrating how KM concepts can be translated into a functioning system in an MSME context. The findings indicate

that the proposed KMS prototype is technically feasible and usable within the Reog Ponorogo MSME context. Limited pilot use suggests that users perceive the system as helpful for organizing and accessing structured knowledge. However, this study did not include baseline comparisons or longitudinal performance measurements. Therefore, the results should be interpreted as evidence of design validity and initial usability, while potential improvements in efficiency or organizational performance warrant examination in future impact-oriented studies. The study has several limitations. It focuses on a single MSME domain and involves a relatively small number of pilot users. In addition, some business-support modules, such as order management and reporting, are currently implemented only at the database schema or conceptual level and were not fully evaluated in operational use. Future research should extend this work by conducting longitudinal impact studies, applying the system in multiple MSME contexts to test generalizability, and enhancing the platform with features such as analytics dashboards, recommendation mechanisms, and integration with government MSME support programs. Future work may extend this study through technical, methodological, and organizational directions. Technically, the system can be enhanced with analytics dashboards, recommendation features, and more advanced search and multimedia management capabilities. Methodologically, longitudinal and comparative studies across different MSME sectors are needed to evaluate the impact of KMS adoption. At the policy level, the platform could be integrated into government-supported MSME and cultural industry programs to enable broader knowledge sharing and sustainability.

Acknowledgements

This study was supported by the Directorate of Research and Community Service (DRPM) of the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia through the PDUPT grant program, with contract number 117/VI.4/PN/2023, dated 12 April 2023.

References

Alavi, M. & Leidner, D. (1999). Knowledge management systems: Issues, challenges, and benefits. *Communications of the Association for Information Systems*, 1, 1-37. https://doi.org/10.17705/1cais.00107

Alavi, M. & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly: Management Information Systems*, 25(1), 107–136. https://doi.org/10.2307/3250961

An, X. & Wang, W. (2010, August). The integrated use of business continuity management systems, records management systems and knowledge management systems. In *2010 International Conference on Management and Service Science (pp. 1-4). IEEE*. https://doi.org/10.1109/ICMSS.2010.5576713

Atayde, R., Garduño, R., Robles, E. & Zúñiga, P. (2021). Market competition and firm productivity and innovation: Responses in Mexican manufacturing industries. *Regional Science Policy and Practice*, 13(4), 1185–1214. https://doi.org/10.1111/rsp3.12417

Barraood, S. O., Mohd, H., Baharom, F. & Almogahed, A. (2023). Verifying agile black-box test case quality measurements: Expert review. *IEEE Access*, 11, 106987-107003. https://doi.org/10.1109/ACCESS.2023.3320576

Becerra-Fernández, I., & Sabherwal, R. (2010). *Knowledge Management: Systems and Processes* (Vol 1). London, England. M.E. Sharpe, Inc. Retrieved from https://peter.quantr.hk/wp-content/uploads/2021/07/Knowledge-Management-PDFDrive.com-.pdf

Becerra-Fernández, I. & Sabherwal, R. (2014). *Knowledge Management: Systems and Processes* (Vol. 2). Routledge, London. https://doi.org/10.4324/9781315715117

Bennet, A. & Bennet, D. (2014). Knowledge, theory and practice in knowledge management: Between associative patterning and context-rich action. *Journal of Entrepreneurship Management and Innovation (JEMI)*, 10(1), 5–55. https://doi.org/10.7341/20141011

Bolisani, E., Scarso, E., Ceccato, R. & Zieba, M. (2023). Knowledge management implementation in small and micro KIBS: A categorization. *Knowledge and Process Management*, 30(3), 241–253. https://doi.org/10.1002/kpm.1723

Buntoro, G. A., Astuti, I. P. & Widhianingrum, W. (2023). Web-based knowledge management system design on micro, small, and medium enterprises (MSMEs) Reog Ponorogo. *Proceedings of the 4th Borobudur International Symposium on Science and Technology 2022 (BIS-STE 2022)*, (pp. 696–705). https://doi.org/10.2991/978-94-6463-284-2_74

Buntoro, G. A., Astuti, I. P., Widhianingrum, W., Arifin, R., Winangun, K. & Selamat, A. (2023). Knowledge management system for handcrafted Reog Ponorogo Products. *The Electronic Journal of Knowledge Management (EJKM)*, 21(2), 130–139. https://doi.org/10.34190/ejkm.21.2.3026

Cerchione, R., & Esposito, E. (2017). Using knowledge management systems: A taxonomy of SME strategies. *International Journal of Information Management*, 37(1, Part B), 1551–1562. https://doi.org/10.1016/j.ijinfomgt.2016.10.007

Entas, S. (2017). Implementasi Knowledge Management pada UKM Sentra Pengrajin Sepatu di Desa Kotabatu, Ciomas, Kabupaten Bogor. *Jurnal Teknik Komputer*, 3(1), 124–128. https://doi.org/10.31294/jtk.v3i1.1475 [in Indonesian]

Gao, T., Chai, Y. & Liu, Y. (2018). A review of knowledge management about theoretical conception and designing approaches. *International Journal of Crowd Science*, 2(1), 42–51. https://doi.org/10.1108/IJCS-08-2017-0023

Grandinetti, R. (2016). Absorptive capacity and knowledge management in small and medium enterprises. *Knowledge Management Research & Practice*, 14(2), 159-168. https://doi.org/10.1057/kmrp.2016.2

Hafeez, S., Shahzad, K., Helo, P. & Mubarak, M. F. (2025). Knowledge management and SMEs' digital transformation: A systematic literature review and future research agenda. journal of innovation & knowledge, 10(3), 100728. https://doi.org/10.1016/j.jik.2025.100728

Handayani, D. S. (2010). Knowledge management: Alternatif strategi meningkatkan kinerja perusahaan. *JBTI: Jurnal Bisnis: Teori dan Implementasi*, 1(2), 246–256. https://doi.org/10.18196/jbti.v1i2.2420 [in Indonesian]

Humairoh, H. & Budi, A. (2019). Integrasi intellectual capital dan knowledge management serta dampaknya terhadap peningkatan kinerja penjualan UKM Kota Tangerang. *Dynamic Management Journal*, 3(2), 30–40. https://doi.org/10.31000/dmj.v3i2.1959 [in Indonesian]

Idrees, H., Xu, J., Haider, S. A. & Tehseen, S. (2023). A systematic review of knowledge management and new product development projects: Trends, issues, and challenges. *Journal of Innovation and Knowledge*, 8(2), 1-10. https://doi.org/10.1016/j.jik.2023.100350

Iskandar, K., Jambak, M. I., Kosala, R. & Prabowo, H. (2017). Current issue on knowledge management system for future research: A systematic literature review. *Procedia Computer Science*, 116(C), 68–80. https://doi.org/10.1016/j.procs.2017.10.011

Jordão, R. V. D. & Novas, J. C. (2022). Information and knowledge management, intellectual capital, and sustainable growth in networked small and medium enterprises. *Journal of the Knowledge Economy*, 15(1), 563-595. https://doi.org/10.1007/s13132-022-01043-5

Khaliq, R. (2016). Meningkatkan Keunggulan Kompetitif Melalui Knowledge Management. *Alhadharah Jurnal Ilmu Dakwah*, 15(29), 55–62. https://doi.org/10.18592/alhadharah.v15i29.1015 [in Indonesian]

Kristianto, I. (2019). Kesenian Reyog Ponorogo dalam Teori Fungsionalisme. *TAMUMATRA: Jurnal Seni Pertunjukan*, 2(1), 69-82. https://doi.org/10.29408/tmmt.v1i2.1171 [in Indonesian]

Kristiyana, N. & Rapini, T. (2017). Dinamika Usaha Pengrajin Reog Ponorogo. *Jurnal Riset Akuntansi Dan Bisnis Airlangga*, 2(1), 149–164. https://doi.org/10.20473/jraba.v2i1.46017 [in Indonesian]

Lee, G. & Xia, W. (2010). Toward Agile: An integrated analysis of quantitative and qualitative field data on software development agility. *MIS Quarterly*, 34(1), 87–114. https://doi.org/10.1142/9789814295628_0006

Miftahurrohman & Wafiroh, R. H. (2022). Implementasi Knowledge Management System pada Usaha Mikro Kecil Kecamatan Rowosari. *Jurnal Manajemen Sosial Ekonomi [Dinamika]*, 2(1), 93–102. https://doi.org/10.51903/dinamika.v2i1.181 [in Indonesian]

Mohiuddin, M., Matei, M., Al-Azad, S. & Su, Z. (2022). ICTs in knowledge sharing and organizational culture. *International Journal of Knowledge Management*, 18(1), 1–19. https://doi.org/10.4018/ijkm.313446

Nguyen, H. D., Truong, D., Vu, S., Nguyen, D., Nguyen, H. & Tran, N. T. (2023). Knowledge management for information querying system in education via the combination of rela-ops model and knowledge graph. *Journal of Cases on Information Technology*, 25(1). https://doi.org/10.4018/JCIT.324113

Poh Choo Cheak, A., Wei Chong, C., Yen Yuen, Y. & Yoke Chu Leong, I. (2022). The relationship between critical success factors, perceived benefits, and usage intention of mobile knowledge management systems in the Malaysian semiconductor industry. *Interdisciplinary Journal of Information, Knowledge, and Management*, 17, 471–496. https://doi.org/10.28945/5021

Polas, M. R. H., Tabash, M. I., Bhattacharjee, A. & Dávila, G. A. (2023). Knowledge management practices and green innovation in SMES: the role of environmental awareness towards environmental sustainability. International Journal of Organizational Analysis, 31(5), 1601-1622. https://doi.org/10.1108/IJOA-03-2021-2671

Retnoningsih, E. & Khasanah, F. N. (2019). User-centered design knowledge management system berbasis android pada usaha mikro, kecil, dan menengah (UMKM) Kota Bekasi. *Business Management Analysis Journal (BMAJ)*, 7(2), 111–122. https://doi.org/10.33558/piksel.v7i2.1814 [in Indonesian]

Rijanto, E. & Dewintari, P. (2020). Perancangan blueprint knowledge management system pada unit Laboratorium Fakultas Ilmu Terapan Universitas Telkom. *Jurnal Tata Kelola Dan Kerangka Kerja Teknologi Informasi*, 6(2), 65–71. https://doi.org/10.34010/jtk3ti.v6i2.5544 [in Indonesian]

Safriadi, N., Salam, U. & Hazriani, R. (2015). Wikipeat adalah implementasi knowledge management system (KMS) untuk pengelolaan hasil penelitian di Universitas Tanjungpura. *Jurnal Edukasi dan Penelitian Informatika (JEPIN)*, 1(1), 37–40. https://doi.org/10.26418/jp.v1i1.10009 [in Indonesian]

Sajadian, S. H., Akhavan, P. & Mohammadi Fateh, A. (2023). Alignment activity domain, strategy, knowledge strategy, business strategy, organizational university. *International Journal of Information Science and Management (IJISM),* 21(3), 95-109. https://doi.org/10.22034/ijism.2023.1977835.0/DOR

Santoso, I. & Abdillah Karim, S. (2019). Rancang bangun knowledge management system Politeknik Statistika STIS. *Jurnal Informatika: Jurnal Pengembangan IT*, 4(2), 112–119. https://doi.org/10.30591/jpit.v4i2.1133 [in Indonesian]

Sijabat, R. (2022). The effects of business digitalization and knowledge management practices on business performance: Findings from Indonesian Micro, Small, and Medium Enterprises. *BISNIS & BIROKRASI: Jurnal Ilmu Administrasi dan Organisasi*, 29(2), 4. 101-116. https://doi.org/10.20476/jbb.v29i2.1350

Wijayanto, H., Sugianto, A. & Vidyastari, R. I. (2021). Peningkatan Literasi Digital Pengrajin Reyog Ponorogo melalui Sistem Digital Marketing. *ProsidingPKM-CSR*, 4, 1446–1450. https://doi.org/10.37695/pkmcsr.v4i0.1122 [in Indonesian]

Zhang, Z. J. (2017). Graph databases for knowledge management. *IT Professional*, 19(6), 26–32. https://doi.org/10.1109/MITP.2017.4241463