



Institute of Social Informatics and Technological Innovations

**Indigenous Symbolic Visual Communication Design (ISVCD)
Framework: Sustaining Indigenous Knowledge Through A Systematic
Innovation Approach**

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**Doctor of Philosophy
2025**

Indigenous Symbolic Visual Communication Design (ISVCD) Framework:
Sustaining Indigenous Knowledge Through A Systematic Innovation
Approach

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A thesis submitted

In fulfillment of the requirements for the degree of Doctor of Philosophy

(Social Innovation Design)

Institute of Social Informatics and Technological Innovations
UNIVERSITI MALAYSIA SARAWAK

2025

DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. Except where due acknowledgements have been made, the work is that of the author alone. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.



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Date: 6 August 2025

ACKNOWLEDGEMENT

I would like to take this opportunity to express my gratitude to everyone who has assisted me directly or indirectly during my PhD study. Firstly, I would like to express my sincere gratitude to my supervisor, Prof. Narayanan Kulathuramaiyer, for his constant guidance, motivation, patience, and support throughout my academic journey. I would also like to extend my appreciation to my co-supervisor, Prof. Tan Chong Eng, for his encouragement, support, and knowledge sharing. Additionally, I would like to thank the staff at the Institute of Social Informatics and Technological Innovations (ISITI), UNIMAS, especially Puan Nor Safura Mahari, for their management support and assistance.

I am especially grateful to the members of the Murut Tahol community at Kampung Pilanas, Pensiangan, Sepulut, and Nabawan, Sabah, for their kind assistance, hospitality, and help during my field trips. I would like to thank Miss Laivirosneyza Damius and her family in particular. I would also like to express my gratitude to my colleagues and friends for their support and emotional encouragement throughout my academic journey.

Finally, I would like to express my gratitude to my family, especially my daughter, for their unwavering support and love that have kept me going throughout my studies. I also want to pay tribute to my beloved late wife, Kristin Goh Li Lian, who is now resting in heaven. This achievement would not have been possible without the help and prayers of everyone involved. I want to emphasise that this thesis is not for me alone, but for all who have contributed. Thank you.

ABSTRACT

This research addresses the critical need to preserve and transmit Indigenous symbolic communication in the digital age by formalising a culturally grounded visual communication framework that employs a multidisciplinary approach and hybrid model. Rooted in the Indigenous Research Paradigm, the study aims to: (1) formulate a design framework for Indigenous symbolic visual communication, (2) implement the framework through a case study involving the Tatandu visual language, and (3) develop and apply validation strategies to assess the framework's effectiveness in symbol representation and Indigenous value preservation. The research presents the Indigenous Symbolic Visual Communication Design (ISVCD) Framework, a multilayered model combining a hybrid visual communication and semiotic framework, the TRIZ Law of System Completeness, and Indigenous epistemologies. An Indigenous Symbolic Design Mapping (ISDM) Instrument was developed to operationalise the framework and guide symbol analysis and co-design. A case study involving local Indigenous experts and youth participants from the Murut Tahol community in Sabah. Facilitated the extraction, interpretation, and digital redesign of 14 Indigenous symbols called Tatandu, each associated with their Indigenous core values. Validation was conducted using a triangulation strategy: (1) expert review of symbol accuracy and inventory integrity, (2) empirical testing of the ISDM Instrument using confusion matrix analysis, and (3) thematic comparison of core values between traditional and digital symbols. The results confirm that the ISVCD Framework maintains both symbolic meaning and cultural authenticity across digital transformation processes. The findings affirm the central hypothesis that “visual communication can be formalised in a design framework and successfully applied to Indigenous symbolic communication language”. This research contributes a scalable, epistemologically aligned model for

Indigenous digital expression, an innovative approach using TRIZ methodology as a social-technical system with implications for Indigenous symbol preservation, design principles, and inclusive visual media development.

Keywords: Indigenous Knowledge Communication Systems (IKCS), Systematic Innovation, Participatory Design. Visual Communication

***Kerangka Reka Bentuk Komunikasi Visual Simbolik Peribumi (ISVCD): Pelestarian
Pengetahuan Peribumi Melalui Satu Pendekatan Inovasi Sistematis***

ABSTRAK

Penyelidikan ini mengemukakan keperluan kritikal untuk memelihara dan penyampaian komunikasi simbolik Peribumi dalam era digital dengan memformalkan rangka kerja komunikasi visual berasaskan budaya yang menggunakan pendekatan pelbagai disiplin dan model hibrid. Berasaskan Paradigma Penyelidikan Peribumi, kajian ini bertujuan untuk: (1) membentuk rangka kerja reka bentuk komunikasi visual simbolik Peribumi, (2) melaksanakan rangka kerja melalui kajian kes yang melibatkan bahasa visual Tatandu, dan (3) membangun dan menggunakan strategi pengesahan untuk menilai keberkesanan rangka kerja dalam perwakilan simbol dan pemeliharaan nilai Peribumi. Penyelidikan membentangkan Rangka Kerja Reka Bentuk Komunikasi Visual Simbolik Peribumi (ISVCD), model berbilang lapisan yang menggabungkan komunikasi visual hibrid dan rangka kerja semiotik, Undang-undang Kelengkapan Sistem TRIZ dan epistemologi Peribumi. Instrumen Pemetaan Reka Bentuk Simbolik Orang Asli (ISDM) telah dibangunkan untuk mengoperasikan rangka kerja dan membimbing analisis simbol dan reka bentuk bersama. Kajian kes yang melibatkan pakar Peribumi tempatan dan peserta belia dari masyarakat Murut Tahol di Sabah. Memudahkan pengekstrakan, tafsiran dan reka bentuk semula digital 14 simbol Orang Asli yang dipanggil Tatandu, masing-masing dikaitkan dengan nilai teras asli mereka. Pengesahan dijalankan menggunakan strategi triangulasi: (1) semakan pakar tentang ketepatan simbol dan integriti inventori, (2) ujian empirikal Instrumen ISDM menggunakan analisis matriks kekeliruan, dan (3) perbandingan tematik nilai teras antara simbol tradisional dan digital. Keputusan mengesahkan bahawa Rangka Kerja ISVCD mengekalkan kedua-dua makna simbolik dan keaslian budaya merentas proses

transformasi digital. Penemuan ini mengesahkan hipotesis utama bahawa "komunikasi visual boleh diformalkan dalam rangka kerja reka bentuk dan berjaya digunakan untuk bahasa komunikasi simbolik Peribumi". Penyelidikan ini menyumbang model berskala, diselaraskan secara epistemologi untuk ekspresi digital Peribumi, pendekatan inovatif menggunakan metodologi TRIZ sebagai sistem sosial-teknikal dengan implikasi untuk pemeliharaan simbol asli, prinsip reka bentuk dan pembangunan media visual inklusif.

Kata kunci: *Sistem Komunikasi Pengetahuan Peribumi (IKCS), TRIZ, Inovasi Sistematis, Reka Bentuk Penyertaan, Komunikasi Visual.*

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LIST OF ABBREVIATIONS

CMC	Computer-Mediated Communication
HCI	Human Computer Interaction
ICT	Information and Communication Technology
ICT4D	Information Communication Technology for Development
IK	Indigenous Knowledge
IKCS	Indigenous Knowledge Communication Systems
IMS	Instant Messaging Services
ISDM	Indigenous Symbolic Design Mapping
ISITI	Institute of Social Informatics and Technological Innovations
ISVCD	Indigenous Symbolic Visual Communication Design
SLR	Systematic Literature Review
TRIZ	Theory of Inventive Problem Solving

CHAPTER 1

INTRODUCTION

1.1 Background

Visual communication systems such as emojis in the instant messaging service (IMS) in mobile phones are increasingly important to facilitate casual communications and spontaneous information exchange in our daily lives. It fills the need to add non-verbal cues in Computer-Mediated Communication (CMC) with visual symbols conveying the intent, emotion, and values behind a message. A further in-depth study of emoji usage as a visual language suggests that we are returning language to an earlier stage of basic human communication (Alshenqeeti, 2016). It resembles the form of communication typical of a natural language. One can trace it back to find its similarity with prehistoric pictographs found in cave drawings. It is an intuitive form of visual communication and expression of human emotions (Marcel, 2016). Similarly, Indigenous communities have used visual languages, relying on visual symbolism to communicate for many years, far before the invention of emojis. The existing study of related work has shown a gap in processing visual communication as a symbolic language.

Indigenous communities traditionally rely on visual symbols to communicate in the natural environment, which has not been widely studied. Many Indigenous groups live in remote areas, such as Sabah and Sarawak, and they are still practising symbolic visual language to communicate and share their unique Indigenous Knowledge (IK) to date. There is potential to study how to unlock Indigenous knowledge from the past and to model the intangible communication exchanges. Visual symbols constructed using twigs, leaves, stones, animal parts, and other natural resources effectively communicate in the forest. Such

a communication method is crucial in exchanging messages and information among the Indigenous people and is a unique way of passing Indigenous knowledge and values from generation to generation.

This system that the Indigenous communicate can be referred to as the Indigenous Knowledge Communication System (IKCS) (Manyozo, 2018). It is the system in which Indigenous communities transmit their vast repository of Indigenous knowledge and values. This system informs, educates, and entertains community members by employing overt and covert communicative practices in their natural way. Indigenous knowledge is a way of knowing which is generated and accumulated over generations of living in an environment by the Indigenous. It differs from the modern world's international or "exogenous" knowledge in several ways. As opposed to the universal "exogenous" knowledge (Mundy & Lin Compton, 1991), such as science and history in modern educational institutions, as we learned in schools and universities, Indigenous knowledge emerges naturally and intuitively in the natural environment. Indigenous knowledge is multilayered, containing hidden intangible aspects that can only be studied within the actual context. The cultural values that accompany Indigenous knowledge also have their unique modes of transmission, differing from what we understand from the exogenous world perspective. The Indigenous knowledge systems involve observing natural processes and constructing knowledge carefully by adapting natural resources such as plants, animals, and other natural materials in their living environment. Therefore, Indigenous knowledge is location-specific, value-laden, and closely linked to the living system of the place they live. Each Indigenous knowledge communication system (IKCS) is distinctive to a specific Indigenous group. It generates, transfers, and shares knowledge and cultural values within the Indigenous social

system. The communication system is self-constructed, locally owned, and controlled. It is a crucial factor in the sustainability of Indigenous cultural heritage, values, and identity.

The wide use of modern visual communication systems such as emojis is increasingly essential to facilitate casual communications and spontaneous information exchange in our daily lives. However, using such systems poses dangers to preserving local symbolic visual languages practised by Indigenous communities. The universality of emoji poses a significant problem to the sustainability of the Indigenous cultural values as it imposes Western cultural and social behaviour hegemony on the Indigenous society. It represents the invasion of foreign visual symbolic language upon these Indigenous communities, especially the younger generation, who are attracted to electronic devices such as mobile phones and tablets. Interactions with Indigenous communities have revealed the devastating effect of such an outside-in communication medium on their cultural resilience (Kral, 2014). The traditional way of cultural communication among the Indigenous people in the natural environment and the inheritance of Indigenous knowledge from the older generation to the younger generation is under threat. This distressing situation underscores the necessity of creating a visual communication design framework to preserve Indigenous knowledge and values while integrating advancements in Information Communication Technology (ICT).

Attempts to diversify the visual communication design by adopting a local cultural flavour alone, as observed in the current literature do not address the issue effectively (Feng et al., 2020; Nasruddin et al., 2018; Wang et al., 2019). As mentioned earlier, IKCS is unique and operates within and outside modernity. The direct application of a modern visual communication design model to the IKCS is inappropriate and could jeopardise the cultural sustainability of Indigenous values and knowledge (Bon, 2019) Through our review of the

related literature (Bala et al., 2022; Mundy & Lin Compton, 1991; Rhoades & Bebbington, 1995), the IKCS has the common characteristics of dynamism, complexity, and being laden with the local community, which many modern researchers have ignored.

Creating a design framework for Indigenous symbolic visual communication is vital to address the challenges mentioned earlier. This involves a systematic analysis of the design of such systems and recognising the Indigenous knowledge (IK) and core values inherent in the Indigenous communication process. It necessitates a deep understanding of the Indigenous worldview and research paradigms. Engaging meaningfully with the Indigenous community and adopting a democratised design approach, particularly emphasising co-creation with the community's youth, are key priorities for establishing a culture-preserving framework.

This research project seeks to develop a visual communication design framework that effectively engages and interacts with Indigenous communities through IKCS mapping. This innovative framework for system modelling could offer valuable insights into reshaping global communication methods to be more attuned to cultural requirements and preserve Indigenous knowledge.

1.2 Research Problem

Indigenous symbolic visual communication design remains an underexplored area in visual communication research, with little formal grounding in existing frameworks. While visual communication broadly emphasises the conveyance of meaning through visual elements, its applications to Indigenous cultures are often constrained by Western-centric design paradigms, which inadequately address Indigenous traditional cultural, historical, and symbolic richness (St John, 2018). This disconnect arises because Indigenous visual

communication systems, deeply rooted in oral histories, ecological knowledge, and cultural rituals, operate outside the formal structures of the Western design domain (Mundy, 1993).

Scholars have highlighted the necessity of integrating culturally responsive methodologies, prioritising Indigenous knowledge systems and symbolic languages. For instance, research into the conceptual models for Indigenous symbolic visual communication systems underscores the importance of context-sensitive frameworks that align with Indigenous worldviews and semiotics (Goh & Kulathuramaiyer, 2022). However, such attempts have remained little within design research to date, which too often relegate Indigenous expression to decoration or the periphery (Mensah Bonsu et al., 2024). The multimodal aspect of the Indigenous symbolic design is often oversimplified.

This is further exacerbated by the global design discourse that sidelines Indigenous perspectives. For example, most of the Indigenous visual languages are either undocumented or poorly understood in formal academic research, leading to an incomplete understanding of their design principles (Goh & Kulathuramaiyer, 2020). This gap can only be bridged through collaborative design practices where Indigenous communities are co-creators and, therefore, ensure the authenticity and sustainability of the visual representations. Without such formal grounding, Indigenous symbolic visual communication risks being misappropriated or diluted in mainstream design practices. Addressing this research gap requires a decolonial approach that redefines visual communication research to include and prioritise Indigenous worldview perspectives, values and knowledge systems.

The implementation of visual communication frameworks for Indigenous symbolic visual communication design is not well-established, and few formalised methodologies exist. Studies suggest that the design field lacks comprehensive frameworks integrating

Indigenous cultural semiotics and symbolic systems with mainstream visual communication (Kovach, 2021b). While some collaborative and interdisciplinary approaches are emerging, they remain scattered and are not standardised across design practices.

Although some interdisciplinary and collaborative methods are beginning to form, they are limited and vary significantly across different design practices (Barry, 2024). Furthermore, Indigenous symbolic visual communication design lacks consistent validation procedures, with most existing efforts prioritising culturally adaptive or participatory frameworks over rigorous validation processes.

The design of symbolic visual communication systems informed by Indigenous knowledge has gained academic attention. However, there is a significant gap in validating these frameworks, as traditional Western methods do not address the cultural, epistemological, and semiotic specificities of Indigenous systems. Current scholarship shows that while frameworks may be developed through participatory design, no universally accepted validation methodology exists.

In participatory research, (Barry, 2024) noted the effectiveness of community participation but highlighted a lack of structured validation for visual outcomes, which depend more on social and cultural resonance than formal metrics. Torres (2024) argue that Indigenous communication systems developed through participatory design resist conventional validation due to their context-specific nature. Kovach's (Kovach, 2021b) review underscores that validation in Indigenous knowledge hinges on relational accountability and intergenerational trust, which challenge Western empirical norms but hold rigour in Indigenous worldviews. Using mainstream validation criteria risks decontextualising Indigenous meaning systems (Kovach, 2021a).

This indicates that no standard method exists for validating symbolic visual communication design frameworks in Indigenous contexts. Although participatory, narrative, and relational methods are potential alternatives, they remain largely informal and lack recognition across academic and professional design fields.

As a result, this research project identifies three research problems as its primary research focus:

1. Visual communication has little formal grounding for application to Indigenous symbolic visual communication design.
2. There is no structured implementation model to apply a symbolic communication design framework in Indigenous visual contexts.
3. There are no validated methods for evaluating the accuracy and cultural appropriateness of Indigenous symbol systems within a formal design framework.

1.3 Hypothesis

Building on the research problem outlined, the hypothesis for this study is as follows:

Visual communication can be formalised in a design framework and applied to Indigenous symbolic communication language.

Traditionally, the practice of visual communication has been taken over and shaped by Western-centric paradigms that have precluded Indigenous worldviews and particular languages from being rendered visually. This has created a significant gap

between the theoretical foundations of visual communication and the actual needs of Indigenous communities in sustaining and innovating symbolic traditions.

A design framework for Indigenous symbolic communication, therefore, presents itself as a means to bridge this gap through formalising the visual communication protocols in a manner that maintains the cultural integrity of the symbols, therefore necessitating a response that is simultaneously traditional, systematic, and adaptive. The ultimate outcome would also facilitate improved representation mechanisms and sustainability of Indigenous visual languages of the designed products and towards the decolonisation of design practice through incorporating Indigenous epistemologies and methodologies.

The hypothesis says that visual communication can be formalised into an all-embracing design framework that effectively integrates and supports the Indigenous symbolic languages of communication. Therefore, it helps to reduce this disconnection gap between theory-based frameworks and applications in cultural and social realms for visual communication designs.

1.4 Research Objective

The main objective of this research is to develop an Indigenous Symbolic Visual Communication Design Framework that can model the dynamic Indigenous symbolic visual language. This can be achieved through the following set of objectives:

- i. To formulate a framework that formalises visual communication within Indigenous symbolic visual communication design.

- ii. To formulate a Visual Communication Design System (ISVCD) Framework implementation strategy involving a case study on selected Indigenous visual languages.
- iii. To develop validation methods for assessing the effectiveness of the ISVCD Framework in terms of symbol representation and the preservation of Indigenous knowledge and values.

1.5 Research Question

To provide a solution to the main research question and the research problem above, the study is divided into the following research questions:

- i. How do we formalise visual communication in applying Indigenous symbolic visual communication design?
- ii. How can the framework be operationalised in Indigenous symbolic visual design through an implementation strategy?
- iii. How can the effectiveness of the ISVCD Framework be validated in preserving Indigenous symbols and core values?

1.6 Research Significance

This research is significant to both the bodies of knowledge, and the sustainability of Indigenous knowledge communication systems as follows:

- 1. Capturing tacit Indigenous knowledge and systematic extraction, construction, and sharing with the Indigenous community in a participatory system design approach.

2. The system design process avoided value contradictions by identifying and using a commonly agreed-upon set of unique Indigenous cultural values of the Indigenous community as a system effectiveness indicator.
3. The completeness of the communication system flow aligns with the worldview of Indigenous knowledge and living systems. Sustaining the unique characteristics of the Indigenous living systems worldview is significant amidst the ICT4D agenda.
4. Applying the practical logic of TRIZ Law of System Completeness in Indigenous visual communication design.

1.7 Scope of Research

The scope of this research project is limited to the formalisation of visual communication in relation to Indigenous symbolic visual communication design. Specifically, it focuses on the symbolic visual language used to communicate in the rainforest, a common practice among Indigenous communities. The research was conducted through a case study of a specific Indigenous symbolic visual communication language, namely the Tatandu, used by the Murut Tahol Indigenous community in Sabah.

As explained in Section 1.1, Indigenous Knowledge and Cultural Systems (IKCS) are location-specific, value-laden, and closely tied to the living systems of the places where these communities reside. The findings of this research are deeply rooted in this particular Indigenous community. However, the framework established here lays the groundwork for future studies involving other Indigenous communities exhibiting similar visual communication patterns.

1.8 Thesis Structure

This thesis is divided into five chapters, which are:

Chapter One: Introduction

This chapter presents the research and elaborates on the preliminary study regarding the research background, research problem, research hypothesis, research questions, research objectives, scope, and significance. At the conclusion of this chapter, a summary of the entire thesis structure is provided.

Chapter Two: Literature Review

This chapter reviews literature relevant to this research, organised into three sections. The first section offers an overview of the Indigenous Research Paradigm, providing foundational background and highlighting unique Indigenous characteristics in the context of digitalisation and symbol design. The second section discusses the Indigenous Knowledge Communication System, the main topic of this research, offering insights into the Indigenous worldview, knowledge, core values, and their distinct approach to meaning making compared to the dominant Western scientific worldview. The final section examines traditional visual communication and semiotic models to propose an integrated symbolic visual communication design framework that aligns with Indigenous priorities. This chapter identifies key components of complex Indigenous symbolic visual communication through systematic analysis and synthesis, establishing the theoretical framework for this research.

Chapter Three: Research Methodology

This chapter outlines the research methodology for the Indigenous Symbolic Visual Communication Design (ISVCD) Framework, covering the study's philosophical, theoretical, and procedural foundations. It begins with an overview of the research

philosophy, situating it within an interpretivist perspective and a pragmatic approach that honours Indigenous knowledge and highlights systematic design solutions. The research adopts a design-led methodology, qualitative inquiry, participatory engagement, and framework construction. It elaborates on the three stages of the study: framework formulation, framework implementation, and validation. The chapter presents the development of the Indigenous Symbolic Design Mapping Instrument and the structure of the ISVCD Framework, informed by the Hybrid Visual Communication and Semiotic Framework, TRIZ Law of System Completeness, and Indigenous worldview. The triangulated validation strategy involves expert reviews, empirical testing using a confusion matrix, and thematic comparison of core values. Additionally, ethical considerations, sampling techniques, and community collaboration processes are addressed.

Chapter Four: Case Study, Results and Findings.

This chapter details the implementation and validation of the Indigenous Symbolic Visual Communication System Design (ISVCD) Framework for digitalising and preserving Indigenous symbolic knowledge. A case study on the Tatandu visual language from the Murut Tahol community in Sabah illustrates this framework. The implementation phase showcases its use in authentic cultural and design contexts, starting with artefact collection and documenting original symbols in the forest. The process transforms these original natural symbols into digital symbols that have the potential to further develop into emoji-like symbols for use on social media platforms. Key to this are three knowledge subsystems: Indigenous Core Values Elicitation, Indigenous Knowledge Extraction, and Indigenous Symbol Digital Design, incorporating collaborative design with youth. The validation phase has two components: first, Indigenous cultural experts confirm that digital symbols faithfully represent traditional meanings and follow community protocols; second, focus groups with

Indigenous youth evaluate the interpretive effectiveness of the digitalised symbols and the framework's ability to preserve and communicate knowledge across generations. This phase examines both the functionality and the cultural significance of the final symbol designs. The chapter concludes with a discussion of the case study findings.

Chapter Five: Discussion, Conclusion and Future Works

This chapter concludes the thesis with a summary and recommendations based on the research. It synthesises findings from Chapter 4, linking them to the earlier research aims and theoretical frameworks. The discussion explores theoretical implications, practical applications, and contributions while acknowledging the study's limitations and suggesting future research. Ultimately, this chapter encapsulates the journey and reaffirms the importance of culturally grounded frameworks in visual communication design, especially regarding Indigenous symbolic systems. The hypothesis was tested by creating, applying, and validating the ISVCD Framework. The results show that visual communication can be organised into a formal design framework that effectively preserves and conveys the meanings of Indigenous symbolic systems in a digital context.

1.9 Chapter Summary

The challenge of modelling the visual aspect in real-world communication exchanges is promising to explore. However, the multidisciplinary nature of this research presents another challenge that needs reframing within an Indigenous context, while age-old wisdom is being neglected. This chapter presents the research and describes the preliminary study, addressing the background, problem, hypothesis, questions, objectives, scope, and significance to tackle these challenges. Table 1.1 summarises and maps the thesis research problems, objectives, and achievements.

Table 1.1: Summary Description and Mapping of The Thesis Research Problems, Objectives and Achievements

Problem Statements	Research Questions	Research Objectives	Research Contributions	Achievements
Problem Statement	RQ 1	RO 1		
Visual communication has little formal grounding for application to Indigenous symbolic visual communication design.	How do we formalise visual communication in applying Indigenous symbolic visual communication design?	To formulate a framework that formalises visual communication within Indigenous symbolic visual communication design.	A theoretically grounded ISVCD Framework combining semiotics, TRIZ logic, and Indigenous knowledge paradigms to articulate a multimodal symbolic communication model.	Developed the ISVCD Framework and validated its structural completeness, epistemological alignment, and practical relevance.
Problem Statement	RQ 2	RO 2		
There is no structured implementation model to apply a symbolic communication design framework in Indigenous visual contexts.	How can the framework be operationalised in Indigenous symbolic visual design through an implementation strategy?	To formulate a Visual Communication Design System (ISVCD) Framework implementation strategy involving a case study on selected Indigenous visual languages.	Design and deployment of a structured ISVCD implementation within the context of a social-technical system based on TRIZ subsystems and symbolic workflow.	Implemented the ISVCD Framework in the Tatandu case study. Extracted, designed, and digitally transformed 14 Indigenous symbols.
Problem Statement	RQ 3	RO 3		

There are no validated methods for evaluating the accuracy and cultural appropriateness of Indigenous symbol systems within a formal design framework.	How can the effectiveness of the ISVCD Framework be validated in preserving Indigenous symbols and core values?	To develop validation methods for assessing the effectiveness of the ISVCD Framework in terms of symbol representation and the preservation of Indigenous knowledge and values.	Developing a triangulation validation method based on expert review, empirical confusion matrix and thematic core value comparison.	Triangulation validation results show a symbol design accuracy exceeding 85%, instrument validity via recall confusion matrix above the 0.85 threshold, and the consistency of the care values across different groups in core value transmission. Collectively validated the ISVCD Framework.
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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review of related studies and theories is presented in this chapter. This chapter is divided into three parts. Part one provides an extensive review of the existing literature on the Indigenous Research Paradigm, which serves as the core background of this research, sustaining the unique characteristics of the Indigenous living system worldview amidst the digitalisation and development of the symbol design framework agenda. Part two comprises a literature study of the Indigenous Knowledge Communication System, which is the primary subject matter of this research, concentrating on an in-depth understanding of Indigenous worldview, Indigenous knowledge, and core values, as well as the unique approach to meaning-making that distinguishes it from the Western scientific exogenous worldview prevalent today. The final part consists of studying and analysing conventional visual communication and semiotic models to seek a cohesive solution with an integrated symbolic visual communication design framework that aligns with the Indigenous agenda. This chapter aims to identify components present in complex Indigenous symbolic visual communication. It involves a systematic analysis and synthesis that grounds the principal elements of visual languages and presents the theoretical framework, which serves as the theoretical foundation of this research.

2.2 Theoretical Framework

Figure 2.1 illustrates the theoretical framework of this research. Derived from a systematic literature review, it represents the comprehensive theoretical foundation

underpinning this research. At the centre of the framework lies the aim of this research, Indigenous Symbolic Visual Communication Design (ISVCD). Three key components are connected to this central framework: the Indigenous Research Paradigm, Indigenous Knowledge Communication Systems (IKCS), and Visual Communication. These components represent the significant roles played in establishing the theoretical foundation for the proposed ISVCD Framework.

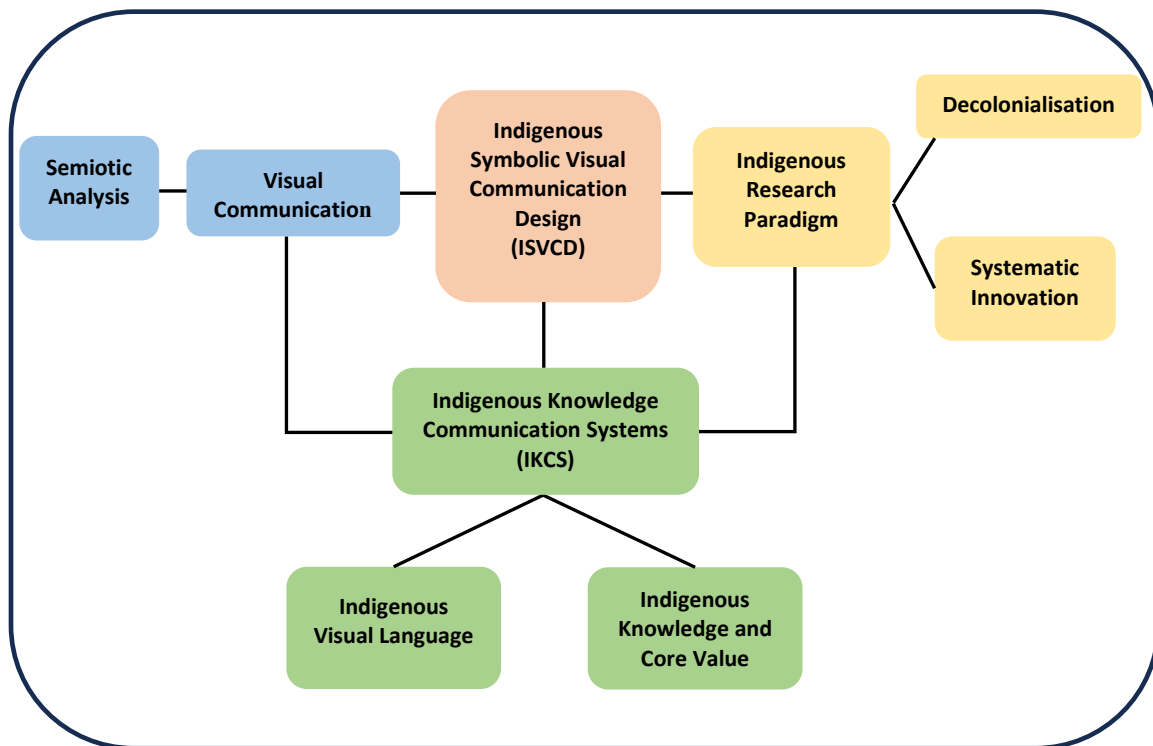


Figure 2.1: Theoretical Framework

2.3 Indigenous Research Paradigm

The Indigenous Research Paradigm is regarded as the most crucial aspect of this research, as it serves as its core. The sensitivity to the Indigenous worldview, along with their Indigenous Knowledge, Ontology, and Epistemology, is the primary consideration for creating a visual communication design system that is unique to them. According to

Wilson (2001, 2008), the research paradigm is “a set of beliefs about the world and about gaining knowledge that goes together to guide your actions as to how you are going to go about doing your research” (p.175). Therefore, the Indigenous research paradigm should stem from Indigenous peoples’ roots and principles rather than referring to the existing dominant paradigm, which is based on the Western perspective of worldview and knowledge systems. He posited four aspects of the Indigenous Research Paradigm that researchers should focus on: the Indigenous research ontology, epistemology, methodology, and axiology that contextualise the unique characteristics of Indigenous communities.

The Indigenous research ontology should have focused on Indigenous beliefs in the nature of reality, their way of being and what they believe is real in the world (Wilson, 2001), which is closely related to the Indigenous Worldview. At the same time, Indigenous epistemology refers to how Indigenous peoples perceive reality and the ways of knowing. It is derived from teachings transmitted from generation to generation related to the study of Indigenous knowledge. These two are interrelated and enclosed in the Indigenous knowledge system (Hart, 2010). The Indigenous methodologies permit and enable Indigenous researchers to understand who they are and what their roles are while actively engaged as participants in the research process (Weber-Pillwax, 2001), which will be discussed further in the decolonisation section 2.4. The last aspect refers to the axiology of the Indigenous Research Paradigm, which relates to the Indigenous values. Table 2.1 illustrates the relationship between the Indigenous Research Paradigm and its application in this research.

The relationship between Indigenous Worldview, Indigenous knowledge, and Indigenous cultural values (which will be discussed in Section 2.4) is intertwined and

foundational to how Indigenous peoples understand, interact with, and make sense of the world. It makes the foundation of this research. (see Figure 2.2)

Table 2.1: Relationship of the four aspects in the Indigenous Research Paradigm as adapted in this research

	Indigenous Research Paradigm			
	Ontology	Epistemology	Methodology	Axiology
Description of Indigenous research paradigm components as suggested by Shawn Wilson (2001, 2008)	What do Indigenous people believe in the nature of reality?	How do Indigenous people think about the reality?	How are Indigenous people going to use their ways of thinking to gain knowledge about their reality?	A set of morals or ethics that guides the Indigenous.
Interpretation and approaches used in this research	The Indigenous worldview's fundamental beliefs about the nature of reality. Emphasise interconnectedness, spirituality, and holistic relationships with the natural world.	How Indigenous peoples generate, validate, and transmit knowledge within their communities.	Indigenous researchers need to understand who they are and their roles while actively engaging as participants in the research processes.	Local community-based values that are distinct from universal values

Indigenous knowledge and worldview, which encompass the foundational beliefs, frameworks, and ways of knowing within Indigenous communities, shape their understanding of the world and are distinct from Western or dominant worldview and knowledge systems. Indigenous knowledge has recently gained increasing recognition as a valuable source of wisdom passed down through generations in various Indigenous communities. This knowledge encompasses a rich understanding of the environment, social structures, and cultural practices that have sustained Indigenous communities for centuries. This section of the literature review seeks to explore what is Indigenous knowledge and worldview and how distinct research ontology and epistemology should

be carried out to engage the Indigenous communities. Additionally, we delve into how Indigenous knowledge is constructed, extracted, and shared and why it is essential to this research. The relationship between Indigenous worldview, Indigenous knowledge, and Indigenous core values (which will be discussed further in section 2.7) is intertwined and foundational to how Indigenous peoples understand, interact with, and make sense of the world. It makes the foundation of this research. (see Figure 2.2)

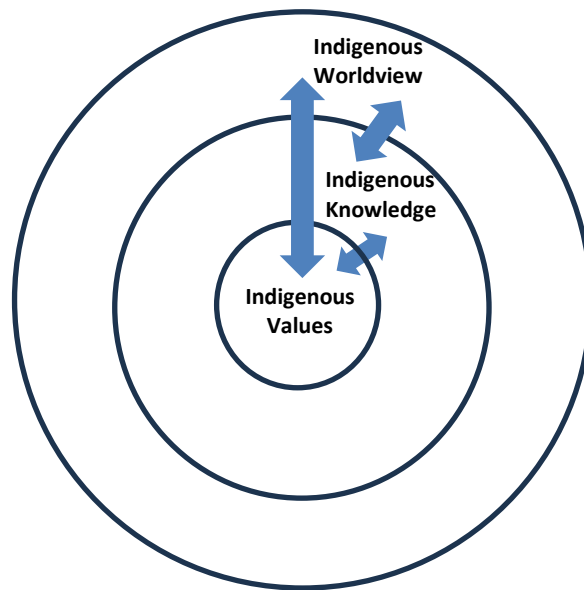


Figure 2.2: Relationship of The Four Aspects in the Indigenous Research Paradigm

2.3.1 Indigenous Worldview

Indigenous research ontology pertains to the Indigenous Worldview's fundamental beliefs about the nature of reality. As stated by Bishop (2002), “understanding worldviews of both the targeted community and ourselves is imperative if we are going to do more good than harm” (p. 611). Mapping the Indigenous worldview as a way for enhancing symbolic communication experience remains a research gap. A profound understanding of the Indigenous worldview should be the priority for any initial

Indigenous research, as the community's worldview affects its belief systems, decision-making, assumptions, and problem-solving modes. More importantly, Indigenous worldviews differ significantly from Western worldviews, which tend to be dualistic and mechanistic (Deloria, 1999). Indigenous worldviews are holistic and relational, emphasising the interdependence of humans, nature, and the spiritual realm (Battiste, 2002). The Indigenous worldview includes animism, the recognition of land as a living entity, and the concept of cyclical time, which contrasts with the linear time prevalent in the dominant Western worldview. It is grounded in a deep connection to the land and nature, viewing the environment as a living system with inherent value.

In contrast, the dominant worldview, which refers to the Western world perspective, often perceives nature as a resource to be exploited for economic gain. Scientific advances, technological developments, and a secular perspective largely shape it. Indigenous worldviews prioritise harmony, balance, and interconnectedness with all living things. The dominant modern paradigm frequently emphasises control over nature, exploitation for economic benefit, and linear progression (Smith, 2021). Such contrasts lead to differing perceptions of environmental stewardship, social cohesion, and individual well-being. These differences in Indigenous worldviews have profound implications for how knowledge is generated, valued, and applied, which is crucial in this research.

While Indigenous worldviews are locally based, various Indigenous groups hold unique perspectives. Many similarities seem to exist among these Indigenous worldviews. (Battiste, 2002, 2019; Cajete, 1994, 2000; Simpson, 2000). Our study reviews the following common characteristics of Indigenous Worldviews:

1. Land-Centred: Many Indigenous worldviews strongly emphasise the sacredness of the land and the environment, recognising that humans are stewards of the Earth.: Indigenous worldviews stress stewardship of the land and nature, while modern worldviews often focus on ownership and exploitation of resources.
2. Ancestral Wisdom: Indigenous worldviews draw on ancestral knowledge, traditions, and oral histories passed down through generations as sources of guidance and wisdom.
3. Communal and Collective: These worldviews prioritise community well-being and decision-making, emphasising cooperation and collective responsibility.
4. Spiritual Beliefs: Indigenous worldviews frequently incorporate spiritual elements, with a deep respect for the spiritual aspects of nature and a belief in the existence of multiple dimensions of reality.

A comparison review between the Indigenous Worldview and the dominant Worldview yielded the results below:

1. Individualism vs. Communalism: Indigenous worldviews often prioritise collective and communal well-being over individual interests, while modern societies emphasise individualism.
2. Linear vs. Cyclical Time: Many Indigenous worldviews perceive time as cyclical, with events recurring in patterns, while Western worldviews often view time as linear, progressing from past to future.
3. Ownership vs. Stewardship: Indigenous worldviews stress stewardship of the land and nature, while modern worldviews often focus on ownership and exploitation of resources.

Cojete's (1994, 2000) viewpoints on the research ontological perspective of Indigenous Worldview is inclusive and profound. Based on his experience in the Indigenous education research with the American native, he explained the relationship of Indigenous with the nature as interconnectedness, spiritual and holistic. It offers a refreshing and deeply insightful perspective of Indigenous Worldview. These three perspectives not only encapsulate the essence of many Indigenous cultures' perspectives on existence but also reflect the core characteristics Indigenous knowledge and values which will be discussed further in this research.

2.3.1.1 Interconnectedness

At the heart of many Indigenous worldviews, including those expressed by Cajete, is the belief that everything in the universe is interconnected. Interconnectedness refers to the profound and intrinsic relationship among all entities within the universe. All forms of life are related, and our existence is part of a complex web of relationships that includes our fellow human beings, other living creatures, the land, and the spiritual world. As Battiste (2002) explained, the Indigenous worldview tends to be holistic, seeing all elements of the universe as interconnected and interdependent. This is a philosophical idea and a practical, everyday understanding of the world. It reflects a view where the self is not separate from others or the environment but is an integral part of a greater whole.

Interconnectedness in the Indigenous Worldview can be seen as a result of the close relationship of human beings with the environment. Researchers (Hart, 2010; Simpson, 2000; Smith, 2021) argue that relationships between individuals, communities, the natural world, ancestors, and the spiritual realm. These relationships are not linear or hierarchical but are complex, interconnected, and cyclic. The vital role of relationships in

the ontological approach in accessing the interconnectedness perspective in Indigenous worldviews should not be neglected.

The concept of interconnectedness is interrelated with the other two perspectives, whereby the human being is connected not only to the physical world but also to the spiritual world and the concept of holistic. Understanding the interconnectedness inherent in Indigenous worldviews is crucial for researchers as they engage with Indigenous communities and knowledge systems. It requires a respectful approach open to learning and integrating these relational perspectives into research methodologies.

2.3.1.2 Spirituality

In the context of Indigenous worldviews, spirituality is not merely a set of beliefs or practices but a way of living that permeates all aspects of life. Spirituality is interwoven into the very fabric of existence, influencing how relationships are formed, knowledge is understood, and life is lived. Spirituality is not separate from other domains of life; instead, it is integrated through all aspects of existence (Smith, 2021). Spirituality is not confined to specific rituals or ceremonies. Instead, it permeates everyday life and is intrinsically linked with the natural world. Indigenous spiritual perspectives often recognise the sacredness in all forms of life. This deep respect extends beyond human beings to include animals, plants, and even inanimate objects, as many Indigenous cultures believe that everything has a spirit (Cajete, 1994).

In many Indigenous cultures, the land is not just a resource but a source of knowledge and a place for teaching and learning. The land is seen as a living entity with which people have a reciprocal relationship, and it is central to their spiritual life (Basso, 1996). Many Indigenous worldviews strongly emphasise the sacredness of the land and the environment, recognising that humans are stewards of the Earth.

Spirituality in Indigenous worldviews often involves a connection to ancestors, who are considered ever-present and actively involved in the lives of the living. The ancestors guide, inform, and contribute to the community and individual identity (Tinker, 1992). Ancestral wisdom and guidance are drawn on ancestral knowledge, traditions, and oral histories passed down through generations. Indigenous knowledge communication plays a crucial role in this context.

Understanding spirituality's profound role in Indigenous worldviews requires an openness to learning from Indigenous people and a willingness to see beyond Western definitions and categories of religion and spirituality. It is significant in the Indigenous research ontology.

2.3.1.3 Holistic

Central to understanding complex systems and the interconnectedness of systems and the entities in the Indigenous Worldview is the concept encapsulated in the phrase: "The whole is more than the sum of its parts." This idea is deeply embedded in holism and the holistic perspective of the Indigenous Worldview. Holism, derived from the Greek word "holos", meaning "whole", is a philosophical and scientific approach asserting that systems (physical, biological, social, or others) and their properties should be studied as integrated wholes, not just as a conglomeration of parts. In his 'Metaphysics', Aristotle emphasised that the whole is different from the sum of parts, suggesting a quality or essence that emerges only in unity (Cohen & Reeve, 2000).

Indigenous Worldview's holistic perspective denotes the unique ways Indigenous people perceive and interpret their environment, nature, relationships, and the cosmos. Their Indigenous knowledge systems cannot be compartmentalised but should encompass all aspects of life as a whole. A holistic approach can be found in traditional Indigenous

education and knowledge-sharing, whereby Indigenous teaching methods incorporate various disciplines – from history to science to ethics – presenting them as interrelated aspects of a larger whole rather than in parts (Battiste, 2002)

The holistic perspective in Indigenous worldviews also informs how many Indigenous communities approach land stewardship—recognising that ecosystems are interdependent wholes, with an emphasis on preserving balance and ensuring sustainable practices (Whyte, 2017). This also transcends in the communal aspect of Indigenous governance structures, decision-making processes, and conflict resolutions (Friesen, 2009). The well-being of the community as a whole is paramount, and solutions that benefit the larger group rather than a select few are sought.

The holistic perspective inherent in Indigenous worldviews offers valuable insights into what Indigenous believe in the nature of reality. The holistic perspective prompts researchers to consider emergent properties: characteristics that are evident at the whole-system level but not at lower levels of organisation (Capra, 1996). Recognising that the whole is more than the sum of its parts can lead to more inclusive, sustainable, and interconnected approaches in this research project, which will be discussed further in Chapter 3.

Grasping these three concepts within the Indigenous perspective—interconnectedness, spirituality, and a holistic approach—forms an ontological basis for the functioning of the Indigenous knowledge system. This basis is firmly integrated into the Indigenous communication system, underpinning the intended ISVCD Framework. As noted by Wilson (2001, 2008) and Cajete (1994, 2000), knowledge cannot be divorced from the knower, and thought cannot be separated from action. Instead, knowledge is understood as interconnected, existing and emerging from relationships among people,

their ancestors, the land, and the universe. In Indigenous contexts, visual communication is more than just functional- it includes symbols, metaphors, oral traditions, and visual imagery that convey deeper truths and connections. This ontological basis calls for a design methodology that respects this interconnectedness while offering clarity and structural coherence for developing tools such as the proposed ISVCD Framework, which conventional design systems often overlook.

As a result, understanding the decolonisation of the Indigenous research process and the need for a systematic innovation technical system design approach is essential to align with the Indigenous research paradigm and facilitate the development of the ISVCD Framework, which will be discussed in the following section.

2.4 Decolonisation in the Indigenous Research Process

Decolonisation in Indigenous research has emerged as a critical discourse within academic and Indigenous communities, aiming to challenge and transform the historically oppressive and Eurocentric approaches that have dominated research methodologies and paradigms. This section delves into the multi-dimensions of decolonisation in Indigenous research, addressing the following key aspects: defining recolonisation in Indigenous research, emphasising the significance of decolonisation to Indigenous communities, exploring the adaptation of the anthropology research approach of etic and emic, considering their complementary nature, and discussing practical methods for implementing these approaches in this research.

Smith's(2021) book, "Decolonising Methodologies: Research and Indigenous Peoples", highlights how traditional research methods have often dismissed or marginalised Indigenous ways of knowing. Decolonisation in Indigenous research refers to the process by which research practices and methodologies inadvertently replicate

colonial structures and perspectives, often undermining Indigenous knowledge systems. It occurs when non-Indigenous researchers and institutions impose their perspectives, values, and priorities onto Indigenous communities, disregarding elements of sustainability that can benefit from the Indigenous worldview, values and their interconnectedness are overlooked. Decolonisation manifests through methodologies that exoticise, objectify, and misrepresent Indigenous peoples, reinforcing stereotypes and contributing to the marginalisation and disempowerment of these communities.

This recolonisation perpetuates a power imbalance where Indigenous voices and perspectives are subordinated to dominant Western research paradigms. It seeks to dismantle these oppressive structures and processes, replacing them with approaches that centre Indigenous voices, knowledge systems, and self-determination. A framework for multimodal integration goes beyond defining; it needs to model multimodal reality based on systematic design integration, building on Indigenous worldview and knowledge.

2.4.1 Significance of Decolonisation Research to Indigenous Communities

Decolonisation research is of paramount importance to Indigenous communities for several reasons. Firstly, it addresses the historical injustices and traumas inflicted upon Indigenous peoples through centuries of colonialism and the academic exploitation that followed. It allows Indigenous communities to reclaim their narratives, identities, and knowledge systems, thus fostering healing and self-determination (Kovach, 2021b).

Secondly, decolonisation research recognises Indigenous communities' rich and diverse knowledge, acknowledging that their perspectives are valuable and essential for addressing contemporary challenges, such as environmental degradation, healthcare disparities, and cultural preservation (Battiste, 2002; Wilson, 2008).

Moreover, decolonisation research empowers Indigenous communities by involving them in the research process as active participants and decision-makers, respecting their agency, and acknowledging their expertise in their contexts. This collaborative approach generates more relevant and practical solutions and enhances Indigenous individuals' and communities' well-being and self-esteem (Walter & Andersen, 2013).

2.4.2 Adaptation of the Anthropological Research Approach of Etic and Emic

The anthropological approach of etic and emic perspectives can be adapted for decolonisation research, albeit with critical considerations. As first introduced by Kenneth Pike (1967), etic refers to the approach of studying the Indigenous communication system from outside the cultural system. In contrast, emic refers to the perspective used to study an Indigenous communication system from within the cultural system by the local community members. Pseudo-etic (Triandis & Marin, 1983)-describes the concept and system initially developed in another context and assumed to be relevant to the Indigenous community. This can, however, be problematic as the developed system does not share the same fundamental values, knowledge, and communication as the Indigenous people.

In decolonisation research, etic perspectives may correspond to the perspectives of non-Indigenous researchers, while emic perspectives align with those of Indigenous community members. Incorporating etic and emic perspectives can provide a more holistic understanding of the research topic, acknowledging Indigenous communities' diverse perspectives and worldviews (Kovach, 2021b; Smith, 2021). This approach can balance analytical objectivity with a deep understanding of Indigenous cultural contexts. It can function as a complementary framework in decolonisation research. This

complementarity is most effective when a cohesive application involves researchers and Indigenous communities. Kovach (2021b) suggests that such an approach can lead to a more holistic understanding of Indigenous experiences, blending objective analysis with Indigenous knowledge and perspectives.

Drawing on the concept of complementarity between etic and emic perspectives, we develop a practical method that guides our research methodology. The function model of the etic, emic, and pseudo-etic relationship, as illustrated in Figure 2.3, demonstrates the role of the insider in making design decisions within a co-design process, highlighting the essential participation and collaboration of stakeholders in this research.

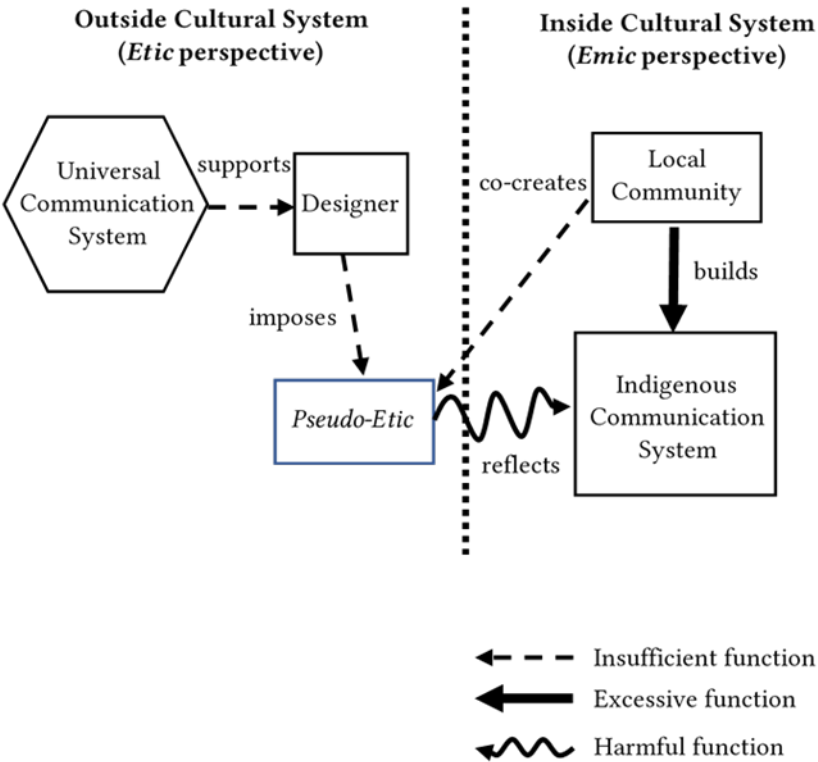


Figure 2.3: Function Model of Etic, Emic and Pseudo-Etic Relationship

2.4.3 Democratisation in Design

As discussed in section 1.2, the challenge of preserving Indigenous communication symbols is primarily due to the outside-in approach of design. For instance, emojis inherit Western values and are designed by individuals who lack a deep understanding of local cultures and values. The design and selection of emojis impact the messages, topics, and interactions that can take place, creating problems of value hegemony for Indigenous youth.

The concept of democratising design focuses on making design processes, tools, and systems accessible to a broader range of people (Myers et al., 2023), beyond professional designers. This empowers individuals to participate in designing products, environments, and services that affect their lives. The idea of democratising design for emojis and other communication symbols in the Instant Messaging System (IMS) was posited by Sutton and Lawson (2017), who argued against the totalitarianism of language vocabulary in social media, which could create problems for minority communities.

As mentioned by William Labov (2011) in a linguistic context, language and its proliferation of new words depend entirely on a community, not on someone alien to it. Democratising design for communication symbols emphasises engaging users in the process and deliberating on the design to meet the specific needs of underrepresented groups, particularly Indigenous communities. This approach disrupts the monopolisation of communication symbol systems, such as emoji creation and selection, by an external party. It could establish a balance by fostering a socio-technical innovation system that empowers local communities to develop their own knowledge. Dynamic, homegrown, bottom-up communication symbols, like emojis derived from their traditional symbols with which they are familiar, can benefit Indigenous communities and further liberate the

dominance of Western cultural values, thereby democratising the ownership of communication symbols set in IMS.

2.5 Systematic Innovation

A significant drawback is that the conventional technical systems do not incorporate a mechanism for epistemological pluralism. They generalise Western

As outlined in the previous sections, Indigenous communication systems are guided by their profoundly interconnected, spiritual, and holistic worldview. Knowledge within Indigenous frameworks is rooted in relationships extending beyond human connections, including the land, ancestors, and the universe. Therefore, visual communication in Indigenous contexts is not a passive medium but a living system of cultural expression, interwoven with spirituality and relational responsibilities. These Indigenous epistemological foundations demand an equally holistic design logic, interconnected, with Indigenous knowledge and values embedded to develop the proposed ISVCD Framework. The Indigenous Research Paradigm questions traditional research frameworks, requiring a decolonising methodology that honours Indigenous knowledge systems, thus calling for an Indigenous-specific approach. (Battiste & Youngblood, 2000; Smith, 2021).

A critical examination of standard technical system models exposes their limitations in meeting these epistemological needs. These models fail to adequately support culturally nuanced and contextually embedded symbolic communication systems, highlighting a significant conceptual and practical gap.

Standard technical design models, however, fall short in supporting these complex, culturally nuanced and contextually embedded symbolic systems. Models such

as the Waterfall Model (Royce, 1987) and Object-Oriented Design (Booch et al., 2008) prioritise linearity, compartmentalisation, and reductionism — principles rooted in industrial and Western epistemologies. These models often ignore relational dynamics, epistemological pluralism, and spiritual meaning embedded in Indigenous design logic (Kovach, 2010; Smith, 2021).

To address this gap, a systematic innovation approach emerges as a unifying methodology. Rooted in structured creativity and rigorous problem-solving, systematic innovation facilitates both conceptual depth and operational completeness (Altshuller & Altov, 1996; Gadd, 2011). It enables translating culturally rich but ambiguous Indigenous knowledge into structured design frameworks while preserving their holistic and interconnected nature. By employing systematic innovation, designers and researchers can ensure both conceptual coherence and practical applicability of Indigenous symbolic communication frameworks. It unifies the needs of a visual symbolic modelling system that is capable of modelling Indigenous symbolic visual communication systems, while also requiring a socio-technical system that provides practical logic in relation to the social aspects mandated by the Indigenous research paradigm. The significance of applying systematic innovation in this research is illustrated in Figure 2.4.

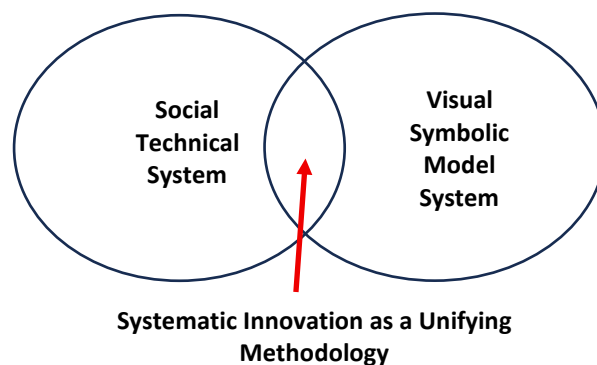


Figure 2.4: Systematic Innovation as a Unifying Methodology

2.5.1 The Need for a Social-Technical System Model

A significant drawback is that the conventional technical systems do not incorporate a mechanism for epistemological pluralism. They generalise Western principles of efficiency and functionality, sidelining Indigenous knowledge systems and design approaches. Therefore, using a traditional design approach may diminish Indigenous design to a mere decorative or symbolic layer instead of a cohesive, lived system of relational understanding. A more congruent framework with the Indigenous interconnectedness and holism is needed.

The model must be technically structured and socially and culturally embedded to capture the Indigenous worldview fully within a design framework. This necessitates shifting from purely “technical systems” to socio-technical systems frameworks that acknowledge the mutual shaping of people, technology, symbols, and culture (Baxter & Sommerville, 2010).

Socio-technical systems theory emphasises that technological designs must be co-developed with social structures, meanings, and user practices. In Indigenous visual communication, digital representations of symbols must carry the values, interpretations, and social roles defined by the community itself. They are not isolated artefacts, but relational expressions rooted in place, ancestry, and collective memory.

2.5.2 TRIZ Law of System Completeness

TRIZ stands for “*Teoriya Resheniya Izobretatelskikh Zadach*” in Russian, which translates to “Theory of Inventive Problem Solving” in English. It was developed by Genrich Altshuller (1984). TRIZ is a theory of inventive problem solving that facilitates systematic innovation. One of its core principles, the Law of System Completeness,

asserts that any functioning technical system must comprise four components: Control, Engine, Transmission, and Working Unit. According to Altshuller's (1996) definition, a system is an organised structure with a definite purpose. It is regarded as a whole entity and consists of interdependent and interconnected components. These components affect each other to sustain their activity and the system's existence, all in pursuit of achieving a common objective. These components have specific functions that must be integrated into a single system, as illustrated in Figure 2.5.

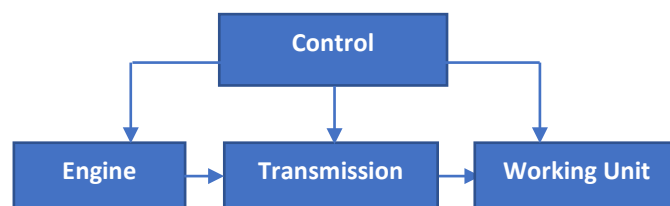


Figure 2.5: The Law of System Completeness

As defined in the Glossary of TRIZ by MATRIZ (2018), the Engine unit transforms energy into the type needed to operate the Working Unit, providing necessary energy for operation. It does not have to be a conventional engine; it can be any component supplying energy for the system's functioning. The Working Unit performs the function for which the technical system is developed, interacting with the object of work to carry out primary actions. The Transmission unit transfers energy from the source to the Working Unit, converting, directing, and regulating energy flow as needed. The Control Unit regulates energy supply to other system parts and coordinates operations, ensuring correct and efficient functioning.

The completeness of the TRIZ law requires that all the components must be present, integrated, and function as a single continuum. Any missing component would render the technical system incomplete, and it would not exist. Additionally, if any

component fails, the entire system will not survive (Mann, 2001) Therefore, the Law of System Completeness is vital to the TRIZ model. It ensures the effective functioning of a technical system by ensuring that all components operate cohesively.

This completeness perspective of TRIZ parallels the holistic perspective of IKCS, which provides the foundation for developing the framework in this research project. Therefore, it is crucial to understand the theoretical basis of the Law of System Completeness to develop an efficient ISVCD Framework.

2.5.3 The Whole is More Than the Sum of Its Parts

Gräbe (2020, 2021) posits that technical systems are not simply mechanical or standalone entities but deeply intertwined with human intentions, actions, and interactions. This viewpoint aligns with the research's goal of creating a culturally sensitive design framework for Indigenous symbolic visual communication. Gräbe (2021) defines technical systems by their functional purposes, stressing the importance of well-defined components collaborating to achieve specified system goals. The TRIZ Law of System Completeness, as described by Gräbe (2020, 2021), asserts that a complete and functional system comprises essential components that can be interpreted metaphorically as socio-technical resources facilitating collaborative human action, rather than just mechanical parts.

These ideas allow for interdisciplinary innovation when applied to social research, particularly concerning Indigenous visual communication systems. While TRIZ generally emphasises engineering principles, Gräbe's socio-technical perspective increases its relevance to the relational and interconnected aspects highlighted in the Indigenous Research Paradigm.

Gräbe's (2020) refers to "the whole is more than the sum of its parts" point out the key principle of systemic holism, which closely aligns with Indigenous epistemological beliefs. Through this holistic lens, a complex system, be it technical, social, or cultural, cannot be fully understood by isolating its individual elements; it must be assessed and experienced as a dynamic, relational, and interconnected whole. Consequently, incorporating TRIZ into the ISVCD Framework provides a structured methodological approach and genuinely respects the holistic, interconnected nature of Indigenous epistemologies.

2.5.4 The Law of Supersystem Completeness

Valeri Souchkov (2017) suggested broadening the TRIZ Law of System Completeness into the Laws of Supersystem Completeness, introducing a new research avenue. This proposed Law of Supersystem Completeness is a subset of the Law of Statics, rooted in the principle that a technical system cannot exist independently. It must be integrated into a larger system that utilises its function. This concept aligns with the goal of creating an ISVCD Framework that effectively engages with complex Indigenous communication systems and interacts with human elements within Indigenous communities.

According to Souchkov (2017), a complete technical system needs collaboration with other systems, as defined in classical TRIZ. Additionally, a higher-level system must leverage the technical system's function. For instance, an engine obtains energy from an outer supersystem while the working unit delivers a specific function to a designated target.

Souchkov (2017) describes a supersystem as “a system that interacts with a technical system (through physical or informational links) at each phase of the technical

system' s lifecycle.” This implies that within a technical system, several supersystems are present, each interacting with its components to facilitate functionality. It is important not to conflate supersystems with the term “environment.” Rather, supersystems are distinct systems characterised by their own language and logic, with the relationship between a supersystem and a system resembling that between system components.

Furthermore, Souchkov (2017) argued that incorporating the supersystem into the technical system would enhance its " completeness, " helping to prevent issues such as product-supersystem mismatches and inadequacy regarding the system's target and application. Gräbe (2020) reinforced this idea, stating that the supersystem would enrich the " totality of the world, " as his technical system proposal essentially reflects a socio-technical system, as previously discussed. Integrating the supersystem in the technical system is vital for developing the ISCD framework, which seeks to map and analyse Indigenous symbolic visual languages. This integration fosters a more holistic model that actively connects with the socio-technical systems and human elements within Indigenous communities. Figure 2.6 illustrates the Law of Supersystem Completeness. In this research context, the supersystem refers to the living space of the Indigenous, encompassing the natural environment in which they reside and obtain resources for constructing visual symbols.

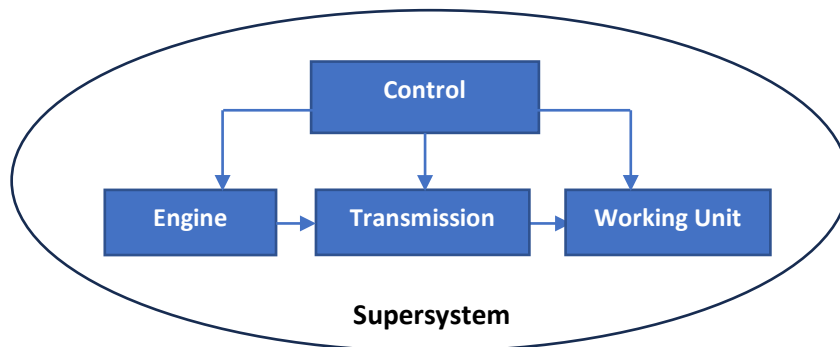


Figure 2.6: Law of Supersystem Completeness

2.5.5 Adaptation of TRIZ's Law of System Completeness in the ISVCD Framework Development

The TRIZ Law of System Completeness was adapted and strategically positioned between the social, technical and visual communication systems to fully realise the Indigenous worldview within a digital framework. This positioning allowed the ISVCD framework to maintain its technical functionality and cultural integrity.

The socio-technical system captures the broader ecosystem in which symbols are created, interpreted, and used, including community norms, storytelling traditions, digital platforms, and participatory design practices. The visual communication system, on the other hand, embodies the symbolic, aesthetic, and semiotic components central to Indigenous knowledge expression.

By embedding TRIZ centrally between these two systems, the framework could translate holistic cultural meanings into technically usable digital forms, without abstraction or reduction. Each TRIZ component (Engine, Transmission, Working Unit, Control) was metaphorically mapped to Indigenous epistemological functions, creating a structurally complete, socially embedded, and spiritually informed design architecture.

When metaphorically mapped to the Indigenous context, the TRIZ Law of System Completeness components correspond respectively to the symbol origin (engine), mode of transformation (transmission), digitalised symbol (working unit), and community validation and feedback (control). The metaphorical mapping is shown in Table 2.2. This integration will transform the semiotic framework discussed in section 2.10 later into a functionally complete and operational design system. The application of TRIZ ensures that the framework is not only epistemologically grounded in Indigenous knowledge systems but also exhibits the core attributes of systematic innovation: predictability,

replicability, and adaptability. This approach enables designers to move from abstract cultural principles to coherent, structured, and context-sensitive visual communication practices, making the framework both theoretically sound and practically actionable. This became the foundation principle for the social-technical system as described in objective two.

Table 2.2: Metaphorical Mapping of TRIZ Law of System Completeness with ISVCD Components.

TRIZ Law of System Completeness (with the supersystem) Components	Design Role	ISVCD Framework Metaphorical Mapping
Engine	Design Input	Symbol Origin – The original symbolic artefacts, materials, gestures, knowledge and core values expression
Transmission	Design process	Modes of Transformation – digitalising the original Indigenous symbolic artefacts into digital form with integrated Indigenous knowledge and core values.
Working Unit	Design outcome	Digitalised Symbols – The co-designed digital symbols that are compatible in IMS usage.
Control System	Manages and governs	Community Validation and Feedback – Indigenous Core Value as Control Policy, permissions, authority of knowledge and values keepers
Supersystem	Working Environment	Indigenous Living Space – includes the Indigenous worldview, lifestyle and natural environment where visual communication symbols are contextualised and practised.

2.6 Indigenous Knowledge Communication Systems (IKCS)

Indigenous Knowledge Communication Systems (IKCS) are essential mechanisms through which Indigenous communities communicate, preserve, and

transmit their knowledge, cultural values, and beliefs. The Indigenous worldview of the Indigenous community informs this understanding. This section synthesises insights from the literature, covering the definition of IKCS, the various communication mediums used, their significance to Indigenous communities, and their key characteristics, which form the basis of this research's Indigenous symbolic visual communication design framework.

Indigenous Knowledge Communication Systems (IKCS) represent a complex and multifaceted framework through which Indigenous communities transmit, share, and preserve their Indigenous knowledge, values, and cultural heritage. This multifaceted system encompasses a wide range of communication methods and mediums that Indigenous communities have developed over centuries to pass down their knowledge from one generation to another. While there is no universally accepted definition of IKCS due to its diversity and context-specific nature, Indigenous peoples can understand it as the collective body of practices, symbols, and processes used to communicate and perpetuate their knowledge.

Mundy (1993; 1991) posited that there are five forms of Indigenous communication, which include: (1) Folk media, (2) Indigenous organisation, (3) Economic Relationship and Service Supplier, (4) Deliberate Instruction, (5) Unstructured Channel. Indigenous communication carried out functions like storytelling, discussion, information sharing, instruction, and chatting among Indigenous community members. It transmits various Indigenous knowledge, such as folklore, religion, farming, hunting, healing, elderly instructions, parenting, and spontaneous communication between two parties. Details of Mundy's five forms of Indigenous communications can be viewed in Table 2.3. Indigenous communications involve various mediums, such as oral, written, and performed texts, created, modified, used, and shared across generations through

communicative practices and performances (Manyozo, 2018; Sillitoe, 2002). Studies by scholars (Cajete, 2000; Memmott, 1996; Ville et al., 2015) also identified that visual symbols have long been an integral medium of the Indigenous communication system. They bridge traditional wisdom and contemporary tools, allowing Indigenous communities to pass on their knowledge while preserving their cultural heritage.

Table 2.3: Five Forms of Indigenous Communication

Forms of Indigenous Communication	Functional	Knowledge/Information
1. Folk Media	Storytelling	Folklore, plays, dance, song, and festival celebration.
2. Indigenous Organisation	Discussion	Organisation activities of a religious group, a tribe gathering, and a tribe leader meeting.
3. Economic Relationship and Service Supplier	Share information	Farming activities, hunting activities, trading, and healers sharing information about diseases.
4. Deliberate Instruction	Instruction	Tribe leader and the elderly's instruction. Parenting, how to eat, how to cook, how to behave.
5. Unstructured Channel	Chatting	Spontaneous and informal conversation about hobbies, entertainment, and gossip.

Each Indigenous communication system is distinct to a specific Indigenous group (Manyozo, 2018). It generates, transfers, and shares knowledge and cultural values within the Indigenous social system. The communication system is self-constructed, locally sustained and controlled in usage and dynamic maintenance. It is a crucial factor in the sustainability of Indigenous cultural heritage, values, and identity. IKCS are unique and operate within and outside modernity (Manyozo, 2018). Direct application of modern technologies and research models into the study of Indigenous communication systems is

inappropriate and could jeopardise the cultural sustainability of Indigenous values and heritage.

2.6.1 Characteristics of The Indigenous Knowledge Communication Systems (IKCS)

While the IKCS may be locally specific, it possesses shared characteristics noted in the existing literature. The majority of IKCS are dynamic, self-sustained, and complex.

2.6.1.1 The Indigenous Knowledge Communication Systems Are Dynamic

The traditional ways of looking at Indigenous knowledge as static and frozen in time and space, which can be captured, digitalised, and preserved as artefacts, must be reconsidered. This approach overlooked the dynamism of culture itself, as culture is malleable, shifting, contextual, and a situational set of meanings and ideas that can change according to perspectives (Wade, 1999). Sillitoe (2002) emphasises that all social systems are dynamic; the behavioural interaction of individuals is constantly generating and sustaining the systems. Hence, IKCS inherits this nature of social system dynamics, continuously evolving in response to the environment and cultural shift. It adapts to contemporary challenges while preserving traditional knowledge (Berkes, 2009). This dynamism is crucial for Indigenous communities to address the complex and ever-changing issues they face. Therefore, the IKCS supporting the process of producing and exchanging Indigenous knowledge is dynamic and not static. A modelling tool that can capture the system's dynamism is essential.

2.6.1.2 The Indigenous Knowledge Communication Systems Are Self-Sustained

One of the remarkable characteristics of IKCS is its self-sustaining nature. It relies on the active participation of community members in transmitting knowledge through storytelling, ceremonies, and symbols. This self-sustaining aspect ensures the continuity

of Indigenous knowledge even in the absence of formal educational institutions. This refers to what Berkes(1999) describes as self-sustainability within IKS: the ability to persist, evolve, and adapt without external interference, reflecting these systems' resilience and inherent strength. For outsiders, Indigenous knowledge may look inconsistent and seen to be based on superstition. However, the Indigenous communities see it as logical in their worldview perspective, valuable and practical to their living needs. Indigenous communities make decisions based on their existing knowledge and experience. Rhoades and Bebbington (1995) observed how local farmers in Peru generate new knowledge daily through trial and error to develop new techniques and adaptations to suit a changing economic and biophysical environment. Similar things happen to the Indigenous people, whereby their knowledge constantly evolves and adapts to changes in their living environment. Their knowledge of climate change is a shred of living evidence of this. Developing an Indigenous communication systems design framework should depict the mechanisms and structures through which Indigenous communities create, preserve, transmit, and manage their Indigenous knowledge independent of external influences or modern technological systems.

2.6.1.3 The Indigenous Knowledge Communication Systems Are Complex

Indigenous knowledge systems involve knowledge–practice–belief complexity (Berkes, 2009); it is a repertoire of Indigenous knowledge from which community members construct their livelihoods. The complexity of the systems is inherited in the communication systems, and it refers to the local land, animals, and plants. It also includes the foundations of rules and norms about interacting with the natural environment and spiritual beliefs. Nevertheless, it includes a worldview which denotes how the person or group interacts with the world. How the Indigenous see shapes how

people make observations, make sense of them, and learn. These elements are interwoven, creating a complex tapestry of communication methods reflecting the depth and richness of Indigenous cultures (Hunn, 1999). Communication systems that perform specific social functions within the IKCS encompass language, naming and classification systems, resource use practices, rituals, spirituality, and worldviews (Haverkort et al., 2003). It carries the complex attributes of the Indigenous knowledge system. Indigenous study scholars (Barker & Yazdani, 2000; Pottier, 2003) refer to holism as the key characteristic of Indigenous knowledge. Therefore, the examination of Indigenous knowledge, particularly the IKCS in this research, needs to be viewed as one continuum of knowledge whose distinct characteristics are only observable under different contexts. Contextualisation is essential in the study of IKCS (Manyozo, 2018). It is inadequate to study Indigenous knowledge communication by looking at a single perspective practised by many modern researchers. It should be treated holistically; the whole is more than the sum of its parts or a completeness approach, as bestowed in the TRIZ Law of Completeness, which was discussed in section 2.5.

2.7 Indigenous Knowledge and Core Values

As illustrated in the theoretical framework, Figure 2.1 demonstrates the connection between Indigenous knowledge and core values, which are closely tied to the IKCS. These aspects represent essential intangible cultural features embedded within the signs and symbols of the Indigenous communication system, playing a vital role in conveying cultural heritage and sustaining Indigenous identity.

2.7.1 Indigenous Knowledge

Myriads of definitions of Indigenous knowledge can be found in the literature of Indigenous studies due to the different perspectives and approaches researchers used in

their respective studies. Indigenous knowledge refers to the unique and culturally specific knowledge systems of Indigenous communities. A general description provided by UNESCO portrayed it as the understanding, skills, and philosophies developed by societies with a long history of interaction with natural environments (Bala et al., 2022).

The specific definition which related to the Indigenous knowledge communication associated with the aim of this research can be identified as what Berkes (1999, 2009) posited as a cumulative body of knowledge, practice, and belief, evolving by adaptive process and handed down through generations by the traditional way of Indigenous communication. Manyozo (2018) further enhanced this definition by describing it as a way of knowing, where knowledge is generated and accumulated over generations of living in a specific environment. It allows communities to make sense of their living world. It illustrates that Indigenous knowledge is deeply rooted in a specific Indigenous community's traditions, customs, and experiences. It encompasses various information, including traditional ecological knowledge, agricultural practices, healing methods, cosmology, storytelling, and social organisations. It is often embedded in oral traditions, rituals, community practices, narratives, and metaphorical forms of language.

Castellano(2000) described how Indigenous knowledge is conveyed in metaphorical forms of language, highlighting a significant way in which this knowledge can be transmitted through visual communication rather than oral means, as noted in various kinds of literature. Further literature that supports this viewpoint can be found in Cajete's(2000) exploration of the foundations of Indigenous science, where metaphoric and symbolic representations are critical components in understanding the natural world and human relationships. Battiste(2002) in his literature reviews of the pedagogical

practices of the First Nations, discussed how Indigenous knowledge is often transmitted through metaphors and symbols rather than solely through oral traditions.

Indigenous knowledge differs from exogenous knowledge in the modern world in several ways. It is opposed to the universal nature of exogenous knowledge (Mundy & Lin Compton, 1991; Warren, 1991), which is associated with formal education, scientific research, and technological advancements. Indigenous knowledge emerges naturally and intuitively in the natural environment. Indigenous knowledge systems involve observing natural processes and constructing knowledge carefully by adapting natural resources, such as plants, animals, and other natural materials, in their living environment. Therefore, Indigenous knowledge is location-specific, value-laden, and closely linked to the local culture of a specific Indigenous group. Indigenous knowledge consists of a vast repository of Indigenous “know-how” and experience regarding their way of living, understanding of nature and environment, social interaction, and spiritual beliefs.

A review of the literature in the context of Indigenous communication revealed various characteristics of Indigenous knowledge, which differ from exogenous knowledge, as outlined in Table 2.4.

Table 2.4: Indigenous Knowledge vs Exogenous Knowledge

Types of Differences	Indigenous Knowledge	Exogenous Knowledge
Contextualisation vs Universality	Deeply rooted in specific cultures, highly contextualised to community identities and practices (Warren, 1991).	Culturally neutral, promoting universality that is transferable across various cultures, communities, and regions (Warren, 1991).
Informal vs Formal Transmission	Primarily transmitted orally and symbolically, it fosters intergenerational relationships and community identity sustainability (Warren, 1991).	Codified, documented, and disseminated formally through education systems, scientific publications, and digital media (Warren, 1991).
Experiential vs Scientific Learning	Involves direct experience, observation, and active	Utilises rational processes such as hypothesis testing,

	participation in community activities; includes moral dimensions related to sustainability and ethical resource use (Smith, 2021).	experimentation, replication, and peer review, seeking to gain a general understanding and drive technological advancement (Smith, 2021).
Relational vs Objectified	Relational, emphasises connections between people and nature; subjective, dynamic, and integrated with life experiences (Cajete, 2000; Wilson, 2008).	Objectified, detached from personal and social contexts, presented as universal truths, abstract and generalisable, focusing on categorisation, measurement, and prediction (Lakatos, 1978; Lansing et al., 2022; Popper, 2005).

Indigenous knowledge, being relational, is not only about understanding the world but also about maintaining a balance within it. It tends to be adaptive, multifaceted, and deeply personal or communal. Exogenous knowledge, in being objectified, attempts to distil complex realities into simplified models and theories that can be universally understood and applied. While Indigenous knowledge is often context-bound and subjective, scientific knowledge strives for objectivity and seeks to transcend particular circumstances. In reviewing the literature, we discovered that there has been an increasing recognition of the value of bridging these two systems of knowledge, acknowledging the importance of relational understanding from Indigenous perspectives in addressing global challenges such as climate change and biodiversity conservation (Agrawal, 1995).

Both knowledge systems possess a high level of adaptability, allowing them to adapt and evolve. Indigenous knowledge adapts to changing local conditions, while exogenous knowledge evolves through scientific inquiry and innovation (Berkes, 2009). Indigenous knowledge and exogenous knowledge can complement each other. Integrating Indigenous and exogenous knowledge can lead to innovations addressing complex problems such as in this research.

2.7.2 Indigenous Core Values

Indigenous researchers (Hart, 2010; Wilson, 2001, 2008) define Indigenous core values as a set of morals or ethics that guide the Indigenous people. This concept is integral to the axiology of Wilson's (2001, 2008) Indigenous Research Paradigm, as illustrated in Table 2.1. Three perspectives on values are relevant here: Indigenous values, researchers' values, and exogenous values typically associated with Western Information Systems (IS) research. It is vital to comprehend the differences between the values held by Indigenous and non-Indigenous researchers, especially within this research context. Researchers are expected to show respect for individuals and communities by seeking and sharing knowledge while being mindful of the community's unique perspectives. Understanding the distinctions between Indigenous values and the prevailing Western-centric values commonly seen in IS research is essential, as is recognising how these values are communicated and measured to prevent value conflicts.

Owing to varying worldviews and belief systems, Indigenous values differ significantly from those in modern society, with Indigenous core values deeply rooted in the traditions and beliefs of Indigenous communities. These values markedly contrast with other systems due to their connections to nature, community, spirituality, and a holistic worldview. Indigenous core values exhibit considerable variation among different Indigenous communities globally, as they reflect each group's unique culture, history, and traditions. Unlike general values, Indigenous core values are foundational cultural principles transmitted through storytelling, rituals, and lived experiences. They represent the deep-seated beliefs that embody the essence of an individual, group, or culture, differing from general values, which are guiding principles affecting behaviour and decision-making. The term "core" indicates that these values underpin all other beliefs,

behaviours, and decisions, are non-negotiable and enduring, and are integral to the collective identity of Indigenous groups. Wilson (2008) notes that “Core values are not simply moral ideals, but codified into governance structures, protocols, ceremonies, and land-based practices” (p.77). Findings by Shein and Sukinarhimi (2022) on the Rukai Indigenous community in Taiwan reveal that local core values prioritise water sustainability through the prevention of contamination, communal sharing, conservation of life sources, and adherence to nature's laws. This holistic, communal approach to natural resource values contrasts sharply with the individualistic, utilitarian perspectives common in broader societies. Table 2.5 below presents the typical characteristics of Indigenous core values as identified in the literature review.

Table 2.5: Characteristics of Indigenous Core Values

Characteristics	Description
Cultural and Spiritual Connections	Indigenous core values encompass spiritual, cultural, and ethical principles deeply rooted in land, nature, and spiritual entities. These principles prioritise harmony, respect for all living beings, and a holistic perception of the universe, emphasising interconnectedness, balance, and reciprocity with the natural environment (Nadasdy, 2003; Smith, 2021).
Communalism and Collective Identity	Indigenous core values emphasise community well-being over individual interests. These values underscore responsibilities and obligations toward family, community, and future generations, promoting the transmission of knowledge, traditions, and identity from elders to youth, thereby ensuring cultural continuity and collective identity (Alfred, 2005; Battiste, 2019).
Environmental Stewardship	A profound connection to land and nature characterises Indigenous core values, with an emphasis on environmental stewardship and sustainability. Indigenous peoples perceive themselves as caretakers, employing sustainable resource management practices developed through generations to protect and preserve resources for future generations (Berkes, 2009).

Examining Indigenous core values is complex due to their significant diversity among different groups and their close relationship with specific environments, rendering a standardised approach ineffective. Thus, the investigation of values within the

suggested ISVCD Framework needs to encompass a variety of intricate Indigenous core values firmly embedded in these communities' traditions and histories, enabling the precise identification of each unique core value within the Indigenous community.

2.7.3 Indigenous Core Values Elicitation

Understanding the elicitation of Indigenous values is a topic of ongoing scholarly discussion and research. Many researchers adopted existing pre-set academic frameworks, such as the Schwartz Values Survey (Schwartz, 1994) and the Portrait Values Questionnaire (Schwartz et al., 2001), which would lead to problems. Some researchers argue about the possibilities of measuring values, as they were seen as intangible and non-measurable (Hitlin & Piliavin, 2004; Meglino & Ravlin, 1998). The ideal framework for identifying and measuring Indigenous values would elicit and validate Indigenous core values at the local level to capture Indigenous people's shared meanings across multiple goals and perspectives. From the discussion in the previous section, it can be determined that such a framework should pose the criteria for capturing the distinctiveness of Indigenous core values as below:

1. Eliciting the intrinsic Indigenous values
2. Emphasise an approach that centres on engaging the local community, as the core values are inherently local and collectively communal in nature.
3. Avoidance of exogenous value conflicts
4. The contextualisation of the core value eliciting process is vital, as Indigenous values are intricately connected to culture, spirituality, community, environment, and are context specific.

Identifying and measuring Indigenous values, which are intrinsic and invisible, is challenging, as quoted by (Podger et al., 2013, p. 9) “.... *they were effectively invisible*”; however, she further argued that *if researchers could measure indicators related to values, they could demonstrate many more ‘soft’ impacts of their work and have more informed planning and ongoing evaluation.* Research works done on minor community social values by (Burford et al., 2015; Burford et al., 2012; Burford et al., 2013; Harder & Burford, 2018; Harder et al., 2014; Podger et al., 2013) yield positive outcomes in measuring the values through value indicators and a participatory research approach with engagement with the local communities. Based on the experience on the European Union’s (EU) Education for Sustainable Development Project-ESDinds, the value-based indicator framework developed by them provides a promising solution to the problem of identifying and measuring intrinsic values.

The value-based indicator is based on the idea that values are enduring beliefs about what is desirable and criteria for what should happen. However, these values are often intrinsic and not fully conscious. People may publicly espouse particular values but do not always behave in ways that align with them. This is known as the value-action gap (Blake, 1999) To overcome the value-action gap, particular values can be identified by articulating them in words, sharing and discussing them with others, and reflecting on one’s own beliefs and behaviours. Value-based indicators are information and word phrases (trigger statements) collected through community-based activities that reflect the values of the community. Identifying and eliciting such indicators can measure the presence of the values.

The complete core value-based indicator framework was a longitudinal study involving collections of hundreds of community core value-based indicators; due to the

limitations of this research, the central ideas of the value indicator were adopted, and the simplification steps of developing value indicators were adapted to suit the requirements of this research. Table 2.6 shows the five steps of value-indicator development.

Table 2.6: Value-Indicator Development

Value Indicator Development Steps	Description
1. Elicitation	Ask participants what matters to them using interviews, storytelling, or visual aids to gather initial ideas about values.
2. Using Trigger Statements	Use pre-developed short statements (proto-indicators) to inspire participants to think of values beyond their usual perspective.
3. Developing a Shared Vocabulary	Collect and group value-related statements gathered during the elicitation phase, using thematic analysis to identify key Indigenous values.
4. Organising Towards Articulating Values	Review and filter the collected statements to select the most relevant ones that clearly describe core or underpinning values.
5. Developing Value Indicators	Create concise value statements tied to specific cultural contexts (e.g., jungle hunting) that serve as indicators, possibly applicable across multiple values.

2.7.4 Challenges in Indigenous Knowledge and Values-Based Research

Indigenous knowledge and core values differ from the dominant Western-centric human values often studied by researchers in the Western scientific domain, just as the Indigenous worldview and knowledge differ. These differences result from distinct worldviews, cultural contexts, and historical experiences that shape each group's values and beliefs. Conducting research on Indigenous values without a deep understanding of their uniqueness, intertwined with their worldview and knowledge, may threaten the sovereignty of Indigenous culture and result in value conflicts. Literature review on local cultural knowledge and value-related research in information systems studies yielded the

following challenges, which serve as implications for this research. Table 2.7 shows the outcome of the review.

Table 2.7: Challenges in Indigenous Knowledge and Values-Based Research

Types of Challenges	Descriptions
Pseudo-Etic Problem	Problems arise when researchers impose external frameworks without understanding Indigenous knowledge, leading to misrepresentation and misunderstanding, as these models may not align with Indigenous values and communication styles. (Jacqueline, 2002; Triandis & Marin, 1983).
Uncritical Adoption of Value Models	This challenge involves using generic, or 'off-the-shelf', value models from unrelated cultural contexts. These models can be inappropriate or harmful when applied without considering Indigenous cultural sensitivities, leading to cultural misalignment and misinterpretation. (Baskerville, 2003; Myers & Tan, 2003; Smith et al., 2010).
Embedment of Western-Centred Values in Technology	A major challenge is embedding Western cultural logics and literacies into technology design and research. These values perpetuate Western ways of organizing and interpreting the world, often neglecting Indigenous perspectives and methodologies. (Dourish & Bell, 2011; Winschiers-Theophilus et al., 2012).
Assimilation of Complex Local Values	Researchers often struggle with fixed cultural models that fail to capture the complex values of Indigenous knowledge systems. Indigenous values are embedded in holistic living systems, rendering simplistic models inadequate. (Le Dantec et al., 2009; Sellen et al., 2009).

The challenges highlighted above, including pseudo-etic problems, the uncritical adoption of value models, the embedding of Western-centered values in technology design, and difficulties in assimilating complex local values, underscore the inherent complexities and sensitivities involved when researching within Indigenous contexts. To effectively counter these challenges, several research measures are indicated and applied in this research.

1. **Participatory Research Approaches:** Adoption of participatory research methods. This collaboration helps ensure that the research process and

outcomes align authentically with Indigenous core values, knowledge systems, and worldviews.

2. Contextualisation of Models: A critical evaluation and adaptation of external models is necessary, rather than direct adoption. This evaluation should ensure alignment with Indigenous epistemologies. A reflective approach enables the development of hybrid models that resonate profoundly with Indigenous values.
3. Decolonisation Methodologies: Adopting methodologies explicitly aimed at decolonisation and democratisation design approach with design frameworks that respect Indigenous autonomy and knowledge sovereignty.
4. Integration of Indigenous Ethics and Protocols: Integrating Indigenous ethical guidelines and protocols into the research process. This measure ensures culturally respectful research practices, fostering trust and meaningful engagement with Indigenous communities

In conclusion, these challenges underscore the need for shifts in research paradigms toward inclusivity, reflexivity, and cultural alignment to develop robust, culturally attuned frameworks that foster genuine understanding and respect for Indigenous knowledge and core values. This provided a constructive indication of the research methodology, which will be discussed in Chapter 3.

2.8 Indigenous Visual Symbols

In the Indigenous Knowledge Communication Systems (IKCS), communication takes on many forms, and visual symbols are prominent and influential. These symbols effectively convey complex concepts, cultural values, and narratives. Examples of these symbols include petroglyphs, totem poles, pictographs, and traditional Indigenous art

forms such as dreamcatchers. Each symbol is imbued with multiple layers of meaning that have deep roots in Indigenous worldviews. Visual symbols are crucial in IKCS by serving as a medium of communication and preserving Indigenous languages. They allow for disseminating knowledge to individuals who may not be fluent in the Indigenous language, promoting inclusivity and continuing cultural traditions. By serving as a bridge between various aspects of the Indigenous world and non-Indigenous peoples, these symbols play a vital role in building understanding and fostering respect for Indigenous cultures.

A comprehensive study of Indigenous visual symbols' various categories and functions is crucial for this research. Examining these visual symbols in detail helps illuminate their significance and roles, thereby establishing a solid foundation for developing and enhancing the ISVCD Framework.

In Section 2.7, it was mentioned that Mundy (1993; 1991; 1992) conducted studies on the Australian and African Indigenous communities and identified five forms of Indigenous communication. In this research, we analysed Mundy's five forms of Indigenous communication, comparing them with the Penan Oroo' symbols and the Murut Tahol Tatandu symbols.

The result of our analysis is shown in Table 2.8. According to the secondary data, the Oroo' symbols are associated with six categories of activities and social behaviour: the number of people, animal descriptions, giving instructions and information, warnings, duration, and the expression of hunger. On the other hand, we discovered four categories of additives related to Tatandu symbols through Burrough's (1975) study and our field trips, including weddings, hunting, warning, and navigation.

The analysis revealed that Oroo's and Tatandu's symbols have two new forms of Indigenous communication that Mundy did not record: warning and navigation. Additionally, the Oroo symbols have another new form of symbol that describes the human emotion of hunger, which is significant to the expression in emoji. Chapter 4 will discuss a detailed description of each category of the Murut Tahol Tatandu.

Table 2.8: Comparison of Mundy's Five Forms of Indigenous Communication with Oroo' and Tatandu.

	Indigenous Communication Categories	Penan Oroo'	Mulut Tahol Tatandu
Based on Paul Mundy, 1991, 1992,1993) Africa & Australian Aborigines	Folklores (storytelling, festivals, dance, plays)		Wedding
	Organizational activities (religion groups, tribe gathering, tribe chief instruction)	Number of people,	
	Economic activities (farming, hunting, fishing, food gathering)	Animals (animals, hunting) River place activity (river, fishing),	Hunting
	Deliberate instruction (parenting instruction, adolescent guidance)	Instructions Information	
	Unstructured Communication (spontaneous and informal communication)		
New categories in the Murut Tahol Tatandu, and Penan Oroo'	Danger Warning	Warnings	Warnings
	Navigation	Directions Duration	Navigation
	Border/Territorial Claim		
	Physiological Expression	Hungry	

This table serves as a crucial analytical foundation. It comprehends how Indigenous peoples encode and convey meaning. The Indigenous symbol categories illustrate how visual forms function as parallel verbal communication systems. Each category corresponds to distinct communicative intentions, including folklore, organisational activities, social roles, and economic activities. Each category represents a semantic field, a specific domain of meaning, which provides information for extracting culturally relevant visual vocabulary. It offers helpful insights on how the Indigenous symbols can be systematically categorised and structured within the proposed ISVCD Framework.

2.9 Visual Communication

Visual communication, in general terms, refers to the process of conveying ideas. Meanings and information through visual elements such as images, symbols, colours, and composition. It plays a significant role across multiple disciplines, including media studies, graphic design, computer science, linguistics, and anthropology. According to Josephson et al. (2020), visual communication is a symbolic process whereby meaning is created and transmitted through visual cues and artefacts. It is often shaped by cultural conventions and social practices.

In the context of Indigenous visual language, visual communication assumes a deeper, culturally embedded role that extends beyond aesthetics or the transfer of functional information. It becomes a medium for social, spiritual, and ecological knowledge transmission, often grounded in oral tradition, ritual, performance, and lived experiences (Manyozo, 2018; Sinha, 2004) Indigenous visual communication systems encode meanings through symbols, patterns, motifs, carvings, landscape features, body

markings, and ceremonial designs. These systems function as semiotic tools for storytelling, preserving memory, and facilitating intergenerational learning.

In this regard, visual communication within Indigenous Symbolic Communication Languages is inherently semiotic, reflecting Peirce's (1931-1958) triadic relational structure of sign-object-interpretant, in which symbols do not merely represent ideas but also mediate cultural meanings and facilitate dialogic and interactive meaning-making (Chandler, 2022; Sinha, 2004). Furthermore, the visual grammar developed by Kress and Van Leeuwen (2020) provides critical analytical tools for understanding how visual arrangements and compositions convey culturally specific meanings, enabling an exploration of the semiotic structures underlying Indigenous visual communication systems.

Thus, Indigenous visual communication in Indigenous Symbol Communication Language is best understood as a culturally embedded semiotic system through which Indigenous knowledge and social values are visually represented, preserved, shared, and sustained (Kress & Van Leeuwen, 2020; Manyozo, 2018; Sinha, 2004). Recognising and formalising these systems within structured design frameworks can provide critical methodologies for preserving Indigenous knowledge and representing it culturally respectfully in contemporary visual practices (Goh & Kulathuramaiyer, 2022).

2.9.1 Visual Communication and Semiotic Models

In the context of developing an Indigenous visual communication design framework, the relationship between visual communication and semiotic theories is both foundational and integrative. They work together to decode, construct, and contextualise meaning within culturally specific visual systems. Visual communication involves the use of imagery, layout, symbols, colour, and composition to convey messages. Semiotic

theories provide the analytical toolkit to interpret these visual systems. Using semiotics, researchers can map the sign systems unique to Indigenous cultures, avoiding misinterpretation or colonial frameworks that strip meaning from visual forms. Studying visual communication models within the context of their relevance for developing the design framework for Indigenous visual communication language, as discussed above, is essential. The systematic literature review has identified several existing visual communication models that can serve as vital references in this context. Five foundational models were evaluated, and their strengths and weaknesses are compared below, assessing their relevance to the proposed ISVCD Framework development.

In developing the ISVCD Framework, the connection between visual communication and semiotic theories is both essential and integrative. They collaborate to decode, construct, and contextualise meaning within culturally specific visual systems. Visual communication uses imagery, layout, symbols, colour, and composition to convey messages, while semiotic theories offer the analytical tools to interpret these visual systems. Semiotics can be utilised to identify the unique sign systems of Indigenous cultures, steering clear of misinterpretations or colonial frameworks that dilute the meaning of visual forms. It is crucial to study visual communication models about their significance in creating the design framework for Indigenous visual communication language, as mentioned earlier. The systematic literature review has recognised several existing visual communication models that can serve as important references in this regard. Below, five foundational models are evaluated, comparing their strengths and weaknesses in relation to the development of the proposed ISVCD Framework.

2.9.2 Shannon and Weaver's Communication Models

Shannon and Weaver's (1948) model presents communication as a linear process, centred on the transmission of information via a sender-message-channel-receiver framework that accounts for potential interferences or noise (Shannon, 1948). This Model illustrates communication's linear nature, comprising a sender, encoder, message, channel, decoder, receiver, and noise, and emphasises the significance of clarity, efficient channels, and noise reduction in communication (Shannon, 1948). Originating from information theory, it defines communication as a linear flow:

Sender → Message → Channel → Receiver (with Noise)

The model's straightforwardness and its attention to noise and channel efficiency make it valuable for grasping basic transmission processes. Nonetheless, its chief drawback lies in its limited scope, failing to address the semantic, pragmatic, and social aspects essential for culturally based communication. It overlooks context, culture, and symbolism, and is inadequate for non-verbal or visual-symbolic systems. Furthermore, it assumes a passive receiver, lacking a dialogic element. Consequently, its relevance to the development of the ISVCD Framework is minimal, as it does not adequately address the complexities inherent in Indigenous visual symbolic communication.

2.9.3 Peirce's Triadic Model

Peirce's triadic model of semiotics consists of three components: the representamen, object, and interpretant (see Figure 2.7). The representamen refers to the form or representation of the sign. In Shannon's (1948) communication model, this can be seen as the form sign created by the sender to represent the intended message. The object is

the actual thing that the sign represents. The interpretant is the sign created in the mind of the receiver or perceiver's meaning based on their interpretation. It is essential to understand that the meaning of a sign can be influenced by the sender and receiver's social and cultural background (Eco, 1979). A sign can have different meanings in different social and cultural contexts. Therefore, the interpretation of a sign is not universal but depends on the context in which it is used.

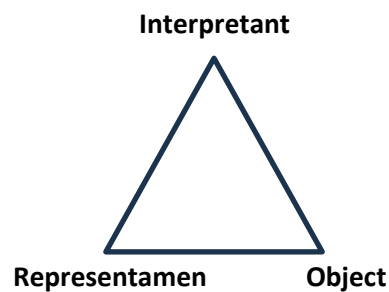


Figure 2.7: Peirce's Triadic Model

This underscores the semiotic relationships and interpretative contexts (Chandler, 2022; Peirce, 1931-1958). This model elucidates how signs are interpreted within their context. It is particularly effective for supporting nuanced interpretations, analysing culturally encoded symbols, and assessing symbolic representation and cultural meanings. Its applicability extends to symbolic and visual language, emphasising meaning-making over mere transmission and fostering culturally rooted interpretations. However, its drawbacks include an abstract quality and a lack of concrete guidance on visual structure or user interaction. Due to its abstract nature, it requires adaptation into a practical design process and does not adequately consider the communication environment or audience dynamics. Regarding its relevance to Indigenous design: it is

notably strong, as it aids in modelling the symbol-meaning-context triads often found in Indigenous communication. This significant model provides essential insights into meaning creation, vital for interpreting Indigenous symbolic representation.

2.9.4 Kress and van Leeuwen's Visual Grammar

Kress and van Leeuwen's (2020) Visual Grammar is a seminal theoretical framework that explains how visual elements function as a structured, rule-governed language, similar to verbal grammar. Visual Grammar offers a way to analyse and understand how images communicate meaning through structured choices, such as composition, colour, framing, gaze, and positioning, based on culturally shared codes. This approach is valuable for analysing how meaning is constructed and conveyed through Indigenous symbols, patterns, and visual narratives. It enables researchers and designers to decode traditional visual practices systematically, preserving their cultural integrity while adapting them for modern communication.

Kress and van Leeuwen's Visual Grammar have strength in providing an analytical approach tailored explicitly to visual communication, allowing for nuanced interpretations of culturally specific visual languages. It is strong in syntactic and semantic visual layout and is culturally adaptable. However, it is primarily analytical rather than generative, which limits its practical application without additional methodological integration. It remains highly relevant and useful for structurally analysing visual motifs, thereby facilitating culturally sensitive design practices within Indigenous contexts.

2.9.5 Chris Sinha's Semiotic Mediation Model

According to Sinha (2004), in his conceptualisation of symbolic construal based on Bühler, K.'s (1990) language theory, symbolic communication emerges from a progression of signal-based interactions to arbitrary, conventional symbols that are culturally defined and socially maintained. Symbols differ from signals or icons because they do not inherently resemble their referents; their meaning is established through social agreement and cultural transmission.

Sinha's model (see Figure 2.8) outlines how symbols function within human communication, emphasising the roles of shared understanding, representation, and interpretation. While highly effective in describing symbolic language from a linguistic and cognitive standpoint, this model requires recontextualisation when applied to Indigenous forms of symbolic communication, which are often non-verbal, deeply spiritual, and rooted in communal life. In the ISVCD Framework, Sinha's model is respectfully adapted to align with Indigenous ways of knowing and transmitting knowledge, offering an important lens for the design of culturally grounded communication systems.

Sinha's (2004) model begins with the premise that communication involves a triadic relationship among expression, representation, and appeal. Expression refers to the outward form of the symbol, such as a spoken word, gesture, or visual element. Representation signifies the intended meaning behind that symbol, grounded in the sender's conceptual understanding. Appeal is the effect the symbol has on the receiver, how it is interpreted, felt, and responded to. These symbolic processes occur within a broader communicative environment that includes a referential situation (the real-world context) and a universe of discourse—the shared cognitive and cultural background that

makes interpretation possible. Also important are the concepts of schematisation (the conceptual structuring of experience) and the figure-ground relationship (how a symbol stands out against its contextual backdrop).

Several key adaptations are necessary when applying this model to Indigenous visual communication. Indigenous symbolic systems are not solely based on linguistic expression or individual cognition; they are embedded in communal knowledge systems, spiritual beliefs, and relationships with land and ancestors. The ISVCD Framework thus reinterprets the components of Sinha's model to reflect these distinct communicative values.

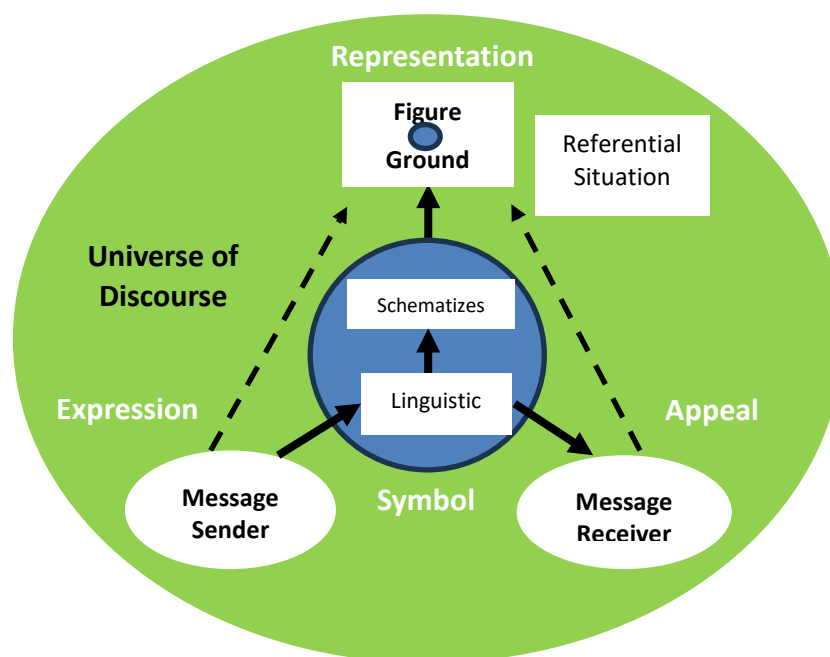


Figure 2.8: Sinha's Semiotic Mediation Model

Sinha (2004) emphasises that symbolic systems are essential to human language and cognition. In Indigenous contexts, they also govern relationships with ancestors, land, and the spiritual world. Thus, symbolic communication in Indigenous cultures is both linguistic and ontological (as discussed in the earlier section), shaping how communities

understand existence, responsibility, and belonging. Therefore, digital systems that aim to capture and preserve these symbols must recognise that symbolic meaning is culturally situated and relational, not merely visual or functional. This perspective is highly relevant for culturally embedded communication systems, as it addresses the social and contextual grounding of meaning.

Some weaknesses need consideration; the matter is complex and may require simplification for design applications. It is theoretical and intricate, necessitating careful simplification for effective practical implementation in visual design processes. It lacks direct visual design guidelines.

2.9.6 Semiotic Ladder Theory by Ronald Stamper

The Semiotic Ladder is a theoretical framework developed by Ronald Stamper in the early 1970s and improved in 1996. It provides a comprehensive approach to designing and utilising information systems. According to Stamper's (1973) approach, all information is conveyed through signs in an information system, which can be analysed using three traditional semiotic branches: syntax, semantics, and pragmatics. Later on, Stamper (1996) follows a Peircean view of semiotics, emphasising the importance of interpreting signs within a cultural context. This follows Peirce's view: "A sign is something which stands to somebody for something in some respect or capacity, in some community or social context" (Stamper, 1996 p.325).

Stamper divided his semiotic ladder into two divisions: a division of Human Information Functions and Information Technology (IT). He added three new levels, "physical world", "empirics", and "social world", to the traditional division of semiotics. The physical world level is related to the hardware, component density, physical distinctions, speed, and signals in the information systems. The "empirics" level concerns

the statistical properties and patterns of sign or signal transmission and storage. This level helps to ensure that the information system is reliable and efficient and that the signs and signals used to convey information are transmitted and stored accurately.

The "social world" level accounts for shared understanding beyond the level of pragmatics. This level concerns how people use signs and signals to communicate and interpret them based on their cultural background, experience, and knowledge. It includes culture, beliefs, expectations, commitments, contracts, and law. Based on the 1996 model, the Stamper Semiotic Ladder is shown in Figure 2.9. Stamper conceptualises six levels of semiotic processing in communication systems, comprising the physical level, empirical level, syntactic level, semantic level, pragmatic level, and social level.

Stamper's idea of applying isomorphism across different systems has been used to develop the semiotic ladder. Isomorphic refers to similarity in structure or form between different semiotic systems or levels. In semiotics, isomorphic describes a relationship where two or more systems share a common structure or pattern, even if the content or specific elements within these systems are different.

This ladder helps assess how holistic and context-sensitive communication models are, especially when dealing with Indigenous symbolic systems, which are rich in pragmatic and social meaning. It integrates lower-level technical processes and higher-order social and cultural dimensions, essential for holistic communication. It is primarily theoretical, thus demanding substantial adaptation for practical design frameworks.

However, it is highly relevant and instrumental in analysing and mapping Indigenous visual symbols. Its holistic structure makes it ideal for grounding an Indigenous visual communication design framework that respects complex cultural norms and socio-pragmatic contexts.

2.9.7 Comparison of Visual Communication and Semiotic Models

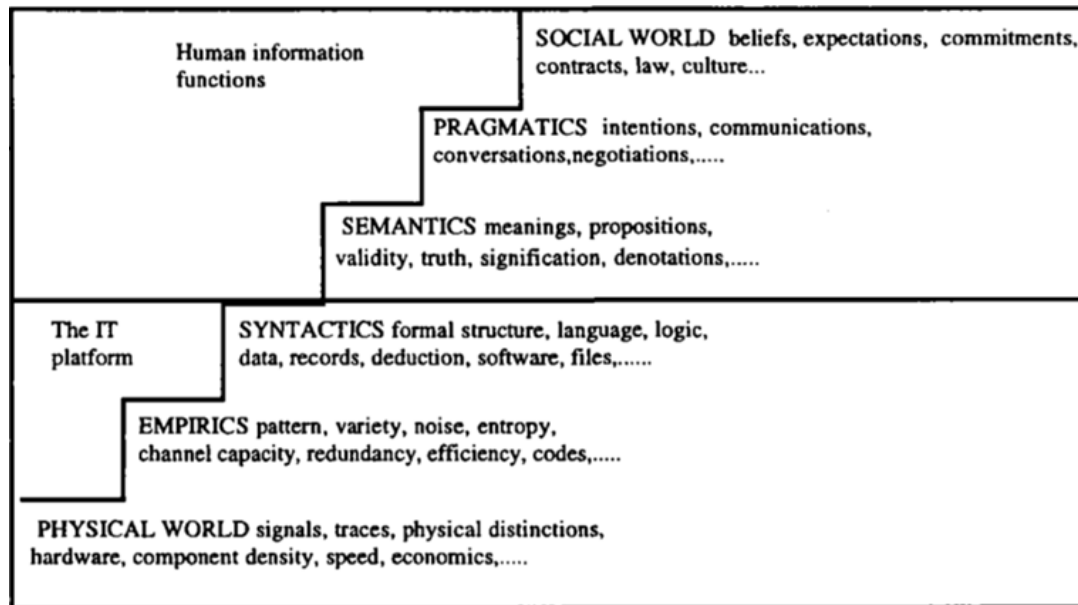


Figure 2.9: The Stamper Semiotic Ladder

A comparison study has been conducted to examine the five visual communication models and semiotic models, and the results are shown in Table 2.9 below:

Table 2.9: Comparison of Visual Communication and Semiotic Models

Model	Strengths	Weaknesses	Relevance to Indigenous Visual Communication
Shannon & Weaver	Focuses on physical and empirical levels (signal/noise/channel efficiency)	No coverage of semantic, pragmatic, or social dimensions	Too narrow for cultural or symbolic communication
Peirce's Triadic Model	Deals with semantic depth via sign-object-interpretant	Doesn't explicitly address social norms or signal structure	Strong in symbol-meaning relation; needs context add-on
Kress & van Leeuwen's Visual Grammar	Strong on syntactic and semantic visual layout; culturally adaptable	Analytical, not inherently generative or pragmatic	Useful for analysing the structure of Indigenous motifs
Sinha's Semiotic Mediation Model	Emphasises contextual action, learning, and meaning negotiation	Complex, needs simplification for design tools	Excellent match for Indigenous learning & transmission

Stamper's Semiotic Ladder	Holistic six-layer model including norms and context; aligns with systems thinking	More theoretical, not directly design-focused	Strongest theoretical foundation for the Indigenous framework
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Most of these visual communication models focus solely on the semantic level, often neglecting the pragmatic and social dimensions vital in Indigenous contexts. Sinha's model and Stamper's ladder successfully reflect the social embeddedness and contextual actions involved in Indigenous communication. While Peirce's model offers a solid foundation in symbolic meaning, it requires pragmatic layering to achieve its full potential. Kress's models, encompassing visual grammar and multimodality, are strong in syntax and visual form but fall short in comprehensively addressing cultural systems. Stamper's ladder is highly relevant; its multi-level structure makes it ideal for the semiotic grounding of an Indigenous visual communication design framework that reflects the complex IKCS and socio-pragmatic contexts across its six levels.

Considering the strengths and weaknesses identified, the ISVCD Framework integrates Stamper's Semiotic Ladder for its comprehensive structure to outline the levels of communication within the ISVCD Framework. Sinha's model was integrated to ensure that dialogue and context are embedded. Peirce and Kress were utilised to address the meaning of symbols and visual arrangement.

2.9.8 Hybrid Visual Communication and Semiotic Framework for ISVCD

The integration of visual communication and semiotic models provides a theoretical foundation for the ISVCD Framework, which can serve as a basis for mapping and analysing Indigenous symbolic systems in a structured and systematic manner. Based on the six semiotic levels of Stamper's Semiotic Ladder as a fundamental structure, Table 2.9 illustrates the hybrid conceptual framework, which serves as the theoretical grounding

for this integration with the Indigenous symbolic visual systems applied in the ISVCD Framework. This offers a theoretical solution for the formalisation of visual communication in the application of Indigenous symbolic visual communication design, as outlined in the research objective of this study.

Combining visual communication with semiotic models forms the theoretical basis for the ISVCD Framework. This framework can be utilised to systematically map and analyse Indigenous symbolic systems. Table 2.10, grounded in the six semiotic levels of Stamper's Semiotic Ladder, illustrates the hybrid conceptual framework that supports this integration with Indigenous symbolic visual systems used in the ISVCD Framework. It provides a theoretical approach for formalising visual communication in Indigenous symbolic visual communication design, as stated in the study's research objective.

Table 2.10: Hybrid Visual Communication and Semiotic Framework for ISVCD

Stamper Semiotic Ladder Theory	Other Visual Communication and Semiotic Models	Adaptation to the Indigenous Communication System	Description
Physical World	Shannon & Weaver's Visual Communication	Physical Aspect	This level examines the tangible aspects of Indigenous symbols, which are the materials used to construct the symbols, such as twigs, leaves, stones etc, and how the shape is formed.
Empiric	Shannon & Weaver's Visual Communication	Usage Patterns	This level focuses on the statistical properties of the symbols, which are the usage patterns and distribution within the community. This level reveals how commonly certain symbols are used. It refers to the categories of Indigenous communications.
Syntactic	Peirce's Triadic Model, Kress & van Leeuwen's Visual Grammar	Symbol Representation	The syntactic level pertains to the visual structural aspects of symbols, such as their arrangement, pattern,

			and forms, as well as the connections between them.
Semantic	Peirce's Triadic Model, Kress & van Leeuwen's Visual Grammar, Sinha's Semiotic Mediation Model	Symbol Meaning	This level deals with the meaning of symbols, exploring what they represent or signify within the Indigenous culture, including symbolic and metaphorical meanings. This level is crucial in deciphering the underlying messages, historical significance, and the symbolic narratives embedded in the symbols.
Pragmatic	Peirce's Triadic Model, Sinha's Semiotic Mediation Model	Symbol Usage	The pragmatic level focuses on how symbols are used in communication, considering the context, the intentions behind their use, and how members of the culture interpret them. Pragmatic analysis illuminates the functional aspects of symbols in social interactions, rituals, storytelling, and other cultural practices.
Social World	Sinha's Semiotic Mediation Model	Indigenous Values Involved	This level helps in understanding the role of symbols in maintaining and transmitting cultural heritage, societal values, and collective memory. Examines the symbols within the broader social, cultural, and ethical context, including their role in expressing cultural values, norms, beliefs, and identity.

2.10 Chapter Summary

The literature review has uncovered some theoretical gaps that require careful consideration. The research paradigm utilised in this study is based on Indigenous knowledge, values, and worldviews. It is important to approach this paradigm with respect and responsibility while prioritising the community's needs by thoroughly understanding their culture and protocols. The Indigenous Knowledge and Communication System (IKCS) under investigation is complex and dynamic,

necessitating careful attention. The methodology is particularly challenging because the Indigenous worldview and knowledge domain differ from conventional models, rendering current frameworks and models unsuitable. To model this intricate system, a holistic and comprehensive framework is required. The use of ad-hoc models, frameworks, or even the design of symbols like emojis poses a risk to the Indigenous cultural heritage and identity. A democratising design approach involving the Indigenous community's participation can provide a solution where community members co-create their communication system, which they can own and utilise. The research project is multidisciplinary, encompassing various domains of study, including Indigenous research, cultural values, semiotics in visual communication, and TRIZ in technical systems, thereby adding to its complexity. Nevertheless, the theoretical foundation of the proposed ISVCD Framework is synthesised and established in this chapter, laying the groundwork for the development of an integrated visual design framework for Indigenous people.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology adopted for the development and implementation of the Indigenous Symbolic Visual Communication Design (ISVCD) Framework. It provides the philosophical, theoretical, and procedural foundations guiding the proposed framework's investigation, construction, and evaluation.

The chapter begins with the research philosophy, positioning the study within an interpretivism with a pragmatic orientation that values Indigenous knowledge and systematic design solutions. The research design employs a design-led methodology, qualitative inquiry, participatory engagement, and framework construction.

Key to this chapter is the framework development process, which incorporates a hybrid visual communication and semiotic framework, integrated with TRIZ's Law of System Completeness for practical design guidance in Indigenous visual communication design.

The data collection strategy is presented next, detailing methods to gather insights from Indigenous community elders, youths, and cultural artefacts. This is followed by data analysis to interpret symbolic structures and community input related to the framework. This is followed by an explanation of the validation strategy used to evaluate the framework and a discussion of the methodological limitations encountered during the study.

Lastly, ethical considerations are addressed, including community engagement, cultural sensitivity, informed consent, and reciprocal sharing of outcomes with Indigenous collaborators. These are to ensure that the research is both epistemologically respectful and practically robust, enabling the development of a framework that supports the authentic communication of Indigenous symbolic language through visual communication design.

3.2 Research Philosophy and Approach

This multidisciplinary research's philosophical grounding is based on interpretivism, guided by the Indigenous Research Paradigm (as discussed in section 2.3) and operationalised through a pragmatic approach. It provided the ontological, epistemological, and methodological coherence required to guide the development of the ISVCD Framework. This aims to connect culturally embedded meaning systems with practical design applications (Creswell et al., 2006; Denzin & Lincoln, 2002) while addressing the sensitivity of Indigenous knowledge.

Interpretivism posits that knowledge is constructed through lived experiences and shaped by cultural, historical, and social contexts (Guba & Lincoln, 1985). In contrast to positivism, which seeks generalisable laws, interpretivism aims to understand the meanings individuals or communities ascribe to their world. This philosophical stance is suited to research involving symbolic systems, visual languages, and cultural narratives, where interpretation, rather than measurement, is the core objective. This study focuses on uncovering the culturally encoded meanings in Indigenous jungle-based visual symbols and translating them into a digital context. This process requires deep contextual understanding, reflexivity, and relational engagement, essential elements of interpretive inquiry.

However, while interpretivism provides deep insights into Indigenous visual communication's cultural and semiotic richness, it lacks the procedural tools to structure these insights into a coherent and usable design methodology. Hence, a pragmatic approach becomes crucial, emphasising practical outcomes and the utility of knowledge in guiding action. This provides epistemological justification for integrating TRIZ's Law of System Completeness, a theory of systematic innovation initially developed within engineering, as a means to operationalise the conceptual framework (Altshuller & Altov, 1996; Gadd, 2011). In this context, TRIZ is not externally imposed but metaphorically adapted to support Indigenous principles of holism, interconnectedness, and systemic interdependence, as posited in the Indigenous Research Paradigm. It provided the theoretical foundation for the implementation strategy of the ISVCD Framework.

This dual philosophical positioning enables the research to remain culturally grounded and functionally oriented. It facilitates the creation of a design framework that respects Indigenous knowledge systems while providing systematic implementation guidance for designers in the meaningful application of symbolic visual languages (Battiste & Youngblood, 2000; Nelson & Stolterman, 2014). The resulting methodology is design-led, collaborative, and transformative, aiming not only to document Indigenous symbols but also to ensure their continued relevance and transmission in contemporary cultural and communication contexts.

3.3 Participatory Research

This research follows the decolonisation proposition put forth by Smith (2021) and adopts the participatory research approach. Berkes et al. (2001) defined the term participatory as generally referring to including local groups and other stakeholders in the decision-making process. A review of the Indigenous research methods conducted by

Drawson et al. (2017) shows that participatory research is considered an acceptable approach to Indigenous research. Participatory research in this research is a collaborative methodology for conducting research with Indigenous communities, where the community members actively participate in the research process as partners rather than just subjects of study. The principle of the etic-emic approach (as discussed in Section 2.5.3) was applied in the Indigenous visual symbols capture and digital design process whereby the designer acts as a facilitator to guide the local community in constructing and contextualising the action and its actual meaning, cooperating to solve a real-world problem in their specific context. This methodology recognises the importance of Indigenous knowledge, values, and perspectives and seeks to empower Indigenous communities in the research process. As discussed in Section 2.3.3, ethical engagement, cultural sensitivity and community protocol were followed.

The participatory research approach also goes in line with the ICT4D 3.0 concept. ICT4D 3.0, introduced by Bon and Akkermans (2014) represents the latest phase of Information and Communication Technology for Development (ICT4D). This research project aims to bridge the digital divide between Indigenous and exogenous communities while preserving and promoting Indigenous knowledge and values. In order to achieve this objective, it is crucial to introduce information communication technology to Indigenous communities. However, it is important to be vigilant, attentive, and respectful of Indigenous wisdom while implementing and developing ICT applications. The traditional top-down approach to intervention in Indigenous communities should be avoided as it may result in social change in a deterministic way (Kulathuramaiyer, 2019). ICT4D 3.0 moves beyond traditional technology-centric thinking toward more participation by stakeholders. ICT4D 3.0 is an open-ended process and not centrally

controlled. Three key concepts in ICT4D 3.0 are collaboration, adaptation, and iteration. Collaboration refers to letting the local community set the goals and objectives of a system and co-create in close collaboration with local users and technologies that are fully adapted to the context. Adaptation refers to adapting technologies to the context and conditions of the local community, which is a crucial factor for successful innovation. Iteration refers to the cyclical and non-linear repetition process to generate preferable outcomes. Following are the grounded principles from both participatory research and ICT4D 3.0 that are used as guiding methodological principles in this research:

1. Recognise and respect the Indigenous community as a unity of identity.
2. Research builds on the strengths and resources of the Indigenous community.
3. Facilitates collaboration with the Indigenous community in all phases of the research.
4. Adaptation of available technologies and methods which can be contextualised with the needs of the Indigenous community.
5. Involves cyclical and iterative processes with the Indigenous community to achieve desirable outcomes.
6. Disseminate findings and knowledge gained to the Indigenous community.

3.4 Research Design

This research is designed into three phases associated with the research questions and objectives. In phase one, the research problem and gaps are identified, leading to the formalisation of Indigenous visual communication of the ISVCD Framework. Phase two involves identifying the critical factors required to facilitate the development of the ISVCD Framework. In phase three, the developed framework is verified and validated.

The research design phases that correspond to the research questions and objectives are presented in Table 3.1. In contrast, the Research Design flow diagram illustrates the entire research process flow, as shown in Figure 3.1.

Table 3.1: Research Design Phases to Answer Research Questions and Objectives

Research Phases	Research Questions	Research Objectives
Phase One	How do we formalise visual communication in the application to Indigenous symbolic visual communication design?	To formulate a framework for the application of visual communication in Indigenous symbolic visual communication design
Phase Two	How can the Indigenous Symbolic Visual Communication Design (ISVCD) Framework be implemented in an Indigenous visual language?	To formulate a Indigenous Symbolic Visual Communication Design (ISVCD) Framework implementation strategy involving a case study on a selected Indigenous visual language.
Phase Three	How to validate the formulated Indigenous Symbolic Visual Communication Design (ISVCD) Framework?	To develop validation methods for the Indigenous Symbolic Visual Communication Design (ISVCD) Framework in terms symbol representation and the preservation of Indigenous knowledge and core values.

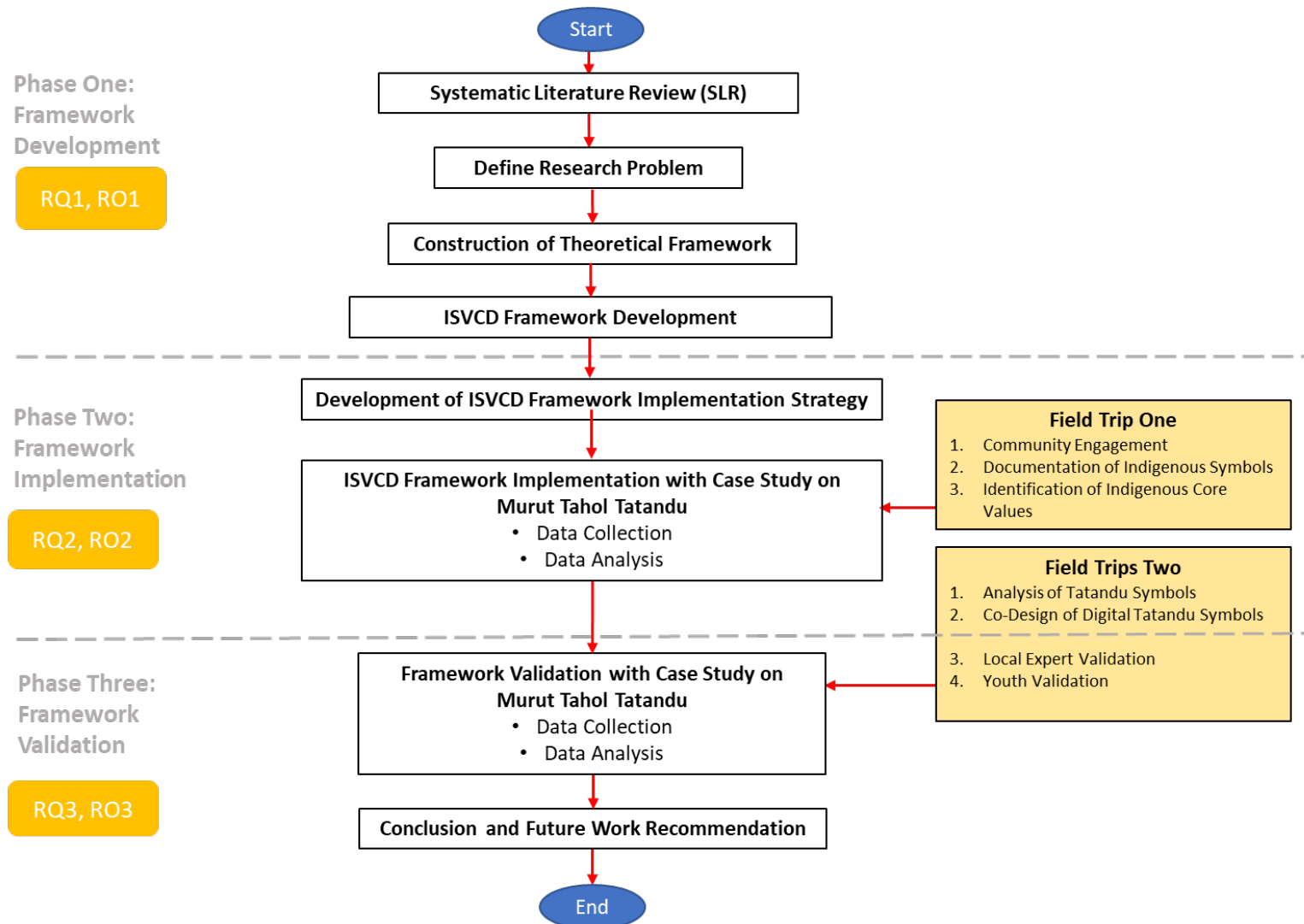


Figure 3.1: Research Design Flow Diagram

3.5 Phase One: Framework Development

In research design, the first phase involves four steps, which include a systematic literature review (SLR), defining the research problem, constructing the theoretical framework, and developing the ISVCD Framework. This phase began with a Systematic Literature Review (SLR) using a snowballing approach to collect and identify current literature research articles, aiming to understand better the research problem, gaps, and current research phenomena relevant to the topic, and define the research problem. The SLR also established a theoretical framework for this research project, outlining the scope of the multidisciplinary field of study and its related theoretical basis. This formed the theoretical foundation of the ISVCD framework. The final step in phase one is developing the proposed ISVCD Framework.

3.5.1 Systematic Literature Review (SLR) with Snowballing Approach

Phase one of the research design involves conducting a Systematic Literature Review (SLR) using the snowballing approach to identify research articles related to this project. The SLR was conducted according to Kitchenham's (2009) Guidelines, the SLR process includes (i) defining the scope and aims of the review, (ii) developing a review protocol, (iii) searching key terms in selected databases, (iv) selecting articles based on inclusion and exclusion criteria, (v) assessing the included articles; (vi) extracting and synthesising data; and (vii) summarising findings.

The snowballing approach was used as a complement to enhance the Systematic Literature Review (SLR). Snowballing refers to using a paper's reference list or citations to identify additional papers (Wohlin, 2014). By systematically looking at where papers are referenced and cited, snowballing can help to identify relevant studies. This method involves forward snowballing by exploring articles cited by a key article and backwards

snowballing by going through references within a key article. After selecting primary studies from the SLR search, examine the references and citations in articles to identify any additional relevant studies. It helps reveal literature not found in the initial SLR database search.

3.5.2 Defining the Research Problem

The Systematic Literature Review (SLR) conducted in this research has identified the various research issues outlined initially in Chapter 1. These issues were grouped into three problem statements. This organised approach clarified the research challenges and significantly enhanced the overall systematic framework of the research process. Based on the three problem statements, three research questions and corresponding research objectives were formulated, and a clear hypothesis was established. Details were presented in Chapter 1.

3.5.3 Development of the Theoretical Framework

Developing a theoretical framework is vital in any research endeavour, as it lays the groundwork and guides the methodology and analysis. This entails a thorough review of pertinent literature to identify key concepts and theories from previous studies. The theoretical framework underpins the research by summarising and synthesising concepts and theories to establish a robust theoretical foundation.

The development of a theoretical framework comprises several important steps. Initially, a comprehensive literature review is undertaken to grasp the current state of research in the domain, pinpointing vital concepts and theories pertinent to the research question. Subsequently, the literature is analysed and synthesised to construct a

conceptual framework that elucidates the relationships among critical concepts and theories and their relevance to the research question.

Ultimately, the theoretical framework is formulated based on the research question. This phase involves organising the essential concepts and theories into a coherent structure that serves as a theoretical underpinning for the research. The theoretical framework results from a systematic literature review (SLR) and is detailed in Chapter 2 of the research report.

Developing a theoretical framework is essential for any research project. It provides a structure that navigates the research methodology and analysis while synthesising key concepts and theories to create a theoretical foundation for the research. The process involves a comprehensive review of the existing literature, analysing and synthesising the material, and building the theoretical framework based on the research question.

3.5.4 ISVCD Framework Development

Adopting definitions of system design from various literature, a framework in system design defines the design as a synthesis process that utilises generic components at various levels of abstraction to structure knowledge required for executing a design. This framework represents the reusable properties of the entire system or a part of it by using a set of abstract classes and determining how their instances interact. (Alberts et al., 1992; Blizzard & Klotz, 2012; Garlan & Notkin, 1991).

As discussed in Chapter 2, despite the Indigenous Knowledge Communication System's (IKCS) rich cultural and symbolic foundations, current visual communication theories do not adequately reflect the epistemological, semiotic, and contextual aspects

of Indigenous symbolic expression. While frameworks like Peirce's triadic sign model, Stamper's semiotic ladder, and Sinha's semiotic mediation present valuable analytical tools for understanding meaning and representation, they are primarily rooted in Western communication and literacy paradigms. Additionally, these models do not provide structured implementation strategies for integrating these insights into a design process relevant to Indigenous contexts. Align with the problem statements in Chapter 1; this is a gap in visual communication frameworks' conceptual and practical dimensions, particularly in their ability to assist designers in integrating Indigenous symbolic language into functional, communicative design outputs. This gap necessitates developing a framework rooted in Indigenous communities that is systematically implementable to enable a meaningful translation of Indigenous symbolic knowledge into contemporary visual communication without eroding its context.

Figure 3.2 illustrates the development process of the ISVCD Framework, primarily constructed based on three fundamental theoretical foundations derived from the systematic literature review and theoretical framework presented in the initial part of this research:

1. Hybrid Visual Communication and Semiotic Framework: Theoretical Grounding
2. TRIZ Law of System Completeness: Practical and Structural Logic
3. Indigenous Research Paradigm: Indigenous Rooted

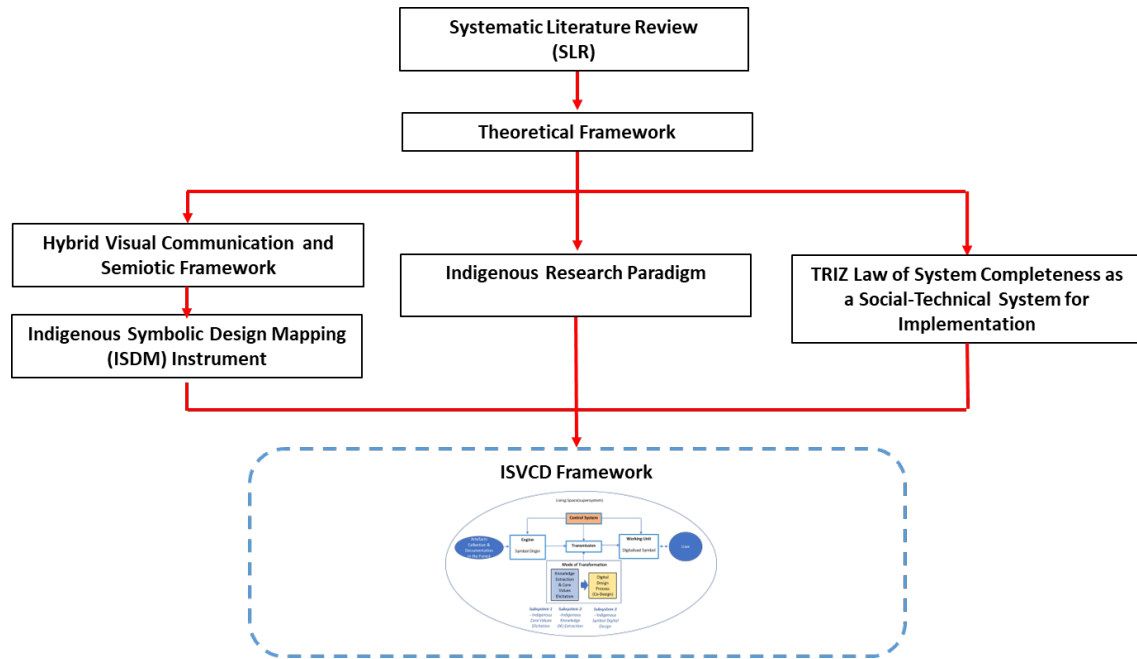


Figure 3.2: The Development Process of the ISVCD Framework

3.5.4.1 Hybrid Visual Communication and Semiotic Framework

This component represents the conceptual depth of the proposed ISVCD Framework. The formalised Indigenous visual communication system integrates established visual communication and semiotic models. It enables the codification of Indigenous symbolic communication into systematic and structural attributes that provide consistent application and empirical analysis.

As discussed in section 2.10.8, the hybrid conceptual framework is a constitutive substructure within the ISVCD Framework, mediating visual semiotics across its components. The hybrid framework was constructed by synthesising four interrelated semiotic and visual communication models: Peirce's Triadic Model of the Sign, Sinha's Semiotic Mediation Model, Kress and van Leeuwen's Visual Grammar, and Stamper's

Semiotic Ladder. Stamper's Semiotic Ladder Model Stamper (Liu et al., 2018; Stamper, 1996) offers a multi-level, hierarchical perspective on communication, linking the abstract cultural values and epistemologies of Indigenous knowledge systems (social and pragmatic levels) to their tangible representations in visual design (semantic, syntactic, empirical, and physical levels). This structure enables the framework to encapsulate Indigenous visual communication, from intangible cultural logic and worldviews to concrete symbolic forms and graphic expressions.

3.5.4.2 Indigenous Symbolic Design Mapping (ISDM) Instrument

Derived from the Hybrid Visual Communication and Semiotic Framework, the Indigenous Symbolic Design Mapping (ISDM) Instrument is a diagnostic tool for assessing Indigenous symbols' formal, semantic, and cultural aspects. It bridges theory and application by enabling consistent evaluation and mapping of symbols within design processes.

To ensure the successful digitisation of Indigenous visual symbols, it is important to first determine the key attributes of these symbols through semiotic analysis. These attributes will serve as the basis for evaluating and validating the effectiveness of the digitalised versions of these symbols. Visual Communication and Semiotics models are a powerful tool for analysing and evaluating symbols and their design in the HCI context (Islam, 2011; Islam & Bouwman, 2016; Qiang & Fei, 2016). As discussed in the previous section, the grounding of Stamper's Semiotic Ladder and other visual communication models offers a more in-depth understanding of symbols in their social and cultural contexts. It provided a strong theoretical grounding to formalise the visual communication for the design of Indigenous symbols. However, an analytical tool is needed. In this section, attributes are identified through selected semiotic levels from the

previous section, which will be used to conduct a summative evaluation of the digitalised Indigenous symbols using the ISVCD Framework. This part of the validation process ensures the digitalised symbols maintain their cultural significance and effectively convey their intended meaning and values.

Three levels of semiotics are employed to test the accuracy of the meaning and values transmitted in digitalised symbols: Syntactic, Semantic, and Indigenous values, adapted from the grounded theoretical foundation of the ISVCD Framework. These three levels were selected because only summative evaluation will be carried out.

The Syntactic level deals with the representation of design features in digital symbols and includes attributes such as familiarity, representation, material, intuitiveness, and colour. On the other hand, the Semantic level focuses on the meaning of the symbols and evaluates whether or not the conveyed meaning is accurate. Lastly, the Indigenous Value level examines the symbols within the context of the Indigenous community. It determines if any associated core values can be transmitted and expressed in action or conversation triggered by the symbols. Table 3.2 details the identified attributes for the semiotic analysis model in this research.

Table 3.2: Indigenous Symbolic Design Mapping (ISDM) Instrument

Semiotic Division	Description	Attributes
Syntactic	The Syntactic level deals with the representation of design features in the digitalised symbols	Familiarity – the recognition of the symbols by the targeted user.
		Representation –the visual construction of the symbols – its lines, shapes, and the way in which these elements are designed digitally.
		Material – the use of natural objects such as leaves, sticks, stones, etc. Can the targeted user relate the design to the natural materials in the forest?
		Colour – Cultural colour. How the use of colours and their combinations are processed and understood by the targeted user.
Semantic	The Semantic level, on the other hand, focuses on the meaning of the symbols and evaluates whether or not the conveyed meaning is accurate	Interpretation Accuracy - Accurate, moderate, conflicting, erroneous, incapable
Indigenous Values Involved	Indigenous Value level examines the symbols within the context of the Indigenous community and determines if any associated core values can be transmitted and expressed in action or conversation triggered by the symbols	Indigenous Values – Indigenous core values in the form of value indicator statements.

Familiarity refers to how recognisable a symbol is to its intended audience. At the syntactic level, familiarity involves the symbol's arrangement and design, making it easily recognisable. For symbols design, this means using shapes, forms, and references that are commonly understood.

Representation deals with how a symbol encapsulates the concept it is meant to convey. On the syntactic level, representation is about the visual construction of the symbols, their lines, shapes, and how these elements are designed digitally.

Materials examine the use of natural objects, such as leaves, sticks, and stones, extracted from the physical aspect of the original Indigenous symbols in the forest. Can the targeted user relate the design to those natural materials in the forest? At the syntactic level, this involves using visual effects in design to simulate the actual symbols.

Colour plays a crucial role in the syntactic analysis of symbol design. It can be used to attract attention. The use of colour at the syntactic level involves understanding how different colours and their combinations are processed and understood by the viewer and how they contribute to the overall readability and recognition of the symbol.

The semantic level deals with the meaning of symbols, exploring what they represent or signify within the Indigenous culture, including symbolic and metaphorical meanings. This level is crucial in deciphering the underlying messages, historical significance, and the symbolic narratives embedded in the symbols. The three scores, correct, partially correct, and incorrect, will be used to evaluate symbol design. Based on Zender's (Zender, 2006; Zender & Mejía, 2013) evaluation method for icon design, the three scores are used to measure the semantic level for the following reasons: (i) These scores provide a clear and straightforward way to differentiate between varying levels of understanding of the icons. It can precisely gauge how well each symbol communicates its intended message to the subjects by categorising responses into these three distinct groups. (ii) The scoring system supports the combination of qualitative analysis by identifying which aspects of a symbol are commonly misunderstood or only partially

understood. This insight is valuable in refining symbol design to enhance clarity and reduce ambiguity.

The level of Indigenous cultural values helps to understand the role of symbols in preserving and passing on cultural heritage, societal values, and collective memory. It examines the symbols in a broader social, cultural, and ethical context, including their significance in expressing cultural values, norms, beliefs, and identity. To analyse the Indigenous core values that are engaged in the action and conversation triggered by these symbols, qualitative thematic analysis and value indicators mentioned in Section 3.6.2 will be applied.

According to the value-assign approach proposed by Boztepe (2007), a symbol's value is subjective and comes from the user's experience rather than the symbol itself. This means that a symbol cannot inherently possess value. Instead, value lies in the message that the symbols communicate. While physical form is important in enabling communication, it cannot be a source of value. Therefore, the value indication process will focus on the conversation and open-ended interviews triggered by symbols to identify the shared values that occur rather than on the objective embedding of individual symbols.

3.5.4.3 Integration of TRIZ Law of System Completeness

While the hybrid conceptual framework offers profound theoretical conceptual grounding, it lacks a mechanism for systematic implementation. To address this (as discussed in section 2.5), the TRIZ Law of System Completeness was integrated as a structural design logic that organises the framework into a complete, functional design system.

Structured visual design and practical logic based on the TRIZ Law of System Completeness provide a systematic innovation approach that enables designers to move from abstract cultural principles to coherent, structured, context-sensitive visual communication practices. This allows symbolic meanings to be preserved and digitalised visually from Indigenous symbols with abstract knowledge and values to tangible design outputs.

3.5.4.4 Integration with Indigenous Research Paradigm

As discussed in section 2.4, the development of the ISVCD Framework was also guided by the Indigenous Research Paradigm (Wilson, 2001, 2008), which emphasises relational ontology, contextual epistemology, and communal accountability. Within this paradigm, knowledge is not considered an abstract, objective entity but is deeply rooted in relationships between people, environment, spirit, and ancestors. As such, the ISVCD Framework has the following methodological focus:

1. Relational accountability: honouring relationships with community members and co-creators of knowledge.
2. Reciprocity: ensuring the research benefits the community and supports cultural continuity.
3. Contextual validity: embedding Indigenous ways of knowing into the framework's theoretical and practical aspects.

This grounding ensures that the proposed ISVCD Framework is rooted in Indigenous principles. It is applied to Indigenous knowledge, actively engages with, and is co-designed by the Indigenous community. They own the outcome of the design artefact and reflect Indigenous perspectives on what constitutes meaningful communication and design.

3.5.5 The ISVCD Framework

Figure 3.3 shows the fully developed Indigenous Symbolic Visual Communication Design (ISVCD) Framework. The Indigenous Visual Communication Design (ISVCD) Framework can be defined as a formalised, multi-dimensional design system that translates Indigenous symbolic communication systems into structured visual design practices. This framework guides the digitisation process of Indigenous visual symbols into symbols compatible with instant messaging systems (IMS) while incorporating Indigenous knowledge and core values.

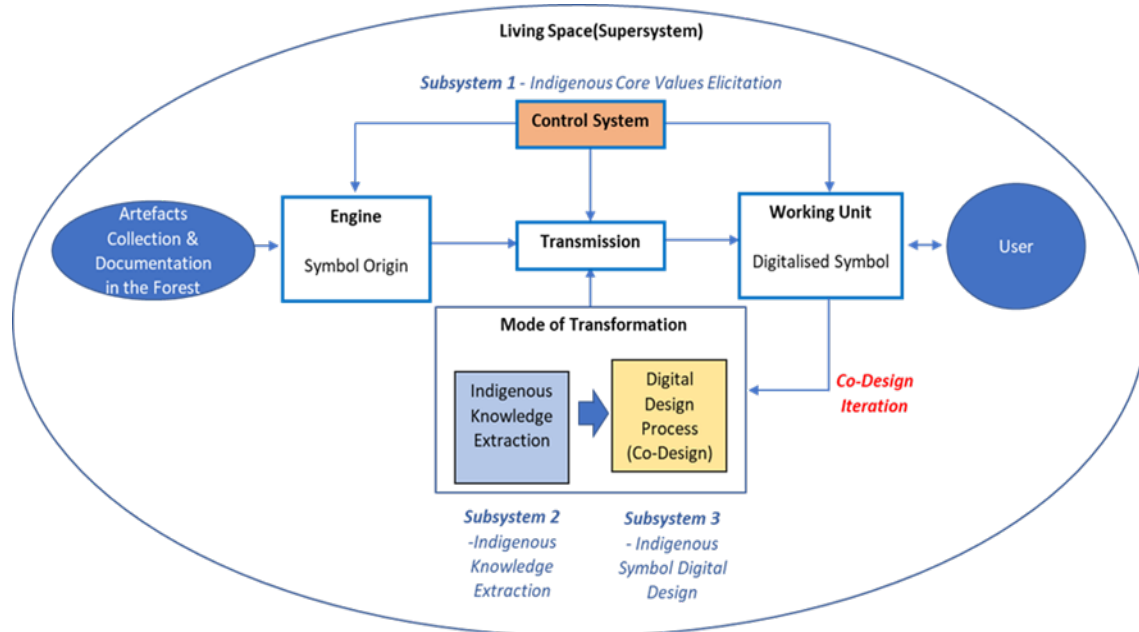


Figure 3.3: The ISVCD Framework

The framework consists of five major components adopted from the metaphorical mapping of the TRIZ Law of System Completeness in Table 2.2. There are: Engine (Symbol Origin), Transmission (Mode of Transformation), Working Unit (Digitalised Symbol), Control System (Community Validation and Feedback), and Supersystem (Working Environment). Engine unit refers to the original symbolic artefacts, materials,

gestures, knowledge, and expression of core values, which are the design input to the design system. The transmission unit refers to the mode of transformation, which is the essential part of the design system where the design process digitalises the original Indigenous symbolic artefacts into a digital form, incorporating integrated Indigenous knowledge and core values. The transmission unit transforms abstract and intangible Indigenous knowledge and core values into structured digital information. The Hybrid Visual Communication and Semiotic Framework laid the foundation for semiotic structure analysis and mapping in this context. This analysis and mapping of their semiotic structure includes semantic, syntactic, empirical, and physical levels, which are represented as semiotic attributes, allowing for the extraction of Indigenous knowledge embedded in these symbols. There are two subsystems nested under the transmission unit, which are:

1. Subsystem Two: Indigenous Knowledge Extraction
2. Subsystem Three: Indigenous Symbol Digital Design, which involved a co-design process.

The working unit refers to the design outcome, the co-designed digital symbols compatible with IMS usage. The control system refers to the community validation and feedback whereby the community engagement, community elders, and youths act as the authority of knowledge and core values keepers that govern the whole design system process. The control system also constitutes the core values and control policies. These values are paramount in determining messages' appropriate encoding and decoding, as discovered in the systematic literature review. For instance, the study of Indigenous values in this research highlights their significant role in ensuring that the transmission of messages is correctly interpreted. Subsystem one, the Indigenous Core Value Elicitation

System, is integrated into the control system. It provides functionality to elicit Indigenous core values. The supersystem refers to the Indigenous worldview, lifestyle and natural environment where visual communication symbols are contextualised and practised.

The framework demonstrated how original artefacts were collected and documented, highlighting Indigenous symbols found in the forest. These symbols will contribute to the design system for the end user, the Indigenous youth in this context.

3.6 Phase Two: Framework Implementation

The second phase of the research design involved the development of an implementation strategy for the developed ISVCD Framework. It requires practical application to assess its validity, and cultural authenticity. Implementing it in real-world scenarios, especially through a participatory case study with Indigenous communities, is vital for connecting theoretical insights with practical outcomes (Smith, 2021; Wilson, 2008). This method aligns with the advice of Chilisa (2019) and Kovach (2021a), who support Indigenous research approaches that emphasise community involvement, alignment of knowledge systems, and ethical co-construction of knowledge. As a result, a well-organised implementation strategy, focused on community collaboration and systematic validation, is crucial for effectively transforming Indigenous symbolic systems into culturally respectful and functionally effective digital visual communication outputs.

3.6.1 Framework Implementation Strategy Steps

The primary purpose of the implementation strategy is to operationalise and validate the ISVCD Framework by systematically applying it to digitise and preserve the symbolic visual language of a selected Indigenous community. Through practical implementation, the research seeks to demonstrate its effectiveness in guiding a

meaningful design process. The strategy aims to ensure the framework's alignment with Indigenous epistemologies and cultural integrity, offering a validated, practical, and culturally authentic method to guide future Indigenous visual communication projects. The implementation strategy unfolds in four interconnected steps based on the ISVCD Framework structure. Details of the implementation strategy is shown in Table 3.3.

3.6.1.1 Step One: Preliminary Study

The preliminary study is the foundational step involving secondary data collection through comprehensive literature reviews and internet research. Key activities include identifying the Indigenous community of interest, their visual language characteristics, and geographical location. This is a preparatory step prior to implementation. Conducting thorough research helps better understand the visual language and the community.

3.6.1.2 Step Two: Indigenous Community Engagement

This step emphasises building meaningful relationships with the community through semi-structured interviews and participatory interactions. Researchers identify key cultural leaders and elderly experts, build trust, and secure consent for collaborative research.

3.6.1.3 Step Three: Framework Application for Digital Design

This is a crucial step in the implementation process, which focuses on practically applying the ISVCD Framework. This refers to the ISVCD Framework diagram in Figure 3.3. This stage includes structural procedures within the ISVCD Framework, starting with the collection and documentation of artefacts and extending to the elicitation of symbols in Engine Components (Symbol Origin), Transmission Components (Mode of Transformation), Working Unit (Digitalised Symbol), and the Control System

(Community Validation and Feedback). Moreover, it involves implementing the three subsystems embedded within the Transmission Component (details will be outlined separately in sections 3.6.2, 3.6.3, and 3.6.4). The framework application for digital design generally entails a comprehensive collection and documentation of Indigenous visual symbols and their cultural contexts through visual data documentation and open-ended interviews. This encompasses creating a symbol inventory, extracting Indigenous core values using thematic analysis, semiotic mapping of symbols, and collaboratively co-designing digital symbols with the community. Iterative co-design processes guarantee the symbols' cultural relevance and accuracy, leading to a validated digital symbol vocabulary. It also includes validation steps within the control system and validation of the working unit. Implementation details of the validation process will be further detailed in section 3.7.

3.6.1.4 Step Four: Framework Refinement and Future Work

This final stage involves evaluating the implemented framework to identify its strengths and limitations, as detailed in a comprehensive research report. Researchers propose refinements based on community feedback and validation outcomes to enhance the framework's adaptability. Recommendations also include extending the framework's application to other Indigenous communities or languages to broaden its impact and validation.

Table 3.3: Implementation Strategy for the ISVCD Framework

Implementation Steps	Framework Components	Methods	Activities
1. Preliminary Study		1. Secondary data Collection from Literature Review 2. Internet Study	1. Indigenous community and visual language identification 2. Location identification
2. Indigenous Community Engagement		1. Semi-Structured Interview with Indigenous Local Experts	1. Conduct a preliminary contact with the Indigenous community. 2. Identification of key community leaders, the elderly, and cultural experts. 3. Building relationships and trust with the Indigenous community 4. Obtain consent and community approval for a participatory research corporation.
3. Framework Application for Digital Design	Artefacts Collection and Documentation	1. Visual Data Documentation 2. Interview with Indigenous Experts	1. Identify and document community visual symbols, meanings, and cultural contexts. 2. Taking photo images to document the symbol in its original form 3. Video and audio recording of the interview.
	Symbol Elicitation (Engine)	1. Visual Data Documentation	1. Creating fieldnotes. 2. Photo image record and storage. 3. Transcribing of the interview video and audio data.
	Mode of Transformation (Transmission)		
	Subsystem One: Indigenous Core Value Elicitation	1. Interview Transcribing. 2. Thematic Analysis 3. Value Indicator Development	1. Identification of Indigenous core values 2. Creating the Indigenous core value indicator reference list.
	Subsystem Two: Indigenous	Analysis and Mapping with Semiotic Attributes	1. Creating an Indigenous symbol inventory involves a semiotic structure and mapping.

	Knowledge Extraction		
	Subsystem Three: Indigenous Digital Symbol Co-Design	Co-Design of Digital Symbols with Indigenous Community	1. Designing Indigenous digital symbols 2. Creating an Indigenous digital symbol vocabulary set
	Iterative Co-Design (Working Unit)	Modify the Designs Based on Indigenous Local Expert Feedback	1. Finalising the Indigenous Digital Symbol Vocabulary Set
	Community Validation and Feedback (Control System)	Framework Validation Triangulation Model	1. Expert Review for Symbol and Inventory Accuracy 2. Confusion Matrix for Instrument Validity 3. Thematic Core Value Comparison
4. Framework Refinement and Future Work			1. Identify framework strengths and limitations through the research report. 2. Proposal for framework refinement and application to another Indigenous language in future.

3.6.2 Subsystem One: Indigenous Core Value Elicitation

In this research, the Value-Based Indicator Framework developed by Burford, Hoover, Dahl, and Harder (2015) and Harder and Burford (2018), discussed in Section 2.8.3, was adapted to identify and highlight the core values of the Indigenous community within the context of activities involving the use of Indigenous symbols. Identifying and highlighting these core values is a crucial part of the validation phase of this research project. This serves the research's third objective, which is to validate the efficacy of the ISVCD Framework in sustaining Indigenous values, with the Indigenous core values acting as a key indicator for this purpose. The ideal method for identifying Indigenous values would be to elicit and validate them at the local level, thereby capturing the shared meanings of Indigenous people within a designated activity context through value indicators and a participatory research approach that engages local communities.

Identifying Indigenous core values was conducted according to the principles of the five steps of value-indicator development discussed in Section 2.7. Figure 3.4 shows the recommended research methods mapped to the value-indicator development steps as guidance for implementing subsystem one.

Research Process	Methods
Elicitation ↓	Unstructured Interview ↓
Using Trigger Statements ↓	Prior Indigenous Core Values from SLR ↓
Developing a Shared Vocabulary ↓	Thematic Analysis ↓
Organising Towards Articulating Underpinning Values ↓	Inclusion and Exclusion Process ↓
Develop Value Indicators	Record of Value Indicator

Figure 3.4: Mapping of Value-Indicator Development Steps with Research Methods

3.6.3 Subsystem Two: Indigenous Knowledge Extraction

Subsystem two is a critical step in uncovering Indigenous knowledge embedded in the Indigenous symbols. The objective is to transform unstructured and implicit information into an organised and explicit format that can be easily examined, stored, represented, and utilised for various purposes. Indigenous symbols hold valuable knowledge that is inherently embedded and contextualised in the activities they represent. Field trip data collection activities are carried out to extract and present this knowledge in a structured way, such as the semi-structured interview with open-ended questions with Indigenous experts and photography documentation of symbols in the forest. The Indigenous symbols were analysed and mapped using the ISDM Instrument. Creating an Indigenous symbol inventory involves a semiotic structure and mapping. Adapting the

concept of the TRIZ Law of System Completeness model, Figure 3.5 demonstrates the knowledge extraction process.

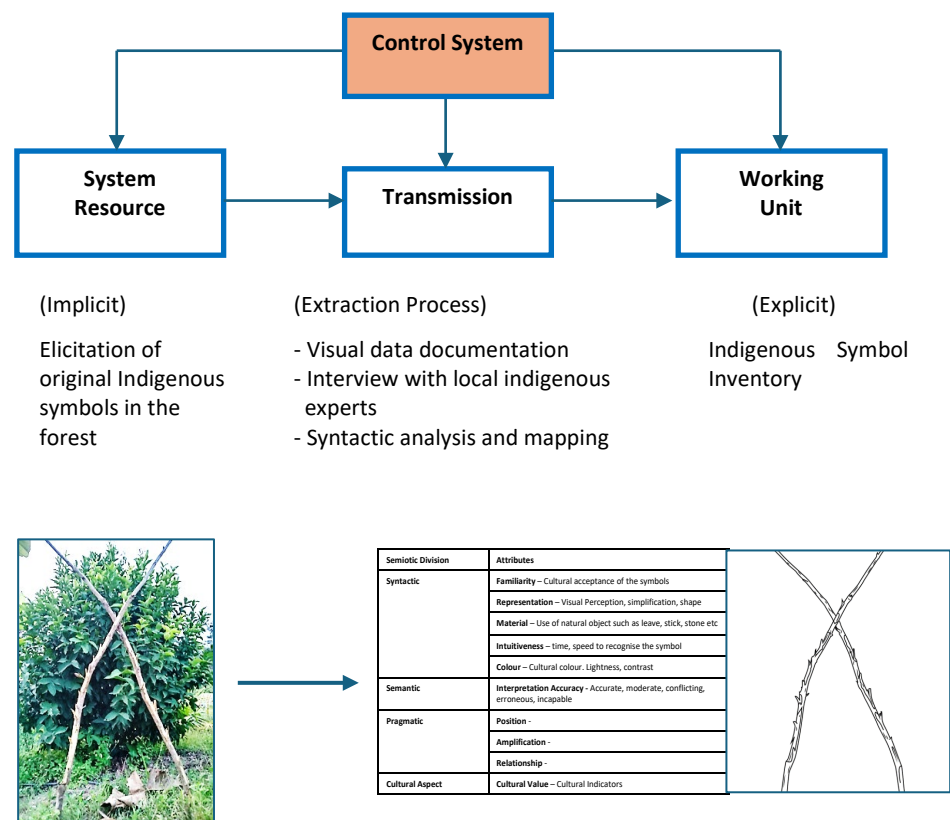


Figure 3.5: Subsystem Two: Indigenous Knowledge Extraction

3.6.4 Subsystem Three: Indigenous Digital Symbol Co-Design

Subsystem three is the continuation of subsystem two, which involves transforming the original Indigenous symbols into digitally designed symbols. In subsystem two, explicit and structured data of Indigenous symbols were extracted and studied. A co-design approach involving Indigenous youth and a graphic designer was used to digitalise these symbols, based on visual data and the symbols’ semiotic analytical mapping from the Indigenous symbol inventory. The etic-emic design approach, as described in Chapter 2, was utilised in this project. Adapting the concept of TRIZ Law

of System Completeness model, Figure 3.6 demonstrates the knowledge extraction process.

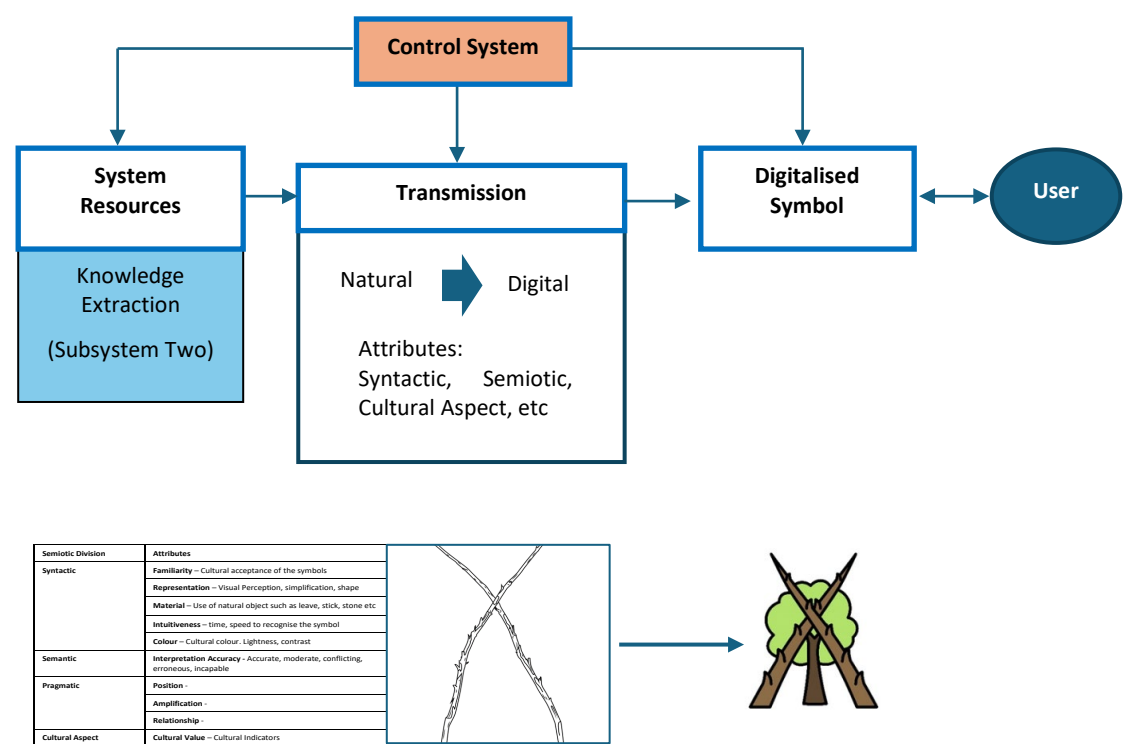


Figure 3.6: Subsystem Three: Indigenous Digital Symbol Co-Design

3.7 Phase Three: Framework Validation

Phase three of the research design involves validating the Indigenous Symbolic Visual Communication Design (ISVCD) that has been developed. The process includes a case study of selected Indigenous visual symbols, which will be digitally designed using the ISVCD Framework. The validation process adopted the summative evaluation approach to evaluate the efficacy of the framework's outcome. To ensure the effectiveness of the ISVCD Framework, a triangulated validation strategy was employed, incorporating local Indigenous expert review, empirical testing, and core value comparison (see Figure

3.7). The triangulation approach validates findings and enhances credibility, cultural authenticity, and design effectiveness through multiple perspectives and methods, which is widely endorsed in academic and industry research (Guba & Lincoln, 1994).

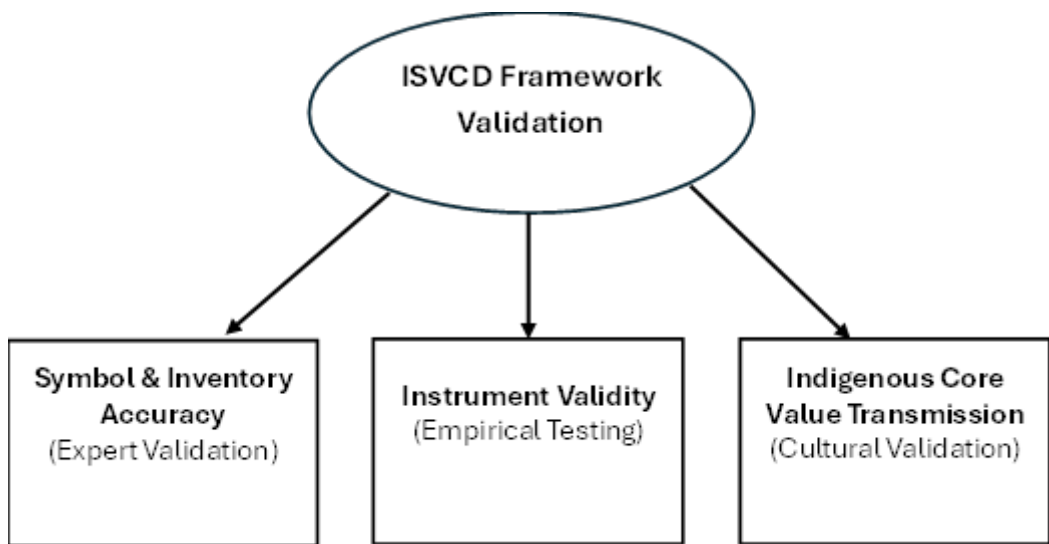


Figure 3.7: Framework Validation Triangulation Model

In Indigenous research contexts, validation must include Indigenous community alignment. As LaFrance & Nichols (2010) argue, respectful design necessitates participatory validation, wherein knowledge holders affirm the accuracy of cultural representations. This culturally grounded approach is consistent with Indigenous paradigms. Local Indigenous expert review validates cultural content, while value transmission analysis ensures that the deep structures of meaning remain intact.

Integrating empirical testing (via confusion matrix analysis) guarantees the instrument’s operational reliability, consistent with best practices in mixed-methods and culturally responsive framework development (Annam et al., 2024; Cronje et al., 2015). This strategy comprises three interrelated validation dimensions:

1. Symbol & Inventory Accuracy: Local Indigenous experts review to verify that digital symbols reflect the cultural meaning embedded in the original Indigenous Symbol Inventory.
2. Instrument Validity: Testing the Indigenous Symbolic Design Mapping Instrument for effectiveness in identifying attributes of Indigenous symbols.
3. Indigenous Core Value Transmission: Validating whether Indigenous core values in original symbols are preserved in their digital transformation, confirming the framework's cultural fidelity.

Each component addresses validation concerns about functionality, representation, and Indigenous knowledge and values, ensuring the framework meets technical and cultural standards. Details of the triangulation validation strategy are shown in Table 3.4 below. The process flow diagram is shown in Figure 3.8.

Table 3.4: Triangulation Validation Strategy

Validation Component	Method	Purpose
Symbol & Inventory Accuracy	Expert Review	Confirm design fidelity to inventory-based attributes
Instrument Validity	Empirical Confusion Matrix	Assess the measurement accuracy of syntactic and semantic data
Cultural Core Value Transmission	Thematic core value comparison	Ensure symbolic values persist through digital transformation

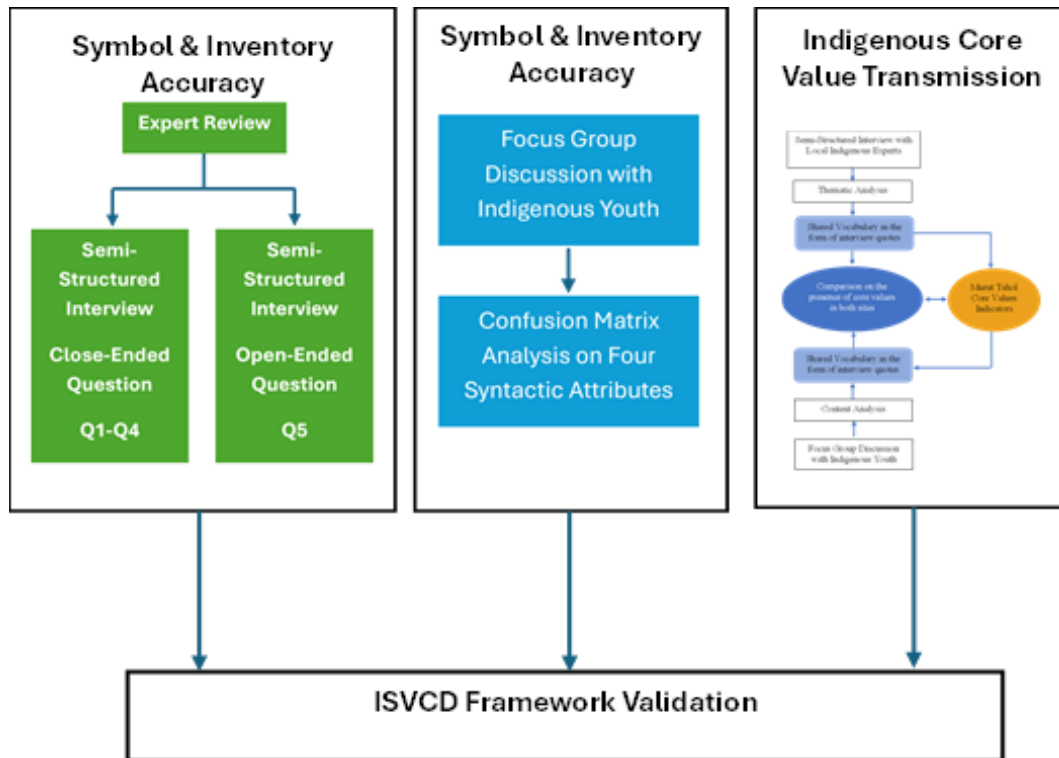


Figure 3.8: Process Flow Diagram for Framework Triangulation Validation

3.7.1 Expert Review for Symbol and Inventory Accuracy

This section describes the process implemented to ensure the validity of the cultural, visual, and contextual accuracy of the Indigenous Symbol Inventory and the digitally designed symbols developed during the final stage of the ISVCD Framework. The validation particularly concentrated on four syntactic attributes: familiarity, representation, material, and colour, which collectively underpin the Indigenous Symbolic Design Mapping Instrument.

Although experts were not explicitly tasked with assessing the inventory in isolation, the digital symbols evaluated were generated from the inventory's comprehensive syntactic and semantic information. Consequently, expert validation of the symbol's meaning and form indirectly validated the inventory itself, aligning with

design research principles where the effectiveness of outputs inherently demonstrates the soundness of underlying design processes.

3.7.1.1 Participants

Four Indigenous cultural experts, coded as E1 to E4 (see Table 3.6), participated in the expert validation process. These experts were specifically chosen based on their extensive knowledge of Indigenous symbols, their recognition within the community, and their active roles in heritage preservation.

3.7.1.2 Research Materials

Research materials that involved facilitating this section are as follows:

1. The complete set of 14 Digital Tatandu Symbols (see Table 4.12) printed on the flash cards.
2. The Indigenous Symbol Inventory (see Appendix F)
3. Semi-Structured Interview Questions for Expert Review consist of four closed-ended questions Q1 – Q4 and one open-ended questions Q5 (Table 3.8)

3.7.1.3 Data Collection Procedure

Experts were shown each symbol and asked four closed-ended questions, Q1-Q4, targeting the four syntactic attributes in the ISDM Instrument: Familiarity, Representation, Material, and Colour.

Each response was given binary scores (1 = correct, 0 = incorrect).

The fifth question, Q5, is open-ended and asks for overall comments on the new symbol design.

What is your overall comment on the new symbol design?

Responses Q5 were recorded, transcribed, and analysed using thematic analysis to extract key cultural appropriateness, resonance, and potential improvement insights.

3.7.1.4 Data Analysis

Data analysis involved aggregating scores for each attribute across all symbols and experts. Summary statistics included:

1. Total number of correct responses.
2. Agreement percentage for each attribute

Qualitative data (Q5) were coded inductively, and thematic analysis was conducted to find the standard code in the data. Details of the result and findings will be presented in Chapter 4.

3.7.2 Confusion Matrix for Instrument Validity

This section describes the empirical validation of the Indigenous Symbolic Design Mapping Instrument, a structured tool for extracting syntactic and semantic attributes from Indigenous symbols. The instrument includes five attributes: Familiarity, Representation, Material, Colour, and Semantic Meaning (see Table 3.2). It was designed to ensure that symbolic features critical to cultural interpretation and digital transformation are captured consistently and clearly across diverse users.

The key validation metric selected was Recall, defined as the proportion of correct identifications for each attribute across all participant evaluations. Recall was chosen because it directly measures the instrument's ability to guide participants to recognise culturally intended symbolic features. Based on established norms for cognitive design assessment and visual recognition accuracy (Hancock et al., 2010), a minimum recall threshold of 0.85 was considered acceptable for syntactic validation.

3.7.2.1 Participants

The instrument was tested with four focus group discussions of Indigenous youths, a total of 20 participants (aged 15–17), recruited from local Indigenous schools and cultural centres. The participants had prior engagement with cultural symbol interpretation through the co-design phase. Detailed sampling for the focus group discussion can be seen in Section 3.8.

3.7.2.2 Research Materials

Research materials that involved facilitating this section are as follows:

1. The complete set of 14 Digital Tatandu Symbol Prototypes printed on the flash cards. (see Table 4.12).
2. Focus Group Discussion Questions (see Table 3.9)

3.7.2.3 Data Collection Procedure

Participants were shown flash cards printed with a digital Tatandu symbol prototype each, and they needed to answer questions based on what they saw on the cards. The interview questions consist of four sets of questions, with each set referring to the four attributes in the Indigenous Symbolic Design Mapping Instrument (Familiarity, Representation, Material, and Colour). There are two questions in each set; questions labelled with a ' are closed-ended, while those labelled with 'b' are open-ended. The participants were encouraged to discuss among themselves and answer the questions as a collective group. The close-ended questions aimed to evaluate the correctness of the designed symbol. A three-point scale was used to record the correctness of the closed-ended questions based on the focus group discussion. It was converted to a 2-Point Scale to facilitate the Confusion Matrix calculation (see Table 3.10). Meanwhile, the open-

ended questions aimed to elicit more discussion from the participants to reveal the underlying core value based on the contextualisation of the Tatandu activities.

3.7.2.4 Data Analysis

Quantitative results were analysed using a confusion matrix approach over the four attributes: Familiarity, Representation, Material, and Colour. The focus of the analysis is the Recall rate. Details of the results and findings will be presented in Chapter 4.

3.7.3 Thematic Core Value Comparison

This validation component evaluated how well cultural core values were transmitted from original Indigenous symbols to their digitally designed versions. Its goal was to ensure cultural fidelity, confirming that the digitally altered symbols accurately represented the Murut Tahol core values initially articulated by local Indigenous experts and later interpreted by youth during focus groups. This research section will compare the previously identified Murut Tahol core values and value indicators (see Table 4.5) with those revealed from focus group interviews (see Table 4.12), contextualised by the youths' understanding of Tatandu symbols. By identifying similar values, we can confirm the transmission of values through the ISVCD Framework. Figure 3.9 illustrates the flow diagram for comparing and validating core values.

The analytical process followed the steps outlined in the Thematic Core Value Comparison flowchart. Initially, thematic analysis (Braun & Clarke, 2006) was independently conducted on transcripts from expert interviews and the youth focus group discussions. Subsequently, a content matching process was applied to these analyses to identify semantic parallels, shared vocabulary, and conceptual overlaps.

Evaluations of content interpretations were classified according to three specific matching criteria: direct matches, indicating identical or synonymous interpretations; partial matches, indicating culturally nuanced similarities; and no matches, signifying significant interpretative divergence. The results of these comparisons were summarised through matching tables and illustrated with relevant quotes from both participant groups.

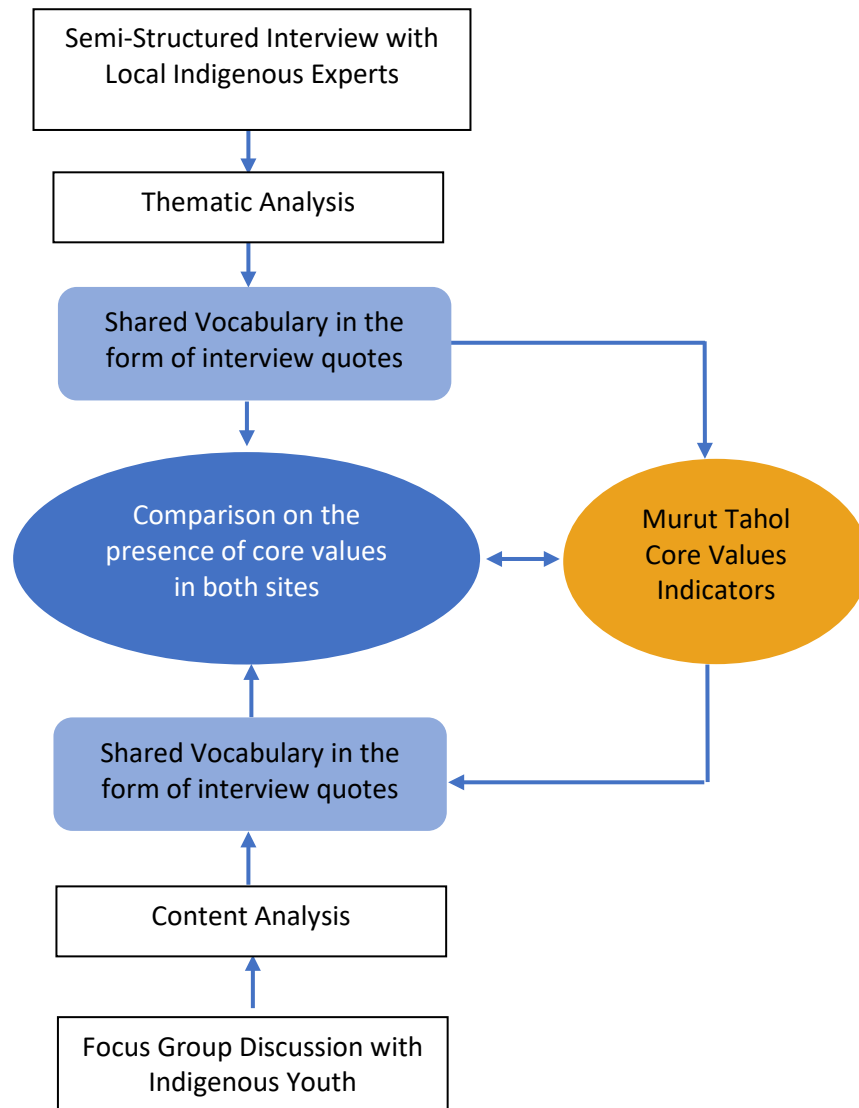


Figure 3.9: Flow diagram for Thematic Core Value Comparison

3.8 Research Participation Sampling

This research employed two community-based, culturally sensitive sampling techniques: snowball and criteria sampling. Both are effective with Indigenous communities and local knowledge experts.

Snowball sampling, or chain referral sampling, is a non-probability method in which initial participants refer others from their community who meet the research criteria (Noy, 2008). It is particularly useful for studying hidden, small, or close-knit populations like Indigenous knowledge keepers or elders, where trust and social relationships are crucial. This method builds on existing trust networks, essential in Indigenous contexts where outsider research may be viewed cautiously, allowing access to respected cultural experts who might otherwise go unnoticed.

Criteria sampling, or purposive sampling, selects participants who meet predefined characteristics central to the research question (Miles & Huberman, 2002). In Indigenous visual communication design, this entails selecting participants recognised as knowledge holders or elders, possessing the cultural authority to discuss the research issues, and who have engaged in traditional rituals or visual practices. This research employs criterion sampling to identify Indigenous youth for participation in the focus group discussion. This research employed two community-based, culturally sensitive sampling methods. Two groups of participants were involved in this research: local Indigenous experts and Indigenous youth.

3.8.1 Local Indigenous Experts Sampling

Local Indigenous Experts were involved in the following research activities:

1. Community Engagement

2. Artefact Collections and Documentation
3. Expert review in framework validation

This research employs a combination of snowball sampling and criteria sampling to engage local Indigenous experts. It ensures the research remains both strategically focused and culturally embedded. The sampling strategy is as follows:

1. Start with a few key informants identified via criteria sampling (Indigenous community leader).
2. Then use snowballing to expand the participant base through trusted referrals, ensuring that each referred participant still meets core criteria.

Local Indigenous Experts Selection Criteria and participants' records are shown in Tables 3.5 and 3.6.

Table 3.5: Selection Criteria for Local Indigenous Expert

	Selection Criteria for Local Indigenous Expert
1	Experience Using Tatandu: The expert must have experience in using Tatandu in the forest.
2	Experience and Background: Participants can include experts with relevant experience in preserving and promoting their Indigenous culture, including elders, cultural leaders, historians, or individuals with a track record of cultural preservation.
3	Cultural Knowledge Expertise: The expert must have a deep and comprehensive understanding of the Murut Tahol culture, including its history, traditions, beliefs, and values. The community should recognise them as a knowledgeable and respected cultural authority.
4	Community Connection: The expert should have strong connections to the Indigenous community, which is vital for gaining access to cultural information and ensuring the trust and cooperation of community members.

Table 3.6: Local Indigenous Expert Participants

Local Indigenous Expert Participants	
E1	Formal District Leader <i>Ketua Anak Negeri</i>
E2	Formal Leader in Murut Tahol Cutlral Association
E3	Current District Leader <i>Ketua Anak Negeri</i>
E4	Village Leader <i>Ketua Kampung</i>

3.8.2 Indigenous Youth Sampling

Indigenous Youth were involved in the focus group discussion activities. Four groups of Indigenous youth, consisting of five people each, were selected to participate in this research. The youth were between 15 and 17 years old.

Involving teenagers aged 15 to 17 in the focus group is essential due to their status as digital natives. Having grown up with technology, they possess strong skills and shaped expectations regarding digital media. Observing this group offers insights into future trends and the evolving relationship between technology and users.

As the Pew Research Centre report details, teenage technology use, particularly mobile phones, emphasises this group's importance in digital culture (Lenhart, 2015). Teenagers aged 15 to 17 are among the most active mobile users, using devices for communication, entertainment, education, and information (Livingstone & Helsper, 2010) & Helsper, 2010). Their high engagement makes them crucial for studying usage patterns, preferences, and the impact of mobile technology on life aspects.

Criteria sampling was used to identify participants in the focus group. The criteria are as follows in Table 3.7:

Table 3.7: Selection Criteria for Indigenous Youth in Focus Group Discussion

	Selection Criteria for Indigenous Youth in Focus Group Discussion
1	Indigenous Murut Tahol youth aged 15 – 17.
2	Youth have experience in using Tatandu in the forest.
3	Resident at one of the four designated data collection areas of Kampung Pilanas, Pensiangan, Sepulut, and Nabawan.

3.9 Data Collection and Analysis

Data collection and analysis for this research were structured to capture rich, culturally contextualised insights essential for effectively formulating and validating the ISVCD Framework. Guided by participatory and Indigenous research methodologies (Chilisa, 2019; Kovach, 2021a; Smith, 2021), data were primarily obtained through qualitative methods involving in-depth interactions with Indigenous community members, including elders, artists, designers, and cultural custodians. The following section discusses the data collection and analysis methods carried out on the case study of this research, which involved the Murut Tahol community in Sabah.

3.9.1 Visual Documentation of Indigenous Symbols

The study began with field-based documentation of visual symbols in their natural and ritual contexts within the Indigenous community's environment. These symbols are created by the Indigenous community using natural materials sourced from the forest. They were recorded through photography, hand sketches, and ethnographic field notes. The symbols were identified during the preliminary study, which involved a secondary data analysis, interviews, and consultations with local Indigenous experts. Once the symbols are identified, field trips to the forest are planned. With the assistance of the local community, we identified and documented the symbols in their original form. These

activities provided a contextual understanding of the actual practice of Indigenous symbols within the physical environment and were integral to the communication systems of Indigenous knowledge.

3.9.2 Semi-Structured Interview

A series of semi-structured interviews was conducted with elders and local Indigenous experts who serve as the cultural custodians of Indigenous knowledge. The aim is to uncover the meanings of the communication symbol and its symbolic, spiritual, and narrative meanings. In accordance with Indigenous relational protocols, the interviews were dialogical rather than extractive, occurring in community spaces familiar to the participants, and often facilitated by a cultural liaison. Audio recordings were made with consent, allowing participants to review and amend the transcripts. The interview transcripts were kept confidential to secure the integrity and ethical concerns of the Indigenous research. (The interview transcripts are attached in Appendices D and N)

Dialogical open-ended questions are focused on open enquiries and storytelling prompts, inviting participants to provide rich, detailed narratives in their own words. These questions facilitate exploratory insights, allowing researchers to understand complex phenomena more deeply, especially when little is known about the topic (Creswell, 2009). They encourage elaboration and can uncover values, beliefs, and experiences that may not surface through structured methods. This method honoured the Indigenous emphasis on story as a knowledge approach and ensured depth and nuance in cultural interpretation

3.9.3 Expert Review

Expert review is a widely accepted qualitative method employed in design-based research to validate a developed framework's accuracy, relevance, and appropriateness. In the context of this research, expert review entails engaging local Indigenous cultural experts who are recognised knowledge holders within the community to evaluate whether the ISVCD Framework authentically reflects Indigenous knowledge systems, values, and symbolic meanings. These experts were selected based on their cultural authority, experience, and familiarity with traditional symbols and meanings. (see sampling criteria in Section 3.8). Interview questions for the expert review are shown below in Table 3.8.

Table 3.8: Semi-Structured Interview Questions for Expert Review

Attributes	Questions
Q1 (Familiarity)	Does the designed symbol look familiar to you? Adakah simbol yang direka bentuk ini biasa dilihat?
Q2 (Representation)	Is the representation of the symbol in the design accurate? Adakah perwakilan simbol dalam reka bentuk tepat?
Q3 (Material)	Are the materials used to construct the symbols in the design look accurate? Adakah bahan yang digunakan untuk membina simbol dalam reka bentuk kelihatan tepat?
Q4 (Colour)	Are the colours used in this design appropriate? Adakah warna yang digunakan dalam reka bentuk ini sesuai?
Q5 (Open-Ended Question)	What is your overall comment on the new symbol design? Apakah ulasan keseluruhan anda tentang reka bentuk simbol Baharu ini?

3.9.4 Focus Group Discussion

Focus group discussions were chosen for their ability to foster group dynamics, explore shared experiences, and capture collective perspectives (Al Qudah et al., 2015). During a focus group discussion, the researcher acts as moderator and poses questions for participants to discuss, enabling a variety of perceptions and opinions to emerge. Throughout the discussions, participants shared and explored their perceptions, ideas, and

opinions in detail, centred around a specific theme (Wilkinson, 2004) . This method ensured that all voices were heard and valued, leading to a constructive and inclusive process. In this study, focus group discussions gathered comprehensive feedback from the Indigenous youth, the primary users of the symbols.

Focus group discussions were held with Murut Tahol youth. Twenty participants, divided into four focus groups of five individuals each, There are Group One (G1), Group Two (G2), Group Three (G3), and Group Four (G4). Participation was on voluntary basis. The criteria for selecting participants are displayed in Table 3.7. Focus groups were conducted in two locations, Sepulut and Pensiangan, during the second field trip to accommodate the participants (see Table 4.2). The focus group discussion has three objectives:

1. To evaluate the correctness of the digital Tatandu symbol prototype that has been designed.
2. To assess the effectiveness of the Indigenous Symbolic Design Mapping Instrument in identifying the attributes of Indigenous symbols.
3. To identify the core values underlying the interview questions' open-ended answers.

The activity involves examining the fourteen digital Tatandu symbol prototypes through semi-structured interviews with the youth to gain insight into the prototype symbols. Participants were shown flash cards printed with a digital Tatandu symbol prototype each, and they needed to answer questions based on what they saw on the cards. The interview questions consist of four sets of questions, each referring to the ISDM Instrument's four attributes (Familiarity, Representation, Material, and Colour). There are two questions in each set; questions labelled with a ' are closed-ended, while those

labelled with ‘b’ are open-ended. The participants were encouraged to discuss among themselves and answer the questions as a collective group. The close-ended questions aimed to evaluate the correctness of the designed symbol. A three-point scale was used to record the correctness of the closed-ended questions, with a value of 1 given for the correct answer, 0.5 for a partially correct answer, and 0.0 for a wrong answer. Meanwhile, the open-ended questions aimed to elicit more discussion from the participants to reveal the underlying core value based on the contextualisation of the Tatandu activities. The semi-structured interview questions are as in Table 3.9 follows:

Table 3.9: Semi-structured Interview Questions for Focus Group Discussion

Attributes	Questions
Q1a (Familiarity)	Have you ever see the components of this symbols in the place you stay? Adakah anda pernah nampak bahan dalam simbol ini di tempat tinggal anda?
Q1b (Familiarity)	Can you describe where you see this? Boleh anda terangkan di mana selalu jumpa simbol ini?
Q2a (Representation)	What is the symbol represent? Apa yang dilambangkan oleh simbol ini?
Q2b (Representation)	Why you say so? Mengapa anda cakap begini?
Q3a (Material)	Can you tell me what are the materials used as the component in this symbol? Bolehkah anda beritahu bahan apakah yang digunakan dalam simbol ini?
Q3b (Material)	Why those materials were used? Mengapa bahan tersebut digunakan?
Q4a (Colour)	Are the colours used in this design appropriate? Adakah warna yang digunakan dalam reka bentuk ini sesuai?
Q4b (Colour)	Is there any significant meaning with the colour used? Adakah warna yang digunakan mempunyai makna tertentu?

3.9.5 Data Analysis: Qualitative Thematic Analysis

Qualitative data transcripts from the interviews were analysed using thematic analysis, a widely recognised method for systematically organising, interpreting, and

reporting themes within rich qualitative data sets (Braun et al., 2014). The choice of thematic analysis aligns with this research's interpretive-pragmatic orientation, providing flexibility to capture nuanced meanings, cultural contexts, and conceptual categories relevant to Indigenous visual communication (Braun et al., 2014; Creswell, 2009).

NVivo software managed and facilitated the analytical process, enhancing rigour and transparency in handling large volumes of qualitative data. NVivo supported effective coding, thematic organisation, visualisation of data relationships, and reporting.

3.9.6 Data Analysis: Confusion Matrix

The confusion matrix is a widely accepted method for evaluating classification performance by comparing predicted outcomes with ground truth values. This study was adapted to assess participants' recognition of syntactic attributes (Familiarity, Representation, Material, Colour) in culturally valid digital Indigenous symbols.

Unlike traditional multi-class classification, the evaluation model used here is a one-class confusion matrix, where the ground truth for all symbol attributes is "correct recognition." Since all tested symbols were intentionally designed to align with Indigenous knowledge systems, invalid or distractor symbols were not included. As a result, False Positives (FP) and True Negatives (TN) were logically and structurally absent from the data. The use of a one-class confusion matrix in this research is validated by established practices in positive-only classification and novelty detection (Khan, 2014). This design reflects the intended purpose of the framework, which is to produce culturally accurate symbols, and the confusion matrix evaluates the validity of the Indigenous Symbolic Design Mapping Instrument.

During data collection, symbol evaluations were recorded using a 3-point ordinal scale. The 3-point scoring scale (Correct = 1.0, Partial = 0.5, Incorrect = 0.0) was converted into a binary format for statistical classification analysis. Only fully correct recognitions were classified as 'Correct'; partial and incorrect responses were grouped as 'Incorrect'. This binarisation allowed for the construction of a confusion matrix. Table 3.10 shows the conversion.

Table 3.10: Conversion of 3-Point Scale to 2-Point Scale

Original Score	Interpretation	Binary Conversion
1.0	Correct	Correct (1)
0.5	Partial Correct	Incorrect (0)
0.0	Incorrect	Incorrect (0)

This conversion was justified because the confusion matrix requires discrete class definitions, and partial recognition falls between the thresholds of correctness and incorrectness. However, the original 0.5 partial scores are preserved and will be used in design iteration analysis. These partial recognitions provide valuable nuance about minor design inconsistencies and participant hesitation, informing future symbol refinement.

Results were analysed using a confusion matrix approach per attribute. This method enabled the calculation of:

$$\text{Precision} = \text{TP} / (\text{TP} + \text{FP})$$

$$\text{Recall} = \text{TP} / (\text{TP} + \text{FN})$$

$$\text{F1 Score} = \text{Harmonic mean of Precision and Recall}$$

$$\text{Accuracy} = (\text{TP} + \text{TN}) / \text{Total}$$

This approach measures how effectively the instrument captures the intended symbolic constructs and how well participants can align with expert expectations using the tool.

3.10 Ethical Considerations

Smith (2021) underscores the importance of ethical research practices, including obtaining informed consent and involving Indigenous communities in knowledge-sharing decision-making. Extracting Indigenous knowledge should be done with respect for Indigenous communities' rights, beliefs, and intellectual property. Respecting intellectual property rights and obtaining informed consent are critical ethical considerations. Collaborative agreements that outline ownership and usage rights are necessary. Extracting Indigenous knowledge should empower Indigenous and local communities by recognising their expertise and contributions. This can lead to increased self-determination and cultural revitalisation.

3.10.1 Culturally Sensitive

Researchers are expected to be culturally sensitive and aware of the historical and social context in which they conduct research. This includes being mindful of the potential for cultural appropriation and ensuring that research benefits the community (Smith, 2021). Extracting Indigenous knowledge must be conducted with utmost respect for cultural norms and values (Nakashima & Roué, 2002). It indicated the importance of the researcher's self-reflections on the possible value conflicts between the researcher's self-cultural and Indigenous cultural values. Inappropriate or disrespectful approaches can lead to mistrust and resistance from Indigenous communities. Implementing Indigenous research methods as posited in the Indigenous research paradigm (Hart, 2010; Wilson, 2001), aligned with the Indigenous Worldview and knowledge, as mentioned in section 2.2, is essential.

3.10.2 Cultural Protocol

Etymologically, protocols refer to an “established code of procedure or behaviour” or “official etiquette” (Riphagen & Stolte, 2016) which can operate as a tool to protect Indigenous knowledge. Various references and descriptions regarding cultural protocols in Indigenous research (Riphagen & Stolte, 2016) concluded that two primary forms of cultural protocols exist. The first form, often described in ethnographies, is protocols applied within an Indigenous community that prescribe the hierarchies of knowledge and rules around passing on ancestral knowledge between generations. The second form emerged as a response to the inadequate legal protection of Indigenous intellectual property and rights. This refers to the ethical research practices and legitimization point of view, which have been discussed in the previous section. In this research, we refer to the first form of cultural protocols, which is essential for us to understand the hierarchical relationships of the Indigenous knowledge in the knowledge extraction process, who are the key referrers, knowledge holders and their roles in the Indigenous knowledge communication systems within the community. It guides the exploration of the indexical relationship, which indicates the bounding between cultural interpretation and the semiotic meaning of visual symbols in the later part of this research.

Identifying and engaging in respectful dialogue with elders and knowledge holders in Indigenous communities is crucial to building trust and obtaining their consent for knowledge extraction. It also fosters collaboration and upholds the rights and well-being of Indigenous communities in research endeavours.

3.11 Chapter Summary

This chapter outlines the research methodology and design. It details the three stages of the study: framework formulation, framework implementation, and validation.

The development of the Indigenous Symbolic Design Mapping (ISDM) Instrument and the structure of the ISVCD Framework are presented, informed by the Hybrid Visual Communication and Semiotic Framework, TRIZ Law of System Completeness, and Indigenous worldview. The triangulated validation strategy involves expert reviews, empirical testing using a confusion matrix, and thematic comparison of core values. Ethical considerations, sampling techniques, and processes for community collaboration are also addressed.

CHAPTER 4

CASE STUDY, RESULTS AND FINDINGS

4.1 Introduction

This chapter outlines the implementation and validation of the Indigenous Symbolic Visual Communication System Design (ISVCD) Framework, created to aid in digitalising and preserving Indigenous symbolic knowledge. A case study showcases this framework through the Tatandu visual language of the Murut Tahol Indigenous community in Sabah.

The implementation phase illustrates how the framework was applied in authentic cultural and design contexts. It follows a structured approach, starting with artefact collection and documentation, which leads to the elicitation of original symbols. The process then advances to converting these symbols into digital formats that fit contemporary communication platforms, like emojis. Central to this implementation are three interconnected knowledge subsystems: Indigenous Core Values Elicitation, Indigenous Knowledge Extraction, and Indigenous Symbol Digital Design, which incorporates co-design efforts with the youth.

The validation phase consists of two key components. First, Indigenous cultural experts verify that the transformed digital symbols accurately reflect their traditional meanings and comply with community protocols. Second, focus group discussions with Indigenous youth evaluate the interpretive effectiveness of the digitalised symbols and assess the framework's ability to preserve and communicate Indigenous knowledge across generations. This evaluative phase directly addresses the practical functionality and cultural relevance of the final symbol designs.

4.2 Case Study on Tatandu of Murut Tahol

A case study within the ISVCD Framework development acts as a focused and participatory research approach for validating and enhancing a design framework. This research centres on the Tatandu of the Murut Tahol community in Sabah, which serves as the primary medium to evaluate the framework's effectiveness in digitising Indigenous symbols and preserving and sharing Indigenous knowledge and core values.

Tatandu is a symbolic representation in a traditional context that serves a function similar to contemporary communication symbols. Tatandu uses materials available in its natural surroundings to depict images through a combination of forms that incorporate carving and affixing with natural materials based on specific rules to convey a message or meaning (Ibrahim, 2015). The Murut community's communication system revolves around hunting and farming, a significant part of their traditional way of life. They live in the forest and learn how to interact with one another in that environment. Tatandu, which are often constructed using natural materials, serve as markers for those walking in the forest. These symbols are placed along forest tracks to provide messages and information.

Burrough (1975) conducted an extensive study on the Tatandu, a symbol used by the Murut people, specifically the Murut Thaol tribe. The study found that Tatandu was widely used in the Murut homeland, covering the area along the Tagul River (Sungai Tagul). This region includes places like Pensiangan, Keningau, Tenom, Kemabong, Rundum, Tomani, and Sipitang, where the main settlements are located. According to the study, Tatandu was used for various purposes, such as direction signs, hunting activities, warnings, and announcements for weddings and other festivals in the Murut community.

Burrough's study also found that the Murut Tahol tribe is among the largest Murut tribes, and Tatandu has been widely used in their daily practice since ancient times. However, as discussed in Chapter Two, the use of Tatandu is becoming limited, and problems are facing the Indigenous community due to the changing lifestyle and loss of interest of the younger generation.

There are four categories of Murut Tahol Tatandu based on Burrough's (1975) study, which was utilised in this research. There are: (i) Navigation Symbols, (ii) Hunting Symbols, (iii) Warning Symbols, and (iv) Wedding and Festival Symbols. Details of the categories of the Tatandu are illustrated in Table 4.1.

Table 4.1: Categories of Tatandu

Categories of Tatandu	Description
1. Navigation Symbols	Used to guide movement through the forest, indicating direction, purpose of travel (e.g., hunting), and traveller identity. Made with natural materials.
2. Hunting Symbols	Indicate prey location, animal type, and hunting strategies. Also used to mark hunting areas for safety and share information with other community members.
3. Warning Symbols	Serve to alert others to dangers like wild animals, poisonous plants, or theft. Sometimes involve spiritual or curse-related elements to deter threats or offenses.
4. Wedding and Feast Symbols	Decorative symbols used to announce ceremonies, invite guests, and express unity and cultural identity. Often placed at entrances and along forest paths.

4.3 Field Trips

In this research, two field trips were conducted to collect data. Table 4.2 and Figure 5.1 show the activities of the field trips. The first trip involved interviews, artefact collection, and documentation activities. The fieldwork was conducted at four Indigenous settlements: Nabawan, Sepulut, Pensiangan, and Kampung Pilanas. Local community leaders were visited, introducing us to local Indigenous experts and community members

who could participate and assist in the research activities. Establishing relationships and trust with the Indigenous community is crucial in Indigenous research. As part of participatory research, being physically present in the community is essential for building good rapport and trust with Indigenous participants. With the guidance of the experts and community members, we identified the Tatandu symbols, which will be documented later. Trips were made to the forest and settlements to capture the Tatandu symbols in their original forms with the camera. Oral explanations by the experts regarding the information of the Tatandu were recorded. Field notes were taken. A preliminary inventory of Tatandu symbols was created.

After the first field trip, we conducted data analysis activities. We transcribed the interview data with the help of community members. We kept in touch with them through mobile phone conversations and messages to assist us in data analysis and interpretation. We used the transcribed interview data from the first trip interview to justify the research problem. The interview data, derived from a semi-structured format with open-ended questions, was conducted dialogically within community spaces familiar to the participants, aiming to identify and document Tatandu for two purposes. First, we extracted the Indigenous knowledge of Tatandu for the Tatandu identification and documentation process. Second, we elicited the Murut Tahol's core values, which will be used to identify their core value indicator. We used the identified value indicators for the framework validation process. This approach was adopted from Dawson's (2017) suggestion of combining various Indigenous research methods within a single study with a common objective, as discussed in Chapter 3.

After transcribing the interview data and extracting information, a syntactic analysis was carried out to further analyse the Tatandu symbols based on the ISDM

Instrument, which was adapted and developed in Chapter 3. The Tatandu symbols were mapped with the syntactic attributes to prepare them for further study in the ISVCD Framework validation activities. Meanwhile, photos of the Tatandu captured during the first field trip were studied and used as a reference to design digital Tatandu symbols. The digitalisation process involved a co-design process in which a Murut Tahol participant, who is a university student, was involved in the design activities. A total of 14 digital Tatandu designs were created. The design process will be discussed further in a later section of this chapter. All the Indigenous knowledge extraction, Tatandu symbol captures, and mapping were done following the developed ISVCD Framework guidance. All the extracted data were stored in the Tatandu Symbol Inventory.

The second trip aimed to verify and validate the ISVCD Framework, which was the outcome of the developed framework. The research project used summative evaluation to verify and validate the digitalised Indigenous symbols. Summative evaluation assesses the efficacy and outcomes after the completion of the framework development process, unlike formative evaluation, which focuses on refining the framework during development. In Chapter 3, the rationale for choosing summative evaluation, which aligns with the nature of Indigenous research, was discussed.

During the second field trip, three research activities were conducted. These included verifying the ISVCD Framework by local Indigenous experts, amending the design of the digital Tatandu symbol, and validating the framework through focus group discussions with Indigenous youth and Tatandu symbol evaluation activities. The field trip occurred at the same four locations as the first trip.

During the framework validation process, we conducted semi-structured interviews with four local Indigenous experts in their designated living and working

locations. These locations were Nabawan, Pensiangan and Kampung Pilanas. The validation process was based on the outcome design of digital Tatandu symbols. After the process, we immediately amended the symbol design based on the comments made by the experts. This activity was carried out in our hostel, which is located in Sepulut. One of the Tatandu symbols was discarded based on the advice of the experts, and the final 14 digital Tatandu symbols were finalised. We then proceeded with the framework validation activities in four focus groups with Murut Tahol youth. The symbol evaluation process was conducted at two locations, namely Pensiangan and Sepulut.

Table 4.2: Field Trips Activities

Field Trip	Activities	Methods	Location
Trip One	Community Engagement Interview	Semi-Structured Interview with Local Indigenous Experts	Nabawan, Sepulut, Pensiangan, Kampung Pilanas
	Identification and Documentation of Tatandu Symbols	1. Artefact Collection and Documentation 2. Semi-Strusted Interview with Local Indigenous Experts	Nabawan, Sepulut, Pensiangan, Kampung Pilanas
Data Analysis	Murut Tahol Indigenous Core Value Identification	1. Interview Transcribing. 2. Thematic Analysis 3. Value Indicator Development	Research Lab
	Semiotic Analysis of the Tatandu Symbol	Mapping with Semiotic Attributes	
	Digital Tatandu Symbols Design	Co-Design of Digital Symbols with Murut Tahol Youth	
Trip Two	Framework Validation	Semi-Structured Interview with Local Indigenous Experts	Nabawan, Sepulut, Pensiangan

	Digital Tatandu Symbol Design Amendment	Co-Design of Digital Symbols with Murut Youth	Sepulut.
	Framework Validation	Focus Group Interview and Digital Symbol Evaluation	Sepulut, Pensiangan,



Figure 4.1: Field Trip Activities

4.4 Implementation of ISVCD Framework on Tatandu Symbols

As discussed in section 3.6, the selected Indigenous visual language, Tatadu, served as a case study in this research to validate the effectiveness of the developed ISVCD Framework. Figure 4.2 illustrates how Tatandu was integrated into the ISVCD Framework. Fieldwork was conducted according to the implementation strategy outlined in Section 3.6, with the field trip activities detailed in Table 4.1.

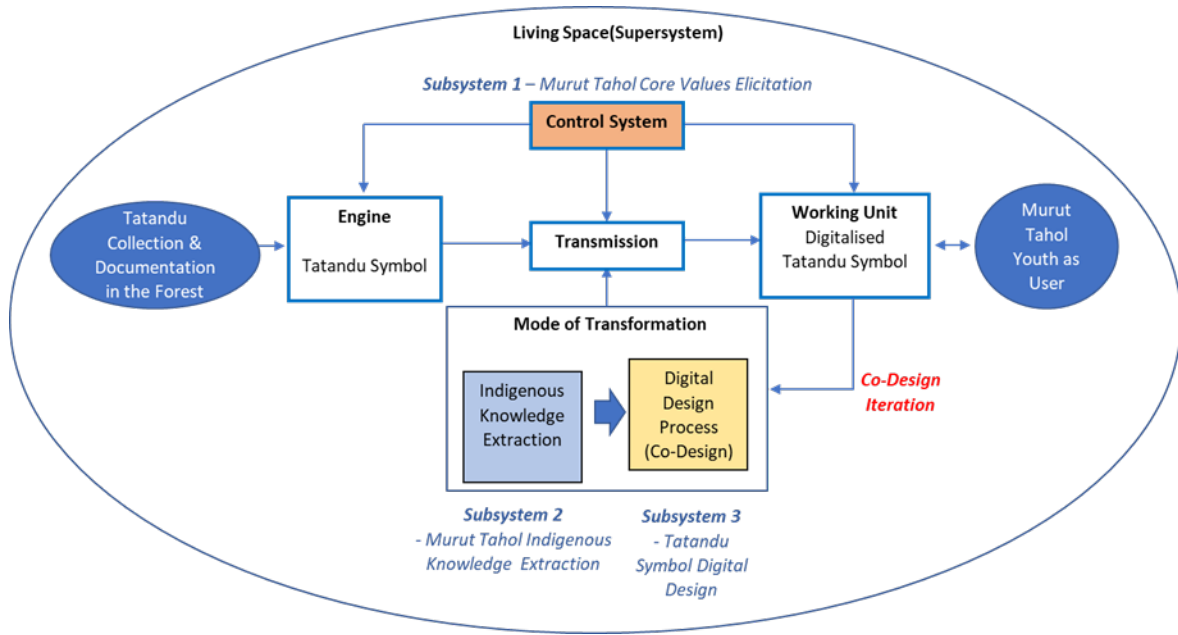


Figure 4.2: Implementation of ISVCD Framework to the Tatandu

4.5 Murut Tahol Tatandu Symbol Elicitation

According to the implementation strategy outlined in Section 3.6, the implementation of the ISVCD Framework begins with engaging the Murut Tahol community. This step is followed by identifying and documenting artefacts, as detailed in Section 4.3, during the initial field trip to the Murut Tahol settlements. During the field trip, we documented 26 Tatandu symbols. After applying the inclusion and exclusion criteria, this initial excursion yielded 14 symbols obtained through visual data collection and interviews with local Indigenous experts. The exclusions were done based on advice from the local Indigenous expert because some symbols are repetitive records of other similar symbols. An example of the field notes, alongside photographs and hand illustrations of the original Tatandu symbols from the trip, is presented in Table 4.3. The complete fieldnote list can be found in Appendix G.

Table 4.3: Field Note Example from The First Field Trip

GAMBAR	MATERIAL (BAHAN YANG DIGUNAKAN)	CARA MEMBUAT	GUNA DI KAWASAN MANA	MAKSUD	TUJUAN
1. TANDA ARAH DALAM HUTAN A1) Hirison am tandukin (hiris kayu dan pacak) Kod image: A1 	- kayu	- Potong sebatang kayu & tajamkan hujung kayu. - Pacak kayu dan hujung kayu menghala ke arah jalan yang hendak dituju.	- hutan	- Saya bergerak ke arah seperti yang ditunjukkan oleh hujung kayu yang ditajamkan.	- memberitahu rakan terhadap arah tempat yang kita tuju. - mengelakkan orang lain daripada sesat.
A2) Sasapin (hiris kayu) Kod image: A2 	-kayu -ranting kayu	- potong sebatang kayu & hiris sedikit batang kayu tersebut. - pacak kayu tersebut. - potong ranting kayu dan tajamkan hujung ranting kayu itu. - sisipkan ranting kayu secara melintang pada bahagian batang kayu yang dihiris tadi.		- mempunyai pelbagai maksud (contoh : tempat itu ada orang yang jahat, tempat itu ada bahaya dll)	- untuk keselamatan.

4.6 Implementation of Subsystem One: Indigenous Core Value Elicitation

This framework component aims to explicitly identify and elicit the core values of the Murut Tahol community. The most effective method to achieve this is by validating Indigenous values at the local level. This can be accomplished by capturing the shared meanings of Indigenous people within a specific activity context, utilising value indicators and a participatory research approach, and engaging local Indigenous experts. For this research, the activity context pertains to the use of Tatandu practice based on four categories (see Table 4.1): navigation activity, hunting activity, warning, and wedding announcement. In line with Boztepe's (2007) suggestion, the identification of the Murut Tahol core values focuses on contextualising the four categories of Tatandu activities instead of individual symbols.

The shared values are captured by analysing the contents of semi-structured interviews featuring open-ended questions conducted during the first field trip to identify the Tatandu symbols. The interviews served two purposes: first, to extract knowledge regarding the use of Tatandu, and second, to elicit the core values of the Murut Tahol. The elicitation of Indigenous core values was carried out based on the recommendations of the ISVCD Framework, alongside the adaptation of the Value-Indicator Development Structures outlined in Table 2.6. The complete implementation process flow is illustrated in Figure 4.3.

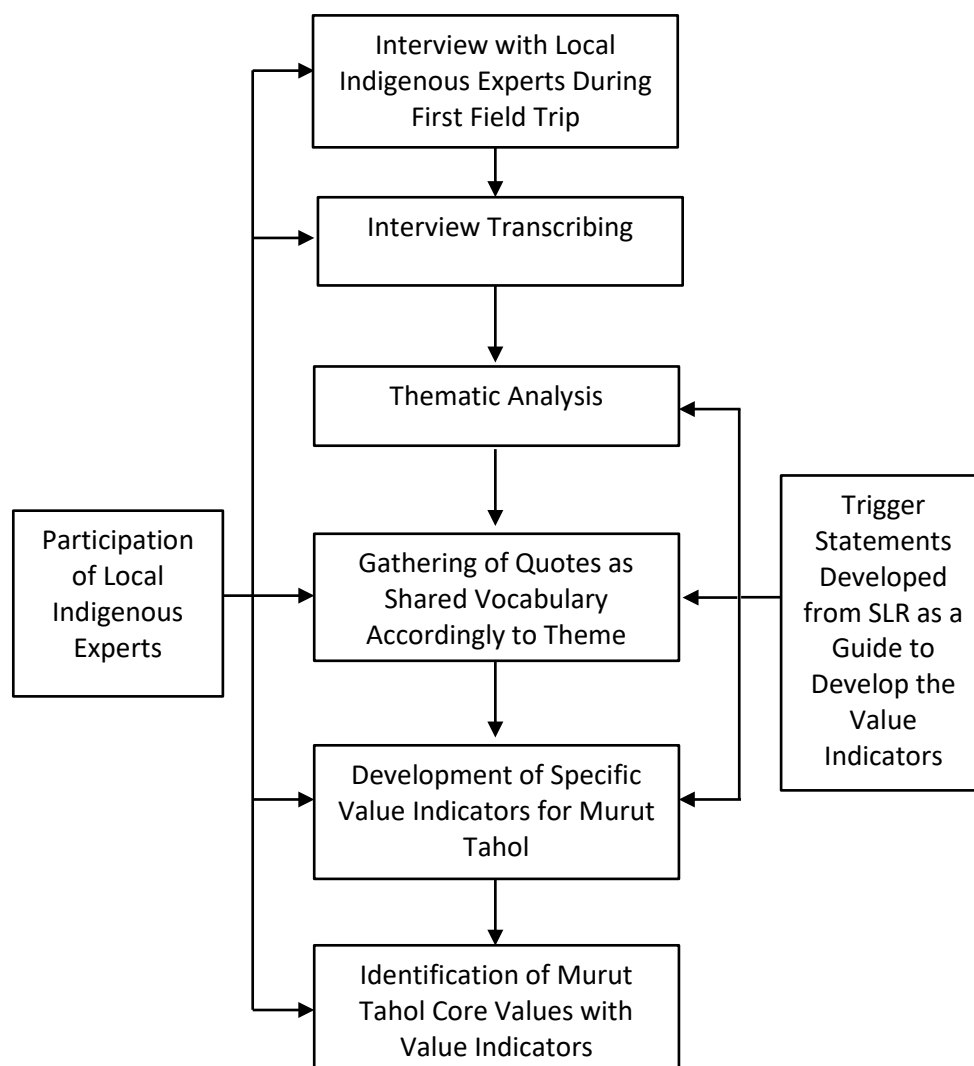


Figure 4.3: Subsystem One Implementation Process Flow

The process of eliciting Indigenous core values within the Murut Tahol community is a structured and culturally grounded methodology designed to surface the deep-seated beliefs, principles, and meanings embedded in their symbolic communication practices. This process combines field engagement, qualitative analysis, and collaborative meaning-making involving local Indigenous experts. The elicitation of Murut Tahol core value process is outlined as follows:

4.6.1 Initial Engagement Through Interviews with Local Indigenous Experts

The process begins with semi-structured interviews with open-ended questions conducted with local Indigenous experts during the first field trip. These conversational interviews allow participants to share their lived experiences, knowledge, and cultural insights without constraint. This format respects the community's oral traditions and aligns with Indigenous research paradigms prioritising relational and dialogical knowledge exchange. The interviews were recorded with permission from the local Indigenous experts, then transcribed. The data was analysed using NVIVO software to identify recurring patterns and themes. Thematic analysis placed extracted quotes under related core values, which will later be converted into statements for developing core value indicators.

4.6.2 Interview Transcription and Data Preparation

The recorded interviews are transcribed in detail to preserve the spoken narratives' nuances, expressions, and contextual elements. This step is critical for maintaining the authenticity of the Indigenous voice throughout the research process. Details of the Interview Transcription are attached in Appendix D.

4.6.3 Thematic Analysis

The transcribed data undergoes thematic analysis, a qualitative method for identifying, analysing, and interpreting patterns of meaning. Themes are derived inductively from the content of the interviews, capturing recurring ideas, beliefs, and symbolic associations that reflect the community's worldview and values.

4.6.4 Quote Gathering and Thematic Vocabulary

Emerging themes lead to the collection and organisation of direct quotes. These quotes create a shared vocabulary that reflects communal expressions of value-driven concepts. By assembling these culturally resonant statements, the research guarantees that the community's voice is integrated into the analysis and interpretation process. The values expressed in these quotes are compiled as a vocabulary of Indigenous value indicators and categorised according to potential values. Inclusion and exclusion criteria help pinpoint key values among these statements, identifying the most important values for the Murut Tahol community.

4.6.5 Integration of Trigger Statements from Systematic Literature Review (SLR)

We generated trigger statements through a systematic literature review to maintain academic rigour and guide the creation of value indicators. These statements function as analytical tools that facilitate the interpretation of Indigenous expressions, linking emic (insider) insights with etic (researcher) evaluations. The trigger statements, referred to as proto indicators, were developed in advance to stimulate ideas and help participants formulate value indicators. For this case study, the trigger statements were drawn from earlier investigations of values in the systematic literature review involving the Murut and other Indigenous groups sharing a similar cultural heritage. They served as references

for identifying value statements during the thematic analysis of the interview data. Five core values are identified from the SLR process and trigger statements. The core values are sharing, spirituality, unity, interconnectedness, and resilience. Details of the trigger statements from SLR can be viewed in Appendix F.

4.6.6 Development of Core Value Indicators

Based on the themes and corresponding quotes, specific value indicators are developed. These indicators function as measurable or observable expressions of abstract Indigenous values and become tools to assess how these values manifest in symbolic forms or communication practices. During the development of core value indicators for Murut Tahol, trigger statements were used to provide guidance and trigger ideas. The local experts were invited to participate in developing the specific value indicator for the Murut Tahol. They gave opinions during the value statement's inclusion and exclusion process. This helped recognise the most relevant and significant values for the Murut Tahol community. Tables 4.4 show the development of one of the Murut Tahol Core Values- Sharing, with identified trigger statements, quotes, and value indicators. The details of the other four core values - spirituality, unity, interconnectedness, and resilience can be viewed in Appendix G.

Table 4.4: Murut Tahol Core Value: Sharing

Murut Tahol Core Value: Sharing	
Trigger Statements and Quotes	Value Indicator
1. Resource Distribution: <i>Bila dapat babi atau binatang yg kasi sama sahaja.</i> When getting a pig or an animal, it is distributed equally. <i>Memotong anggota badan haiwan</i> Cutting the body parts of an animal.	Code: SH1 Sharing of hunted animals among the members of the community.

2. Community Support and Mutual Aid:	Code: SH2
<i>Menemui arah yang dilaluinya dan memburu bersama-sama.</i> Finding the direction he passed through and hunting together. <i>Supaya org lain boleh sampai di sini.</i> So that others can also reach this place. <i>Memberitahu jiran sebelah.</i> Telling the neighbor next door.	Sharing of directions with community members in forest travelling and hunting activities.
3. Ceremonial and Ritual Sharing:	Code: SH3
<i>'Totoohon' ini penting agar pihak pengantin lelaki tidak kelaparan sepanjang perjalanan dan dapat sampai ke rumah pengantin perempuan.</i> Totoohon is important so that the groom does not go hungry throughout the journey and can reach the bride's house.	Sharing of rest place and food during wedding ceremonies.

Three trigger statements are identified under the value of sharing, and each other is matched with one value indicator. The sharing value indicators are coded as SH1, SH2, and SH3.

4.6.7 Outcome of Subsystem One: Murut Tahol Core Values

The process culminates in identifying Murut Tahol's core values, supported by the value indicators and verified through repeated engagement with the local experts. This ensures that the values are academically framed, culturally legitimate, and endorsed by the community itself. The complete set of the Murut Tahol core values and value indicators is shown in Table 4.5. This table will be the reference list that will be used as the control policy in the framework validation process later.

Table 4.5: The Complete Murut Tahol Core Value and Value Indicator Reference List

	Murut Tahol Core Values	Murut Tahol Value Indicators	
		Code	Description
1	Sharing	SH1	Resource Distribution: Sharing of hunted animals among the members of the community.
		SH2	Community Support and Mutual Aid: Sharing of directions with community members in forest travelling and hunting activities.
		SH3	Ceremonial and Ritual Sharing: Sharing of rest place and food during wedding ceremonies.
2.	Spirituality	SP1	Ancestral Reverence: Referring to the idea of ancestor spirits known as Aki and Aru.
		SP2	Ancestral Reverence: Seeking the ancestor spirit's help and guidance in daily activities.
		SP3	Rituals Practice: Ritual practice in curing missing persons.
		SP4	Rituals Practice: The practice of cursing with words.
		SP5	Spiritual Symbols and Art: The use of symbols that are associated with the spiritual realm.
		SP6	Spiritual Symbols and Art: The practice of reciting specific words or chants to invoke the spirit of the crops to ensure a bountiful harvest and to show respect to the forces of nature.
		SP7	Spiritual Belief: Belief in the existence of spiritual beings in their living system
3.	Unity	UN1	Collective Identity: The "tambaka" leaves symbolise family ties or kinship within this community.
		UN2	Interdependence: Community members recognize and value their interdependence for safety during forest travel and hunting.
		UN3	Support and Solidarity: Supporting each other in the preparation of weddings and other events.
		UN4	Community Support: Supporting each other in the preparation of weddings and other events.
4.	Interconnectedness	IN1	Connectedness in All Things: Connection of the Indigenous and their dogs in the hunting activities.
		IN2	Harmony and Balance with Nature: Striving for harmony and balance with nature and acknowledging the power of God.
5.	Resilience	RS1	Cultural Continuity: Maintaining and preserving cultural identity.
		RS2	Inter-Generational Knowledge Transfer: Passing down knowledge, stories, and survival skills from elders to younger generations.
		RS3	Adaptive Governance and Leadership: Disciplinary action and warning in their local context.

4.7. Implementation of Subsystem Two: Indigenous Knowledge Extraction

The second subsystem of the framework plays a significant role in revealing Indigenous knowledge. The goal is to transform and map the implicit and unstructured information into a structured and explicit format that can be easily analysed, stored, represented, and utilised for various purposes. The explicit outcome will be kept as an Indigenous symbol inventory and used as a reference for designing the digital Tatandu symbol in the digital co-design process of Indigenous symbols. Indigenous symbols carry a wealth of knowledge and values that are inherently encoded within them and contextualised in the activities they represent. Data collected from the interviews and photos captured from the visual documentation during the first field trip were carefully analysed and structured to extract and present this knowledge systematically. As mentioned in Chapter 3, the ethical engagement, cultural sensitivity, cultural protocols and collaborative methodologies in this context were closely adhered. Local community members and experts are invited to participate in the process. The four Indigenous local experts mentioned in Section 3.8 remain the same as resource persons and participants in this subsystem. Figure 4.4 demonstrates the process flow of how the subsystem two was implemented.

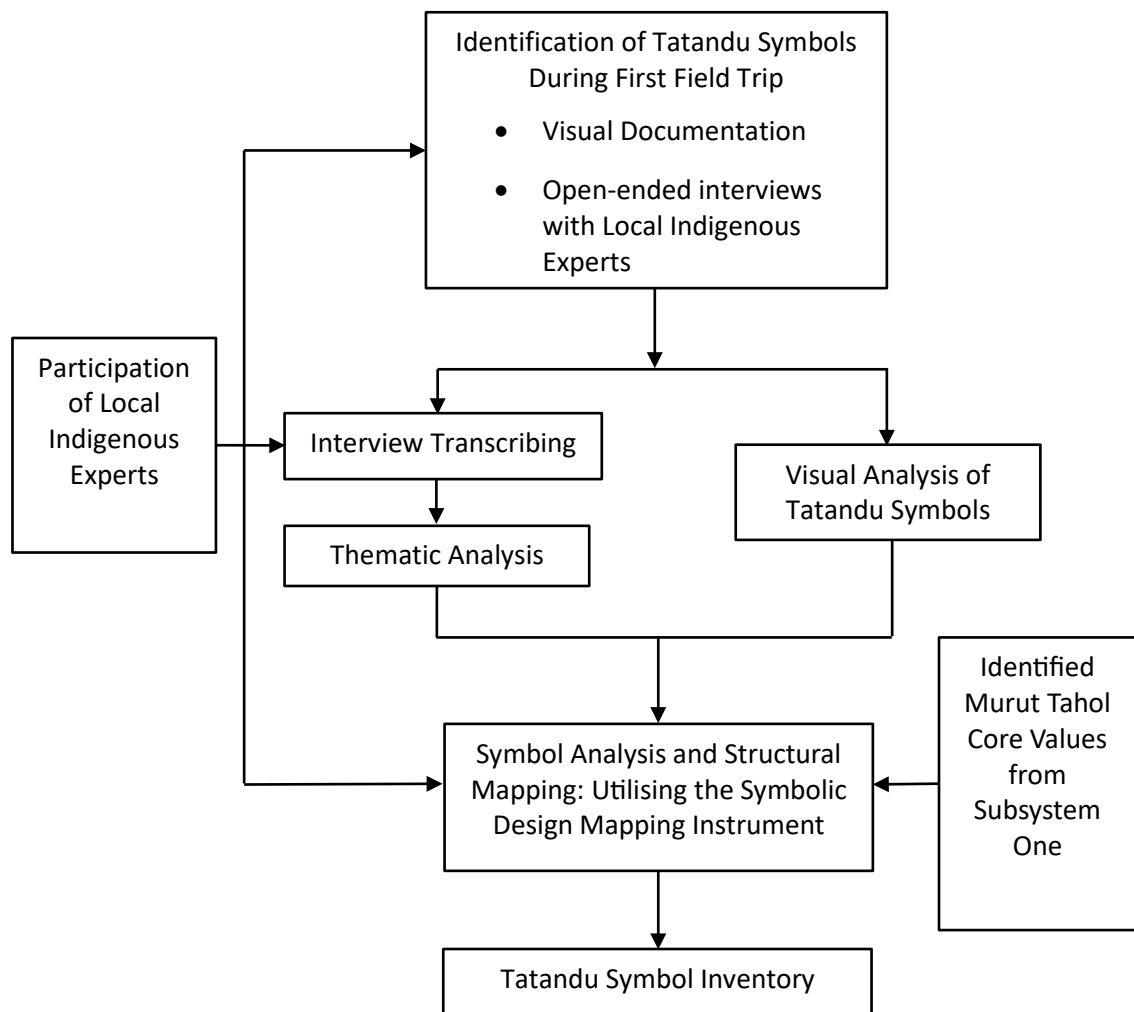


Figure 4.4: The Subsystem Two Implementation Flow

4.7.1 Outcome of Subsystem Two: Tatandu Symbol Inventory

The Tatanda symbols were analysed, and knowledge was extracted using the ISDM Instrument. The data were identified based on six attributes within the instrument, including physical aspects, usage patterns, symbol representation, symbol meaning, symbol usage, and Indigenous values. The findings of subsystem one added the identified Murut Tahol Core Values. The Tatandu symbols have also been categorised into four usage categories: navigation, hunting, warning, and wedding announcements. Tables 4.6,

4.7, 4.8, and 4.9 below present samples of mapped Tatandu symbols according to these categories, displayed in the structured format of the Indigenous Symbolic Design Mapping Instrument and maintained as the Tatandu Symbol Inventory. The complete list of the Tatandu symbols inventory is attached in Appendix H.

Table 4.6: Tatandu Symbol Inventory Sample for Symbol Code A1i, Navigation

1	Code: A1i Category: Navigation	Description: Wood slices and stakes <i>Hirison am tandukin (hiris kayu dan pacak)</i>	
Original Symbol: 		Attributes for Indigenous Symbols	Murut Tahol Tatandu
		Physical Aspect	Material Used: Sticks
		Usage Patterns	• Murut Tahol, southwest region of Sabah • Forest Navigation
		Message Structure and Relationship	Intuitiveness, Representation, Familiarity
		Message Meaning	I moved in the direction indicated by the sharpened end of the stick.
		Message Usage	• Informing a friend about the direction of the place we are heading to. • Prevent others from going astray.
		Indigenous Core Values Involved	Sharing, Spirituality, Unity

Table 4.7: Tatandu Symbol Inventory Sample for Symbol Code 2b, Hunting

10	Code: 2b Category: Hunting	Description: Obtaining large catches from hunting in the forest and requesting assistance from family members.	
Original Symbol:		Attributes for Indigenous Symbols	Murut Tahol Tatandu
		Physical Aspect	Material Used: • Dog • Forest roots
		Usage Patterns	• Murut Tahol, Southwest region of Sabah • Hunting Activities

	Message Structure and Relationship	Intuitiveness, Representation, Familiarity
	Message Meaning	- The hunting person has obtained a large catch and cannot return it home. - Therefore, they ask for the assistance of a dog to convey a message (forest roots) to their family at home, informing them that the hunter needs help to carry the large catch. - If two people cannot lift the catch, the person will tie two knots on the forest roots and attach it to the dog's neck. Family members at home will understand that these two knots indicate that the hunter needs two people to help carry the catch.
	Message Usage	- Facilitating the hunter in bringing their catch back home. - Assisting the hunter in seeking help from their family or siblings at home.
	Indigenous Core Values Involved	Sharing, Spirituality, Unity, Interconnectedness, Resilience

Table 4.8: Tatandu Symbol Inventory Sample for Symbol Code 3ei, Warning

13	Code: 3ei Category: Warning	Description: Half-burned wood tied with red cloth (Sosolov/Tutunu)	
Original Symbol: 		Attributes for Indigenous Symbols	Murut Tahol Tatandu
		Physical Aspect	Material Used: - Red cloth, Wooden embers, Wood - Purpose for burning while cursing at that moment: - Coconut husk (placed on the burning area)
		Usage Patterns	- Murut Tahol, Southwest region of Sabah - Warning
		Message Structure and Relationship	Intuitiveness, Representation, Familiarity
		Message Meaning	Instructing the thief to return the stolen items to the owner.

		Administering punishment to the thief.
	Message Usage	- So that the owner can recover their belongings. - To prevent the thief from committing such wrongdoing again.
	Indigenous Core Values Involved	Spiritual, Unity, Resilience

Table 4.9: Tatandu Symbol Inventory Sample for Symbol Code 3ei, Warning

14	Code: 4a Category: Wedding	Description: Carved wood into flowers (<i>Inkuun</i>)	
Original Symbol: 		Attributes for Indigenous Symbols	Murut Tahol Tatandu
		Physical Aspect	Material Used: - Ceremonial wood. - Kalamok (a special knife used to carve the wood into beautiful designs).
		Usage Patterns	- Murut Tahol, Southwest region of Sabah - Celebration
		Message Structure and Relationship	Intuitiveness, Representation, Familiarity
		Message Meaning	To indicate that the area is hosting a wedding ceremony.
		Message Usage	To give directions to the groom's family to the location of the bride's family house or the wedding venue.
		Indigenous Core Values Involved	Sharing, Spiritual, Unity, Resilience

4.8 Implementation of Subsystem Three: Indigenous Digital Symbol Co-Design

Subsystem three in the ISVCD Framework builds after subsystem two, focusing on digitally designing the Tatandu symbols. A co-design approach with Indigenous youth and a graphic designer was used to digitise the symbols, based on photographic images taken during the first field trip, and the data from the Indigenous symbols design mapping were used to guide the design ideation process. The project employed a democratisation

design approach, as discussed in Chapter 2, involving both the graphic designer and the Indigenous community. The design process flow for subsystem three is illustrated in Figure 4.5. A Murut Tahol youth participated in the co-design with a graphic designer acting as facilitator. The designer provided technical guidance, while the youth offered ideas and decisions for their design outcome. Profiles of the Murut Tahol youth and the graphic designer are in Table 4.10. This project led to the digital transformation of the Tatandu symbol, potentially usable as an emoji on mobile phones, resulting in 14 digital Tatandu symbols designed.

Table 4.10: Participant Profile in The Digital Tatandu Co-design Team

	Co-Design Participant	Experience	Age
1	Murut Tahol Youth	Murut Tahol university student who came from Sepulut, Sabah. She have experience in using Tatandu in the forest.	21
2	Graphic Designer	A professional graphic designer with 3 years working experience.	26

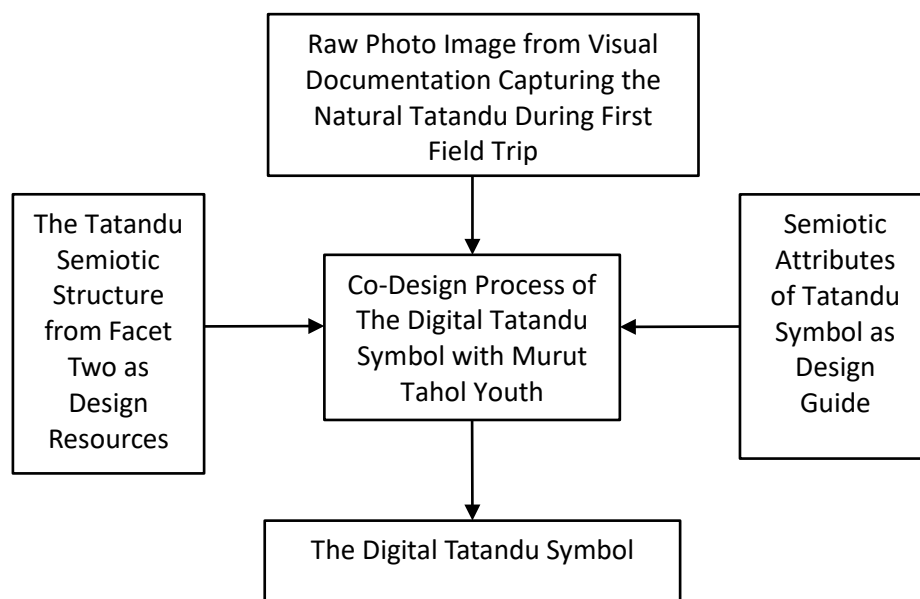
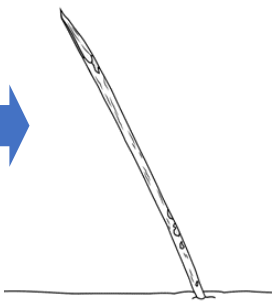
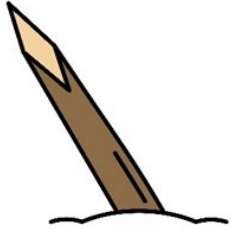
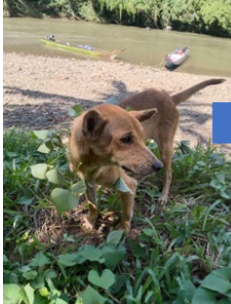
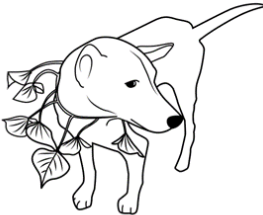
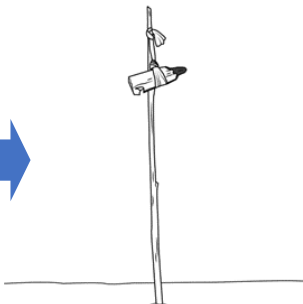
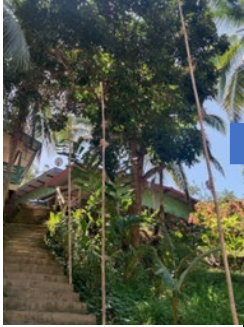
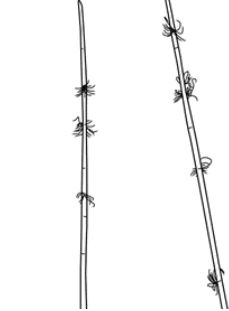
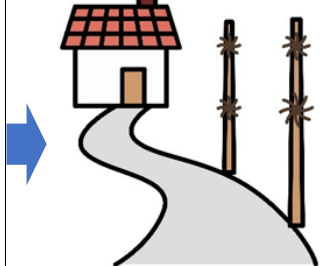


Figure 4.5: The Subsystem Three Co-Design Process Implementation Flow

Table 4.11 displays samples of the design transmission process for the four sample Tatandu symbols. The complete list is in Appendix I.

Table 4.11: Tatandu Symbol Design Transformation Process

	Tatandu Code	Photo Taken During Field Trip	First Drawing	Final Design
1	Code: Ali Category: Navigation Description: Wood slices and stakes <i>Hirison am tandukin</i> (<i>hiris kayu dan pacak</i>)			
2	Code: 2b Category: Hunting Description: Obtaining large catches from hunting in the forest and requesting assistance from family members.			
3	Code: 3ei Category: Warning Description: Half-burned wood tied with red cloth. (<i>Sosolov</i>)			

4	Code: 4a Category: Wedding Description: Carved wood into flowers <i>(Inkuun)</i>			
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4.8.1 Outcome of Subsystem Three: Fourteen Digital Tatandu Symbols

Table 4.12 presents the complete set of fourteen Digital Tatandu Symbol Prototypes designed through co-design and developed based on the information in the Tatandu Symbol Inventory.

Table 4.12: The Complete Set of 14 Digital Tatandu Symbols

Categories	Digital Tatandu Symbols			
Set 1: Navigation	 A1i	 A2i	 1b	 1cii
	 1di	 1e	 1fi	
Set 2:				

Hunting	2ai	2b		
Set 3: Warning	 3b	 3c	 3d	 3ei
Set 4: Wedding	 4a			

A Tatandu Symbol Vocabulary was created based on the symbols designed and the collective agreement of the local Indigenous experts on the meaning and usage of the Tatandu during the expert review interviews. The sample of the Tatandu Symbol Vocabulary is shown in Table 4.13, and the complete list can be viewed in Appendix H.

Table 4.13: Sample of Tatandu Symbol Vocabulary

11	Code: 3c Category: Warning	Description: Blocking using wood in the shape of 'X' (Avol)	
Digital Co-Designed Symbol: 		Message Meaning	- Informing others that the fruit trees cannot be picked/taken without the owner's permission. - No trespassing/entering the house when the owner is absent or without the owner's permission.
		Message Usage	- To prevent theft. - To maintain safety in the area.

4.9 ISVCD Framework Validation Results and Findings

The subsequent sections outline the results and findings of the three components of the framework triangulation validation. They offer insights into the effectiveness of the developed ISVCD Framework.

4.9.1 Symbol & Inventory Accuracy

56 expert evaluations (4 experts $\times$ 14 symbol items) were recorded for each syntactic attribute. Table 4.14 summarises the total correct responses and agreement rates based on the four close-end semi-structure interview questions Q1-Q4.

Table 4.14: Expert Agreement on Four Syntactic Attributes

Attribute	Total Correct	Max Possible	Agreement (%)
Familiarity	53	56	94.6%
Representation	52	56	92.8%
Material	56	56	100.0%
Colour	56	56	100.0%

These high agreement rates indicate that the symbols strongly reflect the syntactic attributes defined in the Indigenous Symbolic Design Mapping Instrument. In turn, this validates the accuracy and relevance of the Indigenous Symbol Inventory, which guided the symbol creation. Above 85%, it is considered strong acceptable and agreeable according to ISO (2007) and ANSI (2007) standards of icon comprehension rate (Zender & Mejía, 2013).

Open-ended responses from the experts based on Q5 were analysed thematically. Table 4.15 shows three themes that emerged.

Table 4.15: Emerging Theme from Q5

	Themes	Qoutes	Experts
		<i>Tanda ini lambang kebudayaan kami</i> The symbols represent our culture.	E2
		<i>Tanda ini jelas memberitahu saya jenis bahan apa dari hutan yang dipakai . Sangat bagus.</i> This one clearly tells me about the forest material used. Very well done.	E1
2.	Visual Clarity	<i>Ini senang, bila saya lihat, saya tahu apa dia cakap.</i> It is simple, but when I see it, I know what it's saying	E4
		<i>Ah.. ini betul. Inilah yg kasih patah itu, tanda yg tahu jalan masuk hutan mulamula.</i> Ah, that's correct. This is what breaks it, the sign that knows the entrance to the forest initially.	E1
		<i>Ok, yg bahagian B, mematahkan hujung-hujung ranting kayu tumbuh-tumbuhan, ah ini betul.</i> Ok, for part B, breaking the tips of branches from plants and trees, ah, that's correct.	E2
3.	Suggestions for Refinement	<i>Ini corak akan kurang jelas bila kecil....boleh tambah tebal sikit</i> This pattern may lose clarity when shrunk....maybe adjust the thickness	E3
		<i>Sasapin... ya, ini ada satu tambahan di sini, macam inikan..</i> Sasapin... yes, there's an additional aspect here...is like this right	E2
		<i>Kurang faham apa itu apalir kalua tenguk gambar ini.</i> I can't understand what it is a pair if you look at this picture.	E3

The three emerging themes are cultural integrity, visual clarity, and suggestions for refinement. Theme one, cultural integrity, indicates that experts affirmed that the digital symbols remained faithful to the essence of the original cultural motifs. Theme

two, Visual Clarity, shows that some experts praised the minimalistic yet culturally grounded representation. Theme three, Suggestions for Refinement, indicates that a few experts suggested enhancing symbol layering or colour gradation for better interpretation on digital screens.

4.9.2 Instrument Validity

Table 4.16 and Figure 4.6 summarise the Recall scores for each syntactic attribute across all participant groups (n = 56 total evaluations).

Table 4.16: Overall Recall by Syntactic Attribute

Attribute	Recall
Familiarity	0.875
Representation	0.804
Material	0.982
Colour	1.000

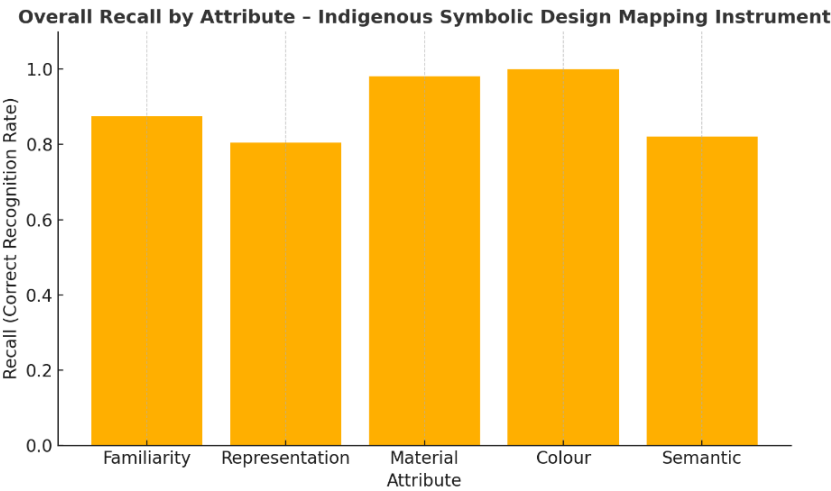


Figure 4.6: Recall by Attribute Bar Chart

The instrument achieved impressive recall scores that were either above or very close to the established threshold of 0.85 for virtually all of the attributes it was designed to

evaluate. However, one notable exception was the attribute of Representation, which yielded a slightly lower score of 0.804. This outcome suggests that while the instrument exhibits generally high recognition reliability for attributes that are visually grounded, there exists a minor limitation regarding the clarity of digital shape representation. Overall, the results illustrate a strong capability in recognizing most attributes effectively, although some refinement may be necessary to enhance the clarity of shape representation in digital formats.

4.9.3 Core Value Transmission

Table 4.17 compares the existence of core values elicited from the experts through interviews and the youth groups through the focus group discussion on the use of Tatandu symbols. This table showcases an important discovery in validating the ISVCD Framework.

Table 4.17: Comparison of Core Values Existence Between Experts Interviews and Youth Focus Group Interviews

	Values	Expert	Youth
Set 1 : Navigation	Sharing	√ SH2	√ SH2
	Spirituality	√ SP1, SP2, SP3, SP5, SP7	√ SP7
	Unity	√ UN1, UN2	√ UN1, UN2
	Interconnectedness		
	Resilience		
Set 2 : Hunting	Sharing	√ SH1	√ SH1
	Spirituality	√ SP1, SP2	√ SP7
	Unity	√ UN2, UN3	√ UN3, UN4

	Interconnectedness	√ IN1, IN2	
	Resilience	√ RS2	√ RS2
Set 3 : Warning	Sharing		
	Spirituality	√ SP4	√ SP4, SP5
	Unity	√ UN2	√ UN2
	Interconnectedness		
	Resilience	√ RS3	√ RS2
Set 4 : Wedding	Sharing	√ SH3	√ SH3
	Spirituality	√ SP5, SP6	
	Unity	√ UN4	√ UN4
	Interconnectedness		
	Resilience	√ RS1	√ RS1

The presence of three values, sharing, unity, and resilience, is consistently the same in both groups, indicating a strong correlation between their presence and absence in the four sets of Tatandu categories across both experts' and youths' responses. Sharing, unity, and resilience were all present in both navigation and hunting activities in the expression of experts and youths during interviews and conversations.

The two values, spirituality and interconnectedness, showed variations between the two groups. Both of these values had instances where their presence or absence differed between experts' and youth responses. This suggests that each group has unique conditions affecting these values.

During the conversation held with youths in focus groups, it was found that they have fewer indicators of spiritual value in comparison to the experts in navigation and hunting activities. However, they showed consistency in warning and wedding activities. Only one of the spiritual value indicators, namely SP7 Spiritual Belief: Belief in the existence of spiritual beings in their living system, was identified during the conversation. This could be attributed to the fact that the youths have less experience and knowledge of other spiritual activities, such as ritual practices and seeking ancestors' divine assistance in prayers, which are only carried out by the elders. Nevertheless, the youths' awareness of the belief in spirituality in certain matters related to navigation and hunting activities is sufficient to prove their knowledge of the belief in spirituality in their Murut Tahol culture.

Spirituality was absent from the youths' conversation when referring to wedding symbols. It seems that the youth are more interested in the celebrations of the wedding feast and helping the wedding family than in understanding and appreciating the underlying spiritual significance of the ceremony, compared to the older generations. This suggests that young people may be drawn to the surface level of the joy and fun of the wedding celebration without fully grasping the deeper meaning of their cultural heritage and spiritual beliefs.

Similarly, the value of interconnectedness was not detected in the conversation about hunting symbols with the youth group. This could be due to the youth's lack of experience with the interconnectedness between Indigenous people and their environment and subjects. As the experts mentioned, the interconnectedness can be seen in the relationship between the Indigenous people and their dogs during hunting activities. The Indigenous people are able to train and communicate with their dogs effectively, and they

are aware of the emotional and physical condition of the dogs. They can give instructions to the dogs to help them in their hunting activities, and the dogs respond well to their instructions. We assume that this kind of connection between the Indigenous people and their dogs can only be achieved through long-term experience, which the youth have not yet gained.

In conclusion, no values consistently differed across all sets between the two groups of experts and youth. This suggests that while some differences exist, they are not pervasive across all values. This indicates that the core values of Murut Tahol, which are deeply rooted in natural Tatandu as it was practised in the forest, can be identified in the digital Tatandu symbols expressed by the youth in the focus group conversation. The transmission of values addressed in the ISVCD Framework works well in this context and validates the framework's functionality.

4.9.4 Triangulated Framework Validation Synthesis

This section synthesises the findings of the three validation components: symbol and inventory accuracy, empirical instrument testing, and core value comparison to present a comprehensive evaluation of the ISVCD Framework.

Expert review Scores exceeding 85% are deemed strongly acceptable and agreeable per ISO (2007) and ANSI (2007) standards (Zender & Mejía, 2013). These results confirmed that the visual form and symbolic representation within the Indigenous Symbol Inventory and digital symbol design maintained high cultural and visual accuracy levels, establishing the framework's alignment with Indigenous visual communication design logic.

Empirical evaluation using a confusion matrix revealed high recall rates across five core symbolic attributes (Familiarity, Representation, Material, Colour, Semantic), with scores above the 0.85 threshold. This validates the internal reliability and functionality of the Indigenous Symbolic Design Mapping (ISDM) Instrument.

Finally, the thematic comparison of core values revealed that the presence of core values during interviews with local Indigenous experts (original symbols) and Indigenous youths (digital symbols) during focus group discussion remained consistent. The presence of three core values: sharing, unity, and resilience, remains consistent in both interview thematic findings. This confirms the framework's success in preserving and transmitting Indigenous values through co-designed digital symbols.

These three components of evidence triangulate to affirm the effectiveness, cultural authenticity, and systemic validity of the ISVCD Framework. The findings confirm the central hypothesis: that visual communication can be formalised in a design framework and successfully applied to Indigenous symbolic communication language.

4.10 Chapter Summary

This chapter presents the data collected during the framework's implementation and validation. It details the extraction and mapping of Indigenous symbols, the development of a digital symbol set through a co-design process, and the preservation of core Indigenous values. The validation findings are presented in three parts: (1) an expert review of symbol and inventory accuracy, demonstrating strong agreement on the framework's cultural fidelity; (2) empirical instrument testing, which confirms the ISDM Instrument reliability across five symbolic attributes; and (3) thematic core value comparison, which shows alignment between expert and youth interpretations of

symbolic meanings. Collectively, these results validate the effectiveness and authenticity of the ISVCD Framework.

CHAPTER 5

DISCUSSION, CONCLUSION AND FUTURE WORK

5.1 Introduction

This chapter serves as the final section of the thesis, providing a comprehensive conclusion and recommendations for the entire research. This chapter synthesises the findings presented in Chapter 4, aligning them with the research objectives and theoretical frameworks outlined earlier in the study. It provides an in-depth discussion on theoretical implications, practical applications, and notable contributions, acknowledges the research's limitations, and offers directions for future research. Ultimately, this chapter encapsulates the journey and reaffirms the significance of culturally grounded frameworks in visual communication design, particularly within the context of Indigenous symbolic systems.

This hypothesis has been tested through the development, implementation, and triangulated validation of the ISVCD Framework. The findings demonstrate that visual communication can be systematised into a formal design framework and that such a framework can also effectively preserve and transmit the semantic and epistemological essence of Indigenous symbolic systems in digital form.

5.2 Discussion

This section discusses the research findings based on previous chapters and the three primary research objectives. It also evaluates the central hypothesis: Visual communication can be formalised in a design framework and applied effectively to Indigenous symbolic communication language.

The Indigenous Symbolic Visual Communication Design (ISVCD) Framework has been systematically examined through meticulous design, practical implementation, and rigorous validation. Each research objective has been instrumental in developing or validating this central hypothesis. The following section discusses it further.

5.2.1 Objective One: Framework Formulation

The initial objective of this study was to formulate a robust and culturally authentic design framework tailored specifically for Indigenous symbolic visual communication. This objective was successfully achieved by developing the ISVCD Framework. This comprehensive framework integrates three foundational theoretical elements:

1. **Hybrid Conceptual Visual Communication and Semiotic Framework:** This framework synthesises Peirce's Triadic Model, Sinha's Semiotic Mediation Model, Kress and van Leeuwen's Visual Grammar, and Stamper's Semiotic Ladder. a multi-level, hierarchical perspective on communication and explicitly addressing both syntactic elements (such as familiarity, representation, colour, and material) and semantic dimensions (symbolic meanings). It uniquely caters to Indigenous contexts where visual signs carry profound cultural and ecological significance.
2. **TRIZ Law of System Completeness:** Derived from engineering principles, the TRIZ model provides a systematic and logical structure that ensures completeness within the visual communication system. It encompasses essential components, including the engine, transmission, working unit, control mechanisms, and feedback loops, thereby guaranteeing comprehensive communication integrity and a mechanism for systematic

implementation. To address this, the TRIZ Law of System Completeness was integrated as a structural design logic that organises the framework into a complete and functional design system.

3. **Indigenous Research Paradigm:** Importantly, the framework aligns with Indigenous knowledge systems, highlighting relationality, shared community insights, and value-driven design principles. This approach guarantees cultural authenticity, integrity, and community ownership while avoiding external imposition by anchoring the framework in Indigenous perspectives.

These combined theoretical components facilitate the development of a logically sound and culturally resonant design framework, thereby directly supporting this research's central hypothesis.

5.2.2 Objective Two: Framework Implementation

To evaluate the practical applicability and effectiveness of the ISVCD Framework, an in-depth case study utilising the Tatandu Indigenous visual language was undertaken. The TRIZ Law of System Completeness, used as a socio-technical system, has been effectively structured as an implementation strategy, and the implementation phase involved several structured activities:

1. **Symbol Extraction and Inventory Creation:** Indigenous symbols were meticulously documented and systematically analysed using the Indigenous Symbolic Design Mapping (ISDM) Instrument. The ISDM Instrument effectively operationalised the theoretical framework by

capturing syntactic and semantic dimensions, producing a structured symbolic inventory.

2. Core Value Elicitation: Comprehensive interviews with Indigenous cultural experts were conducted to pinpoint the intrinsic core cultural values linked to the symbols. These insights were thematically analysed and integrated into the Indigenous Symbol Inventory, embedding cultural authenticity in each symbol and ensuring precise cultural representation.
3. Co-Design and Digital Adaptation: Collaborative co-design sessions with Indigenous youths facilitated the transformation of 14 traditional symbols into digitally compatible formats, such as emojis. The symbolic adaptation process relied on data provided by the ISDM Instrument, maintaining traditional symbolic meanings while optimising designs for contemporary digital usage.

This systematic implementation effectively validated the framework's practical applicability and adaptability, demonstrating that formalised visual communication principles could successfully guide Indigenous symbolic designs and adaptations in real-world contexts.

5.2.3 Objective Three: Framework Validation

A critical aspect of this research was the triangulated validation strategy designed to comprehensively assess the ISVCD Framework's cultural, visual, and functional validity. This validation strategy encompassed three complementary methods:

1. Expert Review: Four Indigenous cultural experts thoroughly evaluated the

symbol inventory and digital symbol designs. The review provided quantitative insights, showing high accuracy across essential symbolic attributes such as familiarity, representation, material, and colour.

2. Empirical Evaluation (Confusion Matrix Analysis): Empirical testing with four Indigenous youth focus groups rigorously assessed the reliability of the ISDM Instrument. The results consistently indicated high precision and recall scores, each exceeding 0.8 across the five symbolic attributes, confirming its reliability and effectiveness.
3. Thematic Core Value Comparison: The symbolic values initially identified by cultural experts were systematically compared to those articulated by youth participants about digitally adapted symbols. Analysis revealed strong alignment, with most core values matching directly or synonymously, confirming successful cultural value transmission across the design processes.

This triangulation validation strategy clearly demonstrates that the ISVCD Framework is visually coherent, culturally robust, and functionally sound. It underscores the framework's ability to effectively preserve and communicate Indigenous cultural meanings through structured symbolic processes, substantiating the central research hypothesis.

5.3 Theoretical and Practical Implications

This research has made substantial contributions to both theoretical frameworks and practical applications. It offers valuable insights and advancements that enhance our understanding and implementation of research.

5.3.1 Theoretical Implications

The developed ISVCD framework effectively demonstrates the feasibility of seamlessly integrating Western semiotic structures with Indigenous epistemological perspectives. This highlights the adaptive potential of semiotic theories through participatory interpretation and nuanced symbolic representation, challenging universalist assumptions in semiotics by showcasing culturally specific adaptations.

5.3.2 Practical Implications

The validated ISVCD Framework offers considerable practical applicability. Firstly, it serves as an authoritative design guide for creating culturally relevant digital content, such as emojis and stickers. Additionally, the framework supports community-led co-design processes, empowering Indigenous communities to actively shape their digital symbolic systems and promote cultural preservation and revitalisation.

5.4 Research Contribution

This research project covered distinct study areas; therefore, the results and contributions involved various disciplines. The detailed contributions are explained as follows:

5.4.1 A New Culturally Grounded Visual Communication Design Framework

The ISVCD Framework is a groundbreaking and influential advancement in both academic and practical visual communication design. This framework is explicitly rooted in Indigenous symbolic systems, which enriches its significance and ensures that it embodies a deep respect for cultural heritage. The ongoing process of developing and validating this framework showcases its potential to empower visual communication practitioners by illustrating how it can maintain cultural authenticity even when applied

within modern digital formats. By integrating these Indigenous symbols and narratives, the ISVCD Framework provides a unique perspective on how visual communication can evolve and adapt while remaining true to its cultural origins.

5.4.2 Methodological Innovation

This comprehensive research distinctly merges the TRIZ methodology with Indigenous epistemologies, presenting a groundbreaking approach that illustrates how systematic innovation methodologies can effectively complement and significantly enhance various strategies to preserve and revitalise Indigenous knowledge. By exploring the interplay between these different frameworks, the research highlights the potential for innovative solutions that respect and integrate cultural wisdom, ultimately fostering a more inclusive landscape for knowledge preservation.

5.4.3 Practical Applications for Digital Symbol Systems

The framework presents a comprehensive illustration of the scalability necessary for the future development of culturally specific emojis and instant messaging symbols. This scalable approach paves the way for a broader expansion of opportunities for rich cultural representation and the affirmation of individual identities within digital communication environments. By accommodating diverse cultural symbols, the framework enhances the richness of our digital conversations and fosters a sense of belonging and validation for various cultural groups. Consequently, this initiative significantly influences how individuals express their unique cultural identities in an increasingly interconnected digital world.

5.5 Research Limitation

This research acknowledges certain limitations that constrain generalisability. It is essential to recognise these limitations and address them in future studies.

1. The research was limited to conducting a case study on a single Indigenous visual symbol, specifically the Murut Tahol Tatandu. Further improvements are necessary to increase the framework's efficiency and effectiveness and address technical issues. A broader scope of study involving more Indigenous visual symbols and communication artefacts will enhance the research.
2. The limited number of participants during the validation phases may affect the representativeness of the findings due to the constraints of location and the Indigenous community's population.
3. Only two field trips were conducted during the research due to the Indigenous community's distance. The distance and domestic issues made it difficult to conduct more field trips. Although it is common practice in Indigenous research to use research data in multiple research processes, this approach must be implemented to make the most of the available data.

5.6 Conclusion

The research effectively addressed its three core objectives, culminating in the comprehensive design, meticulous implementation, and rigorous validation of a culturally grounded visual communication design framework specifically tailored to Indigenous symbolic systems. This innovative ISVCD Framework exemplifies the potential for digitally preserving Indigenous identities. It seeks to authentically reflect the depth of traditional knowledge systems, intricate logical structures, and the rich cultural values that define these communities. By leveraging technology in this way, the framework acts

as a bridge, connecting contemporary digital practices with historical and cultural significance, ensuring that Indigenous narratives are preserved, honoured, and celebrated in the modern context.

5.7 Future Work

Here are some detailed recommendations for future studies in this research:

1. As a follow-up, a greater array of Tatandu symbols could be discovered, thoroughly documented, and digitised, resulting in a more detailed and extensive catalogue. Future efforts might include better-organised visits to the Murut Tahol communities to involve additional groups and enhance the collection of Tatandu symbols recorded.
2. The 14 digital Tatandu symbols designed in this project will be further developed and transformed into digital stickers or emojis. These symbols can be utilised in the Indigenous Messaging System (IMS) to benefit the community. The Tatandu symbols can represent various Indigenous concepts and values, thus facilitating communication among people in their native languages. This can help promote and preserve Indigenous culture.
3. Engage with the Indigenous community through workshops to empower community members, especially youth, with the knowledge and skills necessary to manage the digitalisation process independently. Identifying, digitalising and preserving their own Indigenous symbols amidst the evolving technological landscape.
4. The ISVCD Framework, a visual communication design framework created for Indigenous symbols, will be expanded to include other visual symbols and communication artefacts. This would enhance the framework's functionality

and contribute to the conservation and sustainability of Indigenous knowledge and values. Extending the framework can make it more comprehensive and inclusive of various Indigenous communities.

5. Expanding the study to explore the possibility of formulating values-based emoji model with regards to effectively preserving Indigenous symbolic languages

5.8 Chapter Summary

The chapter confirmed this hypothesis by demonstrating how the ISVCD Framework successfully formalised and preserved Indigenous symbolism in digital formats. Each objective was addressed: the formulation of the ISVCD framework, its implementation through the Tatandu visual language case study, and its triangulated validation. Theoretical implications included the blending of semiotic systems and Indigenous paradigms. Practical implications involved applications in design, education, and cultural preservation. The chapter outlined the study's contributions, limitations, and future directions for expanding and refining the framework across other Indigenous communities and digital platforms. This chapter serves as the conclusion of the entire research.

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APPENDICES

Appendix A: Journal Publications

1. **Goh, C. H.**, & Kulathuramaiyer, N. (2020). Developing an Indigenous Cultural Values Based Emoji Messaging System: A Socio-Technical Systems Innovation Approach. Paper presented at the 12th ACM Conference on Web Science Companion, Southampton, United Kingdom.
2. **Goh, C. H.**, & Kulathuramaiyer, N. (2020). TRIZ Based Conceptual Design Framework for Future Emoji System. Paper presented at the MyTRIZ Conference Proceedings 2020, UOW Malaysia KDU Penang, Malaysia.
3. **Goh, C. H.**, & Kulathuramaiyer, N. (2022). Inventive Design Solutions for the Complex Socio-technical Problems in Preserving Indigenous Symbolic Visual Communication. Paper presented at the Systematic Innovation Partnerships with Artificial Intelligence and Information Technology: 22nd International TRIZ Future Conference, TFC 2022, Warsaw, Poland, September 27–29, 2022, Proceedings

Appendix B: Local Indigenous Expert Interview Invitation Letter



Tarikh:

Alamat:

Tuan/Puan,

Jemputan Penyertaan Kajian Selidik *Indigenous Visual Symbolic Communication Design Framework: Sustaining Indigenous Knowledge Through Systematic Innovation Approach*.

Adalah saya dengan hormatnya merujuk kepada perkara di atas.

2. Saya Goh Chu Hiang (No Pelajar: 16010061) merupakan pelajar kedoktoran di *Institute of Social Informatics and Technological Innovations* (ISITI), UNIMAS. Saya kini sedang menjalankan satu projek kajian selidik untuk membangun Rangka Kerja Reka Bentuk Komunikasi Visual Simbolik Peribumi menggunakan simbol visual kaum Murut iaitu Tatandu. Saya ingin menjemput tuan/puan untuk menyertai kajian ini sebagai peserta pakar dalam hal kebudayaan kaum Murut. Aktiviti kajian ini termasuk temu ramah dengan tuan/puan tentang penggunaan simbol Tatandu daripada pengalaman tuan/puan. Semua maklumat yang diberikan akan diuruskan secara sulit dan tiada butiran peribadi akan direkodkan. Ekstrak kajian selidik ini akan digunakan untuk tujuan penyelidikan sahaja.

3. Sekiranya, tuan/puan ingin mendapatkan sebarang pertanyaan yang lebih lanjut, saya boleh dihubungi dengan no. telefon 016-4067672, email: 16010061@siswa.unimas.my, atau menghubungi penyelia saya Prof. Narayanan Kulathuramaiyer (email: nara@unimas.my).

4. Saya mengalu-alukan penyertaan tuan/puan dalam kajian selidik ini. Segala pertimbangan dan kerjasama amatlah dihargai dan didahulukan dengan ucapan ribuan terima kasih.

Yang benar,

Goh Chu Hiang
Penyelidik Projek

Appendix C: Local Indigenous Expert Consent Letter



Consent Form – Interview

Title of Research: Indigenous Visual Symbolic Communication Design Framework: Sustaining Indigenous Knowledge Through Systematic Innovation Approach.

Saya _____ (Nama penuh), dengan ini saya bersetuju untuk mengambil bahagian dalam penyelidikan seperti dinyatakan atas. Saya memberi kebenaran untuk menggunakan maklumat saya yang diberikan dalam temu bual untuk penyelidikan dan untuk merekod temu bual. Saya telah dimaklumkan dan memahami tujuan penyelidikan, dan kerahsiaan identiti saya. Juga saya faham saya boleh menarik diri pada bila-bila masa tanpa prejudis. Saya telah diberi peluang untuk bertanyakan soalan. Saya telah menerima salinan lembaran maklumat dan borang kebenaran.

KENYATAAN PESERTA

Tandatangan: _____

Nama: _____

Tarikh: _____

Tandatangan Penyelidik: _____

Nama Penyelidik: Goh Chu Hiang

Tarikh: _____

Appendix D: Community Engagement Interview Transcripts Sample

Location: Pensiangan

File: RAKAMAN 1_H1

RAKAMAN 5

EXPERT 1 – E1

Q1: Adakah budaya tatandu ini masih diamalkan sehingga kini?

E1: Ya, masih diamalkan sehingga sekarang terutamanya di kawasan pedalaman.

Q2: Adakah pak cik risau akan masa depan warisan budaya tatandu ini?

Do you worry about the future of the tatandu cultural heritage?

E1: Risau jika tidak ada orang murut tahol yang meneruskan amalan tatandu ini.

Q3: Mengapa pak cik risau?

E1: orang muda tidak tahu akan tatandu ini, suka main game dalam handphone.

Q4: Bagaimanakah cara orang-orang tua atau yang berpengalaman seperti anda memastikan budaya tatandu murut tahol ini tidak pupus ditelan zaman?

E1: Caranya memberi nasihat kepada orang-orang muda, cucu cicit mengenai budaya tatandu murut tahol ini dan kepentingannya. Kita perlu memberitahu dan menceritakan kepada mereka pengalaman atau kehidupan datuk nenek moyang terdahulu menggunakan tanda-tanda tertentu yang mempunyai peranannya tersendiri. Malah, yang terutama sekali orang-orang muda kini perlu mengetahui tanda-tanda amaran dan tidak boleh melanggarnya sesuka hati kerana impaknya berbahaya dan melibatkan nyawa. Melalui nasihat dan cerita, generasi kini akan mengenali sedikit demi sedikit, memahaminya sekali gus mengamalkan budaya tatandu ini dalam kehidupan mereka. Tambahan pula, bercerita memberi keseronokan kepada mereka untuk mendengar dan fokus. Jangan selalu main handphone dan guna dan belajar benda dalam handphone yang bukan budaya kita. Generasi kini seperti anak-anak muda murut tahol perlu menyedari bahawa mereka sudah mempunyai identiti tersendiri sebagai kaum murut tahol dan budaya tatandu ini merupakan salah satu warisan turun-temurun daripada datuk nenek moyang murut tahol terdahulu. Maka, mereka perlu memelihara budaya tatandu ini kerana setiap kaum mempunyai perbezaan dari pelbagai aspek dan semestinya kaum lain akan tertarik untuk mengenali keunikan dan cara hidup kaum murut tahol. Bukan itu sahaja, budaya tatandu ini dapat mendisiplinkan kaum murut tahol sendiri seperti mereka saling menghormati, bantu-membantu, tidak mencuri dan sebagainya.

PIR2

File: RAKAMAN 1_H1

RAKAMAN 5

EXPERT 2- E2

Q1: Adakah budaya tatandu ini masih diamalkan sehingga kini?

E2: Ya, masih diamalkan.

Q2: Adakah nenek risau akan masa depan warisan budaya tatandu ini?

E2: Risau kerana budaya tatandu ini merupakan salah satu identiti bagi sesuatu kaum salah satunya kaum murut tahol dan mempunyai keunikannya tersendiri. Lagipun, tatandu ini sangat penting bagi anak-anak muda kini terutamanya mereka yang tinggal di pedalaman atau melakukan aktiviti perkhemahan di hutan. Ada tanda-tanda yang membantu orang mengelak daripada mendapat bahaya atau malapetaka dan dapat menyelamatkan diri daripada tersesat di hutan.

Q3: Mengapa anda risau?

E1: Anak-anak muda suka tengok handphone tidak suka belajar, Tatandu tidak ada dalam handphone ada dalam hutan.

Q4: Bagaimanakah cara orang-orang tua atau yang berpengalaman seperti nenek memastikan budaya tatandu murut tahol ini tidak pupus ditelan zaman?

E2: Antara caranya ialah mengamalkan budaya tatandu ini atau mengajar anak-anak muda secara langsung supaya mereka mudah faham fungsinya, menghafal bentuk tanda-tanda tersebut dan mengaplikasikannya dalam kehidupan seharian. Apabila orang-orang tua atau yang berpengalaman mengamalkannya, anak-anak muda akan terlihat dan terbiasa sekali gus mengikuti budaya tatandu tersebut. Kebiasaannya, kami akan bercerita dengan cucu cicit mengenai budaya tatandu ini pada waktu petang atau musim cuti persekolahan ketika anak-anak muda balik ke kampung.

Appendix E: Field Trip Notes and Documentation for Tatandu

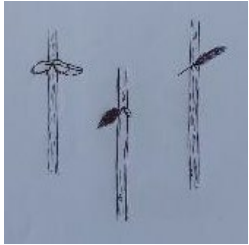
RAKAMAN TATANDU SIMBOL KAUM MURUT TAHOL DI KAWASAN KAMPNG PILANAS, PENSIANGAN, SEPULUT DAN NABAWAN.

GAMBAR	MATERIAL (BAHAN YANG DIGUNAKAN)	CARA MEMBUAT	GUNA DI KAWASAN MANA	MAKSUD	TUJUAN
1. TANDA ARAH DALAM HUTAN A1) Hirison am tandukin (hiris kayu dan pacak) Kod image: A1 	- kayu	- Potong sebatang kayu & tajamkan hujung kayu. - Pacak kayu dan hujung kayu menghala ke arah jalan yang hendak dituju.	- hutan	- Saya bergerak ke arah seperti yang ditunjukkan oleh hujung kayu yang ditajamkan.	- memberitahu rakan terhadap arah tempat yang kita tuju. - mengelakkan orang lain daripada sesat.
A2) Sasapin (hiris kayu) Kod image: A2 	- kayu - ranting kayu	- potong sebatang kayu & hiris sedikit batang kayu tersebut. - pacak kayu tersebut. - potong ranting kayu dan tajamkan hujung ranting kayu itu. - sisipkan ranting kayu secara melintang pada bahagian batang kayu yang dihiris tadi.		- mempunyai pelbagai maksud (contoh : tempat itu ada orang yang jahat, tempat itu ada bahaya dll)	- untuk keselamatan.

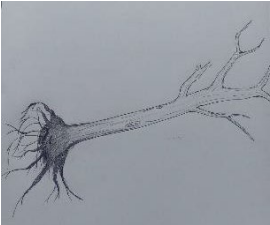
b) Mematahkan hujung-hujung ranting kayu@tumbuhan Kod image: 1b 	- ranting kayu@tumbuhan	- mematahkan ranting-ranting kayu@tumbuhan di sepanjang perjalanan.	- hutan	- Saya bergerak ke arah seperti yang ditunjukkan oleh ranting-ranting kayu yang dipatahkan.	- untuk menandakan jalan supaya tidak sesat dan dapat kembali jalan asal. - mudah mengetahui tempat rakan kita berada.
c) Apalir(orang yang tersesat) Kod image: 1c 	- akar hutan	- ambil akar hutan. - gulungkan akar hutan dalam satu bentuk bulatan yang besar (muat untuk badan manusia). - orang yang sesat itu akan memegang gulungan akar hutan tersebut secara berhadapan dengannya. - orang tersebut akan memasuki bulatan itu secara menunduk bermula dari kepala sehingga kaki. - Orang tersebut terus buang gulungan akar hutan tanpa menoleh ke belakang dan terus melangkah ke hadapan.	- hutan	- orang yang tersesat itu dapat menemui jalan keluar yang asal yang mana tempat permulaannya masuk ke hutan tersebut.	- orang yang tersesat dapat menyelamatkan diri di hutan.

	- rotan - akar hutan (alternatif)	- ambil sebatang rotan yang panjang dan ikat kedua-dua hujung rotan tersebut. - cucuk tengah-tengah rotan tersebut menggunakan pisau dan membelahnya untuk membentuk satu bulatan. - orang yang tersesat itu perlu memijak bahagian bawah rotan dan memegang lagi bahagian atas rotan tersebut. - lalu, masuk ke dalam bulatan rotan tersebut dan berjalan terus ke hadapan tanpa menoleh ke belakang.			
d) Keturunan orang Sulung (moyang-moyang terdahulu) salah satu daripada keturunan Kod image: 1d 	- kayu - daun muda	- potong sebatang kayu & pacak di tanah secara senget. - putik sehelai daun muda dan bentukkannya dalam bentuk bulatan - cucuk tengah-tengah daun yang dibentuk tadi ke kayu (yang mempunyai cabang) yang dipacak tadi.	- Hutan	-orang-orang yang berketurunan Sulung mengetahui bahawa ada orang keturunan sulung yang lain terlebih dahulu masuk/pergi memburu di kawasan hutan tersebut.	- menunjukkan orang- orang yang berketurunan Sulung masuk ke kawasan hutan untuk memburu. - mengelakkan daripada bahaya/pertembungan antara 2 kumpulan berburu.

e) Keturunan murut asli tahol Kod Image: 1e 	- kayu - daun tambaka	- Ambil sebatang kayu dan hiris sedikit bahagian tengah kayu tersebut. - Petik sehelai daun tambaka dan sisipkan pada batang kayu tadi. - pacakkan kayu tersebut secara senget untuk menunjukkan sesuatu kawasan tersebut atau tempat yang dituju.	- Hutan - Kawasan tanah sempadan	- mereka memburu di kawasan hutan @ mengusahakan tanah (menerokai tanah di hutan bagi bercucuk tanam) @ menunjukkan tanda tanah sempadan milik murut asli tahol.	- adik-beradik @saudara mara kaum murut tahol @ orang lain mengetahui orang murut tahol ada yang berburu di hutan @ yang memiliki kawasan tanah tersebut.
f) Tanda arah bagi tanah sempadan Kod image: 1f 	- kayu - parang	- Apabila pemilik tanah sudah meletakkan batu geran /peket bagi tanahnya di hutan, dia perlu menanda arah di sepanjang kawasan tanahnya. - kikis kayu besar dalam bentuk anak panah @ menghiris kayu yg berhampiran bagi menunjukkan tempat batu geran/peket tersebut. - Perkara ini perlu dilakukan di semua tempat batu geran/peket berada. - Contoh: ayah keluarga tersebut meletakkan batu geran/peket di tanah mereka serta dalam masa yang sama mengikis @ menghiris kayu-kayu sebagai penunjuk arah kawasan tanah mereka. - Apabila anak-anaknya sudah besar, mereka mudah mencari kawasan tanah@batu geran milik	- Hutan	- menandakan kawasan yang hendak dituju (air terjun, hiking) - menunjukkan arah di mana terletak batu geran atau peket bagi pemilik tanah tersebut yang berada di hutan.	- orang lain mudah sampai ke destinasi yang hendak dituju. - anak-anaknya mudah mencari batu geran pada tanah ayah mereka jika ayah mereka sudah tidak larat berjalan jauh atau meninggal dunia.

		ayah mereka melalui tanda-tanda tersebut.			
2. AKTIVITI MEMBURU a) Mendapat hasil buruan Kod image: 2a 	- Anggota badan haiwan (ekor, telinga, kaki @ bulu haiwan) - kayu/dahan	- Pacak sebatang kayu & hiriskan bahagian tertentu kayu tersebut. - Sisipkan ekor/telinga/kaki/bulu haiwan	- hutan	- Memberitahu rakan bahawa saya telah dapat menangkap haiwan tersebut semasa memburu bersama-sama di hutan.	- supaya rakan dapat mengetahui kita telah menangkap haiwan & jenis haiwan tersebut semasa berburu bersama-sama di hutan.
b) mendapat hasil buruan di hutan dan meminta pertolongan ahli keluarga di rumah untuk mengangkat bersama-sama hasil buruan Kod image: 2b 	- anjing - akar hutan	- ambil akar hutan dan ikat pada leher anjing. - suruh anjing tersebut balik ke rumah.	hutan	- orang yang memburu itu mendapat hasil buruan yang besar dan tidak dapat membawanya balik ke rumah. Maka, minta bantuan anjing untuk menyampaikan mesej (akar hutan) ke rumah keluarganya bahawa orang yang berburu itu memerlukan pertolongan untuk mengangkat hasil buruan yang besar sekiranya hasil buruan	- memudahkan orang yang berburu untuk membawa hasil buruannya balik ke rumah. - membantu orang yang berburu itu meminta pertolongan dari keluarganya @ saudaranya di

				tidak dapat diangkat oleh 2 orang, maka orang itu akan membuat 2 simpulan pada akar hutan dan mengikatnya ke leher anjing. Ahli keluarga di rumah akan mengetahui 2 simpulan tersebut menunjukkan orang yang berburu itu memerlukan pertolongan 2 orang untuk mengangkat hasil buruan.	rumah.
3. AMARAN/BAHAYA/KARAAT b) Pemasangan jerat (belatik) Kod image: 3b 	- kayu - rotan ranting kayu	- potong sebatang kayu & hiriskan bahagian tertentu kayu. - Pacak kayu. - gulungkan rotan & sisipkan pada kayu. - hiriskan lagi kayu pada bahagian atas gulungan rotan yang telah disisipkan. - raut hujung sebatang ranting kayu menjadi tajam & sisipkan pada bahagian atas gulungan rotan tadi. hujung ranting kayu yang ditajamkan dihalakan ke arah kawasan pemasangan jerat (belatik) tersebut.	Hutan	- menunjukkan ada orang yang telah memasang jerat (belatik) pada kawasan tersebut.	- memberitahu orang lain bahawa kawasan tersebut berbahaya kerana adanya pemasangan jerat (belatik). - mengelakkan orang lain drpd terkena jerat (belatik) tersebut.

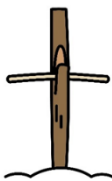
c) Avol (menghadang menggunakan kayu yang berbentuk 'X') Kod image: 3c 	- kayu	- Potong 2 kayu & pacak kedua- dua kayu tersebut secara bersilang berdekatan dengan pokok buah-buahan pemilik. - Semasa memacak kayu tersebut, orang itu akan menuturkan kata-kata sumpahan sambil menghiris sedikit bahagian bawah kayu tersebut dari tengah-tengah titik kedua-dua kayu tersebut menunjukkan bentuk 'x' sehingga ke bawah.	-Kebun (tanaman & pokok buah-buahan) -rumah	-memberitahu orang lain bahawa pokok buah-buahan tersebut tidak boleh dicuri/diambil tanpa kebenaran pemiliknya. -tidak boleh menceroboh/ masuk ke rumah itu ketika ketiadaan pemiliknya @ tanpa kebenaran pemiliknya.	- bagi mengelakkan kecurian - bagi menjaga keselamatan pada kawasan tersebut
d) Haava (Kayu rebah secara tiba-tiba) Kod image: 3d 	- tunggul kayu @ kayu	- Tunggul kayu/kayu tiba-tiba rebah & orang yang memburu terdengar bunyi dentuman tersebut @ terlihat pokok rebah. - orang itu wajib balik ke rumah. - jika orang menghadiri perkahwinan atau mana-mana tempat berjalan melalui hutan, tiba-tiba terdengar bunyi tersebut juga wajib balik semula ke rumah. - jika orang itu melalui sungai (guna perahu) dan tiba-tiba ternampak pokok muda dan subur rebah di tepi sungai, maka orang tersebut perlu patah balik ke rumahnya dan mengangkat semula barang-barangnya ke rumah.	- hutan - sungai	- menunjukkan ada masalah/bahaya yang akan berlaku kepada orang itu @ keluarganya jika orang itu meneruskan perjalanan.	- memberi amaran/memberi tahu petanda buruk kepada orang itu.

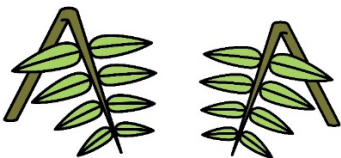
		(sekiranya ia berlaku pada waktu pagi, orang itu berhenti meneruskan perjalanan dan boleh meneruskan perjalanannya semula pada waktu petang).			
e) Sosolov/Tutunu (membakar/bakar) Kod image: 3e 	- kain merah - puntung kayu api - kayu Kegunaan utk bakar sambil menyumpah pada saat itu - sabut kelapa (di atas tempatnya bakar) - cengkerik	- Potong sebatang kayu & pacak. - ambil kain merah, ikat bersama-sama puntung kayu api pada kayu yang dipacak tadi. sekiranya barang pemilik yang dicuri tidak dikembalikan pada tempoh tertentu yang ditetapkan, maka pemilik itu akan membakar kain merah bersama-sama puntung kayu, sabut kelapa dan seekor cengkerik sambil menuturkan kata-kata sumpahan. - Pada masa yang sama, orang itu akan menyumpah sama ada individu yang mencuri barangnya akan buta mata @ mati. impaknya pada orang yang mencuri itu akan berlaku dalam tempoh 4 hari @ seminggu.	- tempat barang tersebut hilang	- memberitahu orang yang mencuri agar mengembalikan semula barang-barang yang dicuri kepada pemilik. - memberi hukuman kepada pencuri tersebut.	- supaya pemilik barang tersebut mendapat semula barang miliknya. - pencuri tersebut tidak lagi melakukan perbuatan tidak baik itu.

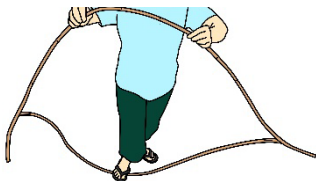
4. NOTIS KENDURI/PERKAHWINAN a) Inkuun (kayu yang diukir/diraut menjadi bunga) Kod image: 4a 	- kayu seraman - kalamok (pisau khas yang mengukir kayu tersebut menjadi cantik)	- Potong beberapa batang kayu & kupas kulit kayu tersebut. - jemur kayu-kayu tersebut dalam 2@3 hari. - Ukir kayu tersebut selapis demi selapis bagi membentuk juntaian-juntaian yang akan menjadi bunga. - Pacak kayu-kayu yang diukir itu dari simpang jalan raya sehingga ke rumah keluarga pengantin perempuan.	- Kawasan rumah keluarga pengantin perempuan	- menunjukkan bahawa Kawasan tersebut mengadakan majlis perkahwinan	- memberi tunjuk arah kepada keluarga pengantin lelaki tempat rumah keluarga pengantin perempuan/tempat majlis perkahwinan berlangsung.
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Appendix F: Tatandu Symbol Inventory

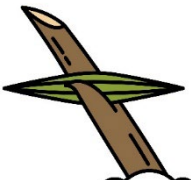
1	Code: A1i Category: Navigation	Description: Wood slices and stakes <i>Hirison am tandukin (hiris kayu dan pacak)</i>	
Original Symbol:  Digital Co-Designed Symbol: 	Attributes for Indigenous Symbols	Murut Tahol Tatandu	
	Physical Aspect	Material Used: Sticks	
	Usage Patterns	• Murut Tahol, southwest region of Sabah • Forest Navigation	
	Message Structure and Relationship	Intuitiveness, Representation, Familiarity	
	Message Meaning	I moved in the direction indicated by the sharpened end of the stick.	
	Message Usage	• Informing a friend about the direction of the place we are heading to. • Prevent others from going astray.	
	Indigenous Core Values Involved	Sharing, Spirituality, Unity	

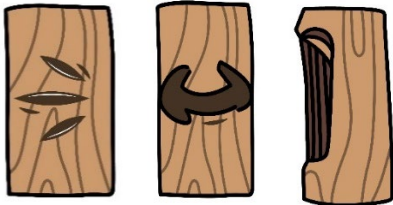
2	Code: A2i Category: Navigation	Description: Wood slices <i>Sasapin (hiris kayu)</i>	
Original Symbol:  Digital Co-Designed Symbol: 	Attributes for Indigenous Symbols	Murut Tahol Tatandu	
	Physical Aspect	Material Used: Sticks, branches	
	Usage Patterns	• Murut Tahol, Southwest region of Sabah • Forest Navigation	
	Message Structure and Relationship	Have various meanings (for example, there are bad people in that place, there is danger in that place, etc.).	
	Message Meaning	For safety	
	Message Usage		
	Indigenous Core Values Involved	Sharing, Spirituality, Unity	

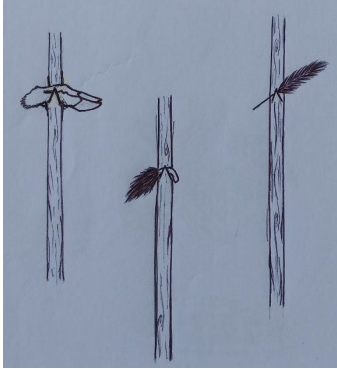
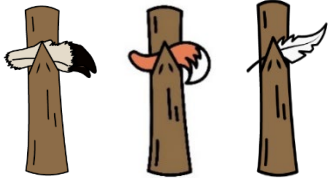
3	Code: 1b Category: Navigation	Description: Breaking the tips or ends of wooden branches or plants	
Original Symbol:  Digital Co-Designed Symbol: 		Attributes for Indigenous Symbols	Murut Tapol Tatandu
		Physical Aspect	Material Used: Branches with leaves.
		Usage Patterns	• Murut Tapol, Southwest region of Sabah • Forest Navigation
		Message Structure and Relationship	
		Message Meaning	I am moving in the direction indicated by the broken branches of the wood.
		Message Usage	• To mark the path so as not to get lost and be able to return to the original path. • Easy to know the whereabouts of our friends.
		Indigenous Core Values Involved	Sharing, Spirituality, Unity

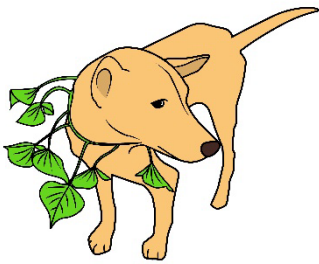
4	Code: 1cii Category: Navigation	Description: A person who is lost <i>(Apalir)</i>	
Original Symbol:  Digital Co-Designed Symbol: 		Attributes for Indigenous Symbols	Murut Tapol Tatandu
		Physical Aspect	Material Used: Forest roots, rattan.
		Usage Patterns	• Murut Tapol, Southwest region of Sabah • Lost in Forest
		Message Structure and Relationship	
		Message Meaning	The person who is lost can find the original way out, which is the place where they initially entered the forest.
		Message Usage	A person who is lost can save themselves in the forest.
		Indigenous Core Values Involved	Sharing, Spirituality, Unity

5	Code: 1di Category: Navigation	Description: Descendants of the Sulung People	
Original Symbol:  Digital Co-Designed Symbol: 		Attributes for Indigenous Symbols	Murut Tahol Tatandu
		Physical Aspect	Material Used: Sticks, young leaves
		Usage Patterns	• Murut Tahol, Southwest region of Sabah • Forest Navigation
		Message Structure and Relationship	
		Message Meaning	People of the firstborn lineage know that there are other firstborns who have entered/gone hunting in that forest area before.
		Message Usage	• Indicating that people of the firstborn lineage enter the forest area for hunting • Avoiding dangers/collisions between two hunting groups.
		Indigenous Core Values Involved	Sharing, Spirituality, Unity

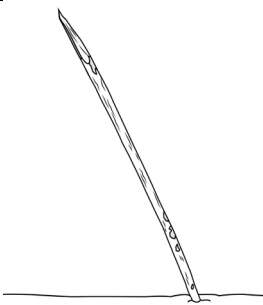
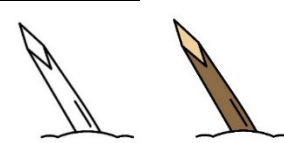
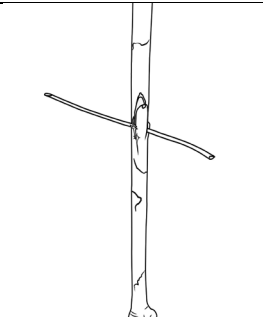
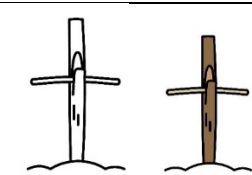
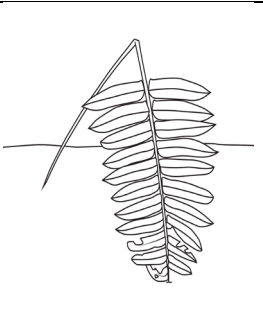
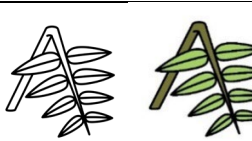
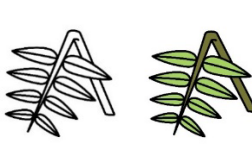
6	Code: 1e Category: Navigation	Description: Descendants of the original Murut tribe, Tahol.	
Original Symbol:  Digital Co-Designed Symbol: 		Attributes for Indigenous Symbols	Murut Tahol Tatandu
		Physical Aspect	Material Used: Sticks, copper leaves
		Usage Patterns	• Murut Tahol, Southwest region of Sabah • Forest Navigation
		Message Structure and Relationship	
		Message Meaning	They are hunting in that forest area @ cultivating the land (clearing land in the forest for planting) @ indicating the boundary signs of the original Murut tribe land, Tahol
		Message Usage	Siblings @ relatives of the Murut Tahol people @ others are aware that some Murut Tahol individuals are hunting in the forest OR own that land
		Indigenous Core Values Involved	Sharing, Spirituality, Unity

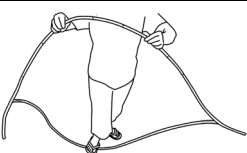
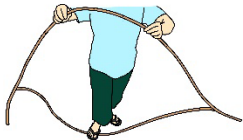
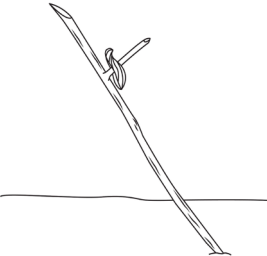
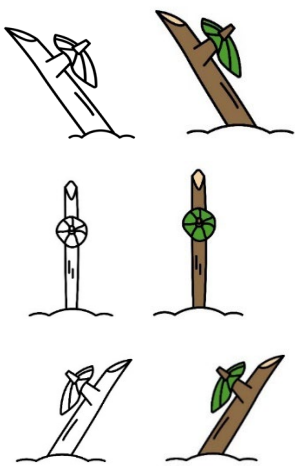
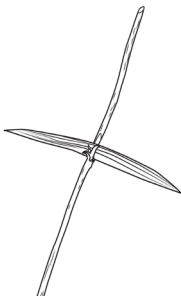
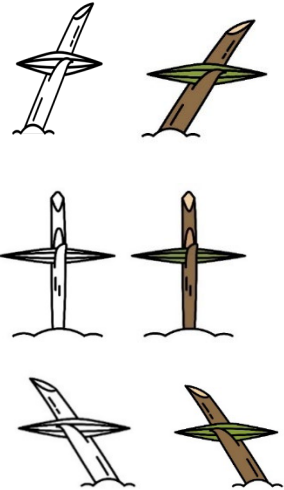
7	Code: 1fi, 1fii, 1fiii Category: Navigation	Description: The direction signs for the land border	
Original Symbol:  Digital Co-Designed Symbol: 		Attributes for Indigenous Symbols	Murut Tahol Tatandu
		Physical Aspect	Material Used: Machete
		Usage Patterns	• Murut Tahol, Southwest region of Sabah • Forest Navigation
		Message Structure and Relationship	
		Message Meaning	• Indicating the area to be reached (waterfall, hiking). Showing the direction in which the boundary stones or landmarks for the landowner in the forest are located.
		Message Usage	• Others can easily reach the intended destination. • Their children can easily find the boundary stones on their father's land if their father is no longer able to walk far or has passed away.
		Indigenous Core Values Involved	Sharing, Spirituality, Unity

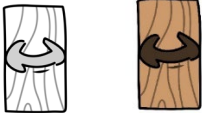
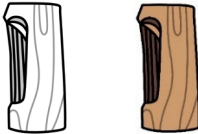
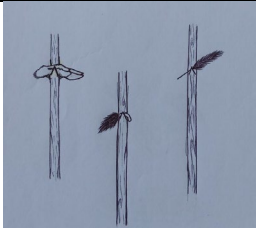
8	Code: 2ai, 2aii, 2aiii Category: Hunting	Description: Getting the hunting yield	
Original Symbol:  Digital Co-Designed Symbol: 		Attributes for Indigenous Symbols	Murut Tahol Tatandu
		Physical Aspect	Material Used: - Parts of the animal body (tail, ears, legs @ animal fur) - Wood/branches.
		Usage Patterns	- Murut Tahol, Southwest region of Sabah - Hunting Activities
		Message Structure and Relationship	
		Message Meaning	Informing friends that I have successfully captured the animal while hunting together in the forest
		Message Usage	To let friends know that we have successfully captured an animal and the type of animal during our hunting expedition in the forest.
		Indigenous Core Values Involved	Sharing, Spirituality, Unity, Interconnectedness, Resilience.

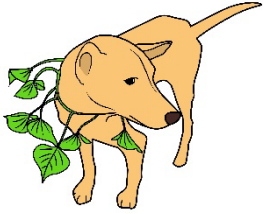
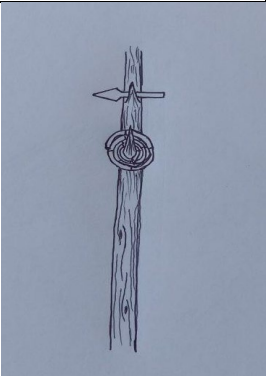
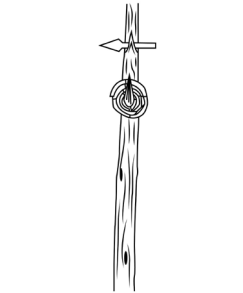
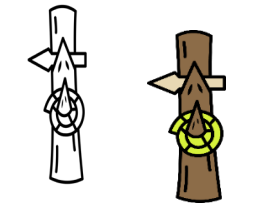
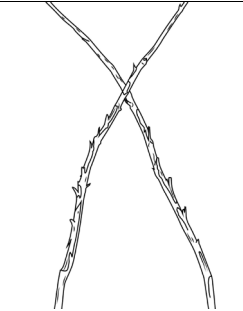
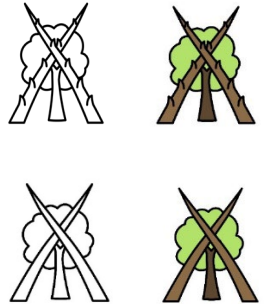
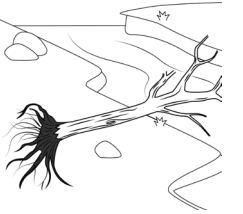
9	Code: 2b Category: Hunting	Description: Hunting message dog	
Original Symbol:  Digital Co-Designed Symbol: 		Attributes for Indigenous Symbols	Murut Tahol Tatandu
		Physical Aspect	Material Used: • Dog • Forest roots
		Usage Patterns	• Murut Tahol, Southwest region of Sabah • Hunting Activities
		Message Structure and Relationship	
		Message Meaning	• The hunting person has obtained a large catch and cannot return it home. • Therefore, they ask for the assistance of a dog to convey a message (forest roots) to their family at home, informing them that the hunter needs help to carry the large catch. • If the catch cannot be lifted by two people, the person will tie two knots on the forest roots and attach it to the dog's neck. Family members at home will understand that these two knots indicate that the hunter needs two people to help carry the catch.
		Message Usage	• Facilitating the hunter in bringing their catch back home. • Assisting the hunter in seeking help from their family or siblings at home.
		Indigenous Core Values Involved	Sharing, Spirituality, Unity, Interconnectedness, Resilience.

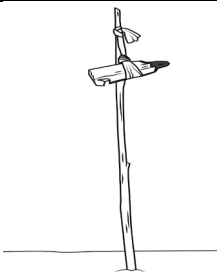
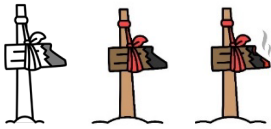
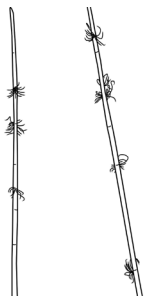
Appendix G: Progress of The Digital Tatandu Symbol Design

	code	Photo	Graphic Image	Simplified Symbol
1.	1. TANDA ARAH DALAM HUTAN A1i Hirison am tandukin (hiris kayu & pacak)			 
2.	A2i Sasapin (hiris kayu)			 
3.	1b Mematahkan hujung-hujung ranting kayu @ tumbuhan			 

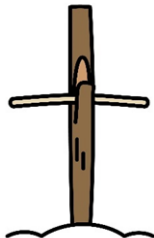
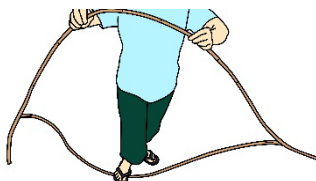
4.	1cii			
5.	1di Keturunan orang Sulung (moyang- moyang terdahulu) salah satu daripada keturunan			
6.	1e Keturunan murut asli tahol			

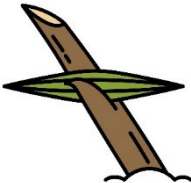
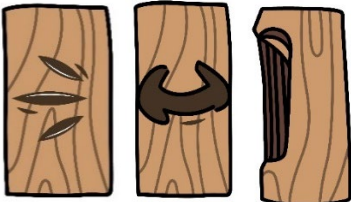
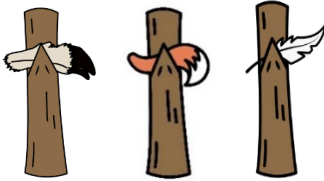
7.	1fi Tanda arah bagi tanah sempadan			
	1fii			
	1fiii			
8.	2. AKTIVITI MEMBURU 2a Mendapat hasil buruan		2ai  2aii  2aiii 	2ai   2aii   2aiii  

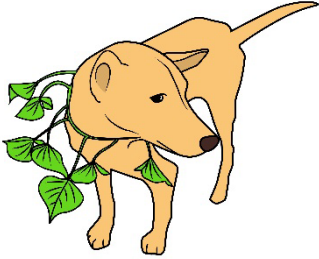
9.	2b mendapat hasil buruan di hutan dan meminta pertolongan ahli keluarga di rumah untuk mengangkat bersama-sama hasil buruan			
10.	3. AMARAN/ BAHAYA/ KARAAT 3b Pemasangan jerat (belatik)			
11.	3c Avol (menghadang menggunakan kayu yang berbentuk 'X')			
12	3d Haava (Kayu rebah secara tiba-tiba)			

13.	3ei Sosolov/ Tutunu (membakar/ bakar)			
14.	4. NOTIS KENDURI/ PERKAHWINA N 4a Inkuun (kayu yang diukir/diraut menjadi bunga)		4ai  4aii 	

Appendix H: Tatandu Symbol Vocabulary

1	Code: A1i Category: Navigation	Description: Wood slices and stakes <i>Hirison am tandukin (hiris kayu dan pacak)</i>	
Digital Co-Designed Symbol: 		Message Meaning	I moved in the direction indicated by the sharpened end of the stick.
		Message Usage	- Informing a friend about the direction of the place we are heading to. - Prevent others from going astray.
2	Code: A2i Category: Navigation	Description: Wood slices <i>Sasapin (hiris kayu)</i>	
Digital Co-Designed Symbol: 		Message Meaning	For safety
		Message Usage	This place is dangerous.
3	Code: 1b Category: Navigation	Description: Breaking the tips or ends of wooden branches or plants	
Digital Co-Designed Symbol: 		Message Meaning	I am moving in the direction indicated by the broken branches of the wood.
		Message Usage	- To mark the path so as not to get lost and be able to return to the original path. - Easy to know the whereabouts of our friends.
4	Code: 1cii Category: Navigation	Description: A person who is lost <i>(Apalir)</i>	
Digital Co-Designed Symbol: 		Message Meaning	The person who is lost can find the original way out, which is the place where they initially entered the forest.
		Message Usage	A person who is lost can save themselves in the forest.

5	Code: 1di Category: Navigation	Description: Descendants of the Sulung People	
Digital Co-Designed Symbol: 		Message Meaning	People of the firstborn lineage know that there are other firstborns who have entered/gone hunting in that forest area before.
		Message Usage	- Indicating that people of the firstborn lineage enter the forest area for hunting. - Avoiding dangers/collisions between two hunting groups.
6	Code: 1e Category: Navigation	Description: Descendants of the original Murut tribe, Tahol.	
Digital Co-Designed Symbol: 		Message Meaning	They are hunting in that forest area @ cultivating the land (clearing land in the forest for planting) @ indicating the boundary signs of the original Murut tribe land, Tahol
		Message Usage	Siblings @ relatives of the Murut Tahol people @ others are aware that some Murut Tahol individuals are hunting in the forest OR own that land
7	Code: 1fi, 1fii, 1fiii Category: Navigation	Description: The direction signs for the land border	
Digital Co-Designed Symbol: 		Message Meaning	- Indicating the area to be reached (waterfall, hiking). - Showing the direction in which the boundary stones or landmarks for the landowner in the forest are located.
		Message Usage	- Others can easily reach the intended destination. - Their children can easily find the boundary stones on their father's land if their father is no longer able to walk far or has passed away.
8	Code: 2ai, 2aii, 2aiii Category: Hunting	Description: Getting the hunting yield	
Digital Co-Designed Symbol: 		Message Meaning	Informing friends that I have successfully captured the animal while hunting together in the forest
		Message Usage	To let friends know that we have successfully captured an animal and the type of animal during our hunting expedition in the forest.

9	Code: 2b Category: Hunting	Description: Hunting message dog	
Digital Co-Designed Symbol: 		Message Meaning	- The hunting person has obtained a large catch, cannot return it home. - Therefore, they ask for the assistance of a dog to convey a message (forest roots) to their family at home, informing them that the hunter needs help to carry the large catch. - If the catch cannot be lifted by two people, the person will tie two knots on the forest roots and attach it to the dog's neck. Family members at home will understand that these two knots indicate that the hunter needs two people to help carry the catch.
		Message Usage	- Facilitating the hunter in bringing their catch back home. - Assisting the hunter in seeking help from their family or siblings at home.

10	Code: 3b Category: Warning	Description: Warnings during hunting in the forest	
Digital Co-Designed Symbol: 		Message Meaning	- Once (signalling the hunter to stop hunting or giving a warning): Signifying that the hunter should cease hunting or conveying a warning that continuing may lead to consequences or mishaps. - Multiple times (indicating success in obtaining the hunt): Signaling that the hunt has been successful. - Something bad will happen if the journey continues: A warning or indication that there may be negative consequences if the journey is continued.
		Message Usage	- In order to prevent something bad from happening to the person hunting or their family if they continue hunting (sounds once). - Obtaining a substantial hunt (sounds multiple times). - To avoid the situation worsening between that person and their family members.

11	Code: 3c Category: Warning	Description: Blocking using wood in the shape of 'X' (<i>Avol</i>)	
Digital Co-Designed Symbol: 		Message Meaning	- Informing others that the fruit trees cannot be picked/taken without the owner's permission. - No trespassing/entering the house when the owner is absent or without the owner's permission.
		Message Usage	- To prevent theft. - To maintain safety in the area.

12	Code: 3d Category: Warning	Description: Suddenly fallen tree (<i>Haava</i>)	
Digital Co-Designed Symbol: 		Message Meaning	To indicate that there is a problem/danger that will occur to that person or their family if they continue the journey.
		Message Usage	To give a warning/to inform of ominous signs to that person.

13	Code: 3ei Category: Warning	Description: Burning / Burn (<i>Sosolov/Tutunu</i>)	
Digital Co-Designed Symbol: 		Message Meaning	- Instructing the thief to return the stolen items to the owner. - Administering punishment to the thief.
		Message Usage	- So that the owner can recover their belongings. - To prevent the thief from committing such wrongdoing again.

14	Code: 4a Category: Wedding	Description: Carved/whittled wood into flowers (<i>Inkuun</i>)	
Digital Co-Designed Symbol: 		Message Meaning	To indicate that the area is hosting a wedding ceremony.
		Message Usage	To give directions to the groom's family to the location of the bride's family house or the wedding venue.

Appendix I: The Murut Tahol Core Values and Trigger Statements Developed From SLR

Murut Tahol Core Values	Proto-Indicators/Trigger Statements	Source From Literature Reviews
Sharing	1. Resource Distribution: In many Indigenous communities, sharing resources, such as food, land, and water, is common. This ensures that all members of the community have access to what they need to survive and thrive. For example, in hunter-gatherer societies, the game hunted by a few is often shared amongst the entire community. 2. Generosity: Acts of generosity are often highly valued and culturally expected. Sharing resources, knowledge, and time with others is seen as a fundamental aspect of community life. 3. Community Support and Mutual Aid: Indigenous communities often demonstrate a strong sense of collective responsibility. They engage in mutual aid, where members support each other during times of need, such as during illness, food scarcity, or natural disasters. 4. Ceremonial and Ritual Sharing: Many Indigenous ceremonies and rituals involve the sharing of food, goods, or stories, symbolising community unity and the distribution of blessings. 5. Reciprocity: Sharing is not just about giving but also involves a reciprocal exchange. This reciprocity is seen as maintaining balance and harmony within the community.	Kaskija (1998); Ingold (1999); Pariyar et. al. (2019); Cajete (2000).
Spirituality	1. Ancestral Reverence: Deep respect and veneration for ancestors, believing they play an ongoing role in the lives of the living and in guiding community decisions. 2. Rituals Practice: Engage in traditional ceremonies or ritual practices that have spiritual significance in their life and daily activities. 3. Spiritual Symbols and Art: The use of symbols, art, and craft in spiritual expression often encapsulates cultural stories, beliefs, and connections with the spiritual realm. 4. Spiritual Belief: Belief in the existing of spiritual being in their living system.	Deloria (2023); King (2015); Shein (2022)

Unity	1. Collective Identity: A strong sense of belonging to a community, tribe, or group, where individual identity is deeply connected to the collective identity. 2. Interdependence: Recognising and valuing the interdependence among community members, understanding that the well-being of each individual is linked to the well-being of the community. 3. Support and Solidarity: Offer support and stand in solidarity with community members, especially in times of need or crisis. 4. Community Support: Embracing strong community networks and support systems to help each other in community events and overcome challenges if there are problems.	Pariyar et. al. (2019); Shein (2022); Kaskija (1998); Thakhathi (2020).
Interconnecte dness	1. Respect for Nature: A deep reverence for the natural world, recognising that all elements of nature – animals, plants, land, water, and air – are interconnected and deserve respect. 2. Connectedness in All Things: Indigenous communities often view the forest as a living entity which is vital for managing natural resources and they are connected to all the entities in the living system. 3. Harmony and Balance with Nature: Striving for harmony and balance with nature, acknowledging that human health and prosperity are connected to the health of the environment.	Fache (2020); Ross (2016); Cajete (2000).
Resilience	1. Cultural Continuity: Maintaining and preserving cultural practices, languages, and traditions despite external pressures and changes, often in the face of adversity. 2. Inter-Generational Knowledge Transfer: Passing down knowledge, stories, and survival skills from elders to younger generations, ensuring community resilience over time. 3. Adaptive Governance and Leadership: Adaptive and responsive leadership and governance structures help communities improve their social systems.	Turner (2020); Locklear (2023); Shein (2020).

Appendix J: Murut Tahol Core Value

Murut Tahol Core Value: Sharing	
Trigger Statements and Quotes	Value Indicator
1. Resource Distribution: <i>Bila dapat babi atau binatang yg kasi sama sahaja.</i> When getting a pig or an animal, it is distributed equally. <i>Memotong anggota badan haiwan</i> Cutting the body parts of an animal.	Code: SH1 Sharing of hunted animals among the members of the community.
2. Community Support and Mutual Aid: <i>Menemui arah yang dilaluinya dan memburu bersama-sama.</i> Finding the direction he passed through and hunting together. <i>Supaya org lain boleh sampai di sini.</i> So that others can also reach this place. <i>Memberitahu jiran sebelah.</i> Telling the neighbor next door.	Code: SH2 Sharing of directions with community members in forest travelling and hunting activities.
3. Ceremonial and Ritual Sharing: <i>'Totoohon' ini penting agar pihak pengantin lelaki tidak kelaparan sepanjang perjalanan dan dapat sampai ke rumah pengantin perempuan.</i> Totoohon is important so that the groom does not go hungry throughout the journey and can reach the bride's house.	Code: SH3 Sharing of rest place and food during wedding ceremonies.

Murut Tahol Core Value: Spiritual	
Trigger Statements and Quotes	Value Indicator
1. Ancestral Reverence: <i>Aki-aki, aru-aru.</i> Aki-aki, aru-aru. <i>Aki dan aru satu pasangan adalah nenek moyang</i>	Code: SP1 Referring to the idea of ancestor spirits known as Aki and Aru.

Aki and aru, as a pair, are ancestors. <i>Bila kami minta tolong, minta bantu, mana-mana kami masuk hutan, itu aki-aki aru-aru sudah buka jalan.</i> When we seek help, ask for assistance, wherever we enter the forest, those 'aki-aki aru-aru' have already opened the way. <i>Bila memburu, aki-aki kami minta bantu, minta bekal binatang, kami memburu minta tolong, mau panggil.</i> When hunting, we ask aki-aki for help, request provisions for the animals, and when we hunt, we seek assistance, need to call.	Code: SP2 Seeking the ancestor spirit's help and guidance in daily activities.
2. Rituals Practice: <i>Menuturkan kata-kata memanggil semangat orang yang tersesat itu.</i> Uttering words to call the spirit of the person who is lost. <i>Mendapat musibah seperti yang diucapkan dalam sumpahan.</i> Facing misfortune as pronounced in the curse. <i>Menuturkan kata-kata sumpahan.</i> Uttering curse words.	Code: SP3 Ritual practice in curing missing persons.
	Code: SP4 The practice of cursing with words.
3. Spiritual Symbols and Art: <i>Kami beranggapan dengan tanda ini makhluk halus atau jin itu tidak dapat mengikuti kami lagi</i> We believe that with this sign, supernatural beings or jinn cannot follow us anymore. <i>Tanda amaran sosolov atau dibakar.</i> Warning signs sosolov, either with markings or by burning. <i>Menuturkan kata-kata bagi memanggil semangat padi.</i> Uttering words to summon the spirit of the rice crop.	Code: SP5 The use of symbols that are associated with the spiritual realm.
	Code: SP6 The practice of reciting specific words or chants to invoke the spirit of the crops to ensure a bountiful harvest and to show respect to the forces of nature.

<i>Menuturkan kata-kata agar padi tersebut akan subur dan mempunyai hasil yang lumayan.</i> Uttering words so that the rice will be fertile and yield a bountiful harvest.	
4. Spiritual Belief: <i>Makhluk halus atau jin atau sesuatu yang membuat orang tersesat yang dipanggil sebagai 'mamalir' di hutan.</i> Supernatural beings or jinn or something that causes people to get lost, called 'mamalir' in the forest. <i>Kami panggil org halus jin.</i> We call them supernatural beings, jinn. <i>Ini jin bawa di tempat air terjun, dia kasih sembunyi di sana.</i> This jinn brings you to the waterfall and hides you there. <i>Gangguan dari alam lain, jin ka, makhluk halus ka.</i> Disturbances from another realm, whether it be jinn or supernatural beings.	Code: SP7 Belief in the existence of spiritual beings in their living system

Murut Tahol Core Value: Unity	
Trigger Statements and Quotes	Value Indicator
1. Collective Identity: <i>Daun tambaka ini dikatakan tanda saudara atau keluarga bagi murut tahol yang tinggal di kawasan Pensiangan.</i> The tambaka leaf is said to be a sign of kinship or family for the Murut Tahol people residing in the Pensiangan area.	Code: UN1 The "tambaka" leaves symbolise family ties or kinship within this community.
2. Interdependence: <i>Kalau tidak kasi tanda, nanti akan tersesat.</i> If you don't provide a sign, you might get lost. <i>Yang sesak itu tanda ini boleh balik ke pangkar jalan.</i> The crowded one is a sign that you can return to the starting point of the path.	Code: UN2 Community members recognise and value their interdependence for safety during forest travel and hunting.

<i>Tanda-tanda yang membantu orang mengelak daripada mendapat bahaya.</i> Signs that help people avoid danger. <i>Keselamatan dan petunjuk</i> Safety and guidance. <i>Keselamatan dan pertanda jalan, tidak sesat</i> Safety and clear signs of the path, not congested. <i>Kau mesti tanda awal, supaya anjing org selamat, org memburu pun selamat.</i> You must mark the territory early so that the dogs and hunters are safe. <i>Membuat tanda supaya orang lain dapat mengetahui dan menjauh daripada kawasan bahaya.</i> Creating signs so that others can be aware and stay away from dangerous areas. <i>Nilai atau tanda ini, satu pertandaan keselamatan kita. Tapi kalau ada tanda-tanda ini dia nampak tahu dia terselamat.</i> The value or significance of these signs is a safety precaution for us. But if there are these signs, he seems to know he is safe.	
3. Support and Solidarity: <i>Paluan gong itu menandakan orang lain atau keluarganya sedang mencarinya.</i> The beating of the gong indicates that someone else or their family is searching for him. <i>Meminta pertolongan daripada ahli keluarganya di rumah.</i> Seeking help from family members at home. <i>Membantu orang yang berburu itu membawa hasil buruan tersebut balik ke rumah.</i> Assisting the person who is hunting to bring the catch back home.	Code: UN3 Offer support and stand in solidarity with community members in times of need or crisis.
4. Community Support: <i>Majlis perkahwinan, dia org balik minta bantu, bantu-membantu, begitu, itulah kerjasama org di sini</i>	Code: UN4 Supporting each other in the preparation of weddings and other events.

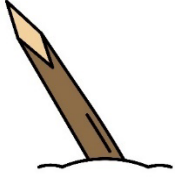
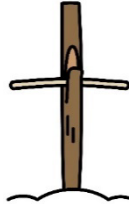
The wedding ceremony, they go back seeking help, mutual assistance, like that, that's how people cooperate here. <i>Satu kampung tolong jugak pergi mencari binatang.</i> The whole village also helps to go searching for animals. <i>Kerjasama, tolong menolong.</i> Cooperation, mutual assistance.	
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Murut Tahol Core Value: Interconnectedness	
Trigger Statements and Quotes	Value Indicator
1. Connectedness in All Things: <i>Orang yang berburu di hutan akan membawa anjing peliharaan mereka untuk ikut memburu kerana membantu mengesan haiwan dengan cepat.</i> Hunters in the forest bring their pet dogs to join the hunt because they help track animals quickly. <i>Kalau Murut: Sut! Sut! Ah, begitu. Walaupun itu anjing sudah tau kau bagi semangat sama dia.</i> If Murut: Sut! Sut! Ah, like that. Even though the dog already knows, you're giving it encouragement. <i>Kalau pasal anjing, saya boleh tahu, anjing yg kuat punya, yg sederhana, yg menyokong saja, kalau yg menyokong ini kalau ia sakit kita jaga.</i> If it's about dogs, I can understand. The strong ones, the average ones, the supportive ones. If it's the supportive one, when it's sick, we take care of it.	Code: IN1 Connection of the indigenous and their dogs in the hunting activities.
2. Harmony and Balance with Nature: <i>Alam punya peraturan, alam punya bahasa.</i> The rules of nature, the language of nature. <i>Macam mana manusia tau, mesti Tuhan yg kasi.</i> How do humans know? It must be God who gives.	Code: IN2 Striving for harmony and balance with nature and acknowledging the power of God.

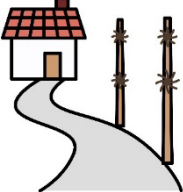
Murut Tahol Core Value: Resillience	
Trigger Statements and Quotes	Value Indicator
1. Cultural Continuity: <i>Tatandu ini merupakan salah satu identiti bagi sesuatu kaum salah satunya kaum murut tahol dan mempunyai keunikannya tersendiri.</i> Tatandu is one of the identities for certain ethnic groups, including the Murut Tahol, and it has its own uniqueness. <i>Tanda ini adalah bangsa sendiri, kita simpan di sana turun temurun segala bangsa boleh tau.</i> This sign represents our own ethnicity, we pass it down through generations, and people of all ethnicities can understand it. <i>Simpan di sana turun temurun segala bangsa boleh tau.</i> Preserved there from generation to generation, for people of all ethnicities to know.	Code: RS1 Maintaining and preserving cultural identity.
2. Inter-Generational Knowledge Transfer: <i>Itulah pasal kami dapat tahu daripada nenek moyang aki-aki.</i> That's how we know from the ancestors, aki-aki. <i>Aki-aki dulu yg menciptainya, utk pengetahuan aki-aki itu secara menyeluruh. Sama-sama itu aki bapa kami dulu, dia kasih tahu dia punya aki.</i> Our aki-aki created it, for the knowledge of our aki-aki as a whole. Together with that, our father's aki, he was informed by his own aki. <i>Dia org bawa pergi masuk hutan. Dia org ajar.</i> They take us into the forest. They teach us. <i>Pakcik saya pergi memburu, saya ada sepupu saya, sama-sama umur ini, kami ikut.</i> My uncle went hunting, and I have a cousin, the same age as me, and we went together. <i>12 tahun sudah bermula, tapi belajarlal.</i> 12 years old has been started, but learning.	Code: RS2 Passing down knowledge, stories, and survival skills from elders to younger generations.

3. Adaptive Governance and Leadership: <i>Mendisplikan bangsa Murut</i> Discipline the Murut people <i>Memcuri ini tidak diamalkan di org-org muda.</i> <i>Tujuannya utk mencegah.</i> Stealing is not practiced among the young people. Its purpose is to prevent.	Code: RS3 Disciplinary action and warning in their local context.
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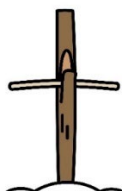
Appendix K: The Result of Four Syntactical Attributes Verification by Local Indigenous Experts

	Symbol Code and Name	Simplified Symbol	Syntactic Attributes				Percentage (%)	Experts
			Familiarity (Q1)	Representation (Q2)	Material (Q3)	Colour (Q4)		
1.	Code: A1i Hirison am tandukin (hiris kayu dan pacak)		1	1	1	1	100%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4
2.	Code: A2i Sasapin (hiris kayu)		1	1	1	1	100%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4
3.	Code: 1b Mematahkan hujung-hujung ranting kayu@tumbuhan.		1	1	1	1	100%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4
			0	0	1	1	50%	E2
			0	0	1	1	50%	E3
			0	0	1	1	50%	E4
4.	Code: 1cii		1	1	1	1	100%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4
5.	Code: 1di Keturunan orang Sulung		1	0	1	1	75%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	F4

6.	Code: 1e Keturunan murut asli tahol		1	1	1	1	100%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4
7.	Code: 1fi Tanda arah bagi tanah sempadan		1	1	1	1	100%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4
8.	2. AKTIVITI MEMBURU Code: 2ai Mendapat hasil buruan		1	1	1	1	100%	E1
			1	0	1	1	75%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4
9.	Code: 2b Mendapat hasil buruan di hutan dan meminta pertolongan		1	1	1	1	100%	E1
			0	0	1	1	50%	E2
			0	0	1	1	50%	E3
			0	0	1	1	50%	E4
10.	3.AMARAN/BAHAYA /KARAAT Code: 3b Pemasangan jerat (belatik)		1	1	1	1	100%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4
11.	Code: 3c Avol (menghadang menggunakan kayu yang berbentuk 'X')		1	1	1	1	100%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4
12.	Code:3d Haava (Kayu rebah secara tiba-tiba)		1	1	1	1	100%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4

13.	Code:3ei Sosolov/Tutunu (membakar/bakar)		1	1	1	1	100%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4
14.	NOTIS KENDURI/PERKAHWI NAN Code: 4a Inkuun (kayu yang diukir/diraut menjadi bunga)		1	1	1	1	100%	E1
			1	1	1	1	100%	E2
			1	1	1	1	100%	E3
			1	1	1	1	100%	E4

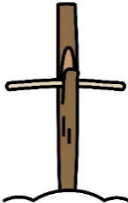
Appendix L: The Result of Interview Q4 as Part of Verification by Local Indigenous Experts

	Symbol Code and Name	Simplified Symbol	Comments and Suggestions	Experts
1.	Set 1: Navigation Code: A1i Hirison am tandukin (hiris kayu dan pacak)		<i>tanda yang digunakan di dalam hutan semasa memburu iaitu kayu dihiriskan, mematahkan ranting kayu atau tumbuhan sepanjang perjalanannya</i> The signs used in the forest while hunting are sliced wood, breaking branches of wood or plants along the way. <i>dengan cara menajamkan sebatang kayu dan memacak kayu tersebut secara senget ke arah laluan yang dilaluinya.</i> By sharpening a piece of wood and thrusting it diagonally in the direction of the path he travels.	E3
2.	Code: A2i Sasapin (hiris kayu)		<i>sasapin... ya, ini ada satu tambahan di sini, macam inikan, berdasar kpd gambar ini, sasapin jenis kayu, kayu rating.. kalau pendedahan ini cara membuat, potong sebatang kayu...batang kayu tersebut... pacak kayu tersebut, ertinya, kalau ikut gambar ini mana boleh pacak lagi kan, ia sudah tumbuh berdiri, jadi kalau kamu faham ini, kalau di tempat lapang yang tumbuh baru pacak.</i> Sasapin... yes, there's an additional aspect here. Based on this picture, sasapin is a type of wood, a graded wood. If we reveal the method, cut a piece of wood... the trunk of that wood... thrust the wood, meaning, if you follow this picture, where it can be thrust, it has already grown standing, so if you understand this, in an open space, it can be newly thrust.	E2

			<i>anggota badan haiwan tersebut ke kayu itu.</i> Thrust a piece of wood, make a small cut in the wood, and insert a part of the animal's body into the wood	
9.	Code: 2b Mendapat hasil buruan di hutan dan meminta pertolongan ahli keluarga di rumah untuk mengangkat bersama-sama hasil buruan		<i>Anjing itu mest nampak berlari lari minta tolong</i> It must show the dog is running to ask for help <i>Saya nampak anjing tapi kurang jelas tujuan dia.</i> I can see there is a dog, but I can understand the purpose.	E2 E3
10	Set 3: Warning Code: 3b Pemasangan jerat (belatik)		<i>Yang no. 3 ini yg patah-patah memang betul semua ini. ..hujung-hujung ranting kayu... tumbuhan... ya betul...</i> Number 3, the broken pieces, is indeed accurate. The tips of branches, plants... yes, that's correct.	E2
11	Code: 3c Avol (menghadang menggunakan kayu yang berbentuk 'X')		<i>Ada pertuahnya</i> It has a significance. <i>Pertuahnya macam ini, kalau kau 10 org, kau petik ranting kayu, tapi jangan kasih buka, ada ranting begitu, atau tumbuh begitu, petik yg begini panjanglah, lepas itu, kau kasih melintang begini, bagi cross dia.</i> The significance is like this: if there are 10 people, each person picks a branch, but don't open it. If the branch is like this or grows like this, pick the longer one. After that, place it horizontally, creating a cross.	E2

12	Code:3d Haava (Kayu rebah secara tiba-tiba)		<i>tanda amaran lain seperti Haava atau kayu tunggul/kayu yang rebah secara tiba-tiba. Ya, macam ini betul.</i> Other warning signs include 'Haava' or fallen stump/wood suddenly. Yes, that's correct	E4
13	Code:3ei Sosolov/Tutunu (membakar/bakar)		<i>Ini kalau bukan kain merah ini sahaja boleh lagi kasih maut, tapi kain merak ini ertinya ada beberapa kali org curi.</i> If it's not the red cloth, it can only bring harm, but the peacock cloth means several people have trespassed.	E2
14	Set 4: Wedding Code: 4a Inkuun (kayu yang diukir/diraut menjadi bunga)		<i>Inkun itu kelengkapan sesanian. Tiada sesanian, tiada inkun. Tapi bila dia sudah pasang inkun, baru pasang sesanian.</i> Inkun is an artistic accessory. Without artistry, there is no inkun. But when it is already installed, only then the artistry is added.	E2

Appendix M: Result of The Evaluation of The Accuracy of Digital Tatandu Symbol Based on the Semiotic Attributes

Symbol Code and Name	Digitalised Symbol	Attributes					Overall Mean Score	Percentage (%)	Groups
		Familiarity	Representation	Material	Colour	Semantic			
Code: A1i Hirison am tandukin (hiris kayu dan pacak)		1	1	1	1	1	1	100%	G1
		1	1	1	1	1	1	100%	G2
		1	1	1	1	1	1	100%	G3
		1	1	1	1	1	1	100%	G4
Code: A2i Sasapin (hiris kayu)		1	1	1	1	1	1	100%	G1
		1	0.5	1	1	0.5	0.8	80%	G2
		1	1	1	1	1	1	100%	G3
		1	0.5	1	1	0.5	0.8	80%	G4
Code: 1b Mematahkan hujung-hujung ranting kayu@tumbuhan.		1	1	1	1	1	1	100%	G1
		1	1	1	1	1	1	100%	G2
		1	1	1	1	1	1	100%	G3
		1	1	1	1	1	1	100%	G4
Code: 1cii		1	1	1	1	1	1	100%	G1
		0	0.5	1	1	0.5	0.6	60%	G2
		1	1	1	1	1	1	100%	G3
		0.5	0.5	1	1	0.5	0.7	70%	G4
Code: 1di Keturunan orang Sulung (moyang-moyang terdahulu) salah satu daripada keturunan		0.5	1	1	1	1	0.9	90%	G1
		0.5	0	1	1	0	0.5	50%	G2
		0.5	1	1	1	1	0.9	90%	G3
		0.5	1	1	1	1	0.9	90%	G4
Code: 1e Keturunan murut asli tahol		1	1	1	1	1	1	100%	G1
		1	1	0.5	1	1	0.9	90%	G2

		1	1	1	1	1	1	100%	G3
		1	1	1	1	1	1	100%	G4
Code: 1fi Tanda arah bagi tanah sempadan		1	1	1	1	1	1	100%	G1
		1	1	1	1	1	1	100%	G2
		1	1	1	1	1	1	100%	G3
		1	1	1	1	1	1	100%	G4
2. AKTIVITI MEMBURU	2ai	1	1	1	1	1	1	100%	G1
Code: 2ai Mendapat hasil buruan		1	0.5	1	1	1	0.9	90%	G2
		1	1	1	1	1	1	100%	G3
		1	1	1	1	1	1	100%	G4
Code: 2b Mendapat hasil buruan di hutan dan meminta pertolongan		1	1	1	1	1	1	100%	G1
		0.5	0.5	1	1	0	0.6	60%	G2
		1	1	1	1	1	1	100%	G3
		1	0.5	1	1	0.5	0.8	80%	G4
3.AMARAN/B AHAYA/KARAT		1	1	1	1	1	1	100%	G1
Code: 3b Pemasangan jerat (belatik)		1	0.5	1	1	0.5	0.8	80%	G2
		1	1	1	1	1	1	100%	G3
		1	1	1	1	0.5	0.9	90%	G4
Code: 3c Avol (menghadang menggunakan kayu yang berbentuk 'X')		1	1	1	1	1	1	100%	G1
		1	1	1	1	1	1	100%	G2
		1	1	1	1	1	1	100%	G3
		1	1	1	1	1	1	100%	G4
Code:3d Haava (Kayu rebah secara tiba-tiba)		1	1	1	1	1	1	100%	G1
		1	0.5	1	1	0.5	0.8	80%	G2
		1	0.5	1	1	1	0.9	90%	G3
		1	1	1	1	1	1	100%	G4

Code:3ei Sosolov/Tutunu (membakar/bakar)		1	1	1	1	1	1	100%	G1	
		1	1	1	1	1	1	1	100%	G2
		1	1	1	1	1	1	1	100%	G3
		1	1	1	1	1	1	1	100%	G4
NOTIS KENDURI/PERK AHWINAN Code: 4a Inkuun (kayu yang diukir/diraut menjadi bunga)		1	1	1	1	1	1	100%	G1	
		1	1	1	1	1	1	1	100%	G2
		1	1	1	1	1	1	1	100%	G3
		1	1	1	1	1	1	1	100%	G4
Average		0.92	0.91	0.95	1.00	0.89	0.94	94%		

Appendix N: Framework Verification Interview Transcripts Sample

Location: Nabawan

File: VIDEO C002

EXPERT 3 – E3, EXPERT 3 – E4

Q: hari itu sudah datang dpt maklumat, saya cuba nak minta kepastian drpd tuan.. ini adalah langkah kedua, langkah pertama sudah temuduga dgn En.Kino... tentang tanda ini, dan kami sekarang sudah membangunkan tanda ini dlm bentuk macam ini whatsapp gambar-gambar ini, kami dah buat emoji dlm bentuk ini, nak tanya pendapat tuan, katakah ini betul kah? salah kah? Macam begini, ini symbol whatsapp hari itu, ada anak panak, kalua kita begini, sticker, emoji, dlm whatsapp pulak, macam org-org muda boleh guna macam begitu... faham apa maksud dia, fungsi dia, supaya budaya boleh kekal selama-lamanya... itulah maksudnya.

E3: Tanda ini adalah bangsa sendiri, kita simpan di sana turun temurun segala bangsa boleh tau. Saya pun byk terima kasih, memang sangat bagus, jadi merendahkan ini bangsa murut adalah tulin di negeri kita, negeri sabah.

Q: Tanda jumpa di mana-mana di pensiangan, saya sudah pergi 3 hari di pensiangan, saya jumpa dgn En.Kino, kelmarin sudah keluar dan jumpa tuan.

E3: Cabaran yg terbaik, budaya-budaya yg asal..

Q: masalah sekarang anak-anak jarang pergi ke kampung, dan mereka menggunakan ini, mereka akan tahu, inilah tujuan kami masukkan ini, masuk ke hutan ada nilai-nilai belajar. Jadi inilah nah kepastian drpd tuan.

E3: Pelancangan yg terbaik.

Q: Apakah kalau masuk ke kampung atau hutan, mesti ada dari segi nilai-nilai kebudayaan yg dia boleh belajar, boleh tak cik beritahu nilai-nilai ya boleh belajar,

E3: Nilai atau tanda ini, satu pertandaan keselamatan kita, sekiranya ada termasuk hutan, itu sudah ada tanda arah mana, dia sudah tahu kawasan ini ada org, dia boleh pergi mana-mana lagi, dia tanda lagi utk dia punya. Pertama keselamatan. Kedua, kalau dia menanda ada barang dia simpan sana, org lain boleh tahu barang simpan di mana. Keselamatan dan petunjuk.

Q: Macam perkongsian infomasi. Dan perjalanan dlm hutan supaya dia tidak hilang dan tidak sesak.

E3: Ya, ya. Keselamatan dan pertanda jalan, tidak sesak, banyak juga maksudnya.

E4: Benda yg dia tanda dia boleh cari, yg kedua macam jarat, macam pelapit, perangkap Binatang.

Q: Kami telah berjaya berkumpul 29 tanda. Duduk 3 hari di Persiangan, inilah hasilnya, hari ini cuba nak dapat kepastian dan pendapat drpd tuan-tuan betul atau silapkah tanda-tanda ini.

E4: Itu memang tanda ya sudah wujud dari dulu, bila sudah wujudnya murut punya bangsa, mana-mana tempat, saya rasa org-org Sarawak pun sama juga. Tapi di sini yg kami buat ini, simbolik yg org-org murut, kami memang ikut apa yg dia org sudah buat dari satu generasi ke generasi. Tetapi kita tahulah generasi yg muda sekarang, memang simbolik ini dari dulu, paling bagus masa ini sekarang telah dibukukan kami juga berterima kasih kerana tidak terlupa. Tapi kalau bangsa yg macam murut

masih mengamalkan simbolik ini di dlm hutan. Contohnya dulu belum ada jalanraya, tanda-tanda itu menunjukkan jalan utk mahu keluar satu-satu tempat. Kebanyakan sesak, yg sesak itu tanda ini boleh balik ke pangkar jalan. Inilah simbolik yg bukan kami bikin-bikin tapi sudah wujud dari dulu sampai generasi sekarang. Tetapi tidak berapa zaman ini, kebanyakan pakai handphone, tapi dulu inilah tujuan yg sebenar, pasal itu hari masih hutan, tapi apabila sudah ada jalan raya itulah perubahan-perubahan pada masa sekarang, tapi masih mengamalkan simbolik ini kalau pergi ke hutan.

Q: Itulah saya nak temuduga dengan tuan-tuan sebagai pakar, kemudian saya pun jumpa dengan remaja-remaja yg menggunakan, saya dapati ada yg tahu, ada yg sudah tak tahu, itulah tujuan projek ini ialah supaya jadikan tatandu ini sebagai emoji macam whatsapp ada emoji, kita akan masukkan dia khas utk org murut tahu, so budak-budak yg menggunakan handphone dia mengerti kebudayaan itu boleh disambung.

E4: Bukan murut tahu sahaja, tetapi org-org luar pun mesti juga, kadang-kadang perlancong datang dari jauh masuk hutan, dia org pun perlu melalui simbolik ini. Satu kebaikan.

Q: Ada seorang rakan lagi di unima di Sarawak, mereka buat utk org peneng, tapi mereka tak panggil tatandu, mereka panggil oroo, fungsinya sama. Mereka guna daun, akar, rating-rating buat symbol.

Q: Kami sudah buat, tuan tengok ada yg mana tak betul tuan bagi tahu, so kita balik kita buat ubah.

Q dan RESPONDEN- RESPONDEN sama-sama tengok dan bincang symbol yg dilukis dalam kertas... symbol ini ok, betul...

E4: Apa yg kami sebut di sini kenyataan semua adalah benar, kalau ada apa-apa pun nanti boleh buat penambahan. Masih ada banyak lagi.

Q: Terima kasih. Mungkin kali pertama, boleh kumpul lagi. Ikut perlawanan saya, pada tahun 1975 sudah ada seorang British buat kajian yg sama tapi itu sudah lama, itulah saya ikut jejak dia sampai ke sini.

Q: Satu lagi nak tanya, kalaulah benda-benda ini katakan generasi muda sudah ada handphone, dia tak kena ini, apakah kerugian atau masalah utk generasi ini?

E4: kita boleh tahu melalui telephon, tapi perlu juga dalam hutan, utk pendedahan jejak dilakukan susah, sendiri masuk hutan pengalaman itu nampak. Ini tiada dalam telephon. Masuk terasa di sana macam betul. Ada hutan kita boleh masuk and tunjuk mereka tanda-tanda yg sesuai boleh mengajar.

Q: Adakah activiti dilakukan sebelum ini?

E4: Belum ada, tapi ada masalah-masalah sesak di hutan in berlaku, banyak yg masuk hutan tapi tiada tanda-tanda dia org tahu, itulah sampai 3-4 hari baru boleh jumpa, tapi kalau ada tanda-tanda ini dia nampak tahu dia terselamat.

Q: Adakah tatandu ini merupakan sesuatu yg penting utk identity org tahu?

E4: Amat penting. Kalau di sini hutan masih tebal.

E3: Ini cabaran-cabaran yg generasi muda sekarang, semakin pupus sekarang. Ada yg minat masuk hutan mengalami tanda-tanda ini, sekarang kebanyakan main telepon, cepat merangkap di telepon sekarang, generasi dahulu inilah permainan dalam hutan.

Q: Ada apa-apa cadangan drpd tuan-tuan?

E4: Cadangan saya perlu banyak lagi tanda-tanda ini dan dimodenkan kalau dapatlah, itu cadangan saya.

Appendix O: Focus Group Consent Form



Tarikh:

Ibubapa/penjaga

KEBENARAN UNTUK REMAJA MENYERTAI AKTIVITI KAJIAN SELIDIK

Title of Research: Indigenous Visual Symbolic Communication Design Framework: Sustaining Indigenous Knowledge Through Systematic Innovation Approach.

Dengan segala hormat, perkara di atas adalah dirujuk.

2. Untuk makluman pihak tuan, kajian selidik yang disebut seperti di atas akan melibatkan remaja umur 15 hingga 17 tahun dan akan diadakan seperti berikut ;

Tarikh:

Hari:

Tempat:

Masa:

3. Kajian selidik ini adalah bertujuan membangun Rangka Kerja Reka Bentuk Komunikasi Visual Simbolik Peribumi menggunakan simbol visual kaum Murut iaitu Tatandu. Semua maklumat yang diberikan akan diuruskan secara sulit dan tiada butiran peribadi akan direkodkan. Ekstrak kajian selidik ini akan digunakan untuk tujuan penyelidikan sahaja.

4. Oleh hal demikian, saya berharap ibubapa/penjaga dapat memberi kebenaran kepada anak tuan/puan untuk menyertai aktiviti kajian selidik ini.

Sekian, terima kasih.

Yang benar,

Goh Chu Hiang

Penyelidik Projek

Tuan/puan,

KEBENARAN UNTUK PELAJAR MENYERTAI KAJIAN SELIDIK

Saya _____ *ibu / bapa / penjaga kepada pelajar yang bernama _____ ***membenarkan / tidak membenarkan** anak di bawah jagaan saya menyertai kajian selidik yang dianjurkan oleh pihak tuan. Saya juga berjanji tidak akan mengambil sebarang tindakan sekiranya berlaku sebarang kemalangan/perkara buruk semasa proses kajian selidik ini berlangsung.

Tandatangan: _____

Nama ibu/bapa/penjaga: _____ Tarikh: _____

Appendix P: Focus Group Interview Questions

Interview Questions (questions mark with ‘a’ are close-ended questions, ‘b’ are open-ended questions):

Familiarity:

Q1a: Have you ever see the components of this symbols in the place you stay?

Adakah anda pernah nampak bahan dalam simbol ini di tempat tinggal anda?

Q1b: Can you describe where you see this?

Boleh anda terangkan di mana selalu jumpa simbol ini?

Representation:

Q2a: What is the symbol represent?

Apa yang dilambangkan oleh simbol ini?

Q2b: Why you say so?

Mengapa anda cakap begini?

Material:

Q3a Can you tell me what are the materials used as the component in this symbol?

Bolehkah anda beritahu bahan apakah yang digunakan dalam simbol ini?

Q3b: Why those materials were used?

Mengapa bahan tersebut digunakan?

Colour:

Q4a Are the colours used in this design appropriate?

Adakah warna yang digunakan dalam reka bentuk ini sesuai?

Q4b: Is there any significant meaning with the colour used?

Adakah warna yang digunakan mempunyai makna tertentu?