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Dear Editor in Chief,

I am writing to submit our manuscript with entitled, Ontology Modeling for Subak Knowledge Management System, for consideration for publication in JOIV **: International Journal** on **Informatics Visualization.**
Because our findings can be directly applied in building ontology-based cultural heritage knowledge. The findings are likely to be of great interest to scientists, researchers, and lecturers who read your journal. This manuscript represents original work and is not under consideration by any other journal. All authors have approved the manuscript and submission. Thank you for receiving our manuscript and considering it for review. We appreciate your time and look forward to your feedback

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Title and Abstract

Title: Ontology Modeling for Subak Knowledge Management System

Abstract: *Subak,* as a Balinese traditional agricultural organization, has knowledge of cultural heritage, including both explicit and tacit elements. This research aimed to develop ontology knowledge model for the digital preservation of *Subak* culture in the form of Knowledge Management System (KMS). The development of model was based on three main stages, including requirement analysis, ontology development, and ontology assessments. Requirement analysis included data collection through field observations, in-depth interviews, and document analysis, while ontology development consisted of hierarchical classes, object and data properties, as well as individual entities. Furthermore, ontology assessments were the stage of evaluating and testing the resulting ontology. Protégé software was used to apply ontology model, generating Ontograph visualizations and producing Ontology Web Language (OWL). Validation was carried out using both Ontology Quality Analysis (OntoQA) and expert comments. The evaluation results showed a Relationship Richness (RR) value of 0.8, an Inheritance Richness (IR) value of 0.78, and an Attribute Richness (AR) value of 3.89, showing that ontology captured a comprehensive and representative body of knowledge. Expert comments stated that ontology model created was worthy of being used to represent *Subak* knowledge as a form of cultural preservation. The developed *Subak* ontology could serve as a foundational knowledge base for further research in related fields such as agricultural management, social organization, and cultural preservation.

Indexing

Keywords: Ontology; Cultural Heritage; Knowledge Representation; Knowledge based; Knowledge Management System

Language: en

Supporting Agencies

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References

References

[1] W. M. W. Isa et al., “An Ontological Approach for Creating a Brassware Craft Knowledge Base,” IEEE Access, vol. 8, pp. 163434–163446, 2020, doi: 10.1109/ACCESS.2020.3022795.
[2] M. A. Osman, S. A. Mohd Noah, and S. Saad, “Ontology-Based Knowledge Management Tools for Knowledge Sharing in Organization—A Review,” IEEE Access, vol. 10, pp. 43267–43283, 2022, doi: 10.1109/ACCESS.2022.3163758.
[3] UNESCO, “Operational Guidelines for the Implementation of the World Heritage Convention,” Oper. Guidel. Implement. World Herit. Conv., no. WHS, p. 188, 2021, [Online]. Available: http://whc.unesco.org/archive/opguide08-en.pdf
[4] Rasyidah, A. Erianda, A. Alanda, and R. Hidayat, “Systematic Literature Review: Digitalization of Rural Tourism Towards Sustainable Tourism,” Int. J. Adv. Sci. Comput. Eng., vol. 5, no. 3, pp. 247–256, Dec. 2023, doi: 10.62527/ijasce.5.3.134.
[5] Y. Hou, S. Kenderdine, D. Picca, M. Egloff, and A. Adamou, “Digitizing Intangible Cultural Heritage Embodied: State of the Art,” J. Comput. Cult. Herit., vol. 15, no. 3, pp. 1–20, Sep. 2022, doi: 10.1145/3494837.
[6] S. Darmawan, N. Agusvina, S. Lusa, and D. I. Sensuse, “Knowledge Management Factors and Its Impact on Organizational Performance: A Systematic Literature Review,” JOIV Int. J. Informatics Vis., vol. 7, no. 1, p. 161, Feb. 2023, doi: 10.30630/joiv.7.1.1644.
[7] N. M. Short, M. J. Woodward-Greene, M. D. Buser, and D. P. Roberts, “Scalable Knowledge Management to Meet Global 21st Century Challenges in Agriculture,” Land, vol. 12, no. 3, p. 588, Feb. 2023, doi: 10.3390/land12030588.
[8] A. Pinto, Y. Cardinale, I. Dongo, and R. Ticona-Herrera, “An Ontology for Modeling Cultural Heritage Knowledge in Urban Tourism,” IEEE Access, vol. 10, pp. 61820–61842, 2022, doi: 10.1109/ACCESS.2022.3179664.
[9] M. S. Rumetna, T. N. Lina, and J. E. Lopulalan, “A Knowledge Management System Conceptual Model for the Sorong COVID-19 Task Force,” JOIV Int. J. Informatics Vis., vol. 4, no. 4, pp. 195–200, Dec. 2020, doi: 10.30630/joiv.4.4.418.
[10] E. Triandini, M. A. Kristyanto, R. V. Rishika, and F. Rawung, “A Systematic Literature Review of The Role of Ontology in Modeling Knowledge in Software Development Processes,” IPTEK J. Technol. Sci., vol. 32, no. 3, p. 159, 2021, doi: 10.12962/j20882033.v32i3.12998.
[11] P. D. H. Ardana, D. O. Suparwata, A. Sudrajat, S. Chatun, and I. Harsono, “The Role of Bali’s Traditional Subak Farming System in the Preservation of Natural and Cultural Resources,” West Sci. Nat. Technol., vol. 2, no. 01, pp. 31–38, Mar. 2024, doi: 10.58812/wsnt.v2i04.754.
[12] S. P. K. Surata, D. A. Puspawati, P. E. P. Ariati, and I. G. A. P. E. Putri, “The ecological views of the Balinese toward their subak cultural landscape heritage,” Environ. Dev. Sustain., vol. 24, no. 11, pp. 12994–13010, Nov. 2022, doi: 10.1007/s10668-021-01979-9.
[13] D. P. Darmawan, G. M. K. Arisena, A. A. A. W. S. Djelantik, A. A. K. Krisnandika, N. K. S. Utari, and N. T. L. Korri, “Farmers’ Independence Level in the Urban Area of Subak Sembung Denpasar City, Bali Province, Indonesia,” J. Agric. Sci. - Sri Lanka, vol. 18, no. 1, pp. 40–54, 2023, doi: 10.4038/jas.v18i1.10097.
[14] P. U. Wijayanti, W. Windia, D. P. Darmawan, and W. Widhianthini, “Sustainable development model of subak in Denpasar City,” Int. J. life Sci., vol. 4, no. 1, pp. 109–117, 2020, doi: 10.29332/ijls.v4n1.418.
[15] M. Casillo, M. De Santo, R. Mosca, and D. Santaniello, “Sharing the knowledge: exploring cultural heritage through an ontology-based platform,” J. Ambient Intell. Humaniz. Comput., vol. 14, no. 9, pp. 12317–12327, 2023, doi: 10.1007/s12652-023-04652-3.
[16] N. Kadek, D. Hariyanti, and L. Linawati, “Strategic Planning Model for the Digitalization of Subak Cultural Heritage: An Integrated SWOT-PESTEL Approach,” in Proceedings of the International Conference on Sustainable Green Tourism Applied Science - Social Applied Science 2024 (ICoSTAS-SAS 2024), Advances in Economics, Business and Management Research, 2024, vol. 308, pp. 33–42. doi:

10.2991/978-94-6463-022-2.
[17] E. Femi Aminu, I. O. Oyefolahan, M. Bashir Abdullahi, and M. T. Salaudeen, “A Review on Ontology Development Methodologies for Developing Ontological Knowledge Representation Systems for various Domains,” Int. J. Inf. Eng. Electron. Bus., vol. 12, no. 2, pp. 28–39, Apr. 2020, doi: 10.5815/ijieeb.2020.02.05.
[18] A. Sattar, E. S. M. Surin, M. N. Ahmad, M. Ahmad, and A. K. Mahmood, “Comparative analysis of methodologies for domain ontology development: A systematic review,” Int. J. Adv. Comput. Sci. Appl., vol. 11, no. 5, pp. 99–108, 2020, doi: 10.14569/IJACSA.2020.0110515.
[19] Z. Sun, C. Hu, C. Li, and L. Wu, “Domain ontology construction and evaluation for the entire process of software testing,” IEEE Access, vol. 8, pp. 205374–205385, 2020, doi: 10.1109/ACCESS.2020.3037188.
[20] N. K. Dessy Hariyanti et al., “Evaluation of Enrichment in Ontology-based Knowledge Management System,” no. November, pp. 29–34, 2024, doi: 10.1109/icsgteis60500.2023.10424116.
[21] E. M. Sanfilippo, B. Markhoff, and P. Pittet, “Ontological Analysis and Modularization of CIDOC-CRM,” Front. Artif. Intell. Appl., vol. 330, no. February, pp. 107–121, 2020, doi: 10.3233/FAIA200664.
[22] CIDOC CRM Special Interest Group, “Definition of the CIDOC Conceptual Reference Model Version 7.2.2,” no. September, pp. 1–234, 2023, [Online]. Available: https://cidoc-crm.org/sites/default/files/cidoc_crm_version_7.2.1.pdf
[23] A. Pinto-De La Gala, Y. Cardinale, and I. Dongo, “CURIOCITY Framework: Managing Heterogeneous Cultural Heritage Data,” ACM Int. Conf. Proceeding Ser., no. December, pp. 664–669, 2021, doi: 10.1145/3486622.3494001.
[24] R. Stewar, Y. Zhelev, and M. Monova-Zheleva, “Development of digital collections of intangible cultural heritage objects - Base ontology,” Digit. Present. Preserv. Cult. Sci. Herit., vol. 11, pp. 51–56, 2021, doi: 10.55630/dipp.2021.11.4.
[25] F. Wang, T. Wei, and J. Wang, “Ontology-driven cultural heritage conservation: A case of the analects of confucius,” Appl. Sci., vol. 12, no. 1, 2022, doi: 10.3390/app12010287.
[26] G. Faraj and A. Micsik, “Representing and validating cultural heritage knowledge graphs in cidoc-crm ontology,” Futur. Internet, vol. 13, no. 11, pp. 1–15, 2021, doi: 10.3390/fi13110277.
[27] S. Haridy, R. M. Ismail, N. Badr, and M. Hashem, “An Ontology Development Methodology Based on Ontology-Driven Conceptual Modeling and Natural Language Processing: Tourism Case Study,” Big Data Cogn. Comput., vol. 7, no. 2, p. 101, May 2023, doi: 10.3390/bdcc7020101.
[28] G. R. Roldán-Molina, D. Ruano-Ordás, V. Basto-Fernandes, and J. R. Méndez, “An ontology knowledge inspection methodology for quality assessment and continuous improvement,” Data Knowl. Eng., vol. 133, no. December 2020, p. 101889, May 2021, doi: 10.1016/j.datak.2021.101889.
[29] N. Mellal, T. Guerram, and F. Bouhalassa, “An Approach for Automatic Ontology Enrichment from Texts,” Informatica, vol. 45, no. 1, pp. 81–91, Mar. 2021, doi: 10.31449/inf.v45i1.2586.
[30] E. Kusnadi, Y. Yanitasari, and S. Supriyadi, “Implementation of knowledge management system in cattle farming,” Ilk. J. Ilm., vol. 13, no. 1, pp. 36–44, 2021, doi: 10.33096/ilkom.v13i1.785.36-44.
[31] S. Indriasari, D. I. Sensuse, Y. Resti, M. Wurzinger, D. S. Hidayat, and B. Widodo, “Requirements Engineering of Knowledge Management System for Smallholder Dairy Farmers,” J. Human, Earth, Futur., vol. 5, no. 2, pp. 151–172, Jun. 2024, doi: 10.28991/HEF-2024-05-02-02.
[32] O. Sebubi, I. Zlotnikova, and H. Hlomani, “Ontology-Driven Semantic Enrichment Framework for Open Data Value Creation,” Data Sci. J., vol. 22, no. 1, pp. 1–18, 2023, doi: 10.5334/dsj-2023-040.
[33] Y. Zheng, S. Törmä, and O. Seppänen, “A shared ontology suite for digital construction workflow,” Autom. Constr., vol. 132, no. January, p. 103930, Dec. 2021, doi: 10.1016/j.autcon.2021.103930.
[34] N. K. D. Hariyanti, L. Linawati, I. M. O. Widyantara, and G. Sukadarmika, “Ontology-based data framework for the digital preservation cultural heritage: A case of Subak,” MATRIX J. Manaj. Teknol. dan Inform., vol. 14, no. 3, pp. 135–145, Nov. 2024, doi: 10.31940/matrix.v14i3.135-145.
[35] J. Watróbski, “Ontology learning methods from text -an extensive knowledge-based approach,” Procedia Comput. Sci., vol. 176, pp. 3356–3368, 2020, doi: 10.1016/j.procs.2020.09.061.
[36] R. S. I. Wilson, J. S. Goonetillake, W. A. Indika, and A. Ginige, “A conceptual model for ontology quality assessment,” Semant. Web, vol. 14, no. 6, pp. 1051–1097, Dec. 2023, doi: 10.3233/SW-233393.
[37] I. Suamba, S. Sumiyati, A. Krisnandika, I. Tika, N. Sulastri, and G. Arisena, “The subak-based agro-tourism management model in the world cultural heritage area of Catur Angga Batukaru Tabanan Regency, Bali province, Indonesia,” African J. Food, Agric. Nutr. Dev., vol. 23, no. 2, pp. 22534–22547, Feb. 2023, doi: 10.18697/ajfand.117.21970.
[38] I. P. Sriartha and I. W. Kertih, “Subak Local Wisdom as Social Studies Learning Source in Junior High School,” in Proceedings of the 4th Asian Education Symposium (AES 2019), 2020, vol. 438, no. Aes 2019, pp. 23–27. doi: 10.2991/assehr.k.200513.006.
[39] I. Skakalska, O. Panfilova, I. Sydun, S. Oriekhova, T. Zuziak, and I. Tatarko, “The Systematization and Preservation of Cultural Heritage of National Minorities in the Context of the Postmodern Philosophy,” Postmod. Openings, vol. 12, no. 4, pp. 241–254, 2021, doi: 10.18662/po/12.4/372.
[40] A. Thouki, “The role of ontology in religious tourism education—exploring the application of the postmodern cultural paradigm in European religious sites,” Religions, vol. 10, no. 12, 2019, doi: 10.3390/rel10120649.
[41] M. Yahya, B. Zhou, J. G. Breslin, M. I. Ali, and E. Kharlamov, “Semantic Modeling, Development and Evaluation for the Resistance Spot Welding Industry,” IEEE Access, vol. 11, no. February, pp. 37360–37377, 2023, doi: 10.1109/ACCESS.2023.3267000.
[42] S. Haridy, R. Ismail, N. Badr, and M. Hashem, “Ontology-driven Conceptual Model and Domain Ontology for Egyptian e-Government,” Int. J. Intell. Comput. Inf. Sci., vol. 23, no. 2, pp. 116–132, 2023, doi: 10.21608/ijicis.2023.176123.1230.

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Ontology Modelling for Subak Knowledge Management System

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***Abstract*— *Subak* is an irrigation and agricultural management organization based on Balinese customs that has cultural heritage knowledge, including not only material artifacts but also tacit knowledge contained in practices, traditions, and expertise, as well as explicit knowledge in the form of stories, literature, and official records. This study found that there has been no research on the development of ontology-based *Subak* knowledge, especially in the context of cultural preservation. This study aims to build a *Subak* ontology knowledge model for digitalization of cultural preservation in the form of a Knowledge Management System. The development of the ontology model goes through three main stages: requirement Analysis, namely data collecting through field observations, in-depth interviews, and document analysis. Ontology Development defines hierarchical classes, object and data properties, and individual entities. The ontology model is implemented using protégé. The ontology builds Ontograf and produces OWL (Ontology Web Language). Then, ontology Assessments are the stage of implementing the evaluation and testing of the ontology produced. Validation is carried out with OntoQA (Ontology Quality Analysis) and expert comments. The evaluation results show a Relationship Richness (RR) value of 0.8, an Inheritance Richness (IR) value of 0.78, and an Attribute Richness (AR) value of 3.89. It can be concluded that the ontology produced is quite rich and has representative knowledge. From the expert comments stated that the ontology model created is worthy of being used to represent *Subak* knowledge as a form of cultural preservation. The resulting *Subak* ontology can be a reference as a knowledge base for the development of other ontologies in the domains of agricultural management, social organization, and cultural preservation..**

***Keywords*— Ontology, Cultural Heritage, Knowledge representation, Knowledge based, Knowledge Management System**

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I. INTRODUCTION

Cultural heritage is increasingly fading [1] due to the influence of globalization and social change, which shift traditional values and a lack of attention to maintaining and disseminating knowledge. Cultural heritage knowledge [2] includes not only material artifacts but also tacit knowledge contained in practices, traditions, and skills passed down from generation to generation, as well as explicit knowledge documented in the form of stories, literature, and official records.

UNESCO calls for joint action in documenting, preserving, and protecting ancestral cultural practices and knowledge that are increasingly being degraded today, one of which is through digitization [3]. UNESCO emphasizes the importance of digitization efforts based on sustainability principles, community participation, access to information, and a comprehensive knowledge management system [4] mainly provided for future generations. Knowledge Management System (KMS) is a system that provides a structured platform [5] that allows an organization to collect, store, organize, and share knowledge efficiently.

The development of KMS requires a knowledge representation model, where the implementation of ontology is one solution to capture knowledge [6] that has yet to be documented. Ontology, as a formal model of knowledge, provides a framework for defining concepts, relations, properties, and rules in the knowledge domain[7]. This enables consistency of organization and interoperability as well as computer understanding of the context and meaning

[8] of knowledge in an effort to use it more effectively for various needs.

Subak is an organization that manages a traditional irrigation system in Bali based on the principles of Tri Hita Karana [9], which has been recognized by UNESCO [10] as a world cultural heritage covering social, cultural, ecological values and agricultural practices related to it. *Subak* has its uniqueness in the creation of collaborative knowledge [11]. Traditional methods in transferring intangible heritage knowledge [12] are often carried out through personal and verbal exchange of information. The challenges of modernization and urbanization [9] trigger a decrease in the younger generation's involvement in direct *Subak* practices, so knowledge is vulnerable to erosion over time. Meanwhile, in supporting the organization's existence, this knowledge needs to be captured and shared with the next generation through technological innovation[13], one of which is through a knowledge management system.

Based on the initial observations, it was found that *Subak* knowledge, tacit and explicit, needs to be managed better and that the media should display it comprehensively. So, it is essential to create an ontology model to represent the knowledge base for developing the *Subak* knowledge management system and support efforts to digitize cultural preservation. In addition, the resulting *Subak* Ontology can later be a reference for developing other ontologies in agricultural management, social organizations, and cultural preservation. Ontology research and development have been widely conducted based on various research methodologies in various cultural preservation domains. Most cultural preservation ontologies are formed from scratch [14]. This causes the research methodology to be more adjusted to the characteristics of data collection challenges and the scope of the knowledge domain [15],[16]. Previous research conducted a literature study[17] in formulating the *Subak* ontology development research methodology as a stage of this research.

In the conceptual data stage, Ontology modeling [18] is needed to represent knowledge. CIDOC-CRM [19] is an ontology modeling developed to align the domains of libraries, museums, archives, and cultural data collections. To date, CIDOC-CRM has determined 99 classes and 198 properties. In this study, CIDOC-CRM is only used as a modeling reference[20], and many adjustments are made [21],[22] considering the complexity and characteristics of specific *Subak* domains are very different from the framework offered.

Ontology assessment involves external validation[23], including Competency Questions-based[24] and Expert confirmatory[7]. Internal consistency uses ontology metrics [1][24][25][26]. Given the ever-growing knowledge, knowledge sufficiency is overcome by continuous and structured knowledge enrichment [17].

Many researches have been conducted about KMS in heritage culture[4]. No research development of ontology-based KMS *Subak* has ever been conducted through the literature review[14]. This study proposes developing ontology-based knowledge model for the digitalization of *Subak* cultural heritage preservation. So, the main problem formulation of this study is how to create ontology-based knowledge model that can represent *Subak* knowledge in the preservation of cultural heritage knowledge. The results of this study are in the form of ontology-based knowledge model for the representation of the *Subak* knowledge management system.

II. METHODOLOGY

Ontology will show how the adequacy of knowledge is presented. Ontology development activities are one of the fundamental steps in supporting the knowledge management process [27]. Therefore, it is necessary to pay attention to how to design ontology in KMS. The adoption of ontology in KMS is based on the KMS Life Cycle approach which consists of seven stages of development. Based on the seven steps of the KMS Life Cycle, ontology development will be at the Knowledge capture stage[28], as shown in Fig 1. In KMS, the Knowledge Capture stage consists of Knowledge Acquisition, Knowledge Creation, and Knowledge Evaluation, which are accordance with the framework in this study.

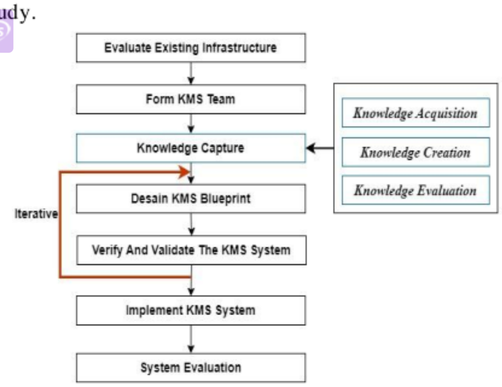

Fig. 1 KMS Life Cycle

The research methodology of this study references CIDOC-CRM[19], with some adjustments made according to the knowledge domain being built. As described in Fig. 2, it consists of four main stages[17]. Ontology development is an iterative process[29].

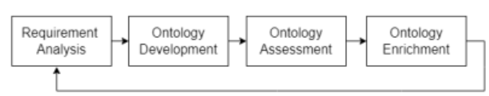

Fig 2 Research Framework

A. *Requirement Analysis*

Building a knowledge base begins with exploratory research, with the aim of determining the facts that form *Subak* knowledge.

1) *Objective Formulation:* formulating general and specific objectives in detail for creating ontology. This objective formulation will form the basis for compiling a list of CQs, which are questions designed to identify the knowledge needed to achieve the purpose of creation[1]. By formulating objectives first, ontology developers can ensure that the CQs compiled will be relevant and focused on achieving the goals that have been set. This stage produces a list of CQs.

2) *Domain Acquisition:* is the stage of acquiring *Subak* knowledge. Because the *Subak* ontology has never been created, the acquisition is carried out from the beginning (scratch)[14]. The data sources that will be used in the study are primary and secondary data. Primary data is obtained from observation data and in-depth interviews with *Subak* administrators and experts. While secondary data is obtained from library/literature studies related to the research topic and data from field observations. Knowledge formation is carried out through ontology modeling, which produces a vocabulary dataset.

B. *Ontology Development:*

The collected data is in the development stage of the reference model in CIDOC-CRM conceptual modeling. It consists of two stages, namely:

1) *Knowledge Conceptualization*

Knowledge will be modeled based on ontology. The concept of knowledge ontology[30] has several main components, namely:

- *Classes*: Explain the concept and general things of knowledge in a domain. A class has subclasses intended to express more specific concepts than the superclass.
- *Properties*: are 2-way relations that connect classes with other classes to form knowledge/concept links. There are two types of ontology properties: object properties that connect objects with other objects and data type properties that connect objects with data type values (text, string, or number).
- *Instance /particular things /objects* are individuals /members, are actual objects of a class containing facts/information from a concept / knowledge.
- *Constraints* or rules for the things
- *Relationship* is the concept of the relationship between the things
- *Functions* are processes that involve things.

2) *Knowledge Modeling:* will be formed in OWL, which allows users to define concepts, properties, and relationships between these concepts in more detail and formally. Protégé is used to help visualize the concept of knowledge. This stage produces ontology class structure and ontology graph.

C. *Ontology Assessments*

This is the stage of implementing the evaluation and validation of the ontology produced. This stage produces recommendations for ontology enrichment. Validation is done using OntoQA (Ontology Quality Analysis) [31] and experts' comments. OntoQA is one technique used to evaluate ontology's quality. OntoQA provides ontology characteristics as a description of the quality of the ontology in terms of knowledge representation potential. The OntoQA used in this study is the OntoQA measurement scheme category, which consists of Relationship Richness (RR), Inheritance Richness (IR), and Attribute Richness (AR) measurements.

1) *Relationship Richness (RR):* is a metric used to describe the relationships used in ontology. This metric measures how ontology utilizes various relationships between existing concepts, inheritance, and non-inheritance relationships. RR indicates whether ontology relies on inheritance hierarchies or utilizes various types of non-hierarchical relationships to represent knowledge. The RR evaluation will describe the ratio between the number of inheritance (SC) and non- inheritance (P) relationships on a scale of zero to one, formulated in equation 1.

$$RR = \frac{|P|}{(|SC| + |P|)} \qquad (1)$$

RR provides important insights into the complexity and flexibility of the relationship structure in an ontology and can be used as one indicator of the quality of an ontology in representing knowledge in a particular domain.

2) *Inheritance Richness (IR)*: is a metric used in ontology evaluation to measure the depth of the inheritance hierarchical structure in ontology. This metric indicates how much ontology utilizes inheritance relationships among its concepts. Inheritance Richness (IR) is the ratio of the total number of subclasses (H) in ontology to the total number of classes (C) on a scale of zero to one. The IR formula is presented in Equation 2.

$$IR = \frac{|H|}{|C|} \qquad (2)$$

3) *Attribute Richness (AR)*

Attribute Richness (AR) is a metric used in ontology evaluation to measure the extent to which ontology utilizes attributes or properties in describing its concepts. Attribute Richness (AR) measures the average number of attributes (att) possessed by each class (C) in ontology. This metric provides an overview of how rich the description of concepts in an ontology is based on the number of attributes used. The AR formula is presented in Equation 3.

$$AR = \frac{|att|}{|C|} \qquad (3)$$

D. *Ontology Enrichment*

This is the stage of completing and enriching concepts and information data for the adequacy of the knowledge population based on recommendations generated from the previous stage. There are two types of enrichment[17], namely:

1) Carried out at the beginning of ontology development to obtain sufficient knowledge. This study will carry out this type of enrichment. Ontology development is a repetitive process until the targeted knowledge adequacy is achieved for creation. This stage will return to the ontology development stage, and it is possible to skip certain stages if deemed unnecessary.

2) Enriches ontology by adding domains to an already existing one, aiming to produce a new ontology or an ontology with an expanded domain.

III. RESULT AND DISCUSSION

The development of knowledge management requires a knowledge representation model, where the implementation of ontology is one solution to capture knowledge [7] that has yet to be documented. As a formal knowledge model, ontology provides a framework for defining concepts, relations, properties, and rules in the knowledge domain [5]. This allows for consistent organization and interoperability and computer understanding of the context and meaning of knowledge so that it can be used more effectively for various needs. Following the research framework (Fig 2), four main stages exist in developing the *Subak* ontology model[17]. The ontology was built using Balinese language representation, considering that many *Subak* terms are terms used by Balinese people in their traditional life. The following is a series of steps taken in ontology development.

A. Requirement Analysis

Determining the ontology's objectives, domain, and scope is the first step in focusing on the scope of knowledge. This is followed by determining the objectives of ontology formulation and acquiring the knowledge domain.

1) Objective Formulation

The main objective of ontology formation is to represent *Subak* knowledge as a cultural heritage that must be preserved. Furthermore, the limitations and scope of ontology are declared. This research focuses on the *Subak* domain as depicted in Fig. 2, which shows the scope of ontology, which is depicted in a Conceptual Data Framework.

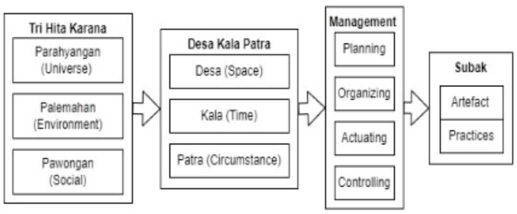

Fig 3. Conceptual Data Model of *Subak* Knowledge

Next, competency questions are compiled to deepen understanding of the scope of the ontology domain being developed. In addition, it will also be used in the ontology validation stage. CQs in Table 2 are questions that must be answered by the knowledge base built from the ontology being developed. CQs are created based on observations, documentation studies, and expert interviews.

The general definition of *Subak* is determined to be an organization that manages traditional irrigation systems in Bali based on the principles of Tri Hita Karana [30], including social, cultural, ecological values and agricultural practices related to it. Therefore, the compiled CQ must be able to explore knowledge in related elements [31]. Table 1 is a list of the established CQs.

TABLE I

COMPETENCY QUESTIONS

Elements	Competency Questions
Tri Hita Karana	What is the Definition of *Subak* in the Parahyangan concept?
	What is the Definition of *Subak* in the Palemahan concept?
	What is the Definition of *Subak* in the Pawongan concept?
Pawongan (Social)	Who plays a role in the *Subak* organization?
Pawongan (Social)	What are the activities in the *Subak* organization?
Palehaman (Environment)	What infrastructure is involved in the *Subak* irrigation system?
Palemahan (Environment)	How is the *Subak* irrigation system organized?
Palemahan (Environment)	What is the irrigation pattern carried out by *Subak*?
Parahyangan (Traditional Ceremonies)	What are the ritual elements associated with *Subak*?
Parahyangan (Traditional Ceremonies)	Where are the ritual ceremonies carried out by *Subak*?
Pawongan (Social)	What is the organizational structure of *Subak* management?
Pawongan (Social)	What is the pattern of communication and coordination between *Subak* members?

2) Domain Acquisition

This stage is the stage of acquiring knowledge in the knowledge domain. The data collected in the objective formulation stage is mapped into the data mapping concept relation depicted in Fig. 2. It begins with the Tri Hita Karana Concept as the basic principle of *Subak* activities. Each aspect of Tri Hita Karana has its Desa-Kala-Patra elements. In each activity, the Desa-Kala-Patra elements are categorized in modern management activities based on POAC (Planning-Organizing-Actuating-Controlling). These management activities include defining activities and artifacts.

Data collection methods through observation, surveys, focus group discussions (FGD), and documentation studies. Because the *Subak* ontology has never been created, the acquisition is carried out from the beginning (scratch). This stage begins by collecting all the vocabulary related to *Subak* through document studies, field observations, and in-depth interviews with several experts. The data collection techniques used are:

- *Document Study*: Various documents and literature have been studied, including lontar, awig-awig *Subak*, government regulations, Village Regulations, and other documents obtained from online sources or directly from sources.
- *Observation:* Participant observation is carried out on *Subak* organizations, both internal and external, to support the analysis carried out in the study.
- *In-depth interview:* used to collect qualitative data. In-depth interviews conducted with *Subak* administrators, farmers, community practitioners, and experts. Given that understanding *Subak* requires a postmodern approach[26], [27], which recognizes the complexity, diversity of perspectives, and challenges in maintaining tradition amidst rapid social and economic change, the selection of informants is determined based on purposive sampling. The essential criteria for informants are that they have been involved in the *Subak* field for over two years. The determination of experts consists of experts in the fields of *Subak*, ecotourism, and socio-culture.

The data collected is then mapped according to the data mapping concept relation domain depicted in Table 2.

TABLE II

ONTOLOGY SCOPE

Tri Hita Karana	Desa Kala Patra	POAC	Identification

	Desa (Place)	Planning	Planning the construction and maintenance of sacred places
		Organizing	Management of sacred places
		Actuating	Use and maintenance of sacred places
		Controlling	Supervision of management of sacred places
Parahyangan (Universe)	Kala (Time)	Planning	Planning of traditional ceremony schedules
		Organizing	Management of traditional ceremony times
		Actuating	Time of implementation of traditional ceremonies
		Controlling	Supervision of management of traditional ceremony times
	Patra (Activity)	Planning	Planning of traditional ceremony activities and ceremonial equipment
		Organizing	Management of traditional ceremony activities and ceremonial equipment
		Actuating	Implementation of traditional ceremonies and ceremonial equipment
		Controlling	Supervision of implementation of traditional ceremonies and ceremonial equipment
	Desa (Place)	Planning	Planning of construction and maintenance of irrigation structures
		Organizing	Management of irrigation structures
		Actuating	Use and maintenance of irrigation structures
		Controlling	Supervision of management of irrigation structures
Palemahan (Environmental))	Kala (Time)	Planning	Planning of schedule for implementation of irrigation management
		Organizing	Management of irrigation management time
		Actuating	Time of implementation of irrigation management
		Controlling	Supervision of management of irrigation management time
	Patra (Activity)	Planning	Planning of irrigation management activities and irrigation equipment
		Organizing	Management of irrigation management activities and irrigation equipment
		Actuating	Implementation of irrigation management and irrigation equipment
		Controlling	Supervision of implementation of irrigation management and irrigation equipment
	Desa (Place)	Planning	Planning of construction and maintenance of organizational management places
		Organizing	Management of organizational management places
		Actuating	Place of implementation of organizational management
		Controlling	Supervision of place of implementation of organizational management
Pawongan (Social Organization)	Kala (Time)	Planning	Planning of schedules implementation of organizational management
		Organizing	Management of organizational management implementation time
		Actuating	Implementation of organizational management
		Controlling	Supervision of organizational management implementation time
	Patra (Activity)	Planning	Planning of organizational management activities and parties involved
		Organizing	Management of organizational management activities and parties involved
		Actuating	Implementation of organizational management activities and parties involved
		Controlling	Supervision of the implementation of organizational management activities and parties involved

B. *Ontology Development*

This stage is the development stage of the ontology model referring to CIDOC-CRM conceptual modeling. It consists of two stages, namely:

1) *Knowledge conceptualization*

This stage produces entity classes, object and data properties, and individuals from each entity. Ontology *Subak* consist of 18 Super Classes, 76 Sub Classes, 21 Object Properties and 366 Data Properties. Object properties define the relationship between classes, where Subclass is an inheritance relationship. Data Properties is properties of data that represent atribut of the class.

2) *Ontology Modelling*

The modeling stage is performed by the Protégé. The structure of the *Subak* ontology class is shown in Fig 3. Meanwhile, Fig 4 is an ontograph that describes all superclasses. Ontograph is a feature in Protégé that can map relations in ontology. Figure 5 illustrates an ontograph of all superclass, and Fig 6 describes the *Palemaman* class and its relations. Protégé also has a feature to generate OWL (Ontology Web Language). OWL is a form of ontology designed for use by applications.

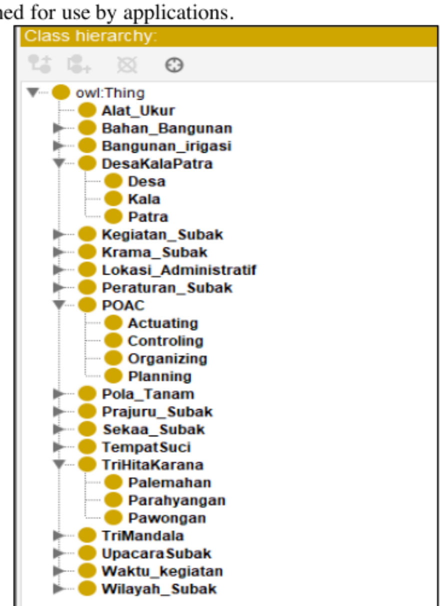

Fig 4 *Subak* Ontology Class Structure

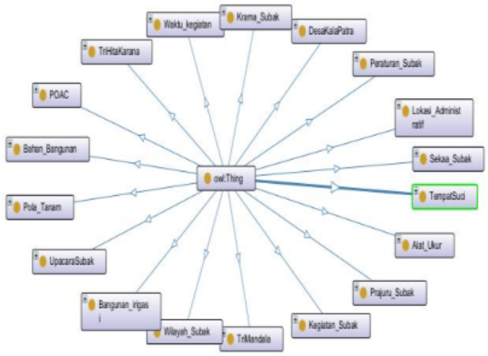

Fig 5 OntoGraph of SuperClass

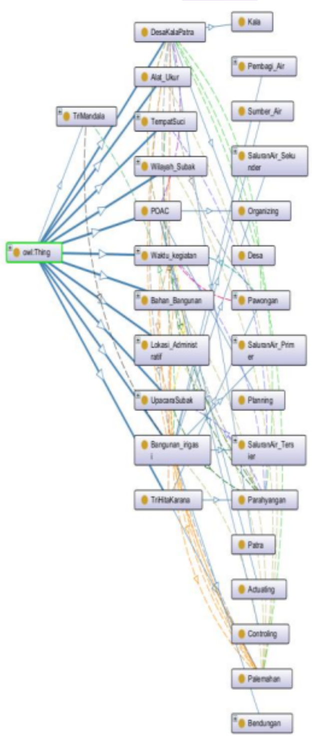

Fig. 6 OntoGraph of SuperClass Palehaman

C. *Discussion of Ontology Assessments and Enrichment*

Ontology assessment using OntoQA which measures three key aspects: Relationship Richness (RR), Inheritance Richness (IR), and Attribute Richness (AR). The result of the assessment will be a recommendation for the enrichment stage.

1) *Relationship Richness (RR)*

This metric helps identify the diversity of relationships in an ontology, which indicates the complexity and similarity of knowledge representation. As describe in knowledge conceptualization, the developed ontology contains 76 non-inheritance relationships and 21 subclasses (inheritance relationships).

TABLE III
RELATIONSHIP RICHNESS

Inheritance Relationships (SC)	Non-inheritance Relationships (P)	Relationship Richness(RR)
21	76	0.8

Table 3 presents the calculation based on equation 1, which result of RR value of 0.8 for *Subak* ontology. With range from 0 to 1, RR values close to 1 indicate that most of the relations are non-inheritance relations. RR value of 0.8 indicates that *Subak* ontology is relatively knowledge-rich, containing more non-inheritance relationships. Ontologies with a higher proportion of non-inheritance relationships represent more information than those dominated by inheritance relationships[32]. The *Subak* ontology utilizes various types of non-inheritance relationships to represent knowledge. This indicates that *Subak* ontology is more complex and flexible, and can capture relationships between concepts to hierarchical structures.

Meanwhile, RR values close to zero indicate that most of the relations in the ontology are inheritance relations, meaning that the ontology structure relies heavily on hierarchy. The ontology focuses more on inheritance or hierarchy relationships between concepts, which can be suitable for domains that require a strong hierarchical structure but may be less able to describe more complex and contextual relationships[31].

2) *Inheritance Richness (IR)*

Ontology *Subak* consist of 94 Classes with 76 are subclass. Using equation 2, which result of IR value of 0.78 for *Subak* Ontogoly (Table 4).

TABLE IV
INHERITANCE RICHNESS

Sub-Class (H)	**Class (C)**	**Inheritance Richness (IR)**
76	94	0.78

The ontology utilizes hierarchy and inheritance between concepts moderately in the ontology structure to organize knowledge better, allowing for a more structured and detailed knowledge representation[33]. Table 4 presents the calculation IR based on equation 2, which results in an IR value of 0.78 for *Subak* ontology. With values ranging from 0 to 1, IR values close to 1 indicate that most classes in the ontology have subclasses. IR value of 0.78 indicating that *Subak* ontology has a more complex and deep hierarchical structure, for more structured and detailed knowledge representations. Meanwhile, IR values close to zero indicate that most classes in the ontology are independent classes, with few or no related subclasses[34].

3) *Attribute Richness (AR)*

Table 5 presents the calculation based on equation 3, which result of AR value of 3.89 for *Subak* ontology.

TABLE V
ATTRIBUTE RICHNESS

Attributes (Att)	Class(C)	ATTRIBUTE RICHNESS
366	94	3,89

This AR value of 3,89 indicates that *Subak* ontology provides fairly rich description of attributes with each class having an average of 3 to 4 attributes. High AR indicates that the ontology provides a rich description of attributes for each class[33]. This allows for a deeper understanding of the concepts by providing more contextual and descriptive information. Meanwhile, low AR indicates that the ontology has a simpler description of the concepts, with fewer attributes that may only cover basic information. Attributes are usually used to describe specific characteristics of a concept, such as color, size, location, or relationships with other concepts[35]. Attributes are essential elements in an ontology because they provide additional information or features that enrich the definition of each concept[5]. In some cases, this may be sufficient for specific domains, but in other domains, the lack of attributes can be a limitation in knowledge modeling.

4) Enrichment

From the results of discussions with experts, it was found that the representation of knowledge in the *Subak* ontology that was built was quite feasible. In addition, from the results of the ontology assessment that has been built, this study will be continued with knowledge enrichment to obtain the expected knowledge adequacy and then implement it into KMS-based knowledge. Enrichment will be done by enriching instances, and it is also possible to include data and object properties. The adequacy of ontology knowledge is intended to answer CQs whose suitability will be confirmed by experts.

IV. Conclusion

The *Subak* ontology model will be implemented as a knowledge base for the *Subak* knowledge management system. The ontology is built based on *Subak*'s approach as an organization based on traditional philosophy (Tri Hita Karana and Desa-Kala-Patra) and the application of modern management (POAC). The ontology model consists of class hierarchy, object properties (relations), data properties (attributes), and instance (individual entities).

The *Subak* ontology was evaluated using Ontology Quality Analysis and focus group discussions with experts. The evaluation results show that Relationship Richness (RR) value is 0.8, Inheritance Richness (IR) value is 0.78, and Attribute Richness (AR) value is 3.89. The ontology produced is quite rich and carries knowledge with specific characteristics, with not too many attributes for each class. Experts' comments stated that the ontology model created is worthy of being used to represent knowledge in the *Subak* Knowledge Management System.

The resulting framework can be a reference for further similar research in developing ontology from scratch related to heritage cultural preservation. The resulting *Subak* ontology can be a reference as a knowledge base for the development of other ontologies in the domains of agricultural management, social organization, and cultural preservation. This study supports the preservation of *Subak* culture so that it is known to future generations.

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References

[1] W. M. W. Isa *Et Al.*, "An Ontological Approach For Creating A Brassware Craft Knowledge Base," *Ieee Access*, Vol. 8, Pp. 163434–163446, 2020, Doi: 10.1109/Access.2020.3022795.

[2] D. Kalita And D. Deka, "Ontology For Preserving The Knowledge Base Of Traditional Dances (Otd)," *Electron. Libr.*, Vol. 38, No. 4, Pp. 785–803, Oct. 2020, Doi: 10.1108/El-11-2019-0258.

[3] Unesco, "Operational Guidelines For The Implementation Of The World Heritage Convention," *Oper. Guidel. Implement. World Herit. Conv.*, No. Whs, P. 188, 2021, [Online]. Available: Http://Whc.Unesco.Org/Archive/Opguide08-En.Pdf

[4] Y. Hou, S. Kenderdine, D. Picca, M. Egloff, And A. Adamou, "Digitizing Intangible Cultural Heritage Embodied: State Of The Art," *J. Comput. Cult. Herit.*, Vol. 15, No. 3, Pp. 1–20, Sep. 2022, Doi: 10.1145/3494837.

[5] M. A. Osman, S. A. Mohd Noah, And S. Saad, "Ontology-Based Knowledge Management Tools For Knowledge Sharing In Organization—A Review," *Ieee Access*, Vol. 10, Pp. 43267–43283, 2022, Doi: 10.1109/Access.2022.3163758.

[6] N. M. Short, M. J. Woodward-Greene, M. D. Buser, And D. P. Roberts, "Scalable Knowledge Management To Meet Global 21st Century Challenges In Agriculture," *Land*, Vol. 12, No. 3, P. 588, Feb. 2023, Doi: 10.3390/Land12030588.

[7] A. Pinto, Y. Cardinale, I. Dongo, And R. Ticona-Herrera, "An Ontology For Modeling Cultural Heritage Knowledge In Urban Tourism," *Ieee Access*, Vol. 10, Pp. 61820–61842, 2022, Doi: 10.1109/Access.2022.3179664.

[8] E. Triandini, M. A. Kristyanto, R. V. Rishika, And F. Rawung, "A Systematic Literature Review Of The Role Of Ontology In Modeling Knowledge In Software Development Processes," *Iptek J. Technol. Sci.*, Vol. 32, No. 3, P. 159, 2021, Doi: 10.12962/J20882033.V32i3.12998.

[9] P. D. H. Ardana, D. O. Suparwata, A. Sudrajat, S. Chatun, And I. Harsono, "The Role Of Bali's Traditional Subak Farming System In The Preservation Of Natural And Cultural Resources," *West Sci. Nat. Technol.*, Vol. 2, No. 01, Pp. 31–38, Mar. 2024, Doi: 10.58812/Wsnt.V2i04.754.

[10] S. P. K. Surata, D. A. Puspawati, P. E. P. Ariati, And I. G. A. P. E. Putri, "The Ecological Views Of The Balinese Toward Their Subak Cultural Landscape Heritage," *Environ. Dev. Sustain.*, Vol. 24, No. 11, Pp. 12994–13010, Nov. 2022, Doi: 10.1007/S10668-021-01979-9.

[11] D. P. Darmawan, G. M. K. Arisena, A. A. A. W. S. Djelantik, A. A. K. Krisnandika, N. K. S. Utari, And N. T. L. Korri, "Farmers' Independence Level In The Urban Area Of Subak Sembung Denpasar City, Bali Province, Indonesia," *J. Agric. Sci. - Sri Lanka*, Vol. 18, No. 1, Pp. 40–54, 2023, Doi: 10.4038/Jas.V18i1.10097.

[12] P. U. Wijayanti, W. Windia, D. P. Darmawan, And W. Widhianthini, "Sustainable Development Model Of Subak In Denpasar City," *Int. J. Life Sci.*, Vol. 4, No. 1, Pp. 109–117, 2020, Doi: 10.29332/Ijls.V4n1.418.

[13] M. Casillo, M. De Santo, R. Mosca, And D. Santaniello, "Sharing The Knowledge: Exploring Cultural Heritage Through An Ontology-Based Platform," *J. Ambient Intell. Humaniz. Comput.*, Vol. 14, No. 9, Pp. 12317–12327, 2023, Doi: 10.1007/S12652-023-04652-3.

[14] E. Femi Aminu, I. O. Oyefolahan, M. Bashir Abdullahi, And M. T. Salaudeen, "A Review On Ontology Development Methodologies For Developing Ontological Knowledge Representation Systems For Various Domains," *Int. J. Inf. Eng. Electron. Bus.*, Vol. 12, No. 2, Pp. 28–39, Apr. 2020, Doi: 10.5815/Ijieeb.2020.02.05.

[15] A. Sattar, E. S. M. Surin, M. N. Ahmad, M. Ahmad, And A. K. Mahmood, "Comparative Analysis Of Methodologies For Domain Ontology Development: A Systematic Review," *Int. J. Adv. Comput. Sci. Appl.*, Vol. 11, No. 5, Pp. 99–108, 2020, Doi: 10.14569/Ijacsa.2020.0110515.

[16] Z. Sun, C. Hu, C. Li, And L. Wu, "Domain Ontology Construction And Evaluation For The Entire Process Of Software Testing," *Ieee Access*, Vol. 8, Pp. 205374–205385, 2020, Doi: 10.1109/Access.2020.3037188.

[17] N. K. Dessy Hariyanti *Et Al.*, "Evaluation Of Enrichment In Ontology-Based Knowledge Management System," No. November, Pp. 29–34, 2024, Doi: 10.1109/Icsgteis60500.2023.10424116.

[18] E. M. Sanfilippo, B. Markhoff, And P. Pittet, "Ontological Analysis And Modularization Of Cidoc-Crm," *Front. Artif. Intell. Appl.*, Vol. 330, No. February, Pp. 107–121, 2020, Doi: 10.3233/Faia200664.

[19] Cidoc Crm Special Interest Group, "Definition Of The Cidoc Conceptual Reference Model Version 7.2.2," No. September, Pp. 1–234, 2023, [Online]. Available: Https://Cidoc-Crm.Org/Sites/Default/Files/Cidoc_Crm_Version_7.2.1.Pdf

[20] A. Pinto-De La Gala, Y. Cardinale, And I. Dongo, "Curiocity Framework: Managing Heterogeneous Cultural Heritage Data," *Acm Int. Conf. Proceeding Ser.*, No. December, Pp. 664–669, 2021, Doi: 10.1145/3486622.3494001.

[21] R. Stewar, Y. Zhelev, And M. Monova-Zheleva, "Development Of Digital Collections Of Intangible Cultural Heritage Objects - Base Ontology," *Digit. Present. Preserv. Cult. Sci. Herit.*, Vol. 11, Pp. 51–56, 2021, Doi: 10.55630/Dipp.2021.11.4.

[22] F. Wang, T. Wei, And J. Wang, "Ontology-Driven Cultural Heritage Conservation: A Case Of The Analects Of Confucius," *Appl. Sci.*, Vol. 12, No. 1, 2022, Doi: 10.3390/App12010287.

[23] G. Faraj And A. Micsik, "Representing And Validating Cultural Heritage Knowledge Graphs In Cidoc-Crm Ontology," *Futur. Internet*, Vol. 13, No. 11, Pp. 1–15, 2021, Doi: 10.3390/Fi13110277.

[24] S. Haridy, R. M. Ismail, N. Badr, And M. Hashem, "An Ontology Development Methodology Based On Ontology-Driven Conceptual Modeling And Natural Language Processing: Tourism Case Study," *Big Data Cogn. Comput.*, Vol. 7, No. 2, P. 101, May 2023, Doi: 10.3390/Bdcc7020101.

[25] D. Kalita And D. Deka, "Ontology For Preserving The Knowledge Base Of Traditional Dances (Otd)," *Electron. Libr.*, Vol. 38, No. 4, Pp. 785–803, 2020, Doi: 10.1108/El-11-2019-0258.

[26] B. Lantow, "Ontometrics: Putting Metrics Into Use For Ontology Evaluation," *Ic3k 2016 - Proc. 8th Int. Jt. Conf. Knowl. Discov. Knowl. Eng. Knowl. Manag.*, Vol. 2, No. Ic3k, Pp. 186–191, 2016, Doi: 10.5220/0006084601860191.

[27] N. Mellal, T. Guerram, And F. Bouhalassa, "An Approach For Automatic Ontology Enrichment From Texts," *Inform.*, Vol. 45, No. 1, Pp. 81–91, 2021, Doi: 10.31449/Inf.V45i1.2586.

[28] S. A. Md Nasir And N. L. Md Noor, "Integrating Ontology-Based Approach In Knowledge Management System (Kms): Construction Of Batik Heritage Ontology," *Cssr 2010 - 2010 Int. Conf. Sci. Soc. Res.*, No. January 2016, Pp. 674–679, 2010, Doi: 10.1109/Cssr.2010.5773866.

[29] M. F. López, A. G. Pérez, M. Dolores, And R. Amaya, "Ontology ' S Crossed Life Cycles," *Proc. 12th Int. Conf. Knowl. Eng. Knowl. Manag.*, No. January 2000, Pp. 65–79, 2000.

[30] M. Bravo, L. F. H. Reyes, And J. A. Reyes Ortiz, "Methodology For Ontology Design And Construction," *Contaduria Y Adm.*, Vol. 64, No. 4, Pp. 1–24, 2019, Doi: 10.22201/Fca.24488410e.2020.2368.

[31] S. Tartir, I. B. Arpinar, M. Moore, A. P. Sheth, And B. Aleman-Meza, "Ontoqa: Metric-Based Ontology Quality Analysis," *Ieee Icdm 2005 Work. Knowl. Acquis. From Distrib. Auton. Semant. Heterog. Data Knowl. Sources*, 2005, [Online]. Available: Http://Citeseerx.Ist.Psu.Edu/Viewdoc/Summary?Doi=10.1.1.131.2087

[32] S. Haridy, R. Ismail, N. Badr, And M. Hashem, "Ontology-Driven Conceptual Model And Domain Ontology For Egyptian E-Government," *Int. J. Intell. Comput. Inf. Sci.*, Vol. 23, No. 2, Pp. 116–132, 2023, Doi: 10.21608/Ijicis.2023.176123.1230.

[33] S. Haridy, R. M. Ismail, N. Badr, And M. Hashem, "The Combination Of Ontology-Driven Conceptual Modeling And Ontology Matching For Building Domain Ontologies : E-Government Case Study," Vol. 29, No. 4, Pp. 269–282, 2023.

[34] R. Poli, M. Healy, And A. Kameas, "Theory And Applications Of Ontology: Computer Aplications," *Theory Appl. Ontol. Comput. Appl.*, Pp. 1–576, 2010, Doi: 10.1007/978-90-481-8847-5.

[35] M. A. Raza, M. Rahmah, S. Raza, A. Noraziah, And R. A. Hamid, "A Methodology For Engineering Domain Ontology Using Entity Relationship Model," *Int. J. Adv. Comput. Sci. Appl.*, Vol. 10, No. 8, Pp. 326–332, 2019, Doi: 10.14569/Ijacsa.2019.0100842.

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Ontology ~~Modelling~~Modeling for *Subak* Knowledge Management System

Ni Kadek Desy Hariyanti[a,*], Linawati[b], I Made Oka Widyantara[b] , Gede Sukadarmika[b] , I Nyoman Gede Arya Astawa[c]

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Abstract— *Subak* is an irrigation and agricultural management organization ~~based on~~rooted in Balinese customs ~~that~~. It has cultural heritage knowledge, including ~~not only~~both material artifacts ~~but also~~and tacit ~~knowledge contained in~~ elements, particularly practices, traditions, and expertise~~, as well as~~ . Knowledge is conveyed through explicit ~~knowledge in the form of~~ forms such as stories, literature, and official records. ~~This study found that~~However, there has been no ~~research on~~investigation into the development of ontology-based *Subak* knowledge~~, especially~~ model, particularly in the context of cultural preservation. ~~This study aims~~Therefore, this research aimed to ~~build a *Subak*~~ develop ontology knowledge model for ~~digitalization of cultural~~the digital preservation of *Subak* culture in the form of ~~a~~ Knowledge Management System~~.~~ (KMS). The development of ~~the ontology~~ model ~~goes through~~was based on three main stages~~:~~, including requirement ~~Analysis, namely~~analysis, ontology development, and ontology assessments. Requirement analysis included data ~~collecting~~collection through field observations, in-depth interviews, and document analysis~~. Ontology Development defines~~, while ontology development consisted of hierarchical classes, object and data properties, ~~and~~as well as individual entities. ~~The ontology model is implemented using protégé. The ontology builds~~Furthermore, ontology assessments were the stage of evaluating and testing the resulting ontology. Protégé software was used to apply ontology model, generating Ontograf visualizations and ~~produces OWL (~~producing Ontology Web Language~~). Then, ontology Assessments are the stage of implementing the evaluation and testing of the ontology produced.~~ (OWL). Validation ~~is~~was carried out ~~with OntoQA (~~using both Ontology Quality Analysis (OntoQA) and expert comments. The evaluation results ~~show~~showed a Relationship Richness (RR) value of 0.8, an Inheritance Richness (IR) value of 0.78, and an Attribute Richness (AR) value of 3.89~~. It can be concluded~~, showing that ~~the~~ ontology ~~produced is quite rich~~captured a comprehensive and ~~has~~ representative body of knowledge. ~~From the expert~~Expert comments stated that ~~the~~ ontology model created ~~is~~was worthy of being used to represent *Subak* knowledge as a form of cultural preservation. The ~~resulting~~developed *Subak* ontology ~~can be a reference~~could serve as a foundational knowledge base for ~~the development of other ontologies in the domains of~~future ontology in related fields such as agricultural management, social organization, and cultural preservation.

Keywords~~—~~: Ontology, Cultural Heritage, Knowledge ~~representation~~Representation, Knowledge based, Knowledge Management System

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I. INTRODUCTION

Cultural heritage is increasingly fading [1] ~~due to the influence~~as a result of globalization and social change, which shift traditional values and lead to a lack of attention ~~to~~toward maintaining and disseminating knowledge. ~~Cultural heritage knowledge~~It [2] includes ~~not only~~both material artifacts ~~but also~~and tacit knowledge contained in practices, traditions, and skills passed down ~~from generation to generation~~through generations, as well as ~~explicit knowledge~~ documented knowledge found in~~ the form of~~ stories, literature, and official records.

UNESCO ~~calls for joint action in documenting, preserving, and protecting~~requests collaborative work to document, preserve, as well as protect ancestral cultural practices and knowledge that are increasingly being degraded~~ today, one of which is~~, particularly through digitization [3]. ~~UNESCO emphasizes~~The organization also shows the importance of digitization efforts based on sustainability principles, community participation, access to information, and a comprehensive knowledge management system (KMS) [4] mainly provided for future generations. ~~Knowledge Management System (KMS) is a system that provides~~However, KMS is a structured platform [5] that allows an organization to efficiently collect, store, organize, and share knowledge~~ efficiently~~.

The development of KMS requires ~~a~~an effective knowledge representation model, ~~where~~with the ~~implementation~~integration of ontology ~~is one~~offering a solution to capture undocumented knowledge [6]~~ that has yet to be documented. Ontology, as~~. As a formal model of knowledge, ontology provides a framework for defining concepts, relations, properties, and rules in ~~the~~ knowledge ~~domain~~context [7]. This ~~enables~~promotes organizational consistency ~~of organization~~ and interoperability, as well as enhances computer understanding of the context and meaning [8] of knowledge in an effort to use it more effectively for various ~~needs~~purposes.

Subak is an organization that manages a traditional irrigation system in Bali based on the principles of Tri Hita Karana [9]~~, which has~~. The principles have been recognized by UNESCO [10] as a world cultural heritage covering social, cultural, and ecological values~~ and~~ , as well as related agricultural practices~~ related to it.~~. *Subak* ~~has its uniqueness in the creation of~~embodies unique collaborative knowledge [11]~~. Traditional methods in transferring intangible heritage knowledge~~ that is traditionally transferred [12] ~~are often carried out~~ through personal and verbal ~~exchange of information. The~~exchanges. However, the challenges ~~of~~posed by modernization and urbanization [9] trigger a decrease in the younger generation's ~~involvement~~engagement in direct *Subak* practices, ~~so~~leaving this knowledge ~~is~~ vulnerable to erosion over time. ~~Meanwhile, in supporting~~In order to support the organization's existence, ~~this~~ knowledge needs to be captured and shared with the next generation through technological innovation [13], ~~one of which is through a knowledge management system~~such as KMS.

Based on the initial observations, ~~it was found that~~ *Subak* knowledge, particularly tacit and explicit, needs ~~to be managed better~~ improved management and ~~that the media should display it comprehensively. So~~a comprehensive platform for its appearance. Therefore, it is essential to ~~create an~~develop ontology model to represent ~~the~~a robust knowledge base for developing ~~the *Subak* knowledge management system~~KMS and support efforts to digitize cultural preservation. ~~In addition, the~~The resulting *Subak* ~~Ontology~~ontology can ~~later be~~serve as a foundational reference for ~~developing~~creating other ~~ontologies~~ontology in related fields such as agricultural management, social organizations, and cultural preservation. Ontology research and development have been widely conducted ~~based on~~across various ~~research methodologies in various~~contexts, with most cultural preservation ~~domains. Most cultural preservation ontologies are~~ontology being formed from ~~scratch~~the preliminary stage [14]. This causes the research methodology to be more adjusted to the characteristics of data collection challenges and the scope of~~ the~~ knowledge domain [15],[16]. Previous ~~research~~investigations have conducted a literature ~~study~~review [17] ~~in formulating~~to refine the methodology for *Subak* ontology development ~~research methodology as~~, forming a preliminary stage ~~of~~in this research.

~~In~~To represent knowledge at the conceptual data stage, ~~Ontology~~ontology modeling [18] is ~~needed to represent knowledge.~~essential. CIDOC-CRM [19] is ~~an~~ ontology modeling developed to ~~align~~unify the ~~domains~~concepts of libraries, museums, archives, and cultural data collections. To date, CIDOC-CRM has ~~determined~~identified 99 classes ~~and~~with 198 properties~~. In this study, CIDOC-CRM~~ and it is only used as ~~a~~ modeling reference [20]~~, and many~~. Many adjustments are made [21],[22] ~~considering~~since the complexity and characteristics of ~~specific~~ *Subak* ~~domains are very different~~vary significantly from the framework offered.

Ontology assessment ~~involves~~includes external validation methods [23], ~~including Competency Questions-based~~particularly CQs [24] and ~~Expert~~expert confirmatory [7]~~. Internal~~, as well as internal consistency ~~uses~~checks using ontology metrics [1][24][25][26]. Given the ~~ever-growing~~continuous expansion of knowledge, knowledge sufficiency is ~~overcome by continuous~~ addressed through ongoing and structured~~ knowledge~~ enrichment [17].

~~Many researches~~Although numerous investigations have ~~been conducted about~~explored KMS ~~in~~within the context of cultural heritage ~~culture~~[4]~~. No research~~ , no investigations have focused on the development of ontology-based ~~KMS~~knowledge model, specifically for *Subak* ~~has ever been conducted~~ through ~~the~~a literature review [14]. ~~This study proposes developing~~Therefore, this research aimed to establish ontology-based knowledge model for the digitalization and preservation of ~~*Subak*~~ cultural heritage ~~preservation. So, the main problem formulation of this study is how~~. It also aims to create ~~ontology knowledge~~ model that can accurately represent *Subak* knowledge in the preservation of cultural heritage~~ knowledge~~. The analysis results ~~of this study~~ are in the form of ontology-based knowledge model designed for the representation of ~~the *Subak* knowledge management system~~KMS.

II. METHODOLOGY

Ontology ~~will show~~showed how ~~the adequacy of~~ knowledge ~~is~~adequacy was presented~~. Ontology development activities are one of the~~, serving as a fundamental ~~steps~~step in supporting ~~the knowledge management process~~KMS [27]. Therefore, it ~~is~~was necessary to pay attention to how to design ontology in

KMS. The adoption of ontology ~~in KMS is~~was based on~~ the~~ KMS Life Cycle [28]~~ approach~~, which ~~consists~~consisted of seven stages of development, as shown in ~~Fig~~Figure 1. Based on the seven ~~steps of the KMS Life Cycle~~stages, ontology development ~~will be at the~~occurred during Knowledge ~~capture~~Capture stage [29]. In KMS, the ~~Knowledge Capture~~ stage ~~consists of~~included Knowledge Acquisition, Knowledge Creation, and Knowledge Evaluation, which ~~are~~were in accordance with the framework ~~in~~of this ~~study~~research.

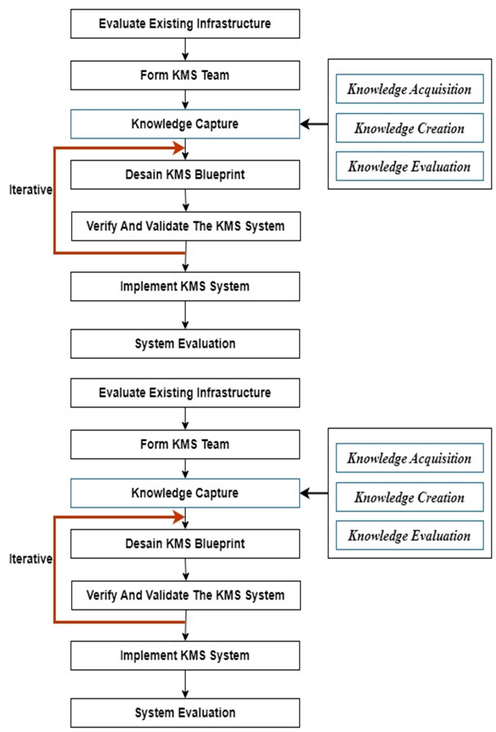


Fig. 1 -KMS Life Cycle

The research methodology ~~of~~in this ~~study references~~research was based on CIDOC-CRM[19], with some adjustments ~~made according~~tailored to the specific knowledge ~~domain being built.~~context. As described in ~~Fig.~~Figure 2, ~~it consists of~~the methodology covered four main stages [17], ~~they are~~including requirement analysis, ontology development, ontology assessment, and ontology enrichment. ~~Ontology~~Specifically, ontology development ~~is~~was structured as an iterative process [30].

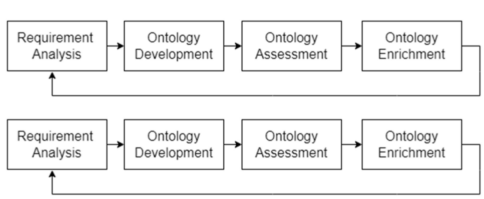


Fig 2 -Research Framework

A. Requirement Analysis

Building ~~a~~ knowledge base ~~begins~~started with exploratory research~~, with~~ aimed at identifying the ~~aim of determining the~~foundational facts ~~that form~~of *Subak* knowledge.

1) Objective Formulation: ~~formulating general and specific objectives in detail for creating ontology.~~ This objective formulation ~~will form~~formed the basis for compiling a list of competency questions (CQs~~,~~), which ~~are~~were questions designed to identify ~~the~~ knowledge needed to achieve the purpose of creation [1]. By formulating objectives~~ first~~, ontology developers ~~can ensure~~ensured that the CQs compiled ~~will~~would be relevant and focused on achieving the predetermined goals~~ that have been set. This stage produces a list of CQs~~.

2) Domain Acquisition: ~~is~~Domain acquisition was considered the stage of acquiring *Subak* knowledge. ~~Because the~~Since *Subak* ontology ~~has~~had never been created, the acquisition ~~is~~was carried out from the ~~beginning (scratch)~~preliminary stage [14]. ~~The data sources that will be used in the study are~~In this research, primary ~~and secondary data. Primary data is~~data was obtained ~~from~~through observation ~~data~~ and in-depth interviews ~~with~~conducted among *Subak* administrators and experts. ~~While secondary~~Secondary data ~~is obtained~~was sourced from a library~~/~~ or literature ~~studies~~review related to the research topic and data from field observations. ~~Knowledge~~Furthermore, knowledge formation ~~is~~was carried out through ontology modeling, which ~~produces~~produced a vocabulary dataset.

B. Ontology Development:

The collected data ~~is~~was currently in the development stage of the reference model ~~in~~within CIDOC-CRM conceptual modeling. It ~~consists~~consisted of two main stages~~, namely:~~

1) Knowledge Conceptualization

Knowledge ~~will~~would be modeled based on ontology. The following were the main components of the concept of knowledge ontology [31]~~ has several main components, namely:~~

.

- Classes: ~~Explain~~This particular component explained the concept and general ~~things~~characteristics of knowledge~~ in a domain~~. A class ~~has~~had subclasses intended to express more specific concepts than the superclass.
- Properties: ~~are 2~~Properties were two-way ~~relations~~components that ~~connect classes~~ connected a particular class with other classes to form knowledge~~/~~ or concept links. There ~~are~~were two types of ontology properties~~:~~, including object and data. Object properties ~~that~~ connect ~~objects~~a specific object with ~~other objects and~~another, while data type properties ~~that~~ connect objects with data ~~type~~ values~~ (~~, such as text, string, or number~~)~~.
- ~~*Instance* /~~Instances or particular ~~*things* /~~objects ~~are individuals /~~represented individual members~~, are actual objects of~~ within a class ~~containing~~that

contained facts/information derived from a concept ~~/~~or body of knowledge.

- Constraints ~~or~~defined the rules ~~for~~governing the ~~things~~objects.
- Relationship ~~is the concept of~~ established the relationship between the ~~things~~objects.
- Functions ~~are~~represented the processes that ~~involve things~~included objects.

2) Knowledge Modeling: ~~will be~~Knowledge modeling was formed in Ontology Web Language (OWL~~,~~), which ~~allows~~allowed users to define concepts, properties, and relationships ~~between these concepts in~~with more detail and ~~formally~~formality. Protégé ~~is~~software was used to help ~~visualize~~in visualizing the concept of knowledge. This stage ~~produces~~produced ontology class structure and ~~ontology~~ graph.

C. Ontology Assessments

This ~~is~~was the stage ~~of implementing~~where the ~~evaluation and validation of the~~produced ontology ~~produced. This stage produces~~was evaluated and validated, thereby producing recommendations for ontology enrichment. Validation ~~is done~~was carried out using ~~OntoQA (both~~ Ontology Quality Analysis (OntoQA) [32] and ~~experts'~~expert comments. OntoQA ~~is~~was one ~~technique~~of the methods used to ~~evaluate ontology's quality. OntoQA provides~~provide ontology characteristics as a description of ~~the~~its quality ~~of the ontology~~ in terms of knowledge representation potential. ~~The OntoQA used in~~In this ~~study is the~~research, OntoQA measurement scheme category, which ~~consists~~consisted of Relationship Richness (RR), Inheritance Richness (IR), and Attribute Richness (AR) measurements, was used to evaluate the quality of ontology.

1) ~~*Relationship Richness (*~~RR~~*): is*~~: RR was a metric used to describe the relationships ~~used~~ that occurred in ontology. This metric ~~measures~~measured how ontology ~~utilizes~~used various relationships between existing concepts, including inheritance~~,~~ and non-inheritance ~~relationships.~~. RR ~~indicates~~showed whether ontology ~~relies~~relied on inheritance ~~hierarchies~~ or ~~utilizes various types of~~ non-hierarchical ~~relationships~~ hierarchies to represent knowledge. ~~The RR evaluation will~~ Furthermore, the metric was used to describe the ratio ~~between~~of the number of inheritance (SC) and non--inheritance (P) relationships on a scale of zero to one, ~~formulated~~as expressed in ~~equation~~Equation 1.

$$\text{~~RR =~~} \frac{|P|}{(|SC|+|P|)} \quad RR = \frac{|P|}{(|SC|+|P|)} \qquad (1)$$

RR ~~provides important~~provided valuable insights into the complexity and flexibility of the relationship structure ~~in an ontology~~ and ~~can~~could be used ~~as one indicator of~~to assess the quality of ~~an~~ ontology in representing knowledge in a particular ~~domain~~field.

2) ~~*Inheritance Richness (*~~IR~~*): is*~~: IR was a metric used ~~in ontology evaluation~~ to measure the depth of the inheritance hierarchical structure ~~in~~. The metric showed the extent to which ontology~~. This metric indicates how much ontology utilizes~~ relied on inheritance relationships among its concepts. ~~Inheritance Richness (IR) is~~On a scale of zero to one, IR was defined as the ratio of the total number of subclasses (H) in ontology to the total number of classes (C~~)~~ ~~on a scale of zero to one. The IR formula is~~), as presented in Equation 2.

$$\text{~~IR =~~} \frac{|H|}{|C|} \quad IR = \frac{|H|}{|C|} \qquad (2)$$

~~3) *Attribute Richness (AR)*~~

3) ~~Attribute Richness (~~AR

AR~~) is~~ was a metric ~~used in ontology evaluation~~adopted to measure the extent to which ontology ~~utilizes~~used attributes or properties in describing its concepts. ~~Attribute Richness (AR) measures~~This metric measured the average number of attributes (att) possessed by each class ~~(C) in ontology. This metric provides~~as well as provide an overview of how rich the description of concepts in ~~an~~ ontology ~~is~~was based on ~~the number of attributes used. The AR formula is presented~~att, as expressed in Equation 3.

$$\text{~~AR =~~} \frac{|att|}{|C|} \quad AR = \frac{|att|}{|C|} \qquad (3)$$

D. Ontology Enrichment

This ~~is~~was the stage of completing and enriching concepts and information data for the adequacy of ~~the~~ knowledge population based on recommendations generated from the previous stage. ~~There are~~ The following were the two types of enrichment [17]~~, namely:~~

~~Carried out~~.

1) Conducted at the ~~beginning~~initial phase of ontology development to obtain sufficient knowledge. ~~This study will carry out~~The current research adopted this type of enrichment. Ontology development ~~is~~was considered a repetitive process until the targeted knowledge adequacy ~~is~~was achieved for creation. ~~This~~The stage ~~will~~ had the tendency to return to ~~the~~ ontology development stage, and it ~~is possible to~~could be skip ~~certain stages if deemed~~when considered unnecessary.

2) ~~Enriches~~ Expand an existing ontology by adding domains to ~~an already existing one, aiming to~~ produce a new ontology or ~~an ontology with an expanded~~to broaden the scope of the current domain.

III. RESULT AND DISCUSSION

The development of ~~knowledge management requires a~~KMS required knowledge representation model, where the ~~implementation~~use of ontology ~~is~~was considered one ~~solution~~of the solutions to capture undocumented knowledge [7]~~ that has yet to be documented.~~. As a formal knowledge model, ontology ~~provides a~~provided a structured framework for defining concepts, relations, properties, and rules in~~ the~~ knowledge domain [5]. This ~~allows for consistent organization~~framework promoted organizational consistency and interoperability~~ and~~, as well as enhanced computer understanding of the context and meaning of knowledge ~~so that~~in an effort to use it ~~can be used~~ more effectively for various ~~needs. Following~~purposes. According to the research framework~~ (Fig~~, as shown in Figure 2~~)~~, there were four main stages ~~exist~~ in~~ developing~~ the development of *Subak* ontology model [17]. ~~The ontology~~Ontology was built using Balinese language representation, considering that many *Subak* terms ~~are terms used by~~ were deeply rooted in Balinese ~~people in their~~culture and traditional life. The following ~~is a series of~~outlined the steps taken in ontology development.

The integration of ontology and ~~Knowledge Management Systems (~~KMS~~) plays~~ played a ~~vital~~crucial role in the digital preservation of cultural heritage by systematically organizing knowledge ~~systematically~~ and ensuring its long-term accessibility. Ontology ~~captures~~captured the meaning, relationships, and context of cultural elements, while KMS ~~manages~~efficiently managed the storage, retrieval, and sharing of this knowledge~~ efficiently. These~~. The two technologies also ~~facilitate~~facilitated the dissemination of cultural knowledge to younger generations through interactive, particularly educational platforms. Furthermore, a modern system design ~~ensures~~ensured that interfaces ~~remain~~remained relevant and user-friendly~~, enabling~~ to enable continued engagement with cultural heritage through evolving technologies, ~~thus~~potentially preserving knowledge for future generations.

A. Requirement Analysis

Determining ~~the~~ ontology's objectives, domain, and scope ~~is~~was the first step in focusing on the ~~scope~~concept of knowledge. This ~~is~~was followed by determining the objectives of ontology formulation and acquiring ~~the~~ knowledge domain.

1) Objective Formulation

The main objective of ontology formation ~~is~~was to represent *Subak* knowledge as ~~a~~ cultural heritage that must be preserved. ~~Furthermore, the limitations and scope of ontology are declared.~~ This research ~~focuses~~focused on ~~the~~ *Subak* domain~~ as depicted in Fig. 2, ~~, which ~~shows~~showed the scope of ontology~~, which is depicted~~ in a Conceptual Data Framework, as detailed in Figure 2.

~~From~~According to the literature ~~study conducted~~review, *Subak* ~~is~~represented an irrigation and agricultural management organization ~~based on~~rooted in Balinese customs that ~~has a~~had cultural ~~knowledge~~ heritage~~, including~~. Knowledge included not only material artifacts but also tacit ~~knowledge~~elements contained in practices, traditions, and expertise, as well as explicit knowledge ~~in the form of~~manifested through stories, literary works, and official records [33]. The philosophy of Tri Hita Karana ~~is the philosophy underlying the~~ showed *Subak* organization, where ~~Subak~~ activities ~~include activities in relation to~~ were categorized into three, comprising relationships with God (Parahyangan), ~~activities in relation to~~interactions with the environment (Palemahan), and ~~activities in relation to other~~connection among *Subak* members (Pawongan). In ~~its implementation~~practice, Parahyangan ~~is in the form of~~ comprised religious~~,~~ and customary ceremonies, Palemahan ~~is~~was in the form of agricultural irrigation activities, and Pawongan ~~is in the implementation of Subak~~included organizational activities~~.~~ within *Subak*. Each ~~Subak~~ activity ~~includes~~consisted of planning~~ activities (Planning),~~, division of tasks (Organizing), ~~implementation~~integration and regulation ~~of activities~~ (Actuating), and supervision by *Subak* administrators (Controlling). ~~All implementation~~The execution of all these activities ~~involves~~was influenced by the ~~place of activity~~location (Desa), ~~time of activity~~timing (Kala), and definition of *Subak* activities (Patra), ~~where~~with each activity ~~consists of~~comprising specific procedures (Practices) and tools used (Artifact). The ~~overall~~total concept of *Subak* activities ~~is~~served as the basis for ~~the Subak~~ ontology data~~ mapping~~, as detailed in Figure 3. The conceptual framework~~, as depicted in Fig 3. This data concept framework has also been confirmed by Subak~~ was validated by experts, who stated ~~that it is feasible~~its feasibility and ~~can be applied to~~applicability for the ~~built~~development of ontology data mapping.

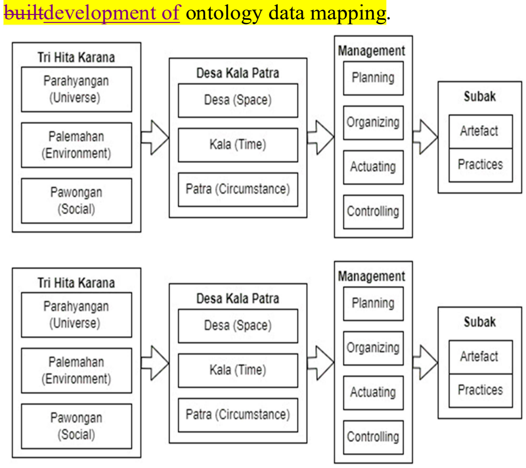


Fig 3. Conceptual Data Model of *Subak* Knowledge

~~Next, competency questions are~~CQs were compiled to ~~deepen~~enhance understanding of ~~the scope of the~~ ontology domain ~~being developed. In addition, it will~~and would also ~~be used~~play a crucial role in the ~~ontology~~ validation stage. ~~CQs are~~Furthermore, they were questions that ~~must be answered by the~~ knowledge base built from ~~the~~ ontology ~~being developed~~must address. CQs ~~are created based on~~were generated using observations, documentation~~ studies~~, and expert interviews.

The selection of ~~competency questions is~~CQs was based on the primary needs of ~~the subak~~*Subak* managers ~~for~~regarding the representation of knowledge that they want to ~~display~~present in the system. ~~Referring to~~In light of the

~~need~~objective to provide information ~~to the next generation of young people, the~~for future generations, knowledge presented by KMS must be comprehensive~~ and provide information~~, providing insights about *Subak* ~~itself~~.

~~Competency questions (CQs) are~~CQs were designed not only to deepen understanding of ~~the scope of the~~ ontology domain ~~being developed and~~but also to serve as a tool for validation of ontology competency. ~~Ontology competency~~ The validation ~~is~~was carried out through agreement among a group of domain experts, who ~~are asked to compile~~compiled a list of questions that ~~the~~ ontology ~~is~~was expected to answer~~, known as competency questions~~. Ontology engineers ~~and~~ collaborated with domain experts ~~work together~~ to formulate this list, ~~which contains~~containing direct questions that ~~the~~ ontology system ~~is~~was expected to ~~be able to~~ answer~~ after implementation. This~~. The list ~~of questions is used~~was instrumental not only ~~in~~for validation but also ~~in~~for the final evaluation of ~~the~~ ontology. ~~Competency questions are~~Moreover, CQs were critical questions that ~~the~~ ontology model must be able to answer ~~and are created~~ based on the observation results~~ of observations~~, documentation~~ studies~~, and in-depth interviews with experts.

The general definition of *Subak* ~~is~~was determined to be an organization that ~~manages~~managed traditional irrigation systems in Bali based on the principles of Tri Hita Karana [9], including social, cultural, ecological values, and related agricultural practices~~ related to it.~~. Therefore, the compiled ~~CQ~~CQs must be able to explore knowledge in related elements [34]~~.~~, as presented in Table 1~~ is a list of the established CQs~~.

TABLE I
COMPETENCY QUESTIONS

Elements	Competency Questions
Tri Hita Karana	What is the Definition of *Subak* in the Parahyangan concept? What is the Definition of *Subak* in the Palemahan concept? What is the Definition of *Subak* in the Pawongan concept?
Pawongan(Social)	Who plays a role in ~~the~~ *Subak* organization?
Pawongan (Social)	What are the activities in ~~the~~ *Subak* organization?
Palehaman(Environment)	What infrastructure is ~~involved~~included in ~~the~~ *Subak* irrigation system?
Palemahan(Environment)	How is ~~the~~ *Subak* irrigation system organized?
Palemahan(Environment)	What is the irrigation pattern carried out by *Subak*?
Parahyangan(Traditional Ceremonies)	What are the ritual elements associated with *Subak*?
Parahyangan(Traditional Ceremonies)	Where are the ritual ceremonies carried out by *Subak*?
Pawongan(Social)	What is the organizational structure of *Subak* management?
Pawongan(Social)	What is the pattern of communication and coordination between *Subak* members?

2) *Domain Acquisition*

This stage ~~is the stage of~~ focused on acquiring knowledge in ~~the~~ knowledge domain. The data collected ~~in~~during the objective formulation stage ~~is~~was mapped into the data mapping ~~concept relation depicted in Fig.~~conceptual relations presented in Figure 2. ~~It begins~~The process started with the Tri Hita Karana Concept, which served as the basic principle of *Subak* activities. Each aspect of ~~Tri Hita Karana has~~the principle had its Desa-Kala-Patra elements~~. In each activity, the Desa-Kala-Patra elements are~~, which were categorized ~~in~~within modern management activities based on ~~POAC (~~the Planning-Organizing-Actuating-Controlling (POAC). These management activities ~~include defining~~included the definition of both activities and artifacts.

Data collection methods ~~through~~used in this stage included observation, surveys, focus group discussions (FGD), and documentation~~ studies. Because the~~. Since *Subak* ontology ~~has~~had never been created, the acquisition ~~is~~was carried out from ~~the beginning (~~scratch~~)~~. This stage ~~begins~~started by collecting all the vocabulary related to *Subak* through ~~document studies~~documentation, field observations, and in-depth interviews with several experts. The data collection ~~techniques~~methods used ~~are:~~included the following.

- ~~*Document Study*~~*Documentations*: Various documents and literature ~~have been studied~~were examined, including lontar, awig-awig *Subak*, government regulations, Village Regulations, and ~~other documents obtained from online sources or directly from sources~~others.
- *Observation*: Participant observation ~~is~~was carried out on *Subak* organizations, both internal and external, to support the analysis carried out in ~~the study~~this research.
- *In-depth interview:* ~~used to collect qualitative data.~~ In-depth interviews were conducted ~~with~~among *Subak* administrators, farmers, community practitioners, and experts~~. Given that~~ to collect qualitative data. Since the understanding of *Subak* ~~requires~~required a postmodern ~~approach~~method [35], [36], which ~~recognizes~~recognized the complexity, diversity~~ of perspectives~~, and challenges in maintaining tradition amidst rapid social and economic change, ~~the selection of informants is determined based on~~participants were selected using purposive sampling. The ~~essential~~ criteria used for ~~informants are that they~~the selection included the participants who have been ~~involved~~ in ~~the~~ *Subak* field for over two years. The determination of experts ~~consists~~consisted of ~~experts~~those in the fields of *Subak*, ecotourism, and socio-culture.

~~The~~ Furthermore, the data collected ~~is then~~was mapped ~~according to~~in accordance with the data mapping concept ~~relation~~ related to the domain ~~depicted~~, as detailed in Table 2.

TABLE II
ONTOLOGY SCOPE

Tri Hita Karana	Desa Kala Patra	POAC	Identification
Parahyangan (Universe)	Desa (Place)	Planning	Planning the construction and maintenance of sacred places
		Organizing	Management of sacred places
		Actuating	Use and maintenance of sacred places
		Controlling	Supervision of management of sacred places
	Kala (Time)	Planning	Planning of traditional ceremony schedules
		Organizing	Management of traditional ceremony times
		Actuating	Time of implementation of traditional ceremonies
		Controlling	Supervision of management of traditional ceremony times
	Patra (Activity)	Planning	Planning of traditional ceremony activities and ceremonial equipment
		Organizing	Management of traditional ceremony activities and ceremonial equipment
		Actuating	Implementation of traditional ceremonies and ceremonial equipment
		Controlling	Supervision of implementation of traditional ceremonies and ceremonial equipment
Palemahan (Environmental))	Desa (Place)	Planning	Planning of construction and maintenance of irrigation structures
		Organizing	Management of irrigation structures
		Actuating	Use and maintenance of irrigation structures
		Controlling	Supervision of management of irrigation structures
	Kala (Time)	Planning	Planning of schedule for implementation of irrigation management
		Organizing	Management of irrigation management time
		Actuating	Time of implementation of irrigation management
		Controlling	Supervision of management of irrigation management time
	Patra (Activity)	Planning	Planning of irrigation management activities and irrigation equipment
		Organizing	Management of irrigation management activities and irrigation equipment
		Actuating	Implementation of irrigation management and irrigation equipment
		Controlling	Supervision of implementation of irrigation management and irrigation equipment
Pawongan (Social Organization)	Desa (Place)	Planning	Planning of construction and maintenance of organizational management places
		Organizing	Management of organizational management places
		Actuating	Place of implementation of organizational management
		Controlling	Supervision of place of implementation of organizational management
	Kala (Time)	Planning	Planning of schedules implementation of organizational management
		Organizing	Management of organizational management implementation time
		Actuating	Implementation of organizational management
		Controlling	Supervision of organizational management implementation time
	Patra (Activity)	Planning	Planning of organizational management activities and participated parties ~~involved~~
		Organizing	Management of organizational management activities and participated parties ~~involved~~
		Actuating	Implementation of organizational management activities and participated parties ~~involved~~
		Controlling	Supervision of the implementation of organizational management activities and participated parties involved

B. Ontology -Development

~~This stage is the development~~The developmental stage of ~~the~~ ontology ~~model referring~~referred to CIDOC-CRM conceptual modeling~~. It consists~~, and it consisted of two stages, ~~namely:~~including,

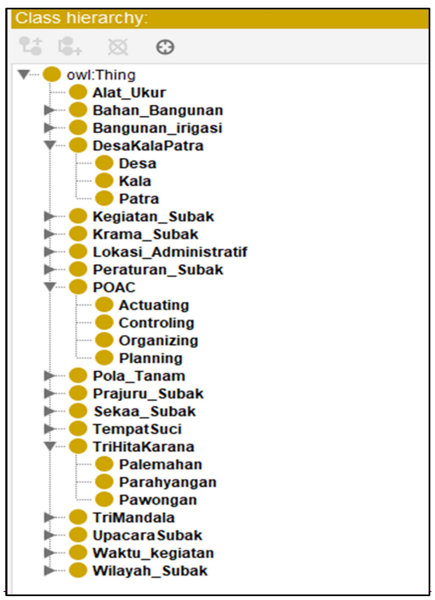
1) Knowledge conceptualization

~~This~~The conceptualization stage ~~produces~~produced entity classes, object and data properties, ~~and~~as well as individuals from each entity. Ontology *Subak* ~~consist~~consisted of 18 ~~Super Classes~~super classes, 76 ~~Sub Classes~~sub classes, 56 object properties, and 366 data properties. Object ~~Properties~~

~~and 366 Data Properties. Object~~ properties ~~define~~defined the relationship between classes, ~~where Subclass is~~subclass was considered an inheritance relationship~~. Data Properties is properties~~, and propertiest represented the number of ~~data that represent atribut~~attributes of the class.

2) *Knowledge ~~Modelling~~Modeling*

~~The modeling~~Modeling stage ~~is~~was performed ~~by the~~using Protégé~~. The structure of the~~ software, with *Subak* ontology class ~~is~~structure shown in ~~Fig~~Figure 4. This structure ~~creates~~created a hierarchy between superclasses and subclasses, ~~making it easier to group~~ facilitating the grouping of related concepts and ~~making~~enhancing data ~~more accessible to manage~~management and ~~understand.~~comprehension. The class structure ~~allows~~allowed general knowledge to be reused across domains, reducing redundancy and facilitating data integration from different sources.



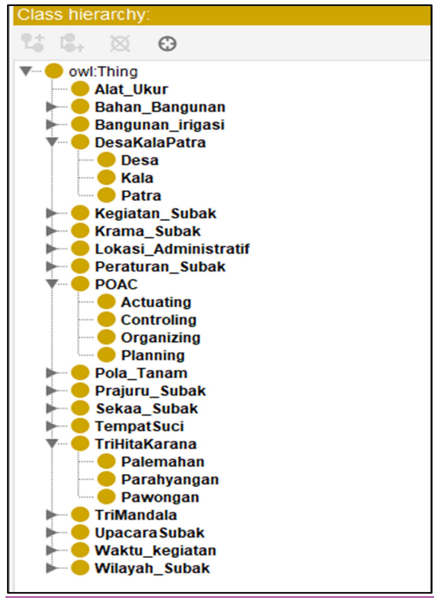
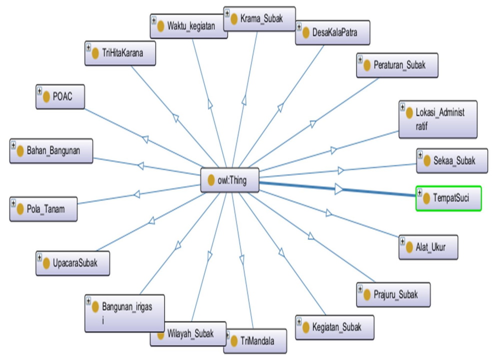


Fig 4 -*Subak* Ontology Class Structure



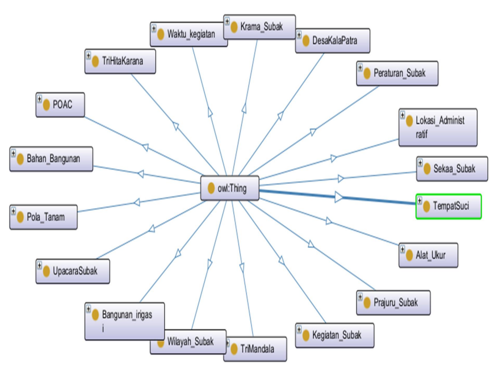
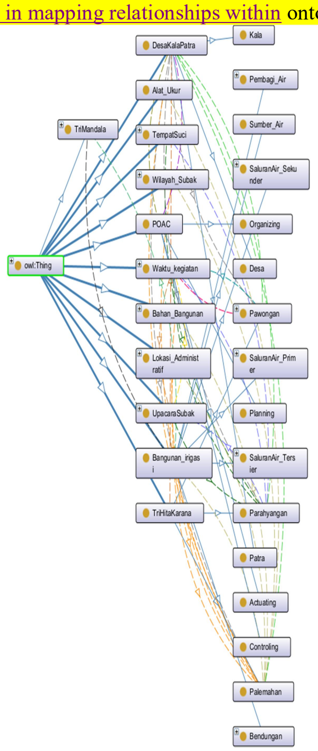


Fig 5 -OntoGraph of SuperClass

~~Meanwhile, Fig~~Figure 5 ~~is~~showed an ontograph that ~~describes~~described all superclasses. ~~Ontograph of superclass in~~In ontology development~~ acts~~, ontograph of superclasses acted as a hierarchical knowledge structure that ~~connects~~connected general concepts (superclass) with specific ~~concepts~~ones (subclass~~) Ontograph is~~). As a feature in Protégé~~ that can map relations in~~, ontograph was instrumental in mapping relationships within ontology.



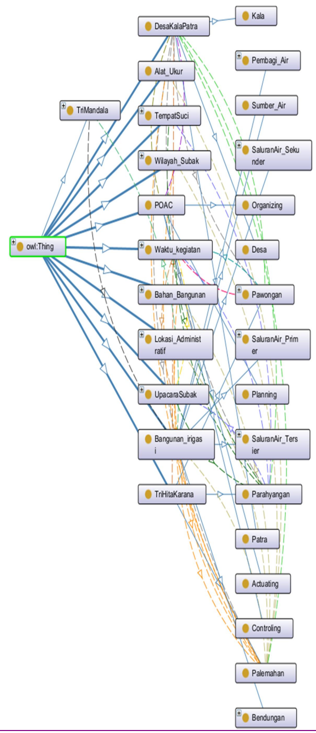


Fig. 6 OntoGraph of SuperClass Palehaman

~~Fig~~Figure 6 ~~describes~~described the *Palemaman* class and its relations. ~~Protégé also has~~Furthermore, protégé had a feature to generate OWL~~ (Ontology Web Language). OWL is~~, which was a form of ontology designed for use by various applications.

C. Discussion of Ontology Assessments and Enrichment

Ontology assessment was performed using OntoQA, which ~~measures~~measured three key aspects~~: Relationship Richness (~~, including RR~~), Inheritance Richness (~~, IR~~),~~, and ~~Attribute Richness (~~AR~~).~~. The result of the assessment ~~will be a recommendation~~would provide recommendations for the enrichment stage.

~~*1) Relationship Richness (RR)*~~

1) ~~This metric helps identify~~*RR*

RR assessed the diversity of relationships ~~in an~~within ontology, which ~~indicates~~showed the complexity and similarity of knowledge representation. As ~~describe~~described in knowledge conceptualization, the developed ontology ~~contains~~contained 56 non-inheritance relationships and 76 subclasses (inheritance relationships).

TABLE III
~~RELATIONSHIP RICHNESS~~RR

Inheritance Relationships (SC)	Non-inheritance Relationships (P)	Relationship Richness(RR)
76	56	0.4

Table 3 ~~presents~~presented the calculation based on ~~equation~~Equation 1, ~~which result of~~resulting in an RR value of 0.4 for *Subak* ontology. This RR value ~~of 0.4 indicates~~showed that ~~*Subak*~~ ontology ~~is~~was relatively knowledge-rich, containing ~~more~~ a higher proportion of inheritance relationships. ~~The~~ *Subak* ontology ~~utilizes~~used various types of inheritance ~~relationships~~ to represent knowledge~~. This indicates that *Subak* ontology is more flexible, and can capture~~, which enhanced its flexibility in capturing relationships between concepts ~~to~~within hierarchical structures.

With the range from 0 to 1, RR values close to 1 ~~indicate~~showed that most of the ~~relations are~~relationships were non-inheritance ~~relations. Ontologies~~. Ontology with a higher proportion of non-inheritance relationships ~~represent more~~ captured a broader scope of information ~~than those dominated by inheritance relationships~~[37]. Meanwhile, RR values close to zero ~~indicate~~showed that most of the ~~relations in the ontology are~~relationships were inheritance ~~relations, meaning that the~~, suggesting ontology structure ~~relies~~relied heavily on hierarchy. ~~The ontology focuses~~Ontology focused more on inheritance or hierarchy relationships between concepts, ~~which can be suitable for domains that require~~showing a strong hierarchical structure suited for domains with well-defined hierarchies but ~~may~~might be less able to describe more complex and contextual relationships [32].

~~2) *Inheritance Richness (IR)*~~

2) ~~Ontology~~ *IR*

Subak ~~consist~~ontology consisted of 94 ~~Classes~~classes with 76 ~~are subclass.~~designated as subclasses. Using ~~equation~~Equation 2, ~~which result of~~the IR value ~~of~~calculated for ontology was 0.78 ~~for *Subak* Ontogoly (~~, as presented in Table 4~~)~~.

TABLE IV

~~INHERITANCE RICHNESS~~IR

Sub-Class (H)	Class (C)	~~Inheritance Richness (IR)~~**IR**
76	94	0.78

~~The ontology utilizes~~Ontology used hierarchy and inheritance between concepts moderately in ~~the~~ ontology structure to properly organize knowledge ~~better~~, allowing for a more structured and detailed knowledge representation [38]. Table 4 ~~presents~~presented the calculation of IR based on ~~equation~~Equation 2, ~~which results~~resulting in an IR value of 0.78 for *Subak* ontology. With values ranging from 0 to 1, IR values close to 1 ~~indicate~~showed that most classes in ~~the~~ ontology ~~have~~had subclasses. The IR value of 0.78 ~~indicating~~showed that ~~*Subak*~~ ontology ~~has~~had a more complex and deep hierarchical ~~structure~~relationship for more structured and detailed knowledge representations. Meanwhile, IR values close to ~~zero indicate~~0 showed that most classes in ~~the~~ ontology ~~are~~were independent ~~classes~~, with few or no related subclasses [39].

~~3) *Attribute Richness (AR)*~~

3) *AR*

Table 5 ~~presents~~presented the calculation based on ~~equation~~Equation 3, ~~which result of~~resulting in an AR value of 3.89 for *Subak* ontology.

TABLE V

~~ATTRIBUTE RICHNESS~~AR

Attributes (Att)	Class(C)	~~ATTRIBUTE RICHNESS~~AR
366	94	3,89

This AR value of 3~~,~~.89 ~~indicates~~showed that *Subak* ontology ~~provides~~provided a fairly rich description of attributes, with each class having an average of 3 to 4 attributes. ~~High~~A high AR ~~indicates~~represented that ~~the~~ ontology ~~provides~~provided a rich description of attributes for each class [38]~~. This allows for a deeper~~, enhancing understanding ~~of the concepts~~ by providing more contextual and descriptive information. Meanwhile, a low AR ~~indicates that the ontology has~~showed a simpler description of the concepts, with fewer attributes that ~~may~~might only cover basic information. ~~Attributes are usually used to describe specific characteristics of a concept~~Several attributes, such as color, size, location, or relationships with other concepts, were usually used to describe specific characteristics of a concept [40]. ~~Attributes are~~Additionally, attributes served as essential elements in ~~an~~ ontology ~~because~~, as they ~~provide~~provided additional information or features that enrich the definition of each concept [5]. ~~In some cases, this may~~While limited attributes might be sufficient for specific domains, ~~but in other domains,~~they could limit the ~~lack~~scope of ~~attributes can be a limitation in~~ knowledge modeling in others.

4) *Enrichment*

~~From the~~The results of discussions with experts~~, it was found~~ showed that the representation of knowledge ~~in~~within the developed *Subak* ontology ~~that~~ was ~~built was quite~~ feasible. ~~In addition, from~~Based on the results of ~~the~~ ontology assessment ~~that has been built~~, this ~~study will be continued~~research would proceed with knowledge enrichment to obtain the expected knowledge adequacy ~~and then implement it into~~for KMS-based knowledge integration. Enrichment ~~will be done~~was achieved by ~~enriching~~enhancing instances, and it ~~is also possible to include~~included data and object properties. The objective was to ensure the adequacy of ontology knowledge ~~is intended~~ to correctly answer CQs ~~whose suitability will be confirmed~~validated by experts.

IV. CONCLUSION

~~The~~In conclusion, *Subak* ontology model ~~will be implemented~~was used as a foundational knowledge base for the ~~*Subak* knowledge management system. The ontology is~~KMS. Ontology model was built ~~based on *Subak*'s approach as an organization~~ based on traditional philosophy (Tri Hita Karana and Desa-Kala-Patra) and the application of modern management (POAC). ~~The ontology model consists~~Model consisted of class hierarchy, object properties (~~relations~~relationships), data properties (attributes), and ~~instance~~instances (individual entities).

~~The~~ *Subak* ontology was evaluated using ~~Ontology Quality Analysis~~OntoQA and focus group discussions with experts. The evaluation results ~~show that Relationship~~

~~Richness (~~showed an RR~~)~~ value ~~is~~of 0.8, ~~Inheritance Richness (~~an IR~~)~~ value ~~is~~of 0.78, and ~~Attribute Richness (~~an AR~~)~~ value ~~is~~of 3.89~~. The ontology produced is quite rich and carries~~, showing knowledge~~-~~-rich ontology with well-defined attributes and specific characteristics~~, with not too many attributes~~ for each class. Experts' comments stated that ~~the~~ ontology model created ~~is~~was worthy of being used to represent knowledge in the ~~*Subak* Knowledge Management System.~~KMS.

The resulting framework ~~can be~~served as a reference for further ~~similar research in~~investigations on developing ontology from scratch~~ related to~~, particularly in heritage cultural preservation. ~~The resulting~~ *Subak* ontology ~~can be~~could also serve as a foundational reference ~~as a~~ for developing knowledge ~~base for the development of other ontologies in the domains~~bases within the fields of agricultural management, social organization, and cultural preservation. This ~~study supports~~research contributed to the preservation of ~~*Subak* culture so that it is known~~cultural heritage, ensuring its legacy was accessible to future generations.

ACKNOWLEDGMENT

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REFERENCES

[1] W. M. W. Isa *et al.*, "An Ontological Approach for Creating a Brassware Craft Knowledge Base," *IEEE Access*, vol. 8, pp. 163434–163446, 2020, doi: 10.1109/ACCESS.2020.3022795.

[2] D. Kalita and D. Deka, "Ontology for preserving the knowledge base of traditional dances (OTD)," *Electron. Libr.*, vol. 38, no. 4, pp. 785–803, Oct. 2020, doi: 10.1108/EL-11-2019-0258.

[3] UNESCO, "Operational Guidelines for the Implementation of the World Heritage Convention," *Oper. Guidel. Implement. World Herit. Conv.*, no. WHS, p. 188, 2021, [Online]. Available: http://whc.unesco.org/archive/opguide08-en.pdf

[4] Y. Hou, S. Kenderdine, D. Picca, M. Egloff, and A. Adamou, "Digitizing Intangible Cultural Heritage Embodied: State of the Art," *J. Comput. Cult. Herit.*, vol. 15, no. 3, pp. 1–20, Sep. 2022, doi: 10.1145/3494837.

[5] M. A. Osman, S. A. Mohd Noah, and S. Saad, "Ontology-Based Knowledge Management Tools for Knowledge Sharing in Organization—A Review," *IEEE Access*, vol. 10, pp. 43267–43283, 2022, doi: 10.1109/ACCESS.2022.3163758.

[6] N. M. Short, M. J. Woodward-Greene, M. D. Buser, and D. P. Roberts, "Scalable Knowledge Management to Meet Global 21st Century Challenges in Agriculture," *Land*, vol. 12, no. 3, p. 588, Feb. 2023, doi: 10.3390/land12030588.

[7] A. Pinto, Y. Cardinale, I. Dongo, and R. Ticona-Herrera, "An Ontology for Modeling Cultural Heritage Knowledge in Urban Tourism," *IEEE Access*, vol. 10, pp. 61820–61842, 2022, doi: 10.1109/ACCESS.2022.3179664.

[8] E. Triandini, M. A. Kristyanto, R. V. Rishika, and F. Rawung, "A Systematic Literature Review of The Role of Ontology in Modeling Knowledge in Software Development Processes," *IPTEK J. Technol. Sci.*, vol. 32, no. 3, p. 159, 2021, doi: 10.12962/j20882033.v32i3.12998.

[9] P. D. H. Ardana, D. O. Suparwata, A. Sudrajat, S. Chatun, and I. Harsono, "The Role of Bali's Traditional Subak Farming System in the Preservation of Natural and Cultural Resources," *West Sci. Nat. Technol.*, vol. 2, no. 01, pp. 31–38, Mar. 2024, doi: 10.58812/wsnt.v2i04.754.

[10] S. P. K. Surata, D. A. Puspawati, P. E. P. Ariati, and I. G. A. P. E. Putri, "The ecological views of the Balinese toward their subak cultural landscape heritage," *Environ. Dev. Sustain.*, vol. 24, no. 11, pp. 12994–13010, Nov. 2022, doi: 10.1007/s10668-021-01979-9.

[11] D. P. Darmawan, G. M. K. Arisena, A. A. A. W. S. Djelantik, A. A. K. Krisnandika, N. K. S. Utari, and N. T. L. Korri, "Farmers' Independence Level in the Urban Area of Subak Sembung Denpasar City, Bali Province, Indonesia," *J. Agric. Sci. - Sri Lanka*, vol. 18, no. 1, pp. 40–54, 2023, doi: 10.4038/jas.v18i1.10097.

[12] P. U. Wijayanti, W. Windia, D. P. Darmawan, and W. Widhianthini, "Sustainable development model of subak in Denpasar City," *Int. J. life Sci.*, vol. 4, no. 1, pp. 109–117, 2020, doi: 10.29332/ijls.v4n1.418.

[13] M. Casillo, M. De Santo, R. Mosca, and D. Santaniello, "Sharing the knowledge: exploring cultural heritage through an ontology-based platform," *J. Ambient Intell. Humaniz. Comput.*, vol. 14, no. 9, pp. 12317–12327, 2023, doi: 10.1007/s12652-023-04652-3.

[14] E. Femi Aminu, I. O. Oyefolahan, M. Bashir Abdullahi, and M. T. Salaudeen, "A Review on Ontology Development Methodologies for Developing Ontological Knowledge Representation Systems for various Domains," *Int. J. Inf. Eng. Electron. Bus.*, vol. 12, no. 2, pp. 28–39, Apr. 2020, doi: 10.5815/ijieeb.2020.02.05.

[15] A. Sattar, E. S. M. Surin, M. N. Ahmad, M. Ahmad, and A. K. Mahmood, "Comparative analysis of methodologies for domain ontology development: A systematic review," *Int. J. Adv. Comput. Sci. Appl.*, vol. 11, no. 5, pp. 99–108, 2020, doi: 10.14569/IJACSA.2020.0110515.

[16] Z. Sun, C. Hu, C. Li, and L. Wu, "Domain ontology construction and evaluation for the entire process of software testing," *IEEE Access*, vol. 8, pp. 205374–205385, 2020, doi: 10.1109/ACCESS.2020.3037188.

[17] N. K. Dessy Hariyanti *et al.*, "Evaluation of Enrichment in Ontology-based Knowledge Management System," no. November, pp. 29–34,

2024, doi: 10.1109/icsgteis60500.2023.10424116.

[18] E. M. Sanfilippo, B. Markhoff, and P. Pittet, "Ontological Analysis and Modularization of CIDOC-CRM," *Front. Artif. Intell. Appl.*, vol. 330, no. February, pp. 107–121, 2020, doi: 10.3233/FAIA200664.

[19] CIDOC CRM Special Interest Group, "Definition of the CIDOC Conceptual Reference Model Version 7.2.2," no. September, pp. 1–234, 2023, [Online]. Available: https://cidoc-crm.org/sites/default/files/cidoc_crm_version_7.2.1.pdf

[20] A. Pinto-De La Gala, Y. Cardinale, and I. Dongo, "CURIOCITY Framework: Managing Heterogeneous Cultural Heritage Data," *ACM Int. Conf. Proceeding Ser.*, no. December, pp. 664–669, 2021, doi: 10.1145/3486622.3494001.

[21] R. Stewar, Y. Zhelev, and M. Monova-Zheleva, "Development of digital collections of intangible cultural heritage objects - Base ontology," *Digit. Present. Preserv. Cult. Sci. Herit.*, vol. 11, pp. 51–56, 2021, doi: 10.55630/dipp.2021.11.4.

[22] F. Wang, T. Wei, and J. Wang, "Ontology-driven cultural heritage conservation: A case of the analects of confucius," *Appl. Sci.*, vol. 12, no. 1, 2022, doi: 10.3390/app12010287.

[23] G. Faraj and A. Micsik, "Representing and validating cultural heritage knowledge graphs in cidoc-crm ontology," *Futur. Internet*, vol. 13, no. 11, pp. 1–15, 2021, doi: 10.3390/fi13110277.

[24] S. Haridy, R. M. Ismail, N. Badr, and M. Hashem, "An Ontology Development Methodology Based on Ontology-Driven Conceptual Modeling and Natural Language Processing: Tourism Case Study," *Big Data Cogn. Comput.*, vol. 7, no. 2, p. 101, May 2023, doi: 10.3390/bdcc7020101.

[25] D. Kalita and D. Deka, "Ontology for preserving the knowledge base of traditional dances (OTD)," *Electron. Libr.*, vol. 38, no. 4, pp. 785–803, 2020, doi: 10.1108/EL-11-2019-0258.

[26] B. Lantow, "Ontometrics: Putting metrics into use for ontology evaluation," *IC3K 2016 - Proc. 8th Int. Jt. Conf. Knowl. Discov. Knowl. Eng. Knowl. Manag.*, vol. 2, no. Ic3k, pp. 186–191, 2016, doi: 10.5220/0006084601860191.

[27] N. Mellal, T. Guerram, and F. Bouhalassa, "An approach for automatic ontology enrichment from Texts," *Inform.*, vol. 45, no. 1, pp. 81–91, 2021, doi: 10.31449/inf.v45i1.2586.

[28] P. Meengoen and R. Meengoen, "A Framework for Ontology-Based Knowledge Management System Case Study of Faculty of Business Administration of Rajamangala University of Technology ISAN," *Integr. Bus. Econ.*, vol. 5, pp. 233–238, 2016, doi: 2304-1013.

[29] S. A. Md Nasir and N. L. Md Noor, "Integrating ontology-based approach in Knowledge Management System (KMS): Construction of Batik Heritage Ontology," *CSSR 2010 - 2010 Int. Conf. Sci. Soc. Res.*, no. January 2016, pp. 674–679, 2010, doi: 10.1109/CSSR.2010.5773866.

[30] M. F. López, A. G. Pérez, M. Dolores, and R. Amaya, "Ontology ' s Crossed Life Cycles," *Proc. 12th Int. Conf. Knowl. Eng. Knowl. Manag.*, no. January 2000, pp. 65–79, 2000.

[31] M. Bravo, L. F. H. Reyes, and J. A. Reyes Ortiz, "Methodology for ontology design and construction," *Contaduria y Adm.*, vol. 64, no. 4, pp. 1–24, 2019, doi: 10.22201/FCA.24488410E.2020.2368.

[32] S. Tartir, I. B. Arpinar, M. Moore, A. P. Sheth, and B. Aleman-meza, "OntoQA: Metric-based ontology quality analysis," *IEEE ICDM 2005 Work. Knowl. Acquis. from Distrib. Auton. Semant. Heterog. Data Knowl. Sources*, 2005, [Online]. Available: http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.131.2087

[33] I. K. M. A. Jaya, "Kensep Tri Hita Karana Menjaga Eksistensi Subak Dari Ancaman Alih Fungsi Lahan," *VIDYA SAMHITA J. Penelit. Agama*, vol. 7, no. 1, p. 1, 2021, doi: 10.25078/vs.v7i1.2430.

[34] I. P. Sriartha and I. W. Kertih, "Subak Local Wisdom as Social Studies Learning Source in Junior High School," in *Proceedings of the 4th Asian Education Symposium (AES 2019)*, 2020, vol. 438, no. Aes 2019, pp. 23–27. doi: 10.2991/assehr.k.200513.006.

[35] I. Skakalska, O. Panfilova, I. Sydun, S. Oriekhova, T. Zuziak, and I. Tatarko, "The Systematization and Preservation of Cultural Heritage of National Minorities in the Context of the Postmodern Philosophy," *Postmod. Openings*, vol. 12, no. 4, pp. 241–254, 2021, doi: 10.18662/po/12.4/372.

[36] A. Thouki, "The role of ontology in religious tourism education—exploring the application of the postmodern cultural paradigm in European religious sites," *Religions*, vol. 10, no. 12, 2019, doi: 10.3390/rel10120649.

[37] S. Haridy, R. Ismail, N. Badr, and M. Hashem, "ONTOLOGY-DRIVEN CONCEPTUAL MODEL AND DOMAIN ONTOLOGY FOR EGYPTIAN E-GOVERNMENT," *Int. J. Intell. Comput. Inf. Sci.*, vol. 23, no. 2, pp. 116–132, 2023, doi: 10.21608/ijicis.2023.176123.1230.

[38] S. Haridy, R. M. Ismail, N. Badr, and M. Hashem, "The Combination of Ontology-Driven Conceptual Modeling and Ontology Matching for Building Domain Ontologies : E-Government Case Study," vol. 29, no. 4, pp. 269–282, 2023.

[39] R. Poli, M. Healy, and A. Kameas, "Theory and applications of ontology: Computer aplications," *Theory Appl. Ontol. Comput. Appl.*, pp. 1–576, 2010, doi: 10.1007/978-90-481-8847-5.

[40] M. A. Raza, M. Rahmah, S. Raza, A. Noraziah, and R. A. Hamid, "A methodology for Engineering domain ontology using entity relationship model," *Int. J. Adv. Comput. Sci. Appl.*, vol. 10, no. 8, pp. 326–332, 2019, doi: 10.14569/ijacsa.2019.0100842.

[JOIV] Submission Acknowledgement

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