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Designing and evaluating a community-based digital dictionary system for the Balinese language: An IT innovation adoption study

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ABSTRACT

Regional and vulnerable languages increasingly depend on digital tools to remain visible and usable in everyday life, yet many dictionary initiatives are described mainly in terms of content or interface features rather than evaluated as information-system innovations. This paper presents an exploratory design science study of a community-based Balinese digital dictionary that supports bidirectional Balinese-Indonesian lookup, Latin and Balinese Unicode script, speech-level information, part-of-speech tagging, related-word search, and role-based contribution workflows. The platform is implemented as a web-based system with a three-tier architecture and relational database. To evaluate adoption readiness, 40 users completed representative tasks and then responded to an adapted Moore and Benbasat IT innovation adoption instrument covering seven constructs. The results show high ease of use, relative advantage, and compatibility, indicating strong functional value and fit with user routines. Image and visibility are moderate, while result demonstrability and visibility show lower reliability and are therefore interpreted as exploratory indicators. The study contributes both a documented digital-dictionary artefact for Balinese language support and a reusable evaluation approach for other early-stage community-facing information and communication technology (ICT) systems. The findings suggest that wider uptake depends not only on technical quality, but also on institutional visibility, outreach, and continued content enrichment.

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1. INTRODUCTION

Balinese is one of Indonesia's major regional languages and a core component of Balinese cultural and religious life. It is widely used in rituals, traditional arts, local governance, and everyday interaction, yet it faces growing pressure from Indonesian and global languages, particularly in schooling, administration, and digital media. Many younger speakers are fully fluent in Indonesian but have more limited competence in Balinese, especially in higher speech levels and written forms, raising concerns about long-term vitality and intergenerational transmission and motivating digital revitalization efforts [1]–[5].

Digital dictionaries are a practical entry point for learners, teachers, and everyday users because they can be updated frequently, support multi-script display, and enable contributions. However, they are not merely lexical databases; they are socio-technical systems shaped by linguistic structure, interface design, community participation, and institutional support, requiring a systemic design and evaluation perspective [6]–[9]. This paper presents the design and evaluation of a community-based Balinese digital dictionary supporting bidirectional Balinese–Indonesian lookup, Latin and Balinese Unicode script, speech-level encoding, part-of-speech tagging, and related-word search. The platform includes role-based workflows for proposing, validating, and administering entries, and is implemented with a relational database to support maintainability and interoperability.

To assess user experience and adoption readiness, we apply the IT innovation adoption framework by Moore and Benbasat [10], adapting its seven constructs (voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability, visibility). Forty respondents used the system to complete typical tasks and then answered a 7-point Likert-scale questionnaire, providing an initial empirical view of adoption perceptions and areas for improvement. This study i) documents the system design and implementation, ii) evaluates user perceptions using the IT innovation adoption lens, and iii) derives implications for digital dictionaries supporting regional and vulnerable languages. The remainder of this paper is organized as follows. Section 2 reviews related work on digital dictionaries, socio-technical language resources, and IT adoption-oriented evaluation. Section 3 presents the research methodology and study design. Section 4 describes the system design, implementation, and evaluation results, followed by discussion of their implications. Section 5 concludes the paper, outlines limitations, and suggests directions for future work.

2. BACKGROUND AND RELATED WORK

Digital language resources such as online dictionaries are increasingly understood as socio-technical systems whose success depends not only on lexical coverage, but also on accessibility, usability, participation, and user acceptance. Arias-Badia and Torner [11] show that access to lexical information in online dictionaries is strongly shaped by website accessibility and interface design. Barham and Clarke [12] further demonstrate that dictionary apps are used in situated and student-centered ways that extend beyond simple word lookup, while Ferrett and Dollinger [13] show that digital dictionaries are not automatically superior to print versions in every respect, because usability and presentation still matter. Khalilia *et al.* [14] highlight the growing importance of participatory and crowdsourced approaches in lexical-resource development, and Piasecki *et al.* [15] argue more broadly for user-centered language-technology infrastructure. From a human-computer interaction perspective, Andrade-Arenas *et al.* [16] illustrate how structured web-based evaluation can help identify interface weaknesses and support iterative improvement. Taken together, these studies suggest that digital dictionaries should be evaluated not only as lexical artefacts, but also as interactive systems embedded in real user practices. Han and de Schryver [17] further show that in the era of generative artificial intelligence (AI), users increasingly compare dictionaries with other language-service technologies and expect lexical support that is more adaptive and context-sensitive than traditional lookup alone.

Community-based dictionaries also require robust multilingual handling, including cross-language lookup, multi-script representation, and support for ambiguous or variable user queries. Kadir *et al.* [18] show that query ambiguity remains a significant challenge in language-oriented search systems, while Nyein and Soe [19] illustrate the technical complexity of handling structurally different language pairs in computational language processing. In the Balinese and Indonesian context, the need for such tools is intensified by ongoing language shift, limited digital resources, and increasing dependence on digital platforms for learning and communication [1]–[5]. Balinese-specific digital initiatives have already demonstrated the importance of script and language technology in this area. Pramartha and Dwidasmara [20] contribute a non-QWERTY keyboard approach for Balinese script, and Pramartha *et al.* [21] present an early digital-humanities prototype for Balinese script use. Beyond Bali, Pramartha *et al.* [22] show through the Enggano digital dictionary project that community-based dictionary systems can function as practical instruments for language maintenance, preservation, and wider digital participation. Collectively, these studies confirm the importance of digital dictionaries, script technologies, and related language-support applications, while also highlighting persistent challenges such as orthographic variation, accessibility, lexical completeness, contribution quality, and long-term sustainability.

A broader systems perspective is therefore needed. Hedeland [23] emphasizes that digital language infrastructures must support diverse usage scenarios, rather than assuming a single stable user need. Sony and Naik [24] show that socio-technical systems are shaped by interactions among technical components, organizational arrangements, and human practices, while Taxén [25] argues that meaningful socio-technical analysis must retain the role of individual users within these larger systems. Applied to digital dictionaries,

these perspectives suggest that adoption outcomes are shaped not only by lexical data and interface design, but also by institutional support, user routines, contribution models, and the visibility of the platform within broader educational and cultural ecosystems.

Despite this progress, formal IT adoption frameworks remain underused in digital dictionary evaluation. Much of the existing literature examines accessibility, interface quality, multilingual handling, script technology, lexical coverage, or preservation outcomes, but comparatively little work evaluates whether users perceive a digital dictionary as an innovation that is advantageous, compatible with their routines, easy to use, socially visible, and worth continued uptake. This gap is particularly important for community-based language technologies, where long-term value depends not only on linguistic correctness and technical functionality, but also on whether users accept and integrate the system into everyday educational and community practice. To address this gap, the present study positions the Balinese digital dictionary as an exploratory socio-technical artefact and applies Moore and Benbasat's IT innovation adoption framework [10] to examine adoption readiness alongside multilingual robustness, community participation, and infrastructure-oriented design.

3. RESEARCH METHODOLOGY

3.1. Overall approach (design science research methodology)

This study adopts the design science research methodology (DSRM) [26], [27] to structure the end-to-end research process as shown in Figure 1, integrating iterative artefact design and empirical evaluation. The study begins with problem identification and motivation, followed by defining the objectives of a solution as requirements derived from stakeholder needs. We then conduct design and development to build the Balinese digital dictionary as a socio-technical artefact, describing its architecture and key features and showing how the technological, linguistic, and community subsystems are aligned. The artefact is demonstrated through hands-on task sessions that simulate realistic use scenarios. We subsequently perform evaluation using an adapted IT innovation adoption instrument by Moore and Benbasat to assess user perceptions across seven constructs—voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability, and visibility—supported by reliability checks and complemented by task-based observations. Finally, the study emphasizes communication by reporting the artefact, the design rationale, the evaluation outcomes, and the resulting design implications for similar community-oriented language systems. The evaluation is exploratory rather than confirmatory: its purpose is to generate early empirical insight into user perceptions of the artifact, identify design strengths and bottlenecks, and inform subsequent refinement of both the system and the evaluation instrument.

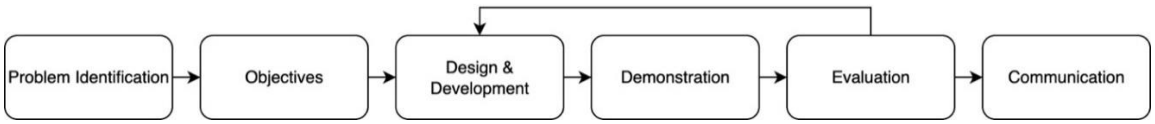

Figure 1. Design science research methodology (DSRM) process adopted in this study

3.2. Case context and participants

The case system is the Balinese digital dictionary website. At the time of the study, the system was already publicly accessible and contained a growing number of entries covering basic vocabulary, example sentences and speech-level annotations. The site had been announced through university channels, social media, and community groups interested in Balinese language and culture. For the evaluation, 40 respondents were recruited via online channels, personal networks and announcements in Balinese language–related groups. Participation was voluntary. Prospective participants were asked to access the website, perform a set of typical tasks—such as searching for Balinese words, viewing speech levels, reading example sentences in Balinese script, trying the related-word search and using the "suggest a new word" feature—and then complete an online questionnaire. The sample included users with varying familiarity with Balinese and with different backgrounds (*e.g.*, students, teachers, community members). Some respondents identified themselves as relatively fluent speakers who wanted a dictionary to check spelling or speech levels, while others were learners who used the dictionary to expand their vocabulary. Although the sample size is modest, it provides an initial snapshot of user perceptions from a diverse group of stakeholders. The final dataset thus comprised $N = 40$ complete responses.

3.3. Data collection and analysis

The questionnaire used the IT Innovation Adoption instrument by Moore and Benbasat, adapted for the Balinese digital dictionary. Items were translated and localized into Indonesian while preserving the original construct meanings. Respondents rated agreement on a 7-point Likert scale (1 = strongly disagree; 7 = strongly agree). Voluntariness was measured with two items on whether use was optional. Relative Advantage used five items on perceived benefits over alternatives. Compatibility included three items on fit with users' needs and routines. Image was assessed with three items on perceived social value of using the system. Ease of use comprised four items on interaction clarity and learning effort. Result demonstrability used four items on how visible and explainable the benefits are, and Visibility had two items on how widely known the dictionary is. The questionnaire also gathered demographics, brief task-based questions on word search and the suggestion feature, and open-ended comments. Responses were exported to a spreadsheet and analyzed with descriptive statistics (means and standard deviations) by item and construct, while qualitative comments were summarized into recurring themes to contextualize the results.

3.4. Validity, reliability and ethical considerations

Several steps were taken to support the validity and reliability of the evaluation. First, the IT innovation adoption items were derived from a validated instrument and only minimally adapted for the Balinese dictionary context, supporting content validity. Second, items were phrased clearly and consistently in Indonesian to reduce ambiguity for respondents with varying levels of English proficiency. Third, we examined internal consistency for each construct using Cronbach's alpha. The coefficients were high for voluntariness ($\alpha = 0.93$), relative advantage ($\alpha = 0.84$), compatibility ($\alpha = 0.83$), image ($\alpha = 0.83$) and ease of use ($\alpha = 0.93$), indicating strong internal reliability for these scales. In contrast, result demonstrability ($\alpha = 0.48$) and visibility ($\alpha = 0.30$) showed lower reliability, and are therefore interpreted more cautiously as exploratory indicators. From an ethical perspective, participation in the study was voluntary and anonymous. The questionnaire did not collect personally identifiable information, and respondents were free to skip any questions they did not wish to answer or to stop participation at any time. The study was conducted within the broader framework of university-based research on digital tools for local languages and complied with institutional guidelines for low-risk survey research involving human participants.

4. RESULTS AND DISCUSSION

4.1. Design and development

The Balinese digital dictionary described in this paper is an ongoing web-based initiative. The system is deployed on a cloud server and organized in a standard three-tier architecture separating the user interface, application logic and data storage as shown in Figure 2. A web frontend handles user interaction, communicates with a RESTful backend service, and accesses a relational database that stores lexical entries, metadata, and user-related information. This architecture supports high availability and responsive performance for dictionary queries at different levels of traffic. To sustain a living, community-facing service rather than a static prototype, the project adopts an iterative development approach. Source code is maintained in a version-controlled repository and integrated with a simple continuous integration/continuous deployment (CI/CD) workflow. Each change to the code base is automatically built and tested before deployment to the production server, reducing the risk of downtime and enabling frequent, incremental improvements. This development model aligns with the long-term goal of maintaining a reliable, usable platform that can evolve with emerging needs and user feedback.

The dictionary content itself is curated and expanded over time. Initial entries are seeded from existing lexical resources and previous documentation efforts, but the platform is designed to gradually incorporate new headwords, senses, examples, and usage notes. The focus is on providing up-to-date coverage of contemporary Balinese while still accommodating older or less frequently used vocabulary. Each entry can include multiple scripts (Latin and Balinese Unicode), speech-level information, part-of-speech tags, and related word links, allowing users to explore the language in more depth as the corpus grows. Community involvement is central to the project's development strategy. Early demonstrations to teachers, students, and language activists generated feedback on interface clarity, search behavior, and lexical gaps. This feedback guided several design revisions, such as reorganizing menu items, improving search suggestions, and clarifying how speech levels and parts of speech are displayed. Over time, the system will increasingly rely on contributions from trained volunteers and domain experts to refine definitions, add examples, and validate new entries, ensuring that the dictionary remains both linguistically sound and socially relevant.

Figure 2. System architecture of the cloud-based Balinese digital dictionary platform

To complement the high-level system architecture, Figure 3 presents the operational workflow and Figure 4 shows a compact excerpt of the relational data model. The workflow illustrates both the lookup process, in which user queries are handled through the web frontend and RESTful backend before retrieving structured lexical data from the database, and the contribution pathway, in which proposed entries or corrections move through review and publication stages. The schema excerpt highlights the main entities required to support multilingual lexical storage, multi-script representation, sociolinguistic annotation, role-based access, and community validation.

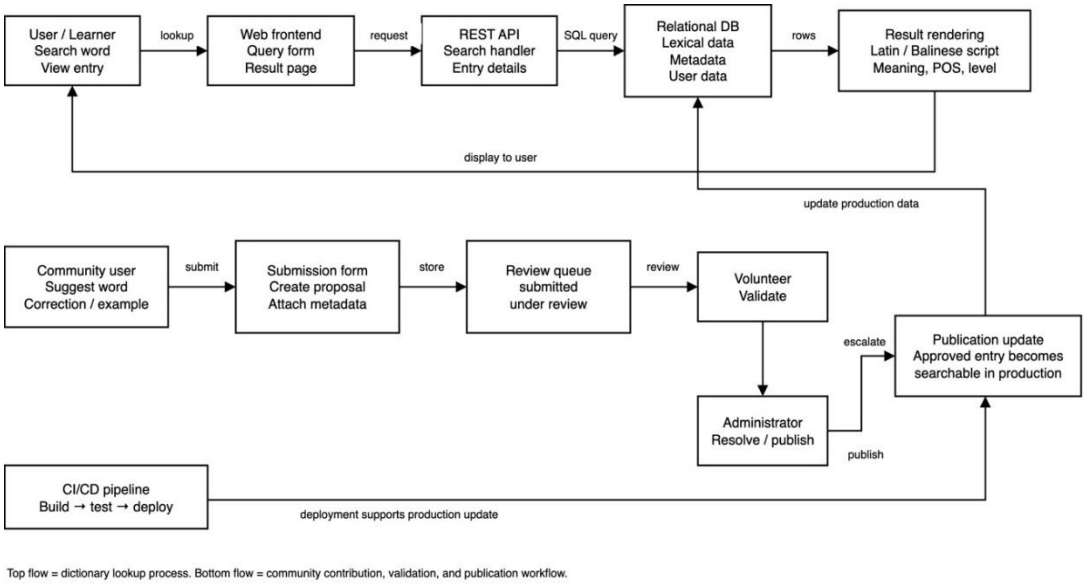

Figure 3. Operational workflow of the community-based Balinese digital dictionary

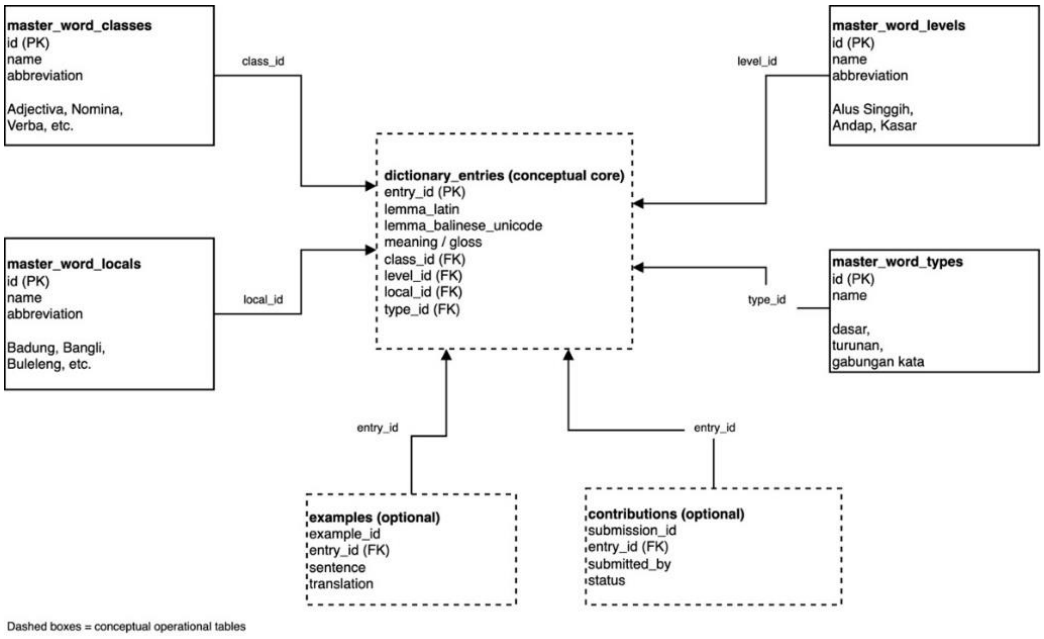

Figure 4. Database schema excerpt

4.2. Lexical model and multi-script representation

The Balinese digital dictionary is designed to support bidirectional lookup between Balinese and Indonesian. Each entry can be stored and searched with either language as source or target. For Balinese entries, the system maintains two orthographic representations: Latin script, which is widely used in everyday communication and in Indonesian-language education, and Balinese script encoded in Unicode, which supports proper digital rendering and is essential for preserving the traditional writing system and for interoperating with other Unicode-based tools. Users can see Balinese words and example sentences in Balinese script, enabling them to connect pronunciation and meaning with the appropriate graphemic form and encouraging literacy in the traditional script. The database schema includes fields for each script, language codes and cross-references, allowing the same concept to be represented consistently across different entry types.

4.3. Speech levels

A central feature of Balinese is its system of speech levels, which encode social relations, politeness and degrees of respect. The dictionary explicitly encodes speech level information for relevant entries. The main categories used are: *Alus Singgih* (ASI), a highly deferential level typically used for addressing deities, nobility and highly respected elders; *Alus Sor* (ASO), a polite refined level used for showing respect in everyday interaction; *Alus Mider* (AMI), a moderately polite level used in many semi-formal situations; *Mider* (M), a middle or neutral level; *Andap*, a low or informal level used among close equals; and *Kasar* (K), a rough or strongly informal level. Each lexical entry can be associated with one or more of these speech levels. In the interface, this information is displayed in a concise, recognizable form (for example using abbreviations or tags) to help users choose forms that are appropriate for given social situations, such as addressing elders, peers, guests or close friends. Making speech levels explicitly visible differentiates this dictionary from simpler bilingual wordlists and aligns the system with real communicative norms in Balinese society.

4.4. Part-of-speech tagging

For base forms (*kata dasar*), the system records the part of speech (POS), using the following categories: *Adjectiva* (a), *Adverbia* (adv), *Nomina* (n), *Numeralia* (num), *Partikel* (p), *Pronomina* (pron), and *Verba* (v) [28], [29]. This POS information is stored in the relational database and presented in the user interface. It supports more fine-grained search and filtering, for example by allowing users to restrict searches to verbs or nouns, and it provides learners with basic grammatical information that can be used in teaching materials and further language processing. The POS tags can also serve as a foundation for future extensions, such as automatic example sentence generation or grammar-aware learning exercises.

4.5. Related-word search and morphology

The system includes a related-word search feature that allows users to explore morphological relations between words. When a user searches for a word, the interface may display not only the base form but also derived forms and words with relevant prefixes and suffixes. These relations are captured in the database through explicit links between lemmas and their derivatives, as well as through pattern-based queries on common Balinese affixes. Given the importance of affixation in Balinese word formation, this feature helps users recognize families of related words and understand how meaning and grammatical function change with different affixes. For example, learners can see how a noun is related to a causative verb or how different verb forms correspond to different degrees of formality. It also supports more exploratory learning, where users move from known forms to new, but related, vocabulary, making the dictionary a more engaging and educational tool.

4.6. Role-based access and community-based crowdsourcing

To enable community participation while maintaining quality control, the dictionary implements a role-based access model with three main roles: administrator, volunteer, and community user. Administrators are responsible for managing system configuration, overseeing content, assigning volunteer roles and handling complex editorial decisions, such as resolving conflicting definitions or updating problematic entries. Volunteers are trusted contributors who validate entries proposed by other users. Volunteers check spelling, meaning, speech-level assignment, part-of-speech tagging and script consistency before publication. They may also refine example sentences to ensure that they are natural and culturally appropriate. Community users are general users who can search and browse entries and also propose new words and example sentences, especially for lexical items not yet covered in the dictionary. Community users can also flag errors or suggest corrections, which are then reviewed by volunteers or administrators.

These roles are implemented via access-control logic in the application and corresponding fields in the relational database, which record the state of each proposed entry (*e.g.*, submitted, under review, approved, rejected). The workflow is designed to be as simple as possible: when a user submits a new entry or suggestion, it appears in a review queue visible to volunteers, who can then approve, modify or reject it. This community-based crowdsourcing mechanism allows the dictionary to grow and remain responsive to actual usage, while the validation layer helps prevent the accumulation of incorrect or low-quality entries.

4.7. Implementation overview

The system is implemented as a web application with a relational database backend. The choice of a relational model, rather than an ontology store, is driven by considerations of simplicity, performance and maintainability in the current institutional environment. The database schema stores lexical forms, meanings, language codes, script representations, speech levels, POS tags, morphological relations, contribution metadata and user roles. The web interface exposes search functionality, entry details, related-word links and contribution forms via standard HTTP-based architecture.

The front-end is optimized for modern browsers and is designed to be responsive, so that the dictionary can be accessed from both desktop and mobile devices. Basic coaching and indexing strategies are employed to keep search times acceptable even as the database grows. From a systemic perspective, this implementation aligns the linguistic subsystem (lexical data and annotations) with the technological subsystem (database and web services) and supports the community subsystem (users, volunteers, administrators) through role-based workflows and feedback channels.

4.8. Evaluation results

4.8.1. Sample characteristics, reliability and descriptive results

Table 1 most respondents are between 21 and 25 years old, live in Bali, and predominantly reside in urban areas. Their Balinese language proficiency ranges from low to high, whereas almost all respondents report medium to high ability in operating digital devices. This profile indicates that the evaluation captures perceptions from digitally competent users with diverse levels of Balinese proficiency, which is appropriate for assessing a web-based language tool.

Table 2 summarizes the reliability analysis for the seven IT innovation adoption constructs. Voluntariness, relative advantage, compatibility, image and ease of use all show high internal consistency (Cronbach's α between 0.83 and 0.93), indicating that items within these constructs measure a coherent underlying perception. In contrast, result demonstrability ($\alpha = 0.48$) and visibility ($\alpha = 0.30$) exhibit lower reliability, suggesting that these scales capture more heterogeneous responses and should be interpreted as exploratory indicators in this study rather than definitive measures. The construct abbreviations used in Tables 2 and 3 are as follows: VOL = voluntariness, RA = relative advantage, COM = compatibility, IMG = image, EOU = ease of use, RD = result demonstrability, and VIS = visibility.

Table 1. Demographic profile of respondents (N = 40)

Characteristic	Category	n	%
Age	≤ 20 years	13	32.5
	21–25 years	26	65
	> 25 years	1	2.5
Place of residence (province)	Bali	38	95
	Outside Bali	2	5
Type of area of residence	Urban	27	67.5
	Rural	13	32.5
Balinese language proficiency level	Low (1–3)	9	22.5
(1 = very low, 7 = very high)	Medium (4–5)	18	45
	High (6–7)	13	32.5
Ability to operate digital devices	Low (1–3)	0	0
(1 = very low, 7 = very high)	Medium (4–5)	5	12.5
	High (6–7)	35	87.5

Table 2. Reliability of IT innovation adoption constructs (N = 40)

Construct	Code	Number of items	Cronbach's α
Voluntariness	VOL	2	0.93
Relative advantage	RA	5	0.84
Compatibility	COM	3	0.83
Image	IMG	3	0.83
Ease of use	EOU	4	0.93
Result demonstrability	RD	4	0.48
Visibility	VIS	2	0.30

The lower internal consistency for result demonstrability and visibility suggests that these constructs may not yet be fully stabilized in this context. A plausible explanation is that respondents had heterogeneous prior exposure to the platform and varied opportunities to observe or discuss its benefits before the evaluation session. In future iterations, these constructs should be refined through item-level inspection, including item wording review, corrected item-total correlation analysis, and pilot testing with a larger and more heterogeneous sample. Accordingly, in this study RD and VIS are retained as exploratory diagnostic indicators rather than as stable confirmatory scales.

Descriptive statistics for the construct-level scores are presented in Table 3. Ease of use attains the highest mean (M = 6.42), followed closely by relative advantage (M = 6.32) and compatibility (M = 5.88). These results indicate that respondents perceive the Balinese digital dictionary as very easy to operate, clearly more beneficial than alternative resources and generally well aligned with their everyday learning and work practices. Voluntariness also has a relatively high mean (M = 5.19), suggesting that users tend to experience the decision to use the website as self-initiated rather than imposed.

Table 3. Descriptive statistics of IT innovation adoption constructs (N = 40)

Construct	Code	N	Mean	SD	Min	Max
Voluntariness	VOL	40	5.19	1.67	1	7
Relative advantage	RA	40	6.32	0.73	4	7
Compatibility	COM	40	5.88	0.92	4	7
Image	IMG	40	5.00	1.20	1.67	7
Ease of use	EOU	40	6.42	0.75	4	7
Result demonstrability	RD	40	5.83	0.86	4	7
Visibility	VIS	40	5.00	1.26	2	7

Image and visibility both show moderate mean scores (M = 5.00), implying that users see some positive status associated with using the dictionary and some degree of awareness of the platform in their environment, but these social dimensions are not yet as strong as perceptions of usefulness and ease of use. Result Demonstrability, with a mean of 5.83, indicates that respondents generally feel able to observe and communicate the benefits of using the dictionary, even though the lower reliability for this construct points to variation in how clearly these benefits are articulated. Overall, the pattern in Table 3 suggests that the core functional aspects of the system (usefulness, ease of use and compatibility) are already well established, while image, visibility and demonstrability of results remain areas where further strengthening is possible.

4.8.2. Qualitative perceptions and patterns

Open-ended responses provide additional insight into these quantitative patterns. Many respondents describe the interface as "simple," "clear" and "easy to learn," aligning with the high ease of use scores. They report that searching for words, reading definitions and viewing speech-level information can be done without prior training. Several users also note that the ability to see Balinese script and speech levels in a single place is particularly helpful for academic assignments and daily communication, reinforcing the high relative advantage ratings.

At the same time, some users comment that not all words they expect are present, and that example sentences or domain-specific terminology are sometimes missing. These observations temper perceptions of result demonstrability and relative advantage, because gaps in lexical coverage occasionally limit the concrete benefits user's experience. Comments related to compatibility emphasize that the dictionary is most useful for students, teachers and individuals who already have an interest in Balinese language and culture, suggesting that further adaptation may be needed to reach more casual users.

With respect to Image and Visibility, several respondents indicate that they only learned about the website through the survey invitation or class-related activities. This explains why visibility does not score as highly as ease of use or relative advantage: while users appreciate the tool once introduced to it, many had not previously encountered it in their usual online environments. A few respondents suggest that formal recognition by schools or government agencies, or inclusion in learning materials, would strengthen the perceived status of the website.

4.8.3. Synthesis of IT innovation adoption findings

Taken together, the IT innovation adoption results suggest that the Balinese digital dictionary is perceived as a highly usable and beneficial innovation for those who have access to it. High scores in ease of use, relative advantage and compatibility indicate that the technological and linguistic design decisions are largely aligned with user needs and practices. At the same time, the more moderate scores for Image and Visibility show that the platform has not yet achieved strong public recognition or prestige as a go-to resource for Balinese, which may limit its diffusion beyond early adopters. This pattern is consistent with a system that works well for current users but is still consolidating its role in the wider socio-technical ecosystem of Balinese language use.

Result demonstrability and voluntariness, while generally positive, provide additional nuance. Respondents report that they can observe and explain the benefits of using the dictionary, but the lower internal consistency for result demonstrability suggests that these benefits are not yet uniformly experienced or articulated. Similarly, Voluntariness scores indicate that users largely feel free to decide whether to use the website, even though some engagement is mediated by courses or specific activities. Overall, the findings portray the dictionary as a growing community-based resource whose core functional value has been established, but whose visibility, social image and demonstrability of long-term benefits still need to be strengthened through increased lexical coverage, outreach and institutional support.

4.8.4. Limitations of the evaluation

The findings of this evaluation should be interpreted in light of several limitations. First, the sample size is modest (N = 40) and was obtained through convenience sampling of individuals who already have some interest in Balinese language and culture. This may bias the results towards more positive perceptions and limits the generalizability of the findings to the wider population of potential users, including more casual learners or individuals with limited prior exposure to Balinese. In addition, the study focuses on a single case system—the Balinese digital dictionary—so the results may not directly transfer to other digital dictionary platforms with different design choices or institutional contexts.

Second, the evaluation relies on self-reported perceptions captured at one point in time, shortly after participants interacted with the system. The IT innovation adoption constructs provide a rich snapshot of how the dictionary is viewed as an innovation, but they do not capture long-term usage patterns, actual learning outcomes or changes in perceptions as users gain more experience. Longitudinal data, such as usage logs and follow-up surveys, would be needed to understand how perceptions of voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability and visibility evolve over time and how they relate to sustained adoption.

Third, although the questionnaire items are adapted from a validated IT innovation adoption instrument and carefully localized into Indonesian, some nuances may have been lost in translation or contextualization for the Balinese dictionary setting. The internal consistency analysis shows high Cronbach's alpha values for voluntariness, relative advantage, compatibility, image and ease of use, but lower reliability for result demonstrability and visibility, indicating that these latter constructs should be interpreted more cautiously as exploratory indicators. Finally, the study does not systematically analyze qualitative feedback beyond basic thematic grouping; future work could employ more detailed qualitative

methods, such as interviews or focus groups, to triangulate and deepen the understanding of user perceptions and contextual factors that influence adoption

4.9. Discussion

The IT innovation adoption results suggest that the Balinese digital dictionary delivers strong functional value: high ease of use, relative advantage, and compatibility indicate that users find it easy to operate, beneficial compared with alternatives, and well aligned with their study and work routines. However, more moderate Image and Visibility scores imply that broader social and institutional embedding is still emerging. Result Demonstrability and Voluntariness further indicate that users generally perceive clear benefits and feel free to choose whether to use the system, although benefit articulation is not yet fully consistent across respondents.

These findings imply several priorities for strengthening adoption and impact. Content should continue to foreground sociolinguistic guidance (*e.g.*, speech levels, usage notes, and social constraints) to reinforce relative advantage and compatibility. Multi-script support should remain central by providing reliable Latin and Unicode Balinese script display with user control, supporting learners at different literacy levels while encouraging script normalization online. Feature development can enhance pedagogical value through improved related-word, derivational, and morphological exploration. For the community contribution model, clearer role-based workflows (contributors, editors, administrators), transparent review procedures, and feedback to contributors can help maintain quality and sustain participation. The IT innovation adoption instrument can also function as an iterative evaluation tool: repeating it after major feature or outreach changes, ideally alongside usage analytics, can track shifts in perceptions and guide incremental refinement.

From a policy and practice perspective, the dictionary appears ready for wider integration into education and community programs to raise visibility and strengthen long-term uptake. Institutional anchoring—through curriculum references, teacher training, and university learning tasks—can normalize digital Balinese resources among new user groups. Cultural agencies and policy-makers can further support community-based maintenance by recognizing contributors, funding local moderation and training, and aligning dictionary development with complementary initiatives such as terminology development and script standardization. Overall, the results reinforce the need to treat digital dictionaries as part of a wider language infrastructure—linking technology, education, cultural policy, and ICT development—so that functional strengths translate into durable adoption and revitalization outcomes.

Methodologically, the study contributes a reusable exploratory evaluation approach for early-stage ICT artifacts whose success depends on user uptake. Although developed in the context of a community-based Balinese digital dictionary, the same combination of Design Science artifact description, task-based exposure, construct-level perception measurement, reliability inspection, and qualitative follow-up can be adapted for other digital dictionaries, cultural heritage platforms, educational language tools, and community-facing information systems.

5. CONCLUSION

This paper has presented a systemic design and evaluation of a community-based digital dictionary for the Balinese language, combining a detailed description of the system's architecture and features with an IT innovation adoption–based user study. The dictionary supports multilingual lookup between Balinese and Indonesian, offers both Latin and Balinese script display and encodes sociolinguistic information such as speech levels and grammatical categories. The evaluation with 40 respondents shows that the platform is perceived as highly easy to use, clearly advantageous compared with available alternatives and broadly compatible with users' study and work routines. At the same time, more moderate ratings for Image and Visibility, and the lower reliability of Result Demonstrability and Visibility, indicate that the platform's social recognition and long-term benefits are not yet fully established.

From a systemic perspective, the study highlights how perceptions of an innovation emerge from interactions between technical design choices, linguistic modelling and institutional or community contexts. Using the IT innovation adoption framework proved useful for making these dynamics visible and for identifying where further design and outreach efforts are needed. Future work will extend the evaluation to more diverse user groups, including school students, teachers and community organizations, and will incorporate longitudinal usage data and qualitative methods to understand how perceptions evolve over time. Comparative studies with digital dictionaries for other regional or vulnerable languages could also help clarify which design and governance patterns generalize across contexts. In the longer term, the experience gained from the Balinese dictionary can inform language policy and digital heritage initiatives that seek to integrate regional languages into everyday digital practice, contributing to a more inclusive and culturally diverse digital landscape.

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AUTHOR CONTRIBUTIONS

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
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E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST

Authors state no conflict of interest.

DATA AVAILABILITY

The authors maintain the data that support the findings of this study and will make them available upon reasonable request. Please contact the corresponding author for access to the data.

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