



Faculty of Applied and Creative Arts

**Reimagining *Marik Empang* with Bamboo Beads: A Sustainable
Framework for Contemporary Costume Design**

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Reimagining *Marik Empang* with Bamboo Beads: A Sustainable Framework
for Contemporary Costume Design

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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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ABSTRACT

This research discusses contemporary costume design that draws inspiration from Sarawak's traditional *Marik Empang* weaving technique. In Sarawak, the unique bead weaving known as “*Marik Empang*” is a cultural icon that embodies centuries-old *Iban* craftsmanship. Through the incorporation of *Marik Empang* features into contemporary costume design, the project aims to bring together tradition and modernity, providing an innovative perspective on cultural heritage. Although the adaptability of bamboo in creative applications has been acknowledged, there is nevertheless a noticeable lack of creative bamboo designs, especially in the field of contemporary costume design. Research to date suggests that costume designers rarely experiment with bamboo designs. This emphasizes the necessity to explore previously untouched creative domains. Additionally, there is a recognized disconnect between traditional crafts and contemporary design, demanding more in-depth research into how these two domains can be brought together. The study employs a studio-based approach, integrating data-driven insights with an artistic approach to determine the type of raw bamboo that is ideal for bead weaving. A collaborative relationship between creative development and cultural preservation is intended to be achieved by merging traditional weaving techniques with contemporary design processes. The research evaluated four bamboo types for bead-making, and types B and C were the best due to their larger inner holes and characteristics analyzed in SEM. Three stringing materials performed well in water soaking tests, allowing the researcher to proceed according to the design requirements. The addition of natural seed beads enhanced the creative aesthetic of the designs. A survey conducted using Google Forms and an exhibition at Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0 and Booth 2025 yielded positive feedback regarding the aesthetics, functionality, cultural value, quality, and pricing of the costume designs. The

research definitively shows that integrating bamboo beads into contemporary costume design enhances aesthetic value while preserving the local cultural heritage of *Marik Empang* patterns.

Keywords: Raw bamboo, Bamboo beads, Contemporary costume design, *Marik Empang* pattern, Cultural heritage

***Pembayangan Semula Kraft Marik Empang dengan Penggunaan Manik Buluh:
Rangka Kerja Lestari untuk Rekaan Kostum Kontemporari di Sarawak***

ABSTRAK

Penyelidikan ini membincangkan reka bentuk kostum kontemporari mendapat inspirasi daripada teknik anyaman manik tradisional Marik Empang di Sarawak. Di Sarawak, hasil anyaman manik yang unik dikenali sebagai “Marik Empang” merupakan lambang budaya yang mencerminkan kemahiran kraf tangan turun-temurun kaum Iban. Melalui penggabungan elemen Marik Empang ke dalam reka bentuk kostum kontemporari, projek ini bertujuan untuk menggabungkan tradisi dan kemodenan, sekali gus memberikan perspektif baharu terhadap warisan budaya. Walaupun kebolehsuaian buluh dalam aplikasi kreatif telah diakui, masih terdapat kekurangan ketara dalam reka bentuk kreatif berasaskan buluh, terutamanya dalam bidang reka bentuk kostum moden. Kajian terdahulu menunjukkan bahawa pereka kostum jarang bereksperimen dengan reka bentuk menggunakan buluh. Hal ini menekankan keperluan untuk meneroka domain kreatif yang belum diterokai. Di samping itu, terdapat jurang yang dikenal pasti antara kraf tradisional dan reka bentuk kontemporari, yang memerlukan kajian lebih mendalam tentang bagaimana kedua-dua bidang ini boleh digabungkan. Kajian ini menggunakan pendekatan berasaskan studio dengan menggabungkan analisis berasaskan data dan pendekatan artistik untuk menentukan jenis buluh mentah yang paling sesuai digunakan dalam pembuatan manik. Hubungan kolaboratif antara pembangunan kreatif dan pemeliharaan budaya ingin dicapai melalui gabungan teknik anyaman tradisional dengan proses reka bentuk kontemporari. Kajian ini telah menilai empat jenis buluh untuk pembuatan manik, dan jenis B dan C didapati terbaik berdasarkan saiz lubang dalam yang lebih besar serta ciri-ciri yang dianalisis melalui SEM. Tiga jenis bahan tali yang diuji menunjukkan prestasi yang baik

dalam ujian rendaman air, membolehkan penyelidik meneruskan proses berdasarkan keperluan reka bentuk. Penambahan manik biji semula jadi telah meningkatkan nilai estetik reka bentuk. Satu tinjauan yang dijalankan melalui Google Forms dan pameran di Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0 and Booth 2025 telah menunjukkan maklum balas positif terhadap aspek estetika, fungsi, nilai budaya, kualiti, dan harga reka bentuk kostum. Kajian ini secara jelas menunjukkan bahawa integrasi manik buluh ke dalam reka bentuk kostum kontemporari mampu meningkatkan nilai estetik sambil memelihara warisan budaya tempatan corak Marik Empang.

Kata kunci: *Buluh asli, Manik buluh, Reka bentuk kostum kontemporari, Corak Marik Empang, Warisan budaya*

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LIST OF ABBREVIATIONS

BDC	Borneo Development Corporation
S.D.	Standard Deviation
SPSS	Statistical Package for the Social Sciences
STIDC	Sarawak Timber Industry Development Corporation

CHAPTER 1

INTRODUCTION

1.1 Study Background

This study discusses the reimagining of *Marik Empang* beadwork with a sustainable framework for contemporary costume design in Sarawak. The utilization of raw bamboo in contemporary costume design was an insightful investigation into sustainable materials and cultural identity. The integration of new sustainable materials, such as bamboo, has added creativity and innovation to traditional crafts in Sarawak, creating new possibilities for incorporating cultural meanings into contemporary costume design.

Contemporary represents something happening or occurring at the same time (Man, 2010). According to Pitts and Price (2020), contemporary art can be described as innovation or pushing boundaries forward into the future, rejecting traditional forms or something that is different and has not been done before. Contemporary design and contemporary costume design are distinct yet interrelated fields that focus on current trends, innovation, and their significance to modern culture. A contemporary piece can spark with the idea of using technology to reflect the changes from ordinary to extraordinary creatively (Pitts & Price, 2020).

Currently, the next-generation textiles (NGTs), a contemporary textiles that incorporate the latest developments in materials, technologies, and functions, represent a paradigm change in the textile industry in a contemporary way (Hossain et al., 2024). The utilization of innovative materials, including recycled materials and bio-fabrics (Rognoli et al., 2022), with techniques such as restructuring, laser cutting, natural dyeing, and 3D

printing (Chen et al., 2021), has been observed in recent years to explore the possibility of creating more durable, lighter, comfortable (Yang & Moody, 2021), aesthetic and eco-friendly products (Hossain et al., 2024). According to Sriyadi et al. (2024) and Sokari (2024), the costume design delivered messages, emphasized storytelling and cultural expression by showcasing the purpose of the costume through design themes, thereby achieving a performance or specific event aesthetic. Recently, the collaboration of costume designers with other industries has become a common practice, including artists, architects, and product designers (Gerrie, 2024). This interpretation of skills, techniques, materials, or ideas is effective in producing more creative, innovative, and meaningful costumes, thereby widening the market to attract a broader audience (Gerrie, 2024).

Bamboo is readily available and widely cultivated in Kuching, Malaysia, due to the country's ideal climate (Huang, 2021). Bamboo is a low-maintenance plant, as it does not require special care, chemical fertilizers, or pesticides, unlike other plants (Saxena & Khare, 2024; Nayak, 2022; Dorfman, 2011). Bamboo can rapidly grow naturally by adapting to its surroundings through the spread of its root system, eliminating the need for replanting (Dorfman, 2011). Additionally, bamboo has been notable for its strength, lightweight, flexibility, durability, and sustainability as an ideal material for a wide range of uses in daily life and traditional crafts over the past few decades (Chattopadhyay P. K. B.Tech. et al., 2022). Its ability to bend without breaking allows it to be shaped into various forms, while its durability ensures longevity. Local natives and artisans utilized bamboo to craft a wide range of items, including buildings, furniture, baskets, mats, containers, and decorative objects (Ratuannisa et al., 2024; Lee, Al-Edrus, & Tahir, 2023; Kumar et al., 2021; Hassan et al., 2015). This made bamboo remain in use by designers and artisans due to its versatility, durability, and sustainability.

Marik Empang (*Marek Empang*), also known as *tango* or *tangu*, is a beaded necklace or part of the traditional costume of the *Iban* ethnic group in Sarawak, Malaysia (Sutlive & Sutlive, 2001; Munan, 2005). This beaded work was often worn as a collar during cultural ceremonies, celebrations, significant events, and most importantly as an accessory for the *Iban* bride to wear around the neck (Ong, 2004). It is strung up with threads and numerous colorful, tiny seed beads to create intricate patterns and motifs that carry the *Iban*'s symbolic identity and meanings (Sutlive & Sutlive, 2001). It is believed that the *Marik Empang* serves as a modern alternative to the traditional, heavy, and uncomfortable layers of the *Iban* beaded costume (Munan, 2005). Although *Marik Empang* is still used for decoration and ornamentation during ceremonies, it has been observed that it has evolved into stylish modern ornaments or souvenirs to meet current market demand, due to its lightweight, comfort, and simplicity of wear.

In short, this research aimed to explore the utilization of bamboo as an alternative material for making *Marik Empang*. It was clear that bamboo was widely used in various industries, such as construction, furniture, and crafts; however, its use in the fashion industry, especially in beading design, remained very limited or almost unseen. This study aimed to investigate the potential of bamboo as a beading material due to its lightweight nature, strength, flexibility, durability, and sustainability. By doing so, the research developed contemporary costume designs that were lighter and more comfortable to wear, while preserving the traditional and cultural value of *Marik Empang*.

1.2 Problem Statement

Sarawak is renowned for its local handicrafts, including textile weaving, forest-based crafts, and traditional costume craftsmanship. Malaysia's natural resources, such as rattan

and bamboo, are ideally suited for creating eco-friendly furniture. The strong fronds of the sago palm, dyed in various shades, are then woven into intricate jewellery, baskets, hats, and rugs (Hospitality, 2019). According to Lias et al. (2020), bamboo is one of the natural resources that are easily found in our environment and widely used in the production of handicrafts and interior decorating products. The recent resurgence of the bamboo industry in Sarawak can be attributed to both government support, such as the expansion of bamboo plantations, and the innovations within the bamboo industry itself.

According to Luo et al. (2020), the size, functions, and materials of local bamboo crafts, as well as their marketing strategies, have been modified to adapt to new development trends and cater to the market. Additionally, weavers used various materials and colors to improve the longevity and attractiveness of their creations (Liufu et al., 2023). The first challenge was that the innovative bamboo designs are rare (Sun & Liu, 2022). Secondly, the bamboo designs in Sarawak were primarily focused on furniture, decorative products, and craft designs. However, the spark of bamboo innovation in Sarawak was focused on handicrafts, food containers, toys, furniture, musical instruments, flooring material, paper, pulp, and vessels (Osman, 2021). Despite the growing innovations in bamboo utilization in Sarawak, the bamboo designs were not applied in Sarawak's costume design, as Perumal et al. (2022) stated that bamboo was employed by various communities in a range of applications, including agriculture, construction, arts and crafts, and furniture production, without mentioning its application in Sarawak's costume design. Additionally, Sun and Shao (2021) noted that the gap between traditional craftsmanship and modern design requires further investigation. There is limited existing research that considers bamboo as a material in fashion and costume studies in Sarawak, particularly in its application to *Marik Empang*. This lack of a theoretical basis has created a gap in the understanding of how bamboo can

be considered both a sustainable material and an innovation for cultural expression in fashion design research.

Bamboo is well-known for its ecological benefits and versatility. However, its potential for use in beadwork and textile applications in costume design in Sarawak has not yet been systematically explored or documented. There is a lack of research examining the properties of bamboo beads, their compatibility with various stringing techniques, and their potential to reimagine *Marik Empang* motifs in a contemporary way. Transforming bamboo into suitable costume materials that balance aesthetics, durability, and cultural value is challenging for designers and artisans without such investigations. The modern development of traditional handicrafts has been well combined with the bamboo industry, contributing to the sustainability of crafted items (Luo et al., 2020). Bamboo beading offered a unique natural texture and appearance, provided a distinct aesthetic, and the lightweight bamboo beads make it comfortable to wear. Adding creativity to bamboo beading patterns aimed to attract and raise awareness among youngsters, bringing back a heritage identity that can be used daily.

1.3 Research Questions

Based on the challenges mentioned above in the problem statement, this research aimed to address the following questions:

Research Question 1: What types of bamboo materials are most suitable for crafting sustainable beads inspired by the *Marik Empang* patterns of Sarawak?

Research Question 2: Which *Marik Empang* patterns are most adaptable for integration into contemporary sustainable costume design?

Research Question 3: How can contemporary bamboo-crafted costumes be designed to preserve the cultural unity and visual integrity of the *Marik Empang* beadwork patterns?

1.4 Research Objectives

Based on the research questions, this study aimed to achieve the following objectives:

Research Objective 1: To identify the most suitable types of raw bamboo materials for crafting sustainable beads inspired by *Marik Empang* patterns in Sarawak.

Research Objective 2: To examine *Marik Empang* beadwork patterns for their adaptability in contemporary sustainable costume design.

Research Objective 3: To develop contemporary costume designs using bamboo-crafted beads that preserve the cultural identity and visual coherence of *Marik Empang* patterns.

1.5 Significance of Study

This research held significant value in both the cultural preservation and sustainable development industries. The integration of bamboo as a potential alternative material for seed beads in *Marik Empang* introduced an innovative costume design approach that combined the craftsmanship with contemporary sustainable design.

1.5.1 Significance to Academic Knowledge

This research made a significant contribution to academic knowledge by expanding the use of bamboo beyond its existing industries into the unexplored fields of fashion and textiles. Integrating bamboo as an alternative material for seed beads in *Marik Empang* patterns into costume design merged traditional craftsmanship with contemporary sustainable design. This research examined the characteristics of bamboo as a beading

material, including lightweight, strong, flexible, and eco-friendly, bead sizes, and arrangements with a combination of beads in different patterns for costume applications. These findings offer valuable insights for designers, researchers, and stakeholders, providing a valuable perspective on the potential of bamboo in design research and promoting bamboo as a sustainable material in culturally inspired fashion.

1.5.2 Significance to Design Practice

The research presented new ideas for reimagining *Marik Empang* motifs with local bamboo types in contemporary costume design. By combining *Marik Empang* motifs with contemporary design, this research promoted innovation while preserving cultural identity. This design idea encouraged younger generations to be interested in native designs. This research contributes to the creative industries of Sarawak by promoting the use of eco-friendly and innovative materials in contemporary design.

1.5.3 Significance to Cultural Sustainability

This research is safeguarding Sarawak's heritage by ensuring that traditional craftsmanship is preserved through the generations. Integrating environmental preservation into traditional craft research enhanced the conservation of cultural heritage, aligning it with global sustainability efforts. This research promoted the continued relevance of indigenous knowledge and practices in the contemporary era, encouraging cultural continuity and environmental responsibility to preserve the essence of *Marik Empang*.

1.6 Scope of Study

This research focused on the development and evaluation of contemporary costume designs that utilized bamboo beads as a sustainable alternative material in creating *Marik Empang* patterns for contemporary costume design. It identified the acceptance of raw

bamboo for bead weaving, influenced by *Marik Empang* patterns, and defined contemporary costume design within Sarawakian culture to determine its scope. The main material of the study involved testing four types of raw bamboo, collected from branches and culms in different regions of Sarawak, namely *Batu Kawa*, BDC, and *Serian*. However, due to time constraints and restrictions on land ownership, the researcher was only able to access and collect bamboo in the Kuching and Serian districts. Despite this limitation, the selected bamboo types are widely available and commonly used by local communities, so they are representative of the material resources found in Sarawak. Furthermore, the suitability of these bamboo types is also supported by existing literature, which reinforces the reliability of the insights provided by the materials collected on the potential of bamboo for bead-making and costume design applications. These bamboo types were evaluated based on the various cutting tools, treatments, dye absorption, strength, texture, inner hole size, and size uniformity to determine their suitability for making beads for costume designs.

In terms of design application, the researcher concentrated on identifying and adapting traditional *Marik Empang* patterns into contemporary costume designs. The researcher observed and examined the structure of *Marik Empang* motifs to adapt them in a contemporary way, using bamboo as the primary material for beading. The design development process involved testing the performance of different bamboo types, creating bamboo beaded samples inspired by the *Marik Empang* motifs, and costume prototypes that integrated bamboo beadwork. This was followed by an evaluation of how effectively these designs conserved the unity and essence of *Marik Empang*. Feedback from surveys and visual assessments was used to measure both aesthetic and cultural impact.

The study was conducted in Sarawak, Malaysia, utilizing a combination of observations, interviews, fieldwork, experiments, and a survey. This localised approach

ensured the cultural relevance and authenticity of the research outcomes. By introducing a new material, bamboo encouraged new ideas and gave designers an innovative way to express stories through their designs and creativity. The insights of bamboo as a sustainable material and innovation in culturally inspired contemporary costume design broaden the interest of designers, researchers, stakeholders, and younger generations in preserving cultural identity through contemporary creative practices.

1.7 Research Method

This study employed a mixed-methods approach, integrating both qualitative and quantitative methods within a studio-based research framework. The methodology was divided into two phases, which included a data generation and artwork phase, to achieve the objective of exploring bamboo as an alternative material for use in beadwork in contemporary costume design inspired by *Marik Empang* patterns. The purpose of this combination of methods was to ensure a comprehensive understanding of the potential of bamboo in sustainable fashion and contemporary costume design.

First, a comprehensive literature review was conducted to provide detailed background information on contemporary costume design, types of bamboo, bamboo usage, bead weaving techniques, Borneo beads, and the background of *Marik Empang*. The interview sessions involved local craftspeople to understand beading techniques, the meaning of the patterns, the materials, and the tools used in making *Marik Empang*. The material testing and analysis, including the examination of different types of bamboo structures and characteristics, was part of the art-making phase under artwork elements. The bamboo samples were analyzed using a Scanning Electron Microscope (SEM) to assess their suitability for making beads, which was under the visual research methodology in data

generation elements. These experiments definitively identified which bamboo species performed best based on criteria such as texture, inner hole size, uniformity, and dye absorption. A water-soaking test was also carried out to determine the most suitable stringing material for bamboo beadwork in terms of strength and durability.

In the experimental phase, the research explored various beading patterns shared by the interviewees from *Marik Empang*. It integrated them into contemporary costume samples using bamboo beads in combination with other natural seed beads. The feedback and public perspectives were gathered through a Google Form survey after the costume design prototypes were developed. The survey was designed to collect data on public opinions regarding aspects such as aesthetics, functionality, cultural value, sustainability, and affordability of the contemporary bamboo beaded costumes. Survey feedback was analyzed using SPSS software to compare the preferences for the costume designs, with results showing the preference for the costume design. Under the cultural value aspect in the survey, the mean scores indicated recognition of cultural preservation, reflecting the effectiveness of preserving the essence of *Marik Empang* patterns.

1.8 Research Framework

A research framework served similarly as a research route plan. An organized approach facilitated the planning of research concepts, techniques, and analysis. The research framework was crucial for understanding the research problem by identifying the concepts, variables, and their relationships, which serve as the foundation for the research. The framework definitely helped the researcher to define the scope of study, determine appropriate methodologies, and interpret findings within a coherent context. It could be theoretical, based on theories that explained the phenomena, or conceptual, which combined

theories, concepts, and assumptions to guide the investigation. A well-developed research framework ensured that the research process was straightforward, logical, and consistent. A conceptual framework is a set of ideas, assumptions, expectations, beliefs, and theories that support and guide a research study. It helped to show how the variables or ideas in the study were connected. The conceptual frameworks made assumptions about the phenomenon under study, allowing for clear conclusions to be drawn by mapping out the variables used in research and the interplay between them (Luft et al., 2022). The conceptual framework provided a foundation for the investigation, described the variables to be examined, the relationships between these variables, and the hypothesized relationships among them. It also helped to clarify the research questions, align the methodology, and provide a foundation for interpreting results.

This research chose a conceptual framework to define the key variables and concepts underpinning its investigation. The contemporary costume design conceptual framework, inspired by *Marik Empang* patterns and the utilization of raw bamboo, provided a fundamental framework for identifying key components and ideas. It outlined the desired aesthetic and thematic goals of the design and attempted to clarify the cultural significance of *Marik Empang*, as well as the characteristics of raw bamboo. Within this framework, specific aspects of *Marik Empang*, such as its colors, patterns, textures, and symbolism, were explored to inspire the design process.

The framework also explored the potential applications of raw bamboo in costume fabrication, considering its adaptability, sustainability, and cultural significance. The conceptual framework guided these aspects in contemporary costume design, utilizing raw bamboo as the primary material, by examining the cultural patterns of *Marik Empang* and its significance in traditional ceremonies. Through this structured approach, the conceptual

framework works as a design theory to provide a comprehensive understanding of the inspirations and objectives of the research by laying the groundwork for the creative exploration and development of costume design. The conceptual framework will be further discussed in Chapter 2 and Chapter 3.

1.9 Limitations of the Study

Despite following a systematic research process, this study encountered several limitations. The limitations break down as follows into three main categories: methodological, resource, and time constraints.

1.9.1 Methodological Limitations

The identification of species was a significant challenge during the research, as accurate differentiation between bamboo species requires expert knowledge. The researcher, who was not a bamboo expert, lacked the expertise to determine the differences between the bamboo species, resulting in a limited selection of bamboo types. Therefore, bamboo species that differed significantly in appearance were collected for this research. Furthermore, issues were identified during the dyeing process, particularly the use of mordants. Both alum and limestone resulted in poor dye absorption with the selected bamboo types, particularly with the limestone solution, which left a visible residue and reduced the aesthetic quality. Technical challenges were also identified during the bead-making stage. Smaller bamboo beads (approximately 0.5 cm in diameter) were found to be fragile and prone to breaking during this process. Consequently, this research concentrated on creating larger beads measuring 1 cm. Finally, limited access to skilled *Marik Empang* artisans restricted the number of direct interviews that could be conducted. However, the experienced artisans were chosen to gather cultural and technical knowledge for this research.

1.9.2 Resource Constraints

The natural variability of bamboo, which resulted in varying sizes, led to a large amount of raw bamboo needing to be collected to achieve a uniform size. A large quantity of raw bamboo had to be collected to obtain specific parts of the bamboo branch that were uniform in size and suitable for making beads. Only a limited number of branches were collected from each bamboo culm to ensure a uniform size. The researcher had to visit the collection sites repeatedly to select suitable and quality bamboo, thereby minimizing waste and ensuring the efficient use of bamboo resources. Additionally, the extensive collection of bamboo culms faced access issues to some bamboo sources that were restricted due to land ownership, protected areas, or harvesting regulations.

1.9.3 Time Constraints

Time constraints affected the access of the researcher to a wider range of bamboo species and collection sites, as repeated visits were required to obtain suitable materials. Time constraints also affected the interview sessions, resulting in only two artisans being interviewed. Many skilled artisans were busy running their businesses and had busy schedules, which made arranging suitable interview sessions difficult. The researcher had to reschedule multiple times and ultimately proceeded with only two interviewees. Nevertheless, both interviewees were highly experienced in making *Marik Empang* and provided valuable insights that made a significant contribution to the study.

1.10 Summary of Chapter

This chapter provided a general overview of the research, which explored the utilization of raw bamboo inspired by *Marik Empang's* beading patterns for contemporary costume design. The study identified a cultural gap in the creative application of bamboo

within contemporary costume design. The study also addressed the underutilization of bamboo as a sustainable material in the contemporary fashion industry. The possibilities and innovation of bamboo as a sustainable beading material were explored and experimented with to create new insights for future study and research. The primary objective of the research was to investigate the suitable types of raw bamboo for use as the primary beading material in contemporary costume designs. The incorporation of *Marik Empang* patterns into contemporary costume designs bridged the gap between cultural heritage and contemporary artistic expression. The research was also significant in promoting cultural preservation, particularly in the context of *Iban* traditional crafts, such as *Marik Empang*, while exploring the possibility of sustainable material use and enriching educational content related to indigenous crafts. The details for the research framework will be discussed in Chapter 2 and Chapter 3. The new idea of integrating traditional crafts into contemporary costume designs, utilizing bamboo beads, aimed to promote and preserve these crafts while reintroducing them into modern daily life.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review for this research explored contemporary designs, including costume designs, various types of bamboo, bamboo applications in different fields, bamboo weaving techniques, beadwork, and bead weaving techniques, as well as *Marik Empang*. Research highlighted the cultural significance of *Marik Empang*, a traditional beading art piece deeply ingrained in Sarawak's *Iban* history. The researcher reviewed literature related to contemporary costume design, bamboo types and their applications in industries, bamboo weaving, various sustainable materials, Borneo beads, beading techniques, and most importantly, the *Marik Empang*. The review highlights the lack of contemporary bamboo costume designs, especially in Sarawak, and emphasizes the need for further research into utilizing bamboo in innovative ways, particularly in contemporary costume design. Additionally, this research highlighted the significance of connecting the gap between contemporary design and traditional crafts, encouraging further study into how these two domains might meet. The literature study offered a strong basis for the current research.

2.2 Introduction to Contemporary Costume Design

The term “contemporary” applies to the present and resulting elements of a specific area or age, and it was used in several contexts. Contemporary refers to what exists or happens now and therefore seems modern. In the realm of design, contemporary design represents breaking boundaries, challenging old limits, and innovating to explore the complexity of today's environment. The challenges and advancements affecting the

environment encompass a range of factors, including technological growth, social change, political instability, and environmental issues.

Contemporary design reflects the current moment, allowing us to comprehend the continuous interaction between tradition and innovation, as well as the connections among various influences that shape our contemporary era (Jalil, 2025). Prabhata et al. (2023) expressed concern about the transformation of traditional artistic concepts into contemporary fashion, raising the possibility that symbolic expressions of a particular culture may be transferred to fashion over time, without losing their ties to the native tradition.

Contemporary costume design often blends traditional influences with innovative techniques, materials, and sustainability values to respond to the current era. The contemporary costume design may have innovation and creativity in experimenting and exploring new sustainable materials, remaking, manipulation of fabric, the interconnection between artists, and cooperation with different industries to break boundaries. The modernity of traditional craftsmanship drives the development of new products in line with current fashion trends. Ritu Kumar, the Indian designer, incorporated the values of traditional craftsmanship by remaking, rearranging, and using different materials and accessories to represent various traditional Indian styles such as bandh ani and heavy beads, dip Bagru block prints, Naga-ornamented saris, and chikan weaves by focusing on the detail in the making process (Chauhan, 2022). According to Pioneer Book Co. Pvt. Ltd. (2016), a black and beige Niscira embroidered saree, paired with an unstitched blouse, features a rich appearance enhanced by magnificent *aari* embroidery and print, inspired by the heritage motifs of the Indian subcontinent, which are derived from ancient art. Recent costume designers are taking a more artsy approach, using costume design as a means of

communicating their ideas. The costume designs exhibited characteristics of contemporary art, adopting an experimental approach with an emphasize on indigenous traditional culture (Meng, 2020). The designer Ma Ke, with the brand Exception, used natural, plain, and motif-less fabric materials and neutral colors such as black, white, grey, and brown, with natural and straightforward cuttings to give a strong sense of peace, tranquillity, and harmony to highlight the diverse nature of contemporary fashion (Prabhata et al., 2023). Her work promoted socially, culturally, and environmentally sustainable design and production by showcasing the intricate relationships between costumes, culture, and body with outstanding craftsmanship (Nauta, 2015).

According to Meng (2020), Ji Cheng revolutionized the traditional Chinese style with elegance and a touch of hippie flair, creating new design trends. Her Dancing Phoenix in Garden and Crane Shadow adopted a 3D embroidered phoenix totem with metallic colors, and the traditional pattern of the crane's wings, together with embroidery and 3D feather-like designs, decorated the hoodie design. A wide range of innovations, such as composite knitting fabric, the application of 3D printing technology, 3D texture fabrics, avant-garde lustre, and a fashionable sense of straightness, have inspired application designers (Meng, 2020).

Adapting traditional craftsmanship to contemporary fashion is often considered from a material perspective (Reis et al., 2016). Nowadays, most traditional craft designs adhere to simple aesthetics and utilize eco-friendly materials. According to Palomino (2020), Atlantic Leather introduced fashionable fish leather, known as fish-skin shoes, which have become part of Iceland's traditional culture, considering the essence of the fishing industry while avoiding harm to threatened animals through environmentally friendly technologies. Leather

Neo (2023) stated that fish leather gained popularity for its use in purses, cigarette boxes, furniture, fragrance bottles, powder cases, and boxes during the 1920s to 1939 Art Deco era. Fish leather manufacturing was banned in the 20th century as a result of colonisation. Rubber boots and manufactured clothing replaced handcrafted fish-skin shoes, boots, and apparel.

Currently, local designers create handbags, footwear, and even automobile interiors lined with salmon skin (Andersen, 2021). Various branded companies, including Dior, Jimmy Choo, Prada, and Alexander Wang, have begun to compete for salmon skin leather. Nike has even used fish leather from Atlantic Leather to produce a clothing line (Leather Neo, 2023). Petican and Foltyn (2022) found that the Fish Skin Clothing in the North Pole Native cultures strongly expressed the common human need for fashion. Arctic Fish Skin apparel was a visual feast for the senses, fusing harmony and economy of materials and textures. At present, not only fish skin but even lizard skin has been found by Saunders (2024), who stated that the small overlapping scales of lizard skin give a polished, smooth appearance to the texture of the products.

Furthermore, Toino Abel introduced its creation not only with natural materials and traditional techniques but also as a cultural heritage in a contemporary way. According to Prabhata et al. (2023), the Tagus River is the source of reeds for making Toino Abel handbags. The reeds are usually dyed in a traditional way using natural plant-based dyes before undergoing traditional handcrafting techniques. According to Irma (2018), dried reed is woven on a loom to create a mat, which is then sewn together and embellished with a rattan handle, a leather buckle, a shoulder strap, and a handcrafted ceramic charm printed with the reed blossom.

Hence, the activities, including costume design and product design for the fashion industry, refined what fashion design was and its place in contemporary design by emphasizing the close relationships between costume, traditions, and contemporary design (Melin & Elliott, 2021). Designers such as Ritu Kumar, Ma Ke, Ji Cheng, and brands like Toino Abel and Atlantic Leather exemplify this fusion by incorporating heritage techniques, sustainable materials, and modern aesthetics. This highlighted how traditional elements, such as Indian embroidery, Chinese motifs, and Arctic fish-skin garments, are being adapted using innovative technologies like 3D printing, eco-friendly dyes, and recycled materials (Jalil, 2025). Designers are not only preserving the cultural identity but also promoting sustainability and creativity through experimental forms, minimalist cuts, and environmentally responsible production methods (Martin et al., 2000). The integration of traditional values with contemporary design trends illustrated a growing global movement toward fashion that was both culturally rooted and forward-thinking (Thompson et al., 1976).

2.3 Types of Bamboo: Bamboo as a Sustainable Material

Bamboo is a fast-growing plant that matures in around three to five years, making it a valuable and renewable resource for sustainable material manufacturing. According to currently available data, China has the most extraordinary richness of bamboo in Asia, with 500 native species, while Japan, India, Indonesia, Myanmar, and Malaysia follow with 139, 119, 118, 97, and 69 species, respectively (Husain & Ilyas, 2022).

2.3.1 Types of Bamboo in Malaysia

According to the Sarawak Timber Industry Development Corporation (STIDC) (2015), Malaysia is home to 69 species of bamboo, of which 50 are found on the peninsula, 30 in Sabah, and 23 in Sarawak. Additionally, 12 of these species are commercially utilized.

National Forest (2024) stated that there were 59 species of bamboo in Peninsular Malaysia, belonging to seven genera: *Bambusa*, *Dinochloa*, *Dendrocalamus*, *Gigantochloa*, *Schizostachyum*, *Thyrsostachys*, and *Recemobamboos*. This statement was supported by research from Panda (2011), who identified 44 species of bamboo in the nation, with *Dinochloa*, *Gigantochloa*, *Bambusa*, and *Schizostachyum* being the most prevalent genera. Research by the National Forest (2024) strengthened the statement by identifying seven genera of *Dinochloa*, *Bambusa*, *Racemobamboos*, *Dendrocalamus*, *Thyrsostachys*, *Schizostachyum*, and *Gigantochloa* found in Peninsula Malaysia, and four of them are similar to the research found by Panda (2011). Among the seven genera, *Gigantochloa Scortechinii* is the widely found bamboo species, with 1.84 clumps/ha, while *Schizostachyum Zollingeri* is the rarest type, with 0.12 clumps/ha.

Gigantochloa Scortechinii is applied for handicrafts and raw material for particleboard, whereas shoots of *Gigantochloa Levis* are consumed and processed into chopsticks (Sarawak Timber Industry Development Corporation (STIDC) 2015; *Perbadanan Kemajuan Kraftangan Malaysia*, 2023). The use of *Gigantochloa Scortechinii* is supported by Kamarudin et al. (2024), who state that it is most commonly used for handicrafts and construction. *Schizostachyum Zollingeri*, also known as *Buluh Dinding*, is utilized in toothpicks, handicrafts (*Perbadanan Kemajuan Kraftangan Malaysia*, 2023; National Forest, 2024), basketry, and food (Alataris et al., 2019). Meanwhile, *Gigantochloa Ligulata* (*Buluh Tumpat*) is ideal for food, frames, and stumps as a medium for plant support, and the shoots of *Dendrocalamus Asper* are consumed and used as raw building material (*Perbadanan Kemajuan Kraftangan Malaysia*, 2023) and also used in making musical instruments and handicrafts (Huang, 2021).

There are several uses for *Bambusa Blumeana* shown in Figure 2.1, including furniture, toothpicks, chopsticks, musical instruments, and edible shoots. *Bambusa Longissima* is used to make a variety of items, such as baskets, lanterns, garden fences, and toothpicks (RECOFTC, 2021). *Schizostachyum Grande* is well-known for its leaves, which are used to wrap Chinese dumplings (*Bak Zhang*), and *Schizostachyum Zollingeri* is used for handicrafts and toothpicks (Sarawak Timber Industry Development Corporation (STIDC), 2015).

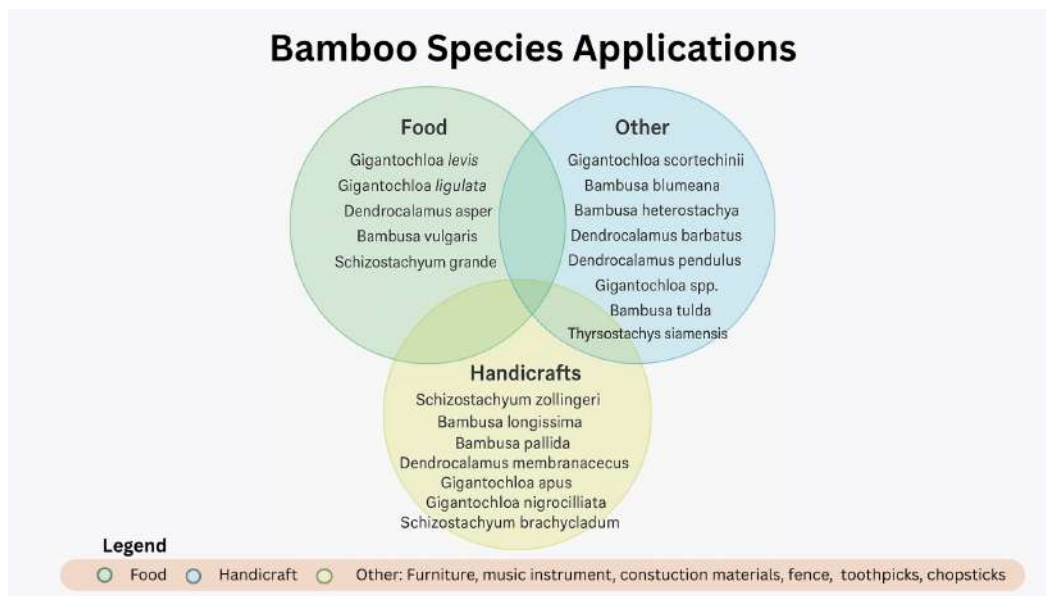


Figure 2.1: Specific uses of bamboo in Malaysia

According to *Perbadanan Kemajuan Kraftangan Malaysia* (2023), *Bambusa Heterostachya* can be processed into poles and window blinds, while *Bambusa Vulgaris* can be processed into ornamentals, chopsticks, and food products. *Bambusa Heterostachya* (*Buluh Galah*), *Bambusa Vulgaris*, *Dendrocalamus Pendulus*, and *Schizostachyum Zollingeri* are turned into satay sticks (*Perbadanan Kemajuan Kraftangan Malaysia*, 2023). Figure 2.1 shows that *Dendrocalamus Pendulus*, *Gigantochloa Wrayi*, *Schizostachyum Brachycladum*, and *Schizostachyum Zollingeri* are mainly used in the crafts industry.

The primary bamboo species used to make handicrafts is *Bambusa Longissima*, whereas *Dendrocalamus Barbatus* is essential for making bamboo-based panels (Vu & Nguyen, 2020). Malaysia has various bamboo species, including *Bambusa Blumeena*, *Gigantochloa Ligulata*, *Bambusa Heterostachya*, and *Gigantochloa Wrayi*, which are easily found in making furniture, musical instruments, crafting, and chopsticks, among numerous others (Othman, 2023). Hence, for this study, the researcher focused on these kinds of bamboo due to the availability of these bamboo species in Sarawak. According to Barbara et al. (2007), *Bambusa Pallida*, *Dendrocalamus Asper*, *Dendrocalamus Membranaceus*, *Gigantochloa Apus*, and *Gigantochloa Nigrociliata* are suitable for making handicrafts, while *Bambusa Tulda* and *Thyrsostachys Siamensis* are suitable for making fences and food.

Bamboo has been used in household items and industrial applications for decades (Osman, 2021). Bamboo species, including *Bambusa*, *Ci*, *Luohan*, *Green Mono*, *Moso*, *Mizutake*, *Mianzhu*, and *Qingpi*, are the primary materials used in Sui Jiang bamboo weaving activities (Shi et al., 2021). According to Gan et al. (2022), the poles and splits of *Giant timber bamboo* are used to make reconstructed composite beams and panels. *Dendrocalamus Asper* in Southeast Asia, *Guadua Angustifolia* in Latin America, and *Moso (Phyllostachys Pubescens)* in China are some of the most industrialized species (Chen et al., 2020). According to Aliffrananda et al. (2021), *Bambusa Arundinacea* and *Dendrocalamus Asper* from Pasuruan, East Java, were suitable for making ships. Table 2.1 shows the classification of the usage of different bamboos.

Table 2.1. Classification of different bamboos

Species	Local Uses
<i>Bambusa Arundinacea</i>	Ships
<i>Bambusa Blumeena</i>	Crafts, furniture, toothpicks, chopsticks, musical instruments, and food
<i>Bambusa Longissima</i>	Handicraft, baskets, lanterns, garden fences, and toothpicks

Table 2.1. Continued

<i>Bambusa Heterostachya</i>	Crafts, poles and window blinds
<i>Bambusa Pallida</i>	Construction, feed, fence, food, handicraft
<i>Bambusa Vulgaris</i>	Ornamentals, chopsticks, and food products
<i>Dendrocalamus Asper</i>	Construction, feed, fence, food, handicraft, ships
<i>Dendrocalamus Membranaceus</i>	Construction, food, handicrafts
<i>Dendrocalamus Pendulus</i>	Craft
<i>Gigantochloa Apus</i>	Energy, handicraft
<i>Gigantochloa Levis</i>	Food and chopsticks
<i>Gigantochloa Ligulata</i>	Food, frames, crafts and stumps
<i>Gigantochloa Nigrociliata</i>	Handicraft
<i>Gigantochloa Scortechinii</i>	Handicrafts and construction
<i>Gigantochloa Wrayi</i>	Handicrafts
<i>Thyrsostachys Siamensis</i>	Construction, feed, fence
<i>Schizostachyum Brachycladum</i>	Handicrafts
<i>Schizostachyum Grande</i>	Food wrapping
<i>Schizostachyum Zollingeri</i>	Handicrafts and toothpick

Recently, bamboo has demonstrated its potential as a sustainable material in innovative product design. According to Perfetto et al. (2020), bamboo, as an eco-friendly material, has great potential as a construction material for bike frames, serving as an alternative to more traditional materials such as steel, aluminum, and composite. Ghana and Kenya are using the Byke Project Bamboo as a sustainable transport alternative (Chele et al., 2012). Bicycle Bamboosero is another example of a new product developed using bamboo due to its excellent lightweight properties (Kindersley, 2016). According to Schmidt and Buhler (2023), the dimensioning of the bamboo tubes and joints is based on extensive bending and tensile tests to determine the strength properties of the natural material bamboo. Finally, the durability of the bicycle frame passed the tests, resulting in a bamboo bicycle manufactured with standardized connectors and joints (Schmidt & Buhler, 2023). According

to Jeffery et al. (2023), bamboo is now widely used in various applications, such as bamboo cases designed to fit the iPhone and iPad, and covers made by BoxWave. The first motorcycle helmet with a bamboo fiber shell, created by the French company Roof, has passed the Standard E22-05 safety standards and received the certification required for sale in Europe (Chele, 2021).

2.3.2 Bamboo as a Sustainable Basketry Material

For decades, bamboo was widely utilized as a primary raw material in the craft of basketry. According to Bincsik and Masanori (2017), the earliest Japanese bamboo baskets, preserved at the Shosoin, the hallowed Treasure House of Todaiji Temple in Nara, date back to the Nara era (710–794). Most of these remarkably well-preserved baskets, known as Keko, were originally used in Buddhist rites as offering baskets or to store fresh lotus flowers, which were either blessed by the spirits or scattered during ceremonies. Bincsik and Masanori (2017) presented a typical Karamono work, a huge flower basket by Hosai II, in the Abbey Collection (Figure 2.2a). It dates to the 1910s and was modeled after an old Chinese bronze vessel, featuring alternating rattan accents and plaiting patterns. Bincsik and Masanori's (2017) research revealed that Nakata Kinseki employed his master characteristic, embroidered-plaiting technique (Take Sashi-ami), to construct a bamboo tea ceremony chest, as depicted in Figure 2.2b, which is currently housed in the Abbey Collection.



Figure 2.2: a) Huge flower basket by Hosai II and b) Tea ceremony utensil chest (Bincsik & Masanori, 2017)

Recently, bamboo basketry products have expanded from functional daily necessities, such as containers and furniture, which were traditionally manufactured using manual production methods. The markets and user groups of these products are primarily located in rural areas, as they can be easily replaced by industrially manufactured, competing products made of plastic or metal. According to Sun and Liu (2022), due to bamboo art items generally being expensive and made in small quantities, there was a limited market for handcrafted, precious bamboo art created by master inheritors. On the other hand, traditional bamboo crafts, including everyday essentials, can be found at reasonable prices, offering a combination of functionality and creative design. Sun and Liu (2022) stated that bamboo was also used in plane-woven goods, such as mats and curtains, which undergo a rather industrialized production process that divides work and utilizes machines.

2.3.3 Bamboo as a Sustainable Basketry Material

Bamboo was used to make durable and recyclable industrial items, including furniture, flooring, decking, beams, panels, and ornamental elements. According to Zhao et al. (2022), many materials with high carbon footprints, such as steel, aluminum, concrete,

and polyvinyl chloride, may be replaced with bamboo. Bamboo was a natural, environmentally friendly material that had strong mechanical and bending properties. Many designers are presently promoting bamboo as a green material for furniture design (Zheng and Zhu, 2021; Sharma et al., 2015; Pan and Miao, 2020). According to Deng et al. (2023), global research has generally focused on developing novel materials for bamboo home furnishings, such as reconstituted bamboo furniture design. Research has verified that reconstituted bamboo has a greater moment strength than regular solid wood in terms of material bonding performance. In the study by Deng et al. (2023), four major types of bamboo furniture are identified: round bamboo furniture, bamboo composite furniture, bamboo reconstituted furniture, and bamboo bent and glued furniture.

According to Deng et al. (2023), a specific hydrothermal carbonization process combined with good sealing can be used to produce bamboo laminated wood without promoting mildew or insect growth. In contrast to hardwood furniture, bamboo-laminated furniture possesses durable mechanical and physical qualities, and its range of designs suits the diversity of customer demands through rich color variations and numerous functions (Deng et al., 2023). Besides, the stable bending strength, extreme hardness, and high density were characteristics of heavy bamboo, which served as a natural substitute for premium rosewood, as the bending was completed in a single piece, with no indication of a joint (Jalil, 2025). In the study by Deng et al. (2023), the multilayer bending and gluing procedure was primarily used to create bamboo-bent and glued furniture, which also utilized bamboo wood veneer, thin bamboo wood, and various additional materials.

Furthermore, bending and shaping bamboo were easy since it was both flexible and hard. It was more pleasant and helpful than rigid panels because the flexible surface of the bamboo weave conformed more closely to the contours of the body. According to Wan

(2019), distinct material combinations have varied impacts on their display, and the design may evoke diverse feelings from the user, as shown in Figure 2.3. According to Zheng and Zhu (2021), bamboo give a look that is warm and cosy when paired with soft materials like leather and fabric (a) while bamboo and sturdy materials like metal (b) may work well together to create a contemporary feeling of harmony and gentleness, while a sense of openness and uniqueness may be achieved by combining bamboo with translucent materials like glass (c) as shown in Figure 2.3.



Figure 2.3: a) Combination of soft bag and bamboo, b) metal and bamboo, and c) glass and bamboo (Zheng & Zhu, 2021)

Generally, a product made from bamboo may have a minimal or zero carbon footprint throughout its lifetime (Surma, 2022). Jeffery et al. (2023) shared the same opinion by stating that bamboo, as a natural composite material, may be used for a range of architectural purposes, including walls, flooring, roofs, and trusses. According to Zheng and Zhu (2021), bamboo was also less harmful to the environment than conventional construction materials, as it was simple to work with and could be easily mixed and sculpted using basic tools.

2.3.4 Bamboo as a Sustainable Paper Production Material

Bamboo paper was once used for a variety of purposes, but nowadays it is primarily used for religious purposes in the Lanten Yao and other faiths. There are three key uses for bamboo paper, for which no other paper can be used. According to Delang (2006), bamboo paper is the most commonly used material for decorating ceremonial altars, as well as for

paper curtains used in religious ceremonies and for publications that describe religious practices to be followed. Although any bamboo can be utilized, *Bong bamboo* was typically avoided since it provided stronger and whiter paper (Delang, 2006). Additionally, bamboo can be processed into pulp and used to create paper, cardboard, and other products. Silva et al. (2020) stated that the rapid growth and short growth cycle of bamboo make it a valuable source of sustainable biomass, which is widely utilized in the paper industry. According to Jeffery et al. (2023), bamboo paper is more environmentally friendly than standard paper, as it uses fewer chemicals and less water to produce. According to China National Building Material (2019), bamboo is an ideal material for paper and pulp production because it is a firm and lightweight fiber with a high cellulose fiber content, as well as plasticity. It can be used to generate eco-friendly packaging paper and a premium lifestyle.

Zeya bamboo paper, which is currently mainly used for bathroom, draft, or joss paper, acquired new significance when it was resurrected as contemporary Chinese lights (Vrenna & Cui, 2023). The paper lanterns and lights have been used since the sixth century, and they were still utilized in China for decorating public and private venues during festivities, which represented the pride of China (Vrenna, 2023). According to Vrenna and Cui (2023), an evocative ambient light illuminated “A beautiful scenery” by using little pieces of Zeya paper to form a mountain shape for the lampshade. Memories of the Village is another project that hovered between graphic and product design. It is a beautifully packaged desk lamp with laser-cut wooden panels that is simple to construct. According to Vrenna and Cui (2023), every side of the lampshade was covered in four sheets of Zeya paper, each with a different design printed on it that was influenced by traditional local architecture, primarily windows, roofs, and eaves.

2.4 Integration of Bamboo Traditional Crafts into Contemporary East Asian Designs

The integration of traditional crafts and contemporary design represented a dynamic intersection of cultural history and innovation. This combination preserved artisan knowledge passed down through centuries while also modernizing it to match contemporary preferences and sustainable designs. This section outlined the preparation of raw bamboo from selection and treatment to splitting and examined diverse weaving techniques shaped by cultural practices and functional needs. Techniques such as twilling, hexagonal, and pick-and-press are identified as most suitable for integration due to their strength, flexibility, and aesthetic potential. These methods supported both flat and 3D forms, making them ideal for applications in sustainable product design, contemporary costume, and artistic installations. The bamboo weaving techniques, with their rich history and artistic value, demonstrated the adaptability of bamboo as a sustainable material for a wide range of applications by bridging traditional craftsmanship with contemporary design innovation.

2.4.1 Integration of Malaysian Traditional Crafts into Contemporary Design

In Malaysia, *batik* acts as a cultural icon, having deep roots with distinctive styles and unique cultural motifs. Nevertheless, *batik* faced market circulation, creative innovation, digital change, and the preservation of cultural legacy as a result of globalization (Steelyana, 2012). Now, the production and manufacturing process of *batik* blocks in Malaysia and Indonesia has been advanced in line with the latest innovation to resolve the globalization issue (Syed et al., 2021). In the study of Lias et al. (2020), the substitution of natural resources, which is bamboo for copper, with the integration of block *batik* craft in Malaysia successfully created new and fresh ideas for the *batik* industry.

Besides, Malaysian furniture design is integrating traditional techniques and materials with contemporary design to meet the market demand. With many Malaysian furniture designers utilizing eco-friendly materials and production techniques, sustainability is also becoming more and more popular. According to Omar et al. (2024), Malaysian furniture designers are combining native resources like wood, bamboo, and rattan with contemporary technologies like digital fabrication and 3D printing.

2.4.2 Integration of China Traditional Crafts into Contemporary Design

Ancient China has a profound history of bamboo crafting, shown by the traditional hand fan, which highlights the adaptability and cultural importance of bamboo in daily life and creative expression. They not only used bamboo for practical purposes but also held symbolic and aesthetic value. According to Kucera (2017), fans were made from a wide variety of priceless materials, including mottled bamboo, boxwood, bone, ivory, and extremely rare jade in ancient China. A mixed fan bone double-sided painted ivory veneer figure pattern folding fan (*Qing Dynasty*) in the Dongguan Museum. Among the decorative techniques of ancient fans were contour and intaglio carving, hand painting, inlay or overlaying with gemstones, molded lacquer work, as well as sculptural carving using boxwood (Kucera, 2017). Gong fans used thin bamboo strips woven together to create fans during the Guangxu Dynasty (1871–1908). According to Hua et al. (2022), the bamboo strip round fan, Cheng Du painted pottery, and Liang Ping bamboo curtain were recognized as a high-grade handicraft of Sichuan. The fame of Gong Yuzhang, the son of Gong Juewu, soared after he was able to weave well-known artwork onto the surface of the fans.

The Gong fan was made from local, one-year-old yellow bamboo cultivated on Yinshan Mountain. In the research of Hua et al. (2022), the bamboo strips that have been prepared using specialized instruments became just as thin as a cicada's wings, crystalline,

and shiny. Subsequently, they undergo meticulous threading, hanging, inlay, and breaking in adherence to the calligraphic and original painting techniques. The folding fan is manufactured through several different processes. The thick-culm, well-colored *Moso bamboo*, which is cultivated in the regions of Anhui and Zhejiang, is used to make the ribs. According to Hua et al. (2022), bamboo that is spotless and devoid of black lines is chosen, and it is subsequently baked, split, scraped, boiled, polished, carved, and varnished. Before a fan is finished, it must go through 58 stages.

Bamboo umbrellas in China have been an integral part of Chinese culture for centuries, while serving as both functional accessories and symbols of Chinese tradition and craftsmanship. Hua et al. (2023) stated that the oil-paper umbrellas originating from Fenshui Town in Luzhou, Sichuan, have a long history, with evidence indicating that they have been in use for over four centuries. The water-divided oil-paper umbrellas are crafted through over 90 distinct steps, including the application of tung oil, as well as the use of bamboo, leather, and paper, which have been designated as a national intangible cultural heritage. The resulting umbrellas are notable for their strength and durability, which can withstand winds of level five without deformation and can be unfolded and folded repeatedly over 3,000 times without sustaining damage (Hua et al., 2023). Vrenna and Cui (2023) stated that fine craftsmanship and the patience of the artisans are required, as the shaft was the foundation of the entire bamboo umbrella and was the basis upon which all other elements were built.

Nowadays, paper umbrellas are heritage Chinese tradition innovatively. According to Zhang et al. (2023), Zhu Yu showcased the oil-paper umbrellas, which involved imprinting Sichuan symbols onto it, creating a meaningful connection that goes beyond mere combinations. The pairing of pandas and bamboo is thoughtfully matched, symbolising prosperity and growth. A spectacle frame from the Ming dynasty was designed with clean

lines, reminiscent of another era, and true to the philosophy of order and minimalism. It was very light, combining aesthetics, craftsmanship, and function (Chele et al., 2012).

2.4.3 Integration of Taiwan Traditional Crafts into Contemporary Design

Designers utilize bamboo as a sustainable material due to its aesthetic appeal and environmental benefits (Ramakrishnan et al., 2020; Pan and Miao, 2020). Wang et al. (2017) demonstrated that bamboo can be woven into flat or 3D furniture pieces, showcasing patterns and natural textures in a contemporary manner. Preston (2016) stated that bamboo is widely used for furniture in Taiwan due to its lightweight design and unique patterns. A waterfall inspired the Lattice Chair by Chen Kuan Cheng, shown in Figure 2.4a. The Lattice Chair was made from a Taiwan-specific *Moso bamboo*; the chair was crafted using unique bending and forming methods. Jin Kuramoto, with Jian Cheng Lin and Wen Chun Tang, created the Indigo-dyed Bamboo Chair. The slender bamboo pieces were manually woven and bent to form a curvaceous armchair, as shown in Figure 2.4b.



Figure 2.4: a) Lattice Chair made of *Moso bamboo* and b) woven Dyed-Bamboo Chair (Deng et al., 2023; Sheth, 2021)

Additionally, Zheng and Zhu (2021) showcased the Nomad chair by Kristian, which blended Moroccan and Scandinavian design elements, featured a light, airy back, a basic

bamboo frame, and a seat composed of woven bamboo mesh. The seat and neck rest of the chair had leather upholstery, which enhanced the overall hue and reflected the color of the bamboo while also making the chair more comfortable.

2.4.4 Integration of Indonesian Traditional Crafts into Contemporary Design

In terms of design and diversity, bamboo-woven items are now experiencing a rise in originality and innovation. In response to evolving consumer preferences, Indonesian bamboo artisans adapted their practices to align with contemporary design trends (Murhadi et al., 2024). They now produce a wide range of bamboo products that showcase diverse forms woven with innovative patterns and designs to meet customer-specific requirements, reflecting both aesthetic appeal and functionality. According to Murhadi et al. (2024), the products were designed for long-term use, with an emphasize on durability and sustainable value. Elements of cultural traditions' storytelling were embedded within the product designs, enhancing their uniqueness and market appeal. Food coverings, rice baskets and steamers, sieves, and other types of containers are among the bamboo goods made in Indonesia. A vast array of basketry products is still made for both the local and tourist markets (Ave, 2008). In the research of Sumarna (2002), bamboo was used in several historical events in Indonesia as a material for defense constructions and weapons during the final colonial era. These days, bamboo is used to make bridges, structures, hedges, furniture, fishing and farming tools, musical instruments, culinary utensils, and even some decorations (Mulandari & Budiani, 2025). It still fulfills its primary function in several ancient customs' ceremonies and rituals, as well as in the more contemporary industrial endeavors of prefabricated house panels and paper pulp production.

According to Sumarna (2002), bamboo is used in the majority of Indonesian rituals, including circumcision, the seventh month of pregnancy, wedding ceremonies, and

childbirth. On a number of ceremonial occasions, the bamboo musical instrument known as the *angklung* is performed. A bamboo knife is required in Indonesia to cut the baby's umbilical cord; the knife used on a girl is made from male bamboo, and the one used on a boy is made from female bamboo. Besides, bamboo plaiting, which is typically used to make hats, fans, lunchboxes, pet cages, and containers, was employed in handicrafts and household tools (Sumarna, 2002). Bamboo is used to make a variety of domestic items, such as baskets, strainers, vases, containers, brooms, egg mixers, rice bowls, steamers, includes bamboo shoots, and several meals are prepared using tubes of bamboo (Rahardiani, 2024). According to Sumarna (2002), applying paint or varnish, soaking in fresh or salty water, boiling with additives like boric acid or caustic soda (*direbus*), heating over fire to remove sap (*dunun*), and sun-drying for approximately a month until the odour is gone (*dijemur*) are some treatments to increase the durability of bamboo.

Generation Z in Indonesia is demonstrating a significant preference for bamboo jewelry. Bamboo's natural and renewable properties make it the perfect material for this customer demand, which prioritizes eco-friendly products. According to Aurani et al. (2024), the blending of traditional natural elements with modern design, innovations like the use of flower-inspired patterns inspired by Indonesia's native flora, not only improve the visual appeal but also support the sustainable idea.

Traditional Indonesian livelihoods have always relied heavily on bamboo, especially in coastal and riverine communities. Bamboo rafts, which are still used on Indonesian rivers, are said to have been used for river travel by the Javanese for ages, even reaching Australia. According to Sumarna (2002), some traditional fishermen utilise the trap *bubu*, a bottle-shaped plaited bamboo basket with the open end shrinking and folding inwards, to catch fish in calm rivers, lakes, and coastlines of Indonesia. *Bambusa Wrayi* is the material of the

Southeast Asian bamboo weapon known as a *sumpitan*, or blowgun, which is used for hunting by tribal groups including the *Dyaks*, *Kubus*, and *Hmong* (Sumarna, 2002). Currently, it is only used to hunt small animals and birds, although it was previously a weapon in tribal conflicts.

2.5 Bamboo's Strengths and Limitations Compared to Other Eco-Friendly Materials

The proper selection of material is the foundation for its application in every industry, and it is crucial for assessing its suitability and compatibility for various end products and usage. According to Rahaman et al. (2024), the term sustainable is used in the textile industry to describe the effort to meet the desires of producers and customers while minimizing harm to the environment and humans. The most often used eco-friendly textiles are hemp, flax, cotton, and jute due to their biodegradability and being safe to wear (Rahaman et al., 2024). A similar statement showed that plant fibers such as leaf, seed, bast, grass, straw, and wood are replacing synthetic fibers due to their performance and sustainability advantages (Ramamoorthy et al., 2015). Clothing made from organic cotton is easy to wear, has excellent air permeability, and is environmentally friendly (Zhang, 2023). However, cotton is a crop that requires a lot of water. Recent statistics indicate that 10% of the world's pesticides and 25% of its insecticides are used in India alone for cotton cultivation (Dana et al., 2023). A similar statement was made by Muthukumar (2020), saying that the production of cotton has environmental impacts, including yield, defoliation, fertilizers, pesticides, and irrigation. Consequently, there is a growing need for pesticides and insecticides, which harm the environment. Beyond cultivation, bamboo-based products are also known for their durability compared to other green materials such as oak. There is

research shows that a bamboo bowl remains intact when dropped onto a tile floor, where an oak-made bowl breaks under the same conditions (Chattopadhyay et al., 2022).

Another plant-based material made from the leaves of the *Agave Sisalana* plant, sisal, is another reasonably priced fiber that may be utilized for sustainable, durable, and versatile use in the textile sector (Foulk et al., 2011). Comparative studies have shown that flax fiber is twice as strong as cotton fiber (Foulk et al., 2006). Flax fiber is considered one of the most promising plant fiber options to replace synthetic fibers because of its renewable and biodegradable properties. Biodegradable and renewable fibers derived from bamboo, soy, and bananas have developed rapidly in recent years. These can be used in place of non-recyclable synthetic fibers. Straw is structurally strong and widely found in China (Hopkins, 2024; Sjostrom, 2014). Straw may be used to make stylish and lightweight summer beach hats, caps, bonnets, baskets, and hat ornaments (Hughes, 2017). Corn husk is an alternative material for crafting as it is abundant in our environment (Hasan et al., 2021), affordable, and harmless to the environment (Hua et al., 2023).

A renewable plant source, soybean protein fiber is made from the hulls of soybeans at an affordable price (Nayak, 2022). According to Vynias (2011), clothing made from soy fibers has an elastic handling, a softness comparable to cashmere, and has the sheen of silk; soy fiber is just as comfortable as cotton. Eco-friendly tableware is made from cornflour, a material that dissolves naturally, leaving only carbon dioxide and water, both of which are good for the environment, poison-free, and minimising environmental pollution by disintegrating in 90 days at room temperature after being buried in soil (Chattopadhyay P. K. B.Tech. et al., 2022). Lyocell, a rayon fiber made from eucalyptus trees, is a resource that grows incredibly quickly, needs little water, requires no pesticides for growth, and is regarded as an environmentally friendly fabric. Its sole drawback is that soaking causes a

minor loss of mechanical strength and fibrillation, despite its wrinkle resistance, softness, biodegradability, and renewable supply (Nayak, 2022).

Lenpur is a sustainable cellulosic fiber derived from the wood pulp from specific trees, as white pine, which is soft, has greater moisture absorption, greater thermal range, and antibacterial qualities (Dissanayake & Perera, 2016). Lenpur is an alternative to cotton fiber because of its comfort qualities, especially in high-quality fashion goods (Nayak, 2022). According to (Chattopadhyay P. K. B.Tech. et al., 2022), a renewable resource, sugarcane fibers are used to create aesthetically pleasing and robust food packaging items with compostable and biodegradable certification. According to Nayak (2022), the iron-rich seaweed used to make SeaCell fiber is also a fantastic source of iodine, vitamin B12, antibacterial compounds, and anti-inflammatory qualities. In spite of these qualities, SeaCell fiber is a naturally healthy material for skin-friendly clothes.

Products and materials made of rattan have been traded across Asia for ages, and it is believed that rattan mats were transported from the Malay Peninsula to China over a thousand years ago. Rattan is widely used in making furniture, toys, and crafts as it is lighter and ventilated compared to wood, making it perfect for the summer time (Hua et al., 2023), especially in a country like Malaysia, which has a year-round tropical environment with high temperatures and humidity.

According to Duru and Okpalauba (2022), botanical materials such as reeds, bamboo, cane, vines, and honeysuckle plants are suitable to use for weaving basketry and mats. According to Yve (2019), willow, tule, juncus, and sumac are commonly used in Southern California to make coiled basket warps. While tribes from the Pomo to the South developed both twined and coiled baskets, tribes in Northern California weave twined baskets. Reeds have unique qualities, such as naturally being resistant to fire due to their

high silica content, which is suitable for a variety of crafts, including weaving and thatching. According to Cattail is valued for its silky texture and flexibility, whereas bulrush is recognized for its strength and durability (Bell and Ai, 2025).

The making of boats is undoubtedly one of the most unexpected uses for reeds. The ancient Egyptians built boats out of bundles of papyrus reeds, which are very similar to common reeds (Bell and AI, 2025). Rick (2021) claimed that coiled basket weaving skills are used in the making of a large reed boat at the port. In the research of Bell and Ai (2025), Thor Heyerdahl's Kon-Tiki expedition in 1947 showed that it is possible to travel across large oceanic expanses aboard a raft made of reeds and balsa wood. According to Navajo (2012), reed is strong and durable, making it more often used in crafts including basketry, furniture manufacturing, and even painting. They are a desirable substitute for synthetic materials in many different industries because of their sustainability, renewability, and inherent beauty, as mentioned in (Bell & Ai, 2025).

Bamboo is an environmentally friendly, fast-growing plant that does well without irrigation, pesticides, or herbicides (Suwal et al., 2020). It is a very sustainable resource since it organically regenerates, matures in three to four years, and has a vast root structure that promotes both rapid growth and soil stability (Adnan et al., 2020). According to Sreejith and Chichaghare (2022), bamboo is a good alternative to wood in a variety of applications, such as the furniture and construction sectors, because of its qualities, including as hardness, lightness, flexibility, and tensile strength. Bamboo is degradable, durable, moisture-absorbing, and longer-lasting than cotton (Zhang, 2023). Bamboo has considering elements including surface shape, length, and diameter (10–13 μm), combustion behaviour, moisture regaining (on average 8.0%), moisture content (on average 7.5%), and solubility qualities (Chin et al., 2020). Additionally, longer and coarser bamboo fibers have a high breaking

tenacity (63.74–138.63 N/Tex) and a lesser elongation (2.06–2.46%) (Rocky & Thompson, 2020), proving that bamboo is strong and durable. Bamboo anatomical characteristics like fiber length, vascular bundle size and distribution, and cell wall thickness are employed as parameters, whereas physical characteristics like moisture content, density, and shrinkage are quantified (Hassan et al., 2015), making it a standout material compared to other plant-based materials. Bamboo also has excellent mechanical quality, anti-UV, bacteriostatic, and antibacterial qualities (Rahaman et al., 2024). Bamboo demonstrates remarkable growth capacity, with rates ranging from approximately 75 to 400 mm per day (Suwal et al., 2020). It can be cultivated without the use of pesticides and insecticides due to its natural resistance to pests and diseases (Chattopadhyay et al., 2022). These characteristics make bamboo a highly sustainable and environmentally friendly alternative not only in textile production but also in the craft industry.

2.6 Raw Bamboo Preparation Process

There is various bamboo utilized for weaving techniques, each with its unique characteristics and applications. Depending on the desired outcome and cultural traditions, weavers may employ different species of bamboo with various combinations of these techniques to create functional and decorative bamboo products. The weaving techniques showcased the versatility of bamboo as a material and highlighted its use in developing a wide range of functional and decorative items. Each method offered unique possibilities for creativity and expression in bamboo craftsmanship as beading. In terms of materials, processes, and purposes, weaving and beading are two different techniques. The process of weaving makes fabric by interlacing two sets of threads or fibers, known as the warp and the weft, usually done on a loom using yarn and cotton thread. It is to produce baskets, mats, and fabrics that emphasize usability, durability, and structure. In contrast, beading is the craft

of creating artistic patterns by threading or stringing tiny beads made of materials like plastics, stone, seeds, or glass onto threads or fabrics. Color, purpose, and intricate details are frequently added to clothing, accessories, and cultural artifacts through their application. This research primarily focuses on beading, particularly the use of bamboo beads inspired by *Marik Empang* in Sarawak. The following section discusses the details of some famous and basic bamboo weaving techniques, including the preparation process of raw bamboo, and the beading techniques will be discussed in detail in the next section.

2.6.1 Raw Bamboo Preparation

In general, the selection of bamboo, branch and knot removal, block and gabion splitting, green scraping, splitting, and weaving are the basic bamboo preparation processes (Shi et al., 2021). The techniques used for weaving bamboo are generally the same. The four primary methods of Dai bamboo weaving involved selecting the bamboo, preparing the materials, weaving, and locking the edges (Shi et al., 2021). First, bamboo needs to be chosen according to the product; large objects should be made of thick and old bamboo, while small and delicate objects should be made of flexible and strong bamboo. Next, the bamboo needs to be prepared by being shredded, scorched, and sterilized to prevent decay. Lastly, it needs to be woven, and the edges should be locked to complete the process. The embellishments included lacquering, painting, and coloring. The six steps of the Yi Liang bamboo weaving technique include bamboo cutting, stripping, trimming strips, dying, weaving, and shaping (Shi et al., 2021). Four types of basic bamboo weaving techniques and six types of Chinese traditional bamboo weaving techniques, along with the corresponding weaving steps, are discussed below.

2.6.2 Twilling Technique

Bamboo weaving was a traditional craft that utilized bamboo strips, employing various techniques to create intricate and durable woven products. The methods can vary based on the region, cultural traditions, and the specific item being crafted. According to Sun and Liu (2022), the structure of most basketry products can be summarized into four main categories, which include twilling, coiling, plaiting, and weaving.

To start the twilling process, the initial bamboo strip is attached diagonally to a frame or base, and it is then woven at a diagonal angle over and beneath subsequent strips. Each strip overlaps the one before it in the pattern, creating a twill pattern that is both attractive and harmonious. To ensure a neat look, the artisans must maintain a constant tension. Twilling, as shown in Figure 2.5a, is widely used in basketry techniques because it allows for the adjustment of the twill angle to create various effects (Sun & Liu, 2022). The twill pattern is completed after reaching the desired size, using wrapping or lashing techniques, and the ends of the bamboo strips are secured. According to Noshiro et al. (2019), people from the middle to the end of the Jomon era who lived at the Shimoyakebe site in Tokyo used bamboo splints, most likely *Pleioblastus Chino*, to weave and twill baskets.

2.6.3 Coiling Technique

In California, coiled and twined baskets, as shown in Figure 2.5b, are the most common types. According to Yve (2019), a beginning knot that spirals outward is the foundation of a coiled basket. Wefts are wrapped around a basin, making a water-holding basket. To weave the thin strips as tightly as possible, and to weave the three sides of the basket simultaneously, ensures consistent thickness, which helps keep the strands and stretch from the knot like a web (Yve, 2019).

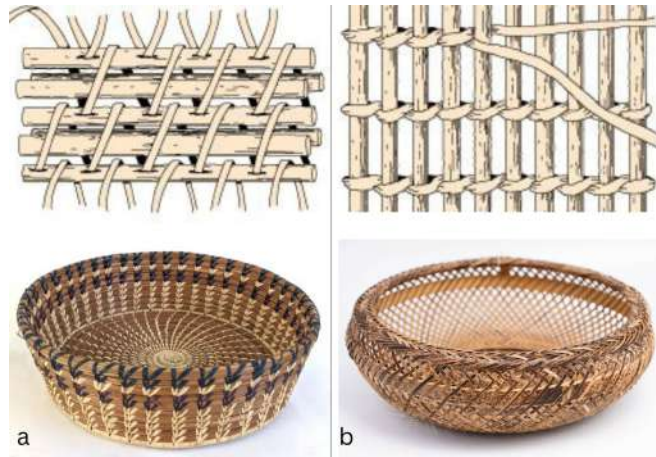


Figure 2.5: a) Twilled technique basket and b) coiled technique baskets (Sun & Liu, 2022)

2.6.4 Flat and 3D Weaving Techniques

Typically, the craftspeople select the best kind for the item they are making. According to Zheng and Zhu (2021), bamboo can be classified into various spatial geometric shapes, including both flat and curved forms. However, only flat bamboo can be further classified into non-geometric shapes, while curved bamboo can be further classified into spatially free-form surfaces. Flat bamboo weaving may be categorized into three types: horizontal, vertical, and oblique. Curved bamboo surfaces give a delicate, dynamic, and intimate feel, whereas flat bamboo weave is constant, calm, and organized.

Various weaving patterns are produced by utilizing different knotting and weaving techniques. When weaving two-dimensional planes, the various bamboo weaving techniques adhere to the “pick and press” weaving technique. In weaving, weft refers to the weave, and warp refers to the pick. Three types of traditional patterns can be distinguished, including geometric forms, characters, and imitations of flora and fauna (Zheng & Zhu, 2021). Weaving bamboo in 3D requires different weaving techniques than those used in flat bamboo weaving. Pick and press and through and through are two methods for flat weaving that are often used. According to Zheng and Zhu (2021), the varying warp and weft gap widths and

thicknesses of the bamboo strips used to weave the flat designs produce a range of effects, including the combination of richer visual effects achieved using various strip thicknesses.

Curved bamboo weaves are commonly used as chair backrests, bases, and panels in furniture design. In contrast, flat bamboo weaves are frequently employed for door panels on shelves and cabinets, screens, the tops of tables and cases, and the seating surfaces of stools and chairs (Zheng & Zhu, 2021). Weaving handicrafts often use finer pieces, whereas furniture panels use larger pieces. The bottom of the piece is woven using a specific number of bamboo strips, similar in thickness to the backbone, that intersect with each other (Wu et al. 2020). In traditional East Asian bamboo weaving, bamboo strips are selected and pressed to create the woven threads, with the picks serving as the warp threads and the weft as the weft. The most fundamental method in bamboo weaving is picking one and pressing one, which led to the development of other widely used methods, including picking one and pressing two, picking two and pressing two, and picking three and pressing three (Jiang & Fu, 2021). Additionally, various techniques were developed through the picking and pressing processes, resulting in the formation of back, hexagonal, and quadrangular hole patterns. According to Jiang and Fu (2021), traditional bamboo weaving primarily employed the pick and press method to weave on a flat surface; however, 3D weaving utilized flat bamboo weaving to create a 3D product on the outside of the mold.

2.6.5 China Traditional Weaving Techniques

Xiang Xi offers a wide variety of planar and 3D bamboo weaving products (Yang et al., 2008). According to Guo and Xu (2021), flat bamboo weaving products include bamboo mats and bamboo weaving paintings, whereas 3D bamboo weaving products mostly include bamboo hats, sieves, back baskets, cages, and tables. Bamboo weaving products are

available in a wide variety of manufacturing techniques and ornamentation styles, and the same type of product often features several models with different designs (Guo & Xu, 2021).

Sui Jiang's flat bamboo weaving involves a variety of weaving techniques, including imitating woven patterns, referencing the pattern, filling in the frame's coordinates, and weaving based on personal preference. According to Shi et al. (2021), twill weaving, cross weaving, herringbone weaving, hexagonal weaving, and chrysanthemum bottom weaving were commonly used for 3D bamboo weaving. Daily essentials and agricultural tools, including artwork, baskets, dustpans, fans, lanterns, vases, hats, and straw shoes, were among the products made from 3D bamboo weaving. The two primary categories of Sui Jiang bamboo weaving products were 3D bamboo weaving and flat bamboo weaving. The two types of bamboo used in plane bamboo weaving were *Ci bamboo* and *Green bamboo*, both of which have long, thin fibers and smooth textures. To create bamboo paintings, the thinnest strips of bamboo need to be as fine as hair, or even thinner than hair strands. This technique yielded the most remarkable results in Sui Jiang's plane bamboo weaving and bamboo painting. According to Shi et al. (2021), bamboo paintings are created by hand, utilizing warp and weft as their basis. A wide variety of subjects, including the invisible Goddess of Mercy, are woven into the highly artistic value painting through techniques such as picking, pressing, breaking, spelling, lifting, and other weaving methods (Shi et al., 2021).

The humid environment of Xiang Xi is ideal for bamboo cultivation. Baskets have superseded the carrying stick as the preferred means of transportation among the inhabitants due to the narrow routes in the mountainous terrain. Xiang Xi uses locally grown bamboo as raw material, cuts it into strips, and weaves various utensils for daily use, adapting to local conditions. The most crucial step in making a water-holding basket is to weave the thin strips

as tightly as possible and to weave the three sides of the basket simultaneously to ensure consistent thickness, which helps keep the water in the basket (Guo & Xu, 2021).

Parallel weaving, square hole weaving, and hexagonal hole weaving are the three primary bamboo weaving techniques used in Rui Chang (Huang, 2021). The primary technique of parallel weaving involves using thin bamboo strips to lay on the surface of the weaving mould, allowing for greater control over the overall shape of the woven product. According to Huang (2021), it is also crucial to pay attention throughout the weaving process, as the mould shape determines the structure of the finished product. Weavers may utilize excellent weaving skills to make products that perfectly balance attractive and functional elements by practicing the fundamental weaving technique.

There are five types of Dai bamboo weaving methods, including picking, folding, pressing, curving, and coiling (Shi et al., 2021). According to Shi et al. (2021), this forms the foundation for its division into two categories including new weaving techniques, such as broken warp weaving, flora weaving, immersion weaving, leakage weaving, float and carving weaving; and classic weaving techniques such as Chinese character (Figure 2.6), chrysanthemum bottom, cross, hexagonal, square hole, and twill weaving. Weaving designs are rich in shape and include character, geometric, flora, and fauna patterns (Shi et al., 2021).



Figure 2.6: Dai character bamboo weaving (Shi et al., 2021)

Bamboo weaving from Yi Liang has a long and rich history with distinctive artistic value. The Yi Liang bamboo weaving craft has developed a consistent weaving technique over hundreds of years of heritage. The most famous artistic bamboo weaving product is the bamboo fish tank woven by master Li Jiayun. This bamboo fish basket is watertight, subverting the Chinese proverb of “all the water in a bamboo basket is in vain, which means that a bamboo-weaved basket is impossible to hold water. Besides, the most flexible and durable bamboo, *Phyllostachys Edulis*, often referred to as *Mao bamboo*, is usually used in Yi Liang bamboo weaving (Shi et al., 2021). In Yi Liang, bamboo cutting typically took place annually between the seventh and the twelfth month of the lunar calendar. Chinese character weaving, back weaving, cross weaving, hexagonal weaving, elephant eye block weaving, pepper leaf weaving, and twill weaving are among the standard Yi Liang bamboo weaving techniques, which are mostly comparable to the Dai weaving technique (Shi et al., 2021). According to Shi et al. (2021), flat, bottom, and coordinating weaving patterns are the three main types of weaving patterns. In general terms, there are many varieties of weaving patterns, including human characters, crosses, hexagons, stone forests, and plum blossom designs. Li Gayun also learned additional weaving techniques from Yagizawa Masayoshi, a Japanese bamboo weaving expert, including Aomi weaving, Hulu weaving, plum flower weaving, pine leaf weaving, and wire weaving (Shi et al., 2021).

2.6.6 Weaving Technique for Reed, Willow, and Grass

According to Duru and Okpalauba (2022), weaving baskets using grass, reeds, bamboo, cane, vines, and honeysuckle plants proved effective with three basic weaving methods: coiling, plaiting, and twining. The usual manner of weaving the mat is to ensure that the grass is pliable before it is inserted into the weft. It was packed down using a flat piece of wood. According to Yve (2019), willow, tule, juncus, and sumac are commonly used in Southern California to make coiled baskets. These materials are also utilized to make the wefts that join the warps. While tribes from the Pomo to the South developed both twined and coiled baskets, tribes in Northern California weave twined baskets. Rick (2021) claimed that coiled basket weaving skills are used in the making of a large reed boat at the port. Now, the bamboo fiber is also developing, as Jalil (2025) explored the potential of bamboo fiber and hand-woven techniques as a sustainable approach for the textile and clothing industry.

2.7 Sarawakian Heritage in Beadworks, Design, and Fashion: The Cultural and Artistic Significance

Beads are small decorative objects made from various materials such as glass, plastic, wood, metal, stone, or other natural materials. They come in diverse shapes, sizes, colors, and textures, and have been historically significant in cultural and religious practices. Today, beads are used in a wide array of artistic endeavors, including jewelry making and embroidery. They held both aesthetic and symbolic value, serving as versatile embellishments in contemporary fashion and design. Beads continued to be cherished for their ability to adorn and enhance various forms of creative expression.

2.7.1 Beading Techniques

Beading employs a range of techniques to create intricate designs and patterns, utilizing beads as the primary medium. It has been practiced for centuries across different

cultures and regions with their unique challenges and opportunities for creativity, making bead weaving a versatile and rewarding craft. Generally, bead weaving used strong threads, such as monofilament nylon thread, and the size of the beads needed to be greater than the size of a needle for them to fit through each thread (Hafez et al., 2018). Hector's (1995) research showed that most experts agreed that the methods used to make beads can be categorized into two groups. The first category involves attaching beads to a surface using appliqué or sewing techniques, while the second category is more complex, systematic, and challenging, where beads are combined with threads to create the base without any additional materials to support it (Seiler, 1994; Francis, 1980).

2.7.1.1 Off-loom / Needle Weaving

According to Hafez et al. (2018), off-loom weaving, also known as needle weaving, is mainly used for weaving flat fabric pieces with evenly sized beads. The varied methods may be formed into a tube or circle to create 3D forms, showing the unique properties and defining their application. Starting from a short distance from where the old thread seems, thread the needle with a new thread through plenty of beads, following their path, and then form a hitch half within two beads by following the previously mentioned instructions (Hafez et al., 2018). A half knot is made when the thread and the needle are passed through many beads, while the old thread is hidden. The same steps should be followed to hitch again. After that, remove the end of the bead or tie an additional knot for extra security.

2.7.1.2 Stitch Square

According to Hafez (2018), the stitch square, as shown in Figure 2.7, is like loom work. Nevertheless, loom work can be more practical to work with. The absence of thread ends to hide is an iconic characteristic of the square stitch for bigger pieces.

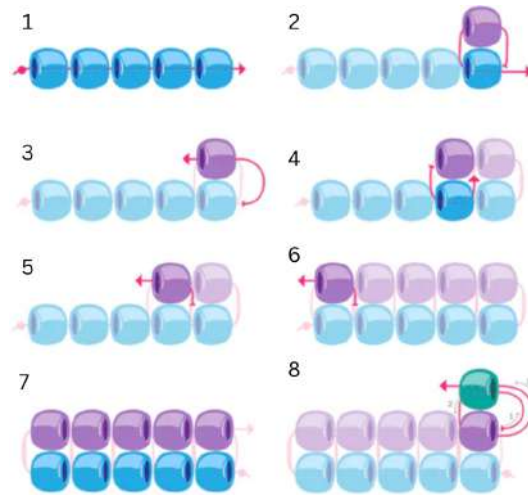


Figure 2.7: Stitch square technique (Beadaholique, 2024)

2.7.1.3 Stitch Ladder

The stitch ladder is frequently used as the base row for stitch brick, stitch herringbone, and can also be used alone. To use this technique, as shown in Figure 2.8, ensure the thread is the correct length by joining two beads together and passing the needle over the first bead (Hafez et al., 2018). Next, connect another bead, thread the needle past the previous bead, and add beads in the correct sequence to ensure the two beads remain together.

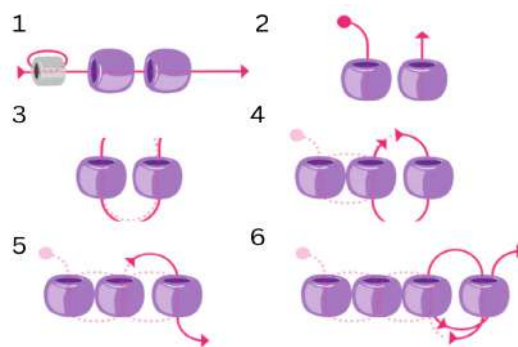


Figure 2.8: Ladder stitch (Beadaholique, 2024)

2.7.1.4 Stitch Brick

Stitch Brick is also known as Cheyenne or Comanche stitch. Unlike other stitches, this technique adds beads by threading them onto the needle through the loops of thread

formed between the beads in the previous row, as shown in Figure 2.9. According to Hafez et al. (2018), 3D containers and wallets are popularly made due to their solidity. The needle is inserted into the bottom hole once the stitch foundation row is completed. After passing two beads, the needle is passed below the loop of thread formed between the first two beads. To add the second bead, one bead is threaded through the previous loop, and then the needle is put through the bottom hole of the bead (Hafez et al., 2018).

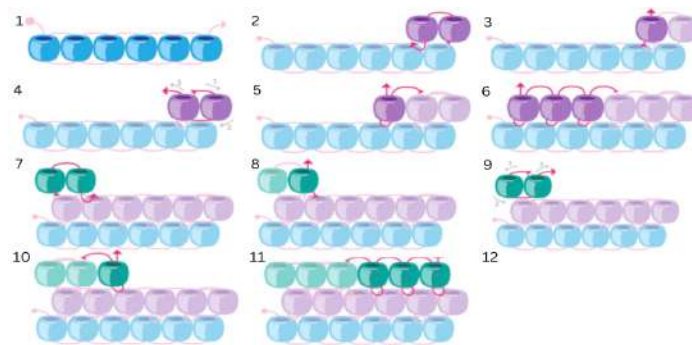


Figure 2.9: Brick stitch (Beadaholique, 2024)

2.7.1.5 Stitch Herringbone

The most popular and useful stitch is the herringbone stitch, which is named for the way the beads are arranged to resemble a fishbone. The stitch is unique in that it requires less time to complete, as the beads are inserted in pairs. According to Hafez et al. (2018), to form rows in a letter (v) shape like the stitch brick, start with the ladder stitch as a foundation. The ladder stitch is used to create a foundation row for this technique, as shown in Figure 2.10. This row is then inverted to ensure the thread is hung from the very top of the final bead. Next, take two beads. Thread the needle down through the following bead, then thread the needle up through the previous bead in the row of the top stitch, and so on, until the needle reaches the end of the row (Hafez et al., 2018).

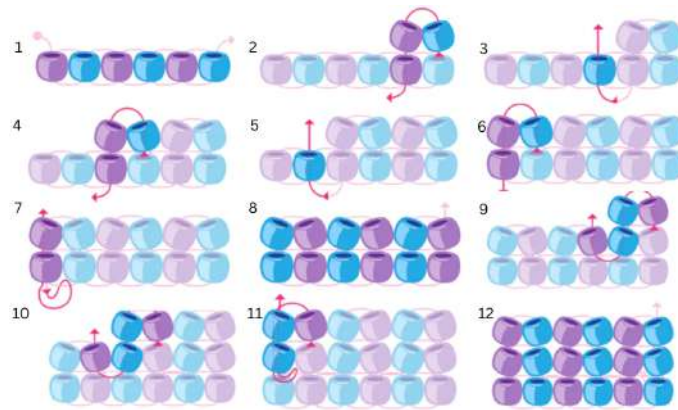


Figure 2.10: Herringbone stitch (Beadaholique, 2024)

2.7.1.6 Stitch Peyote

Like the block stitch, the stitch known as the stack stitch or peyote is an ancient technique with a variety of applications and ease of usage. The appearance of the woven piece can be adjusted by manipulating the thread thickness. A woven piece made with a single thread is flexible, but when the doubled-thickness thread is used to fill in the gaps left by the beads, the work becomes more substantial, much like other stitches (Hafez et al., 2018). The flat-woven pieces, with even-count doubles counting (Figure 2.11a) or odd-count singles counting (Figure 2.11b), are better suited for use with beads of the same size. For even count peyote stitch doubles counting, start a new set of beads, decide an even number with the desired width, pick up the first bead within the following row and thread the tip of the needle through the second bead, pick up an additional bead, avoiding the bead next to it, and thread the needle across the bead after that (Hafez et al., 2018). This weave uses the same procedure as even count; however, an additional transformation is required at the end because each last stitch of the row is an overhead bead. This method is used when a fully symmetrical piece needs to be woven (Hafez et al., 2018).

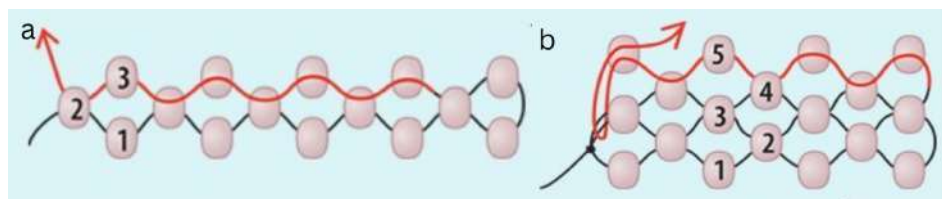


Figure 2.11: a) Even count and b) odd count peyote stitch (Beading Daily, 2023)

2.7.1.7 Other Weaving Techniques

Various types of weaving techniques could meet the specific needs of the outcomes. According to Hector (1995), some weaves involve beads that are connected by a long horizontal, continuously thread to create patterns (Figure 2.12a and b) while some of the threads have multiple, separated parts that move in different directions, like diagonal threads weave (Figure 2.12c), vertical thread weave with open (Figure 2.12d) and close (Figure 2.12e) variations. These techniques are often utilized in 19th and 20th-century examples of Asian beadwork. Notably, most pieces are constructed using a single method, but some are made by combining two or even three techniques. A skilled bead worker can manipulate techniques according to their needs and develop subtle nuances in color and form by adjusting bead spacing and thread tension (Hector, 1995). Bead grading is the evaluation of the appearance of a piece. The bead worker sorts through the beads during the grading process. Beads of uniform size and shape create one effect, while irregular beads create another.

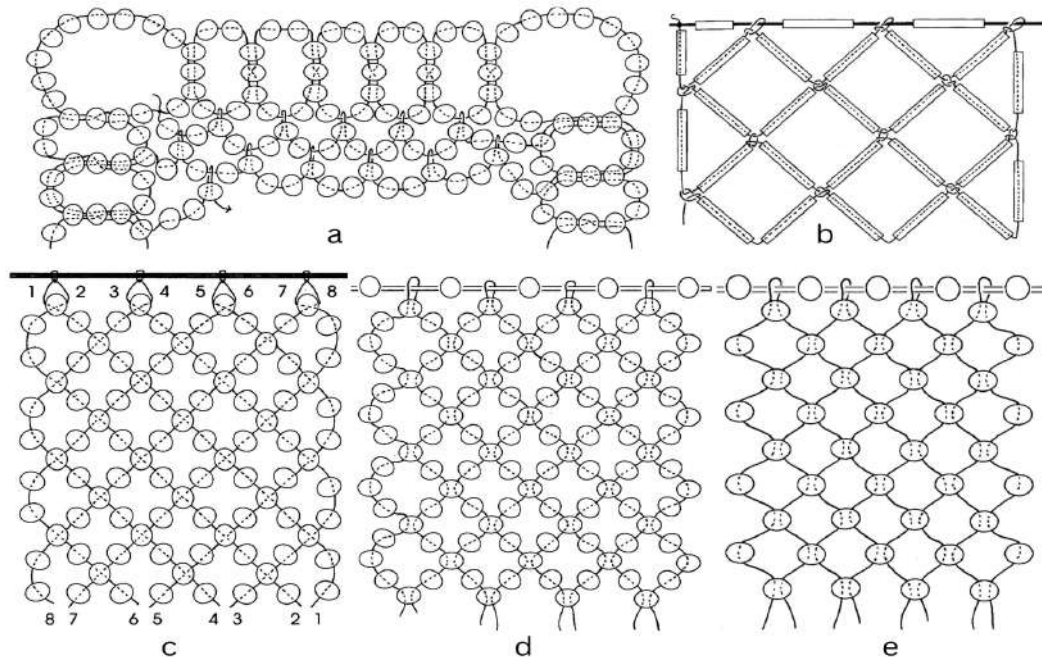


Figure 2.12 a) Continuous horizontal thread weave technique, b) horizontal diamond thread weave technique, c) diagonal thread weave, d) vertical thread weave open variation, and e) vertical thread weave close variation (Hector, 1995)

2.7.2 Borneo Beads

Borneo is the world's third-largest island, shared by the Malaysian states of Sabah and Sarawak, the Indonesian province of Kalimantan, and the small nation of Brunei (Hutchison, 2005; King et al., 2016). According to Thiessen (2012), Borneo has a diverse population, comprising the *Dayak* people, who are indigenous to the island's interior, and the *Malay* people, who reside primarily near the coast. Along with minor tribes like the *Bidayuh*, *Ibans*, *Orang Ulu*, and *Melanau*, there are also sizable numbers of Chinese and Europeans who are well known for their traditional cultures and unique crafts (Munan, 2005). Beads typically hold cultural significance, often indicating the *Dayak's* status or wealth (Museet, 1938). The beads of the *Dayak* are believed to be more than just decorations, as each type of bead carries a specific meaning or usage and is usually an heirloom item. According to Tomalin (2016), the iconic "*lukut sekala*" beads are beautiful ancient bead heirlooms that were transported by commercial ships during the colonial era and are honored

in Sarawak, Borneo. In ancient times, Chinese traders transported glass beads to Borneo, where the *Dayak* people treasured them for generations as symbols of social status and a form of early currency.

These indigenous people view beads as more than just ornaments worn on the body; they also have connections to several elements of their cultural backgrounds and beliefs (Munan, 2001). According to LaDuke (2000), they played a significant role in a variety of routine tasks and ceremonial events, including festivals, farming, birth and death cycles, coming-of-age rituals, hunting, and health rituals, such as the use of healing beads.

According to LaDuke (2000), beads put behind a corpse's eyelids are believed to possess supernatural properties, enabling the ghostly spirit to bridge the river of death. Ceremonial attire, hats, betel nut and tobacco pouches, skirts, and infant carriages are all embellished with beads. Let or beads are known as blue barrel beads by Sarawak bead collectors, and are of wound translucent glass ranging from deep bluish black to light green, light blue, and transparent turquoise. Most are barrel-shaped, but some are tube-shaped, varying in length from 8.5 to 11 mm and in diameter from 7 to 10 mm (Cole, 2022).

The most significant bead in the *Kelabit* tradition is the blue bead. The blue ones are known as “*let silo mo 'hun*” where the term “let” is used to denote the general concept of bead, while “*mo 'hun*” is understood to signify old (Francis, 2002). These beads are worn by both men and women, particularly as a mark of status and wealth. According to Ong (2004), long strands are worn by women with the opaque yellow filler beads at the sides and valuable ones prominently in front. Men have either long strands or a shorter choker-style, but with valuable beads close to the neck for spiritual protection, and the front features a bobble of seed beads. The *Kelabit*, *Kayan*, *Kenyah*, and *Lun Bawang* people of Sarawak shared a common interest in beautiful polychrome beads worn by both men and women as

status symbols and heirlooms (Ong, 2004). The *Kelabit* and *Lun Bawang* have a bead skullcap. Old *Kelabit* bead skullcaps are heavy, composed of carnelian, shell, and large glass beads. In contrast, the new bead skullcap uses smaller and lighter tubular beads but in the traditional colors of turquoise, carnelian, yellow, and white (Ong, 2004).

In Asia, people have been making beading for thousands of years using threads made from animal or plant materials, as they mostly used threads scraped from the leaves of pineapple trees or vines without needles, as the stiff thread is enough to pass twice through the 1.5mm diameter beads without piercing the cloth (Tillema & Strickland, 1990; Munan, 1995).

2.7.2.1 The *Orang Ulu* Beadworks

According to Ong (2004), one of the most fascinating beadworks of *Orang Ulu* is notably the baby carriers, a plaited semi-circular rattan basket attached to a wooden base with two rattan straps for the shoulders. To indicate the sex of children and the socioeconomic standing of parents, bead adornment patterns including human figures, dogs, hornbills, reptiles, tigers, or abstract themes were employed. Colors also carry meaning; blue represents life, green represents the forest, yellow represents monarchy, and pink represents bravery (LaDuke, 2000). In *Kenyah* culture, only the blue-blooded or aristocratic babies are believed to have particular symbols, such as the tiger, God-man, and hornbill motifs, to ward off evil spirits and protect the baby (Ong, 2004). The research of Munan (1995) supported this view by documenting those specific motifs, namely the human figure, hornbill, and tiger or leopard featuring curly-haired, curly-handed, curly-toed human figures, larger beads, hawk bells, and animal teeth were affixed to the carrier's upper rim to stimulate the auditory of the infant and visually signifying social status. These designs are reserved for high-ranking individuals, specifically *Maren*, the aristocrats. The decorations and designs of

middle-class families (*Hipui*) feature human faces, stylized animals, and scroll designs. Meanwhile, the lower class, also known as *Panyin*, uses minimal bead embroidery or simple rattan or bark construction (Munan, 1995; Campbell et al., 2024).

Orang Ulu women demonstrate remarkable versatility in beadwork applications on garments, including jackets and skirts, as well as functional items such as war caps, seat mats, loincloth ends, and body ornaments like armbands, necklaces, ear decorations, and belts. According to Munan (1995), the predominant use of red, russet, white, yellow, and black colors mirrors the distinctive beak of the hornbill, while muted blues and greens were introduced to the color palette during the late 19th century. Aside from placing great value on their heirloom beads, the womenfolk of the *Kayan* and *Kenyah* had also developed their art of beadwork into a large hat called ‘*sa-ong*’, as a proper protection against the tropical sun and rain by leaving their hands free to work. According to Ong (2004), Sa-ong hats are made of overlapping layers of fan-palm leaves stitched together, held in place by a rattan ring around the rim. The outer and visible part of the hat is often decorated with beautiful circular beadwork of tiny glass seed beads.

2.7.2.2 The *Bidayuh* Beadworks

The *Bidayuh* people do not possess heirloom beads among the general population. However, healing specialists rely on them to communicate with the spirits during ceremonies. Research conducted by Francis (2002) revealed that the beads handled by the healer can be restrung in any sequence and incorporate new beads into the pattern as preferred. It is noteworthy that the beads themselves retain their power even if they break. The utilization of a wildcat tooth for healing purposes, in conjunction with a selection of brass bells designed to prevent discord amongst the beads, was a prerequisite. The remaining

beads were predominantly glass, unleaded or opaque Chinese wave beads, and some European beads (Francis, 2002).

The *Bidayuh* men wore an impressive necklace of wild boar-husk and barrel-shaped blue beads. At the same time, the *Bidayuh* women's necklace comprises five or more strands of monochrome beads strung in sections of red, white, and yellow with the front section of coiled brass or silver wire with a few special 'protective' old beads, Chinese coins, and other talismans (Ong, 2004). They were also valued by the *Bidayuh*, who strung them on rattan into necklaces featuring the teeth and claws of honey bears and wild boars. These were worn along with other charms by healers and priests during ceremonies (Cole, 2022).

The traditional *Bidayuh* wore bead necklaces not only for ornamentation but as talismans and status symbols. According to Ong (2004), specific large monochrome glass beads of red, black, yellow, and white, translucent blue, green, and amber were preferred to decorated ones, with a few lime green beads with spiral and eye decorations, known as the tiger bead, together with another valuable bead is known as the chevron bead. The combination of beads with animal claws, teeth, tusks, and brass bells made necklaces strengthen the *Bidayuh-Jagoi* shaman's soul when performing ceremonies (Ong, 2004). According to Hector (1995), besides animal materials, other plants, including dried flower buds, cloves, orchid stems, fruit pits, and seeds such as Job's tears, were used in Asian beadwork.

2.7.2.3 The Chinese Beadworks

Chinese people moved from southern China to towns in Southeast Asia for a very long time. Between the late 19th and early 20th centuries, Chinese people living on the Malay Peninsula and in Indonesia started making beaded decorations for weddings. These decorations were very detailed and made from glass beads and were very similar to European styles (Hector, 1995). According to Hector (1995), the panel of the bridal bed was

approximately 1.9 meters in length, featuring a wooden canopy adorned with beautiful embroidery that included lucky symbols, crafted using silk threads or beads. These decorations were made on the island of Penang, located near the west coast of Peninsular Malaysia. Some scholars believe that these pieces may have been crafted by the bride-to-be in the months leading up to her wedding as a means of showcasing her virtues as a woman (Chee, 1989). A set of 176,000 small, single-cut glass beads from Europe, approximately 1.25 to 1.50 mm in diameter, was arranged in a complicated, multi-diagonal weave (Chee & Seok, 1987). A panel would typically feature matching beaded mirror covers, pillows, and other decorative elements from local Malaysian or Indonesian traditions (Ho, 1987). The bed panel was very similar to its smaller counterpart from the Chinese mainland, featuring traditional Chinese symbols; a particular flower was paired with a specific bird (Williams, 1976). The peonies and phoenix birds were placed against a green background, where both motifs hold lucky symbolic meanings for the couple. Peonies represent spring, love, and prosperity, while phoenixes symbolize summer, the new bride and groom (Ho, 1987; Williams, 1976). Saturated hues, delicately shaded, created vitality and a sense of visual depth in the dense Straits Chinese composition of reds and greens, believed to be the most auspicious colors for wedding bliss.

2.7.2.4 The *Iban* Beadworks

Beads still play a significant role in *Iban* weddings. However, since World War II, many couples have adopted Western wedding attire or opted for a combination of traditional and Western elements in their ceremonies (Munan 2005). A traditional *Iban* bridal outfit includes an open-work overdress composed of large carnelian and glass beads, an elaborate wedding crown with strings of beads dangling from its framework, and a long-beaded train culminating in brass frog bells that trail behind the bride, producing a tinkling sound (Munan,

1995). In the nineteenth century, a traveler described witnessing an *Iban* woman dressed in a beaded outfit from the neck to the hips, covered over with large agate beads, a string of them was heaped on a string, till many of the women were cuirassed an inch thick in solid stone before and behind (Munan 2005). These beaded dresses alone could weigh up to 33 pounds. Understandably, some *Iban* women tired of wearing such heavy outfits and began to opt for wearing a beaded-net yoke with pompom tassels in its place.

2.7.3 *Marik Empang / Tango*

According to the Department of Statistics Malaysia (2025), *Iban* people (59.1%) were recorded as the highest population in Sarawak, becoming the largest indigenous group in Sarawak. The *Iban*, often known as Sea Dayaks, live in longhouses along the Kapuas River, from Lubok Antu (the Kalimantan border) to the northern part of Sarawak, and migrate to the northern part of Sarawak following the river (Javeril, 2018). *Ngepan Indu* is the common name for the *Iban* traditional costume in Sarawak. According to Kiyai and Tugang (2021), the *Ngepan Indu* is frequently worn during the *Gawai Dayak* festival season and at several other ceremonial events, including the *Melah Pinang* (marriage) and the *Miring* ceremony (offerings). The *Ngepan Iban* is seen by the *Iban people* as a cultural representation and a symbol of identity in customs nowadays.

According to (Kiyai & Tugang, 2021), *Ngepan Saribas* (*Betong*, *Paku*, and *Krian*), *Ngepan Kuas* (*Undop*, *Semanggang*, and *Lingga*), *Ngepan Batang Rajang* (*Kapit*), *Ngepan Batang Ai* (*Lubuk Antu*, *Lemanak*, and *Engkelili*), *Ngepan Ringgit* (*Skrang*), and the general *Ngepan Iban* (used by all *Iban*) are the various varieties of *Ngepan Iban* that have been identified based on the name of a residential area or river near the *Iban* in Sarawak. One of the unique features of *Ngepan Iban Saribas* is the use of a *Rawai Tinggi*, or silver corset, which is made from rattan or silver and made into a circle that fits the woman's hip

measurements with coins made of silver. Typically, *Ngepan Iban Saribas* is paired with a set of *Tumpa Pirak* (silver arm bracelets), *Lampit Perak* (silver *lampit*), *Sugu Tinggi* (high comb/headdress), a pair of silver earrings, *Kalung Perak* (silver necklace), *Kebat* cloth (*Iban* weaving with a water spiral design), and the hands will be tucked in a white lacy handkerchief while clutching the *buah pauh* as an extra ornament, and the legs will be wrapped with a set of silver anklets with bells (Kiyai & Tugang, 2021). The *Ngepan* for *Iban* people who live in the Kapit, Song, and Balleh areas along the Batang Rajang River is *Ngepan Batang Rajang* or *Dujung Marik*. *Dujung Marik*, which translates to “a large pile of beads being made according to the *Ngepan* characteristic,” is characterized by a large number of high-quality, multicolored beads with beading techniques, including cowrie shells, brass bells, glass beads, blue barrel beads, straw beads, and fire agate (Kiyai & Tugang, 2021). It will be complemented with hand accessories like *gerunung siong*, *tumpa bulu* (a bracelet made of rubber trees), *burie* cloth (cloth embroidered with snail beads), and *dujung* (a headpiece made of beads and paper flowers). The *Embaloh* ethnic group, who were the first people to settle on the Rajang River before moving to the highlands of Bario and Ba’kelalan, and the *Urang Ulu* (*Kayan, Kenyah, and Kelabit*) are said to have influenced the *Ngepan Iban* in Batang Rajang (Kiyai & Tugang, 2021). *Ngepan Batang Ai*, also known as *Ngepan Lampit Besusu*, is the traditional costume of Ibans who live in the Lemanak, Engkelili, and Lubok Antu districts. According to Javeril (2018), the *Ngepan Batang Ai* complete costume features *Sugu Tinggi* (headdress), *Lampit*, *Tumpa Bentuk*, *Tumpa Rangkup Pandak*, *Pandak Pirak Rawai*, *Kain Sungkit* (woven cloth), *Gelang Kaki* (anklets), *Tali Leka Peria* (silver ropes), *Sementing Ringgit*, and *Buah Pauh* (hand accessories). Physically, *Ngepan Batang Ai* is very similar to *Ngepan Iban Skrang*, but they can be distinguished by the *tenun sungkit*, which is a woven textile (Kiyai & Tugang, 2021).

According to (Kiyai & Tugang, 2021), the use of *lampit* (silver belt) as the primary accessory on women's chests is what makes *Ngepan Batang Ai* special. *Ngepan Skrang*, also known as *Ngepan Ringgit*, is a traditional *Dayak Iban* costume from the Skrang district. According to (Kiyai & Tugang, 2021), *Ngepan Ringgit* commonly wears a *Sugu Tinggi* (headdress), *Baju Ringgit*, *Rawai*, *Kain Kebat* (weaving fabric), and accessories such as *Lampit Ringgit*, *Tumpa Pirak*, *Simpai Pirak*, *Buah Pauh*, and *Gerunung Kaki* (bell anklet). The *Ngepan Ringgit* is distinguished by the usage of silver coins from Europe. *Ngepan Iban* refers to the traditional attire of the *Iban* in Sarawak and Kalimantan. This type of *Ngepan* is not limited to one place but is a familial heritage passed down from generation to generation. According to (Kiyai & Tugang, 2021), *Sugu Tinggi*, *Tali Mulung*, *Rawai*, *Buah Pauh*, *Bentuk Tumpa*, *Gerunchung Kaki*, *Lampit*, *Sementing Ringgit*, *Selampai*, and *Tango* are all elements of the *Iban* women in the *Gawai* Ceremony. The *Iban* group uses this style of *ngepan* to distinguish itself from other ethnic groups, as shown in Figure 2.13.

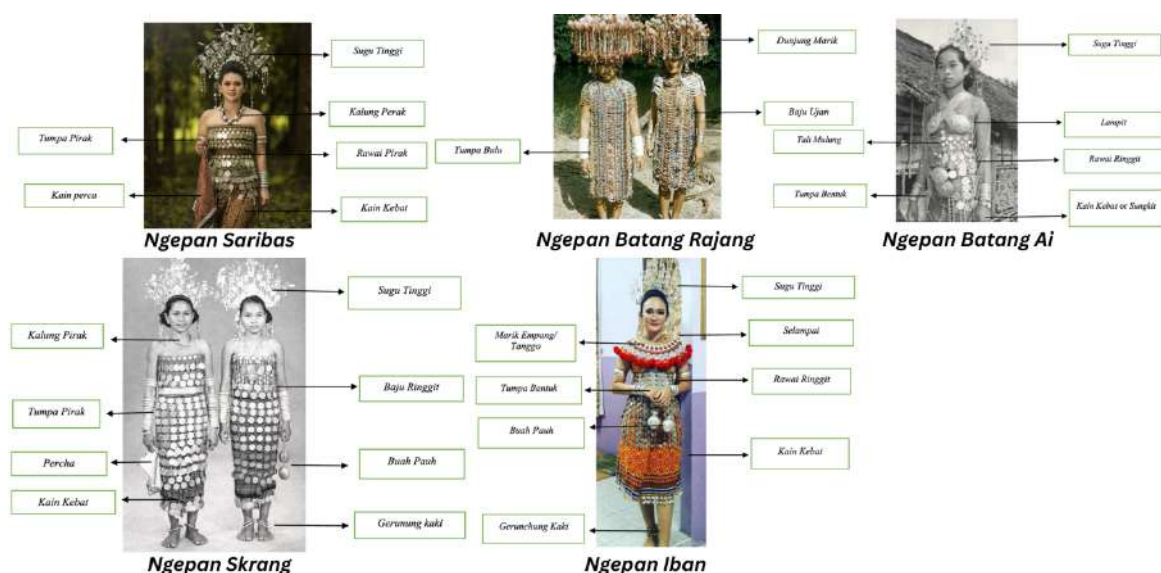


Figure 2.13: Five types of *Ngepan Iban* in Sarawak with their own elements

Source: Adapted from the journal of Kiyai and Tugang (2021)

Traditional costumes are complete, stunning, and ornamented with jewelry (Kiyai & Tugang, 2021). *Marik Empang* is considered a jewelry or a necklace in the traditional costume of the *Iban* ethnic group. In most Sarawakian festivals and dances, *Iban* women wear a beaded necklace called *Marik Empang* (*Marek Empang*) or *tango* (*tangu*) in the local language. *Marik Empang* is a part of the *Iban* traditional costume worn by women around the neck as a necklace accessory (Anding, 2011). According to Linggi (2001), historically, ladies of higher classes or those who had attained a certain social status wore *Marik Empang*. The *Iban* ladies dress in knee-length garments known as *bidang* or petticoats, which are embellished with coloured patterns. The belts serve as a corset, wrapped around the waist, and are made out of a sequence of split rattan rings on which brass rings are strung. The attire is decorated with a jacket, also known as a *kalambi*. The top of the *bidang* fabric will be ornamented with a girdle of coins, silver and brass chains, or strips of coloured cane, while the neck is covered with silver coins, a cane, and a *tanggok* or beaded necklace (Emeih & Pitol, 2018). The *Marik Empang*, also known as *tangu*, is exquisitely placed over the chest area and embellished with vibrant beads (Daro, 2014; Emeih & Pitol, 2018). It is an essential part of the *Iban* women's traditional costume, but it can be worn alone as a daily use necklace accessory in a contemporary adoption. *Marik Empang* was described as beads threaded and worn in rows down to the breasts (Howell & Bailey, 2022). According to Mitchell (2004), a *tango* is a bead collar made with concentric circles of beads that wrap around a woman's neck and fall just above her breasts. It is a magnificent work of art that has been skilfully put together using a variety of colored beads to create patterns and motifs that perfectly represent the essence of *Iban* art, as shown in Figure 2.14a. A round piece of cloth is used to cover the breasts or adorn tiny clothing, and is typically made up of beads, known as *Marik Empang*. According to Ong (2004), among the *Iban* women, a traditional part of their costume today

is the *Marik Empang*, or beaded collar, made of multicolored seed beads in a geometric design. The varied radius of the *Marik Empang* is between 15 cm and 20 cm, with the end finishing in a tasseled large bead or pompom.

According to Heppell (2020), the cheap seed-size beads from Europe began to flood Borneo in the middle of the 19th century, and silver ornamentation replaced the *Iban*'s authentic displays of wealth. There was really no need to continue using beaded ornaments since the beaded outfits had been replaced with silver corsets, silver belts, and silver necklaces. However, the *Iban* disagreed, and the *tangu* endured a transformation into a simple netted yoke of seed-sized beads (Heppell, 2020). The basic net served as a transitional piece and gave way to a more delicate yoke with geometric and other motifs. This was strengthened by Munan (1995), who stated that although the traditional colors preferred are white, red, yellow, and black, modern fashion has also influenced new designs incorporating plastic pearls, silver, and gold beads. The beaded yoke seems totally out of place among all this silver. Even though the redesigned design was very different from the original *tangu*, it was still a *tangu* in the Batang Ai and a *Marik Empang* in the Saribas (Heppell, 2020).

The craftsmanship of the beads, colors used, and designs easily identify the *Iban* as a distinct ethnic group from other groups (Nais, 2021). Small pom-poms are attached to the end, which come in an array of patterns and hues (Figure 2.14b). According to Nais (2021), each ethnic group has its patterns and symbols for its bead designs; therefore, ethnic influence has also had a significant impact on beading techniques and patterns. It is thought to be a replacement for cumbersome, uncomfortable layers of beaded gear. Even while beads remained in use as decorations and ornaments, many contemporary varieties were crafted into fashionable pieces of art that are worn by young people nowadays and marketed as souvenirs (Tour, 2021).



Figure 2.14: a) Traditional *Marik Empang* and b) *Marik Empang* with mini pom-poms
Source: Adapted from the journal of Lee (2020) and the Africa and Beyond Art Gallery

Based on the reviewed literature, the researcher summarized the existing literature to identify significant themes, variables, and research gaps (Figure 2.15) that influenced the construction of the proposed conceptual framework. A literature or research gap, according to Panezai (2016), is an issue, limitation, or topic that has not been thoroughly investigated in previous studies. Identifying such gaps is essential because it allows researchers to position the research within a wider scope of knowledge, address unanswered questions, and give new insights to the field. Several gaps are found, including no contemporary bamboo costume design in Sarawak, no bamboo species applied for beading, no beading techniques for bamboo beading, and no specific meanings for *Marik Empang* motifs. Addressing these gaps lays the foundation for the researcher to develop a proposed conceptual framework that is consistent with the research questions and objectives to create a clear direction throughout the research.

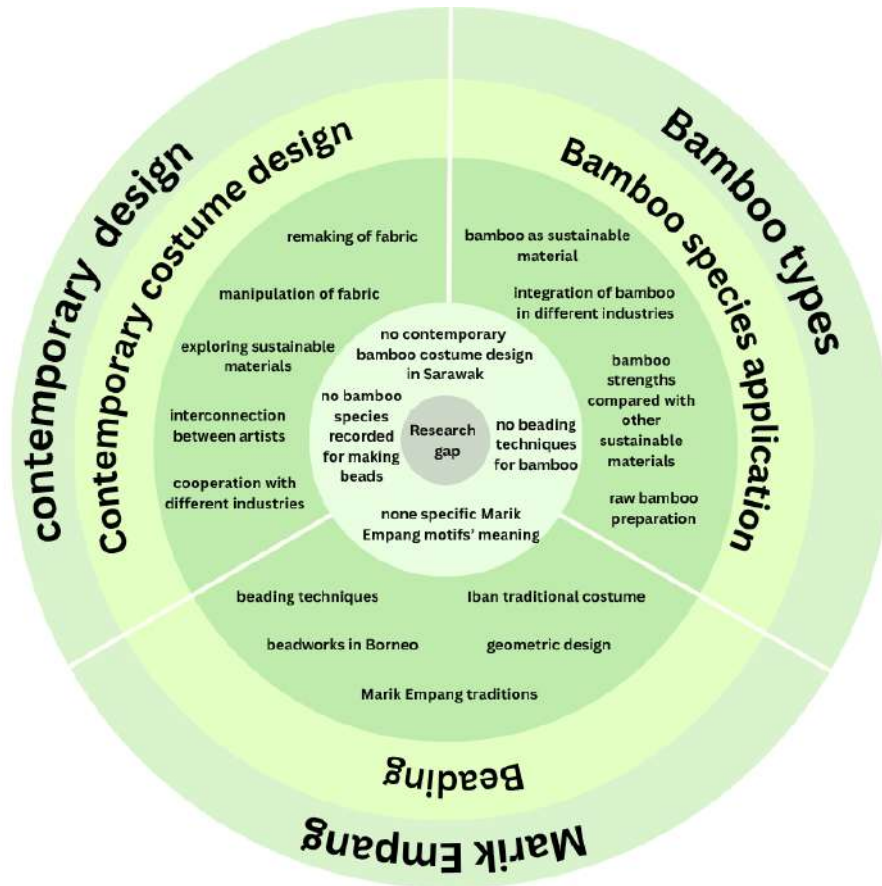


Figure 2.15: Research gap found in the literature

2.8 Proposed Conceptual Framework

The review of the existing literature has highlighted several significant areas that serve as the basis for this research. Firstly, the explanation of contemporary design shows how traditional elements can meet current functional as well as aesthetic requirements. The exploration of bamboo types in Malaysia highlights its potential as a sustainable resource in papermaking, furniture making, and basketry, further highlighting the versatility and potential of bamboo for sustainable business practices in a variety of industries. Besides, the integration of traditional bamboo crafts into contemporary East Asian culture illustrates an evolution between past and present. The review on the preparation of raw bamboo and weave techniques identifies the procedures required to

improve its utility, flexibility, and durability in the final product. Besides, the integration of traditional bamboo crafts into contemporary East Asian designs in Malaysia, China, Taiwan, and Indonesia illustrates an evolution between past and present. Additionally, the background and overview of *Marik Empang* help establish its identity and heritage, strengthening its significance as an essential part of the *Iban* traditional costume.

The researcher found that a cultures framework theorizes that cultural ensembles have a causal relationship with sustainability outcomes, a concept that is conveyed by the two-headed arrow, as the starting point for research design could be at either end of the arrow (Stephenson, 2023), as shown in Figure 2.14. The purpose of this framework is to integrate sustainable innovation in design with cultural heritage, which makes it particularly applicable to the current research. Adopting this framework, the researcher explored how *Marik Empang* beadwork can contribute to the investigation of sustainable materials using bamboo and how contemporary costume design can promote heritage preservation by utilizing sustainable materials. The research gap of this research is found through the literature review, and the framework was developed to address research gaps and guide the present study in examining relationships between independent, mediating, and dependent variables. It focuses on the qualities and performances of bamboo as a sustainable material for research objective one, supports *Marik Empang* as a cultural core, including beading techniques for research objective two, and contemporary design as the trend for designing costumes for research objective three. The proposed conceptual framework was adopted from the FEA Model, shown in Figure 2.17. This framework will be discussed based on the variables for each question in Chapter 3, specifically on pages 77 to 84.

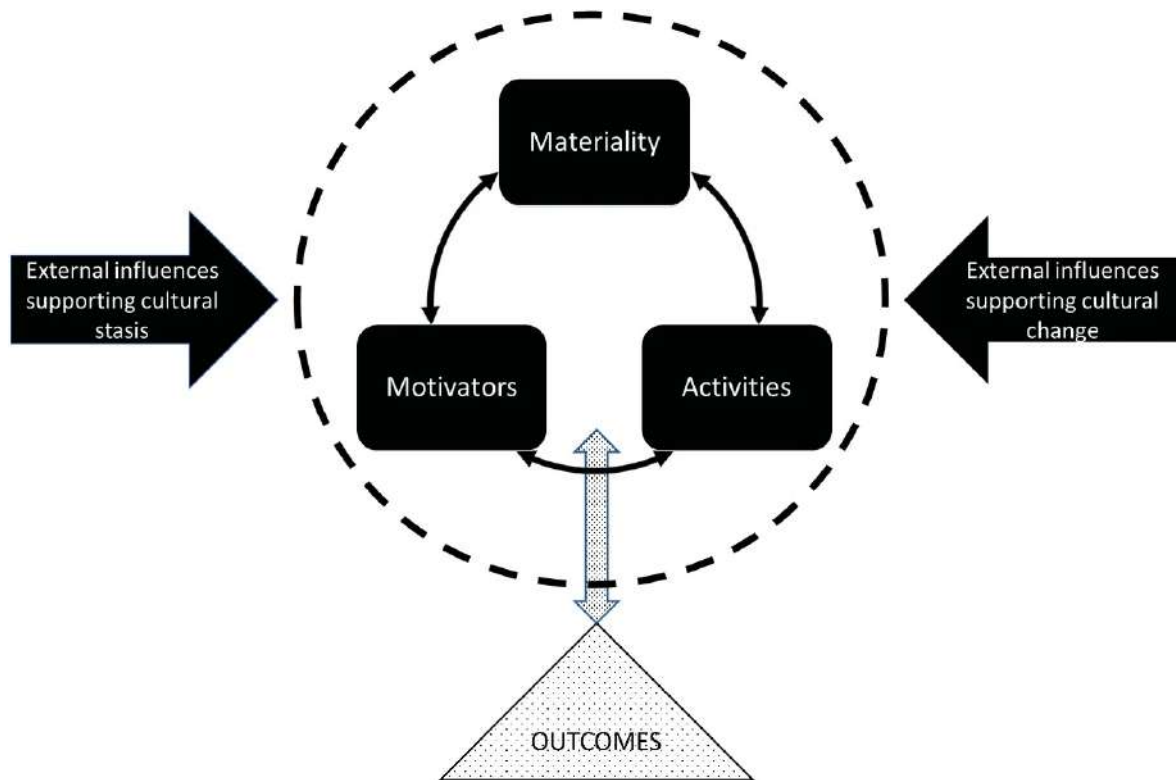


Figure 2.16: Cultures framework adopted from (Stephenson, 2023)

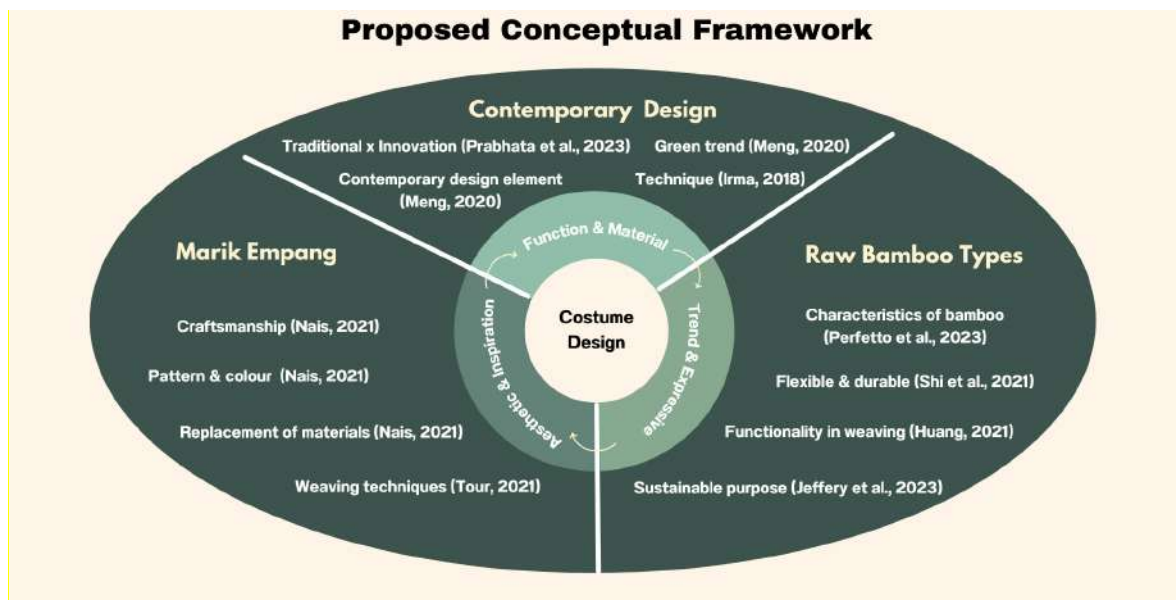


Figure 2.17: Proposed conceptual framework

2.9 Summary of Chapter

In brief, the literature review examined the reinterpretation of traditional crafts within contemporary design practices, with a particular focus on the fashion industry. The works of designers like Ritu Kumar, Ma Ke, and Ji Cheng, as well as brands like Toino Abel and Atlantic Leather, demonstrate how heritage techniques can coexist with contemporary aesthetics to promote both cultural identity and environmental responsibility. Bamboo emerged as a central material in this discourse, valued for its sustainability, versatility, and deep cultural significance. Its application spans crafts, construction, furniture, paper production, and contemporary design. Malaysia, China, Taiwan, and Indonesia demonstrated that the traditional roles of bamboo are being adapted to meet contemporary aesthetic and ecological demands. The comparison between bamboo performances and applications with other sustainable materials strengthens the potential of bamboo as an alternative material for sustainable design. The review also highlighted the intricate art of bamboo weaving, its preparation methods, and traditional weaving techniques such as twilling and pick-and-press weaving. These techniques not only enhanced the strength and visual appeal of the designs but also provided functional solutions for contemporary applications, such as sustainable fashion and artistic endeavors.

Furthermore, the Sarawak beadworks demonstrated the cultural depth and artistic complexity inherent in indigenous crafts. The function of beads extends beyond mere ornamentation; they served as conduits for expressing identity, social status, and spiritual convictions. The documented weaving techniques and symbolic motifs, especially *Marik Empang*, highlighted the importance of cultural expression in design practices, particularly in contemporary costume innovation. The literature review revealed that combining tradition

and innovation with sustainable materials enhances design practice and is crucial to sustainable development, cultural continuity, and the creative industry.

The insights gained from the literature review formed the basis of the research methodology. Discussions on the versatility of bamboo, beading techniques, and cultural symbolism emphasized the importance of material experiments and cultural analysis. These guided the design of the research framework, the material testing process, and the development of costumes. Similarly, the documented significance of beadwork in Sarawak emphasized the need to investigate the technical and cultural dimensions of *Marik Empang*, thereby ensuring that the methodology aligned with the goals of cultural preservation and sustainable contemporary costume design innovation. This chapter laid the theoretical and contextual foundations for the research methods and practical investigations outlined in Chapter 3.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter explains the research method used to achieve the study's objectives. It explained how the research was designed, how the data were collected, how the samples were chosen, and how the analysis was done. A studio-based design approach was adopted, which allowed the researcher to engage in both experimental practice and qualitative research through interviews. The experimental process involved bamboo testing, developing bamboo beads, beading arrangements, stringing materials testing, and constructing costume prototypes. The interviews with artisans provided qualitative insights into *Marik Empang* patterns and beading techniques. The research combined experimental and interview methods to address the research questions. This chapter demonstrated the preferred methods, ensuring the research was reliable and effectively addressed the research questions.

3.2 Research Approach

The design approach for this research was based on a studio-based design approach to address the utilization of raw bamboo as a sustainable material for making contemporary costume design using the most suitable *Marik Empang* patterns. According to Puadi et al. (2021), studio-based design is a research approach where the thesis research is conducted within a controlled studio environment. This approach combines theoretical study with practical experimentation to produce new knowledge or creative works.

The researcher integrated both qualitative and quantitative data to answer the research questions. The qualitative approach involved processes such as observations and

interviews to collect data on experiences and opinions. The quantitative approach of this research included experiments and testing to determine the relationship between variables. An online survey conducted using Google Forms and an exhibition also collected data and opinions from the public to clarify the achievement of the research objectives. This approach combined a background study, observation of cultural heritage, experimentation with tools and materials, and a survey, resulting in reliable data for the researcher.

3.3 Research Design

The primary objective of this research design was to identify suitable raw bamboo for creating beads with the appropriate *Marik Empang* patterns, thereby designing contemporary costume designs. The primary inspiration for this research was the lack of bamboo fashion design in Sarawak and the cultural aesthetic pattern of *Marik Empang* among the *Iban* ethnic group. A combination of ideas, utilizing bamboo as a sustainable material and integrating traditional cultural craft, specifically *Marik Empang* patterns, sparked the researcher's creativity in designing contemporary bamboo-crafted costume designs. This innovation led the researcher to the following stages, enabling a better understanding of the research objectives.

The research design of this study was structured to ensure a clear and systematic progression from conceptualization to final design and evaluation. The primary focus was on selecting a research topic, with a core focus on integrating sustainable materials, such as bamboo, with *Marik Empang* patterns into contemporary costume design. This was followed by the identification of the research problem, which played a crucial role in formulating the research questions and objectives within the scope of study. A thorough review of all existing literature, encompassing bamboo types and characteristics, bamboo applications in various fields, beadwork, and beading techniques, was then conducted to gain a comprehensive

understanding of the research background. The researcher then determined an appropriate research methodology, a studio-based approach, which involved observations, interviews, experimental material testing, design prototyping, and an online survey, all of which were carried out accordingly. The data collection process involved observations, material experiments with different bamboo types, treatment methods, dyeing methods, interviews with artisans, and documentation of the testing design process. The data were then analyzed to identify the most suitable materials and techniques for later costume design. The researcher developed sketches of contemporary costume designs by adding bamboo beadwork inspired by *Marik Empang* patterns. Finally, a survey of 102 participants was conducted to evaluate the final costume designs in terms of aesthetics, functionality, quality, pricing perception, and cultural significance, providing solid evidence. The final product is then exhibited in Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0 and Booth 2025. The research design progress can be simplified and explained in Figure 3.1.

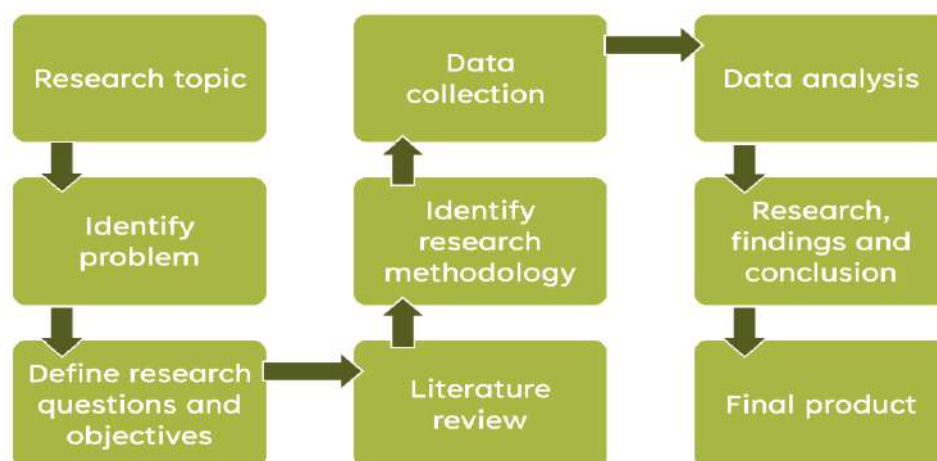


Figure 3.1: Research design flow

3.4 Research Method

A studio-based research method was chosen and employed for this study to address the research objectives more effectively. Studio-based research was a method of inquiry in

which creative work served as the primary means of discovering new knowledge (Barrett & Bolt, 2007). Studio-based research has enormous potential to expand our understanding of creative processes. Studio-based research utilized innovative visual art to advance science, much like any other type of study (Marshall, 2010). Puadi et al. (2021) shared a similar opinion, stating that studio-based research aims to advance science through artistic creations. According to Amankwah et al. (2022), studio-based research in art and design refers to those studies where creative activity was the primary component of the cluster of research methodologies applied. According to Puadi et al. (2021), an experiential, research-based visual artwork is a creative process that involves an intellectual phase of aesthetic object creation, combining theory and practice through repeated cycles of making, thinking, and improvement. This differed from traditional research, where knowledge was discovered through the creative process and became an integral part of the final product. By working in art and design studios, designers and artists gained knowledge of concepts, materials, techniques, and applications (Amankwah et al., 2022).

The studio-based research approach was selected for this study due to its emphasize on interaction and manipulation of different materials, as well as the innovative use of creative strategies based on ideas that are expected to yield desirable outcomes. The data generation for Phase One and the artwork approach for Phase Two were the two related components of the methodology, as described in Figure 3.2. The data generation phase and the artwork phase were the two stages of this research technique, in which the ideas and techniques were combined to produce a creative process model or methodology that differed from traditional research (Marshall, 2010; Puadi et al., 2021). According to Puadi et al. (2021), the qualitative approach, neo-narrative process, visual research method, and object

(subject of study) were the four components of the study element for the data generation phase, as shown in Figure 3.3.

The art-making process (Mace and Ward, 2002) and the studio experience (Sullivan, 2006) comprise the two essential parts of studio-based research techniques, as both approaches entail the creation of artwork. The art-making process comprised two distinct phases, with the first phase encompassing activities related to idea conception. This included daily experiences and conscious reflections that contributed to the generation of artistic concepts. According to Puadi et al. (2021), from these ideas, artists selected relevant and engaged concepts in a process known as idea selection, which served as the overarching theme for their artwork. In the second phase of the art-making process, the researcher engaged in studio experimentation, utilizing a dedicated space for in-studio activities, including discussion boards, documentation, and sketching, to enhance their experience further and gather additional information. In the context of studio investigation research, Phase One played a crucial role in generating ideas to produce visual artwork. At the same time, Phase Two focused on implementing these ideas within the art studio through design activities.

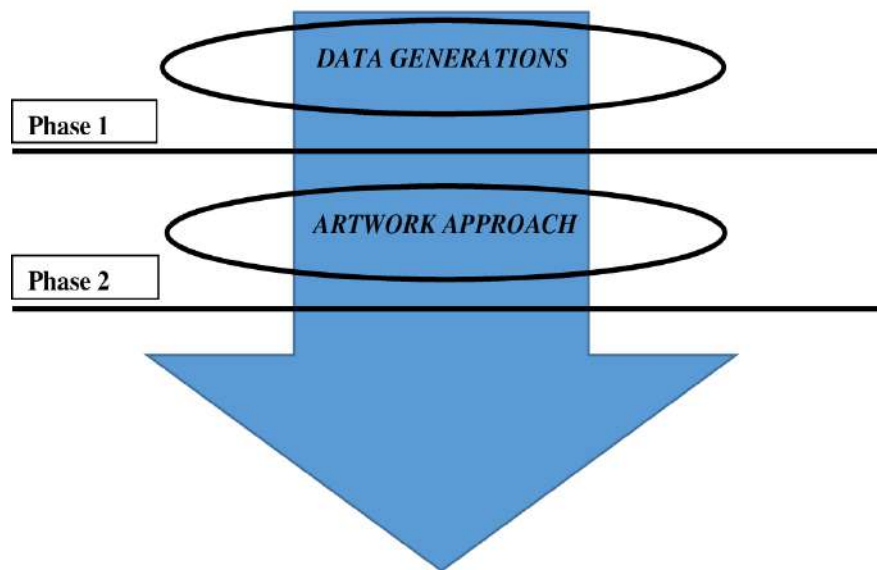


Figure 3.2: Studio investigation methodology
Source: Adapted from the journal of Puadi (2021)

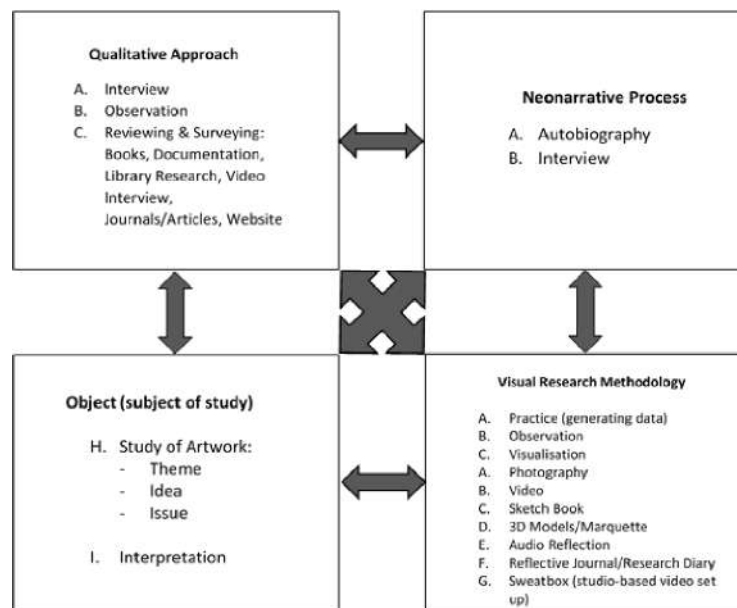


Figure 3.3: Data generation element
Source: Adapted from the Journal of Puadi (2021)

3.4.1 Preliminary stage: Literature Review and Visual Research Methodology

This initial stage focused on developing a strong theoretical and visual foundation. A comprehensive literature review was conducted to understand the different types of bamboo, their applications, and bamboo weaving techniques, as well as beadwork and beading techniques, especially those related to *Marik Empang*. The visual work was essential for informing the subsequent experiments and costume designs. These were essential to building a strong foundation of knowledge on bamboo and beading techniques for creating costume designs inspired by the patterns of *Marik Empang*. The detailed information for the visual research boards was clearly shown in Appendix B.

3.4.1.1 Literature Review (under object study in data generation elements):

- Types of bamboo
- Bamboo applications in various industries
- Bamboo weaving techniques
- Beading techniques

3.4.1.2 Visual Research (under visual research methodology in data generation elements):

- Mind mapping
- Brainstorming
- Concept board
- Mood board
- Color boards
- Fabric swatches
- Design sketches

3.4.2 Research Objective One: To identify the most suitable types of raw bamboo materials for crafting sustainable beads inspired by *Marik Empang* patterns in Sarawak.

This stage identified the most suitable type of bamboo for creating beads, which is related to research objective one. The researcher prepared samples of four bamboo types to analyze the inner hole size, surface, treatment effect, cross-section, and durability of each type of bamboo. The bamboo was then examined using Scanning Electron Microscope (SEM) analysis to validate its physical characteristics further. In the field of membrane science and technology, the structural and morphological characterization of polymeric membranes using Scanning Electron Microscopy (SEM) is a cornerstone (Wu et al., 2024; Suleiman et al., 2023; Alqaheem & Alomair, 2020). SEM analysis provides invaluable insights into the surface morphology and cross-sectional architecture of materials, both of which are critical determinants of performance (Wu et al., 2024). According to Eriksson (2025), cross sections provide a view of the internal layers, interfaces, and microstructural details of materials, offering important information about their properties and performance. The inner hole size of four bamboo species is analyzed in detail using SEM to identify the best bamboo type for making beads. According to Schlenkrich (2025), scanning electron microscopy (SEM) is ideal for imaging surfaces, fracture surfaces, or transverse sections with high resolution (2 - 5 nm) and high depth of field that enables magnification to be adjusted by a factor of 20 to 200,000 within seconds, rapid switching between samples, and imaging of non-conductive surfaces using vapor deposition. The magnification captures the presence of the fungus in the bamboo sample clearly, which validates that the dyeing process increases the risk of growing fungus. SEM analysis becomes the ideal tool for damage analysis, combining microscopic visualization and chemical point analysis (Schlenkrich, 2025), which is ideal for analyzing the cross-section of bamboo using

different cutting tools. These tests provided critical data for selecting optimal bamboo for bead making. Figure 3.4 illustrates the variables for research question one.

3.4.2.1 Experimental and Testing (under studio experiments and art-making process in artwork elements):

- Testing four types of bamboo for:
 - Bead size
 - Surface treatment
 - Cutting tools
 - Dye absorption using natural and synthetic dyes
 - Finishing and Polishing

3.4.2.2 SEM (Scanning Electron Microscope) Analysis: (under visual research methodology in data generation elements):

- SEM (Scanning Electron Microscope) Analysis to examine:
 - Inner hole size
 - Cross-sectional structure of bamboo
 - Surface of bamboo (with and without epidermis)
 - Dyeing effects
 - Treatment (presence of fungus)

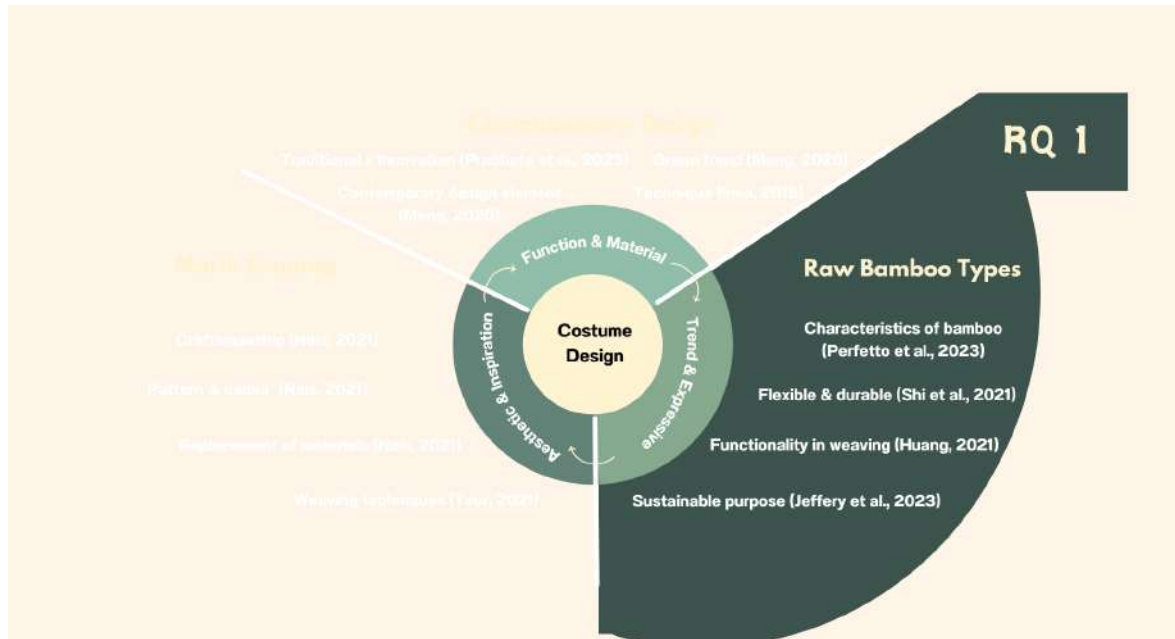


Figure 3.4: Proposed conceptual framework for research question one

3.4.3 Research Objective Two: To examine *Marik Empang* beadwork patterns for their adaptability in contemporary sustainable costume design.

This phase involved two interviews with beadwork artisans to understand the patterns, tools, materials, color, and beading techniques of *Marik Empang*, which is related to research objective two. The artisans shared their wisdom on bead selection, beading patterns, beading tools and materials, as well as the cultural significance of some design motifs. These interviews were conducted both face-to-face and online, where two interview sessions were carried out face-to-face, while an interview session was carried out online, with audio recordings used to facilitate a more thorough analysis of the information shared by the interviewees. Two interviewees are artisans that having experience in making *Marik Empang* beadwork. Another interviewee is a student and also a bead crafter in making polymer clay beads with basic *Marik Empang* beadwork knowledge. The interview questions were as referred to in Appendix A. Then, the researcher conducted a studio experiment after analyzing the interview data to test the patterns, tools, and materials used

in making *Marik Empang*. The combination of beads and stringing materials in water-soaking was evaluated through experimental testing. The variables for research question two are shown in Figure 3.5.

3.4.3.1 Interviews with Artisans (under qualitative approach in data generation elements):

- Tools and materials used
- Color symbolism
- Patterns and motifs
- Beading techniques of *Marik Empang*

3.4.3.2 Experimental and Testing (under studio experiments and art-making process in artwork elements):

- Testing natural beads and bamboo combinations
- Applying *Marik Empang* patterns
- Evaluating various stringing materials (water soaking test)
- Combinations of beads and stringing materials
- Making prototypes

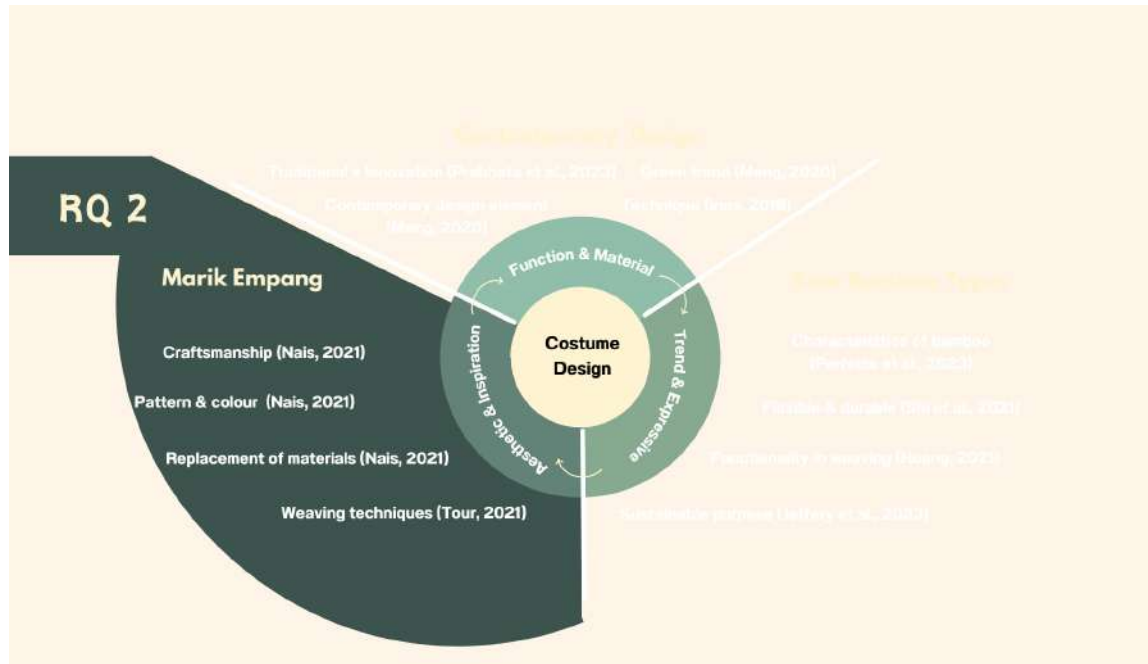


Figure 3.5: Proposed conceptual framework for research question two

3.4.4 Research Objective Three: To develop contemporary costume designs using bamboo-crafted beads that preserve the cultural identity and visual coherence of the *Marik Empang* patterns.

With the insights gained from interviews, the researcher now focuses on experimenting with the best samples from previous tests, which is related to research objective three. The best bamboo bead samples were selected and incorporated into a prototype for male and female costumes. The researcher used two types of bamboo, combined with other natural seeds, to create three patterns based on the *Marik Empang* patterns. The combination of stringing materials in beading patterns also provided better support and flexibility to the costume design.

As the costumes take shape, the researcher sent a survey via Google Forms to gather the opinions and feedback of the audience on the final prototypes, ensuring that the costume design authentically reflects the patterns of *Marik Empang* while also meeting contemporary standards of artistic expression. The survey was designed to evaluate key aspects of the prototypes, including aesthetics, functionality, comfort, durability, cultural authenticity,

innovation, and value. The survey included multiple-choice questions, short-answer questions, and Likert scale questions. This allowed for efficient and accessible distribution of the study to various demographic groups, including students, designers, local communities, and cultural practitioners.

The SPSS (Statistical Package for the Social Sciences) software was used to analyze the survey responses from the Google Form survey questions. SPSS is particularly effective for analyzing demographic data by describing data using frequencies and percentages. Frequency refers to the number of times a particular response or category appears in the dataset. At the same time, the percentage indicates the proportion of that response compared to the total number of respondents. In this research, SPSS was used to display information such as gender, age, education level, and occupation. To analyze Likert-scale responses, SPSS calculates the mean (average) and the standard deviation (S.D.). The mean gives an overall average score for each question, showing the general trend or level of agreement among the respondents. The standard deviation indicates the degree of variation from the mean. A low standard deviation (S.D.) means the responses were similar or close to the average, while a high S.D. indicates a broader range of opinions. In this survey, Likert scale responses (ranging from 1 = strongly disagree to 5 = strongly agree) were analyzed using the mean and standard deviation (SD) to understand how participants felt about the costume designs in terms of aesthetics, functionality, price, quality, craftsmanship, and cultural significance.

The feedback collected served not only as a validation tool but also as a means of refining and strengthening the final designs, as shown in Appendix E. The researcher ensured that the final costume designs were not only rooted in the aesthetics of *Marik Empang* but also in line with contemporary standards and audience preferences by incorporating public

input alongside expert reviews in the exhibition responses from the public. Figure 3.6 illustrates the variables for research question three.

3.4.4.1 Experimental and Testing (under studio experiments and art-making process in artwork elements):

- Create prototypes from the best bamboo samples with other natural seeds
- Design and develop male and female contemporary costume designs

3.4.4.2 Survey with Google Form:

- Aesthetics
- Functionality
- Quality and price
- Cultural significance

3.4.4.3 Analysis with SPSS:

- Mean (average)
- Standard Deviation (S.D.)

3.4.4.4 Exhibition:

- Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0 and Booth 2025

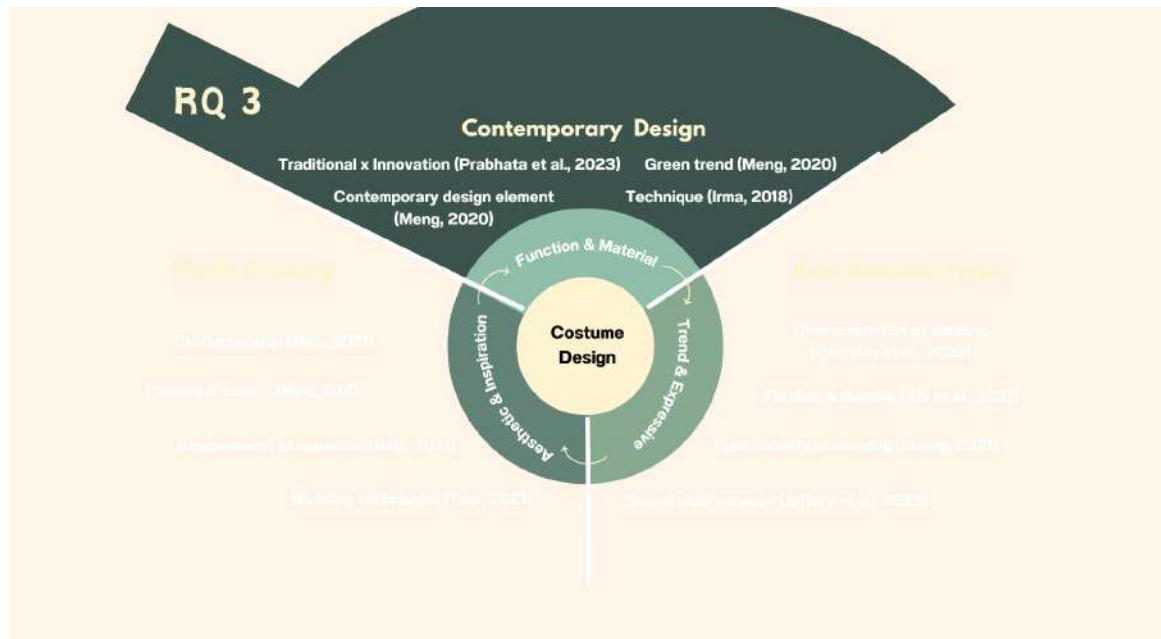


Figure 3.6: Proposed conceptual framework for research question three

In this studio-based research journey, the researcher undertook thorough data generation phases, and the artwork phase culminated in the creation of costume prototypes that integrated the best techniques in bamboo bead and bead weaving. Ultimately, the artwork phase of this studio-based research served as a testament to the fusion of tradition and innovation. This research framework blended traditional knowledge with material experimentation, visual research, and public engagement. Each step supported the research objectives by generating insights from both scientific and artistic perspectives, culminating in meaningful, sustainable, and culturally-rooted contemporary costume designs. Figure 3.7 illustrates a studio-based design that streamlines the entire research process.

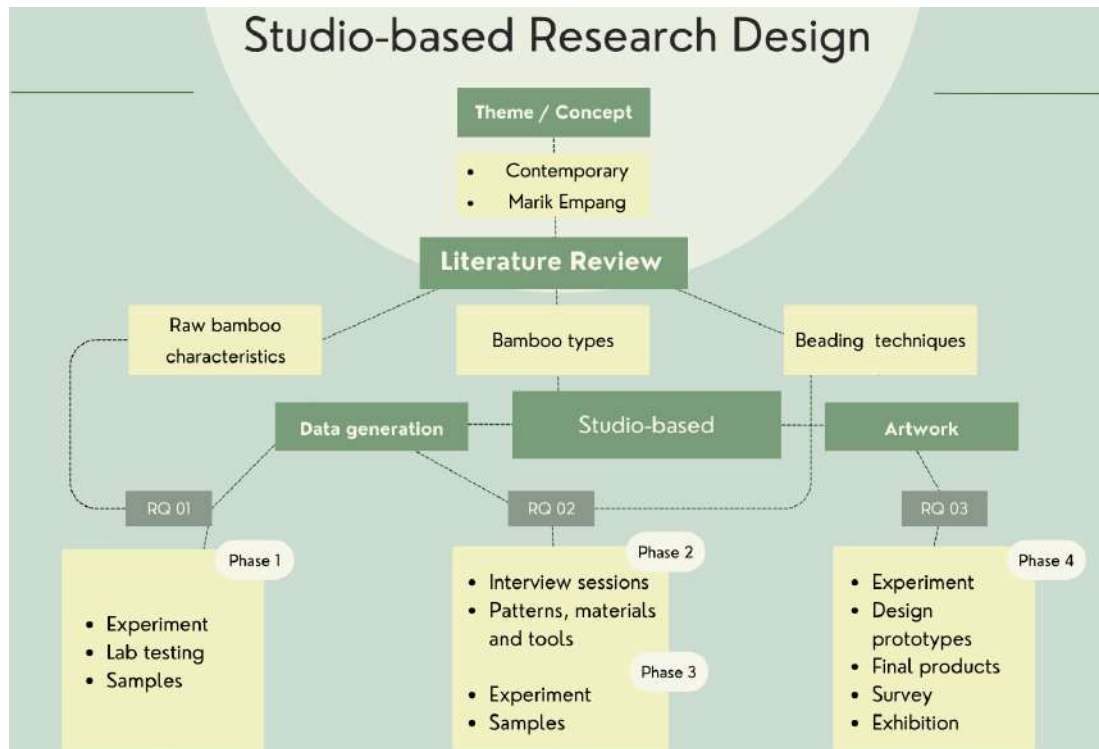


Figure 3.7: Studio-based research design

3.5 Materials and Tools

The materials used in this study consisted of four types of aged, over a year matured bamboo samples collected from various locations in Kuching, Sarawak. Bamboo A, B, and C were collected from bamboo branches, while Bamboo D was sourced from the culm to test its suitability for beading. The bamboo was also prepared both with and without the outer epidermis of the bamboo skin to test its durability and lifespan. Besides, various tools were utilized for cutting the bamboo, including a garden cutter, knife, mini electric grinder, and wood cutter machine. The stringing materials tested included cotton thread, nylon twine, and copper wires (0.2 mm, 0.5 mm, and 0.6 mm in diameter). Alum and limestone were used as treatment agents. The skins of avocados, green grapes, and red onions are used for natural dyes, while green, red, and yellow food colorings are used as dyes. Natural seed beads, such as adlay, windmill palm seeds, and red bean seeds, are also used as beading materials, often

combined with bamboo beads. The costume designs utilized maroon and black velvet fabric with a lining and an interfacing waistband to create a clean and perfect look.

The equipment employed during the experiments included a heavy-duty sewing machine, straight and bent tweezers, a Leatherman multitool, an awl, needles, scissors, sandpaper, a lighter, a candle, a ruler, and a cutting mat. The researcher then conducted an in-depth analysis using a JSM-6390LA Scanning Electron Microscope (SEM) from JEOL Sdn. Bhd will determine the most suitable type of bamboo for making bamboo beads. The SEM analysis evaluates the surface characteristics, cross-sections, and presence of fungus in the bamboo samples. These tools and materials were essential for conducting detailed experiments on bamboo preparation, cutting, stringing, beading, and finishing, as well as the development of bamboo bead designs.

3.6 Summary of Chapter

In conclusion, this studio-based research on designing a contemporary costume using raw bamboo, inspired by the patterns of the *Marik Empang* in Sarawak, has been a meaningful journey that combines tradition with contemporary creativity. The primary objective of the research was to investigate how *Marik Empang*'s patterns can be applied in contemporary costume designs, while emphasizing the use of bamboo as a natural and sustainable material. The strength of the studio-based method is its ability to combine experimentation and creation, enabling creative thinking, experimentation, and reflection, besides to cultural and qualitative research. The studio-based method allowed the researcher to actively experiment with materials, techniques, and creative processes, which ensured that the findings were based on both academic understanding and practical results, in contrast with mainly theoretical or qualitative research. It offered the flexibility to validate theories through surveys and exhibitions, while interviews also tested them through practical

creation. This integrated technique not only made the study more relevant, but it also made it possible to find creative solutions that would not have been found using more traditional approaches. The studio-based method improved the potential of the researcher to address the research questions effectively by linking theory and practice. Through these steps, the researcher discovered practical knowledge and skills and used them to create costume designs that reflected both tradition and contemporary design.

CHAPTER 4

FINDINGS AND RESULTS

4.1 Introduction

In this chapter, the results of observations, interviews, experiments, and a survey are presented in detail and structured according to the three research objectives of the research. In order to determine which bamboo types were most suited for making beads, controlled experiments were conducted to examine the inner hole size, aesthetic appeal, and material performance in terms of sustainability and durability. Collecting the knowledge of *Marik Empang* beadwork to examine *Marik Empang* beadwork patterns for their adaptability in contemporary sustainable costume design was also carried out to achieve the research objective two. Interviews with artisans collected data on various *Marik Empang* patterns with some motif meanings, and detailed explanations of the materials, tools, and techniques used in making *Marik Empang*. Evaluating the potential and flexibility of stringing materials in a water soaking test is also crucial for this research to identify the best stringing material. The research objective three focuses on the design process for creating contemporary costumes. This involved experiments in finalizing beading patterns, sketches, pattern drafting, and fittings to ensure the quality of the final outcome of the costume designs. The arrangement of beads and stringing materials was fitted directly on the costume prototypes before sewing, and the completed costumes were evaluated through a survey assessing aesthetics, functionality, price and quality, and cultural value. The final costume designs are exhibited in the Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0 and Booth 2025, showcasing how *Marik Empang* can be reimaged through sustainable contemporary fashion.

4.2 Data Collection and Analysis for Research Objective One: To identify the most suitable types of raw bamboo materials for crafting sustainable beads inspired by *Marik Empang* patterns in Sarawak.

Data collection for research question one involved a multifaceted approach aimed at understanding the characteristics and suitability of raw bamboo in Sarawak for contemporary costume design inspired by the *Marik Empang* in Sarawak. Initially, the researcher conducted thorough literature reviews to gather existing knowledge and insights on the properties of raw bamboo. This included investigation and testing on durability, flexibility, texture, inner hole size, cross-section, and color variations of different bamboo species. Additionally, hands-on experimentation was conducted to test various types of raw bamboo samples, assessing their structural integrity and feasibility for costume design.

4.2.1 Experimental Process

In the experimental process, the researcher generated new insights through repeated testing and creative experimentation with materials, tools, and techniques. The primary materials involved in the experiment process focus on four types of bamboo collected in Kuching, Sarawak, as well as treatment types, dyeing materials, and cutting tools.

4.2.1.1 Bamboo Types

Initially, several types of bamboo with distinct appeals and characteristics were collected to test their properties, performance, and potential applications through experimentation. Two types of bamboo branches and one bamboo culm were collected from the *Bambusa Longissima* type, and a type of *Bambusa Vulgaris* was collected in bamboo branches. *Bambusa Longissima* is easily found and widely available in Kuching, Sarawak. It has been identified in the literature as a suitable material for handicraft production due to its strength, durability, and versatility. In contrast, *Bambusa Vulgaris* was selected for this

study primarily for its distinctive yellow appearance with green stripes, which adds a sense of aesthetic to the research. They were named Bamboo A, Bamboo B, Bamboo C, and Bamboo D accordingly (Figure 4.1). The distinct physical characteristics and internal hole size, as shown in Figure 4.2, set them apart from one another.

Bamboo A, collected from Batu Kawa in Kuching, was noted for its largest branches and green color. It was characterized by its longest and thickest culm wall, with the smallest internal hole compared with other types of the same size. The smallest internal hole may become difficult to pass through the thread. The second bamboo had light green skin and was also collected from Batu Kawa, Kuching. It had the smallest size with a moderate culm length. It featured the thinnest culm wall and the largest internal hole of the three branches. The thinner wall and larger hole formed naturally make it suitable for beading, as it allows the thread to pass through it. Bamboo C, collected from the Borneo Development Corporation (BDC) in Kuching, was characterized by its distinctive yellowish and green striped appearance when fresh, which distinguished it from other types. It had a moderate body size and culm length compared to different kinds of bamboo. A thin culm wall characterized it, and a large internal hole, like Bamboo B, made it suitable for beading since it allowed the thread to flow through it. The last type of bamboo was collected from Serian, Kuching. Unlike the others, which were collected by branches, the culm of Bamboo D was collected for experiments. It was green in color and was commonly used for cooking. It had a large body size with a long, column-like body, like Bamboo A. As it was collected in a culm, it had a thinner culm wall and a larger internal hole, which was too big and not suitable for beading.



Figure 4.1: a) Bamboo A tree, b) Bamboo B tree, c) Bamboo C tree, and d) Bamboo D culm

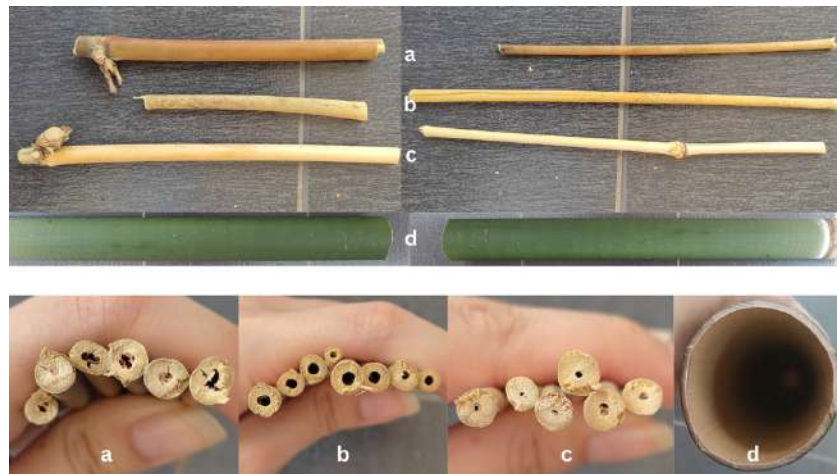


Figure 4.2: Compare the internal hole sizes of Bamboo A, B, C, and D

4.2.1.2 Bamboo Selection

The researcher then proceeded to the bamboo selection after gathering four distinct species of bamboo, as shown in Figure 4.3. The selection of bamboo was carried out carefully, with straight bamboo branches, free from black spots, decay, or mite bites, being chosen to ensure the beads produced later were consistent in size and color.



Figure 4.3: Selected bamboo branches and culms

After selecting the bamboo, the researcher continued to clean it. The bamboo branches were thoroughly cleaned to ensure they were free of any impurities that might reduce their lifespan and quality. The branches were initially soaked and rinsed with clean water to remove any surface dirt, such as a circular pattern of brownish spots on the epidermis of the bamboo. The branches were then meticulously washed with the scour pad. This step was crucial for removing impurities from the bamboo surface, which would later affect the appearance of the bamboo beads. The fungal infections usually appeared in a circular pattern, could be a consequence of age, and were not particularly harmful to the bamboo. This step removed the outermost layer of impurities from the bamboo before treatment (Figure 4.4). After washing, the bamboo was then left to dry in the sun. After this phase, the bamboos were put aside in a shaded and dry place to help it dry properly and prevent shrinking by shielding it from direct sunlight. This may take two to four days to dry, depending on the size of the bamboo and the prevailing weather conditions. The bamboo should be rotated every three to six hours for even drying. After that, the chance of rot would be significantly reduced by keeping it in a dry environment.



Figure 4.4: Bamboo branches a) before and b) after washing

Besides, the researcher also experimented with removing the outer epidermis of the bamboo skin to test the durability and lifespan of the bamboo. The outer epidermis was carefully removed using consistent strength to achieve a flawless finish (Figure 4.5). The researcher noticed that maintaining even hand pressure consistently was crucial to preventing damage to the bamboo and resulting in uneven surfaces. The researcher found that excessive pressure could damage the innermost part of the bamboo. In contrast, insufficient pressure was unable to remove the epidermis, resulting in the bamboo having a rough, uneven feel. Due to this lengthy and tedious process, the bamboo was guaranteed to have a smooth surface, suitable for further craftsmanship and beadwork. Soon, the researcher noticed that all of the bamboo types lost their characteristic color aesthetic when the epidermis was removed, which left them less visually identifiable. The bamboo was less attractive, with all varieties having a similar pale, dull appearance.



Figure 4.5: Four bamboo types removed the epidermis

As shown in Table 4.1, the characteristics of bamboo, especially the internal hole size, significantly influence its suitability for beading. Bamboo A, with the smallest internal hole, presents challenges in threading, making it less suitable for beadwork. In contrast, Bamboo B and C's naturally thinner walls and larger holes make them ideal for beading, allowing threads to pass through effortlessly. The vast, substantial internal hole of Bamboo D's culm is unsuitable for beading application, compromising the structural integrity required for precise beadwork.

Table 4.1. Four bamboo types with their characteristics

Bamboo type	Color	Inner hole size	Challenges in bead making	Bead making suitability	Usage
Bamboo A	Green	Small, inconsistent	Hard to string	Low	Unsuitable for beading
Bamboo B	Light green	Big, uniform	No significant challenges	Ideal	Beads or fine crafting
Bamboo C	Yellow and green strips	Medium, uniform	Avoid thicker threads	High	Decorative craft of beads
Bamboo D	Green	Large	Loose stringing result	Not suitable	Unsuitable for beading

4.2.1.3 Bamboo Treatment

The researcher then treated the bamboo by boiling it in a solution of 250g of alum mixed with one liter of water for different durations. According to Ji (2011), the solution for

treating bamboo consists of 250g of alum dissolved in 1 liter of water at a temperature of 98°C for 15 minutes. The same formula was used by the researcher when experimenting with another mordant, namely limestone. The researcher experimented for 15 minutes, 30 minutes, and 1 hour with the above formula. The bamboo became glossier and more yellowish after boiling with alum (Figure 4.6). However, this effect was not affected by the boiling durations, so the researcher proceeded with a further experiment with a half-hour boil. The limestone leaves a white residue on the bamboo, while alum showed better efficacy of boiling in preserving the bamboo. Thus, the researcher decided to use alum to treat the bamboo in the future.



Figure 4.6: Three types of bamboo branches boiled with alum

4.2.1.4 Bamboo Dyeing

After the bamboo was treated with alum, it went through the dyeing process. The bamboo was first dyed without agents in natural and food coloring solutions. Then, the researcher used two agents, alum and limestone, to experiment with natural dye and food coloring. The skins of avocados, green grapes, and red onions were utilized as natural dyes, while the colors green, red, and yellow were used as food coloring. To observe the

absorption of the dye solution, the bamboo was prepared both with and without the external epidermis. The experiment revealed that although bamboo without an external epidermis absorbed better, it produced dull, darkened, and poorly dyed results, which were unsuitable for the subsequent bamboo beading production process. The bamboo that was colored in an alum solution with epidermis did not display a significant visible change in color and did not absorb the dyes effectively (Figure 4.7a). Bamboo without epidermis lost its natural texture and was uneven, as consistent pressure was required when removing the epidermis, as stated by Nkeuwa et al. (2022). Additionally, the white residue left on the bamboo surface by the limestone solution affects its appearance (Figure 4.7b). The findings indicated that the bamboo did not dye properly in every dye and instead turned a darker shade. The researcher found it difficult to distinguish the bamboo after dyeing it in several solutions, as shown in Figure 4.8. As a result, the researcher stopped dyeing bamboo in further experiments.

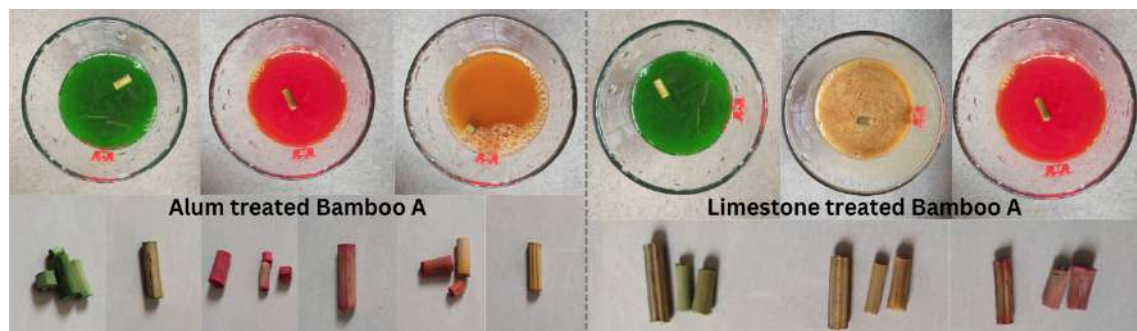


Figure 4.7: a) Bamboo dyed with alum and b) limestone



Figure 4.8: Compare bamboo dyed with a) alum and b) limestone

4.2.1.5 Bamboo Cutting

The researcher then cut the bamboo into different lengths to determine the most suitable size and length for beading. Bamboo A, B, and C were cut into 0.5 cm, 1 cm, and 3 cm, while Bamboo D was cut into 3 cm and above. A detailed explanation of the tools used for Bamboo A, B, C, and D highlighted the effectiveness of each tool. Several tools, as shown in Figure 4.9, were used to cut bamboo into different sizes (Figure 4.10) to determine the most suitable tools for achieving a perfect finish.

The garden cutter proved to be the fastest and easiest tool for controlling and cutting bamboo branches from the bamboo culm, which was effective for Bamboo A, B, and C. The finishing by the garden cutter was neat and smooth, followed by the marking of the length. However, the length, such as 0.5 cm, was a bit challenging compared to more precise tools like the mini electric grinder. The garden cutter was less suitable for cutting larger bamboo branches, as more strength was needed. The knife was used for cutting bamboo into various

lengths and sizes, as well as for harvesting the bamboo culm from the bamboo tree. Especially when dividing the bamboo culm vertically into the necessary parts, this approach was effortless. Even though the cuts were neat, a smooth finish still needed polishing. The knife was especially ideal for splitting jobs, particularly for splitting bamboo vertically into smaller, manageable pieces. Marking the bamboo culm before cutting guarantees more precise measurements. Bamboo culms can only be split vertically and into square or rectangular shapes with a knife, and need polishing to get a neat finish. The most efficient tool for cutting bamboo was the mini electric grinder. Compared to other tools, it created the cleanest, smoothest cuts, giving the bamboo a polished appearance. The grinder made it possible to more accurately control the measurement of the bamboo pieces, even if more polishing was still necessary for the ideal finishing. Due to its accuracy, it was well-suited for cutting bamboo into precise lengths, particularly for intricate beadwork. Bamboo D was the only bamboo that was cut by the wood-cutting machine. The machine was not suitable for bamboo since it left a rough surface, considering it is made of harder materials like wood. To achieve a perfect finish, the cuts required excessive polishing with sandpaper. Not every type of bamboo was a good fit for this tool.

The most efficient tool for cutting Bamboo A, B, and C was the garden cutter; Bamboo D could be split with the help of the knife; Bamboo A, B, C, and D could be divided with high accuracy measurement using the mini electric grinder; and the wood cutting machine was less suitable for cutting bamboo. Besides, the researcher encountered challenges when working with 0.5 cm bamboo beads, finding them difficult to control and not conducive to achieving precise measurements. The beads longer than 1 cm provided better control, allowed for more accurate measurements, and were less likely to break,

ensuring a more robust and reliable final product. This adjustment led to improved consistency and durability in the designs.



Figure 4.9: a) Garden cutter, b) knife, c) mini electric grinder, and d) wood cutting machine

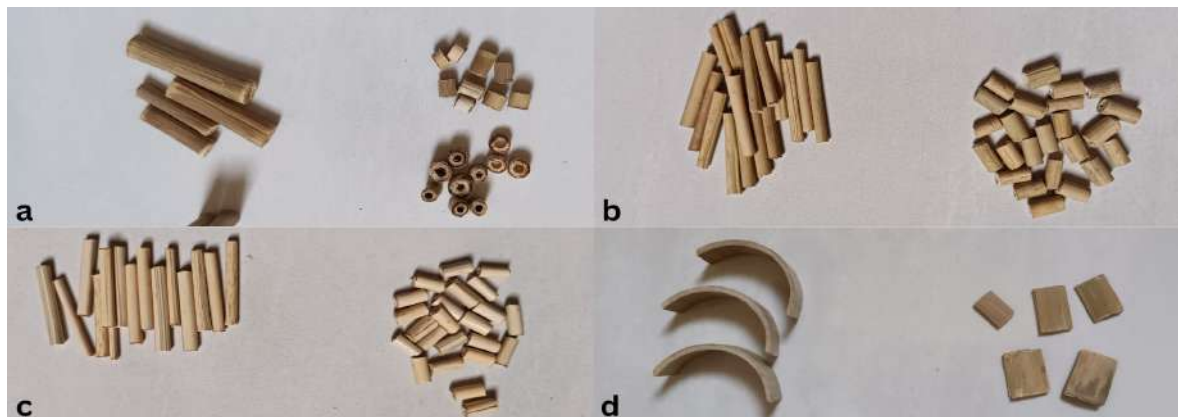


Figure 4.10: a) Bamboo A beads, b) Bamboo B beads, c) Bamboo C beads, and d) Bamboo D beads

4.2.1.6 Bamboo Finishing

As the final step in preparing bamboo beads, the bamboo was polished with sandpaper to ensure safety and smooth handling. The bamboo beads, after being polished, showed an improvement in visual quality, with smoothed, sharp edges and a polished surface. The lengths of the beads were also refined by this technique, resulting in precise final measurements and making them comfortable to wear or use in crafts. The bamboo

beads were stored in a dry, ventilated environment, protected from direct sunlight, to prevent them from rotting.

4.2.2 SEM Analysis

As shown in Figure 4.11a, the SEM analysis revealed significant differences in the surface characteristics of bamboo treated with alum and limestone solutions from a morphological view. Bamboo treated with alum displays a smooth and uniform surface, free from visible cracks, residue, or irregularities. This suggested that alum treatment effectively stabilized the surface of the bamboo by preserving its natural texture and making it ideal for delicate applications such as beading. Additionally, alum acted as a preservative and smoothing agent, reducing the surface decay and protecting the bamboo from fungal growth, enhancing its durability and aesthetic appeal. In contrast, the bamboo treated with limestone solution showed a rough and uneven surface with visible residue and surface irregularities. The calcium carbonate or mineral deposits left behind by the limestone treatment interfere with the smoothness of the bamboo, which was critical for delicate beading. The resulting coarse texture from limestone treatment decreased the flexibility of the bamboo material, making it less suitable for decorative beading design.

The analysis in Figure 4.11b highlighted the differences in fungal growth between untreated and alum-treated bamboo surfaces. On untreated bamboo, fungal spores and mould structures were distinctly visible, indicating active fungal colonization. In contrast, alum-treated bamboo showed no fungal structures, demonstrating its effectiveness in preventing fungal growth. This protection was achieved without compromising the natural appearance or texture of the bamboo samples. Besides, bamboo without its epidermis lost its natural texture and became uneven, due to the researcher's lack of experience in maintaining consistent pressure when removing the epidermis. Additionally, the color became dull after

treatment, increasing the risk of rot since the epidermis, which acts as a protective barrier against moisture, was compromised. As a result, maintaining the epidermis may improve the performance and stability of the treated bamboo.

As shown in Figure 4.18c, the SEM analysis showed significant variations in the inner hole sizes of the three bamboo samples. Bamboo A features the smallest and most inconsistent inner hole size, significantly reducing its applicability in precision crafting. Bamboo B exhibited the largest and most uniform inner hole size among the three types of bamboo. Its consistent and big diameter inner hole made it an ideal choice for bead-making, as it provided ample stringing space. Bamboo C displayed a medium inner hole, which offered moderate functionality. While its inner hole size was smaller compared to Bamboo B, it still had the potential to make beads, as it was larger than Bamboo A.

Figure 4.11d showed that the dyeing process did not result in visible color differences on the bamboo surface in SEM analysis. The treated surfaces remained unchanged in texture, with no cracks or deformities introduced by the dyes. However, the visual effect of dyeing on bamboo was inconsistent, with uneven absorption and non-uniform coloration across the samples. This inconsistency compromised the aesthetic quality of the bamboo, which was crucial for bead-making, where a uniform appearance was highly desirable. Furthermore, the dyeing process increased the risk of fungal growth. The moisture introduced during dyeing, combined with the uneven application of color, created conditions conducive to fungal proliferation. This made the dyed bamboo less durable and unsuitable for crafting applications that required longevity and resistance to biological degradation. Given these findings, dyeing was not recommended for bamboo bead-making. The inconsistent visual effects and heightened risk of fungal growth outweigh any potential benefits, underscoring the importance of maintaining raw bamboo for crafting high-quality, durable bamboo beads.

Lastly, Figure 4.11e compares the results of the cross-section of bamboo using different cutting tools. The SEM analysis clearly showed that the mini electric grinder produced the cleanest, smoothest cross-section due to its high-speed cutting action and precision, minimizing fiber tearing and leaving a polished finish. The samples cut by the mini electric grinder displayed well-defined, uniform edges with little to no fraying. The garden cutter was typically used for cutting bamboo branches from bamboo poles. As it relied on manual force, it was effective for smaller tasks, such as trimming branches. However, cutting bamboo into shorter sizes produced uneven cuts that caused minor fiber damage, leading to rough edges and an inconsistent appearance compared to the mini electric grinder. On the other hand, the wood-cutting machine, designed for harder woods, was the least efficient and unsuitable for bamboo. The machine resulted in torn, uneven cuts and even breaks as it was too aggressive for the bamboo fibers, further compromising the structural integrity and aesthetic quality of the bamboo. Its forceful cutting motion caused excessive fiber tearing and structural damage, showing irregular, broken edges and significant surface disruption. Thus, the mini electric grinder proved to be the most suitable tool for cutting bamboo. Polishing was necessary to make the bamboo beads safe and smooth for bead-making applications.

As a result of SEM analysis, the researcher found that alum-treated bamboo, which offered smoothness, resistance to fungi, and increased durability, was ideal for crafts. Bamboo B was perfect for beading due to its enormous, consistent inner hole and better structural stability. The Bamboo C was also suitable for making beads due to its consistent inner hole size and aesthetic appearance. The mini electric grinder was the most efficient cutting tool for precision and a clean finish. Dyeing was not recommended since it increased the risk of fungal infections and caused uneven absorption. Maintaining the epidermis of

bamboo was proven to improve its mechanical characteristics and lifespan, making it ideal for long-lasting and intricate crafting applications. Additional SEM results are presented in Appendix C.

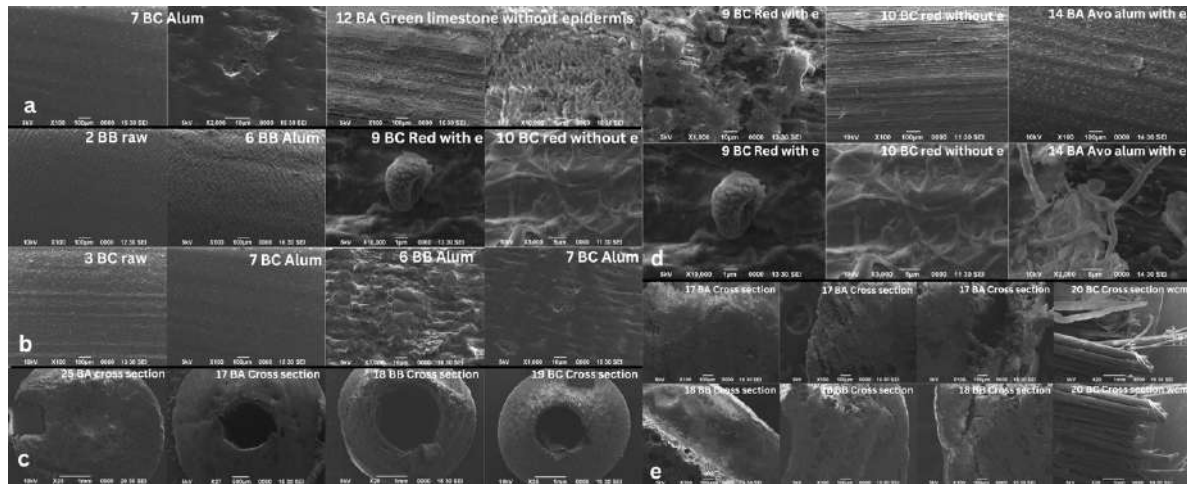


Figure 4.11: a) bamboo surfaces treated with alum and limestone, b) fungal growth on alum-treated and untreated bamboo surfaces, c) inner hole sizes of three samples, d) dyeing effect on bamboo, and e) cross-section of bamboo using various cutting tools

4.3 Data Collection and Analysis for Research Objective Two: To examine *Marik Empang* beadwork patterns for their adaptability in contemporary sustainable costume design.

Data collection for research objective two involved an investigation into suitable *Marik Empang* patterns for application in contemporary sustainable costume design. This objective was achieved through a combination of qualitative and experimental methods. The researcher conducted observations at three locations to collect data and insights about *Marik Empang*. This involved documenting the patterns, color, beading techniques used, tools, and materials needed to make the *Marik Empang*. In addition to field observation, the researcher conducted interviews with two artisans, two of which were conducted in person and one online, to gain valuable insights into the patterns, making techniques, and methods of *Marik Empang*. A series of experiments was conducted to investigate how the patterns can be effectively applied to bamboo beaded costumes. This included creating samples that

referenced the selected motifs using bamboo beads, along with combinations of other natural beads. The final samples were then evaluated through a survey distributed via Google Forms. A Likert scale ranging from 1 to 5 was used to measure audience perceptions of the final contemporary costume designs across four aspects, including aesthetics, functionality, quality and price, and cultural value. The high mean scores in SPSS results validated that these aspects were successfully achieved, indicating that the integration of bamboo beads in contemporary costume design was both effective and culturally meaningful. The full survey results can be found in Appendix D, while the SPSS analysis can be found in Appendix E.

4.3.1 Observation

Before conducting the interviews, the researcher carried out some observations in Kuching to gather basic knowledge about *Marik Empang* and bead weaving. The researcher made a checklist before carrying out the observation to ensure that data collection was clear, systematic, and consistent. Key elements on the checklist were the varieties of *Marik Empang*, including both traditional and modern patterns, the color scheme, motifs, the size and shape of the beads, the bead materials, the beading techniques, the stringing materials, and the finishing tools, location, time, date, as attached in Appendix F. These initial investigations laid the groundwork for the researcher and helped to develop the right questions for the interviews and to design the experiments. On 28 November 2023, the researcher conducted an initial observation at the Tun Jugah Foundation in Kuching, Sarawak, to collect preliminary data about *Marik Empang*. Guided by Madam Janet Rata, curator of the Beads Gallery at the Tun Jugah Foundation, the researcher gained invaluable insights into the world of weaving and beading, particularly in *Marik Empang*. Madam Janet introduced the weaving and beading pieces, revealing the stories woven within the threads and beads. Her guidance broadened the researcher's understanding of *Marik Empang*,

promoting each work beyond its artistic value to serve as an expression of the rich *Iban* tradition. Later, the researcher conducted observations at two cultural events in 2024: the *Festival Kraft Borneo Sarawak* on 27 October and the *Borneo Craft Festival 2024* on 30 November. Both events were held at the Kuching Waterfront, aimed at studying and documenting the *Marik Empang* patterns exhibited by the participating artisans. The various patterns of *Marik Empang* shown in Figure 4.12 and Figure 4.13 served as a source of inspiration for the researcher in the later designs. Additional patterns, motifs, and designs observed and shared by the interviewees in *Marik Empang* are presented in Appendix B.



Figure 4.12: *Marik Empang* patterns



Figure 4.13: Traditional and modern *Marik Empang* designs

4.3.2 Interview

Following the observation, the researcher proceeded with two interviews involving artisans in the fields of *Marik Empang*, which were with Madam Connie and Madam Ina. These interviews aimed to gain in-depth knowledge and collect data relevant to research question two, which focused on understanding the *Marik Empang* patterns, color symbolism, as well as the beading techniques, methods, and stringing tools required to produce this intricate craft. These insights helped to refine the focus of the experimental phase further. The interview questions primarily focused on demographic data, *Marik Empang* beading patterns, beading techniques, materials and tools for beading, and opinions on the utilization of bamboo beads. The complete set of interview questions is attached in Appendix A for further reference.

4.3.2.1 Demographic Data

The first section of the interview focused on gathering demographic data to provide background information for each interviewee. Table 4.2 categorized the demographic information of the two interviewees, including their age, gender, ethnicity, occupation, and personal experiences in beading or crafting.

Madam Connie is the first interviewee. The researcher conducted an online interview with Madam Connie via an online platform. Madam Connie is a 35-year-old *Iban* woman from Miri. She began her journey in beading during her school years and turned her hobby into a business in 2017 after becoming a stay-at-home mom. Madam Connie Kam began by making beadwork, including traditional and modern *Iban Marik Empang*, which her family members, including her sister, had taught her. “*I learned from my sister,*” she explained, establishing the foundation of her craft through familial knowledge transfer. Madam Connie now has eight years of experience in making *Marik Empang*, as she said, “*I started making this actively since 2017.*” She was actively involved in beading communities and was now registered with SCDC and the Sarawak Craft Council. As her skills developed, she expanded her resources beyond family teachings by sharing, “*I collect and refer patterns from friends and colleagues.*” She added, “*I participate in a WhatsApp group where beading enthusiasts share patterns,*” showing how traditional crafts have adapted through electronic communication. She kept and collected the *Marik Empang* designs properly as they served as inspiration. “*I print and file reference images for future use.*”

Madam Ina Sendar is the second interviewee. Madam Ina is from Kapit, Sarawak, and she has loved beadwork since childhood. She has been actively creating beaded products since 2018. She has been working with *Kraft Tangan Sarawak* since 2021, and now she has seven years of experience in making *Marik Empang*, saying, “*I have liked beading since I was small, and I have worked with Kraft Tangan Sarawak since 2021 till now.*” Madam Ina ran her business online and did her crafts at home. She shared, “*So far, I do not own a shop, I do it at home.*”

Table 4.2. Demographic data collected from the interviewees

Question	Interviewee 1	Interviewee 2
Name	Connie anak Kam	Ina anak Sendar
Age	35	55
Gender	Female	Female
Ethnic	<i>Iban</i>	<i>Iban</i>
Origin	Miri	Kapit
Occupation	Craftsman	Craftsman
Experiences in making <i>Marik Empang</i>	Yes	Yes
Years in the crafting field	8	7

4.3.2.2 *Marik Empang* Beading Patterns

The second section of the interview question collected data for the patterns and designs of *Marik Empang*. Table 4.3 provides a comparative overview of the preferences of two interviewees for bead pattern design and color usage. It demonstrated the differences between the beading process, beading patterns, preferred colors, and materials used.

First, Madam Connie shared that she learned to make *Marik Empang* from her sister and through online resources, combining traditional knowledge with self-taught methods to develop her skills. She emphasized the importance of using attractive and suitable colors, stating, “*It must be attractive, so usually I use three colors.*” She also highlighted the cultural significance of specific colors, mentioning, “*Red, yellow, white. Green is important as well.*” Additionally, she shared that monochrome combinations are sometimes popular, such as “*Black and white are used for monochrome design.*” In terms of design, she stressed that the final work must be neat, saying, “*One more thing is tidy.*” Madam Connie also claimed the originality and creativity in design, advising, “*If we refer to others’ design, make sure we modify creatively.*” To avoid plagiarism, she recommended, “*Change in terms of color of design, we should not plagiarise others’ designs.*”

Madam Ina introduced some of *Marik Empang*'s patterns. She said, *“This is eggplant flower with squid design, or this is dragon design.”* Madam Ina shared that there was a popular color used for making *Marik Empang*, but she followed the preferences of the customer by sharing that, *“So it depends on the patterns, usually it needs more black beads.”* She also shared the estimated number of beads used for making a *Marik Empang* and how she priced her product. She said, *“If there are more yellow and black, it will take around 150 beads. For 20 grams it costs RM 7.”* Madam Ina worked directly from images without mapping out designs. She said, *“If you can understand the pattern, you can refer to the images and do it directly. Just with the images, you can see the direction of the beads.”*

4.3.2.3 Beading Techniques

The bead weaving techniques shared by the two interviewees were categorized in Table 4.3. Madam Connie built her designs by starting with a neckline thread and adding horizontal threads, inserting beads one by one according to her drawn pattern. Madam Connie shared that the process of making *Marik Empang* started by inserting beads, as she shared, *“It passed through in an amount. First, we have a thread, which is the neckline thread, then we tie more threads horizontally. After that, we put the beads one by one or follow the design.”* She emphasized neat finishing using double-threading or extra threads by saying, *“You can add thread or pass two threads in a bead to make it packed and finer.”* Madam Ina described both single-thread and multi-thread techniques as applicable in making *Marik Empang*. Depending on the design, different directional methods, such as weaving from top to bottom or left to right, can be applied when showing her works. She shared, *“It depends. Some is from top to bottom, one thread, some is left to right, with many threads. There is one thread design and many thread designs.”*

4.3.2.4 Beading Materials and Tools

The data collected for the following section consisted of the materials and tools used in making *Marik Empang*, as shared by the interviewees, as shown in Table 4.3. As for materials and tools, two interviewees both favored the use of Toho beads, particularly sizes 8.0 and 11.0, due to their quality, consistency, and color. Madam Connie shared, “*The beads I use are Toho beads. Toho beads are a kind of fine bead. If you visit any bead shop, you will likely see them; they are named Toho beads. It’s a quality bead. It’s stronger, harder, and doesn’t fade in color. The beads are made in Japan and are the most popular and expensive of their kind. I usually use size 8.0, the bigger, and 11.0, the smaller type.*” Madam Connie shared her experiences with using other beads, such as Indonesian beads, crystal beads, and plastic beads, by saying, “*I tried with another bead from Indonesia. It’s not nice. So far, I haven’t sold the Indonesian beads; it’s not nice to sell them, so I keep them. That one is not even; some are big, some are small, and some are broken. The Toho beads are the same; they’re fine and easier to work with, whereas other brands are long, oval, and made of plastic. This is made of crystal and is more expensive.*” Madam Ina shared the same beads used by Madam Connie by saying, “*For beads, I use the quality beads, the Toho beads.*”

Although both Madam Connie and Madam Ina shared the same preferences in selecting beads, they used different types of stringing materials for making *Marik Empang*. Madam Connie used Angel brand cotton thread, selecting different thicknesses based on the design, and sealed the thread ends with paper glue for a neat finish. She said, “*This is the thread, it comes with code, code 72, 67, 80. Usually I use numbers 2 to 8 for making Marik Empang, 8 can also do, 8 is moderate, and 10 is fine.*” In contrast, Madam Ina preferred nylon twine, noted for its strength and durability in humid conditions. She said, “*I use nylon*

twine, which is a kind of thread the constructor used for building. This thread is stronger and has a longer lifespan. Usually, the cotton thread will break due to sweating, as mentioned by my customers.” For the finishing, Madam Connie shared her way of making by saying, *“Then if I want to do Marik Empang, I cut the thread at the end, which is fury, I apply glue to make it tidy. Some craftsmen are using a candle, but I prefer using glue for finishing. That’s the basic materials I use to bead, four materials.”* Madam Ina only used the quality beeswax candles she sourced from Kapit to treat her threads, saying, *“This beeswax candle I ordered from Kapit is quality proof. The impure will break easily, but this is pure, and it has stayed up to five years already.”*

4.3.2.5 Opinions on Bamboo Beads

Unfortunately, when asked about the utilization of bamboo for beads, none of the interviewees had direct experience incorporating bamboo into their beadwork. However, they all expressed openness and curiosity about the potential of utilizing bamboo beads. Madam Connie believed that bamboo beads could be compatible with basic beading techniques and could be ideal for accessories like bracelets, drawing on her experience with wooden beads. She shared, *“The one you shared with me, I think bamboo can be used. I haven’t seen it before, but I think you can give it a try. Maybe for a bracelet? I think it works.”*

Similarly, Madam Ina had no experience with using bamboo beads. Still, she expressed that bamboo could work well in beadwork, given her expertise with other natural materials, such as wood beads imported from China. She also shared her inspiration from Sabah’s craftsman on the utilization of Job’s tears. She said, *“No, but I have tried with wood. I am not sure what its name is, but it’s made of wood. It’s made of wood and it’s from China.”*

Like I just used Job's tears in my designs. This is from the jungle, which we used for beading. Now the Sabahan is doing this in gold, and it is darker."

Table 4.3. Data collected from the interviewees

Question	Interviewee 1	Interviewee 2
Beading patterns	Traditional and modern patterns	Traditional patterns: eggplant flower, squid, and dragon
Color	Red, yellow, white, green, or monochrome	Black, yellow, and red
Design approach	Develop from ready patterns	Recreates from visual references without mapping
Beading techniques	Starts with neckline thread, adds horizontal threads, and inserts beads one by one horizontally	Uses both single-thread and multi-thread methods from top to bottom or left to right
Threading method	Double-threading adds extra layers for fullness	Depending on the design
Bead types	Toho beads (sizes 8.0 and 11.0), crystal and plastic beads	Toho beads (sizes 8.0 and 11.0)
Stringing material	Angel brand cotton thread	Nylon twine
Finishing tools	Use paper glue for neat finishing	Treated with beeswax candles

The interview data provided valuable knowledge and insights that were crucial to the research journey. Through the shared experiences of the artisans, the researcher gained a deeper understanding of traditional *Marik Empang* patterns, beading techniques, and the practical use of tools and materials. These insights served as a guideline for experimental decisions, such as the use of natural materials like Job's tears, also known as adlay.

4.3.3 Experimental Process

The researcher began by exploring and experimenting with *Marik Empang* beading patterns after conducting detailed observations and analyzing the data collected from the interviewees. The researcher also tested the stringing materials to examine their strength and durability in holding beads securely in place.

4.3.3.1 Initial Testing for Bamboo Beads

The researcher was inspired to try making the *Marik Empang* pattern after finding information and initially observing the Tun Jugah Foundation. The researcher gained basic knowledge of visual and contextual studies on traditional patterns, color arrangements, and the structure of beadwork. Based on these findings, the researcher then explored different stringing materials and basic weaving techniques to create simpler patterns. The first experiment aimed to determine if it was possible to use other types of thread on bamboo beads (Figure 4.14) and whether they would look aesthetically pleasing. Samples a, b, and c were threaded using clear nylon fishing line, a standard stringing material that is strong, flexible, and transparent. Sample D used white cotton thread, a traditional choice because it was soft and provided better grip, but it was more visible in the final piece. In the same experiment testing with 0.5 cm bamboo beads, the researcher found them to be fragile and difficult to handle, prone to breaking during the crafting process. This compromised the overall effectiveness and durability of the design. To address this issue, the researcher transitioned to 1 cm bamboo beads and larger sizes. These provided greater stability, improved control, and were less likely to break, ultimately enhancing the durability and precision of the designs. This adjustment ensured both the strength and aesthetic appeal of the final product. By comparing these materials, the researcher could see the performance and durability of the stringing materials with bamboo beads.



Figure 4.14: Four simple samples

4.3.3.2 Arrangement of Beads

The researcher experimented with the observed or shared *Marik Empang* beading patterns by interviewees during fieldwork. The researcher analyzed the detailed patterns, color combinations, and beading techniques to reinterpret these ageless designs. By referring to the references, the researcher identified a digital pattern, as shown in Figure 4.15, to study the beading techniques and utilized different sizes of bamboo for beading. The meanings of the motifs or patterns and color are found in the online references, as shown in Figure 2.15. However, the real meanings of the motifs remain unknown presently due to the loss of traditional knowledge and the effects of modernization. The long bead is believed to symbolize longevity, while the round bead represents fertility. The water droplet shape reflects rivers and continuity, the diamond-shaped motif symbolizes fertility and rice fields, and the zig-zag motif represents bamboo shoots, unity, and community. The colors that are most highlighted by interviewers are black, red, and yellow. Black symbolizes power, red signifies blood and vitality, and yellow represents light and fortune. These colors represent beliefs that are essential to the cultural identity of the *Iban* community.

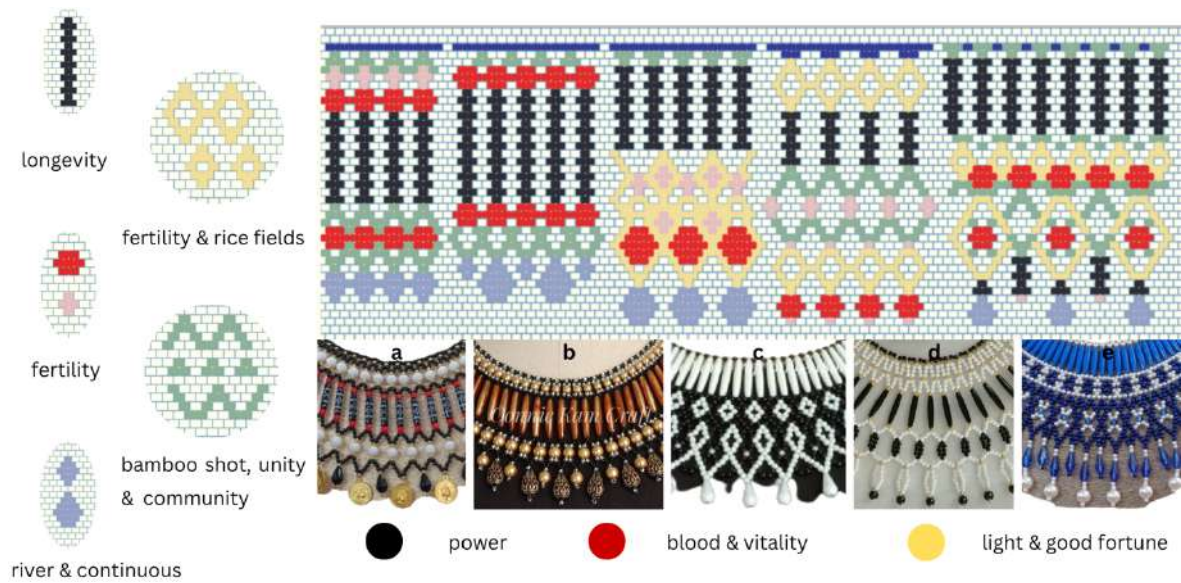


Figure 4.15: Digital *Marik Empang* patterns developed, referring to the references with meanings

4.3.3.3 Developing Patterns

The color selection of beads when making *Marik Empang* was not just an aesthetic choice, but also a deep and meaningful cultural symbol. Together with bamboo beads, the combination of textures and tones enabled the creation of harmonious patterns that showcased the sustainable beauty of organic materials. The researcher experimented with patterns in Figure 4.15 using bamboo beads and natural seed beads. The researcher employed a combination of natural materials, including adlay, windmill palm seeds, and red beans, as shown in Figure 4.16, along with bamboo beads to create intricate patterns. Adlay represented the black color, windmill palm seed represented white, red bean symbolized red, and bamboo beads signified yellow. Together, these natural colors of the materials represented the basic colors traditionally used in *Marik Empang*. Then, the researcher used threads and different sizes of copper wire to test the durability of the samples. The copper wires used were 0.2 mm, 0.5 mm, and 0.6 mm in diameter, while the threads were made of cotton and nylon twine (Figure 4.17).



Figure 4.16: a) Adlay, b) windmill palm seed, and c) red beads



Figure 4.17: a) Copper wires, b) cotton thread, and c) nylon twine

The researcher initially experimented with pattern e in Figure 4.15 with a 0.2mm wire for beading, but found it unsuitable due to several limitations. The small size of the wire presented difficulties and challenges during the stringing process, as it lacked the strength required to securely hold the beads in place, particularly during the finishing stage. This resulted in a fragile structure with noticeable gaps between the beads, disrupting both the stability and aesthetic of the design, as shown in Figure 4.18.

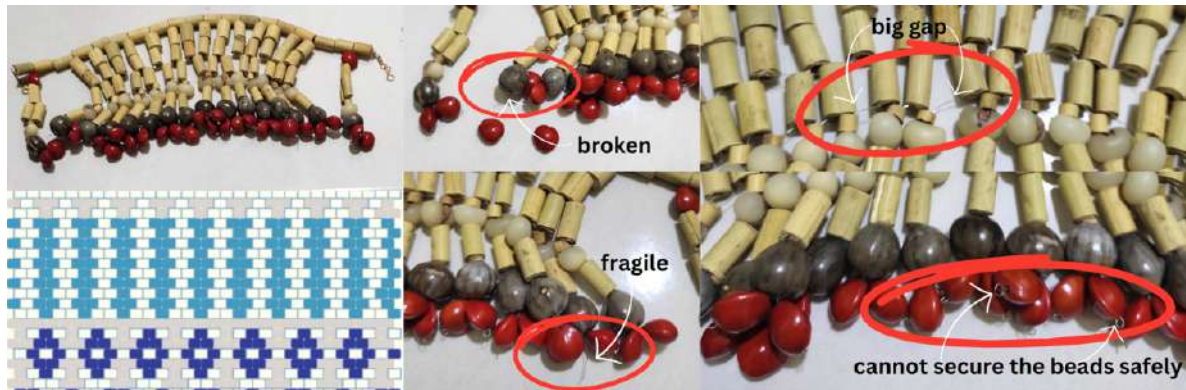


Figure 4.18: Sample using wire size 0.2 mm

To address these challenges, the researcher tested wires with larger diameters, specifically 0.5 mm and 0.6 mm, which proved to be more effective than the 0.2 mm size. As shown in Figure 4.19, these wire sizes provided better structural support, reduced gaps, and enhanced the overall cohesion of patterns a and c, ensuring the beads remained securely in place while maintaining the solidity of the designs.

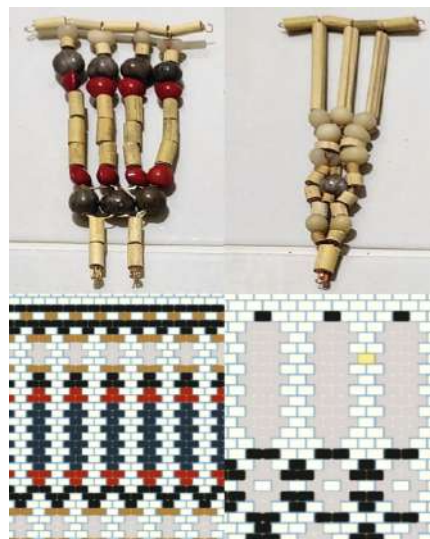


Figure 4.19: Samples using wire sizes 0.5mm and 0.6mm

After testing with 0.5mm and 0.6mm wires, the researcher explored alternative materials recommended by interviewees, including cotton thread and nylon twine. These materials offered distinct properties compared to wires by providing greater flexibility and

softness. To assess their combined effects on flexibility and visual appearance, the researcher mixed wires with threads and nylon twine to test patterns b and d as shown in Figure 4.20.

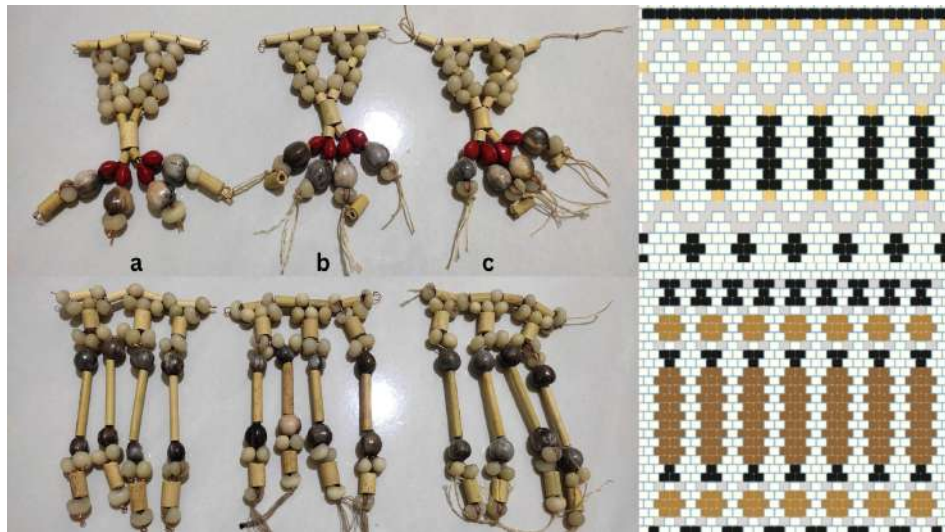


Figure 4.20: a) Samples with wire, b) samples with cotton thread, and c) samples with nylon twine

The researcher observed distinct differences in the properties of copper wires and threads when used for beading. The copper wires provided an adjustable and stiff effect, making them ideal for creating structured and firm designs that maintain their shape. This stiffness enabled precise adjustments to the arrangement of beads, ensuring a stable and cohesive final product. In contrast, threads and nylon twine offered a flexible effect, better suited for designs that require mobility and movement. Their flexibility enabled the creation of softer, more dynamic patterns, although they lacked the rigidity needed for specific, structured designs. These contrasting properties enabled the researcher to select between wires and threads based on the requirements of the beading project, striking a balance between structure and flexibility to achieve the desired outcome.

4.3.3.4 Water Soaking Test for Stringing Materials

A water soaking test was conducted to evaluate the durability, strength, and water resistance of various stringing materials used in the construction of *Marik Empang*

beadwork. Water soaking test to test the absorbency, durability, tensile strength, resistance to rot, and mildew (Textile American Publishing Company, 1912; Verma, 2011). In this soaking test, the soaking materials included copper wire, cotton thread, and nylon twine. Each type of string was submerged in pure tap water for three different durations: one day, three days, and seven days, to simulate exposure to moisture over varying periods. The results indicated that there were no visible changes or significant deterioration in any of the materials after soaking. All three materials demonstrated good water resistance, maintaining their visual appearance, structural integrity, and strength even after a week of immersion. The stringing materials retained their shape, texture, and tensile strength, with no signs of fraying, corrosion, swelling, or weakening. Based on these findings, the selection of stringing material can be made according to the intended function of the beadwork or the researcher's preference, as all materials tested performed reliably under wet conditions.

The results of the interviews provided important knowledge on the meaning of motifs, tools, materials, and beading techniques for making *Marik Empang*. Additionally, the interviewees showed a positive acceptance of the application of bamboo beads in contemporary design. Drawing from collected data, the researcher experimented with natural materials such as red beans, windmill palm seeds, and Job's tears, which showed excellent application in neat arrangement combined with bamboo beads. The stringing materials also showed that all tested materials maintained their structural stability under wet conditions, providing for flexibility in selecting based on the aesthetic preferences and specific design needs of the researcher.

4.4 Data Collection and Analysis for Research Objective Three: To develop contemporary costume designs using bamboo-crafted beads that preserve the cultural identity and visual coherence of *Marik Empang* patterns.

Data collection for research question three focused on designing contemporary bamboo-crafted costumes to conserve the unity of the *Marik Empang* pattern through an experimental process and a survey to evaluate the costume designs. This stage began with the pattern drafting, followed by the costume design sketches. The drafted patterns are then used to create a toile, allowing the researcher to test the structure and fit on a standard-size dummy for the necessary adjustments before finalizing the patterns. The refined patterns were transferred onto the chosen fabric, followed by sewing the fabric and hand-stitching bamboo beads onto it according to the designs. The process was completed with the addition of a linen lining to achieve a perfect look. This ensured the durability, comfort, and presentation quality. This experimental method proved to be the most effective way to assess techniques, craftsmanship, and the integration of beading patterns into contemporary costume design. A survey was distributed to gather feedback from the audience regarding the costume design prototypes using Google Forms. The provided input offered valuable insights into the aesthetics, functionality, price, quality, and cultural value of the designs.

4.4.1 Experimental Process

This experimental stage focused on the process of making the costume. The process began with pattern drafting and transferring the patterns from the toile onto the velvet fabric. This was followed by careful cutting and sewing to shape the costume properly. Finally, bamboo beadwork based on *Marik Empang* patterns was carefully sewn onto the costume.

4.4.1.1 Developing the Final Beading Patterns

The final digital beading patterns (Figure 4.22) were developed based on interviewees' references. It incorporated traditional and modern beading patterns, ideas

observed during fieldwork at the Tun Jugah Foundation, the *Kraft Borneo Festival*, and the Borneo Craft Festival. These three final patterns were selected as they demonstrated the most effective integration of design, material, and cultural significance. First, the neatness of the bead arrangement emphasized the excellent combination of bamboo beads and other natural seed beads, resulting in stylish and visually pleasing results. Second, the structural durability of the patterns string with the stringing materials was evaluated to verify their strength and flexibility in supporting the beads for actual costume use. Lastly, the motif patterns represented essential *Iban* traditional concepts, including longevity, fertility, continuity, and community. Symbolic motifs such as the diamond shape and bamboo shoots were used, and the natural tones of the seed beads reflected the traditional colors associated with the *Iban* culture. These elements considered together supported the selection of the three final designs as the best fit for contemporary costume design.



Figure 4.21: Final beading samples

4.4.1.2 Sketches

The inspiration boards, mood boards, concept boards, and color boards in Appendix B served as the inspiration bank for the researcher to develop costume sketches. The

researcher developed four contemporary costume sketches (Figure 4.22a), incorporating cultural design elements, color selection, ease of movement, and aesthetic integration of beading motifs into contemporary costume design. The fabric swatches in Appendix B showcased the velvet fabric and the choice of colors that blend cultural elements with contemporary design. The investigation and discussion were mostly based on audience opinions and preferences in survey data, that is then analyzed with SPSS. The collected data influenced the design to align with market demands and target audience preferences. Based on these findings, the selected designs were polished into final costume pieces, preserving their cultural importance while increasing their chances of wider acceptability before mass production. With these opinions collected from the survey results, the researcher concluded that the two designs in Figure 4.22b effectively represented the essence of contemporary costume design while maintaining cultural significance. The selected designs in Figure 4.22b showcased a blend between tradition and contemporary and were then further developed into the final costume pieces. The male design featured a structured silhouette in red and black, the traditional colors used for making *Marik Empang*, decorated with bamboo beads in symmetrical patterns. The female design adopted the same color of red and black to create a softer and contemporary look, allowing the ease of movement while considering the weight of the beads and incorporating beadwork on the chest part, inspired by the *Marik Empang*, which was worn on a chest beaded collar.



Figure 4.22: a) Costume design sketches and b) final costume design sketches

4.4.1.3 Patterns Drafting

The development of the toile began with pattern making, where the costume design was first translated into a basic pattern for the top and bottom. These patterns were carefully drafted to reflect the silhouette, shape, and construction details of the intended final costume design. Accurate measurements were taken to ensure a proper fit on the standard M-sized mannequin, which represents the average size of the human body. Following the pattern drafting, the toile was assembled using calico to create a test garment. The initial toile was then fitted onto a mannequin, allowing the researcher to assess the general fit, drape, and balance of the garment (Figure 4.23). Particular attention was given to areas where the beadwork would be applied, ensuring enough surface area and stability for the bamboo beads and stringing materials.

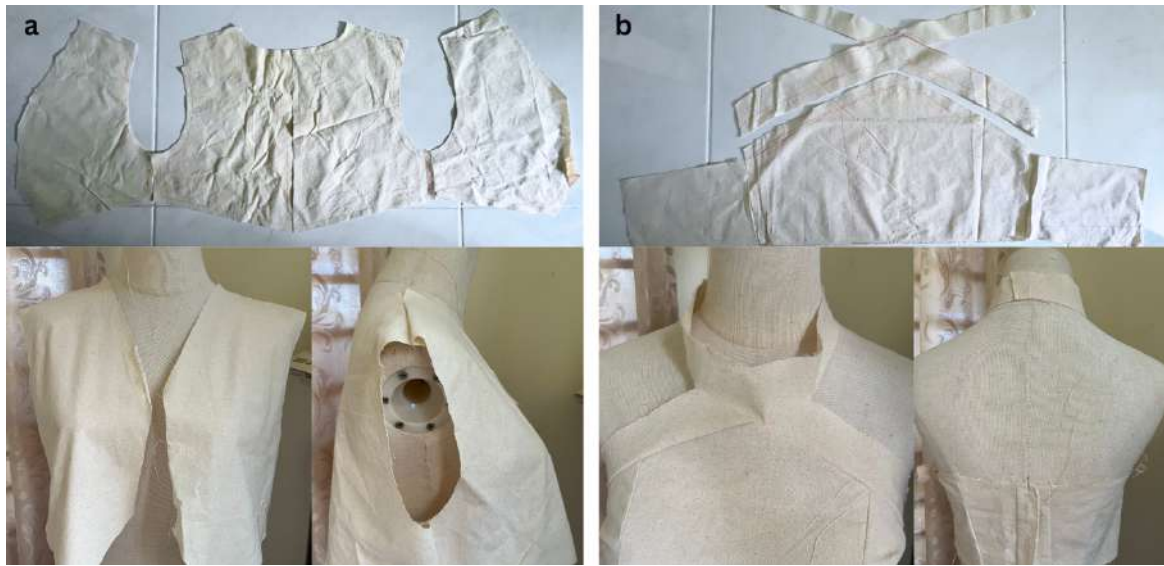


Figure 4.23: Initial toile making for a) male and b) female

The researcher revised the neckline and collar shapes for the female top, as well as the overall proportion of panels, to ensure optimal integration of *Marik Empang* patterns. After revising the pattern, the calico fabric fit well around the neckline as shown in Figure 4.24. Once the fitting was satisfactory, the pattern was transferred onto the final fabric for the actual costume (Figure 4.24). The dummy fitting stage was crucial for observing how the garment responded to the added weight of the beads and how the fabric structure held up when tensioned by stringing materials, such as nylon twine or cotton thread. The final version of the toile provided a reliable base for transferring the refined pattern onto the actual fabric, serving as a critical step before the full execution of the final costume pieces with complete beadwork.

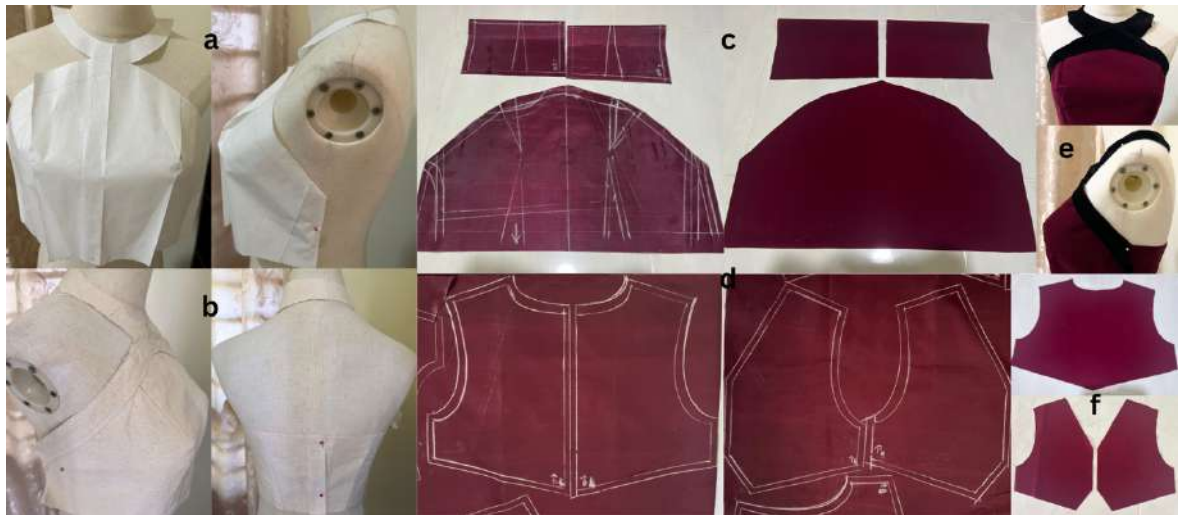


Figure 4.24: a) Revised patterns on the mannequin, b) revised patterns transferred on calico and fitted on the mannequin, c) female final patterns, d) male final patterns, e) female fitting, and f) male top and back patterns

4.4.1.4 Beading Prototypes

Following the perfect toile, the researcher proceeded to create the beading prototypes based on the motifs and patterns outlined in the original design sketches. Each prototype was crafted using bamboo beads threaded with selected stringing materials, such as combinations of materials or copper wires, nylon twine, and cotton thread, which had been tested earlier for durability and suitability. The beadwork was then carefully fitted onto the toile, with precise attention given to the arrangement, alignment, and positioning of each pattern segment (Figure 4.25). This step was crucial to ensure that the beadwork enhanced the overall aesthetic of the costume without compromising its structure, balance, or comfort. Adjustments were made directly on the toile to modify the spacing, curvature, and layering of the bead patterns, achieving a harmonious visual flow across the garment. Throughout the process, special attention was placed on wearability, particularly concerning the weight of the bamboo beads, the flexibility of the materials, and the movement of the garment when worn. The researcher ensured that the beading did not restrict mobility or cause discomfort,

especially in areas such as the shoulders, neckline, and waist, by selecting a suitable stringing material for the beads.



Figure 4.25: Placing beads on a costume

4.4.1.5 Final Design

After finalizing the fabric selection, the researcher proceeded to the construction phase of the final costume design. The process began by transferring the finalized patterns from the toile onto the velvet fabric, with an added seam allowance. Once the pieces were cut, they were sewn together following the design. Particular attention was given to maintaining seam alignment, achieving proper fit and drape, and reinforcing sections where bamboo beadwork would be attached. To further support the structure of the garment and enhance its durability, a lining was added to both the top and bottom pieces. The lining helped distribute the weight of the beadwork, prevented distortion of the velvet, and contributed to a more comfortable and professional finish.

The beads were then carefully sewn onto the top of the velvet fabric before the lining was added, ensuring the beadwork was securely integrated and allowing for a clean and perfect finish. To further support the structure of the garment and enhance its durability, a lining was then added to both the top and bottom pieces. The lining helped to distribute the

weight of the beadwork, prevented the distortion of the velvet, and contributed to a more comfortable and professional finish. The interface was added to both female and male waistbands to provide structure, shape, and prevent rolling. This was crucial to achieve a fitted costume with the perfect finishing.

Finally, the costume designs for females (Figure 4.26) and males (Figure 4.27) were successfully brought to life, as shown in Figure 4.28. From conceptual sketches and toile development to fabric selection, beadwork integration, and precise hand stitch techniques, each step was carefully executed to preserve cultural significance while ensuring modern wearability and clean finishing. The costumes reflected a harmonious blend of traditional *Marik Empang* inspiration, sustainable materials, and contemporary design, showcasing the researcher's commitment to both heritage preservation and innovative craftsmanship.



Figure 4.26: Costume designs for female



Figure 4.27: Costume designs for male



Figure 4.28: a) Final costume designs worn by models and b) mannequins

4.4.2 Survey Analysis

After completing the final costume designs, the researcher conducted a survey using Google Forms to collect feedback from the 102 audience. The survey questions are attached in Appendix D. The study aimed to evaluate the public's response to the designs, particularly in terms of aesthetic appeal, cultural authenticity, material selection, functionality, quality, and price. The survey consisted of multiple-choice questions, short-answer questions, and Likert scale questions, and SPSS was used to analyze the data. Most of the questions used a Likert scale to enhance accessibility by delivering clear and comprehensible information to the public. Respondents were invited to share their thoughts on how effectively the costumes represented traditional *Marik Empang* elements while embracing sustainable and contemporary approaches. The survey included aesthetics, functionality, price and quality, and cultural value. Before these questions were presented to respondents, clear explanations and simplified definitions were provided in each heading section of the question. This was necessary as such terms may not have been familiar to the respondents. The survey ensures that respondents can understand the questions by offering basic definitions, enhancing the clarity of the survey and the reliability of the responses.

4.4.2.1 Demographic Information

The demographic information section was the first part of the survey, collecting the respondent's basic demographic information from questions 1 to 8. The survey yielded a total of 102 respondents with varied backgrounds, as shown in Table 4.4. The results showed that the majority of participants (58.82%) were between 21 and 30 years old, indicating that the survey attracted a young adult audience. Female respondents were recorded in greater numbers (74.51%) compared to male respondents (25.49%). Ethnically, the survey reached a diverse range of respondents, with the largest group being Chinese (37.25%), followed by

Bidayuh (19.61%), *Iban* (16.67%), and other ethnicities, as shown in Table 4.3. Regarding professional background, the survey recorded the most responses from students, who represented 46.08% of the participants, followed by private sector employees at 24.51%. Notably, 85.29% of respondents reported having no experience in textile or fashion. In terms of identifying *Marik Empang*, 59.8% of the respondents, or 61, were unfamiliar with the shown items. Among those who could identify the items, the majority (48.78%) recognized it as *Tango* or *Tangu*, followed by a slight difference of 46.34% who identified the item as *Marik Empang*, and 4.88% named the item as a beaded collar. This insight indicated that *Marik Empang* was familiar to the respondents by different names.

Table 4.4. Frequency distribution table

Question	Respond	Frequency (N=102)	Percentage (%)
Q1 Age	18 - 20	24	23.53
	21 - 30	60	58.82
	31 - 40	13	12.75
	Above 40	5	4.90
Q2 Gender	Female	76	74.51
	Male	26	25.49
Q3 Ethnic group/ Tribe	Chinese	38	37.25
	<i>Bidayuh</i>	20	19.61
	<i>Iban</i>	17	16.67
	<i>Malay</i>	13	12.75
	<i>Melanau</i>	6	5.88
	<i>Orang Ulu</i>	3	2.94
	Indian	3	2.94
	<i>Dusun</i>	2	1.96
Q4 Profession/Occupation	Student	47	46.08
	Private Sector Employee	25	24.51
	Government Employee	13	12.75
	Educator/Researcher	5	4.90
	Self-Employed/Freelancer	5	4.90

Table 4.4. Continued

Q5 Do you have experience in textile or fashion?	No	87	85.29
	Yes	15	14.71
Q6 If yes, how many years of experience?	Less than 1 year	5	33.33
	Between 1 to 7 years	8	53.33
	More than 7 years	2	13.33
Q7 Can you identify the names of the items in the pictures shown?	No	61	59.80
	Yes	41	40.20
Q8 If yes, please state the name.	<i>Tango/Tangu</i>	20	48.78
	<i>Marik Empang</i>	19	46.34
	Beaded collar	2	4.88

Based on the survey data shown in Table 4.4, the survey involved 102 respondents from diverse backgrounds and professions who provided their recognition of the *Marik Empang*. As most of the respondents fell within the age range of 21 to 31, followed by the range of 18 to 20, with a total of 84 respondents, they demonstrated unfamiliarity in recognizing *Marik Empang* in the following theme. These respondents from the younger age group were mainly female and either students or private sector employees from diverse ethnic backgrounds, mostly without prior experience in the textile or fashion fields. Their responses highlighted the lack of knowledge or heritage in cultural traditions in *Marik Empang*, as more than half, 61 respondents out of a total of 102, could not correctly identify the *Marik Empang* shown in the survey. This showed that the *Marik Empang* was not practiced in daily life, although it is a crucial craft or part of the traditional costume of the *Iban* ethnic group. Consequently, the findings regarding cultural value are primarily based on the perceptions of the public rather than audiences with rich cultural knowledge. As the respondents were from the public rather than being experts in *Marik Empang* or individuals with specific *Iban* cultural knowledge, their responses reflect general impressions rather than

culturally based assessments. However, 41 of the respondents were recorded as familiar with the *Marik Empang* shown in the survey, despite differences in the naming of the items. *Tangu* or *Tango* was a local way of calling *Marik Empang*, especially for the *Iban*. *Marik Empang* and the beaded collar were also known to some of the respondents, indicating that *Marik Empang* was associated with three prominent names in Sarawak. This result showed that the younger generation in Sarawak lacked knowledge of cultural crafts, especially *Marik Empang*. The gap between traditional cultural craft and modern life highlights the importance of raising awareness of cultural heritage and the significant preservation of cultural craft to broaden the public's knowledge of craft items in Sarawak.

4.4.2.2 Aesthetic Theme

The aesthetic was the first theme of the core study question in the survey, which collected the opinions of 102 respondents about costume design preferences from questions 1 and 2, as shown in Table 4.5, and the visual aesthetic theme of the costume designs from questions 3 to 6, as shown in Table 4.6.

The aesthetic aspects of the costume designs received overwhelmingly positive feedback. Design 1 (Female) emerged as the favorite for 76%, which represents 80 of the respondents, while Design 2 (Male) was preferred by 22 of the respondents, representing 24% of the 102 respondents. As both male and female respondents could review the final chosen design, their selections reflect an overall preference for either the Design 1 (Female) or Design 2 (Male) costume, regardless of gender. In other words, males could evaluate the female costume and females could evaluate the male costume. Several initial sketches were developed and refined before arriving at the final design, ensuring that the costume presented in the survey was the most refined outcome of a careful selection process.

Cultural significance was the most commonly selected reason, with 64 respondents (62.7%) highlighting it as a key consideration, indicating that cultural relevance played a significant role in the decision-making process. The innovation and uniqueness were noted by 63 respondents (61.8%), reflecting an appreciation for the creative and distinctive qualities of the designs. Apparel aesthetic closely followed, with 62 respondents (60.8%), while functionality and practicality were cited by 42 respondents (41.2%), indicating that the wearability and practicality of the costume were essential to some participants. Material and craftsmanship were mentioned by 40 respondents (39.2%), which shows they are less frequent than other factors.

The evaluation of the aesthetics theme of the designs revealed generally positive feedback from participants, as shown in Table 4.6. The mean scores for all questions ranged from 4.17 to 4.25, and the standard deviations for each question were relatively low, ranging from 0.891 to 1.060, indicating that most participants found the designs visually appealing. For Q3, “the designs are visually appealing” received a mean score of 4.23, suggesting that respondents largely agreed. Similarly, the choice of colors and patterns, with a mean of 4.19 (S.D. = 1.060), showed participants felt the colors and patterns enhanced the overall visual appeal. The unique texture and natural look of the bamboo and beads also received a mean of 4.25, indicating strong agreement that these elements added distinctiveness to the designs. Additionally, Q6 “the designs contain modern elements while retaining their uniqueness” was recognized, with a mean score of 4.17 (S.D.=0.891), showing that the majority of respondents appreciated the balance between contemporary and traditional.

4.4.2.3 Functionality Theme

The functionality was the second theme in the core study question in the survey, which gathered opinions about the usability of the costume designs, as shown in Table 4.6,

from question 7 to question 9. The functionality attributed to the designs received positive feedback from respondents. Q7, which asked “the designs combine both style and usability,” scored 3.90 for mean, indicating that most respondents generally agreed that the designs successfully integrated aesthetic appeal with practical use. The mean of Q8 was 3.89, while the standard deviation (S.D.) was 0.932, indicating a similar level of agreement among participants regarding the ease of use of the designs. The practicality of the design in Q9, which received the highest mean score of 4.00, shows that respondents found the designs to be generally practical and functional. Overall, the responses reflected a positive functionality of the designs.

4.4.2.4 Quality and Price Theme

Quality and price were the third theme in the survey, which aimed to collect the acceptance of craftsmanship, quality, and price. Respondents demonstrated a balance between price sensitivity and appreciation for the quality and craftsmanship of the bamboo beading costume designs, as shown in Table 4.6, from question 10 to question 13. The Q10, “the slight variations in size and color are acceptable as they are natural materials and seeds, giving each piece a unique character,” recorded a 4.17 mean score with an S.D. of 1.025. This indicated a generally positive acceptance of slight differences in natural materials and seeds in costume designs. It was worth buying if the quality and price of the design are reasonable, as collected by Q11, with a standard deviation of 1.002, demonstrating strong agreement among respondents. Q12, “a higher price is acceptable if the design is handmade and supports sustainable and cultural craftsmanship,” received the highest mean score of 4.23 with an S.D. of 0.953. This reflected a strong endorsement of supporting handmade, sustainable, and culturally meaningful products, with a relatively low variation in opinions. The last question regarding price and quality was Q13, “The designs and quality offer good

value for money,” which has a mean score of 4.12 with the lowest standard deviation of 0.904, indicating consistent positive feedback. This suggested that most respondents expected reasonable pricing of handcrafted cultural items and were willing to pay more for authentic, sustainable craftsmanship.

4.4.2.5 Cultural Value Theme

Lastly, the cultural value of the costume designs was collected from questions 14 to 17. Table 4.6 showed that the cultural significance of the costume designs received strong recognition across the survey results. The mean score for Q14, “the use of bamboo beads in the design reflects cultural traditions (*Marik Empang*) creatively and effectively,” was 3.62 with an S.D. of 0.890, indicating a generally favorable response with some variation in opinions. In Q15, “wearing these designs makes me feel more connected to *Marik Empang* culture,” recorded S.D. of 0.837. In contrast, Q16, which asked whether “the cultural features in this design feel real and authentic,” received a higher S.D. of 0.909, reflecting a high level of agreement with slightly broader variability. Lastly, Q17, “these designs help in preserving and promoting the cultural identity of *Marik Empang*,” received the highest mean score of 4.22 and an S.D. of 0.991. Overall, the data showed a strong and positive perception of the cultural authenticity, effectiveness, and significance of the designs.

Table 4.5. Core study questions

Question	Respond	Frequency (N=102)	Percentage (%)
Q1. Which costume design do you like the most?	Female	80	78.4%
	Male	22	21.6%
Q2. What is the reason you chose that costume as your favorite?	Aesthetic Appeal	62	60.8%
	Cultural Significance	64	62.7%
	Functionality and practicality	42	41.2%
	Material and Craftsmanship	40	39.2%
	Innovation and Uniqueness	63	61.8%

Table 4.6. Descriptive analysis of data

Question	M	S.D.
Q3 The designs are visually appealing.	4.23	1.001
Q4 The choice of colors and patterns enhances the overall visual appeal.	4.19	1.060
Q5 The textures and natural looks of bamboo and other natural beads add uniqueness to the designs.	4.25	0.961
Q6 The designs contain modern elements while retaining their uniqueness.	4.17	0.891
Q7 The designs combine both style and usability.	3.90	0.928
Q8 The designs are easy to use.	3.89	0.932
Q9 The designs are practical.	4.00	0.912
Q10 The slight variations in size and color are acceptable as they are natural materials and seeds, giving each piece a unique character.	4.17	1.025
Q11 If the quality is good and the price of this design is reasonable, then it is worth buying.	4.13	1.002
Q12 A higher price is acceptable if the design is handmade and supports sustainable and cultural craftsmanship.	4.23	0.953
Q13 The designs and quality offer good value for money.	4.12	0.904
Q14 The use of bamboo beads in the design reflects cultural traditions (<i>Marik Empang</i>) creatively and effectively.	3.62	0.890
Q15 Wearing these designs makes me feel more connected to the <i>Marik Empang</i> culture.	3.85	0.837
Q16 The cultural features in this design feel authentic.	4.08	0.909
Q17 These designs help preserve and promote the cultural identity of <i>Marik Empang</i> .	4.22	0.991

As a result of the survey, most consumers showed strong interest in contemporary costume designs that utilize raw bamboo, particularly when these designs successfully balance aesthetic appeal, functionality, cultural significance, and quality craftsmanship at reasonable price points. Furthermore, the showcase of the contemporary costume designs for both female and male at the *Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0* and *Booth 2025* received positive feedback and wide acceptance from the public, as shown in Figure 4.29. It also raised public awareness of the importance of practicing sustainability through the utilization of natural and eco-friendly materials.



Figure 4.29: Final costume designs exhibited in Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0 and Booth 2025



Figure 4.30: Public showing interest in the costume

4.5 Summary of Chapter

This chapter documents the data collected from the three research objectives. The research objective one, which aimed to identify the most suitable types of bamboo for making beads, was achieved with the experimental results demonstrating that Bamboo B and Bamboo C possessed the most desirable qualities, including uniform inner hole size, smooth texture, durability, and visual appeal. As supported by the findings of Chung and Wang (2017), SEM analysis results further validated and confirmed that maintaining the bamboo epidermis may enhance the performance and longevity of the bamboo samples. These findings highlight the potential of bamboo beads when compared with other sustainable materials reviewed in Chapter 2. Interviews with artisans for research objective two collected valuable knowledge of *Marik Empang* beadwork, including the motif meanings, beading materials, tools, and techniques. The combination of bamboo beads, adlay, windmill palm seeds, and red beads with stringing materials reimagine the *Marik Empang* beadwork in a contemporary way. The research objective three is focusing on the design process, to develop contemporary costume designs using bamboo-crafted beads that preserve the cultural identity and visual coherence of *Marik Empang* patterns. The design process includes finalization of the beading samples, sketching, pattern drafting, toile making, and fitting. Additionally, the arrangement of beads and stringing materials was fitted before stitching them on the final fabric patterns to ensure the perfect look. 102 survey respondents gave the final costume designs positive feedback, validating that the final costume designs show aesthetic, functionality, cultural value, and practical quality. The positive feedback and acceptance of the costume designs are collected by the exhibition in the Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0 and Booth 2025, in Aeon Shopping Mall, Kuching, Sarawak. This shows that the final contemporary costume designs

successfully reimagine the *Marik Empang* patterns with a combination of bamboo and natural seed beads in an innovative and sustainable way.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Introduction

This chapter presents an in-depth discussion of the research findings aligned with each objective, a discussion of the findings from experimental tests, interviews, and survey data, offers recommendations, identifies limitations, and draws a conclusion of the study. The debate was structured to address the research objectives of this study by focusing on the characteristics of bamboo, treatment methods, and dyeing results shown by SEM analysis. The chapter also included the results of the water soaking test conducted on various stringing materials to determine the most appropriate stringing option for beading applications on costumes. The experimental findings were further supported by insights from interviews with local artisans, who provided practical perspectives on material selection, beading patterns, beading techniques, and methods, as well as the survey, providing solid evidence.

5.2 Discussion on Research Objective One: To identify the most suitable types of raw bamboo materials for crafting sustainable beads inspired by *Marik Empang* patterns in Sarawak.

To address research question one, the researcher focused on analyzing the physical and surface characteristics of four bamboo type samples prepared under different conditions. The samples were tested with and without their external epidermis, treated and untreated with either alum or limestone, and dyed using both natural and chemical dyes before and after treatment. Additionally, the samples were assessed with and without polishing. These variables were examined to evaluate their effects on the bamboo's inner hole size, surface properties, dye absorption ability, and the quality of the cut surface. The findings provided

insights into the best types of bamboo and the most suitable preparation techniques for producing consistent, high-quality bamboo beads for beading applications.

Bamboo A, B, and C clearly showed their inner hole size in the SEM analysis results. The Bamboo A, with the smallest and inconsistent inner hole size, showed its unsuitability for making beads. The irregular diameter and smallest hole size of Bamboo A make it challenging for beading, as threading materials through the bamboo may be difficult and time-consuming. In contrast, Bamboo B samples showed the largest and most uniform inner hole size among the three samples. Its most significant, consistent, and uniform properties ensured better structural integrity, making it suitable for fine decorative crafting and more robust structural designs in sustainable beads and other artistic applications. Bamboo C demonstrated a medium and consistent inner hole size, making it a suitable choice for bead applications. It strikes a balance between strength and flexibility, serving well in medium-sized beads or less intricate decorative pieces. Bamboo D, which was collected from the culm, is not suitable for making small beads, as the inner hole size was too large for any common stringing materials. This analysis demonstrated that Bamboo A was unsuitable for making bamboo beads due to its small and inconsistent inner hole size, hindering stringing, and its practicality for bead-making. The absence of Bamboo A's inner hole resulted in material waste during production compared to Bamboo B and Bamboo C, even though the collecting length was the same. In contrast, Bamboo B was the most suitable option for making bamboo beads due to its large and uniform inner hole size, which facilitates easy threading and enhances its efficiency in crafting applications. With its smaller inner hole size, Bamboo C presented more challenges when stringing thicker materials or threads, making it less versatile than Bamboo B; however, it was considered a second choice or a

suitable combination of beads. The bamboo culms collected were not considered a suitable option for bead application.

Through the analysis of SEM, most of the bamboo types showed the absence of surface cracks and residues, indicating that alum facilitated a more controlled drying and curing process, likely reducing internal stress within the bamboo material. This result showed that alum successfully contributed to maintaining the natural texture and appearance of bamboo beads, which is essential in crafts, where both visual appeal and surface smoothness are critical for stringing and aligning beads. Additionally, the bamboo beads exhibited poor dye absorption both before and after treatment with or without alum and limestone. The bamboo samples resulted in uneven color distribution with both natural and chemical dyes. This inconsistency compromised the visual harmony needed in beading, where uniform appearance played a key role in consumer appeal.

Therefore, the researcher decided not to proceed with further dye testing and retained the natural appearance of bamboo to maintain consistency and aesthetic quality in the final product. Hence, alum-treated bamboo demonstrated superior performance for applications requiring precision and aesthetics. Its smooth surface and resistance to fungal growth ensured its longevity, making it an excellent choice for beading designs. On the other hand, the rough and uneven result of limestone-treated bamboo was not suitable for this research application. The findings highlighted alum treatment as a sustainable and culturally significant solution for integrating traditional craftsmanship with contemporary fashion, particularly in intricate beading and sustainable design.

The fungal growth between the alum-treated surface and the untreated surface shows distinct differences. The alum-treated bamboo showed no fungal structures, while the fungal spores and mould were distinctly visible on untreated bamboo surfaces, regardless of the

type of bamboo. This result suggested that the untreated bamboo surface provided a conducive environment for fungal spores to grow and spread. The alum-treated bamboo samples demonstrated their capability in preventing fungal growth and creating a protective barrier, making the surface unfriendly for fungal activity. The bamboo samples without external epidermis lost their natural appearance and became uneven as a result of uneven strength when the external epidermis was removed. Even the bamboo samples without external epidermis underwent alum treatment, but the results showed that the color of the samples became dull and darkened. It was believed that the samples lost the protection layer against moisture. This finding was consistent with the results of other researchers, who have demonstrated that the outer layer of bamboo is a glossy, smooth, dense, and flexible layer composed of silica cells and stomata that serve as water barriers. The impacts of removing bamboo epidermis showed that it decreased the mechanical qualities of bamboo, as the probability of water absorption increased, which was mentioned by Chung and Wang (2017). This process may reduce the likelihood of a termite or ant attack, but it also reduces the visual attractiveness that was essential to beadwork. Additionally, the removal of the epidermis increased the water absorption rate, which directly led to the bamboo's rotting. Therefore, the maintenance of the epidermis of bamboo was reasonable and beneficial for the stability of bamboo and its lifespan. As a result, maintaining the epidermis may improve the performance and stability of the treated bamboo. Unlike untreated bamboo, which fosters conditions favorable for fungal proliferation, alum-treated bamboo maintains its structural integrity and smooth surface, ensuring its suitability for acceptable applications such as bead-making. These findings demonstrated the effectiveness of alum in enhancing the longevity of bamboo by reducing fungal growth, while emphasizing the importance of retaining the epidermis for optimal performance.

It is clear from the SEM analysis that the dyeing process did not result in visible color differences on the bamboo surface. The visual effect of dyeing on bamboo was inconsistent, with uneven absorption and coloration across all tested samples. The issue occurred regardless of the type of dye, whether natural or chemical, and was observed in untreated bamboo, as well as in alum-treated and limestone-treated bamboo. The dye did not absorb evenly into the surface, creating patches of varying intensity and tone. Such inconsistencies in appearance reduced the aesthetic value of the bamboo, especially in applications such as beading, where visual harmony was crucial. The non-uniform finish indicated that the bamboo surface, even after treatment, may still possess irregularities that affect dye absorption. These findings demonstrated that three types of bamboo were unsuitable for dyeing. They suggested that a dye solution with an additional agent may achieve a more visually appealing outcome in fine craft applications.

Moreover, the cutting tools played a crucial role in crafting delicate bamboo beads. The mini electric grinder produced the cleanest and most refined cross-section among the tools. Its high-speed rotation and precision cutting capabilities resulted in minimal fiber tearing and a smooth, polished surface. This clean finish supported efficient bead-making by ensuring consistency in the bamboo's inner hole size and smooth contact surfaces, reducing the risk of splintering or structural weakness during stringing. In contrast, the garden cutter, which operated manually and was commonly used for trimming bamboo branches, demonstrated moderate performance. While it was effective for rough cuts or removing small segments, it lacked the precision required for bead preparation. The garden cutter samples showed uneven surfaces and slight tearing along the fibers, which can cause rough edges and inconsistencies in bead shape. Although it was suitable for preliminary cutting or branch separation, it was not ideal for finishing cuts where uniformity is essential. The wood

cutting machine, despite being designed for harder materials, performed the poorest in bamboo cutting. It caused excessive fiber tearing, showing irregular, broken edges not only in the cross-section but also significant surface disruption. The natural fibers of the bamboo were often crushed or displaced, making the bamboo unsuitable for detailed craftwork. This tool compromised both the aesthetic quality and structural integrity of bamboo, rendering it ineffective for bead-making applications. With the comparisons, it was clear that the mini electric grinder was the most appropriate tool for precise and clean bamboo cutting based on SEM evidence. However, polishing was the final step to ensure that the bamboo beads were perfectly smooth, safe to handle, and suitable for bead-making applications.

The research determined that Bamboo B and C were the best bamboo types for making bamboo beads, with fungus protection and durability provided by alum treatment and outer skin maintenance. The best cutting tool for creating precise and smooth bamboo bead cross-sections proved to be the mini electrical grinder. These findings stand in contrast with previous studies that emphasized different outcomes, such as limestone treatment being effective for bamboo treatment, and removing epidermis, increasing chemical dye absorption of the bamboo samples. The variables identified in research question one are clearly illustrated in the framework presented in Figure 5.1, while the conceptual framework for research question one is in Figure 5.2.

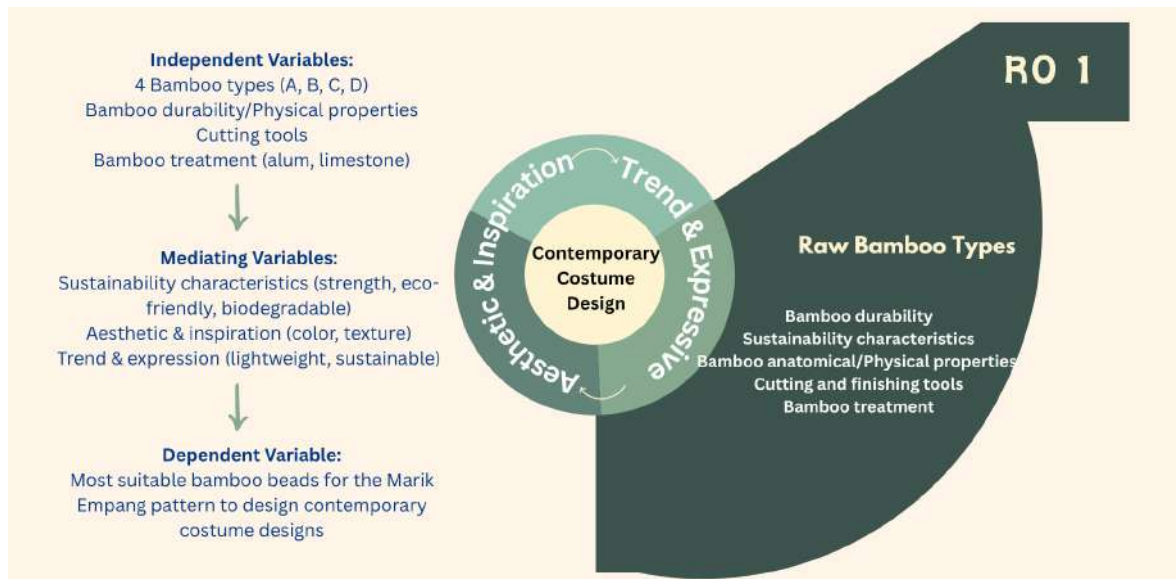


Figure 5.1: Variables for research objective one

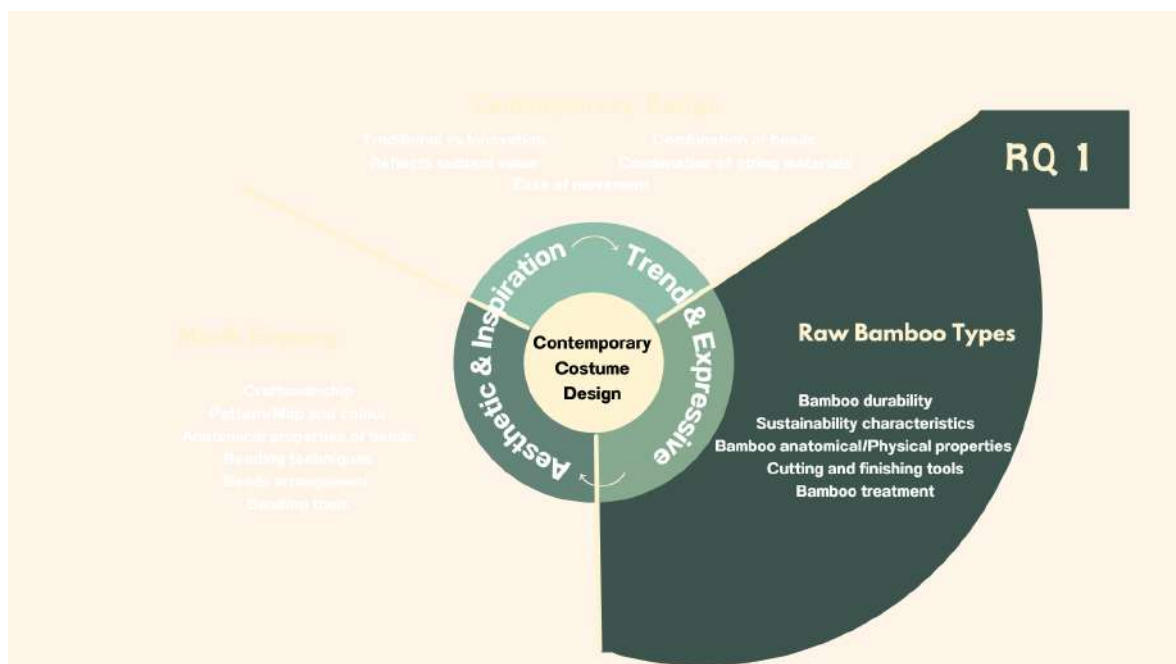


Figure 5.2: Conceptual framework for research objective one

5.3 Discussion on Research Objective Two: To examine *Marik Empang* beadwork patterns for their adaptability in contemporary sustainable costume design.

The interviews conducted with Madam Connie Kam and Madam Ina Sendar provided valuable insights into the traditional *Marik Empang* beadwork, offering the

researcher meaningful references for further exploration and experimentation. Both artisans shared intricate knowledge of beading patterns, techniques, and materials that were culturally significant and practically applicable.

Madam Connie showcased her expertise in traditional *Iban Marik Empang* patterns, often working with motifs that emphasize symmetrical structure and rich cultural colors such as red, yellow, white, and green. She built her beadwork beginning with a neckline thread, followed by structured horizontal threading, adding beads one by one. Her approach incorporated detailed attention to color combinations and neatness, enhancing the aesthetic and cultural value of her pieces. Madam Ina introduced the researcher to some popular traditional motifs, such as the eggplant flower, squid, and dragon patterns. Rather than mapping out patterns formally, she relied on visual references and her experience to replicate designs, which highlighted the intuitive and practiced nature of her beading skills.

In terms of materials and tools, Madam Connie used Toho beads and Angel brand cotton thread for her work, finishing the ends with paper glue for a cleaner result. However, Madam Ina emphasized the superiority of nylon twine for bead weaving, especially under humid conditions. She explained that nylon twine was much more durable and resistant to sweat, a point highlighted in her customer feedback, which noted that cotton thread breaks easily and is less suitable for long-lasting products. Madam Ina used beeswax to treat the threads, further reinforcing the quality and longevity of her beaded creations. Madam Ina, who has worked with natural materials such as Job's tears and imported wood beads, believed that bamboo beads could be integrated successfully. Their openness offered encouragement and validated the researcher's direction, providing support and space to carry out further experiments with bamboo as an alternative sustainable material. This positive

reception hinted at the potential for innovation and creative development in future beadwork practices. Although none of the artisans had prior experience using bamboo beads, all of them expressed positive interest and acceptance, offering encouragement for future experimentation. Madam Connie believed that bamboo beads could be integrated using basic beading methods and might work well in accessories, such as bracelets. Madam Ina, drawing on her experiences with Job's tears and wooden beads, also affirmed the possibility of using bamboo beads effectively.

Together, these insights provided the researcher with strong cultural and practical validation to pursue the development of bamboo beads, while also affirming that traditional artisans were receptive to innovative uses of natural materials. This support strengthened the foundation for further experimental work and opened up new creative possibilities for integrating bamboo into contemporary beadwork.

Building upon the insights gathered from the interviews, the researcher adopted a thoughtful approach by incorporating adlay (Job's tears) as suggested by Madam Ina. Recognizing the symbolic and aesthetic value of natural materials, the researcher combined adlay beads with other natural seed beads, including windmill palm seeds and red seed beads, alongside undyed bamboo beads to achieve a harmonious and culturally meaningful palette. This creative decision compensated for the natural light tone of bamboo, which remained uncolored in the absence of dye treatment. By using the natural hues of bamboo and various seeds, the researcher was able to reflect the traditional color scheme of *Marik Empang*, which prominently features red, black, yellow, and white colors deeply embedded in *Iban* cultural identity and beadwork traditions. The red tone, represented by red seeds, white from windmill palm seeds, black from adlay seeds, and the yellowish hue of bamboo, added

balance to the composition. This material combination not only preserved the authenticity of *Marik Empang* symbolism but also introduced sustainability and textural contrast in the design. This integration demonstrated the researcher's commitment to sustainable practices while maintaining cultural aesthetics. It reflected the creativity in beadwork, supported by the openness of the interviewees to new materials, such as bamboo. It marked a meaningful step forward in reimagining traditional crafts through sustainable innovation.

The water soaking test results demonstrated that copper wire, cotton thread, and nylon twine withstand prolonged exposure to water without significant degradation. This confirmed their potential for use in *Marik Empang* beadwork or other traditional crafts that may be subjected to environmental humidity or moisture. The nylon twine exhibited excellent water resistance and retained its durability throughout the test. There were no visible changes in its structure, color, or strength, affirming its reliability for both indoor and outdoor applications, especially in humid or wet environments. The nylon twine stood out as a highly durable and water-resistant option, commonly favored for its flexibility and strength. It was suitable for outdoor displays or costume use where resistance to mould and mildew was essential. Although cotton was an organic material that could absorb water, it showed no signs of mould growth, softening, or weakening. The structure remained stable, with no fraying or breakage. However, the cotton thread did become slightly fuzzy in texture after soaking, becoming more absorbent; yet, it still performed well and retained its structural integrity. It was more suitable for indoor applications or designs where traditional aesthetics and natural materials were prioritized. The copper wires remained completely intact with no signs of rust or corrosion, as expected due to their natural resistance to water. It maintained its original flexibility and metallic strength throughout the 7-day soaking period. As the copper wires were known for their resilience and minimal stretch, they can benefit complex

or geometric *Marik Empang* patterns by offering a strong and rigid structure. Its consistent performance after water exposure added value for applications that required both strength and a metallic aesthetic.

As a result, no material showed any detrimental effects from water soaking tests, suggesting that the choice of stringing material can be made based on the desired functionality, aesthetic appeal, and cultural or contextual preferences. This freedom allowed the researcher to tailor the material choices to suit specific project goals.

The interview sessions showed that the patterns, colors, and techniques used in making *Marik Empang* had significant cultural importance. The *Marik Empang* patterns with meanings are reimaged and arranged with the combination of natural beads to represent the essence of the beadwork. The water soaking test demonstrated that copper wire, cotton, and nylon all had potential based on design requirements. The variables identified in research question two are clearly illustrated in the framework presented in Figure 5.3, while the conceptual framework for research question two is in Figure 5.4.

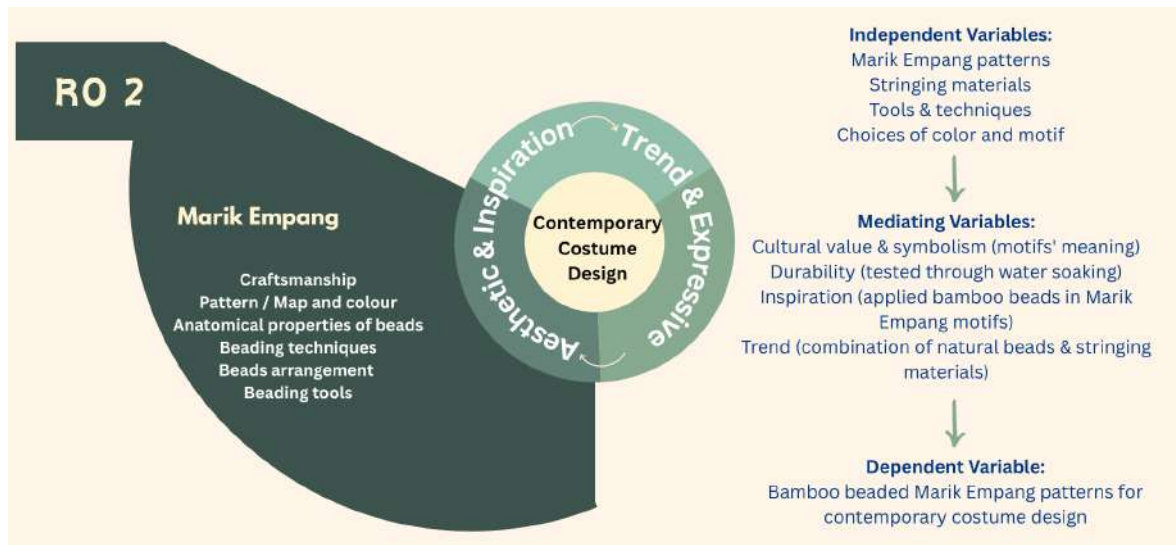


Figure 5.3: Variables for research objective two

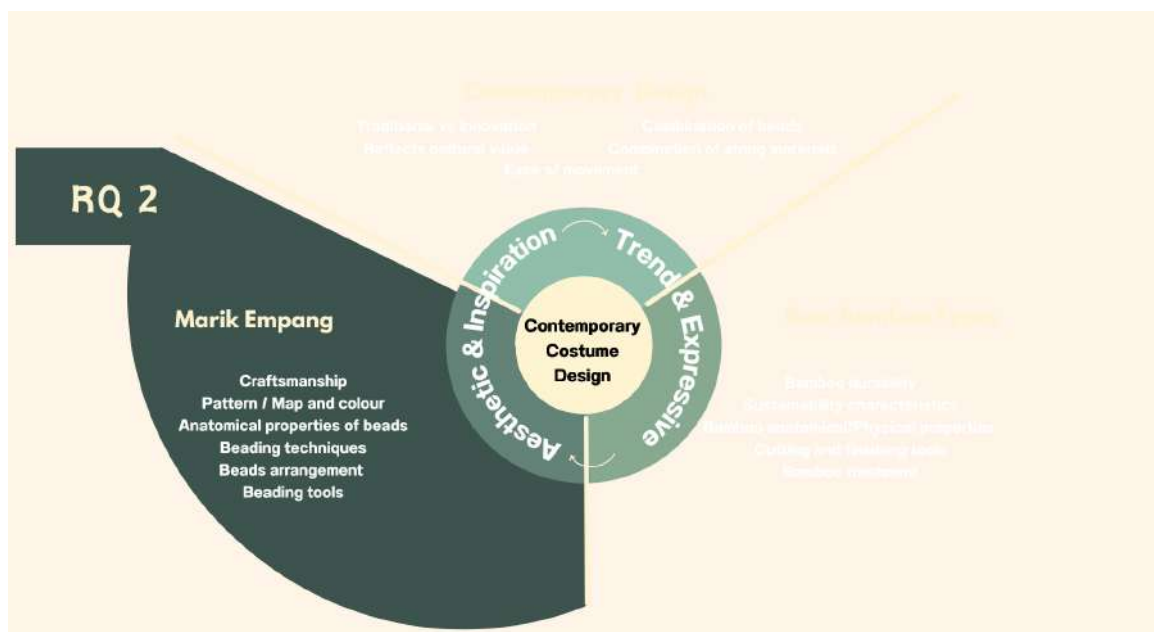


Figure 5.4: Conceptual framework for research objective two

5.4 Discussion on Research Objective Three: To develop contemporary costume designs using bamboo-crafted beads that preserve the cultural identity and visual coherence of *Marik Empang* patterns.

The process of creating the final costume designs began with sketching and drafting the initial design patterns for both the male and female costumes. These sketch patterns were then used to create a toile using calico fabric. The male top and bottom toile fitted the

mannequin perfectly, while the female top required adjustments, especially around the collar area, to achieve a fit neckline. Corrections were made directly on the mannequin to improve the pattern. The revised calico, which resulted in a good fit on the mannequin, was then transferred to the velvet fabric. The patterns were finally cut with added seam allowance from the velvet fabric. After preparing the velvet fabric, bamboo beads were carefully sewn by hand onto the surface, following the beading design inspired by *Marik Empang* patterns. This beading stage was very detailed and required patience and precision. Then, the linen fabric was attached to the inside of the costume to give it structure and comfort. The costume was then neatly finished, including hemming, pressing, and final fitting on the mannequin to ensure everything was in place.

The final process was gathering reviews and feedback from the audience on the final costumes with an online survey. The survey was a blast and involved 102 participants, focusing on five key aspects: aesthetics, functionality, quality, price, and cultural value. The majority of responses were positive. A survey analysis of contemporary bamboo costume designs revealed that demographic data showed a predominance of younger adults aged 21-30 (56%), with female respondents comprising 65%. The Chinese and *Iban* represented 38% and 23%, respectively, as the largest ethnic groups among participants, most of whom were students (42%) with no prior experience in fashion (79%). Among the 102 respondents, 61 were recorded as having no prior knowledge of *Marik Empang*. Consequently, the findings relating to the cultural value aspect are primarily based on the perceptions of the general public, rather than individuals with specific cultural knowledge. As the survey was targeted at a general audience rather than experts in *Marik Empang* or respondents with specific expertise in *Iban* cultural traditions, the responses reflect general impressions rather than culturally rooted perspectives.

The aesthetic appeal category received exceptional ratings, with 76% of respondents preferring Design 1 (Female), 69% citing visual appeal as their primary reason for selection, and 88% specifically appreciating the natural textures and organic qualities of the bamboo materials used in the designs. Regarding functionality, 82% of participants highly rated the combination of style and usability, 80% considered the designs practical for everyday use, and 40% specifically selected functionality as a key factor in their preference, demonstrating that the pieces successfully balanced decorative elements with wearability. Cultural value metrics showed 58% of respondents valued the cultural significance of the designs, 86% believed they effectively preserved cultural identity, and 62% could correctly identify the traditional items by name, indicating strong cultural recognition and appreciation. Accordingly, the cultural value findings in this research represent the perceptions of the general public rather than the evaluations of cultural specialists. Despite this limitation, the findings are valuable as they provide insight into the current level of public awareness of and recognition for *Marik Empang*. This underscores and aligns the urgency of preserving this cultural art piece and highlights its potential for wider promotion to enhance cultural visibility and heritage. In the quality and price assessment, 90% of participants accepted variations in the natural materials as adding unique character, 80% agreed that good quality at reasonable prices made the designs worth purchasing, and 86% were willing to pay premium prices for handmade items that supported sustainable cultural craftsmanship, showing a strong perceived value proposition despite price sensitivity.

Respondents acknowledged the effort to maintain cultural authenticity while introducing motifs with new materials. Many showed positive feedback on the designs inspired by *Marik Empang* patterns, which were adapted to suit contemporary and sustainable materials. Many participants agreed that the final designs remained visually and

symbolically rooted in traditional patterns while adapting to current trends, aesthetic preferences, and the use of sustainable materials, such as bamboo beads. This adaptation served as a design innovation and a meaningful step towards the revitalization and evolution of heritage craft in contemporary designs.

The survey conclusively demonstrated strong market appreciation for contemporary bamboo costume designs that successfully blend traditional cultural elements with contemporary aesthetics, particularly among younger female consumers who value both the cultural significance and practical wearability of these pieces. The most significant finding was that almost all participants agreed that the costume effectively represented the culture of Sarawak. Both male and female costume designs were received favourably by the general audience in the Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0 and Booth 2025. The costumes successfully blended traditional *Marik Empang* patterns with contemporary costume innovation, while reflecting aesthetics, functionality, quality, and cultural significance. As the costumes demonstrated the potential of bamboo beads as sustainable materials in contemporary fashion, they also raised public awareness of the value of environmental responsibility and cultural preservation through the exhibition. They agreed that the designs helped to promote the cultural *Marik Empang* in a contemporary way while protecting traditional crafts and bringing new ideas into fashion. Overall, the results showed that bamboo was an excellent material in fashion, not only for the utilization of eco-friendly materials, but also helped to preserve the cultural heritage of *Marik Empang* beading patterns. The variables identified in research question three are clearly illustrated in the framework presented in Figure 5.5, while the conceptual framework for research question three is in Figure 5.6.

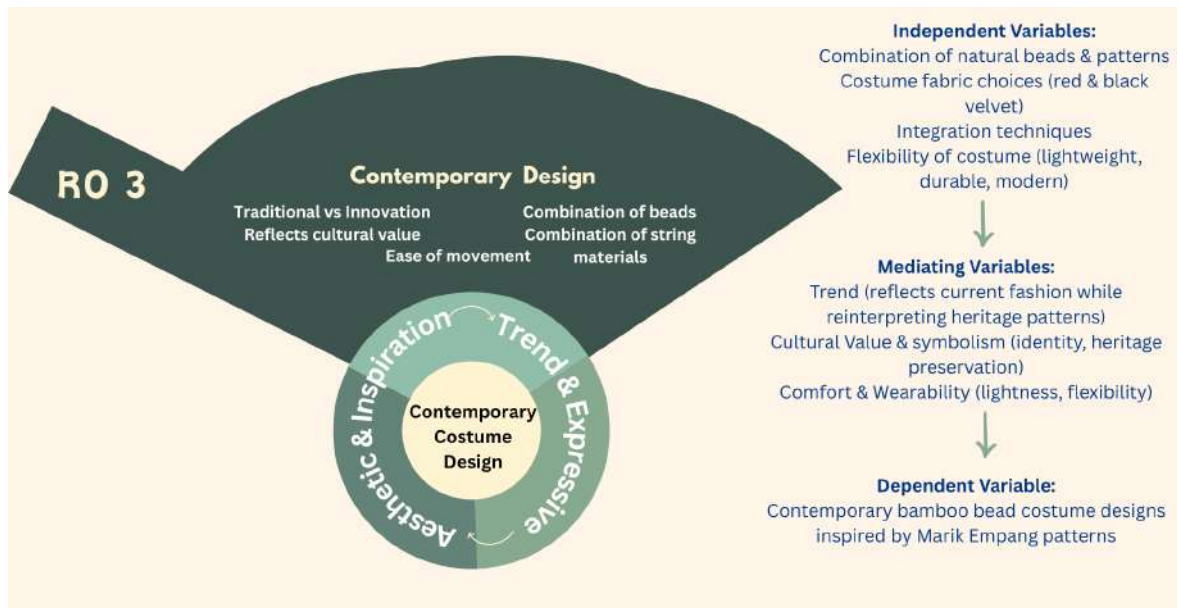


Figure 5.5: Variables for research objective three

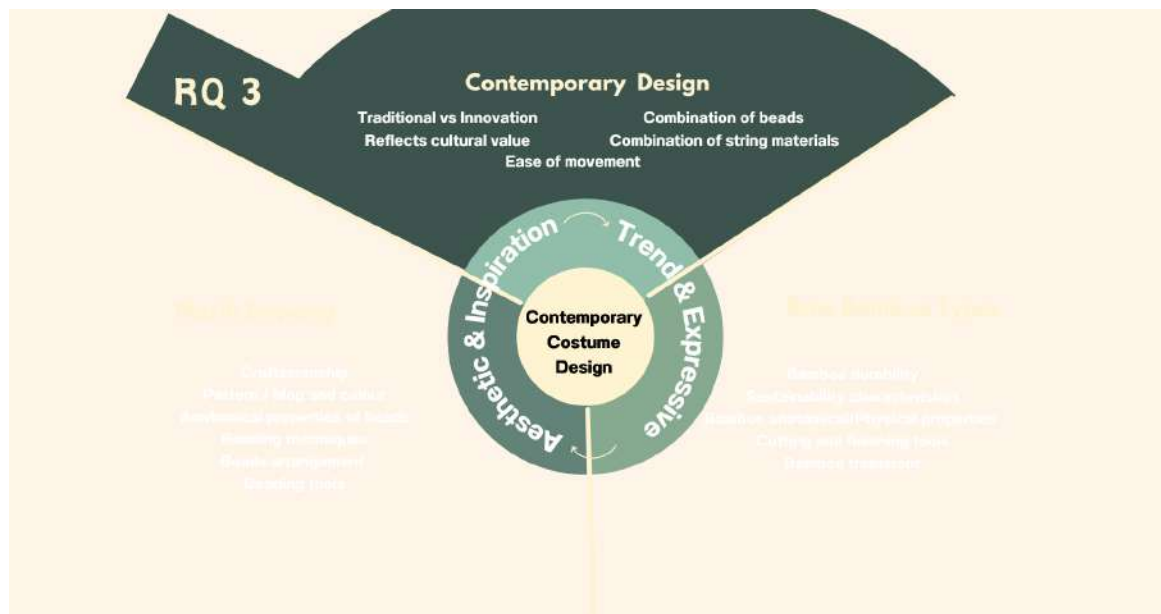


Figure 5.6: Conceptual framework for research objective three

The final conceptual frame integrated the three main themes, including their variables in raw bamboo types, *Marik Empang*, and contemporary design, as shown in Figure 5.4. Raw bamboo, as the central theme, focused on the functional characteristics of bamboo as a material used for beading. Bamboo was notable for its flexibility, durability,

and sustainability, which were essential qualities in the creation of bamboo beads and elements for costume design. The inner hole size of the bamboo was a crucial factor as it affected the bead in the stringing process. The smaller inner holes were challenging when the string thread needed to pass through the bamboo hole multiple times. The bigger inner holes of bamboo eased the process of stringing and provided greater support for the product. Cutting tools for bamboo were also important, as the suitable cutting tools for cutting different parts of bamboo affected the finishing of the cross-section or cutting surface of the bamboo. Besides, the treatment process involving alum and limestone agents showed distinct effects, ensuring that the bamboo retained its durability and color while preserving the bamboo. Both natural and chemical dyeing methods applied to bamboo hurt the final aesthetic appeal of the beads. The bamboo beads were safe to hold or use after the finishing process, as they ensured the cross-section of the bamboo beads was smooth and clean.

Secondly, *Marik Empang* played a central role in this framework as it served as one of the sources of inspiration for this research design. The patterns, motifs, and colors of *Marik Empang* served as a reference point for the aesthetic direction of contemporary costume designs. The red and black colors were not only visually significant but also carried cultural meanings in *Iban* traditions. The beading techniques of *Marik Empang* were central to the research, including the types, quality, size, color, and materials used for stringing, as well as the tools needed to create *Marik Empang*. The quality of the beads ensured that the product's quality and craftsmanship remained high, as it significantly impacted the overall look and durability of the design. The size of the beads and their arrangement were carefully considered in designing a balanced and visually appealing costume. At the same time, the stringing materials and finishing tools ensured that the beads were securely strung, resulting in a contemporary look. Beading tools and beading techniques, such as the threading method

and bead attachment, directly influenced the visual integrity and longevity of the final product. Innovations like new natural beads and stringing materials also reflected how traditional patterns were being adapted and refined to suit contemporary and sustainable use.

Contemporary costume design can be defined as the design elements that emphasize combining tradition with innovation. This included integrating timeless colors that reflected both cultural significance and modern style preferences, as well as the green trend of using sustainable and natural materials, such as bamboo and Job's tears, which contributed to the overall eco-consciousness of the design. The balance between traditional and contemporary is achieved where sustainable and contemporary materials for contemporary costume designs replace the beads of *Marik Empang* patterns. The integration of velvet fabric with bamboo beads and other natural beads provided excellent support, and the lightweight comfort enhanced the wearer's ease of movement. Moreover, combining beads and stringing materials created a visually appealing, functional design that retains its cultural authenticity. The quality of craftsmanship ensured that the final product was not only visually aesthetic but also durable, practical, and reflected artistic value. The variables associated with the three themes are shown in Figure 5.4.

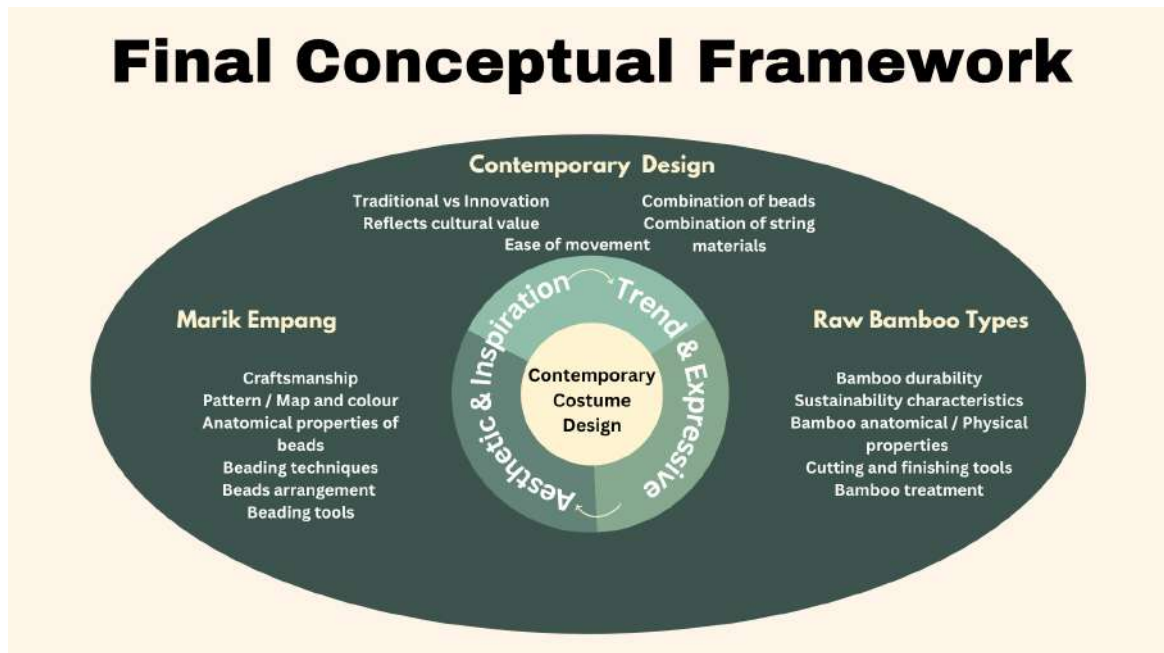


Figure 5.7: Final conceptual framework

5.5 Recommendation

Several recommendations are made in these research findings to direct future advancements in practice, policy, and academic research. These suggestions are intended to assist the incorporation of bamboo into contemporary fashion and textile design, increase its position as a sustainable material, and improve traditional craft methods.

5.5.1 Recommendation for Practical

Local costume designers and artisans are encouraged to employ bamboo beads in both costume and textile designs, since they offer environmentally friendly alternatives. The use of mechanical tools or machines for creating unique bamboo bead designs would result in higher uniformity and variety while increasing the functionality and aesthetic appeal. Bamboo beads may be used in accessories, home decor, and textiles besides costumes, allowing artisans to appeal to a broader market. Designers can also use eco-friendly dyeing

procedures, such as natural mordants and plant-based dyes, to increase color retention, maintain fabric durability, along promote environmental safety.

5.5.2 Recommendation for Policy

Besides, the government agencies and non-governmental organizations (NGOs) dedicated to cultural heritage should support actions that promote bamboo and other natural materials as sustainable alternatives in the fashion and textile sectors. This support may take the shape of financing and resources for artisan education initiatives that combine traditional knowledge with contemporary sustainable designs. Policies may also encourage collaboration among artisans, designers, and ecological to preserve the traditional legacy while meeting current demands. Public awareness campaigns and exhibitions may showcase bamboo-based crafts as both environmentally friendly and culturally important. Educational events and public workshops can also be beneficial in promoting knowledge transfer and preserving traditional crafts.

5.5.3 Recommendation for Academic

A greater variety of bamboo species must be investigated in future research, with an emphasis on structural characteristics including density, durability, mould resistance, and dye absorption capability. Further investigations might also examine how effectively bamboo beads work in commercial fabrics, evaluating their durability, appearance, and overall environmental effect in contrast to more common bead materials such as plastic and precious stone-based materials. Using bamboo beading techniques in contemporary fashion is another attractive way that might increase their relevance and appeal to audiences. Collaborations among academics in the fields of sustainability, art, design, and cultural studies might also be valuable in creating fresh ideas that combine contemporary sustainable products inspired by traditional handicraft.

5.6 Limitations

The study encountered several limitations in achieving the research objectives. First, the preparation of bamboo materials posed a challenge due to natural variations in size, shape, and texture, requiring a large sample pool for consistent bead-making. Second, the eco-dyeing experiments, though insightful, were limited by access to a variety of natural dye sources, mordants, and advanced testing methods. Third, the research was constrained by the limited availability of scholarly literature specifically focused on bamboo bead-making in the context of Sarawakian cultural crafts and sustainable fashion, which affected the depth of the comparative analysis and the availability of supporting references. The challenge was recruiting participants who were both willing and available to dedicate time to interviews. This was particularly relevant when communicating with the artisans, who often have demanding work schedules and may be hesitant to take time away from their craft or business.

In the stage of experiment, the researcher also experienced limitations during the experimental stage due to the unavailability of 3D scanning facilities at UNIMAS. The 3D scanner was intended for examining the structure and tension between the beads, to ensure the durability of the beadwork and its suitable arrangement. As an alternative, the researcher attempted to use an Einstar 3D scanner. However, this scanner also failed to capture the beading samples effectively as the beads were too small for the device to detect.

5.7 Conclusion

The findings and outcomes from the research and experimentation stages in developing a costume design inspired by *Marik Empang*, utilizing sustainable bamboo beads, involved several steps, including material testing, design development, and audience evaluation. First, the bamboo selection process identified Bamboo B and C as the most

suitable types for bead-making due to their larger and consistent inner hole size, which makes them easier to string into beads. In terms of treatment, alum-treated bamboo proved effective in preserving the bamboo and preventing decay, although it did not significantly improve dye absorption. Most importantly, it protected and prohibited bamboo from fungal growth. The use of a mini electrical grinder for cutting bamboo helped speed up the process; however, the cross-section needed to be polished with sandpaper to ensure a smooth and safe finish, thereby avoiding sharp or uneven edges.

The interviews with local artisans provided valuable insights into the patterns, methods, techniques, and tools used in making *Marik Empang*. These insights were helpful for the researcher to carry out experiments and testing for design development, especially the nylon twine, which is suggested by the interviewee for its strength, durability, and resistance to sweat. For stringing materials, the water-soaking test revealed that three out of the tested materials performed well and can be selected based on the design function or the researcher's preference. This flexibility supports creative freedom while ensuring strength and durability in the stringing process.

Additionally, the combination of bamboo beads with natural seed beads added a touch of creativity and variety to the costume design, while maintaining its traditional essence. The process of making prototypes includes drafting patterns, creating calico, fitting, and revising to bring the final costume designs to life. Finally, the designs were evaluated through a Google survey shared with the public. The audience provided positive feedback on four aspects: aesthetics, functionality, quality and price, and cultural value. These results gave the researcher more confidence in the design outcome and showed a clear market interest in contemporary costume designs that utilize bamboo, incorporating traditional cultural beading patterns. In conclusion, the research successfully demonstrated that bamboo

can be used as a sustainable and meaningful material in contemporary costume design and was validated in the exhibition through the positive feedback from the audience. The project not only preserved cultural heritage but also showed potential for future development in an eco-friendly fashion.

5.8 Summary of Chapter

This chapter explained the results of testing and developing costume designs using bamboo beads inspired by *Marik Empang*. Among the four bamboo types tested, Bamboo B and C were found to be the most suitable for making beads because they have larger inner holes. The interviews with local artisans provided valuable insights into traditional patterns, tools, and techniques, which aided the researcher in developing and testing the designs. The stringing materials used in the water soaking test performed well, and three types were suitable depending on design needs. Combining bamboo beads with natural seed beads added a creative touch to the overall look. The performances of all the stringing materials give the researcher the freedom to design a bamboo bead pattern based on functionality, visual appearance, and ease of movement for the costume design. The costume design process was carefully executed, with several revisions made to achieve the final result. Lastly, a Google survey blast to the public showed positive feedback on design, function, cultural value, quality, and price. This demonstrated that there was interest and support for sustainable fashion that combines traditional culture with contemporary design, which is validated in the exhibition of the final costume design in the Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0 and Booth 2025. In conclusion, the data collected showed that integrating traditional bamboo beads into contemporary costume design not only enhanced aesthetic value but also helped preserve and promote local culture. The positive survey responses affirmed that these costume designs had the potential to be

appreciated in both the cultural and contemporary fashion design industry. Ultimately, this research highlights the potential of contemporary costume design with an alternative sustainable material, bamboo, to preserve the cultural identity and visual coherence of *Marik Empang* patterns in an innovative way while contributing to both cultural continuity and sustainable contemporary fashion in Sarawak.

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Conference and Journal Publication

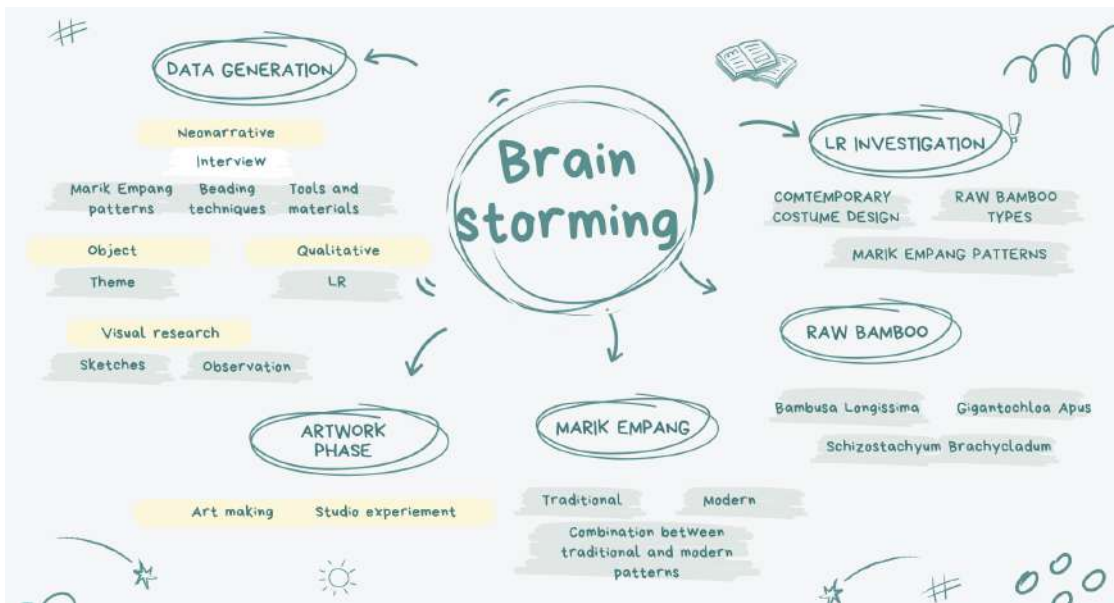
1. Chee, Q. H. K., & Jalil, M. H. (2024). Bamboo weaving and textile performance: Synthesizing research for sustainable solutions. *ICACA 7th Journal*. Selected to publish in the ICACA 7th Journal.
2. Chee, Q. H. K., & Jalil, M. H. (2025). Reimagining Indigenous Material Culture: Exploration and Utilizing Bamboo as a Sustainable Approach in Contemporary Costume Design – A Case Study on *Marik Empang* Beadwork. Published in Scopus-indexed journal - *Asian Journal of Arts and Culture*, 25(3), e287056. <https://doi.org/10.48048/ajac.2025.287056>
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APPENDICES

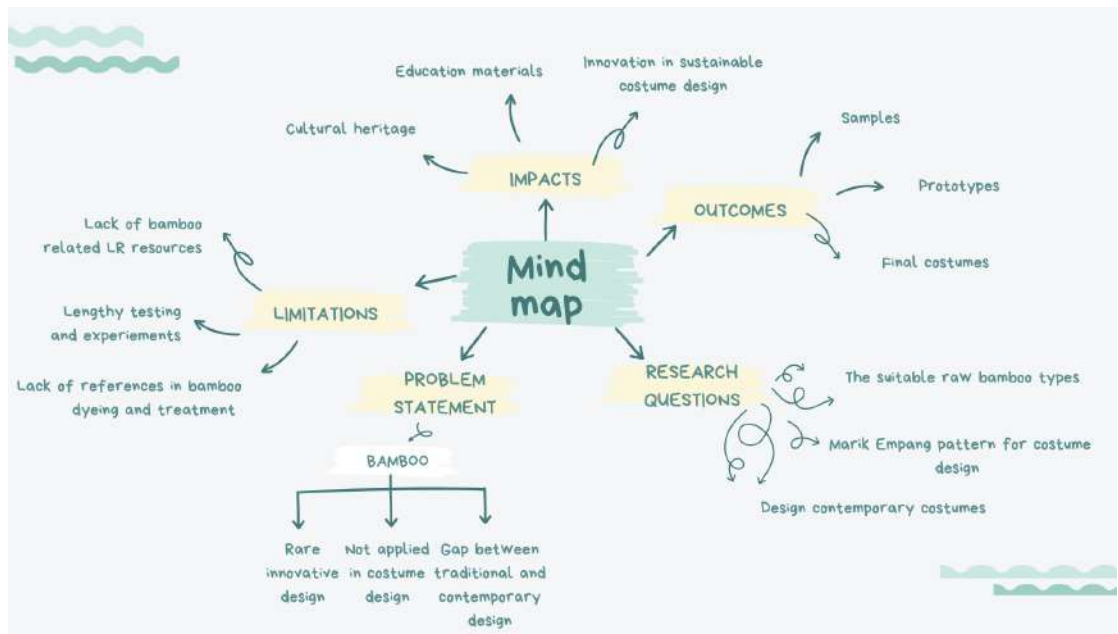
Appendix A: Interview Question List

1. Could you please provide some background information about yourself and your journey in bead weaving? (Name, age, experience)
2. Are you familiar with any hand weaving or hand techniques in beadwork? If so, could you elaborate on them?
3. What materials are typically required for bead weaving?
4. Which types of beads do you consider suitable for bead weaving projects? (Materials, color, size, shape)
5. What are the basic bead weaving techniques?
6. Have you had any experience using bamboo in your weaving projects?
7. If applicable, what weaving techniques do you believe are most suitable for working with bamboo beads?
8. How to create your patterns using bead weaving techniques?

Appendix B: Visual Boards



Brainstorming



Mind mapping



Concept board



Mood board for the female



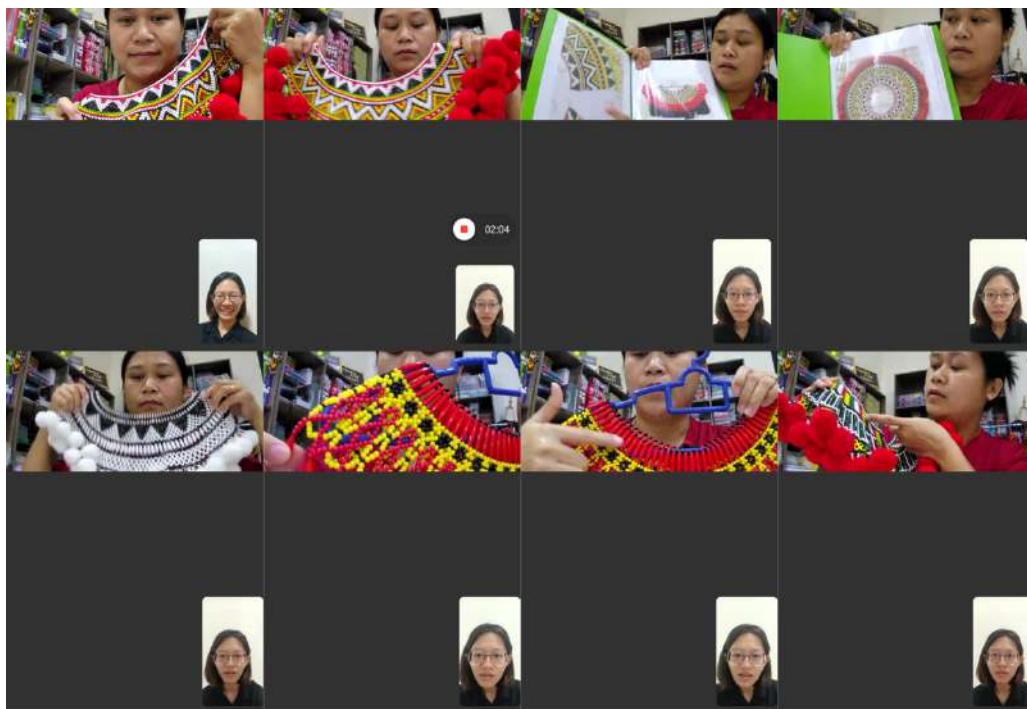
Mood board for the male



Color board



Fabric swatches



Marik Empang patterns introduced by interviewee one



Beading products



Researcher with interviewee two



Final costume prototype on models



Female costume



Male costume



Audiences at the exhibition



Audiences at the exhibition

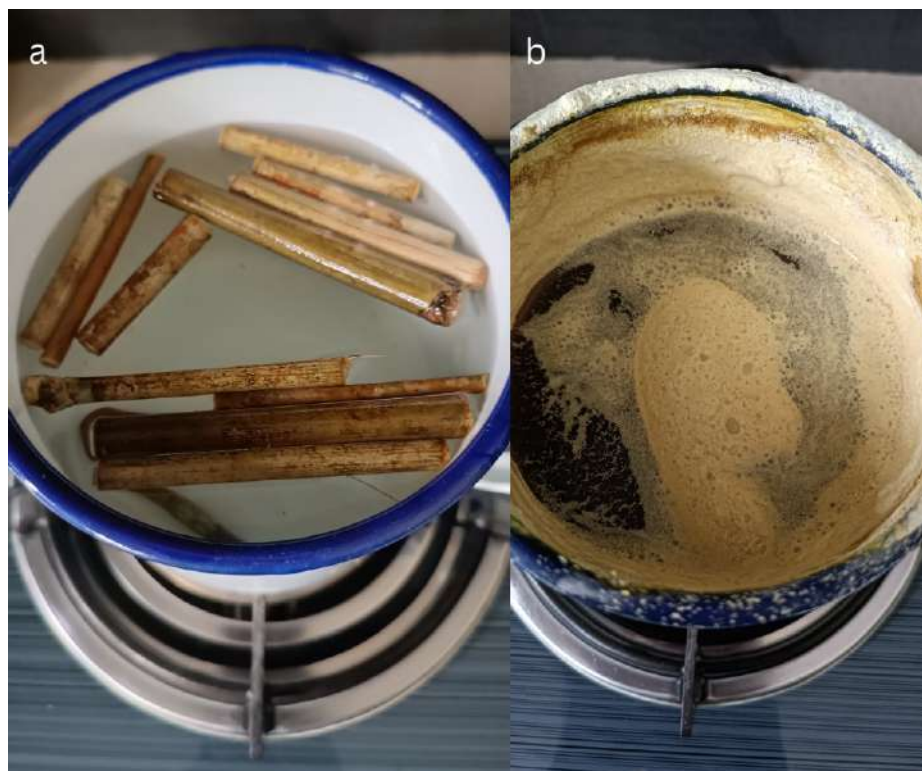


Audiences at the exhibition

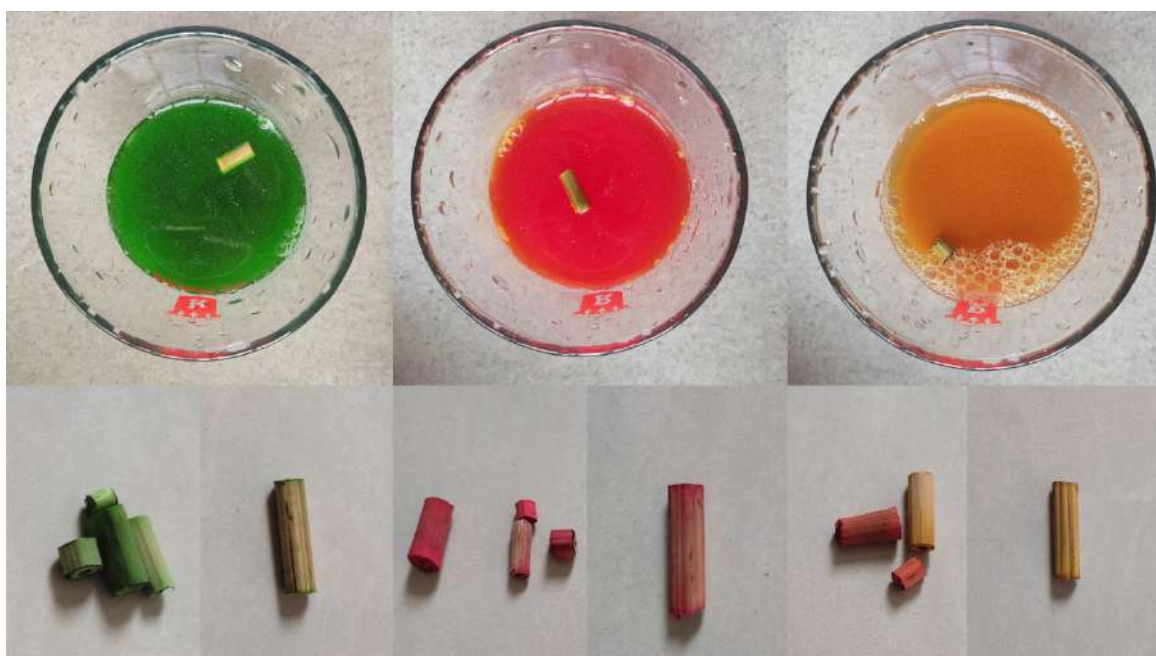


Audiences at the exhibition

Appendix C: Experiment Process



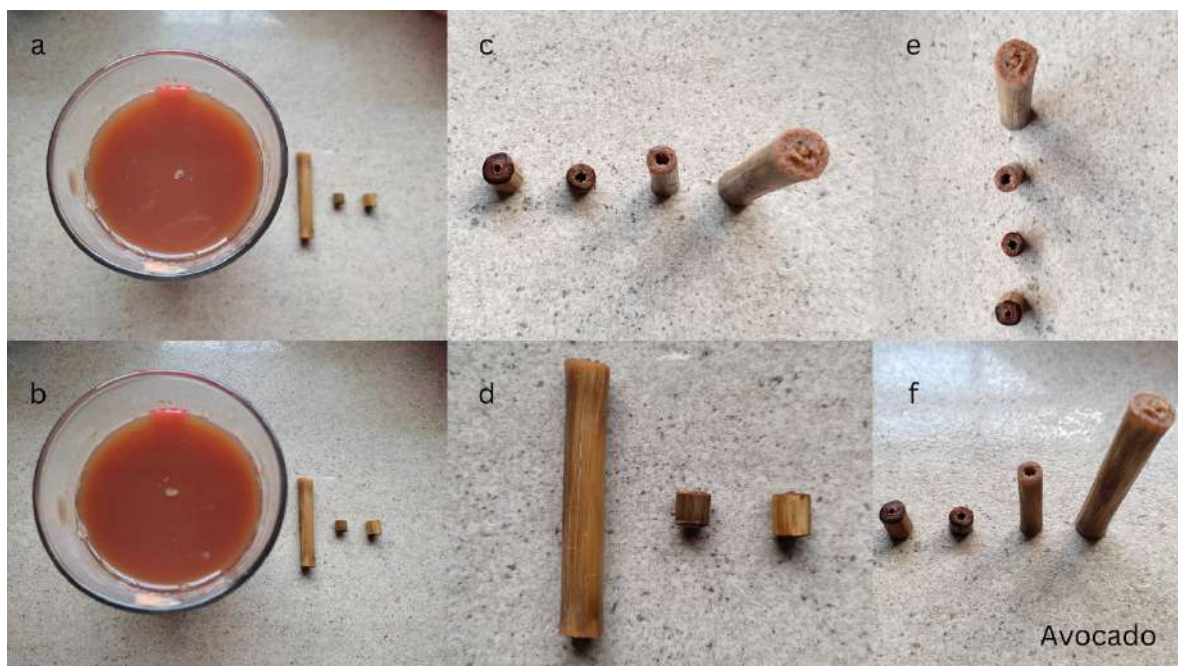
Bamboo treated with alum and limestone



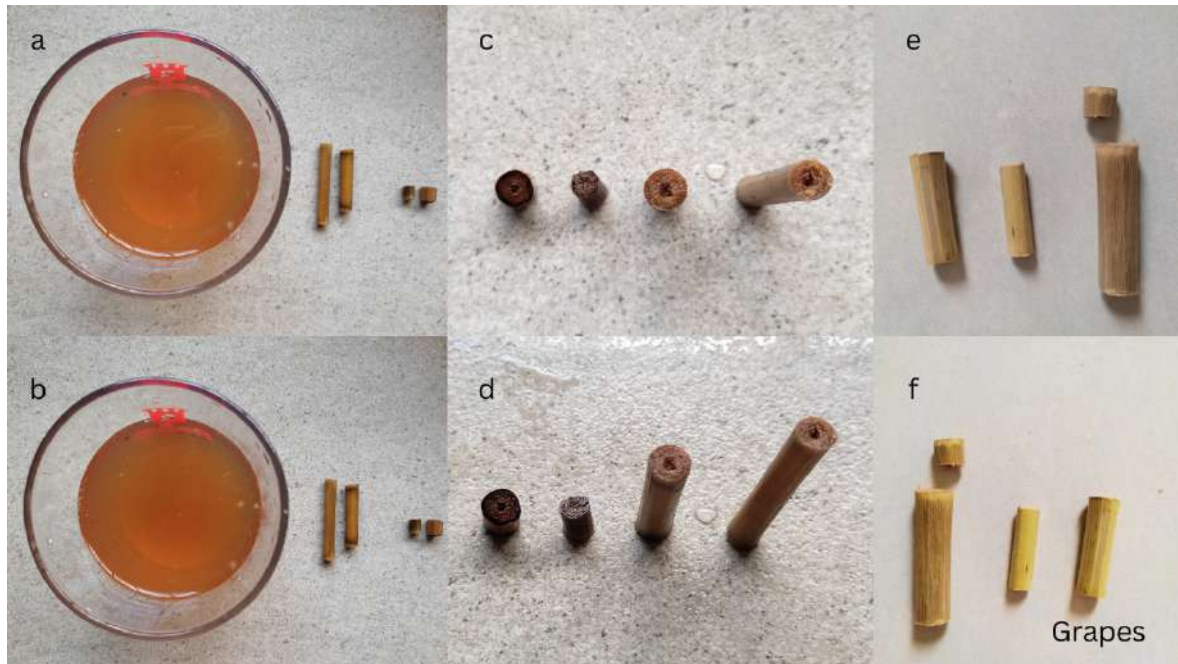
Bamboo in an alum solution with food colorings



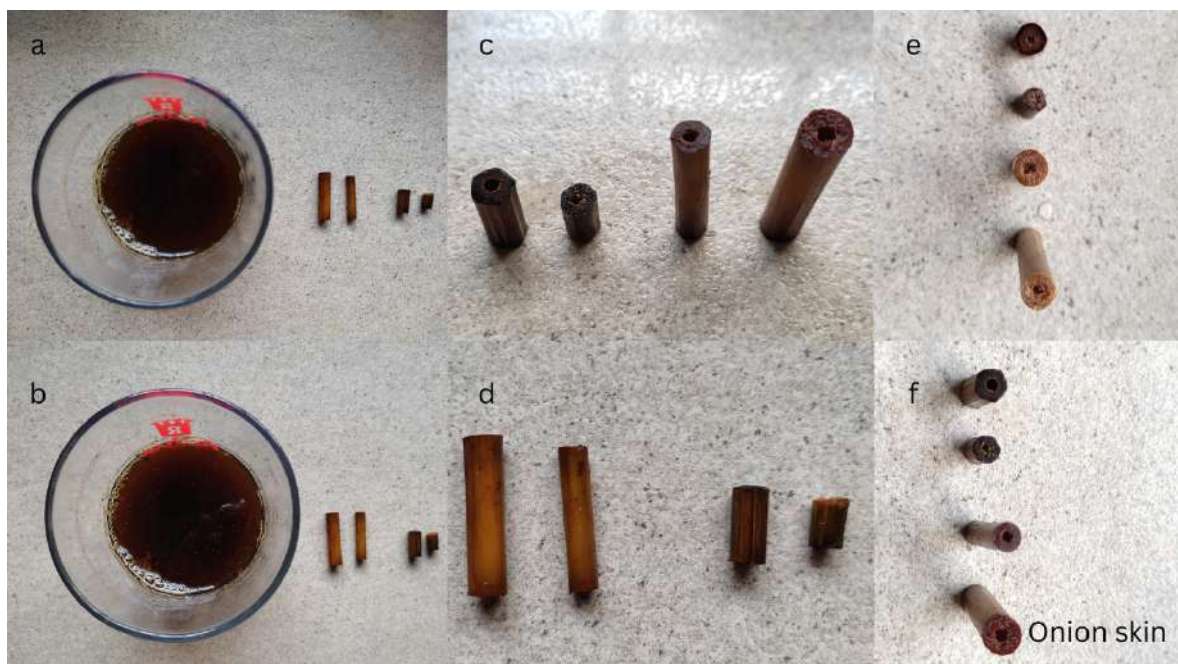
Bamboo in a limestone solution with food colorings



Bamboo samples dyed with avocado



Bamboo samples dyed with grapes



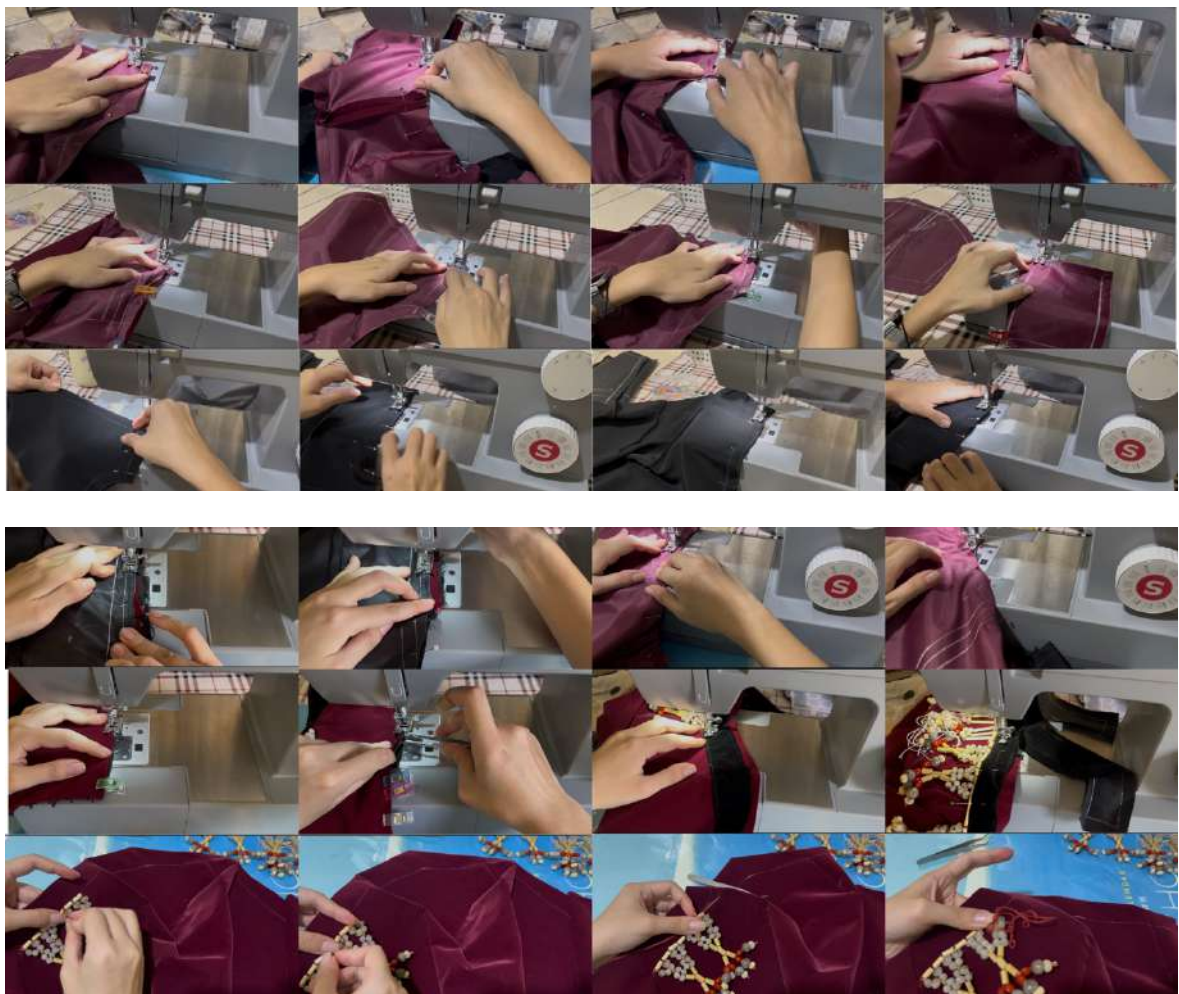
Bamboo samples dyed with onion skin



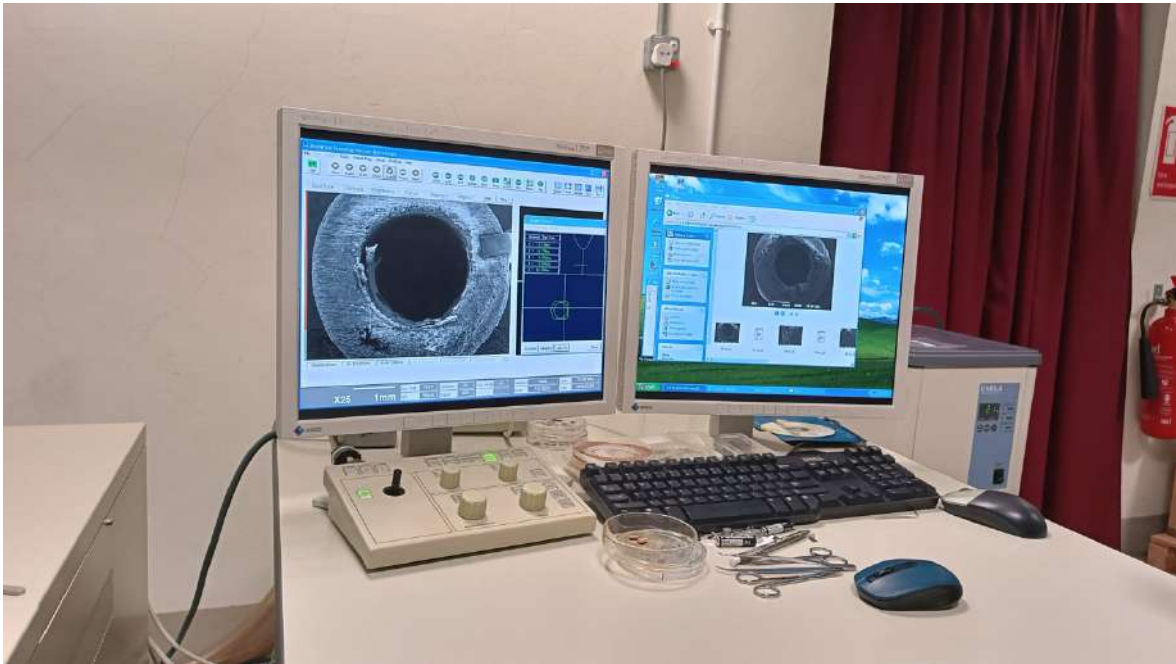
Beading process



Beading process for the bamboo sample



Sewing and stitching process



SEM analysis



SEM analysis



Bamboo samples undergo a drying process before analysis by the SEM machine



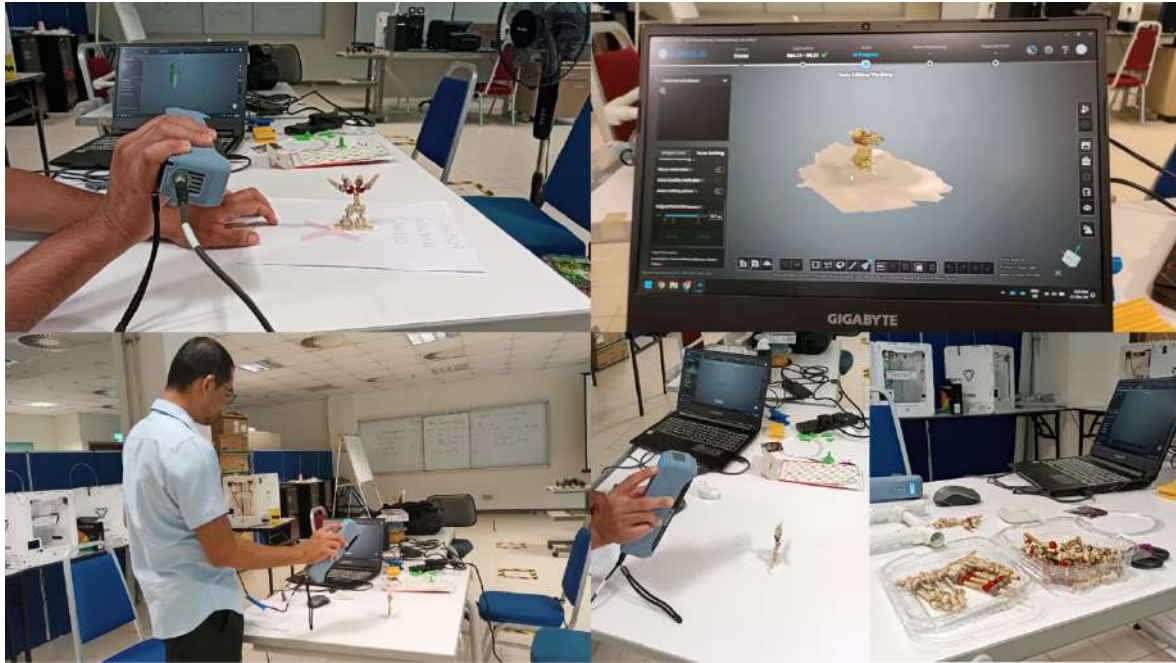
Bamboo samples for SEM analysis



Bamboo sample scanned with Einstar 3D scanner



Bamboo sample scanned with Einstar 3D scanner



Scanning bamboo samples in the FENG lab

Appendix D: Google Form Survey

Contemporary Costume Designs with the Utilisation of Raw Bamboo Inspired by Marik Empang in Sarawak

This survey aims to gather insights on the aesthetics, functionality, price, quality, and cultural value of a bamboo bead design inspired by Marik Empang. The findings from this study will be included in my Master's thesis at Universiti Malaysia Sarawak (UNIMAS) and may also be shared in academic journals, conferences, and exhibitions to support research in textile and costume design. Your identity will remain confidential, and no personal information will be shared in any publication. Thank you for your participation!

* Indicates required question

Demographic Information

1. What is your age? *

- ☐ 18 - 20
- ☐ 21 - 30
- ☐ 31 - 40
- ☐ Above 40

2. What is your gender? *

- ☐ Female
- ☐ Male

3. What is your ethnic group or tribe? *

- ☐ Bidayuh
 - ☐ Chinese
 - ☐ Iban
 - ☐ Indian
 - ☐ Malay
 - ☐ Melanau
 - ☐ Orang Ulu
 - ☐ Other: _____
-

4. What is your profession or occupation? *

- ☐ Student
- ☐ Artisan/Craftsman
- ☐ Designer (Fashion, Textile, Graphic or Product)
- ☐ Educator/Researcher
- ☐ Business Owner/Entrepreneur
- ☐ Government Employee
- ☐ Private Sector Employee
- ☐ Self-Employed/Freelancer
- ☐ Retired
- ☐ Other: _____

5. Do you have experience in textile or fashion? *

☐ Yes

☐ No

6. If yes, how many years of experience?

Your answer _____

7. Can you identify the name of the items in the pictures shown? *



☐ Yes

☐ No

8. If yes, please state the name.

Your answer _____

Core Study Questions



The two costume designs shown below are inspired by Marik Empang patterns. Please answer the following questions based on your perception of these designs, considering their aesthetics, functionality, price and quality, and cultural value. You may choose based on your preferences; there is no limitation on gender. Your feedback will help evaluate their appeal and significance.

1. Which costume design you like the most? *



☐ Design 1 (Female)



☐ Design 2 (Male)

2. What is the reason you choose that costume as favourite? (May more than one) *

- ☐ Aesthetic Appeal – The design, colors, and patterns of the costume are visually striking and align with personal taste.
- ☐ Cultural Significance – The costume carries cultural meaning, traditions, or heritage that resonate personally or evoke pride.
- ☐ Functionality and practicality – The costume is designed for durability and suitability for various occasions, making it both stylish and practical to wear.
- ☐ Material and Craftsmanship – The quality of the fabric, beading techniques, or handcrafted details make the costume unique and valuable.
- ☐ Innovation and Uniqueness – The costume integrates traditional elements with contemporary creativity, making it stand out while preserving heritage.
- ☐ Other: _____

Aesthetics



Aesthetics refers to how attractive, appealing, or pleasing the costume looks. This includes the overall appearance, design, shape, colors, and patterns. It reflects the first impression of beauty and style that the costume gives to people who see it.

A **Likert Scale** is a survey tool used to measure people's opinions or feelings about something. It asks respondents to rate their level of agreement with a statement using a scale, usually from **1 (Strongly Disagree)** to **5 (Strongly Agree)**. This scale helps researchers understand what people think about a topic in a simple and organized way.

3. The designs are visually appealing.

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

4. The choice of colors and patterns enhances the overall visual appeal. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

5. The textures and natural looks of bamboo and other natural beads add uniqueness to the designs. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

6. The designs contain modern elements while retaining its uniqueness. *

Functionality



Functionality is about how well the costume works for its specific purpose. It considers whether the costume is practical to wear, comfortable, and suitable for movement or performance. A functional costume is not only beautiful but also usable in real-life situations.

(Linear Scale: 1 - Strongly Disagree, 5 - Strongly Agree)

7. The designs combine both style and usability. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

8. The designs are easy to use. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

9. The designs are practical. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

Price and Quality



Price and quality are connected aspects. Price refers to how affordable or expensive the costume is for potential users. Quality refers to how well the costume is made—whether the materials are durable, the stitching is strong, and the finishing is neat. Together, these aspects help people decide if the costume offers good value for money.

(Linear Scale: 1 - Strongly Disagree, 5 - Strongly Agree)

10. The slight variations in size and color are acceptable as they natural materials *
and seeds, giving each piece a unique character.

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

11. If the quality is good and the price of this design is reasonable, then it is worth *
buying.

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

12. A higher price is acceptable if the design is handmade and supports *
sustainable and cultural craftsmanship.

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

13. The designs and quality offers good value for money. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

Cultural Value



Cultural value refers to the importance of the costume in representing, preserving, or expressing cultural identity and traditions. It considers whether the design reflects cultural meanings, symbols, or heritage, and whether it contributes to keeping cultural practices alive.

(Linear Scale: 1 - Strongly Disagree, 5 - Strongly Agree)

14. The use of bamboo beads in the design reflects cultural traditions (Marik Empang) creative and effectively. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

15. Wearing these designs make me feel more connected to Marik Empang culture. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

16. The cultural features in this design feel real and authentic. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

17. These designs help in preserving and promoting cultural identity of Marik Empang. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

Appendix E: SPSS Results

Demographic Data

	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Sum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic	Variance Statistic
Gender	102	1	1	2	128	1.25	.043	.438	.192
Age	102	3	1	4	203	1.99	.074	.751	.564
EthnicOrTribe	102	9	1	10	341	3.34	.225	2.271	5.158
Profession	102	9	1	10	705	6.91	.236	2.380	5.665
DoYouHaveExperience	102	1	1	2	117	1.15	.035	.356	.127
YearsOfExperience	102	13	1	14	203	1.99	.282	2.848	8.109
CanYouName	102	1	1	2	144	1.41	.049	.495	.245
TheNames	102	24	1	25	600	5.88	.710	7.167	51.372
Valid N (listwise)	102								

Core Study Questions

	N	Minimum	Maximum	Mean	Std. Deviation
@1CostumeYouPreferred	102	1	2	1.22	.413
@2TheReason	102	1	28	12.17	8.784
Valid N (listwise)	102				

Aesthetics

	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Sum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic	Variance Statistic
@3. Thedesignsarevisuallyappealing	91	4	1	5	385	4.23	.105	1.001	1.002
@4. Thechoiceofcolorsandpatternsenhancetheoverallvisual	102	4	1	5	427	4.19	.105	1.060	1.123
@5. Thetexturesandnaturallooksofbambooandothernaturalbe	102	4	1	5	434	4.25	.095	.961	.924
@6. Thedesignscontainmodernelementswhileretainingitsunique	102	4	1	5	425	4.17	.088	.891	.794
Valid N (listwise)	91								

Functionality									
	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Sum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic	Variance Statistic
@7. Thedesignscombinebothstyleandusability	102	4	1	5	398	3.90	.092	.928	.862
@8. Thedesignsareeasytouse	102	4	1	5	397	3.89	.092	.932	.869
@9. Thedesignsarepractical	102	4	1	5	408	4.00	.090	.912	.832
Valid N (listwise)	102								

Price and Quality									
	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Sum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic	Variance Statistic
@10. Theslightvariationsinsizeandcolorareacceptableasth	102	4	1	5	425	4.17	.102	1.025	1.051
@11. Ifthequalityisgoodandthep riceofthisdesignisreaso	102	4	1	5	421	4.13	.099	1.002	1.003
@12. Ahigerpriceisacceptablei fthdesignishandmadeand ds	102	4	1	5	431	4.23	.094	.953	.909
@13. Thedesignsandqualityoffe rsgoodvalueformoney	102	4	1	5	420	4.12	.090	.904	.818
Valid N (listwise)	102								

Cultural Value									
	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Sum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic	Variance Statistic
@14. Theuseofbamboobeadsin thdesignreflectsculturaltr ad	102	4	1	5	369	3.62	.088	.890	.793
@15. Wearingthesedesignsmak emefeelmoreconnectedto MarikE	102	4	1	5	393	3.85	.083	.837	.701
@16. Theculturalfeaturesinthisd esignfeelrealandauthentic	102	4	1	5	416	4.08	.090	.909	.825
@17. Thesedesignshelpinprese rvingandpromotingcultural liden	102	4	1	5	430	4.22	.098	.991	.983
Valid N (listwise)	102								

Appendix F: Checklist for observation

CHECKLIST

Marik Empang patterns (Traditional/ Modern)

1. _____

2. _____

3. _____

Color scheme

1. _____

2. _____

3. _____

Motifs

1. _____

2. _____

3. _____

Shape of the beads

1. _____

2. _____

3. _____

Size of the beads

1. _____

2. _____

3. _____

Date: / /

Day:
S ☐ M ☐ T ☐ W ☐ T ☐ F ☐ S ☐

Location:

Types of beads (Materials)

1. _____
2. _____
3. _____

Beading techniques

1. _____
2. _____
3. _____

String materials and tools

1. _____
2. _____
3. _____

Ideas/Brainstorming:

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Notes:

Appendix G: Permission Letter

Fakulti Seni Gunaan dan Kreatif
Faculty of Applied And Creative Arts

UNIMAS/NC-20.03/04-41 Jld. 2 (62)

5th December 2024

Associate Professor Dr. Faisal Ali Bin Anwarali Khan
Dean of Faculty of Resource Science and Technology
Faculty of Resource Science and Technology
Jln Datuk Mohammad Musa,
94300 Kota Samarahan, Sarawak

Dear Associate Professor Dr. Faisal Ali Bin Anwarali Khan,

Subject: Confirmation as a Graduate of Universiti Malaysia Sarawak for the Purpose of Conducting Master's Research Study

I hope this letter finds you well.

I am writing to formally inform you that the individual named below is a graduate student at the Faculty of Applied and Creative Arts, Universiti Malaysia Sarawak (UNIMAS), and is currently conducting research for her Master's thesis. Please find the details of the student as follows:

- **Student Name:** Kelreedy Chee Qian Hwui
- **Program:** Master of Arts, Faculty of Applied and Creative Arts
- **Student Matric Number:** 23020187
- **Student Mobile Number:** 0128458586

The title of her research study is *Contemporary Costume Design with Utilisation of Raw Bamboo Inspired by Marik Empang in Sarawak*.

In light of this, we kindly request your cooperation in granting permission for the student to conduct her research study at Faculty of Resource Science and Technology to analysing bamboo surface structures to further sustainable textile development.

For this research, the student requires access to the specialized equipment/tools on FRST as stated for detailed surface examination:

1. Stereo microscope
2. SEM (Scanning Electron Microscope)

The student has been in contact with Sir Shafri from the SEM lab, who has been assisting with equipment guidance. With your permission, I hope the student may utilize these tools to carry out the necessary observations.

Should you require any further details or clarification, please do not hesitate to contact the student's Master's supervisor, Marzie Hatef Jalil, at 01112084667.

Approved
Diluluskan
Please liaise
with Mr. Zetty or
Mr Shafri on the
needs.



Your support and cooperation in this matter will be greatly appreciated, and we thank you in advance for your kind assistance.

Thank you.

Yours sincerely,



Prof. Dr. Musdi Hj. Shanat
Dean

Appendix H: Certificates



CERTIFICATE OF APPRECIATION

proudly presented to

Kelrreey Chee Qian Hwui and Marzie Hatef Jalil

Paper Title:

Bamboo Weaving and Textile Performance: Synthesising Research for Sustainable Solutions

as presenter in

**THE 7TH INTERNATIONAL CONFERENCE
OF APPLIED AND CREATIVE ARTS**

/ 25 - 27 September 2024

at

**BORNEO CULTURES MUSEUM
KUCHING, SARAWAK,
MALAYSIA.**

A handwritten signature in black ink, appearing to read 'Dr. Muhammad Jameel Mohamed Kamil', is written over a faint, stylized background pattern.

Dr. Muhammad Jameel Mohamed Kamil
Conference Chairperson



Reimagining Indigenous Material Culture: Exploration and Utilizing Bamboo as a Sustainable Approach in Contemporary Costume Design – A Case Study on *Marik Empang* Beadwork

Kelrreey Chee Qian Hwui¹ and Marzie Hatef Jalil²

^{1,2}Faculty of Applied and Creative Arts, University Malaysia Sarawak, Malaysia (23020187@siswa.unimas.my, hjmarzie@unimas.my)

Keywords: Bamboo beads, Bamboo treatment, Contemporary costume design, Design innovation, *Marik Empang* patterns, Material testing.

Introduction

Today's designers ensure traditional creativity by emphasizing sustainable approaches and indigenous crafts. Integrating traditional craftsmanship into contemporary design is often achieved by utilizing incredibly sustainable materials (Shaharudin et al., 2021). *Marik Empang*, a conventional part of the Iban women's costume, is a beaded collar made of multi-colored seed beads in meaningful motifs and patterns, characteristic of the ethnic group in Sarawak, Malaysia. There are 59 bamboo species in Malaysia, and some are used to weave into intricate jewellery, baskets, hats, and rugs (National Forest, 2024; Hospitality, 2019). Weavers utilized various materials and colors to enhance the aesthetic appeal of their creations (Liufu et al., 2023). Jalil (2025) explored the potential of bamboo fiber and hand-woven techniques as a sustainable approach for the textile and clothing industry.

However, the spark of bamboo innovation in Sarawak was not even applied in costume design. The first challenge was that the innovative bamboo designs are rare (Sun & Liu, 2022). Secondly, the bamboo designs in Sarawak were primarily focused on furniture, decorative products, and craft designs. The bamboo designs were not applied in Sarawak's costume design, as Perumal et al. (2022) stated that bamboo was employed in agriculture, construction, arts and crafts, and furniture production, without mentioning its application in Sarawak's costume design. Additionally, Sun and Shao (2021) noted that the gap between traditional craftsmanship and contemporary design requires further investigation. Therefore, the purpose of this research was to design contemporary costume design with raw bamboo beading inspired by *Marik Empang* patterns in Sarawak. The findings show that the lightweight bamboo beads are comfortable to wear while combining traditional craftsmanship with contemporary aesthetics, appealing to environmentally conscious audiences.



Green Science And Technology Association Malaysia (GSTAM)
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Website: <http://www.gstam.org/>
Email: greenscienceandtechnology@gmail.com
Phone: +(60)13-5682235

Faculty of Applied & Creative Arts (FACA) UNIMAS

20th August 2025

Jln Datuk Mohammad Musa,
94300 Kota Samarahan, Sarawak

Dear Sir/Madam/Miss,

**INVITATION TO EXHIBIT AT THE SARAWAK ETHNIC ELEGANCE:
SUSTAINABLE FASHION DESIGN COMPETITION AND BOOTH 2025.**

We are pleased to invite you to showcase your product or services at Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0 and Booth 2025, happening on **3rd - 5th October 2025** at **AEON Shopping Mall Kuching Central**. This exciting event brings together artisans, designers from across Malaysia, and eco-conscious entrepreneurs to celebrate creativity, culture, and sustainability in fashion and lifestyle.

We believe your business aligns perfectly with the event's ethos of promoting sustainable development, local craftsmanship, and eco-friendly practices. **Please note that this is a non-sales exhibition.** Your participation will focus on showcasing and promoting your brand's sustainable initiatives and creative offerings, rather than selling products on-site.

By participating, you'll have the opportunity to present your products or services to a wide audience who values sustainability and innovation, while also building meaningful connections with other like-minded vendors and attendees.

Details of the event are as follows:

- **Event Name:** The Sarawak Ethnic Elegance: Sustainable Fashion Design Competition 2.0 and Booth 2025.
- **Date:** 3rd - 5th October 2025
- **Location:** AEON Mall Kuching Central
- **Booth:** Free Booth
- **Participation Benefits:** Engage with potential customers, showcase your brand's sustainability efforts, and network with other vendors.



Green Science And Technology Association Malaysia (GSTAM)
No 15-O, Lorong 11A Jalan Ellis, 93300 Kuching, Sarawak
Website: <http://www.gstam.org/>
Email: greenscienceandtechnology@gmail.com
Phone: +(60)13-5682235

Please find the tentative program attached in **Appendix I**. We kindly request your confirmation of presence at the event **before 15 September 2025**. Should you require further information, please do not hesitate to contact us (+60)12-8542287 (Chong Che Jia En) or email via greenscienceandtechnology@gmail.com. We look forward to collaborating with you to make this event a success and promote a greener future; further information is attached.

Yours sincerely,

Chong Che Jia En

Event Coordinator

Green Science And Technology Association Malaysia (**GSTAM**)

Appendix I

TENTATIVE PROGRAMME 3rd - 5th October 2025:

• BOOTHS

Date	3rd - 5th October 2025 (Friday - Sunday)
Venue	AEON Shopping Mall Kuching Central
9:30 am - 10:00 am	Booth setup & distribution of passes
10:00 am - 10:00 pm	Booths open to the public

• COMPETITION

Date	4th October 2025 (Saturday)
Venue	AEON Shopping Mall Kuching Central
9:30 am - 11:00 am	Competition Preparation by All Participants.
11:00 am - 1:00 pm	Judging Session from the judges
1:00 pm	Opening Ceremony: Official Opening and Welcome Speech by the host, including an introduction to the event objectives and appreciation for sponsors and partners.
1:00 pm - 1:30 pm	Welcome of the Guest of Honour. Cultural Dance, and Singing Performance by Local Artists. Speech by the Minister of MTCP, YB Dato Sri Haji Abdul Karim Rahman Hamzah.
1:30 pm - 3:30 pm	Opening of the "Sarawak Ethnic Elegance: Sustainable Fashion Design" Competition 2.0. Introduction of the Judges Present.



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	Participants Present Their Final Designs on stage to the judges.
3:30 pm - 4:00 pm	Award Ceremony: Winners Announcement and Prize Presentation by the Guest of Honour. Certificates of Participation are awarded to all participants. Photography Session.
4:00 pm - 5:00 pm	Closing Ceremony: Closing Announcement by emcee, reflections on the event, and an announcement of future initiatives.