



ZERO WASTE RECYCLING OF LEATHER SCRAPS IN A NEW PERSPECTIVE



By

MR. Yuttana ANOTHASINTAWEE

A Thesis Submitted in Partial Fulfillment of the Requirements
for Master of Fine Arts Design Arts (International Program)

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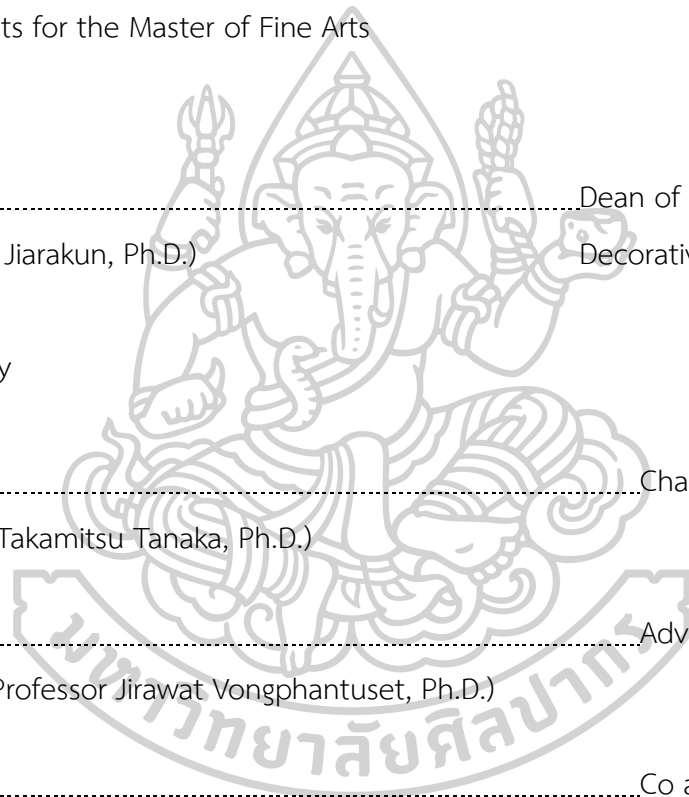
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Chapter 1

BACKGROUND OF THE STUDY

1.1 Background and the Significance of the Research

The ReMaker brand represents a paradigm shift in the fashion industry, focusing on sustainability and environmental consciousness. The philosophy behind The ReMaker is not only to create stylish and functional products but also to address the growing environmental concerns associated with the fashion industry. Upcycling old leather jackets into timeless fashion products is one of the core practices of The ReMaker, highlighting the brand's commitment to sustainability. According to Fletcher (2008), sustainable fashion is not just about using organic materials; it encompasses the entire lifecycle of a product, including production, use, and disposal.

In 2015, Thailand saw a substantial increase in the import of used clothing, from 157.29 tons in the previous year to 4,292 tons (Manager Online, 2015). This surge highlights the significant volume of second-hand clothing entering the country, creating both opportunities and challenges. While there is a robust market for most types of second-hand clothing, surplus leather jackets pose a particular problem due to their material properties and lack of a secondary market. As noted by Niinimäki (2013), the challenge with such materials lies in their durability and the complexities involved in recycling them into new products.

The ReMaker's initiative to transform surplus leather jackets into fashionable bags is a pioneering effort to address this problem. The technique of repurposing leather jackets into bags not only adds value to what would otherwise be waste but also aligns with the principles of circular economy. The circular economy model emphasizes keeping resources in use for as long as possible, extracting the maximum value from them while in use, then recovering and regenerating products and materials at the end of each service life (Ellen MacArthur Foundation, 2013).

However, the process of upcycling leather jackets is not without its challenges. Operational data indicates that only 60-70% of a leather jacket can be repurposed into a bag, leaving behind a significant amount of leather scraps. This presents a disposal challenge for The ReMaker, as traditional disposal methods such as incineration release harmful pollutants into the environment (Van Krieken, 2019). The remaining leather scraps, estimated to be around 1.5-2 tons annually, need innovative solutions to prevent environmental degradation.

The environmental impact of leather waste is a growing concern. According to a study by Kant (2012), the disposal of leather and textile waste contributes significantly to pollution, releasing toxic substances into soil and water. The need for sustainable waste management practices in the leather industry is critical. The ReMaker's focus on finding new uses for leather scraps, such as through handloom weaving and patchwork techniques, is a step towards mitigating this impact.

The economic viability of upcycling initiatives is another significant aspect. While there is increasing consumer interest in sustainable products, the cost of recycling technologies and the fluctuating market demand for recycled materials can be barriers. As highlighted by Tokatli (2012), the fashion industry needs to balance sustainability with economic feasibility to ensure the longevity of such initiatives. The ReMaker's approach to creating high-value products from leather scraps aims to address these economic challenges by tapping into niche markets that value sustainability.

Furthermore, the cultural significance of leather and its use in fashion cannot be overlooked. Leather has been a staple material in fashion for centuries, valued for its durability and aesthetic appeal. The practice of upcycling leather not only preserves this cultural heritage but also adapts it to contemporary sustainability demands. According to Crane and Bovone (2006), fashion is a cultural and social phenomenon that reflects the values and practices of a society. The ReMaker's efforts to repurpose leather align with the evolving cultural emphasis on sustainability and environmental responsibility.

Recycling materials like leather for new products or art has significant environmental and social benefits. The process of recycling reduces the need for new raw materials, thereby conserving natural resources and reducing environmental degradation. According to Cline (2012), the fashion industry is one of the most resource-intensive industries, and the adoption of recycling practices can significantly reduce its environmental footprint.

Creating new products or art from recycled leather also promotes creativity and innovation. Artists and designers are increasingly exploring the potential of recycled materials, leading to unique and sustainable creations that challenge traditional notions of art and fashion. This shift not only enhances the aesthetic value of products but also raises awareness about the importance of sustainability. As noted by Thompson and Trumble (2012), the integration of recycled materials into art and design can inspire new ways of thinking about consumption and waste.

Moreover, the use of recycled leather can have economic benefits. By turning waste into valuable products, businesses can tap into new markets and attract environmentally conscious consumers. This approach not only generates revenue but also fosters a positive brand image and strengthens customer loyalty. The ReMaker's success in creating fashionable bags from old leather jackets demonstrates the potential of recycling to drive economic growth while promoting sustainability.

The social impact of recycling materials like leather is also significant. By reducing waste and promoting sustainable practices, businesses can contribute to the well-being of communities and the environment. This approach aligns with the principles of corporate social responsibility (CSR) and can enhance a company's reputation and credibility. According to Carroll and Shabana (2010), CSR practices can lead to a competitive advantage by differentiating a company from its competitors and building strong relationships with stakeholders.

In summary, The ReMaker's initiative to upcycle old leather jackets into fashionable bags and explore further uses for leather scraps is a significant step

towards sustainable fashion. By addressing the challenges associated with leather waste, The ReMaker is contributing to a more sustainable and circular economy. The brand's efforts underscore the importance of innovative approaches in waste management and the potential for creating value from materials that would otherwise be discarded. The research on this topic is essential to identify further opportunities and challenges in the field of sustainable fashion and to develop strategies that can be adopted by other players in the industry.



Figure 1 The Mountain of vintage leather jacket

Figure 1 The literature research fields context.



Figure 2 In 2015, 4,292 tons of used clothing flowed into Thailand, compared to only 157.29 tons in the previous year.



Figure 3 The products were upcycled from old leather jackets.



Figure 4 30-40% of the leather left over from cutting and sewing becomes scraps that are difficult to recycle.

Impact of Recycled Art and Design Works on Society

Recycled art and design works have a profound impact on society, serving as powerful catalysts for environmental awareness, cultural transformation, and social change. By repurposing discarded materials into creative and functional objects, artists and designers challenge the traditional perceptions of waste, encouraging a more sustainable mindset among consumers. This practice not only reduces the environmental footprint by diverting waste from landfills but also fosters innovation in material use, demonstrating that beauty and utility can emerge from what was once considered refuse. Moreover, recycled art and design works often carry a narrative of conservation and responsibility, inspiring communities to rethink their consumption habits and embrace more sustainable practices. They act as tangible representations of the circular economy, where resources are continually reused and repurposed, thereby promoting ecological balance. Additionally, these works can stimulate local economies by creating new markets for recycled goods

and providing employment opportunities in the green sector. The aesthetic and functional appeal of recycled art and design also plays a critical role in cultural expression, highlighting the creative potential inherent in sustainability. Ultimately, the impact of recycled art and design extends beyond environmental benefits, contributing to a broader cultural shift towards sustainability and responsible stewardship of the planet.

1.2 Problem Statements:

The ReMaker brand, while successfully repurposing old leather jackets into fashionable bags, faces significant challenges related to the leather scraps generated during the process. These challenges need to be addressed to improve the efficiency and sustainability of the upcycling process. The specific problems include:

1.2.1 The Sizes of the Scraps of Leather Are Not the Same: Leather scraps generated from cutting and sewing processes vary significantly in size. This variation poses a challenge in terms of uniformity and usability for creating new products. Larger scraps may be easier to repurpose into smaller items, but smaller scraps often go to waste due to their limited application. According to Allwood et al. (2006), material wastage in the fashion industry is a critical issue, and managing scrap sizes effectively can help in reducing overall waste.

1.2.2 The Shapes of Leather Scraps Are Clearly Different: The irregular shapes of leather scraps further complicate the repurposing process. Unlike uniform materials that can be easily reassembled or combined, leather scraps come in various shapes that do not fit together seamlessly. This irregularity requires innovative design approaches to make use of the scraps effectively. As noted by Fletcher (2008), the challenge in sustainable fashion lies in creatively addressing the inconsistencies in recycled materials.

1.2.3 The Intensity of the Leather Colors Is Different: Leather scraps from different jackets often exhibit varying shades and intensities of color. This color

variation makes it difficult to create aesthetically pleasing products without additional processing, such as dyeing or color matching. The inconsistency in color can limit the design possibilities and affect the marketability of the recycled products. This issue is highlighted in a study by Lewis and Gertsakis (2001), which discusses the complexities of managing color variations in recycled materials.

1.2.4 The Creases Created During Storage by Compressing and Stacking:

Leather scraps are often stored by compressing and stacking, which leads to the formation of creases and wrinkles. These creases can compromise the quality and appearance of the final products made from these scraps. Addressing the creases requires additional processing, which can increase the cost and reduce the efficiency of the recycling process. The impact of material handling and storage on the quality of recycled products is extensively discussed by Gwilt and Rissanen (2011).

1.2.5 The Use of 30-40% of Leather Scraps from Cutting and Sewing Would Significantly Reduce Waste from Leather Scraps:

Efficiently utilizing 30-40% of leather scraps can significantly reduce waste and enhance the sustainability of the upcycling process. However, finding practical and economically viable methods to use these scraps remains a challenge. Current disposal methods, such as incineration, lead to the release of harmful pollutants, including carbon dioxide, methane gas, and toxic substances into the soil and water. Incineration not only contributes to environmental pollution but also represents a loss of potentially valuable materials. According to Kant (2012), sustainable waste management practices are crucial to mitigating the environmental impact of textile and leather industries.

Disposal methods like incineration are particularly problematic as they release greenhouse gases and other pollutants. Methane, for instance, is a potent greenhouse gas with a global warming potential many times greater than that of carbon dioxide. The release of such gases exacerbates climate change and poses serious environmental and health risks. The environmental hazards of traditional disposal methods are well-documented in the literature, highlighting the need for more sustainable alternatives (Niinimäki & Hassi, 2011).

1.3 Objectives

1. **To Identify Challenges and Opportunities:** Identify key challenges and opportunities related to the recycling of leather scraps, including technical limitations, market demand, environmental concerns, and economic viability.
2. **To Explore Innovative Utilization Methods:** Investigate innovative techniques and approaches for reusing leather scraps, such as recycling, upcycling, and alternative utilization methods to minimize waste and maximize value.
3. **To Investigate Technical Challenges:** Identify the technical challenges and constraints associated with processing and repurposing leather scraps, such as material compatibility, structural integrity, and manufacturing processes.

1.4 Definition of Terms

Upcycling: Upcycling refers to the process of transforming by-products, waste materials, or unwanted products into new materials or products of better quality or for better environmental value. Unlike recycling, which typically involves breaking down materials to their base components, upcycling retains the original material's integrity and adds value to it through creative reuse. This process not only extends the life cycle of the material but also reduces the demand for new resources. Upcycling is a key concept in sustainable fashion, promoting innovation and environmental responsibility (Goldstein, 2009).

Leather: Leather is a durable and flexible material created by tanning animal rawhide and skins. The most common sources of leather are cattle, sheep, goats, and pigs. Leather has been used for centuries in various applications, including clothing, footwear, bags, and accessories, due to its strength, longevity, and aesthetic appeal. The production of leather involves several stages, including curing, tanning, and finishing, each contributing to its final properties. Leather is valued for its natural texture, versatility, and luxury (Heidemann, 1993).

Scraps of Leather: Scraps of leather are the leftover pieces of leather that result from the cutting and sewing processes in the production of leather goods. These pieces vary in size, shape, and color, making them challenging to reuse in conventional manufacturing. However, scraps of leather can be valuable raw materials for upcycling and creating new products, reducing waste and promoting sustainability. Effective management and creative reuse of leather scraps are crucial for minimizing environmental impact (Niinimäki, 2013).

Recycle: Recycling is the process of converting waste materials into new materials and objects. This process typically involves collecting and processing used materials, breaking them down into their raw components, and manufacturing new products from these components. Recycling aims to reduce the consumption of fresh raw materials, decrease energy usage, lower greenhouse gas emissions, and prevent pollution. In the context of leather, recycling can involve mechanical, chemical, or biological processes to transform waste leather into usable materials (Staikos & Rahimifard, 2007).

1.5 The questions of the Research

1. How can the variability in the sizes and shapes of leather scraps be managed to create consistent and high-quality upcycled products?
2. What innovative design processes can be implemented to effectively use leather scraps with different colors and textures?
3. What are the technical challenges in processing leather scraps for upcycling, and how can they be overcome?
4. How can the economic viability of using leather scraps in new products be improved to make upcycling a sustainable business practice?

1.6 Research Methodology

A research framework for leather scraps, wickerwork, and patchwork can be structured as follows:

- Defining the specific aims of the research, such as exploring the historical significance of wickerwork, weaving, and patchwork techniques, investigating their cultural and artistic impact, or assessing their contemporary applications in different industries.
- Conducting a comprehensive investigation of the existing literature on braiding, weaving, and patchwork techniques, looking at historical origins, cultural significance, traditional techniques, contemporary trends, and practical applications.
- Identifying gaps in current knowledge and areas for further research.
- Determining the research design and approach, whether qualitative, quantitative, or mixed methods, based on the research objectives.

Technics	Materials	The relevant parts in the work		
Wicker	Large leather scraps	Tailors	Wicker artisan	Assembly workers
Woven	Small leather scraps	Loom operator	Tailors	
Patchwork	Leather scraps of various sizes	Artist	Tailors	

Figure 5 Research Framework

1.7 Limitation of Research

Despite efforts to explore and implement sustainable solutions for the management of leather scraps, there are still some limitations in research in this field. These limitations include:

1.7.1 Scope of Studies: Many research studies focus on specific aspects of leather scrap utilization, such as recycling techniques or market demand analysis. The narrow scope of these studies can lead to broader systemic issues being overlooked or failing to capture the interconnected challenges of waste management and sustainability in the leather industry.

1.7.2 Generalizability: The results of research studies are not always transferable to different contexts or geographical regions. Factors such as local regulations, market dynamics, and cultural preferences can significantly influence the feasibility and effectiveness of leather waste recycling strategies.

1.7.3 Availability and Quality of Data: The limited availability of comprehensive and standardized data on leather waste generation, disposal practices, and environmental impacts hinders a thorough assessment of current practices and the development of evidence-based solutions. Inconsistent reporting and data collection methods also make it difficult to compare the results of different studies.

1.7.4 Technical Limitations: Despite advances in recycling technologies and material science, there are still technical limitations to the effective processing and reuse of certain types of leather scraps. Differences in the quality, composition, and degree of contamination of leather can pose challenges to recycling processes and limit the applicability of certain techniques.

1.7.5 Economic Viability: Although interest in the use of leather scraps for sustainable purposes is growing, economic viability remains a major issue. High costs associated with recycling technologies, market fluctuations in the demand for recycled materials, and competition from low-cost alternatives can prevent investment in initiatives to utilize leather waste.

1.7.6 Social and Cultural Factors: Social attitudes towards leather waste and perceptions of recycled products can influence consumer acceptance and market

demand. Cultural preferences for new or virgin materials over recycled or upcycled goods can influence the adoption of sustainable practices in the leather industry.

1.7.7 Policy and Regulatory Framework: The effectiveness of leather waste recycling initiatives is influenced by policy frameworks and regulations that govern waste management, recycling incentives, and environmental standards. Inconsistencies or gaps in regulatory enforcement can hinder the implementation of sustainable practices and inhibit industry-wide adoption.

To overcome these limitations, interdisciplinary collaboration, stakeholder engagement, and continuous research efforts are needed to develop holistic solutions that address the environmental, economic, and social dimensions of leather scrap utilization. By addressing these challenges, researchers and practitioners can work towards a more sustainable and circular economy in the leather industry.

1.8 Scope of the Research

Handloom Weaving Techniques: Exploring the incorporation of leather scraps into handweaving, focusing on traditional and modern methods adapted for handloom weaving. This includes the study of weaving patterns, loom structures, and material combinations to produce handmade mats from recycled leather materials.

Handicraft Wicker Applications: Investigating the use of leather scraps in various handicraft wicker techniques beyond textiles, such as basketry, mat making, and other wicker structures. This may include experimenting with different weaving methods, such as coiling and braiding, to create functional and decorative objects from recycled leather materials.

Patchwork Approaches: Investigating the integration of leather scraps into patchwork designs, including quilting, appliqué, and piecing techniques. This includes studying traditional patchwork methods and exploring contemporary

approaches to integrating leather scraps into patchwork compositions, focusing on handcrafted and artisanal processes.

Collage Art: Investigating the potential of leather scraps in collage art, exploring techniques such as layering, cutting, and juxtaposition to create visually dynamic artworks. This may include studying the work of contemporary collage artists who incorporate recycled materials, including leather, into their compositions.

Design Exploration: Analyzing design possibilities and creative expressions resulting from handloom weaving, handicraft weaving, and patchwork and collage works made from leather scraps. This may include exploring textural variations and pattern arrangements to create unique and aesthetically pleasing handmade products from recycled leather materials.

Technical Challenges: Recognizing technical challenges and considerations related to the use of leather scraps in handloom weaving, handicraft weave, and patchwork projects. This may include issues of material handling, structural integrity, and surface finishing techniques, as well as exploring innovative solutions to these challenges.

Craft Practices: Documentation of traditional and contemporary craft practices in the use of leather scraps in handloom weaving, handicraft weave, and patchwork techniques. This may include documentation of indigenous knowledge, cultural expressions, and community-based approaches to the use of leather scraps in craft and artisanal contexts.

Chapter 2

LITERATURE REVIEW

2.1 History and Background

Leather scraps, a by-product of leather production, have long posed significant challenges for the industry due to their environmental impact and disposal problems. This literature review provides an overview of existing research and literature on leather scraps, focusing on sustainable practices, innovative techniques, market dynamics, and policy implications.

2.2 Current Challenges and Opportunities:

The leather industry is confronted with significant challenges related to waste management, pollution, and resource depletion. The generation of leather scraps exacerbates these issues, necessitating the exploration of sustainable recycling methods as alternatives to traditional disposal practices such as landfilling and incineration.

Challenges

Waste Management: The disposal of leather scraps presents a critical waste management challenge. Traditional methods such as landfilling and incineration are environmentally detrimental. Landfilling leather scraps contributes to soil and groundwater contamination due to the leaching of chemicals used in tanning processes. Incineration, on the other hand, releases harmful pollutants, including carbon dioxide, methane, and other toxic substances, contributing to air pollution and climate change (Kant, 2012).

Pollution: The tanning and production processes in the leather industry are resource-intensive and generate significant environmental pollution. The use of chemicals such as chromium salts in tanning not only poses health risks to workers but also results in hazardous waste that is difficult to manage. Additionally, the

disposal of leather scraps through incineration leads to the emission of greenhouse gases and other pollutants, further exacerbating environmental degradation (Niinimäki & Hassi, 2011).

Resource Depletion: The production of leather relies heavily on natural resources, including water, energy, and animal hides. The inefficiencies in the production process, which result in substantial amounts of leather scraps, contribute to resource depletion. Addressing these inefficiencies is crucial for promoting sustainability within the industry (Heidemann, 1993).

Opportunities

Despite these challenges, there are considerable opportunities to transform leather scraps into high-value products, leveraging art, craft, and design to create sustainable solutions.

Upcycling into Fashion Accessories: Leather scraps can be upcycled into fashion accessories such as handbags, wallets, belts, and jewelry. This approach not only reduces waste but also creates unique, high-quality products that cater to the growing market demand for sustainable fashion. Upcycling enhances the aesthetic and functional value of leather scraps, turning them into desirable consumer goods (Fletcher, 2008).

Furniture and Home Décor: Another promising avenue for the utilization of leather scraps is in the creation of furniture and home décor items. Techniques such as patchwork, weaving, and braiding can be employed to incorporate leather scraps into the design of chairs, cushions, rugs, and other decorative items. This not only provides a sustainable use for the scraps but also introduces innovative and artisanal design elements into interior spaces (Gwilt & Rissanen, 2011).

Art and Craft: The use of leather scraps in art and craft projects offers a creative solution to waste management. Artists and craftsmen can repurpose leather scraps into artworks, sculptures, and other decorative pieces, thereby extending the

lifecycle of the material and reducing the environmental impact of waste. This approach also supports the cultural and aesthetic appreciation of recycled materials (Thompson & Trumble, 2012).

Technological Innovations: Advances in technology, such as laser cutting and 3D printing, provide new opportunities for the efficient and precise use of leather scraps. These technologies can optimize the cutting and shaping processes, minimizing waste and enabling the creation of complex and customized designs. Technological innovations thus play a critical role in enhancing the feasibility and appeal of upcycling leather scraps (Goldstein, 2009).

In summary, while the leather industry faces substantial challenges related to waste management, pollution, and resource depletion, there are significant opportunities to address these issues through sustainable practices. By transforming leather scraps into high-value products using art, craft, and design, the industry can reduce its environmental footprint and contribute to a circular economy. Ongoing research and innovation are essential to unlocking the full potential of these opportunities and promoting sustainability in the leather industry.



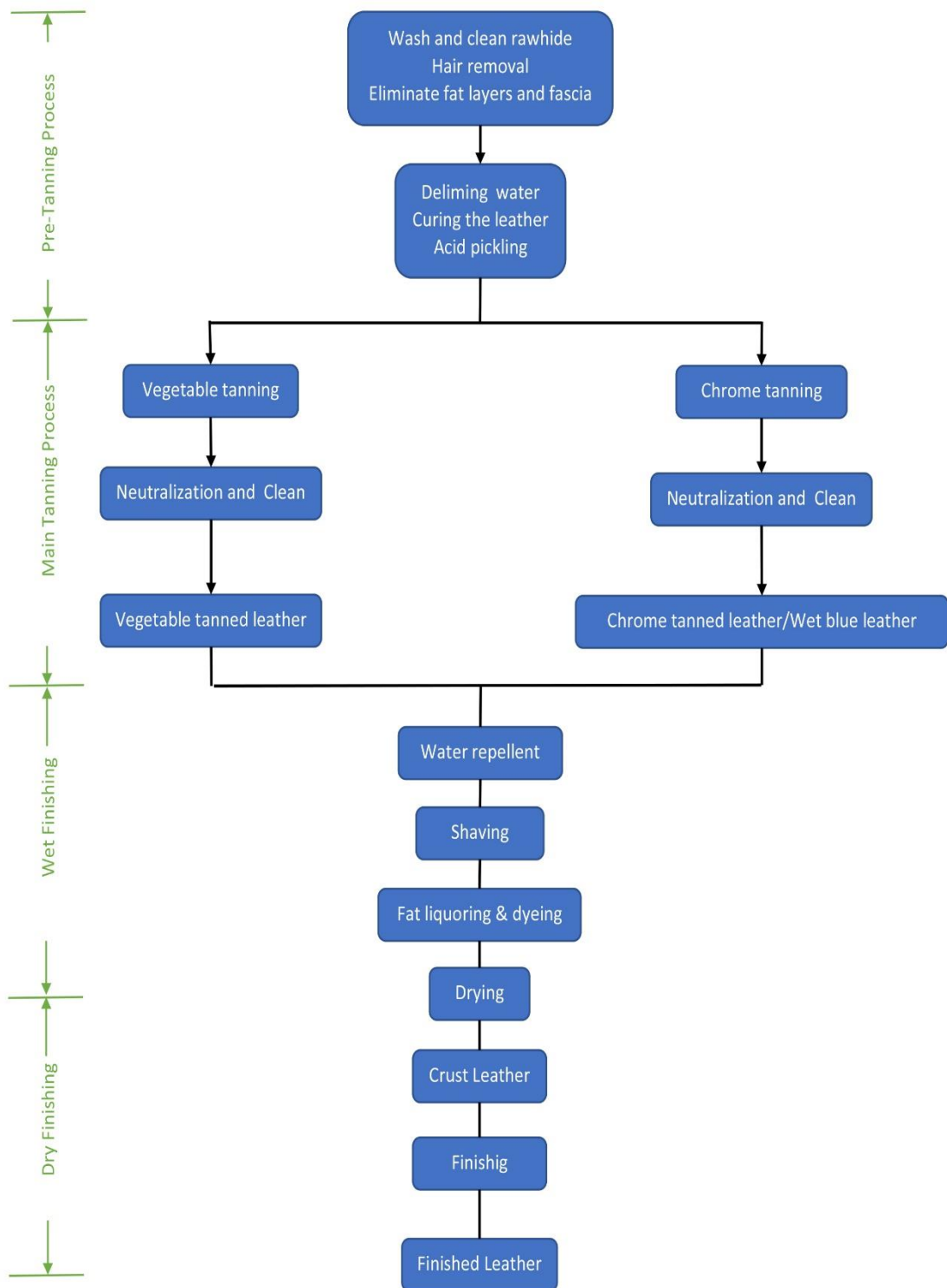


Figure 6 Leather Processing, from Thai Tanning Industrial Association

2.3 Guidelines for the Design and Development of Leather Products

Selection of material:

The selection of high-quality leather materials is crucial for the development of durable and aesthetically pleasing leather products. Several studies emphasize the importance of understanding the properties of various types of leather, including durability, texture, grain, and color variations. According to Hans (2003), the selection process should consider these properties to ensure the material's suitability for specific product applications. High-quality leather materials are characterized by their resilience, natural texture, and distinctive grain patterns, which contribute to the overall quality and longevity of the final product (Deskera, 2023).

Understanding the nuances of different leather types enables designers to make informed decisions about material selection. This knowledge is essential for aligning the material properties with the intended use of the product, thereby enhancing its performance and appeal. For instance, full-grain leather, known for its strength and natural imperfections, is often preferred for high-end products, while top-grain leather, which undergoes surface treatment, is used for items requiring a more uniform appearance (Deskera, 2023).

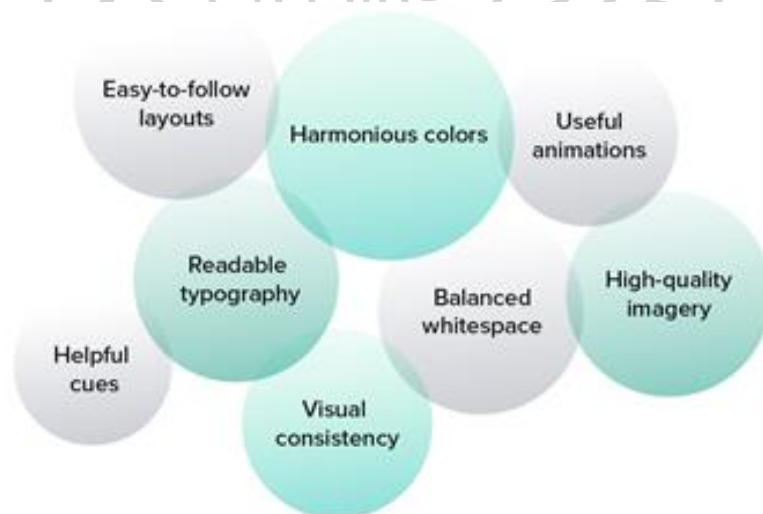


Figure 7 The Main Elements of Esthetically Pleasing UX Design

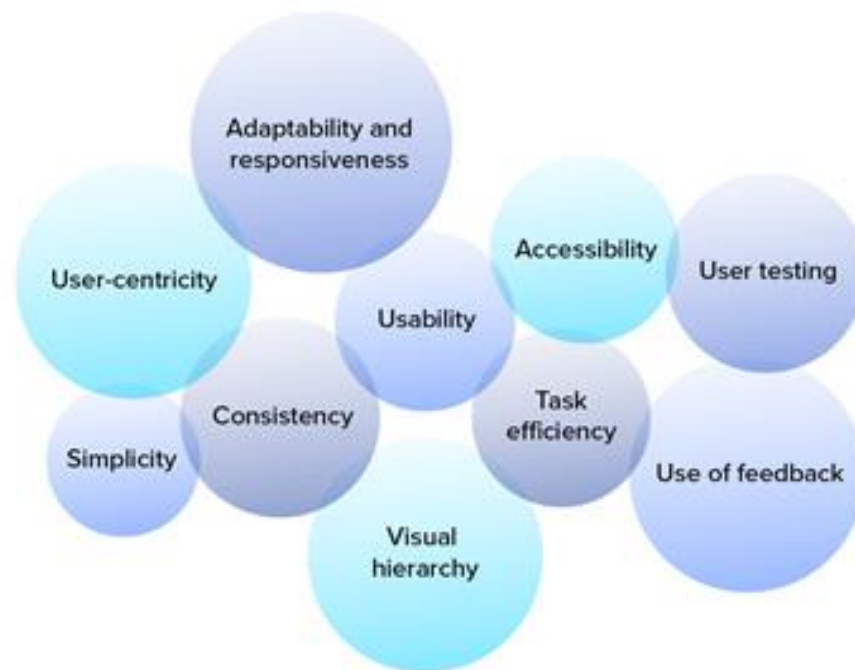


Figure 8 The Main Elements of Functional UX Design

Design, Aesthetics, and Functionality

Balancing design aesthetics and functionality is a critical aspect of creating successful leather products. The literature underscores the need for designers to harmonize visual appeal with practical usability. Elamrosy (2023) argues that an effective design must not only attract consumers through its aesthetic qualities but also meet their functional needs. This balance is achieved by considering factors such as ergonomics, usability, and user experience, ensuring that the product is both attractive and practical.

Ergonomics and usability are particularly important in product design, as they directly impact the user experience. Designers must take into account how a product feels, how it is used, and how it fits into the consumer's lifestyle. Incorporating these considerations helps in creating products that are comfortable, intuitive, and

enjoyable to use. Moreover, the aesthetic aspect should reflect the brand's identity and appeal to the target market, making the product desirable (Elamrosy, 2023).

Sustainability and Ethical Considerations

In light of increasing environmental concerns, integrating sustainable practices and materials into the design and manufacturing processes of leather products is imperative. Studies highlight the significance of adopting environmentally friendly production techniques, minimizing waste, and sourcing leather from ethical and responsible suppliers (Yadav, Xu, & Hergeth, 2024). Sustainability in leather production involves using methods that reduce the ecological footprint, such as vegetable tanning, which uses natural tannins from plants, and recycling or upcycling leather scraps.

Ethical considerations also play a crucial role in sustainable leather production. This includes ensuring fair labor practices, humane treatment of animals, and transparency in the supply chain. Consumers are increasingly aware of and concerned about the ethical implications of their purchases, prompting a shift towards more responsible consumption. By adhering to sustainable and ethical standards, designers and manufacturers can not only reduce environmental impact but also build trust and loyalty among consumers (Yadav, Xu, & Hergeth, 2024).

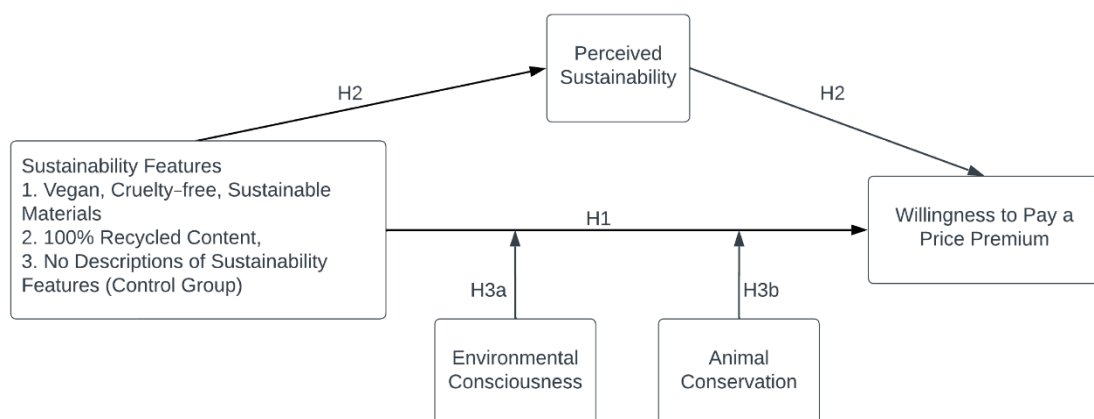


Figure 9 Conceptual Framework

By synthesizing the findings from these literature sources, designers and manufacturers can develop comprehensive guidelines for the design and development of leather products. These guidelines should aim to meet consumer needs, conform to industry standards, and align with sustainability principles. The integration of high-quality materials, balanced design aesthetics, functionality, and sustainable practices will result in products that are not only marketable but also environmentally and ethically responsible.

2.4 Case Studies

Below you will find case studies and examples of various methods for using leather scraps.

Handbags made from upcycled leather using existing materials. This approach, which is not based on the demand for new raw materials, is a sign of OAZÔ's concern for the environment. The recycling of materials stems from the understanding that no material is unworthy. Research and innovation make it possible to recognize and re-evaluate the qualities and potential of materials. Artisanal production provides the means to do this. The focus is on a mindful consumer, with sound principles; values; and beliefs, who is looking for ways to break away from the outdated model of mass consumption.



Figure 10 Patchwork Leather Bag from OAZÔ ARTISAN 1



Figure 11 Patchwork Leather Bag from OAZÔ ARTISAN 2

Dapper-Re leather scraps patchwork Upcycle Tote Bag made from Leather scraps from our shoes factory. The bag was made from surplus materials, products and artifacts that we repurposed into completely new products. Because of this upcycling process, no two Dapper-Re products are identical and have unique characteristics of the original materials.



Figure 12 Dapper-RE Tote Bag

The cleverly designed, limited edition bags and accessories from TRMTAB are upcycled from the production waste of a leather factory. While working with a factory in India, the founders of TRMTAB discovered that each production cycle can generate up to 4,000 pounds of waste. So they worked with the factory's artisans to turn the waste into upcycled leather tech sleeves. But TRMTAB is more than just a product – it is about making minor changes in factories that can have a significant impact.



Figure 13 Leather Scraps from India

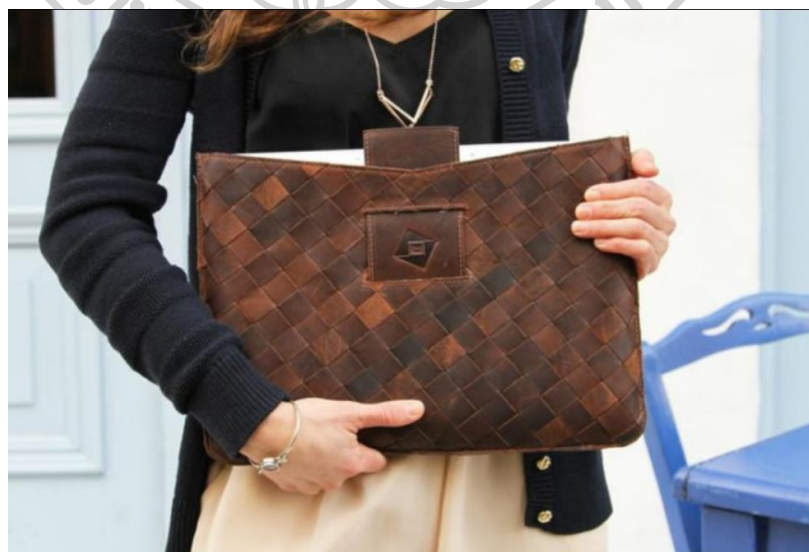


Figure 14 Woven Leather Bag from TRMTAB

Hand-woven leather handbags with ELENA BERTON

A handmade leather object is simply unique. Only the experts in their trade with years of experience can breathe new life into a piece of leather and transform it into a bag and a lifelong companion. These precious leather objects accompany me every day, the leather touches my body, follows my every move; my hands run over its surface and over time its warmth will give the bag its special patina – it will become my very personal bag.

The roots of my passion for creating such extraordinary objects lie in my collaboration with the artisans who make them. They master their craft with infinite patience, skill and a unique feel for the right material and its production. They use age-old techniques that create a very different kind of fashion in times of hyper-consumption. The hand-woven bags are the core product of our brand. They are designed for strong, beautiful, and unique women who appreciate the origin and values of a product and make it a part of their own identity.

Before the actual hand weaving can begin, the leather is tanned in a complex and strictly organic process using extracts from tree bark to ensure the exceptional quality and lifelong durability of the leather.



Figure 15 Hand weaving leather by Elena Berton

2.5 Contemporary Design

Contemporary design refers to a design style that reflects current trends, ideas and influences of the present. It often emphasizes simplicity, functionality and minimalism while incorporating innovative materials, technologies and esthetics. Contemporary design is dynamic and constantly evolving, drawing inspiration from a variety of sources including art, architecture, culture and technology.

In the context of leather products, contemporary design can include sleek and clean lines, geometric shapes and modern finishes. It can also incorporate sustainable practices and eco-friendly materials, reflecting the growing environmental awareness in design. Contemporary leather products often focus on both form and function. They offer stylish yet practical solutions for everyday use.

Designers working in the contemporary style often experiment with new techniques and materials to create fresh and innovative designs that resonate with modern consumers. They may also take inspiration from traditional craftsmanship and cultural influences and reinterpret them in a contemporary context.

Overall, the contemporary design of leather products represents innovation, creativity and relevance to the current cultural and social landscape, while honoring timeless design principles and craftsmanship.



Figure 16 Bottega Veneta's Long-standing Leather wickerwork

2.6 Wickerwork in Thailand

Wickerwork, including the weaving of rattan and other natural fibers, has a long tradition in Thailand. Here are some important points about wickerwork in Thailand. Traditional handicrafts: Wickerwork has been practiced in Thailand for centuries. Skilled artisans weave intricate patterns and designs from natural materials such as rattan, bamboo, water hyacinth, etc. This traditional craftsmanship is often passed down through generations in weaving communities, helping to preserve cultural heritage.

Wickerwork in the Early Days:

People take natural raw materials that can be found nearby to make them useful, such as leaves, branches and vines, to weave and shape them into simple shapes. They were used as containers or woven into cloths that served as cushions for sitting and sleeping, before evolving into exquisite basketry in later eras. Basketry is an art and a craft that people have developed in many ways. It was developed for making tools for daily life by interlacing and weaving strands of material. By shaping the form of the invention according to its intended use and geographical location. In accordance with the customs, beliefs, religion and materials in each region, basketry is called "wicker" or "Jak San" in the Thai language. It is a word that comes from the method by which bamboo wickerwork is originally made. As various wicker goods are finished in the shape they need to be complete, they must go through the following process:

1. "Jak" This means that the material is cut into lines, lobes or strips for weaving. The characteristics of the "Jak" generally depend on the type of material. Each type has a specific method that differs. Sometimes the cutting of bamboo or rattan is also referred to as "hammering" or "Tok" in Thai, where cutting can be considered as a step in the preparation of the material; the first step in the production of wickerwork.

2. “San” is a creative process in which people use natural materials to make useful things, using human ideas and skills as the basis for weaving wire. Which pattern is woven depends on its suitability for use. There are 3 methods:

- Weaving with the interlacing method
- Weaving with the diagonal interlacing method
- Weaving with the spiral method

2.6.1 Material for Wicker Work

2.6.1.1 Bamboo is a material used to make many types of basketry. It has the appearance of a jointed plant with many thorns and branches. When it is old, it is yellow. By bringing the trunk part. Used as "Jak" for weaving various vessels.



Figure 17 Bamboo



Figure 18 Bamboo Preparation for Wicker



Figure 19 Bamboo Wicker



Figure 20 Products from Bamboo

2.6.1.2 Sedge or called in Thai, KOK, *Cyperus imbricatus* and *Cyperus involucrate*, is a type of plant that likes to grow in damp places and is often found in rice fields, along swamps, marshes and damp flooded areas. The round or triangular stems are available as large and long stems as well as small and short stems. Most of them are woven into mats and not woven directly.



Figure 21 KOK (*Cyperus imbricatus* and *Cyperus involucrate*)



Figure 22 Drying KOK (*Cyperus imbricatus* and *Cyperus involucre*)

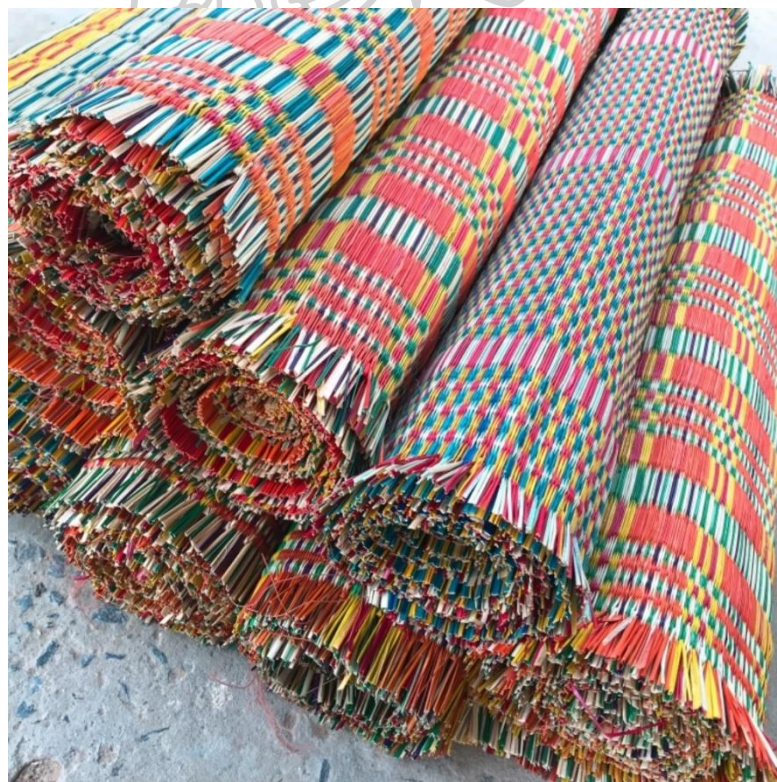


Figure 23 Products from KOK

2.6.2.3 YANG, KLA: *Schumannianthus dichotomus* or *Donax arundastrum*, has a similar appearance to bamboo, but is softer, has no joints, is harder than rattan and is more durable than "KOK". It grows when it is wet. It has a beautiful yellow skin and is used for weaving mats, making house walls, etc.

There are other local names such as Klum (eastern region), Yang (northern region), Kanpra Kla (central region), Klai (southern region), Bumaji Chaba Mae Burmae (Malay- Narathiwat), Boomajjiaai (Malay-Pattani), Bumaji Ja I (Malay), Kla Bai Ngern, Kla Kan Yaeng.



Figure 24 YANG or KLA: *Schumannianthus dichotomus*



Figure 25 YANG Cut: *Schumannianthus dichotomus*



Figure 26 Mat wickerwork from YANG: *Schumannianthus dichotomus*



Figure 27 Basket from KLA

2.6.1.4 Rattan, a vine-like palm native to Southeast Asia, is an important material wicker weaving in Thailand. The country has a well-established rattan industry, with rattan harvested from forests and cultivated plantations. Rattan weaving provides employment opportunities for rural communities, especially in regions where rattan is abundant.

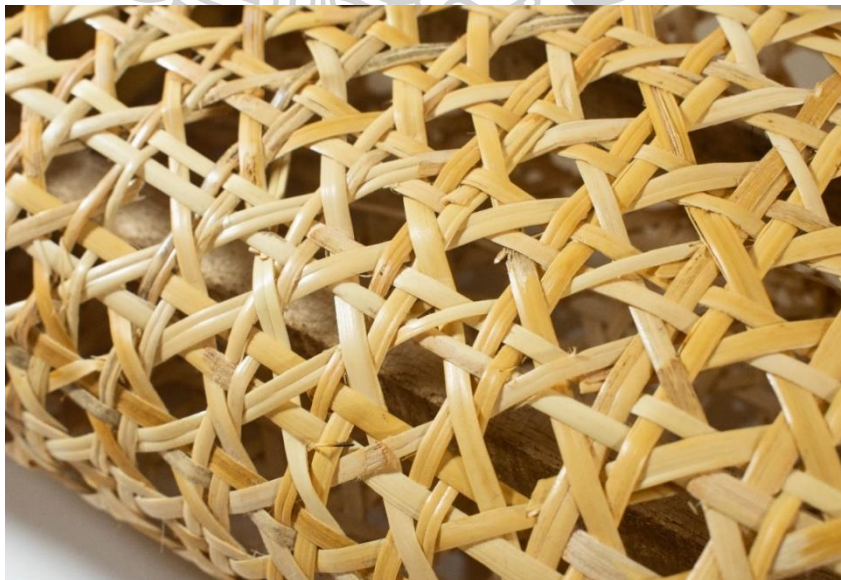


Figure 28 RATTAN

2.6.1.5 Leaves of the Palmyra palm, *Borassus flabellifer* L., or “BAI TARN” in Thai: The trunk is as tall as a coconut. The leaves are a large plate that resembles a fan. They are used for making baskets by cutting the inside into lines similar to hammered lines, suitable for young leaves. It is used for weaving hats.



Figure 29 Tarn tree or Palmyra palm, *Borassus flabellifer* L.



Figure 30 Tarn leaves or Palmyra palm, *Borassus flabellifer* L.



Figure 31 Basketry from palmyra palm, also called “BAI TARN”

2.6.2.6 Bai Lan ; In ancient times, it was used to record information and stories. Used for roofing, They are woven into various utensils. In addition, palm leaves are burned on fire and used to make medicine to extinguish various poisons, cure inflammation, swelling, and cure various poisons. The roots can be used as drinking water to cure internal heat, sweat, and cure colds.



Figure 32 Fan palm leaves called BAI LAN, *Corypha Umbraculifera* L.

2.6.1.7 Coconut leave stem: When the middle stem of a coconut leaves are ripped off so that the stem remained are woven or braided into baskets and small fruit basket.



Figure 33 Coconut-leave-stem baskets

2.6.1.8 Climbing fern, also called in Thai YAN LIPAO, *Lygodium circinatum*, has the appearance of a kind of vine. It is as big as a straw. It grows in mountains, mountain ranges and groves. To use it, the trunk must be peeled, and the bark removed, then it is processed into strips. In the Yan Lipao region, it is usually woven into patterns such as betel nuts, trays, etc.



Figure 34 Climbing fern, also called in Thai YAN LIPAO, *Lygodium circinatum*



Figure 35 YAN LIPAO ready for hand weave



Figure 36 Wickerwork from YAN LIPAO (*lygodium circinatum*)

2.6.1.8 Krajoed: *Lepironia articalata*, is a plant species from the same family as sedge or KOK. It likes to grow in damp places. The stem is round and about the size of a little finger. Before you weave it, the trunk must be dried in the sun and pounded. First make it flat like a hammered line, then weave it.



Figure 37 Krajoed: *Lepironia articalata*



Figure 38 Krajoed Cut: *Lepironia articalata*



Figure 39 KRAJOOD, *Lepironia articalata*, hand weaving

2.6.1.9 Seashore screwpine or called in Thai as Toei Talay: *Pandanus tectorius Parkinson ex Du Roi*, is a type of tree with long leaves that resemble pineapple leaves or Lam Jiak leaves and grows on the seashore. The leaves have thorns. Before weaving, the thorns on the edges of the leaves must be removed. They are then roasted over a fire, soaked in water and then twisted into strips.



Figure 40 Toei Talay or Lam Jiak: *Pandanus tectorius Parkinson ex Du Roi*



Figure 41 Toei Talay or Toei Panan or Lam Jiak Hand Weave

Krajood weaving patterns subdivided into traditional patterns and applied patterns. Traditional patterns include pattern 1 “Lai Khad Nueng”, pattern 2 “Lai Khad Song” and pattern 3 “Lai Khad Sam”. They are considered primary patterns when you are just learning how to make them. You need to learn from these basic patterns first to improve your skills and expertise and be able to adapt and apply them to a more advanced pattern, such as a double hammer pattern, a plaid pattern, a Phikun flower pattern, etc. Lai Khad Song or Lai Song is a pattern that is often used for weaving. It is the most matte pattern. Due to the strength and durability of the mat, it is more beautiful, easy to weave and can be modified into many other patterns, such as the “Lai Look Kaew” pattern, the “Down-lom-duan” pattern, the “Down Kra Jai”, etc. These three patterns are considered to be ancient patterns that the communities in the south preserve together to keep this ancestor alive. The patterns are developed or applied to adapt and change according to popularity or according to what is popular to expand the market, such as the L-

shaped pattern, the small arrow pattern, the big arrow pattern, the zigzag pattern etc.

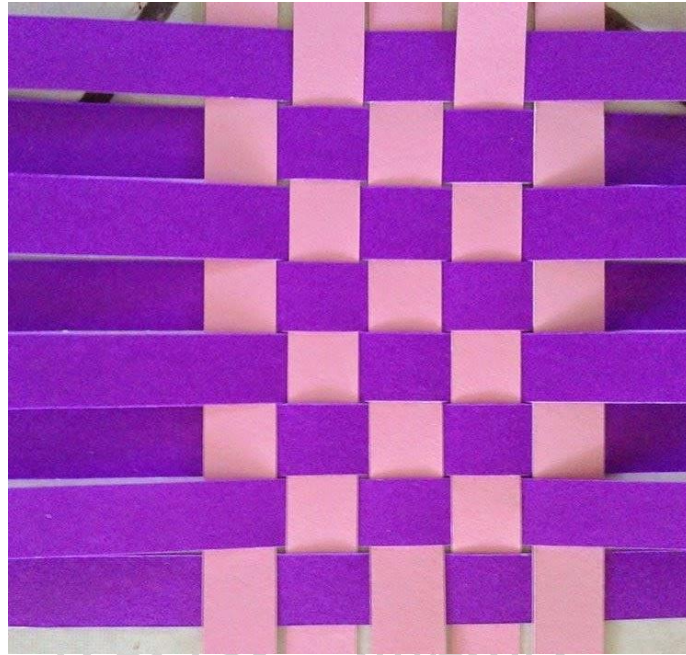


Figure 42 Pattern 1 "Lai Khad Nueng"

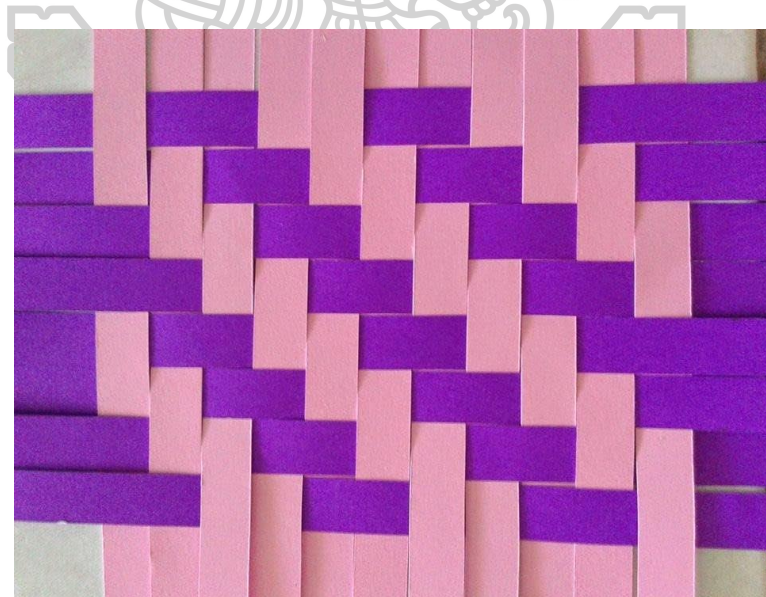


Figure 43 Pattern 2 "Lai Khad Song"

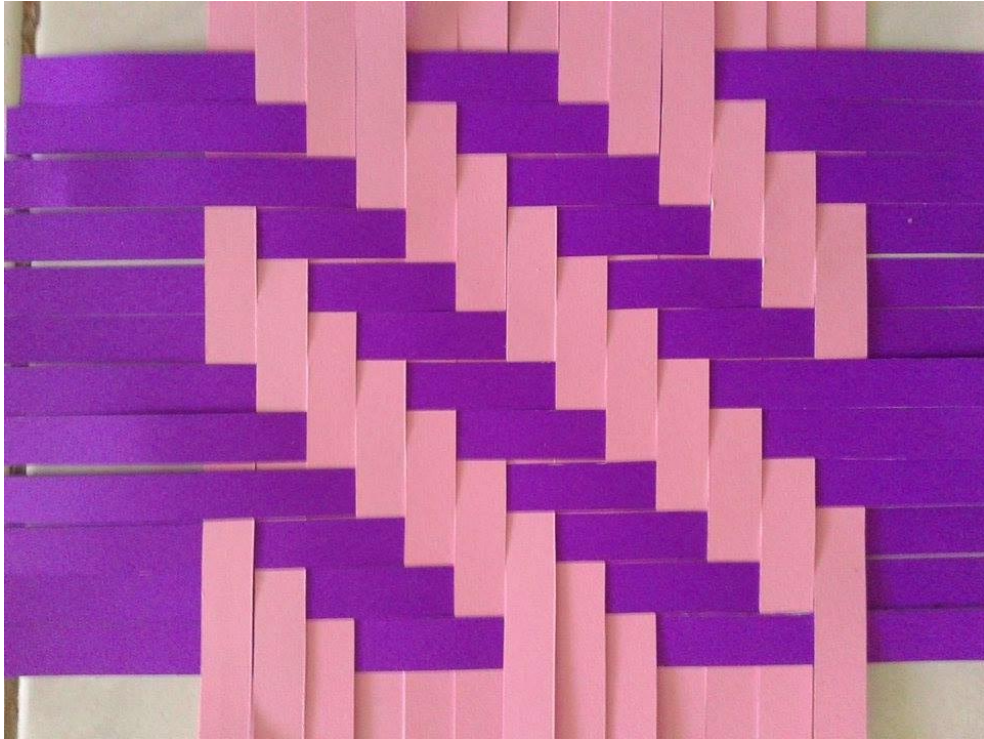


Figure 44 Pattern 3 “Lai Khad Sam”



Figure 45 “Down Kra Jai” Pattern

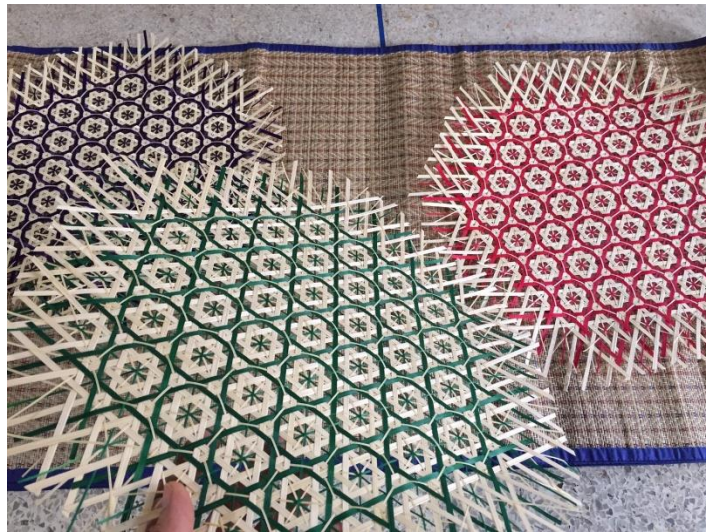


Figure 46 "Phikun Flower" Pattern

In the three southern border provinces, Muslim communities such as Ban Thon Community, Khok Khian Subdistrict, Narathiwat Province, are another community that uses krajoed, a material abundant in the swamp forests of the area, to make utensils. Following the method that reflects the culture of life through various forms and products, such as weaving krajoed in the form of a basket. It is used as a container for storing rice or it is woven to store things with a lid. The lid and bottom are woven in 6 corners, 8 corners and 12 corners called "Tumu". It is considered a trendy style after the Sardjoed or Krajoed mat. The appearance of this product is considered delicate and wise and baffles the villagers because weaving "Yor Mum" or angles is a skill that also requires expertise and small krajoed lines that are the same size must be selected. If the krajoed lines are not the same size, this will result in the fabric being woven crooked. One side may be distorted. It is another craft of basket weaving. The krajoed of the Muslim community in Narathiwat province has a unique identity that cannot be found anywhere else. Important krajoed production areas are Talay Noi village in Phatthalung province, Bo Krang village in Surat Thani province, Sakom village in Songkhla province, Thon village in Narathiwat province, etc. Currently, a lot is produced and distributed in Khreng Subdistrict, Cha-uat District, Nakhon Si Thammarat Province. Each area has unique

styles, patterns and unique styles for making Krajoood weaving products. Some of them have evolved according to the way of life, ideas, beliefs and uses that vary by community. Nakhon Si Thammarat province is one of the provinces that is rich in Krajoood trees. The Krajoood trees are not only processed into products in the community itself, but also exported from the community to be used as raw material in other areas. This generates income for the community. Another way, but the uniqueness of the krajoood product format In Cha-uat district in Nakhon Si Thammarat province, traditional work is still predominant, with most still preferring krajoood weaving. Products in the form of hats, mats, and sacks. It is a continuation. With the wisdom of the community that has been passed down for a long time and the way of life of the people in the community who still value these products. Therefore, other forms of products are rarely seen. Ta Lay Noi, Khuan Khanun District, Phatthalung Province, is another town with a swamp forest and a large number of Krajoood trees, resulting in a variety of Krajoood weaving products and still retaining the charm and aura of local handicrafts that reflect the uniqueness of the community, have become famous souvenir products that are very popular with tourists visiting Ta Lay Noi (*Sacit.co.th*).



Figure 47 Krajoood mat weaving

2.7 Mat Weaving

The weaving of sedge mats is the wisdom of the natives, who process reeds into threads, dye them and then weave them into sheets that are used as cushions for sitting or lying on. Reeds, which occur naturally in the area, are used for various activities as well as religious ceremonies and beliefs. Ancestral wisdom Later used in the household, it was created as additional income for the community. Through continuous development, wisdom is turned into excellent products.



Figure 48 Sedge or KOK mat loom weaving

KOK (*Cyperus imbricatus* and *Cyperus involucrate*) mats are products that are widely used throughout the country or abroad. This is because papyrus is a natural plant that grows everywhere in the region and because of the wisdom of the locals who transform reeds. It has similar properties or has been influenced by the ideas of others, so reed mats are considered one of the necessary factors for people's lives in the past.



Figure 49 KOK's loom woven mat from Northeastern Thailand

Materials and equipment for hand weaving mat:

1. Scissors
2. Sedge stems
3. Nylon or sack rope
4. Two-meters beater
5. Mat frame loom: 2-meter wide, 2.30-meter long.
6. Shuttle
7. Color for Reed dye



Figure 50 Materials and Equipment for loom woven mat

Steps to Mat Weaving:

1. Cut the sedge stems into strips and dry them in the sun for about 1 week.
2. When the strips are dry, you can dye it to your liking. The dyed color is a good chemical dye. Most are dyed brown, white, red and blue.
3. Take the nylon rope or jute sack and stretch it on the mat loom to draw lines along the loom and comb.
4. Insert the sedge strip into the shuttle so that it can be inserted into the mat loom.
5. Push the sedge strips towards you as you insert them so that the sedge strips are woven together firmly with different designed patterns.
6. Patterns that are woven regularly are popular: Mudmee pattern, plain pattern, Krajub pattern.
7. The woven reed mats are then made into various products such as folding mats, coasters, bags, etc.



Figure 51 KOK mat preparing process



Figure 52 KOK mat weaving process

2.8 Patchwork from Piece Quilt

Patchwork of Piece Quilt means taking fabric, cutting it into different patterns or geometric shapes and sewing them together into one large piece. The patterns used are those that have been popular for a long time, including triangles, and squares. Rectangular and hexagonal shapes.



Figure 53 Patchwork of Piece Quilt sample

2.8.1 Collage and Portraiture

Collage and portraiture are two different art forms that can be combined to create unique and expressive works of art. Here you will find an overview of both:

Collage:

Collage is an artistic technique in which various materials such as paper, photographs, fabric and found objects are combined and arranged into a cohesive composition. Artists use collage to explore themes such as texture, color, juxtaposition and narrative. Collage offers creative freedom and experimentation as artists can manipulate and layer materials to convey their ideas and feelings.

Common collage techniques include tearing, cutting and pasting materials onto a surface to create visual interest and depth.

Portraiture:

Portraiture is the art of depicting a person or group of people. Portraits can range from realistic depictions to abstract interpretations, capturing the subject's essence, personality and emotions. Artists use various media, such as painting, drawing, sculpture, photography and digital media to create portraits. Portraiture often requires careful observation and diligence as artists strive to capture the likeness and character of their subjects.

Combining collage and portraiture offers a dynamic and versatile approach to creating art. Here are some ways they can be combined:

Collage portraits:

Artists can create portraits using collage techniques by using varied materials and textures to depict different aspects of the sitter's personality, interests and experiences. Collage portraits can include layers of paper, photographs, fabrics and other found objects arranged to express the person's unique identity.

Mixed-media portraits:

Mixed-media artists often incorporate collage elements into their portraits, combining painting, drawing, collage and other techniques to create visually rich and complex works of art. Mixed media portraits can feature a combination of painted or drawn elements with collage materials that add depth, texture and dimension to the artwork.

CHAPTER 3

Research Methodology

3.1 Mixed Research Methodology Approach

Initial research revealed that the leather scraps left over from sewing the bags varied significantly in size, ranging from pieces over 30 cm long to fragments less than 1 cm. Given this diversity, a multi-faceted research methodology was adopted to maximize the utility of these leather scraps and work towards achieving the concept of "zero waste." The overarching aim of this approach is to optimize the use of resources across all size ranges while minimizing energy consumption, primarily through the application of upcycling methods.

Research Design

The mixed research methodology integrates both qualitative and quantitative approaches to provide a comprehensive understanding of the potential for upcycling leather scraps. This combination allows for a robust analysis of the material properties, design possibilities, and market potential of products made from recycled leather.

Phase 1: Material Analysis

The first phase involves a detailed analysis of the leather scraps, categorized by size, shape, and quality. This phase employs quantitative methods, including:

Size and Shape Measurement: Utilizing digital calipers and image analysis software to accurately measure the dimensions and shapes of the leather scraps.

Quality Assessment: Conducting physical tests to assess the durability, tensile strength, and flexibility of the scraps. These tests will follow standardized protocols, such as those outlined by ASTM International.

Phase 2: Design and Prototyping

The second phase focuses on the design and prototyping of products using the analyzed leather scraps. This phase combines qualitative and quantitative methods:

Design Workshops: Facilitating workshops with designers to brainstorm and sketch potential product ideas. These workshops will use a qualitative approach, gathering insights and feedback through observations and discussions.

Prototyping: Developing prototypes based on the workshop outcomes. This involves iterative testing and refinement, using quantitative methods to evaluate the feasibility and functionality of the designs.

Phase 3: Energy Consumption Analysis

The third phase evaluates the energy consumption involved in the upcycling process. This phase employs quantitative methods to measure:

Energy Use: Recording the energy consumption of different upcycling techniques, such as cutting, sewing, and finishing. This data will be collected using energy meters and analyzed to identify the most efficient methods.

Environmental Impact: Conducting a life cycle assessment (LCA) to quantify the environmental benefits of upcycling compared to traditional disposal methods. The LCA will follow ISO 14040 standards.

Phase 4: Market Research

The final phase assesses the market potential of the upcycled leather products. This phase uses both qualitative and quantitative methods:

Consumer Surveys: Distributing surveys to potential consumers to gather data on their preferences, willingness to pay, and perceptions of upcycled leather products. Statistical analysis will be used to interpret the survey results.

Focus Groups: Conducting focus group discussions to gain deeper insights into consumer attitudes and expectations. These discussions will be recorded, transcribed, and analyzed using thematic analysis.

Data Collection and Analysis

Data collection will be systematic and structured, ensuring reliability and validity. Quantitative data will be analyzed using statistical software, such as SPSS, to perform descriptive and inferential analyses. Qualitative data from design workshops and focus groups will be analyzed using coding and thematic analysis to identify patterns and themes.

Conclusion

By adopting this mixed research methodology, the study aims to comprehensively explore the potential of upcycling leather scraps. Each phase of the research is designed to address specific aspects of the process, from material analysis to market research, ultimately striving for the concept of "zero waste." This approach not only enhances the academic rigor of the study but also provides practical insights for designers and manufacturers looking to implement sustainable practices in the leather industry.

3.2 Quantitative Research

The research process is divided into 3 steps as follows.

1. Hand Weaving
2. Loom Weaving
3. Patchwork

3.3 Research Methods

3.3.1 Hand Weaving

Design Process in the 1st step: Attribute

Based on preliminary experiments, the researcher took leather scraps and cut them into strips. These strips were then woven together in a simple, alternating pattern. (top one, bottom one)



Figure 54 Initial Experiment

Having discovered his interest in textures, the researcher decided to explore this concept further. The researcher began to explore the potential of the material to uncover its various possibilities.

In the initial stages of development, a challenge arose as the leather scraps were deemed too short for practical use. Consequently, the investigation had

to be continued. A further problem arose when it was found that conventional bonding methods resulted in noticeable seams that compromised the esthetics and structural integrity of the leather. To solve this problem, the researcher opted for a technique similar to plain scarf wood joint, ensuring smooth leather joints without interruptions.

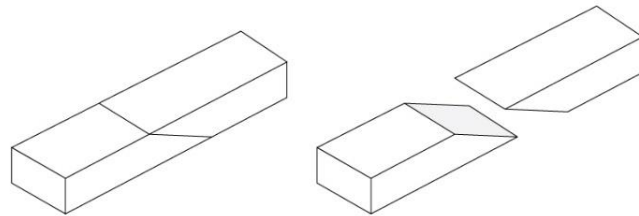


Figure 55 Plain Scarf Wood Joint Technique that wood piece are cut diagonally



Figure 56 Diagonally Leather Cut 1



Figure 57 Diagonally Leather Cut 2



Figure 58 Leather that has already been jointed diagonally

Design Process in the 2nd step: Define

Once you had successfully created a smooth leather surface using the above technique, the next step was to fold the leather to keep it clean. Once the desired length was achieved, weaving began.



Figure 59 Start experimenting with hand weaving

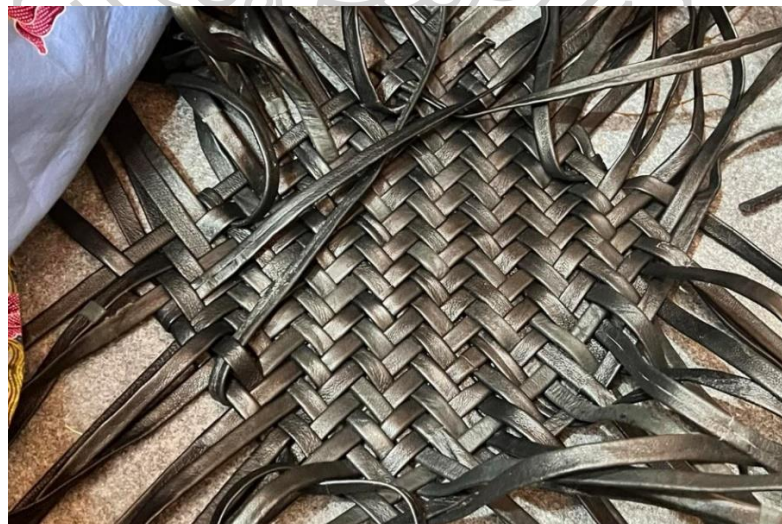


Figure 60 Sheet of Hand-Weaving Leather Strips

3.3.2 Loom Weaving

Design Process in the 1st step: Attribute

As the focus of the experiment is on weaving, the researcher investigated different weaving techniques and loom types to find a method that matched the aims of the project. Ultimately, the Isan mat weaving method from Northeastern Thailand was chosen, in which the sedge strip shuttle is inserted into the weft one after the other. However, conventional mat looms tend to be very large, which prompted the researcher to design a new loom suitable for the material. This new loom required some adjustments to the tools to ensure easy handling and simple operation.



Figure 61 Traditional Northeastern Loom

Design Process in the 2nd step: Define

Due to the size of conventional looms and the large distance between the stand lines, the researcher decided to design and build a new loom tailored to the requirements of the material. This new loom was designed to be compact, suitable for the desired size of the material and equipped with customized tools for effortless operation without unnecessary complexity.

The researcher improved the loom by adding a threaded hook for hanging and lifting the standing cord, which made it easier to insert the wooden shuttle to lift the cord. The size of the leather insert was also adjusted to ensure compatibility with the loom. A nylon thread was then used to stretch the warp to the correct tension so that the desired leather texture was created during pressing.



Figure 62 Screw hook for stretching the weft



Figure 63 Modified loom

The leather weaving experiment consists of the following steps:

Leather Strips: Preparation:

- Cutting: Cut the leather into strips about 8 mm wide and 45 cm long.
- Joining the strips: If the cuts have not reached the desired length, joint the strips using an plain scarf wood joining technique to achieve the desired length.
- Smoothing: As many of the leather scraps you receive may be wrinkled, you will need to smooth them with a suitable iron.
- Ironing techniques to avoid damaging the leather. Before ironing, you must cover it with a layer of calico fabric so that the sole of the iron does not come into direct contact with the leather.
- Choose a suede line that is completely black. For beauty, if you want to weave a texture.



Figure 64 Many shades color of Suede side



Figure 65 Wrinkling of leather before ironing



Figure 66 Cover fabric over leather before ironing



Figure 67 Ironed leather

Steps to Loom Weaving

- Use a wooden beater to raise the weft. By alternating the lines up and down. Upwards to insert smooth calluses.
- When the leather strip is inserted, fold the wooden beater down to push the strip towards you.
- Insert another leather by alternating the wooden beater with the warp line that was inserted the first time.
- Lift the wooden beater and insert the next piece of leather.
- Then push the wooden beater towards you. When you press the wooden beater together with weight, it is so strong that the strip folds together tightly.

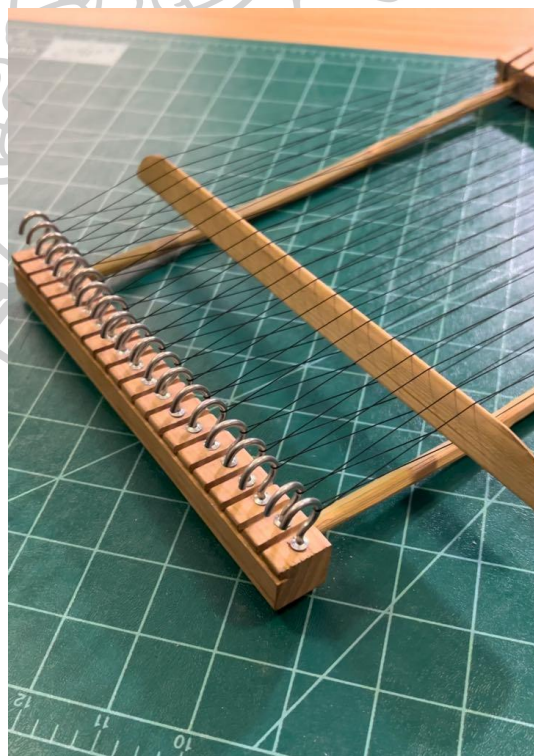


Figure 68 Lifting wooden beater



Figure 69 Insert leather strips



Figure 70 Pulling the beater



Figure 70 Hard pressing the leather strips

3.2.3 Patchwork Collage Portrait

1. Design Process in the 1st step: Attribute

The leather scraps left over from sewing vary in size and range from exceptionally large to exceedingly small pieces. The patchwork method offers a solution for jointing these scraps into a coherent piece. In addition, the collage technique offers another way to create art and add significant value to the materials.



Figure 71 Leather scraps of assorted sizes and shapes, beyond control

2. Design Process in the 2nd step: Define

When the researcher had the opportunity to present work made from leather remnants at Bangkok Designs Week 2024 on Rambuttri Road, he was faced with the challenge of creating a piece inspired by the name of the venue.

Rambuttri Road takes its name from the bridge that spans the canal at Wat Chana Songkhram, known as "Rambuttri Bridge" or Khlong Bang Lamphu. This bridge is of historical significance as it was built by a gift from Princess Pao Suriyakul, daughter of Her Royal Highness Princess Suriya Department of Rama Issares, in honor of her father, His Royal Highness Suriya Department of Rama Issares. The construction of the bridge was completed after His Majesty King Chulalongkorn named it "King Chulalongkorn" Rambuttri Bridge.

For this reason, a portrait of His Majesty King Chulalongkorn, also known as King Rama V, the royal figure who gave Rambuttri Road its name, was procured. This portrait served as the inspiration for the creation of a work of art, a portrait artwork to be precise.

As all the leather scraps were black, the suede side of the leather scraps had various shades ranging from light gray to dark gray, and some were completely black.



Figure 72 Differences in color shades on the suede side

CHAPTER 4

Design Development

4.1 Hand Weaving

4.1.1 Design Development

Preparation of the Leather Strips:

1. Cut leather scraps into even strips of different widths, making sure they are uniform in size and length.
2. Selecting the Weaving Pattern: Choose a weaving pattern that is suitable for the desired result, e.g. a simple over-and-under weaving pattern or more complicated patterns such as twill or herringbone.
3. Weaving: Begin weaving the leather strips together according to the chosen pattern, following the established methodology for each weave. Pay close attention to maintaining tension and alignment to ensure a uniform appearance.
4. Documentation: Document the trial process, including details of the weaving pattern, materials used, problems encountered and observations on the results.

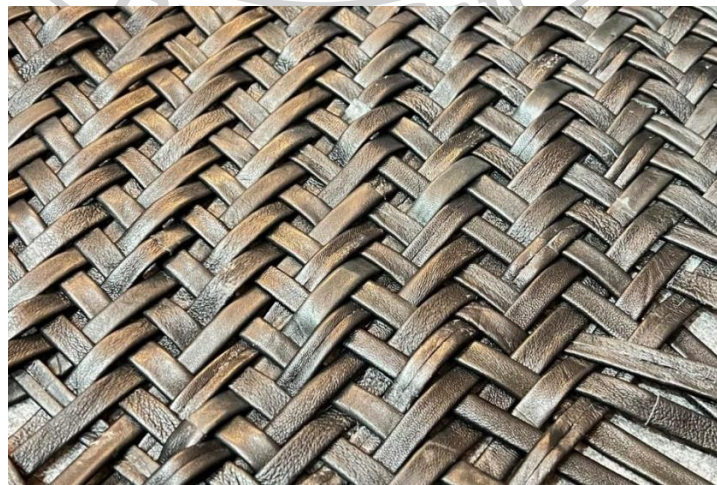


Figure 73 Texture of leather weaved

4.1.2 Prototype



Figure 74 Prototype of leather woven

4.2 Loom Weaving

4.2.1 Design Development

- 4.2.1.1 Do this alternately up to the 6th line of the leather, letting the inserted leather appear on the suede side. For the woven leather, create texture and pattern.



Figure 75 Alternating weaving of leather texture

4.2.2 Prototype

After taking the woven leather off the loom, work on the prototype began as follows. The prototype was designed as a clutch bag, defining the woven part of the leather as the front cover of the bag. The design concept of using used leather jackets as additional components of the bag was maintained.

1. Draw the woven leather according to the designed pattern.
2. Sew together according to the pattern drawn.
3. Cut according to the drawing.
4. Take a used leather shirt and cut it into pieces for a bag according to the pattern.
5. Then take all the prepared leather and sew it into shape until it finally becomes a bag.



Figure 76 Cutting the leather woven



Figure 77 Woven leather after cutting according to the pattern.



Figure 78 The leather from used leather jackets is used as part of the bag.



Figure 79 Loom woven leather sheet is sewn together to leather from a jacket.



Figure 80 Assembling with the necessary parts for the bag



Figure 81 Finished Bag

4.3 PATCHWORK

4.3.1 Design Development

1. Start by sorting the raw material by size and divide the suede colors into distinct groups.
2. Plan the gradation of light and shade for the forehead and cheeks. The challenge is to effectively control light and shadow with a limited palette of shades.
3. When experimenting with the gradation of leather colors, it turned out that up to 15 shades of gray can be achieved. This realization prompted us to experiment further and develop a prototype.



Figure 82 Sorting leather



Figure 83 Smoothing out the leather by ironing before proceeding to the next step



Figure 84 Selected leather

4.3.2 Prototype

1. Lay out pieces of leather at random using the patchwork technique until the background is completely covered.
2. Outline the contours of the face at each position.

3. Use the collage technique to carefully arrange and glue on the leather pieces to make the light and shadow on the face as realistic as possible.
4. 4.3.2.4 Sew each piece of leather used in the collage technique into place.

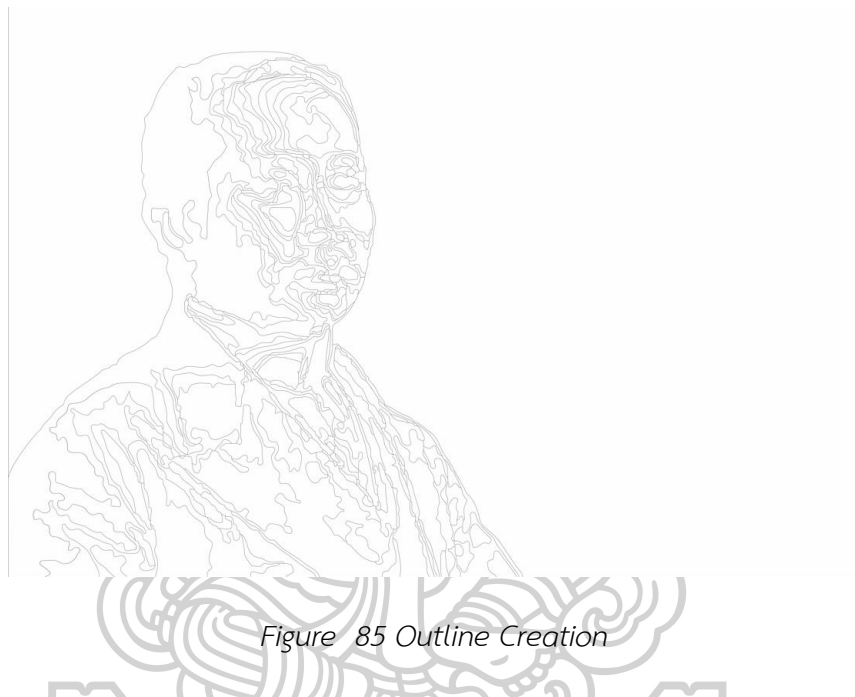


Figure 85 Outline Creation



Figure 86 Outlining the face



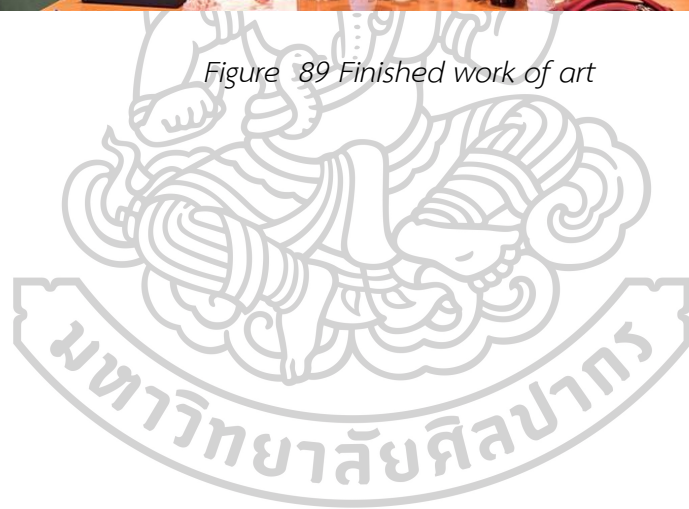
Figure 87 Collaging shades and shadows



Figure 88 Sewing all the cut pieces of leather together



Figure 89 Finished work of art



CHAPTER 5

Conclusion

5.1 Conclusion

This thesis has delved deeply into the concept of zero waste recycling of leather scraps, presenting a comprehensive analysis of the environmental, economic, and social implications associated with leather waste. The study has confirmed that upcycling leather scraps into high-value products is not only a feasible solution but also one that brings significant benefits across various dimensions.

The initial chapters identified the pressing challenges faced by the leather industry, including waste management, pollution, and resource depletion. Traditional disposal methods, such as landfilling and incineration, are not only environmentally harmful but also represent a missed opportunity to recover and repurpose valuable materials. This research underscores the urgent need for innovative recycling methods as sustainable alternatives.

The literature review provided a robust foundation for understanding the complexities and potentials of leather scrap recycling. It emphasized the critical importance of selecting high-quality leather materials, which are characterized by their durability, texture, grain, and color variations. Knowledge of these properties enables designers to choose the most suitable materials for specific applications, ensuring that the final products are both functional and aesthetically pleasing.

The balance between design aesthetics and functionality emerged as a pivotal theme. Effective design must not only captivate consumers with its visual appeal but also meet their practical needs. This balance is achieved through careful consideration of ergonomics, usability, and user experience, ensuring that the products are comfortable, intuitive, and enjoyable to use. Furthermore, integrating sustainable and ethical considerations into design and manufacturing processes is paramount. This includes adopting environmentally friendly production techniques, minimizing waste, and sourcing leather from ethical suppliers.

The case studies of RecycLeather, ECCO, and Elvis & Kresse illustrated real-world applications of these principles. These companies have successfully implemented upcycling practices, transforming leather scraps into valuable products that cater to the growing demand for sustainable fashion and design. Their innovative approaches demonstrate the economic viability and market potential of recycled leather products, highlighting the role of creativity and craftsmanship in driving sustainable innovation.

The impact of recycled art and design works on society was also explored. These works serve as powerful catalysts for environmental awareness, cultural transformation, and social change. By repurposing discarded materials, artists and designers challenge traditional perceptions of waste and encourage a more sustainable mindset among consumers. This shift not only reduces the environmental footprint but also fosters a culture of innovation and responsibility.

In conclusion, this thesis has demonstrated that zero waste recycling of leather scraps is a viable and impactful strategy for addressing the environmental challenges of the leather industry. By integrating sustainable practices, innovative techniques, and ethical considerations, the industry can develop high-quality, marketable products that contribute to a more sustainable and circular economy.

5.1.1 Art as Experience - John Dewey

1. In the context of "The Art of Experience - The Dewey Theory": the material of the leather scraps is significant as a tangible embodiment of Dewey's philosophical framework in relation to esthetic experience and artistic creation. Dewey's theory emphasizes the inseparable relationship between the artwork, the artist and the audience, highlighting the dynamic and interactive nature of the esthetic encounter.

Leather scraps, with their tactile qualities, texture and history, serve as raw material that artists can transform into new expressions of esthetic experience. In the context of Dewey's theory, the materiality of leather scraps becomes an integral part

of the artistic process. It represents the artist's engagement with the physical world and the creative act of transforming raw materials into meaningful forms.

Furthermore, Dewey's theory emphasizes the continuity of experience and the intertwining of art and everyday life. Leather scraps, often derived from discarded materials, symbolize themes of sustainability, renewal and the cyclical nature of artistic creation. By repurposing these scraps into new works of art, the artists demonstrate Dewey's belief in the transformative power of esthetic experiences to enrich and enliven human existence.

Overall, leather scraps symbolize the interplay of materiality, creativity and human perception in Dewey's theory of esthetic experience. They embody Dewey's vision of art as a dynamic process of engagement with the world, in which the boundaries between artist, artwork and audience are blurred and esthetic experience unfolds as a rich and multi-layered dialog between the material and immaterial realms.

5.1.2 Tools (Loom)

In "The Art of Experience - Dewey's Theory": the tools used to weave scraps of leather into works of art represent the practical manifestation of Dewey's philosophical framework regarding esthetic experience and artistic creation. Dewey's theory emphasizes the integration of art into everyday life and the transformative potential of creative expression.

The loom, as a tool for weaving leather scraps, serves as a medium through which artists engage with materials and shape them into meaningful forms. In Dewey's framework, the loom embodies the artist's engagement with the physical world and the creative act of transforming raw materials into esthetic expression.

The choice of a loom for weaving leather scraps reflects Dewey's emphasis on craftsmanship and skillful handling of materials. Loom weaving requires precision, mindfulness and a deep understanding of the properties of the materials used.

Artists using looms to weave leather scraps demonstrate Dewey's belief in the importance of craftsmanship and the tactile experience of creating art.

Moreover, the loom also symbolizes continuity and tradition in Dewey's theory of esthetic experience. As a tool with a long history and rich cultural significance, the loom connects contemporary artists to a tradition of craftsmanship and artistic practice. By weaving scraps of leather on a loom, artists participate in a time-honored tradition while renewing and reinterpreting the medium for contemporary expression.

In addition, the loom serves as a platform for collaboration and community engagement, reflecting Dewey's belief in the social dimension of art. Artists using looms to weave leather scraps can collaborate with others and share techniques, ideas and resources to create collective artworks that reflect diverse perspectives and experiences.

In the context of Dewey's theory of esthetic experience, the leather remnant weaving leather scraps represents the intersection of craftsmanship, tradition and community. It embodies Dewey's vision of art as a dynamic process of engagement with materials and the physical world, where creativity and expression converge to enrich the human experience.

Overall, within Dewey's theory of esthetic experience, the loom for weaving leather scraps represents the intersection of craft, tradition and community. It embodies Dewey's vision of art as a dynamic process of engagement with materials and the physical world, in which creativity and expression converge to enrich the human experience.

5.1.3 Special Technique

In "The Art of Experience - Dewey's Theory": the specific techniques used in working with leather scraps embody Dewey's philosophical framework for esthetic experience and artistic creation. These techniques are the practical manifestation of

Dewey's emphasis on the integration of art into everyday life, the transformative potential of creative expression, and the dynamic interaction between the artist, the artwork, and the audience.

1. Ironing the Wrinkles of Leather Scraps:

The ironing of leather scraps to remove creases and imperfections represents the artist's diligence and commitment to craftsmanship. In the context of Dewey's theory of esthetic experience, this technique symbolizes the artist's desire to refine and enhance the material qualities of the leather scraps, transforming them into flawless surfaces for artistic expression. It also underscores Dewey's emphasis on the integration of art into everyday life, as the act of ironing becomes an integral part of the artistic process.

2. Leather Scraps with the Wood Jointing Technique:

jointing scraps of leather scraps using a wood joint technique involves jointing pieces of leather together with plain scarf wood joints. In the context of Dewey, this technique epitomizes the artist's creativity and ingenuity in reusing materials and experimenting with different media. It reflects Dewey's belief in the transformative power of esthetic experiences to enrich and enliven the human condition. The leather scraps combined with the wood jointing technique also symbolize the themes of sustainability and renewal, as discarded materials are given a new life and purpose through artistic expression.

3. Loom Woven Leather Scraps:

In this technique, leather scraps are woven into a textured pattern that is then pressed or folded to create three-dimensional shapes or textures. In the context of Dewey, this technique reflects

the artist's engagement with the materials and the creative act of shaping these materials into meaningful forms. It embodies Dewey's belief in the importance of craftsmanship and the tactile experience of creating art. The woven, pressed and folded technique invites the viewer to engage with the artwork on both a visual and tactile level, developing a deeper connection and appreciation for the esthetic qualities of the material.

4. Patchwork and Collage Art Portrait:

Combining patchwork and collage techniques to create a portrait from leather scraps is an innovative approach to storytelling and visual expression by the artist. Within Dewey's theory of esthetic experience, this technique reflects the artist's ability to combine varied materials and techniques to convey complex narratives and emotions. It embodies Dewey's belief in the intertwining of art and everyday life, as the portrait becomes a reflection of subjective experiences, memories and cultural influences. The patchwork and collage portrait invites the viewer to engage with the artwork on multiple levels, interpreting and exploring its multi-layered meanings.

5.1.3 Art as Form - Clive Bell

In Clive Bell's theory of art, associated with formalism, the emphasis is on the visual qualities and formal elements of artworks rather than their representational or narrative content. According to Bell, the main purpose of art is to evoke a purely esthetic response in the viewer through the arrangement of these formal elements.

If we consider leather scraps, strips, colors and leaves in the context of Bell's theory, we can interpret them in terms of their formal qualities and their contribution to the esthetic experience:

1. **Leather Scraps:** In Bell's theory, scraps of leather are valued for their visual qualities rather than their representational or functional aspects. Artists can arrange these scraps into visually interesting compositions, considering factors such as texture, shape, and surface qualities to evoke esthetic responses from the viewer.
2. **Strips:** Strips of leather can be considered elements of form and composition within the context of Bell. Artists can manipulate these stripes to create lines, patterns or geometric shapes, considering the principles of balance, rhythm and harmony to achieve esthetically pleasing arrangements.
3. **Color:** Color plays a crucial role in Bell's theory, as he believed that pure visual elements such as color and form are the essence of art. Artists can use color in leather scraps to create contrasts, harmonies or focal points in their compositions to evoke emotional or esthetic responses in the viewer.
4. **Sheet:** Leather sheets offer a larger surface for artistic expression in the context of Bell. Artists can use leather sheets as canvases for painting, collage or other forms of artistic manipulation, incorporating principles of composition, proportion and unity to create cohesive and visually striking artworks.

In the context of Clive Bell's art theory, leather scraps, strips, paints and sheets are valued for their formal qualities and their potential to evoke esthetic responses in the viewer. Artists manipulate these materials with careful consideration of composition, color and form to create artworks that go beyond mere representation and engage the viewer on a purely visual and emotional level.

5.1.4 Organic Theory

In the context of the organic theory of art, which emphasizes the interconnectedness of artistic creation with nature and life, the inclusion of leather scraps weaving, weaving and patchwork art portraiture can be interpreted in different ways:

1. **Leather Scraps Weaving:** In the context of Organic Theory, the act of weaving leather scraps can be seen as a metaphor for the interweaving of elements in nature. By weaving together different scraps of leather, artists symbolize the harmonious integration of different elements into a unified whole. This process reflects the organic principles of growth, adaptation and interdependence found in nature.
2. **Woven Art:** The woven artworks created from leather scraps embody the Organic Theory's emphasis on natural forms and processes. The intricate patterns and textures created through weaving are reminiscent of organic motifs such as plant fibers, animal skins or geological formations. These woven works celebrate the inherent beauty and complexity of natural materials and emphasize the artist's reverence for the organic world.
3. **Patchwork Art Portrait:** The creation of a patchwork art portrait from leather scraps extends the focus of Organic Theory to the connections in the realm of human experience and identity. By assembling fragments of leather scraps into a portrait, the artists explore themes of individuality, diversity and the passage of time. Each piece represents a unique aspect of the sitter's identity, while the overall composition reflects the complexity and richness of human existence.

To summarize, within the organic theory of art, leather scraps hand weaving, loom weaving, and patchwork art portraiture serve as expressions of the

fundamental interconnectedness between humanity and the natural world. These artworks celebrate the beauty, diversity and unity found in both organic materials and the human experience, inviting the viewer to reflect on the profound connections that link us to the world around us

5.2 Recommendations

Based on the findings of this research, several recommendations are proposed to further advance the zero waste recycling of leather scraps and promote sustainability within the leather industry. These recommendations are aimed at enhancing the academic element by developing explicit knowledge through the systematic documentation and dissemination of the process.

1. **Adoption of Upcycling Practices:** Leather manufacturers and designers should adopt upcycling practices to transform leather scraps into high-value products. Techniques such as patchwork, weaving, and braiding can be utilized to create unique and marketable items. Documentation of these processes should be conducted to build a repository of explicit knowledge that can be shared across the industry.

2. **Investment in Research and Development:** Continuous investment in research and development is essential for innovation in recycling technologies. Advanced techniques such as laser cutting and 3D printing should be explored and documented to optimize the use of leather scraps and minimize waste. Collaborative research initiatives between academia and industry can foster the development of new technologies and methodologies.

3. **Promotion of Sustainable Design:** Designers should prioritize sustainable design principles by selecting high-quality materials, balancing aesthetics with functionality, and incorporating eco-friendly production methods. Detailed case studies and best practices should be published to guide designers in implementing these principles effectively.

4. **Consumer Education and Awareness:** Raising consumer awareness about the benefits of recycled and upcycled leather products is crucial. Educational campaigns, workshops, and transparent communication about the sustainability and quality of these products can help shift consumer perceptions and increase demand. Academic institutions can play a key role in developing educational programs and materials.

5. **Collaboration with Ethical Suppliers:** Companies should collaborate with suppliers who adhere to ethical and sustainable practices. Ensuring fair labor practices, humane treatment of animals, and transparency in the supply chain will enhance the overall sustainability of leather production. Detailed guidelines and certification programs can be developed to assist companies in selecting ethical suppliers.

6. **Implementation of Policy and Regulatory Frameworks:** Governments and regulatory bodies should implement policies and frameworks that encourage sustainable practices in the leather industry. Incentives for recycling and upcycling, as well as stricter regulations on waste management and pollution, can drive industry-wide improvements. Academic research can support policy development by providing evidence-based recommendations and impact assessments.

7. **Development of Circular Economy Models:** The leather industry should embrace circular economy models that emphasize resource efficiency and waste minimization. Designing products for durability, reuse, and recyclability is essential. Detailed case studies and economic analyses of successful circular economy models should be documented and shared to promote wider adoption.

8. **Engagement with Local Communities:** Engaging with local communities to develop recycling and upcycling initiatives can create economic opportunities and promote environmental stewardship. Community-based projects can enhance the social impact of sustainable practices and foster a culture of

sustainability. Academic institutions can facilitate community engagement through outreach programs and collaborative projects.

By implementing these recommendations, the leather industry can make significant strides towards achieving zero waste recycling of leather scraps, reducing its environmental impact, and promoting a sustainable future. The integration of innovative technologies, sustainable design principles, and ethical considerations will pave the way for a more responsible and resilient leather industry. Furthermore, the systematic documentation and dissemination of these practices will enhance the academic knowledge base, fostering a culture of continuous learning and improvement within the industry.

5.3 Future Research Directions

To further enhance the understanding and implementation of zero waste recycling in the leather industry, future research should focus on the following areas:

1. **Life Cycle Assessment (LCA) of Upcycled Leather Products:** Conducting comprehensive LCAs to evaluate the environmental impacts of upcycled leather products compared to traditional leather products. This will provide valuable data on the sustainability benefits and identify areas for improvement.
2. **Economic Viability and Market Potential:** Investigating the economic viability and market potential of upcycled leather products. This includes analyzing consumer preferences, market trends, and pricing strategies to identify profitable opportunities for manufacturers.
3. **Innovative Recycling Technologies:** Exploring new and emerging recycling technologies that can enhance the efficiency and effectiveness of leather scrap recycling. This includes advancements in material science, biotechnology, and digital fabrication methods.

4. **Sustainable Supply Chain Management:** Examining sustainable supply chain management practices that can ensure the ethical sourcing and processing of leather materials. This includes developing frameworks for traceability, transparency, and accountability throughout the supply chain.

5. **Policy and Regulatory Impact Analysis:** Assessing the impact of existing and proposed policies and regulations on the sustainability of the leather industry. This includes evaluating the effectiveness of incentives, subsidies, and regulatory frameworks in promoting sustainable practices.

6. **Interdisciplinary Approaches:** Encouraging interdisciplinary research that combines insights from materials science, design, environmental studies, economics, and social sciences to develop holistic solutions for leather waste management.

By pursuing these research directions, the academic community can contribute to the development of innovative and sustainable practices in the leather industry, driving positive environmental, economic, and social outcomes.



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VITA

NAME	Yuttana Anothaisintawee
AWARD RECEIVED	<p>รางวัล - Silver Prize SIIF2008 Seoul International Invention Fair 2008 Korea</p> <ul style="list-style-type: none">- Second Best DIC2009 Design Innovation Contest of National Innovation Agency- Wins 2010 ICFF Editors Award for Best Material From New York , USA.- Certificate of Top Ten Innovation Business 2010 (Fifth)- K SME Award 2011- CBS Innovator Awards 2011- DEmark Award 2012 for Eco Fashion Category- DEmark Award 2012 for Lifestyle Category- PM Award 2012 (Prime Minister's Export Award)- Demark Award 2014 for Industrial Category- Gmark Award 2014 from Japan- DEmark Award 2023 for Lifestyle Category X 2 Prizes

