DEVELOPMENT OF THE LI NIHA DICTIONARY DATA MODEL TO SUPPORT THE DIGITALIZATION AND PRESERVATION OF THE NIAS LANGUAGE

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ABSTRACT

Language is a priceless cultural heritage, playing an important role as a means of social communication passed down from generation to generation. The Nias language, also known as Li Niha, is a regional language with its own unique characteristics compared to other regional languages in Indonesia. However, along with the development of the times and technological advances, the use of the Nias language has experienced a significant decline. The influence of the national language, lingua franca, and other foreign languages has caused many native vocabulary words to be rarely used, even replaced or changed form. This phenomenon poses a real threat to the preservation of the Nias language. Therefore, concrete efforts are needed in the form of digital technology-based preservation. This study aims to design a relational data model to build the Li Niha Dictionary, a digital dictionary of the Nias language that can be accessed online through a web-based application. The design is carried out through database development stages starting from conceptual, logical, to physical models, using MySQL. It is hoped that this data model can become the basis for the development of a broader digital dictionary, support integration with artificial intelligence (AI) and natural language processing (NLP), and become an educational medium for the younger generation in learning and preserving the Nias language.

Keywords: Li Niha, Nias Language, Digital Dictionary Model Data, Language Digitalization

1. INTRODUCTION

Currently, there is a phenomenon where regional languages are less used or less preferred for use as everyday languages, especially among the Gen Z and Gen Alpha generations. This is caused by several factors, including the existence of Indonesian as the national language used outside the home, such as school, work, and other format events. The development of social media that makes it possible to make friends and socialize with others outside one's own tribe who use Indonesian. There is also the current habit of parents who find it easier to use Indonesian to teach their children from a young age, and even the language used at home is Indonesian. Many other factors cause children born into certain tribes that typically have regional languages, rarely or not taught within the family environment. So that children later grow up not to be fluent in the regional language, even unable to speak it and reluctant and there is a sense of embarrassment, especially if the family and children are born outside the region. This occurs especially in the Nias Islands region.

Ono Niha means Nias people, or the Nias Tribe, who inhabit Nias Island and the Batu Islands in North Sumatra. They are known for their strong social structure based on clan kinship, inherited through patrilineal inheritance. Li Niha, or the Nias language, is the regional language of the Nias people or Nias tribe, spoken by approximately 700,000 to 1 million people, both on Nias Island and outside Nias, including the Nias diaspora in Indonesia. There are three main dialects: Northern, Central, and Southern, with approximately 80% vocabulary similarity between dialects (*Nias Language*, n.d.). The Nias language is not only a means of communication but also preserves the cultural values, proverbs, folklore, and philosophy of life of the Nias people. This language is also a symbol of cultural identity and a means of maintaining close emotional ties between community members.

The Nias language has a unique language, compared to other regional languages. This language is known as an open-syllable language, meaning there are no consonants at the end of syllables or words, syllables end with vowels, unlike languages such as Indonesian or other regional languages. For example, "kotak" is pronounced as "kota" by Nias speakers (*Nias Language*, n.d.). The Nias language has rare phonemes that are not common. The word mutation system: nouns change into verbs through changing the initial word (amagu → namagu): my father, without changing the ending. The structure of the Nias language adopts a predicate–subject–object–adverb structure. Examples are as follows:

Bahasa Indonesia:	Bahasa Nias:
Saya pergi ke kebun besok sore	*Möi do ba kabu mahemolu bongiluo*
S + P + O + K	P + S + O + K

Terjemahan dalam bahasa Indonesi:
Pergi aku ke kebun besok sore

A unique writing system (phonology & orthography) with the use of symbols such as (Gulö, 2014): umlaut on the letter ö, circumflex on the letter w, apóstrophe to separate syllables in repeated words or contractions. Unique phonemes that are very rarely found in other languages.

Challenges of Preserving Regional Languages

A qualitative study (Sembada & Vivian, 2020) of the Nias community in Jakarta (a diaspora) found a shift in language transmission behavior among Generation Z. Younger children are becoming reluctant or rarely use Nias language due to several factors: Parents abroad do not always teach Nias language; School environments and friendships use Indonesian or a foreign language; and children feel they are not part of the Nias identity because they were born and raised outside their area of origin. Research shows that Li Niha speakers often experience language interference when speaking Indonesian, such as dropping final consonants, reversing word order, or excessive phrases, because the phonological and grammatical structures of Nias are fundamentally different (Mendrofa, 2020). In general, young Indonesians including Nias more often use slang, abbreviations, or a mix of English on social media. Causal language studies among Generation Z show that this reduces the consistent use of formal language and influences the transfer of regional languages, including Nias (Susilawati et al., 2024).

One linguistic phenomenon currently occurring among the younger generation of Nias is the use of Nias language that does not conform to the original rules, both in terms of pronunciation, structure, and meaning. Many young people mix Nias language with Indonesian in the same sentence, often adding artificial prefixes or suffixes that have no linguistic meaning in Nias. This phenomenon is exacerbated by the trend of using alay language on social media, which tends to haphazardly modify word forms for the sake of uniqueness or humor. As a result, deviations in the use of Nias language have occurred, which, if allowed to persist, could lead to shifts in meaning and the loss of standard language forms. This highlights the importance of documenting, preserving, and educating the younger generation about Nias language through engaging digital media based on correct linguistic rules. In addition to deviations in usage, another phenomenon threatening the sustainability of the Nias language is the increasing use of loanwords from Indonesian and other languages that are trending in society. This use of loanwords is slowly replacing native words in Nias, resulting in many local words becoming rare, or even no longer used in everyday communication.

The lack of digital content in Nias is one of the main causes of the language's low exposure and use, especially among the younger generation. On social media platforms like Instagram, Facebook, or TikTok, posts or videos using Nias are rare. Most young people prefer to use Indonesian or English in their digital communications. Furthermore, there are no widely accessible Nias language learning platforms or apps. This makes it difficult for those wishing to learn or preserve the language to find appropriate resources. This situation is further exacerbated by the lack of technological support, such as auto-correction or Nias language translation features, on digital devices. As a result, Nias language is becoming less relevant to the younger generation and is at risk of being further marginalized from everyday life.

Currently, many regional languages in Indonesia are facing extinction due to disuse. According to UNESCO and Ethnologue data, there are more than 7,000 languages still spoken out of a total of approximately 8,300 languages in the world, but more than 40% of them are considered endangered (*Bahasa Dunia Dan Indonesia*, n.d.). Indonesia has between 715–726 regional languages, making it one of the countries with the highest linguistic diversity. Around 139–154 languages are categorized as endangered, and 11–15 languages have already become extinct, especially in the regions of Maluku, Papua, and Sulawesi. Some languages that have been declared extinct include: Tandia, Mawes, Kayeli, Piru, Moksela, Palumata, Hukumina, Serua, and Nila (Budiwiyanto, n.d.; Jakarta Globe, n.d.). In the paper Glocalization of Intangible Cultural Heritage, it is stated that many local minority languages are considered to have no future due to generational transition, migration, and national policies that do not support the preservation of minority languages (Septiyana & Margiansyah, 2018).

Objectives and Benefits

Language is a fundamental element of cultural identity and existence. In Indonesia, the diversity of regional languages reflects extraordinary cultural richness. However, in recent decades, many regional languages have faced the threat of extinction. This threat is caused not only by a lack of intergenerational transmission, but also by limited documentation and digitization of these languages. One example is Nias, a regional language spoken by the people of the Nias Islands, North Sumatra. This language has a unique structure, distinctive phonology, and significant historical value, but is increasingly being eroded by the dominance of Indonesian and external cultural influences.

Amidst the widespread use of digital technology in everyday life, a gap exists in digital literacy for the preservation of regional languages. Digital literacy can play a crucial role in preserving regional languages. However, most regional languages in Indonesia, including Nias, have not been well documented in digital format. This limits access, learning,

and distribution of these languages to the younger generation, especially those living outside their home regions. Without systematic documentation efforts and data-driven digitization, it is feared that many regional languages will disappear in the near future without any trace. The digitization of the Nias language was also inspired by BASAbali, a community-based Balinese language wiki, a successful example of regional language digitization. This platform has received recognition from UNESCO and IEEE for its impact in strengthening local languages through collaborative and educational content (*BASABali*, n.d.).

On the other hand, technological advances in Artificial Intelligence (AI) and Natural Language Processing (NLP) are opening up new opportunities for preserving regional languages. Currently, various AI-based applications such as machine translation, speech recognition, and conversational agents require rich and structured linguistic datasets. Unfortunately, most NLP research and development still focuses on global or national languages, with very little incorporating regional languages as data sources. However, with the right approach, regional languages such as Nias have the potential to be incorporated into AI systems capable of learning, recognizing, and even using them. In other areas, such as Madurese, the MadureseSet (Ifada et al., 2023), a digital version of the physical Complete Madurese-Indonesian Dictionary, is already under development. It aims to become a primary resource for Natural Language Processing (NLP) research.

Based on this background, this research aims to design a relational data model as the basis for compiling a dataset and online application for a Nias language dictionary. This dataset will be developed as an open and sustainable digital system, and can be used as a database for the preservation, education, and development of regional language technology in the future. This design is the first step towards digital preservation of the Nias language and opens up the possibility of its integration in the development of local language-based technology applications. This approach not only saves the language from extinction but also equips future generations with digital resources that can be used in education and technology development.

2. METHOD

Conceptual Design

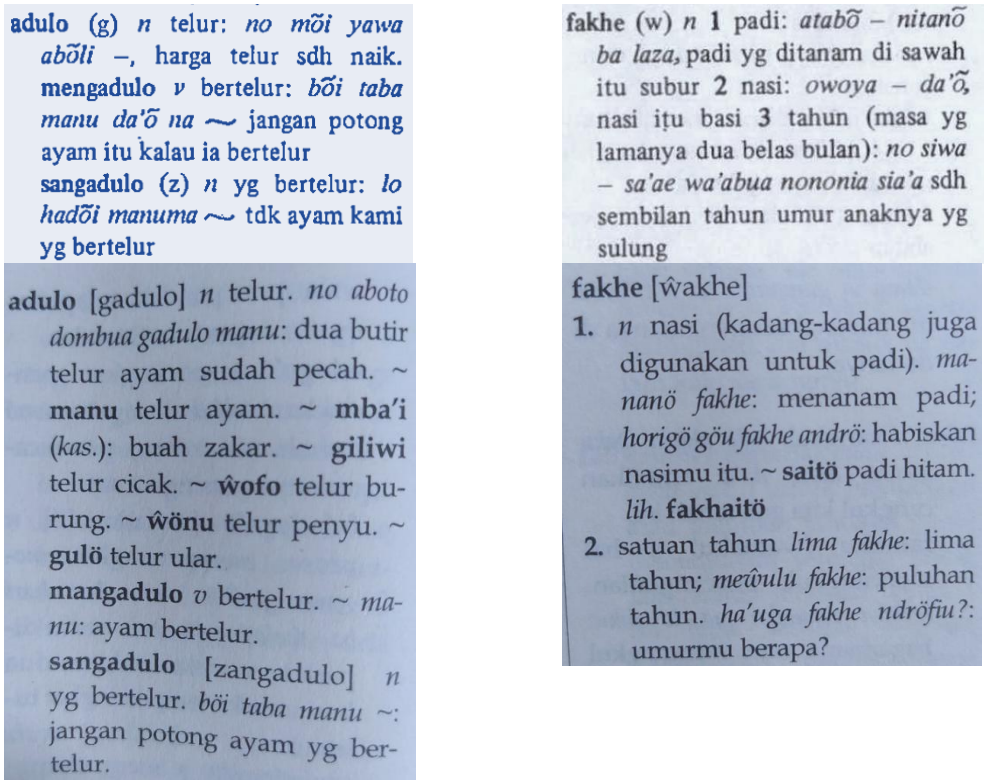
A lemma is a representative form of a set of related words in a lexicon and plays a crucial role in corpus linguistics and in the construction of digital dictionaries. As an abstract representation, a lemma is the center of a group of words that have a relationship in form and meaning, such as eat, eats, eaten, and eater, all of which refer to one core lemma, namely eat. Meanwhile, a word is the concrete form or manifestation of a lemma that appears in the context of a sentence or discourse. This concept is fundamental in natural language processing (NLP), morphological annotation, and linguistic database design. According to Matthews (1997), a lemma is a basic entry in a dictionary that represents a lexical unit and serves as a reference point for all variants of related word forms. In the study of computational linguistics, lemma recognition and mapping play a crucial role in enabling efficient word grouping in automatic search, classification, and labeling systems. Data source specifications:

Table 1. Description of Li Niha Corpus and Data Model

Subject	**Li Niha corpus, Data Model Li Niha**
Data type	Data Structure, MySQL database, Web application
How the data was obtained	The dataset was collected from a physical document of the Nias-Indonesian Language Dictionary, the Nias Language Bible, online sources (web pages) and contributors.
Description of data collection	The dataset is collected and processed from some resources.
Data accessibility	The next research is the development of the Li Niha online dictionary application which can be accessed online.

Lemmata or root words in Nias language will be extracted from various sources, one of which is the Nias language Bible text (Soera Ni'amoni'ö), which is one of the most complete and structured digital corpora of Nias language. This Bible has a variety of word forms, sentences, and language structures that reflect the use of Nias language in narrative and descriptive contexts, making it very relevant to be processed as a lexicon source in compiling a digital dictionary. Data from this Bible can be accessed online through several platforms, such as: Bible.is - Nias Language Bible (Audio + Text) (https://www.bible.is/NIADCL/Matt/1), SABDA Bible – Nias Bible Text (open module) (https://alkitab.sabda.org/version.php?b=niadcl) and SABDA Labs – Download Nias Language Bible Module (https://labs.sabda.org/Bahasa_Nias). By using the biblical text as a lexical source, this research also opens up opportunities to enrich linguistic annotations, such as labeling word classes (parts of speech), dialects, and variations in word forms, which are important in the development of digital dictionaries and natural language processing

applications. Then, as a second data source, analyze the structure of the existing Nias - Indonesian language dictionary, using two dictionary sources:



adulo (g) *n* telur: *no mõi yawa abõli* –, harga telur sdh naik. **mengadulo** *v* bertelur: *bõi taba manu da'õ na* ~ jangan potong ayam itu kalau ia bertelur **sangadulo** (z) *n* yg bertelur: *lo hadõi manuma* ~ tdk ayam kami yg bertelur

adulo [gadulo] *n* telur. *no aboto dombua gadulo manu*: dua butir telur ayam sudah pecah. ~ **manu** telur ayam. ~ **mba'i** (*kas.*): buah zakar. ~ **giliwi** telur cicak. ~ **ŵofo** telur burung. ~ **ŵönu** telur penyu. ~ **gulö** telur ular. **mangadulo** *v* bertelur. ~ *manu*: ayam bertelur. **sangadulo** [zangadulo] *n* yg bertelur. *böi taba manu* ~: jangan potong ayam yg bertelur.

fakhe (w) *n* **1** padi: *atabõ – nitanõ ba laza*, padi yg ditanam di sawah itu subur **2** nasi: *owoya – da'õ*, nasi itu basi **3** tahun (masa yg lamanya dua belas bulan): *no siwa – sa'ae wa'abua nononia sia'a* sdh sembilan tahun umur anaknya yg sulung

fakhe [ŵakhe]
1. *n* nasi (kadang-kadang juga digunakan untuk padi). *mananö fakhe*: menanam padi; *horigö göu fakhe andrö*: habiskan nasimu itu. ~ **saitö** padi hitam. *lih.* **fakhaitö**
2. satuan tahun *lima fakhe*: lima tahun; *meŵulu fakhe*: puluhan tahun. *ha'uga fakhe ndröfiu?*: umurmu berapa?

Figure 1. Words from the 1985 Nias Language Dictionary (Laiya et al., n.d.) and the Nias Language Dictionary - Apolo Lase (Lase, 2011)

The two dictionaries used as data sources underwent a flattening process, transforming complex, hierarchical, or nested data structures into simpler, flat tables. The goal of this process is to adapt the data format so it can be stored and managed efficiently in a relational database system. Each linguistic entity, such as lemma, meaning, word class, sentence example, and dialect, is separated into structured tables with clear relationships, making the data easier to access, search, and analyze.

kata	kata turunan	bentuk lain	kata dasar	index	jenis kata	id makna	arti bahasa indonesia	contoh bahasa nias	contoh bahasa indonesia	jenis	sinonim	sumber	dialek
fakiko					v		rusakkan, merusakkan	böi fakiko zi no tohöna sökhi	jangan rusakkan yang telah kian baik			82	
	famakiko	wamakiko			n		pengrusakan (cara, hal, dsb merusak)					82	
	tekiko				a		rusak	no tekiko TV da'a	sudah rusak TV ini			82	
	fa'atekiko	wa'atekiko			a		kerusakan	abölöbölö sibai fa'atekiko moto da'ö	terlalu parah kerusakan mobil itu			82	
fakole		wakole					pisau yg biasa dipakai di dapur yg ukurannya tdk terlalu					82	
adulo		gadulo			n		telur	no möi yawa mböli gadulo	harga telur sudah naik			Kamus 1985	
	mangadulo				v		bertelur	böi taba manu da'ö na mangadulo	jangan potong ayam itu kalau ia bertelur			Kamus 1985	
	sangadulo	zangadulo			n		yang bertelur	lö hadöi manuma sangadulo	tidak ada ayam kami yang bertelur			Kamus 1985	
fakhe		wakhe			n	1	padi	atabö wakhe nitanö ba laza	padi yang ditanam di sawah itu subur			Kamus 1985	
						2	nasi	owoyu wakhe da'ö	nasi itu basi			Kamus 1985	
						3	tahun (masa yang lamanya dua belas bulan)	no siwa fakhe sa'ae wa'ebua nononia sia'a	sudah sembilan tahun umur anaknya yang sulung			Kamus 1985	

Figure 2. Example of converting a dictionary structure into a tabular data table using the flat table approach.

Logical and Physical Design

From the conversion results into a flat table, the next step is to perform a normalization process to identify the entities and relationships required in the data model. Normalization is a systematic process in relational database design to organize data into tables with the aim of reducing redundancy, avoiding anomalies, and ensuring data integrity and consistency. This process produces a number of interconnected relational tables, each representing a major entity in the dictionary structure. Each table is designed with attributes that describe the specific characteristics of its data, along with an explanation of the function of each attribute within the context of a digital dictionary system.

Table 2. Description of Entities in the Li Niha Relational Data Model

Entity/table name	Information
lemmata	A list of words (lemmas) in Nias, consisting of the following attributes: basic_lemma, homonym, pos (part of speech), and dialect. The Nias language is divided into three dialects: North, Central, and South. Each region has its own distinct dialect: the northern dialect is soft, the central dialect is moderate, and the southern dialect is harsh.
lemma_variant	Lemma variant is another word form of the basic word lemma, can be a synonym, differences in pronunciation due to dialect and circumstances, consisting of the attributes variant, type, and dialect. Example: 1. *atua*: meaning old, can change into acua, usually in central and southern dialects using the form "acua". 2. *fakhe*: meaning rice, can change into "wakhe". 3. *falukha*: meaning meeting, has a synonym "falakhi", the word falakhi is usually used in southern dialects.
sentences	Translation and explanation in Indonesian, accompanied by example sentences in Li Niha and Indonesian. Example, “fakhe” has three meanings: 1. rice, *atabö wakhe nitanö ba laza*: the rice planted in the rice field is fertile 2. rice, *owoyu wakhe da'ö*: the rice is stale 3. year, *no siwa fakhe sa'ae wa'ebua nononia sia'a*: his eldest child is already nine years old
part_of_speech	List of parts of speech: verb, adjective, adverb, noun, numeral, particle, pronoun, proverb.
descr_subs_lemmata	Data categories consist of dialect, speech level. 1. Dialect: consists of North, Central, and South. 2. Speech level: the degree of softness in pronunciation of words or dialects, including regular, soft, and hard. 3. Foreign loanword: a word borrowed or absorbed from a foreign language that is adopted into a language, either in its entirety or with adjustments to sound, meaning, or structure. Words like moto, radio, hondra, etc., are part of the vocabulary used among the Nias people. The word hondra comes from the Honda brand, with a slight pronunciation change by adding the letter "r," but the word is used to refer to all two-wheeled motorized vehicles, regardless of brand, whether Honda itself, Yamaha, or other brands.

The following image is an Entity Relationship Diagram (ERD) of the Li Niha Dictionary Data Model. This model was designed using Visual Paradigm to structure the entities, attributes, and relationships between data within the Nias Language digital dictionary system.

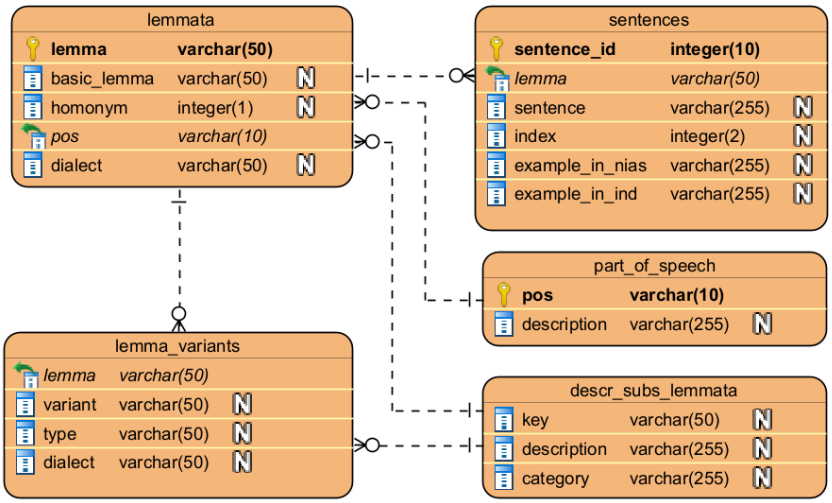


Figure 3. Entity Relationship Diagram Data Model Li Niha

Data Acquiring

The data collection in this study aimed to build a Nias-Indonesian dictionary dataset that could serve as the basis for designing a relational data model and developing the Li Niha online dictionary. The data extraction process was conducted through a documentation approach and digitization of publicly available dictionary sources and contributions specifically from the Nias community. The data collected came from several primary sources, namely:

1. The Nias-Indonesian Dictionary (1985), one of the oldest and most comprehensive references on Nias vocabulary. Its original print format was then digitized into a PDF.
2. From the Nias Bible. The initial step was to download and combine the entire Bible text into a pure text file. This was followed by a tokenization process, which involves breaking the text into tokens. This tokenization aims to identify each unique word appearing in the text corpus, including its variant forms, repetitions, and frequency of use. The results of this tokenization process then formed the basis for compiling an initial list of lemmata, which were then analyzed and grouped by word class.
3. Digital Community Contributions (crowdsourced): Additional data was obtained from open sources on the internet, including regional language blogs, digital documents shared by local researchers, and language entries contributed by volunteers from the Nias diaspora community.
4. Some additional data was collected from traditional leaders or Nias families who documented traditional words or phrases in handwritten form or in personal files.

3. RESULTS AND DISCUSSION

The results of this study demonstrate that designing a relational data model for a Nias language dictionary can be done with a structured approach and is aligned with the needs of regional language preservation. With a relational schema consisting of key entities such as lemmata, parts of speech, sentences, variants, and dialects, Nias language vocabulary data can be classified and stored in a structured manner that is easily understood by both humans and applications or machines. Subsequent research will implement this model in the form of a publicly accessible web-based dictionary application.

Beyond presenting content, the development of the Li Niha dataset and dictionary demonstrates that information technology can play an active role in cultural preservation. The data, transformed into relational form, opens up significant opportunities for further development, such as integration with NLP systems, machine learning, and online education platforms for regional languages. During the data collection process, the main challenges lay in the following: inconsistent formats of old dictionary sources; limited digital data from native speakers; and differing dialect variants across regions in Nias. However, these challenges were overcome with a combined approach: manual extraction and structured data cleaning. With the documentation and development of this digital system, the Nias language now has a digitalized initial database that can be preserved across generations through online media.

Also explain the future development opportunities. Articles can be strengthened with relevant documentation related to services or goods as outputs, or the main focus of activities. Documentation can be in the form of pictures of the application or implementation process, pictures of product prototypes, tables, graphs, and so on.

From the data extraction process conducted using various sources, including the Nias-Indonesian dictionary, the Nias Bible, as well as contributions from online sources and community participation, a total of 21,707 words were collected. This number encompasses a diverse lexicon, from basic lemmas and variants to loanwords, to entries with example sentences.

Table 3. Distribution of the Number of Lemmas Based on Initial Letters

Alphabet	Word count	Alphabet	Word count	Alphabet	Word count
A	995	K	258	T	1015
B	616	L	1136	U	639
C	2	M	2756	V	0
D	773	N	2280	W	1837
E	279	O	330	X	0
F	1670	Ö	575	Y	781
G	1231	P	1	Z	1265
H	367	Q	0		
I	1178	R	120		
J	0	S	1603		

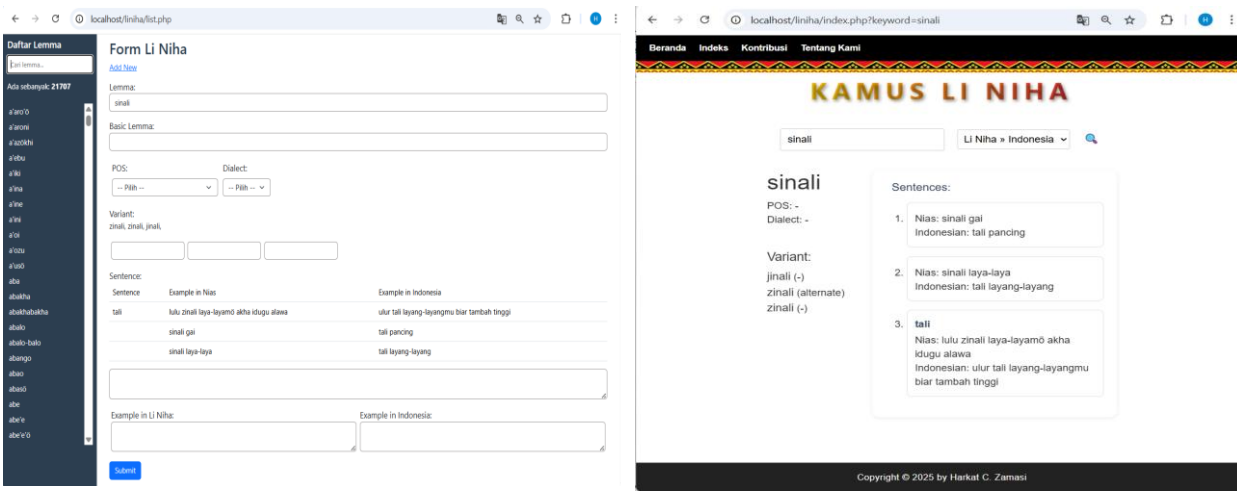


Figure 4. Lemma entry and editing form, and Li Niha – Indonesian online dictionary page design

4. CONCLUSION

This research successfully designed and built a relational data model for the Li Niha dictionary dataset (Nias - Indonesia), as part of a digital regional language preservation strategy. This data model supports systematic vocabulary storage, and allows for easily accessible searches and contributions through a web-based platform. Designing the dataset in this relational format opens up opportunities for future development, including: a). This data model can then be developed as a database for the development of online digital dictionary applications. b). Integration with Natural Language Processing (NLP). The structured stored dataset allows it to be used for training NLP models for the Nias language, for example for machine translation. c). Development of regional language-based AI applications, such as the addition of thematic dictionaries (e.g., cultural, religious, historical terms). By adding metadata such as pronunciation and example sentences, this system can support the development of local chatbots, AI-based educational

applications, and speech-to-text for Nias language pronunciation. d). Digital Preservation which can become a long-term digital repository for the documentation and preservation of regional languages. e). This research can be further developed through the involvement or collaboration of academics, including researchers, teachers, students, cultural experts, and native speakers, both from the Nias region and beyond.

Thus, this system serves not only as a digital dictionary database but also as a primary platform for locally based language technology and a tangible instrument for preserving Indonesia's cultural heritage. It is hoped that a similar approach can be replicated for other regional languages in Indonesia that are also facing extinction.

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