


An ontology-based knowledge modeling for the rite of Bai Sri Su Kwan: a ritual of the Greater Mekong Subregion

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Article Info	ABSTRACT
<p>Article history:</p> <p>Received Feb 25, 2024 Revised Oct 10, 2024 Accepted Oct 18, 2024</p> <p>Keywords:</p> <p>Bai Sri Su Kwan Knowledge representation Ontological knowledge base Ontology Rituals Thai blessing ceremony</p>	<p>The development of ontologies is crucial in digital humanities research. This study focuses on creating a system to extract meaning from knowledge related to the Bai Sri Su Kwan ritual. Addressing semantic gaps, the second phase of our research outlines methods for developing an ontology for Bai Sri Su Kwan rituals. To fully understand this significant ritual in the Mekong Basin, we employed a theoretical framework with seven ontology development steps, using the Hozo Ontology Editor. Our ontology includes nine main classes: Bai Sri Su Kwan (A ritual subclass), persons, chants, belief, purpose, wish, literature, locations, and equipment. The Bai Sri Su Kwan subclass connects with all other classes in the ontology. This ontology forms the basis for a meaning search system for the Bai Sri Su Kwan ceremony in future research stages. The ontology was evaluated syntactically through human assessment and the OOPS! Ontology Pitfall Scanner. Validation results for the Bai Sri Su Kwan Ontology show no pitfalls in critical dimensions, indicating high integrity and reliability.</p> <p><i>This is an open access article under the CC BY-SA license.</i></p> 
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1. INTRODUCTION

Cultural heritage constitutes a significant reservoir of intellectual capital, comprising both tangible and intangible dimensions that are transmitted across generations, reflecting the creative expressions of communities and groups in response to their surroundings [1], [2]. As highlighted by The United Nations Educational, Scientific and Cultural Organization (UNESCO) 2003, cultural heritage emerges from a community's engagement with its environment and historical origins, serving to cultivate a sense of identity and continuity [3]. This notion of cultural identity, as articulated by Brumann [4], encompasses a wide array of elements including places, artifacts, rituals, knowledge systems, and other cultural practices deemed significant by specific societies [4]. Preservation efforts are typically spearheaded by specialists to ensure the protection of this heritage. UNESCO (2017) further delineates cultural heritage into tangible and intangible categories. Tangible cultural heritage encompasses movable items such as artworks, manuscripts, and coins, as well as immovable structures like monuments and archaeological sites, including underwater cultural relics like shipwrecks and submerged ruins. In contrast, intangible cultural heritage spans linguistic traditions, oral narratives, performing arts, rituals, and knowledge systems associated with the natural world, along with various handicrafts, underscoring the diverse and multifaceted nature of cultural heritage [5].

In recognition of the paramount importance of cultural heritage, numerous nations actively endeavor to safeguard and preserve both their national and global cultural legacies. UNESCO played a pivotal role in this endeavor by instituting the convention for the safeguarding of the intangible cultural heritage in 2003. The

main goals of this convention encompass safeguarding intangible cultural heritage, promoting appreciation and reverence for the intangible cultural heritage of various communities, groups, and individuals. Additionally, it seeks to enhance awareness at local, national, and global scales about the importance of intangible cultural heritage, encouraging mutual respect, and facilitating international collaboration and support for its preservation. [6]. However, effective preservation of cultural heritage necessitates adept management. An integral aspect that requires simultaneous attention alongside cultural heritage is cultural heritage information (CHI). CHI encompasses information pertaining to cultural heritage, encompassing details about the cultural heritage itself, such as its name, concept, creator, production site, and recorded content. Additionally, CHI includes information instrumental for cultural heritage management, such as historical data, conservation information, production techniques, and exhibition organization. Beyond merely preserving a diverse array of cultural heritage artifacts, CHI proves valuable for research, knowledge expansion, presentation in various formats, and the transmission of knowledge to succeeding generations [7].

The Bai Sri Su Kwan Ceremony serves as a tangible expression of intangible cultural heritage, serving multiple purposes such as expressing gratitude or providing solace and encouragement to recipients through the presentation of gifts by attending relatives. Rooted in Brahmin beliefs, this ceremonial tradition utilizes banana leaves in crafting a Bai Sri tray, symbolizing purity and serving as a medium for various rituals consistent with Brahmin customs. The design of the Bai Sri tray, resembling Mount Meru, the sacred dwelling of Lord Shiva, incorporates ceremonial elements essential to the Bai Sri Su Kwan ritual observance [8]. This ritual holds significant cultural and ritualistic significance, embodying benevolence and contributing to the welfare of both individuals and communities. Furthermore, it plays a pivotal role in preserving community traditions, fostering unity, and promoting goodwill among community members [9].

Despite the Bai Sri Su Kwan ceremony's intrinsic value and its embodiment of ancestral knowledge and wisdom, expertise in this ritual remains limited among contemporary individuals. To ensure the preservation of this valuable cultural heritage over an extended period, there is a pressing need for systematic information and knowledge management. The application of digital humanities methods offers a promising avenue for knowledge preservation, facilitating widespread access to cultural heritage knowledge. Drawing inspiration from successful initiatives in other cultural contexts, such as the previous study on employing knowledge technology to elucidate the meaning of Bulgarian folk heritage [10], and the work of Pavlova and Pavlov [11] in developing an ontology for semantic information retrieval of folk songs in digital libraries [11] and metadata schema for folktales in the Mekong River Basin by Kwiecien *et al.* [12], the Bai Sri Su Kwan ceremony can benefit from a similar approach. Noteworthy examples from research in metadata schema for folktales in the Mekong River Basin, the multimedia presentation system for Malaysian folk tales by Abidin and Razak [13], and the knowledge framework on intangible cultural heritage for ontology development [14]. Furthermore, the contribution of Tuamsuk, Chansanam & Kaewboonma in developing a folktale ontology specifically tailored for the Mekong subregion countries underscores the potential for structured and effective knowledge management in this domain [15]. These examples serve as compelling models for the integration of digital humanities methodologies in the preservation and dissemination of knowledge related to the Bai Sri Su Kwan ceremony, fostering a comprehensive and accessible repository for both current and future generations. In addition, ontologies also open to visualization techniques that leverage the structure of semantic relations to bridge the gap between the complexity of data and the need for immediate, simplified access [16]. Indeed, the imperative to learn and preserve cultural heritage knowledge necessitates the establishment of tools or a standardized cultural heritage knowledge management platform that can be collaboratively utilized. Such a platform would serve as a cohesive repository, facilitating the preservation, dissemination, and shared understanding of cultural heritage across diverse stakeholders [17]. This study recognizes the critical need to preserve cultural heritage knowledge and the necessity of creating a standardized cultural heritage knowledge management tool or platform that can be widely shared. While previous studies have explored models for integrating digital humanities methods to promote a comprehensive and accessible repository for both current and future generations, they have not clearly specified how to manage that data effectively. Our research addresses this gap by developing an ontology that helps connect related knowledge, providing a structured and detailed framework for managing and disseminating CHI specific to the rite of Bai Sri Su Kwan.

Hence, recognizing the imperative to advance scholarly understanding, the researcher advocates for the creation of the Bai Sri Su Kwan ontology. Ontology will elevate knowledge by imbuing content with deeper meaning, enhancing its potency. This concept aligns with various studies that define ontology, as referenced by different authors [18]. Essentially, ontology simplifies definitions by establishing a set of precise vocabulary with specific meanings that constrain how concepts are described [19]. It involves identifying fundamental categories through the systematic cataloging of domain-specific terms and establishing rules for mapping these terms to their corresponding concepts [20]. This perspective is reinforced by Chou's research [21], which emphasizes the role of ontology in facilitating swift and accurate information retrieval and has proven to be an excellent medium for capturing the knowledge of a domain [22]. This ontological framework aims to elucidate

the meaning (definition) and attributes (properties) inherent in terminologies and knowledge associated with the Bai Sri Su Kwan ceremony. The envisioned ontology is intended to serve as a comprehensive knowledge base for Bai Sri Su Kwan, fostering the design and implementation of a semantic retrieval system specifically tailored to the nuances of the Bai Sri Su Kwan ceremony. This system, once developed, will facilitate the extraction of nuanced meanings from various aspects of Bai Sri Su Kwan ceremonies, ensuring comprehensiveness, completeness, and alignment with users' contextual usage.

2. METHOD

The current investigation aimed to construct an ontology delineating the knowledge surrounding the Bai Sri Su Kwan ceremony. This ontological framework serves the dual purpose of elucidating the breadth of knowledge and fostering a lucid comprehension of the ceremonial rite. The resultant ontology is intended to underpin the advancement of semantic search systems, enhancing the ability to retrieve nuanced information pertaining to Bai Sri Su Kwan.

The study adopted the conceptual framework proposed by Uschold and King [23] for domain ontology development, which entails three core processes: i) determination of purposes and scope, ii) ontology development, and iii) ontology evaluation. The focus of this communication centers on the second phase of the study, specifically the ontology development process. Through the application of Uschold and King's framework, the study systematically progressed through the stages essential for creating a comprehensive ontology [23].

2.1. Determination of purposes and scope

The primary objective of this ontology development study was to elucidate the breadth of knowledge and foster a comprehensive understanding of the Rite of Bai Sri Su Kwan. By systematically representing the various elements of this ceremonial practice, the study aimed to create a structured and detailed knowledge base. This comprehensive approach not only highlights the cultural and ritualistic significance of the Bai Sri Su Kwan ceremony but also facilitates the development of semantic retrieval systems.

2.2. Ontology development

The ontology development process was guided by Noy and McGuinness's conceptual framework [24] and utilized the Hozo Ontology Editor. The systematic approach consisted of the following sequential steps,

- Determining the scope: Clarify the ontology's boundaries and focus by defining the specific aspects of the Bai Sri Su Kwan Rite to be captured.
- Considering reuse: Explore existing ontologies for potential reuse of established concepts, ensuring consistency and interoperability with broader knowledge frameworks.
- Enumerating terms: Identify and list key terms relevant to the Bai Sri Su Kwan Rite, establishing a foundational vocabulary for ontology development.
- Defining classes: Categorize terms into classes, encapsulating shared characteristics and attributes to create a structured representation of knowledge.
- Defining properties: Specify the relationships and attributes between classes, outlining the connections and dependencies within the Bai Sri Su Kwan ontology.
- Defining constraints: Establish logical constraints and rules governing the interactions between classes, ensuring the ontology's coherence and adherence to defined standards.
- Creating instances: Instantiate the ontology by populating it with concrete examples or instances, providing practical context to the abstract conceptualization.

This systematic process aimed to produce a coherent representation of the Bai Sri Su Kwan Rite, facilitating a nuanced understanding and enabling effective semantic search systems. Major challenges included ensuring interoperability with existing ontologies and creating a user-friendly interface.

2.3. Ontology evaluation

The ontology evaluation aimed to validate the academic credibility of content related to the Rite of Bai Sri Su Kwan, scrutinizing the validity of structural characteristics and ontology description. The evaluation process involved the following steps:

- Using the OOPS!: This tool specialized in ontology pitfall scanning and validation with a specific focus on ensuring adherence to FAIR principles [25].
- Human assessment: Conducted against predefined criteria, the evaluation form was developed following Gomez-Perez's ontology evaluation concept to assess the ontology's structure in line with its intended purpose or scope [26].
- Expert evaluation: Purposively sampled ontology experts, possessing qualifications in ontology studies and semantic web research with a track record of publishing academic papers in recognized journals, conducted the evaluation.

- Descriptive statistics: A five-point Likert scale [27] was employed to assess the ontology's quality, and user feedback was sought for further improvement. The quality evaluation results were interpreted using mean score evaluation criteria [28].

By employing these methods, the study aimed to ensure the reliability and validity of the Bai Sri Su Kwan Ontology, making it a robust resource for researchers and practitioners.

3. RESULTS AND DISCUSSION

The outcomes of the study about the creation of an ontology for understanding the Rite of Bai Sri Su Kwan are delineated and structured based on the various stages of ontology development. This structured approach includes defining the scope, identifying key terms, and establishing relationships between concepts to accurately represent the ceremony. Additionally, the ontology was evaluated for its completeness and consistency, ensuring it provides a reliable knowledge base for future research and practical applications.

3.1. Determine the scope

In this study, the developed ontology comprehensively encompasses the Rite of Bai Sri Su Kwan as practiced in the northeastern region of Thailand. This ontology encapsulates both written and oral rites, serving as a repository for aggregating knowledge about the Bai Sri Su Kwan ceremony. The articulation of knowledge about the Rite of Bai Sri Su Kwan involves furnishing definitions, elucidating meanings, defining properties and attributes, presenting sample data, and establishing relationships between classes and terms. The ontology's structure is meticulously crafted by defining the primary domain, with the pre-existing knowledge of Bai Sri Su Kwan instrumental in delineating distinct classes. Major difficulties of this process included accurately capturing the nuanced elements of the Bai Sri Su Kwan ritual and ensuring the ontology's comprehensiveness.

The overarching goal of ontology development is to furnish foundational data for the construction of a search engine - specifically, a semantic search system. This system is engineered to extract information by delving into the meaning (definition) and characteristics (attributes/properties) of words or knowledge associated with Bai Sri Su Kwan. The envisioned search system is poised to enhance the retrieval of information related to the Rite of Bai Sri Su Kwan, contributing to the accessibility and understanding of this cultural ceremony.

3.2. Consider reuse

The ontology building involves the ontology reuse and reengineering of existing models, along with the construction of some classes from a non-ontological resource. The approach to ontology reuse and reengineering demonstrates ontology reusability [29]. The research employs methods for restructuring and incorporating pertinent knowledge. A domain ontology is conceptualized as a compilation of keywords capable of characterizing domain concepts and delineating data collection patterns, along with shared indexes applicable across diverse applications. Given that the Bai Sri Su Kwan ceremony is a type of ritual intricately connected to tradition, a coherent ontology encompasses various segments. Specifically, certain portions of existing ontologies relevant to the development of the ontology in this study were adapted to align with the specific scope of the investigation, as detailed below.

The ontologies for common cultural traditions in the Greater Mekong Subregion (GMS) identified in this study encompass 15 main classes: common culture, history, belief, purpose, location, ritual, activity, literature, values, place, time, principle, person, equipment, and ethnic group. Upon comparing the ontology of common cultural traditions in the GMS with the ontological framework developed in this study with a distinct scope, it was observed that seven classes exhibited similarities. These common classes include belief, purpose, persons, equipment, locations, and literature [30].

The ICOM International Committee for Documentation (CIDOC) conceptual reference model (CRM), a comprehensive ontology framework for CHI, offers a range of classes and relationships for modeling various cultural aspects, including events and activities [31]. The Bai Sri Su Kwan Ontology, designed for rituals, can be expanded by integrating with the CIDOC CRM. This integration involves adding classes and properties relevant to rituals, such as participants, ritual objects, and temporal aspects. Developing a domain-specific ontology based on CIDOC CRM entails customization to meet specific application or research needs. It involves using CIDOC CRM as a foundational framework and then refining it to create a specialized ontology for rituals. Major challenges encountered during this process included ensuring the interoperability of the newly developed ontology with existing ones, adapting general classes to fit the specific context of the Bai Sri Su Kwan ritual, and addressing the complexity of integrating diverse cultural elements into a coherent and comprehensive framework. These difficulties required careful analysis and iterative refinement to maintain consistency and relevance in representing the intricate details of the Bai Sri Su Kwan ceremony.

3.3. Enumerate terms

The researcher compiled a list of terms by pertinent documents and subsequently undertook an analysis of their meanings to mitigate redundancy within the dataset. The synthesis and analysis primarily relied on the definitions of the terms. Following this, the fundamental elements within ontology were categorized into three features: i) terms; ii) properties; and iii) key definitions of ontology and the specification of term properties. One significant challenge was the identification and inclusion of terms that accurately reflect the nuanced aspects of the Bai Sri Su Kwan ritual without overlapping or duplicating concepts. This required meticulous cross-referencing and validation against existing literature and expert knowledge.

3.4. Define classes

In delineating classes pertinent to the investigation, a total of 59 classes were identified, comprising 9 primary classes: persons, chants, belief, Bai Sri Su Kwan, purpose, wish, literature, locations, and equipment. Bai Sri Su Kwan, intricately linked with all other classes, was articulated in accordance with the semantic web table specification to adhere to the resource description framework (RDF) standards established by the world wide web consortium (W3C). The presentation of ontology data followed the exemplar provided in Table 1.

Table 1. Ontology of Bai Sri Su Kwan

Class	Term Name Subclass	Definition
Bai Sri Su Kwan		The overarching class representing the entire Rite of Bai Sri Su Kwan.
Persons		Persons encompass individuals participating in the ritual.
	ImportantPerson	Important Person refers to an individual who holds a significant role or status within the context of a specific ceremonial.
	Officiant	Officiant refers to individuals holding official roles or positions in the ritual.
	Participants	Individuals actively involved in the Rite of Bai Sri Su Kwan but not in official roles.
Chants		Chants used for the Rite of Bai Sri Su Kwan
	ChantForWedding	Chants expressions performed during wedding ceremonies.
	ChantForAgricultural	Chants encompassing lyric expressions associated with agricultural rituals.
	ChantForFamily	Chants represent lyric expressions linked to family-related rituals.
	ChantForHousehold	Chants denote lyric expressions performed in household rituals.
	ChantForReligious	Chants indicates lyric expressions associated with religious ceremonies.
	ChantForSpiritual	Chants represents lyric expressions in spiritual or contemplative contexts.
	ChantForVehicle	Chants denote lyric expressions associated with vehicles.
Belief		Belief related to the spiritual and cultural aspects of the Rite of Bai Sri Su Kwan
	Buddhism	Beliefs related to Buddhism within the ritual.
	Superstition	Superstition related to the ritual.
Purpose		Purpose related to the objectives and significance of the ritual.
	Optimistic	The purpose of the ritual is positive.
	Pessimistic	The purpose of the ritual is negative.
Wish		Wish represents blessings conveyed during the Rite of Bai Sri Su Kwan.
	WishesForChildren	Wish related to fertility, childbirth, or the well-being of children.
	WishesForMarriage	Wish associated with marital bliss, union, and relationship prosperity.
	WishesForTheSick	Wish for the health and recovery of individuals facing illness.
	WishesForJob	Wish for success and opportunities in professional endeavors.
Literatures		Literature related to written or oral works associated with the Rite of Bai Sri Su Kwan.
	Tales	Traditional stories or narratives passed down through generations.
	ReligiousLiterature	Religious literature is associated with religious or spiritual practices within the ritual.
	Narrative	Subclass under literatures, representing any form of storytelling related to the ritual.
	Legend	Narrative or legendary narratives associated with the ritual.
	Phaya	Proverbs within the literary context of the ritual.
Equipment		Important equipment used in the Rite of Bai Sri Su Kwan.
	PhaBaiSri	PhaBaiSri represents a Bai Sri tray used as equipment in the ritual.
	DecorativeElements	Decorative elements represent embellishments and adornments used in the ceremonial object.
	Foods	Foods used in the ceremonial object.
Location		The location of the Rite of Bai Sri Su Kwan.
	Location country	Country the ritual is located.
	Location city	City the ritual is located

3.5. Define properties and define constraints

This step entails establishing conditions or criteria for validating class properties. Classes within Bai Sri Su Kwan exhibited relationships with all other classes within the ontology, facilitating the linkage of data in the semantic search of the ritual. An examination of the properties of classes and relationships between concepts revealed that 59 concepts possessed an "is-a" property, while 8 concepts were characterized by a "part-of" property, and 42 had an "attribute-of" property, as illustrated in Figure 1.

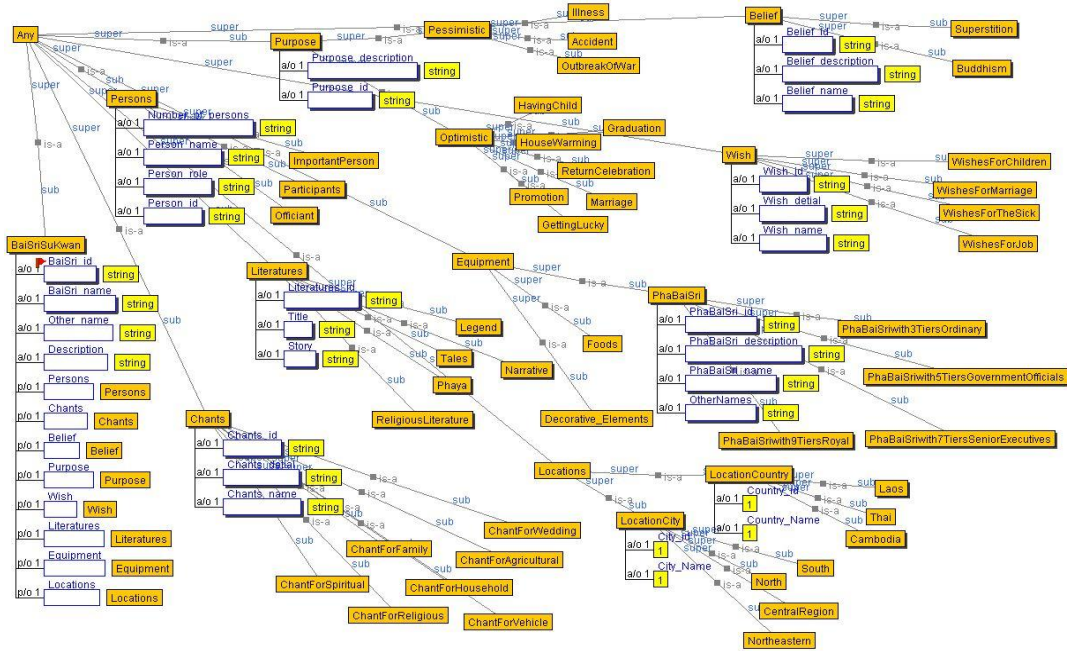


Figure 1. Defining class properties of Bai Sri Su Kwan

The Bai Sri Su Kwan ontology can be effectively presented using visual notation for web ontology language ontologies (VOWL). VOWL is a meticulously defined visual language crafted for user-centric ontology presentations. It offers graphical representations of web ontology language (OWL) components, organizing them in a directed graph layout to provide a visual depiction of the ontology, as illustrated in Figure 2. What sets VOWL apart is its emphasis on a user-friendly and comprehensive presentation, making it accessible to individuals who may not have expertise in ontology [32].

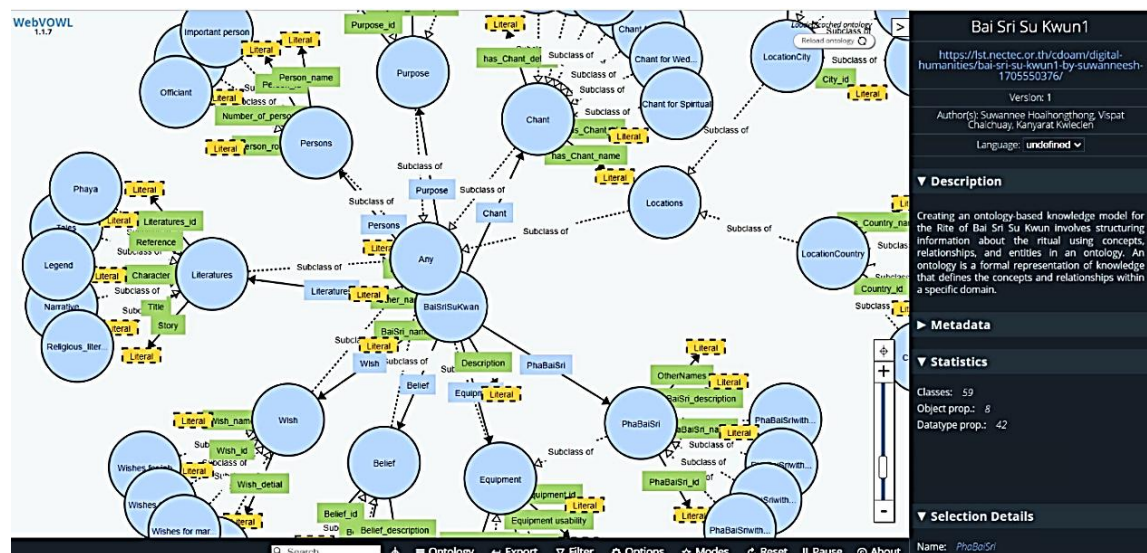


Figure 2. BSSK model ontology classes and their relations. Visualization done with Web-VOWL

3.6. Create instances

This step involves generating instances for concepts and terms in the ontology, including classes and subclasses. Relationships are formed among attributes in the ontology. Table 2 shows examples of Bai Sri Su Kwan instances linked to the "Rice field" subclass. Instances are systematically created for all classes and subclasses, each containing multiple memberships.

Table 2. Example of creating instances

Role Concept	Class Constraint	Instance
BaiSri_id	integer	1
BaiSri_name	string	Bai Sri Su Kwan for Rice Field
Other_name	string	Su Kwan Lan
Description	string	"Bai Sri Su Kwan for Rice Field" represents a ceremonial observance conducted to commemorate the rice harvest season and express gratitude to the spirits believed to have assisted in the cultivation process. This ritualistic instance is situated within the broader class of "Bai Sri Su Kwan" and is specifically associated with the subclass "Rice Field." The ceremony involves symbolic actions, prayers, and expressions of appreciation directed towards the spiritual entities associated with the rice field...
Has Persons	string	Farmer
Has Chants	string	Chant for Rice Field
Has Belief	string	Guardian Spirit Rice Fields
Has Purpose	string	To celebrate the rice harvest season and express gratitude to the spirits for aiding in cultivation, offering charity can boost productivity in the upcoming year.
Has Wish	string	-
Has Literatures	string	The legend of Phi Ta Hak.
Has PhaBaiSri	string	PhaBaiSriwith3TiersOrdinary
Has Locations	string	Ban Chiang, Udon Thani

3.7. Ontology evaluation

Ontology evaluation is an important step in ensuring quality, usability, and accuracy. This research utilizes two widely accepted approaches for evaluating ontologies: expert evaluation and automated tools like the Ontology Pitfall Scanner (OOPS!). Expert evaluation leverages the knowledge of domain specialists who assess the relevance and comprehensiveness of the ontology's components, while OOPS! aids in identifying common modeling errors that could compromise the ontology's structure. Together, these methods enhance the ontology's overall effectiveness and ensure it meets the required standards for intended applications.

a. Ontology evaluation by experts

Ontology evaluation is conducted to verify the structure and descriptions of the ontology. The structure was assessed by three ontology experts (refer to Table 3), and further evaluations were performed using the OOPS! The table provides an overview of the ontology development evaluation. For the determine scope process, the mean score is 3.33, indicating moderate consensus. In the define classes process, the mean score is 3.56, showing a high level of agreement. the define properties process received a mean score of 3.92, indicating strong consensus. The create Instances process achieved a mean score of 4.00, signifying substantial alignment. Lastly, the application to ontology development process received a mean score of 3.50, indicating a moderate level of agreement among evaluators.

b. Ontology evaluation by OOPS!

The OOPS! analysis identified numerous pitfalls in ontology development, categorized by importance and frequency across 693 ontologies. Manual review categorized errors into critical, important, and minor degrees, prioritizing critical issues [19]. Validation of the Bai Sri Su Kwan ontology highlighted a minor fault involving file extensions in the uniform resource identifier (URI). The evaluation classified inspection outcomes into three dimensions, indicating high integrity and reliability, as illustrated in Figure 3.

This study investigated the development and evaluation of an ontology-based knowledge modeling system for the Bai Sri Su Kwan ritual, a significant cultural practice in the Mekong Basin region. While earlier studies have explored various aspects of cultural heritage preservation, they have not explicitly addressed the semantic representation and retrieval of knowledge specific to the Bai Sri Su Kwan ceremony. We found that the structured ontology, encompassing nine main classes (Bai Sri Su Kwan, persons, chants, belief, purpose, wish, literature, locations, and equipment), effectively captures the intricate elements of the Bai Sri Su Kwan ritual. The developed ontology establishes a comprehensive knowledge base that highlights the cultural and ritualistic significance of the ceremony and facilitates the creation of a semantic retrieval system tailored to its nuances.

Our study suggests that the detailed and structured representation of the Bai Sri Su Kwan ritual through ontology can significantly enhance the retrieval and understanding of cultural knowledge. This aligns with other research in cultural heritage ontology, such as the use of the CIDOC CRM framework, which also emphasizes the importance of a structured approach to knowledge representation. The integration of advanced artificial intelligence and machine learning techniques could further refine these systems, making them more adaptive and responsive to user needs. Ontology integration for linked data involves the process of combining multiple ontologies to enhance the interoperability and semantic richness of data across different domains or datasets [33].

This study explored a comprehensive ontology development process with a focus on the Bai Sri Su Kwan ritual. However, the scope was limited to this specific ritual, and further studies may be needed to

confirm the ontology's applicability and effectiveness across other related rituals and cultural practices in the Mekong Basin and beyond. Additionally, the minor issue regarding the inclusion of file extensions in the ontology URI (P36) suggests that further refinement is necessary to enhance the ontology's precision.

Our study demonstrates the potential of ontology-based systems in preserving and understanding cultural heritage. Future research could expand the scope of this ontology to include other rituals and cultural practices, providing a more comprehensive cultural knowledge base. Comparative studies between different ontological frameworks could offer deeper insights into the universal and unique aspects of various traditions. Moreover, exploring user interaction and feedback mechanisms could help refine and improve the ontology, ensuring it remains relevant and useful for diverse user groups. Recent observations suggest that structured ontology development is crucial for preserving and understanding cultural heritage. Our findings provide conclusive evidence that the ontology-based representation of the Bai Sri Su Kwan ritual enhances knowledge retrieval and understanding, contributing significantly to cultural heritage preservation.

Table 3. Evaluation of ontology results by experts

Statements		Levels of agreement (N=3)			Mean	Interpretation
		1	2	3		
Determine scope process						
1	The ontology aligns consistently with the knowledge domains outlined in this study.	4.00	3.00	3.00	3.33	Moderate
2	The ontology is appropriate and encompasses the breadth of knowledge within the scope of this study.	4.00	3.00	3.00	3.33	Moderate
3	The ontology is appropriate and can be applied to develop a semantic search system.	4.00	3.00	3.00	3.33	Moderate
	Total	4.00	3.00	3.00	3.33	Moderate
Define classes process						
4	The ontology defines concepts that accurately describe knowledge.	4.00	4.00	3.00	3.67	High
5	The ontology appropriately classifies the superclass.	4.00	4.00	2.00	3.33	Moderate
6	The ontology appropriately classifies the subclass.	4.00	4.00	2.00	3.33	Moderate
7	Datatype is correctly specified in the ontology.	5.00	4.00	3.00	4.00	High
8	Terms are defined appropriately within the ontology.	4.00	4.00	3.00	3.67	High
9	Class constraints are accurately defined in the ontology.	4.00	3.00	3.00	3.33	Moderate
	Total	4.17	3.83	2.67	3.56	High
Define properties						
10	The ontology defines related properties to describe concepts appropriately.	5.00	4.00	3.00	4.00	High
11	The ontology defines relationships between related concepts to describe concepts appropriately.	5.00	4.00	3.00	4.00	High
12	The ontology defines Value appropriately.	4.00	4.00	3.00	3.67	High
13	The ontology has consistent relationships.	5.00	4.00	3.00	4.00	High
	Total	4.75	4.00	3.00	3.92	High
Create instances						
14	The ontology accurately delineates instances using standard definitions.	5.00	3.00	3.00	4.00	High
15	The ontology accurately specifies instances with appropriate terminology and grammatical accuracy.	5.00	3.00	3.00	4.00	High
	Total	5.00	3.00	3.00	4.00	High
Application to ontology development						
16	The ontology demonstrates precision and dependability.	4.00	4.00	3.00	3.67	High
17	The ontology has the potential for repurposing in the development of systems.	4.00	3.00	3.00	3.33	Moderate
	Total	4.00	3.50	3.00	3.50	Moderate

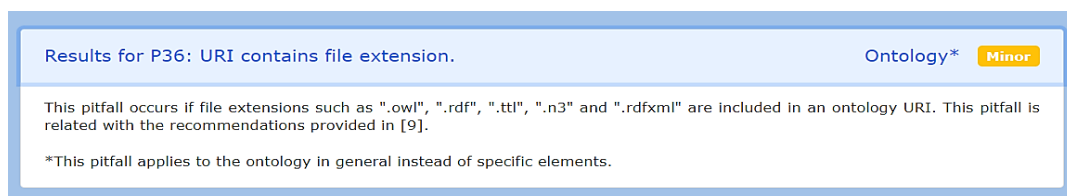


Figure 3. An excerpt from the pitfall

4. CONCLUSION

This study has adopted a systematic and comprehensive approach to develop and evaluate the Bai Sri Su Kwan Ontology, aiming to create a meaningful and user-centric knowledge representation system for understanding the intricacies of the Bai Sri Su Kwan ritual, a significant cultural practice in the Mekong Basin region. The theoretical framework guided seven ontology development steps executed through the Hozo

Ontology Editor, resulting in a constructed ontology comprising nine main classes, including Bai Sri Su Kwan (a ritual subclass), persons, chants, belief, purpose, wish, literature, locations, and equipment. Notably, the Bai Sri Su Kwan class forms a foundational link with all other classes, bolstering the ontology's potential for future research endeavors. Future research could expand the scope of the ontology to include other related rituals and cultural practices in the Mekong Basin and beyond. Comparative studies between different ontological frameworks for various cultural practices could provide deeper insights into the universal and unique aspects of these traditions. Furthermore, integrating advanced artificial intelligence and machine learning techniques could enhance the semantic retrieval systems, making them more robust and adaptive to user needs. Research could also explore user interaction and feedback mechanisms to continually refine and improve the ontology. The syntactic evaluation, facilitated by reasoners and the OOPS!, affirmed the structural integrity of the ontology. Inspection classification by dimension further provided insights into its quality across structural, functional, and usability-profiling dimensions, considering criteria such as consistency, completeness, and consciousness. The absence of pitfalls within these dimensions underscores the reliability of the Bai Sri Su Kwan Ontology. However, a minor issue regarding P36 – the inclusion of file extensions in the ontology URI – was identified, recommending further refinement. Moving forward, visualization through VOWL enhances accessibility and user-friendliness, fostering inclusivity among diverse user groups. This study not only contributes to cultural heritage preservation but also paves the way for broader discussions, emphasizing user-centric design principles for greater inclusivity and understanding. The ontology's robustness, confirmed through evaluation and inspection, positions it as a valuable resource for researchers, practitioners, and the community, highlighting the significance of dedicated tools like OOPS! for ontology assessment. As the Bai Sri Su Kwan Ontology evolves, it remains poised for further collaborations, expansions, and refinements, setting the stage for ongoing research in cultural ontology development and knowledge dissemination.

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